APPENDIX 10

Boco Rock Wind Farm Ecological Assessment

Eco Logical Australia Pty Ltd

BOCO ROCK WIND FARM

Ecological Assessment

Prepared for
Wind Prospect CWP Pty Ltd

23rd October 2009

Boco Rock Wind Farm

ECOLOGICAL ASSESSMENT

PREPARED FOR	**Wind Prospect CWP Pty Ltd**
PROJECT NO	**0295-0002**
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Contents

List of Figures ..... **viii**

List of Tables ..... **viii**

Abbreviations ..... **xi**

Executive Summary **1**

1 Introduction **6**

1.1 Key Terms 6

1.2 Study Area 7

1.2.1 Site Location 7

1.2.2 Rivers, Creeks and Watercourses 8

1.2.3 Soils and Geology 8

1.2.4 Vegetation Communities 8

1.2.5 Surrounding Reserves 8

1.2.6 Climate 8

1.3 Report Structure 9

2 Description of Project **10**

2.1 Wind Farm Infrastructure 13

2.1.1 Turbine Rotor 13

2.1.2 Towers 13

2.1.3 Blade Tip 14

2.1.4 Nacelle 14

2.1.5 Turbine Foundations 14

2.1.6 Crane Hardstand and Site Access 14

2.1.7 Monitoring Masts 15

2.1.8 Electrical Infrastructure 15

2.1.9 Generator Transformer 15

2.1.10 Collector Substation 15

2.1.11 Overhead and Underground Cables 16

2.1.12 Operation Facilities Building 17

2.2 Site Access 17

2.2.1 Site Entry 17
2.2.2 Ancillary Roads and Remediation 21
2.3 Utility Services 21
2.4 Resource Requirements 21
2.5 Potential Design Layout Variations 23
2.6 Wind Farm Development Phases – Development Approval to Operation 23
2.6.1 Anticipated Project Timeline – Development Approval to Operation 23
2.6.2 Construction Staging Considerations 26
2.6.3 Detailed Design and Contract Development 26
2.6.4 Pre-construction Works 27
2.6.5 Construction Works 27
2.6.6 Commissioning 30
2.6.7 Operation 30
2.6.8 Servicing and Maintenance 31
2.6.9 Refurbishment 31
2.6.10 Decommissioning 31
2.6.11 Fire Management 32
2.6.12 Overview of Connection of the Wind Farm to the Electricity Grid 33

3 Planning & Assessment Framework 36
3.1.1 Commonwealth Legislation 36
3.1.2 New South Wales Legislation 37
3.1.3 State Environmental Planning Policies 40
3.1.4 Local Government Plans 40

4 Ecological Site Assessment 41
4.1 Literature Review 41
4.1.1 Aerial Photo Interpretation / Past Vegetation Mapping 41
4.2 Methods 42
4.2.1 Survey Conditions 44
4.2.2 Site Reconnaissance 45
4.2.3 Vegetation Mapping 45
4.2.4 Flora and Fauna Surveys 48
4.2.5 Biobanking Surveys 57
4.2.6 Limitations of Vegetation Mapping and Flora and Fauna Survey Methods 59
4.3 Results 61
4.3.1 Literature Review 61
4.3.2 Vegetation Communities / Condition 63
4.3.3 Flora 66
4.3.4 Fauna and Fauna Habitat 68

4.3.5 Fauna Groups 70
4.3.6 Threatened Fauna 71
4.3.7 Migratory Fauna 73
4.3.8 SEPP 44 – Koala Habitat 73
4.3.9 Watercourses and Lakes 74

5 Impact Evaluation 75
5.1 Introduction 75
5.2 Avoidance Measures 75
5.2.1 Grassland Earless Dragon 75
5.2.2 Little Whip Snake 77
5.2.3 Natural Temperate Grassland 77
5.2.4 Snow Gun Woodland and Ribbon Gum Open Forest 78
5.2.5 Concrete Batching Plant 78
5.3 Mitigation / Recommendations 78
5.4 Direct Impacts 95
5.4.1 Construction 95
5.4.2 Operation 104
5.4.3 Summary of Direct Impacts 110
5.5 Indirect Impacts 111
5.5.1 Construction 111
5.5.2 Operation 113
5.5.3 Decommissioning 114
5.5.4 Cumulative Impacts 114
5.6 Key Threatening Processes 115

6 Offset Strategy 118
6.1 Introduction 118
6.2 Offsetting Options 118
6.2.1 Purchase and Retire Credits 119
6.2.2 Review Expression of Interest (EOI) Register 119
6.3 Potential Offset Size 120
6.3.1 Biobanking Offset Calculations for Impact Site 120
6.3.2 Ecosystem Credits Required at Offset Site 120
6.3.3 Species Credits Required at Offset Site 121
6.4 Proposed Offset Packages 124
6.5 Concurrence of Offset Package with Offset Principles 127

7 Conclusion 132

8 References 133

Appendix A – Figures **138**

Appendix B – Plates **150**

Appendix C – Director General's Requirements **153**

Appendix D – Survey Weather Conditions **165**

Appendix E – Decision Chart and EPBC Act Natural Temperate Grassland Criteria (Rehwinkel) **172**

Appendix F – Biobanking Survey Methodology **173**

Appendix G – Flora Species List **176**

Appendix H – Fauna Species List **186**

Appendix I – Threatened Species Likelihood of Occurrence **203**

Appendix J – Dragon Habitat Characteristics **217**

Appendix K – Bat Collision Risk Matrix **220**

Appendix L – Part 3A Impact Assessment Criteria **223**

Appendix M – Biobanking Report **282**

Appendix N – Threatened Species Relocation Strategy **283**

Appendix O – EPBC Natural Temperate Grassland Impact Assessment **286**

List of Figures

Figure 1: Offsetting Process 118
Figure 2: Project site in a regional context 139
Figure 3: Study area and proposed turbine, reticulation, road and associated facilities layout 140
Figure 4: Vegetation quadrat locations 141
Figure 5: Survey locations 142
Figure 6: Vegetation mapping 143
Figure 7: Biobanking vegetation type and condition mapping 144
Figure 8: Native grassland in Boco area – priority groups (unpublished SRCMA, 2008) 145
Figure 9: Threatened species records 146
Figure 10: Grassland Earless Dragon habitat 147
Figure 11: Fauna habitat 148
Figure 12: Potential offset sites 149

List of Tables

Table 1: Site location details 7
Table 2: Annual weather conditions 9
Table 3: Area (hectares) impacted upon the proposed action 10
Table 4: Project components and approximate dimensions (based on greatest impact) 11
Table 5: Wind turbine Clusters 13
Table 6: Anticipated project timeframes 25
Table 7: Summary of preferred site office and construction compound locations 28

Table 8: Summary of preferred batching plant locations 28

Table 9: Eco Logical Australia field team 42

Table 10: Summary of survey conditions (averages) (BOM 2009) 44

Table 11: Example for calculating floristic value score 48

Table 12: Survey effort and timing 49

Table 13: Detailed fauna survey methods (approach agreed to between DECCW and Eco Logical Australia) 54

Table 14: Vegetation communities mapped within project site 61

Table 15: Noxious weeds recorded within the study area 68

Table 16: Key fauna habitat features present across the study area 69

Table 17: General mitigation measures 79

Table 18: Species Specific Mitigation Measures 89

Table 19: Proposed impact areas for each layout and road option 96

Table 20: Estimated clearance of each vegetation type under each road option 98

Table 21: Impacts on known, high potential and low Grassland Earless Dragon habitat 101

Table 22: Anticipated impacts on Little Whip Snake habitat 102

Table 23: Anticipated impacts on Striped Legless Lizard habitat 103

Table 24: Risk of turbine collision by bird species common throughout the study area 111

Table 25: Ecosystem credit requirements for 6 m road option 122

Table 26: Species credits required for 6 m road option 122

Table 27: Ecosystem credit requirements for 12 m road option 123

Table 28: Species credits required for 12 m road option 123

Table 29: Compliance table for Director General's Requirements dated 12 September 2009 and inputs from relevant agencies 153

Table 30: DECC Threatened Species and EEC Survey Requirements 159

Table 31: Supplementary Director-Generals Requirements (EPBC Act) 162

Table 32: Methods for Biometric Surveys 173

Table 33: Flora species recorded on Springfield, Yandra and Boco 177

Table 34: Flora recorded on Sherwins 180

Table 35: Opportunistic flora records 183
Table 36: Bats recorded across the study area and their flight character 186
Table 37: Diurnal bird records Yandra 187
Table 38: Diurnal records Sherwins, Springfield and Boco 189
Table 39: Opportunistic bird records Yandra and Springfield 191
Table 40: Opportunistic bird records Boco and Sherwins 195
Table 41: Spotlighting, stag watching and call playback records 199
Table 42: Mammal records 201
Table 43: Amphibian records 201
Table 44: Targeted reptile records (tiles, funnels and rock rolling) 202
Table 45: Opportunistic reptile records Sherwins and Boco 202
Table 46: Threatened species likelihood of occurrence 203
Table 47: Dragon habitat characteristics 217
Table 48: Bat collision risk matrix 220
Table 49: TSC Act listed species known to or with the potential to occur within the study area 223
Table 50: NTG Removal 287

Abbreviations

ABBREVIATION	DESCRIPTION
APZ	Asset Protection Zone
BEP	Bushfire Emergency Plan
CAP	Catchment Action Plan
CEMP	Construction Environmental Management Plan
CMA	Catchment Management Authority
CMP	Conservation Management Plan
DBH	Diameter at Base Height
DEC	Department of Environment and Conservation
DECC	Department of Environment and Climate Change
DECCW	Department of Environment, Climate Change and Water
DEWHA	Commonwealth Department of Department of the Environment, Water, Heritage and the Arts
DGRs	Director General's Requirements
DoP	NSW Department of Planning
DPI	NSW Department of Primary Industries
DrG	Derived Grassland
DW	Degraded wetland
DWE	NSW Department of Water and Energy
EEC	Endangered Ecological Community
ELA	Eco Logical Australia Pty Ltd
EMP	Environmental Management Plan
EOI	Expression of Interest
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
ha	hectares
HCV	High Conservation Value
km	kilometres
km /hr	Kilometres per hour

ABBREVIATION	DESCRIPTION
kph	Kilometres per hour
kV	Kilovolt
LEP	Local Environment Plan
LGA	Local Government Area
m	Metres
m^3	Metres cubed
ML	Mega litres
mm	millimetres
MW	Mega Watt
NTG	Natural Temperate Grassland
NW Act	*Noxious Weeds Act 1993*
OEMP	Operations Environmental Management Plan
RBVT	Revised Biometric Vegetation Type
RBVT	Revised Biometric Vegetation Type
RFS	Rural Fire Service
RGOF	Ribbon Gum / Snow Gum Open Forest
RoTAP	Rare or Threatened Australian Plants
rpm	Revolutions per minute
SEPP 44	State Environmental Planning Policy
SGW	Snow Gum / Candle Bark Woodland
SRCAP	Southern Rivers Catchment Action Plan
TSC Act	NSW *Threatened Species Conservation Act 1995*
TSMP	Threatened Species Management Plan
WMP	Weed Management Plan
WONS	Weeds of National Significance
WPCWP	Wind Prospect CWP Pty Ltd

Executive Summary

Eco Logical Australia Pty Ltd (Eco Logical) was commissioned by Wind Prospect CWP Pty Ltd to undertake an ecological assessment of a proposed wind farm at Boco Rock, southern NSW. The proposal includes the construction of a wind farm with up to 125 turbines at Boco Rock in the NSW Snowy Mountains (Figure 2). The proposal is to be assessed under Part 3A of *the Environmental Planning and Assessment Act 1979*.

Two road layout options are being investigated in order to reduce the likely vegetation clearance from the proposal:

- 12 m clearance area which will be revegetated / rehabilitated back to 6 m following construction;
- Roads 6 m wide with intermittent passing bays 12 m wide.

A Referral under the EPBC Act was submitted to DEWHA in May 2009 for the likely impacts of the proposal on the Grassland Earless Dragon (*Tympanocryptis pinguicolla*) and Natural Temperate Grassland. Negotiations were held between the proponent and DEWHA in an attempt to minimise impacts on NTG and threatened species. A decision to deem the proposal a Controlled Action under the EPBC Act was made on 18 August 2009.

In January 2007 the Commonwealth and NSW Governments signed a Bilateral Agreement which allows the assessment regimes under Part 3A of the EP&A Act to be automatically accredited under the EPBC Act. However, in light of recent planning reforms the Commonwealth is reviewing the application of the NSW Assessment Bilateral to projects subject to this part of the Act which have been determined a Controlled Action under the EPBC Act. The review is scheduled for completion and until a decision has been made the NSW Bilateral Assessment will no longer automatically apply to eligible Part 3A projects which have been deemed a Controlled Action.

Consequently, DoP has requested that the assessment for Boco Rock under Part 3A be subject to a one-off accredited assessment process and agreed that the assessment would be subject to the general administrative steps outlined in the NSW Assessment Bilateral administrative procedures.

For the benefit of stakeholder understanding, the study area has been broken down into four main clusters (see Figure 3), namely:

- ‘Yandra’, the north-east cluster (27/ 32 turbines)
- ‘Springfield’, the north-west cluster (20 / 23 turbines)
- ‘Boco’, the south-east cluster, and (21 / 23 turbines)
- ‘Sherwins’, the south-west cluster (39 / 47 turbines)

Targeted surveys for threatened species were undertaken across the study area between October 2008 and May 2009. Vegetation mapping, flora quadrats and an assessment using the Biobanking methodology were also undertaken.

The study area was found to support seven threatened fauna species and one endangered ecological community. Habitat was also present for a variety of threatened flora species although none were recorded. Threatened species and endangered ecological communities recorded on site included:

- Natural Temperate Grassland (EPBC Act)
- Grassland Earless Dragon (TSC Act & EPBC Act)
- Little Whip Snake (*Suta flagellum*) (TSC Act)
- Diamond Firetail (*Stagonopleura guttata*) (TSC Act)
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) (TSC Act)
- Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*) (TSC Act)
- Squirrel Glider (*Petaurus norfolcensis*) (TSC Act)

One migratory species, the White-bellied Sea-Eagle (*Haliaeetus leucogaster*) (EPBC Act), was also recorded within the project site, along the Maclaughlin River.

The study area supports extensive areas of NTG on the western side and hence large areas of potential habitat for a variety of threatened reptile species. The proponent has made a number of amendments to the proposed layout to minimise and avoid impacts of the proposal 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 the ridge top, the opportunities to avoid all impacts on NTG were limited.

Detailed below are 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. These include:

- Access paths have been designed around current tracks and roads present within the study area where possible to minimise vegetation clearance for access;
- The reticulation (electrical cabling) has been placed underground and within the road footprint where possible to allow for temporary rather than permanent disturbance. Reticulation will pass overhead across gullies and waterways to reduce impacts;
- Two turbines (93a/81b, 92a/80b) located in the west of the project site, where a number of Grassland Earless Dragons have been recorded, have been removed from the proposal. This will prevent the proposal impacting on the largest known population of Grassland Earless Dragon within the site area;
- Turbine micro-siting will be used to avoid other known locations of Grassland Earless Dragon, such as those within the Springfield and Sherwins clusters (see Figure 9). For these individuals the road and reticulation design has been altered to allow for a minimum 50 m buffer from the recorded Grassland Earless Dragon location.
- The road and reticulation layout has been designed to follow current tracks throughout the site wherever possible in order to minimise the effects on Grassland Earless Dragon habitat;
- Where existing tracks do not exist, roads and reticulation have been routed along the edges of the known habitat of the Grassland Earless Dragon 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 Grassland Earless Dragon habitat and low potential habitat (primarily observed on the steeper slopes of the range).

- Construction during sensitive lifecycle stages of the Grassland Earless Dragon (i.e. mating, laying and incubation period: November – January) will not occur on the Sherwin and Springfield clusters.
- Pre-clearance surveys will be undertaken and Grassland Earless Dragons relocated from the proposed impact area to nearby relocation sites.
- In order to have the opportunity to implement adaptive management based on findings and lessons from the initial relocations, the Springfield and Sherwins clusters will be constructed separately.
- In order to avoid impacts on the Little Whip Snake, the road layout has been amended to provide a 50 m buffer between the road and this record.
- Road layouts have been placed outside areas of NTG so as to minimise fragmentation of NTG wherever feasible;
- Potential locations for concrete batching plants have been located in disturbed and sown areas to avoid further impacts on NTG;
- Placement of turbines such that tree clearing is minimised 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; and
- Where possible, turbines have been placed in woodland areas where groundlayer disturbance has previously taken place (eg. sown areas).

Biodiversity Offsets using 'Maintain and Improve' Principles

A number of mitigation measures will also be implemented to minimise impacts from the proposal on the ecological values of the site. For those impacts that cannot be mitigated, biodiversity offsets have been proposed using the quantitative formula's within the DECCW's Biobanking tool to provide a guide to the size of offsets required.

An assessment of the offset required for the 125 layout and both 12 m and 6 m road options has been undertaken in accordance with an indicative Biobank assessment of the impact site. A summary of the credits required to offset the impact of the proposal in included below.

6 m road option

Ecosystem credits

The 6m layout requires a total of 3,898 credits to offset the impact on the five impacted vegetation types. Two offset scenarios have been tested, including an offset site in benchmark condition and an offset site in moderate/good condition supporting the required vegetation types. Based on the number of credits that could potentially be generated at sites in these conditions, between 390-557 hectares of offset is required to fully offset the impact of the 6m layout.

Species credits

In addition to the 390-557 hectares of offset required for the ecosystem credits, approximately 185 hectares of offset is required for the Grassland Earless Dragon habitat impacted by the proposal. Under

Biobanking these credits can be obtained from the same Biobank site as the ecosystem credits, or a different Biobank site should that be required.

12 m road option

Ecosystem credits

The 12m layout requires a total of 4,991 credits to offset the impact on the five impacted vegetation types. Two offset scenarios have been tested, including an offset site in benchmark condition and an offset site in moderate/good condition. Between 499-713 hectares of offset is required to fully offset the impact of the 12m layout.

Species credits

In addition to the 499-713 hectares of offset required for the ecosystem credits, approximately 230 hectares of offset is required for the Grassland Earless Dragon habitat impacted by the proposal. Under Biobanking these credits can be obtained from the same Biobank site as the ecosystem credits, or a different Biobank site should that be required.

It is noted that all of the vegetation communities being impacted are “Red Flagged “ due to either being listed as endangered ecological communities (NTG under the EPBC Act) or vegetation types in moderate-good condition that are greater than 70% cleared in the Southern Rivers CMA region. The GED is not red flagged. Consistent with the principles for varying red flags, it is proposed that additional credits will be purchased and retired including surplus credits generated for the Grassland Earless Dragon and Striped Legless Lizard.

Approval is being sought for the proposal based on an assessment of the impacts and offset requirements based on the understanding of impacts at the time of approval. The credit calculations will be repeated post approval following final micro-siting of turbines and road design and any other modifications or impacts as a result of the approval.

Offsets Options

Three alternative offset packages have been proposed, based on the indicative calculations undertaken, to compensate for the residual impacts of the proposal that cannot be ameliorated through avoidance and mitigation measures. There is also the potential for these to be modified and a combination of options to be provided. Further details regarding each of the proposed offset options are outlined below and have been discussed with DECCW. The DECCW stated that given the significance of the Grassland Earless Dragon records and habitat, their preferred offset option would be Option 2.

Option 1: Biobank Agreements with adjacent landowners to protect;

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

Figure 12 illustrates those lands within which offsets could be provided to ensure the in perpetuity protection of each of these vegetation types. Initial consultations with landowners interested in entering into Biobanking Agreements have taken place. The Yandra cluster and the eastern portion of the Sherwins and Springfield clusters could contribute to meeting the SGW and RGOF offset requirements whilst those properties in the west would meet the NTG offset requirements.

It is anticipated that under this option all areas would be protected under a Biobanking Agreement. Given the proposal is still to undergo a detailed design phase and micro-siting, it is envisaged that the Biobanking Tool would be re-run following the detailed design phase and the proposed offset areas for each vegetation type amended in accordance with the revised Biobanking calculations.

Option 2: Biobank Agreement with adjacent land owner 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 12):

- 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 Grassland Earless Dragon, Little Whip Snake and Striped Legless Lizard, this site is considered the highest priority for conservation and discussions have taken place with the landowner who has expressed interest in entering into a Biobank Agreement and thus making credits available to Wind Prospect CWP. In addition, areas where clusters of dragons have been recorded will be incorporated wherever possible.

Option 3: Three year monitoring program

The provision of funding for research as a part of the mitigation package is also an option. It is believed that the research proposed below would contribute valuable information to the body of knowledge that informs regional land management practices, particularly in areas containing Grassland Earless Dragons. The proposed research is to be conducted in the two stages outlined below and includes links with the key objective in the National Recovery Plan for the Grassland Earless Dragon. The University of Canberra has expressed interest in conducting the research should this option be incorporated into the offset package. It is possible that this work may also be undertaken by a private consultant.

The proposed research has been separated into two phases:

- Survey of distribution and habitat; and
- Relocation studies

1 Introduction

Eco Logical Australia Pty Ltd (Eco Logical) was commissioned by Wind Prospect CWP Pty Ltd to undertake an ecological assessment of a proposed wind farm at Boco Rock, southern NSW. The proposal includes the construction of either a 107 or 125 turbine wind farm at Boco Rock in the NSW Snowy Mountains (Figure 2). The proposal is to be assessed under Part 3A of *the Environmental Planning and Assessment Act 1979*.

Wind Prospect CWP are proposing to develop and build a wind energy facility known as Boco Rock Wind Farm (the 'project') within a 10 km by 12 km area on the edge of the Great Dividing Range in NSW. The project will consist of up to 125 turbines with an overall project capacity of approximately 270 MW. The proposed development comprises the wind turbines as well as ancillary structures and equipment which will be positioned in accordance with site constraints. The ancillary structures and equipment include underground electrical cabling (reticulation), access tracks, wind measuring masts, a collector substation and facilities building, and temporary/compound facilities during the construction phase.

1.1 KEY TERMS

For the purposes of this report the following terminology has been used when referring to the investigation area and these boundaries are shown in Figure 3.

Project site: Land within the cadastre boundaries of all properties likely to be directly impacted by the proposal

Study area / development envelope: 200 m wide corridor in which the turbine footprint, roads and reticulation will be contained

Development footprint: includes all proposed locations of the turbines, roads, reticulation, substation and facilities building.

The site area has been broken into four main areas for ease of reference during this report. These are listed below and shown on Figure 3.

- 'Yandra', the north-east cluster (107 layout - 27 turbines, 125 layout – 32 turbines)
- 'Springfield', the north-west cluster (107 layout - 20 turbines, 125 layout – 23 turbines)
- 'Boco', the south-east cluster, and (107 layout - 21 turbines, 125 layout – 23 turbines)
- 'Sherwins', the south-west cluster (107 layout - 39 turbines, 125 layout – 47 turbines)

Locality: Area encompassing all lands within a 10 km buffer around the project site.

Substation cluster: Incorporates the northern ten wind turbines, internal roads, electrical cabling and the site collector substation of the Sherwins Cluster.

1.2 STUDY AREA

1.2.1 Site Location

The proposed Boco Rock Wind Farm project is located about 10 km south-west of Nimmitabel and 30 km north of Bombala on the edge of the Great Dividing Range in NSW. The study area falls within the Cooma - Monaro Council and Bombala Council areas and is zoned Rural. The project site comprises farming land owned by 17 different landowners. The farms are currently grazed by sheep and / or cattle and have been for multiple generations. A mix of set stocking and rotational grazing has occurred by the different landowners. Cropping is also evident across some parts of the site and spray seeding has occurred across many areas for decades.

The total 'project site' area, based on cadastre lot layout is 11,750ha and it falls within the following Latitude and Longitude points shown below in Table 1.

Table 1: Site location details

Latitude			Longitude		
Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
-36	31	17	149	13	9
-36	33	46	149	13	37
-36	35	51	149	12	15
-36	36	10	149	11	55
-36	37	40	149	6	44
-36	39	44	149	4	38
-36	39	21	149	4	10
-36	34	46	149	4	58
-36	32	23	149	7	14
-36	31	47	149	10	22

The Boco Rock Wind Farm is situated along the high altitude plateau of the Monaro Plains. The ranges are of moderate-to-high elevation (900 to 1,100 m above sea level, Australian Height Datum), dominated by the Sherwin Range running in a north-south direction. The nearest township is Nimmitabel, which is located approximately six (6) kilometres (km) east of the proposed site.

Roads of significance are Avon Lake Rd towards the eastern extension of the project site, Ando Rd (the Snowy Mountain Way) on the southern section and Springfield Rd borders the northern section of the project site. The project site and its immediate surrounds are illustrated in Figure 3.

The majority of the landscape is used for agricultural and farming practises under varying management regimes.

1.2.2 Rivers, Creeks and Watercourses

There are a number of dry creeks and lakes occurring on site, including Boco Creek, Gentle Barlow Creek and Coopers Lake. There are also several dams and small streams located on site. Most dams show signs of current cattle and sheep access. The main water course within the project site is the MacLaughlin River which flows through the project site generally from west to east. This is a damned river so water flow is variable and controlled throughout the year.

1.2.3 Soils and Geology

Mitchell Landscapes are a system of ecosystem classification mapped at 1:25 000 scale, based on a combination of soils, topography and vegetation (NPWS 2003). Two Mitchell landscapes have been mapped for the study area. The Monaro Plain Basalts and Sands landscape is the most dominant landscape at the locality with Monaro Alluvium also occurring, along Boco Road.

Soil landscapes in the study area comprise erosional, alluvial and residual landscapes mostly of basalt origin. The predominant soil landscape is Brothers occurring on moderately steep slopes beneath summits on basalt, followed by Quidong occurring on undulating to rolling low hills on low quartz sedimentary, and Upper Cooma Creek occurring in valley flats on black clays. Relatively small patches of Maneroo occur at lower altitude to Brothers, and small patches of Maneroo variant occur at higher altitude to Brothersarea (Tulau, 1994; Mark Young, DECC, 2009a, pers comm.).

1.2.4 Vegetation Communities

Natural Temperate Grassland (NTG), Snow Gum / Candle Bark Woodland (SGW), Ribbon Gum / Snow Gum Open Forest (RGOF), derived grassland and disturbed grassland / exotic pasture are the vegetation types on site. Native vegetation communities vary in condition across the study area and vary according to grazing intensity and pastoral impacts.

1.2.5 Surrounding Reserves

The closest reserve to the study area is a Crown reserve located 1.6 km to the north of the study area and approximately 5 ha in size. The closest Nature Reserves are Marriangaah Nature Reserve approximately 7km south of the study area, Ironmungy Nature Reserve approximately 10km west of the study area and Bobundara Nature Reserve located 12km to the North West.

1.2.6 Climate

The nearest meteorological station to the study area is Nimmitabel Wastewater Treatment Facility (Station No. 70067, elevation 1075 m) which is located 10km to the north east of the study area. Climate data for Nimmitabel are summarised below (Bureau of Meteorology website www.bom.gov.au, accessed 23 April 2009).

Table 2: Annual weather conditions

Average weather conditions	Measurements
Annual rainfall:	687.7 mm
Highest monthly rainfall	68.2 mm (December)
Lowest monthly rainfall	46 mm (August)
Annual minimum / maximum temperatures	3.4° C / 15.6° C
Highest mean monthly maximum temperature	22.8° C (January)
Lowest mean monthly minimum temperature	-1.9° C (July)

1.3 REPORT STRUCTURE

The report is structured in order of the following:

Introduction – provides context for the landscape in which the study area is located.

Description of the proposal – Outlines the proposal, layout options and all project components and their likely impact areas.

Planning and assessment framework – Outlines the legislative framework under which the proposal is to be assessed include Commonwealth and NSW legislation and any requirements under State Environmental Planning Policies (SEPPs).

Ecological Site Assessment – outlines the survey methodology and findings of the surveys.

Impact Evaluation – Outlines the measures undertaken to avoid and mitigate impacts from the proposal and assesses the likely direct and indirect impacts from the proposal

Offset Strategy – presents the proposed offset options for those residual impacts that cannot be avoided or mitigated.

Conclusion / Recommendations – Summarises the key findings of this assessment under state and Commonwealth legislation.

2 Description of Project

Wind Prospect CWP Pty Ltd are proposing to develop and build a wind energy facility known as Boco Rock Wind Farm (the 'project') within a 10 km by 12 km area on the edge of the Great Dividing Range in NSW. The project will consist of up to 125 turbines as well as ancillary structures and equipment which will be positioned in accordance with site constraints. The ancillary structures and equipment include underground electrical cabling, access tracks, wind measuring masts, a collector substation and facilities building, and temporary/compound facilities during the construction phase.

When first announced in September 2008 the Project consisted of up to 73 turbines spread over nine different properties, with the capability to produce enough energy to supply over 70,000 average Australian households.

However in response to the announcement and a local resident "door-knocking" exercise, several changes were made to the Project. The majority of the responses received were positive. Where responses were less positive consultation with those affected parties was undertaken to mitigate the impact of the Project. Together with more detailed grid connection studies, other Project related studies and discussions with turbine manufacturers the Project was modified both in terms of scale and the area on which the Project will be situated.

The Project now comprises a wind farm with two potential design layouts; one consisting of 125 wind turbines (Layout Option 1) and the other 107 wind turbines (Layout Option 2) spread over 17 different properties (the Project site). The difference in number between the two layouts is due to the relative sizes of the wind turbine models being considered for the Project, and in particular their blade lengths, which determines turbine spacing. The choice between these two design layouts is largely dependent on a successful tender process for the supply of wind turbines to the Project.

Two road layout options are also being investigated in order to reduce the likely vegetation clearance from the proposal:

- 12 m clearance area which will be revegetated back to 6 m following construction;
- Roads 6 m wide with intermittent passing bays 12 m wide.

The Development Footprints (the area directly impacted upon by the construction of the Project) differ slightly with respect to the two layouts and road options, and are summarised in Table 3 below.

Table 3: Area (hectares) impacted upon the proposed action

Impact Area	Area (ha)	
	6 m Road	12 m Road
Development Envelope	1652.65	1652.65
Development Footprint layout option 107	160.31 (Permanent 65.86) (Temporary 90.45)	197.04 (Permanent 105.14) (Temporary 91.90)
Development Footprint layout option 125	162.53 (Permanent 68.12) (Temporary 94.41)	200.15 (Permanent 106.75) (Temporary 93.40)

The Project will have an installed capacity of approximately 270 MW, which is dependent on the turbine model selected, and will consist of the following components:

- the installation of up to 125 wind turbines in the area south west of Nimmitabel, NSW (refer to Figure 3) with a maximum blade tip height of 152 m;
- one collector substation comprising cable marshalling, switchgear and transformers,
- site operations facilities and services building;
- underground electrical interconnection lines (33 kilovolt (kV) capacity) and control cables within each of the wind turbine Clusters, connecting to the collector substation;
- overhead electrical interconnection lines (33 kV capacity) and control cables between three of the wind turbine Clusters and the collector substation;
- access roads from the public highways to the turbine locations and collector substation;
- crane hardstand areas for the erection, assembly, commissioning, maintenance, recommissioning and decommissioning of the wind turbines;
- approximately four permanent wind monitoring masts;
- temporary site office and storage compound including site parking;
- appropriate wind farm signage both during the construction and operational phases of the proposed development; and
- mobile concrete batching plant(s) and rock crushing facilities.

The output of the Project will connect via a new 132 kV double-circuit overhead transmission line to existing Country Energy owned lines east of the Project site. This new line and associated substation at the point of connection will be assessed separately from the Project and will be subject to a separate approval under Part 5 of *the Environmental Planning and Assessment Act 1979* (EP&A Act). However, to provide context to this EA, a description of the proposed transmission line is included in Section 2.6.12.

Typical dimensions of the components that comprise the Project are presented in Table 4 below. The estimated impact area for the transmission line is also detailed below to give stakeholders the opportunity to understand the overall study area of all activities associated with the Project.

Table 4: Project components and approximate dimensions (based on greatest impact)

Project Component	Approximate Dimensions
Permanent	
Turbine footings (max footprint)	15 x 15 m
Turbine assembly / crane hardstand areas	50 x 25 m
Collector substation	100 x 100 m
Facilities building	30 x 6 m
Site access: new roads *	70 km x 12 m
Site access: upgrade of existing internal roads/tracks *	9 km x 6 m
Underground cabling on-site	64 km x 1 m

Project Component	Approximate Dimensions
Under or above ground cabling on-site #	4 km x 30m
Internal overhead electrical interconnection / easement #	14 km x 30 m
Temporary (during construction)	
Earthworks alongside permanent infrastructure (roads/hardstands) ^	70 km x 10 m (est.)
Concrete batch plant	50 x 100 m
Rock crushing facility	50 x 60 m
Site office	40 x 100 m
Construction compound	150 x 200 m
Components Subject to Part 5 of the EP&A Act (1979)	
External overhead electrical cable #	25 km x 45 m
External substation	200 x 200 m

** It is expected that if a 12 m wide road design is considered appropriate for construction, then up to 6 m of road width will undergo rehabilitation after the infrastructure has been installed (post construction phase). The width of the road required is dependent on final turbine selection and availability of suitable cranes. Track-mounted cranes require roads up to 12 m in width where as tyre-mounted cranes require roads 6 m in width. If a 6 m road design is constructed then no rehabilitation would occur to the road after the infrastructure has been installed (post construction phase).*

 # The estimated easement width is 30 m for the internal overhead powerlines and 45 m for the transmission line, however the actual impact area has been estimated to be 5 % of this total area given the low level of impacts associated with installing the power/transmission lines and the sparse vegetation cover along the selected routes.

^ Construction of the internal road network will require earth works that are beyond the limits of the permanent road impact within the study area. This is required to level areas of steep gradient to a design suitable for safely transporting Project components into position. Detailed civil designs have been prepared for Layout Option for the 125 turbine layout (considered to have the greatest impact) that include impacts associated with permanent road, hardstand and turning head areas in addition to the area considered the extent of the earth works.

The two layout options have been designed with respect to a number of technical, environmental and social factors and more detailed site assessments. The layouts ensure optimum, undisturbed use of the measured and predicted wind resource, after accommodating constraints, for the range of turbines currently being considered for the project.

Given the scale of the project it is likely that 'Clusters' of turbines will be constructed and commissioned in stages. Consequently, and for the benefit of stakeholder understanding, we have broken down the project into four main Clusters (Table 5, Figure 3).

Table 5: Wind turbine Clusters

Turbine Cluster	Number of Turbines (125 layout)	Number of Turbines (107 layout)	General location
"Yandra"	32	27	North eastern Cluster, accessible via Yandra and Benbullen Roads off Springfield Road
"Springfield"	23	20	North western Cluster, accessible via Dummy Lane off Springfield Road
"Boco"	23	21	South eastern Cluster, accessible via an internal access road and Boco Road off the Snowy River Way
"Sherwins"	47	39	South western Cluster, accessible via Avon Lake Road and the Snowy River Way

A fifth Cluster, referred to as the 'Substation Cluster' (see Figure 3), incorporates the northern wind turbines, internal roads, electrical cabling and the Project site collector substation of the Sherwins Cluster. This has been defined with respect to any staging of construction activity. If the Sherwins Cluster is not constructed in the first phase of works, it will be necessary to construct the electrical infrastructure associated with the 'Substation Cluster', to enable the power generated to connect to the collector substation and be exported.

2.1 WIND FARM INFRASTRUCTURE

It is not yet known which model of wind turbine will be used for the Project as final turbine selection will occur through a competitive tender process pending development approval. However, in terms of generation capacity, the wind turbines under consideration for this Project vary in the range from between 1.8 and 3.3 MW. By way of example the Suzlon S88, 2.1 MW machine (as installed at the Capital Wind Farm, east of Lake George, New South Wales (NSW)) is typical of the type of wind turbine that could be used.

2.1.1 Turbine Rotor

The turbines used for the Project will be three-bladed, semi-variable speed, pitch regulated machines with rotor diameters between 88 and 104 m and a swept area of 6,083 to 8,490 square metres (m^2). Typically turbines of this magnitude begin to generate energy at wind speeds in the order of 4 metres per second (m/s) (14.4 kilometres per hour (kph)) and shut down (for safety reasons) in wind speeds greater than 25 m/s (90 kph). Wind turbine blades are typically made from glass fibre reinforced with epoxy or plastic attached to a steel hub, and include lightning rods for the entire length of the blade. The blades typically rotate at about 12 revolutions per minute (rpm) at low wind speeds and up to 18 rpm at higher wind speeds.

2.1.2 Towers

The supporting structure is comprised of a reducing cylindrical steel tower fitted with an internal ladder or lift. The largest tower height under consideration is 101.5 m with an approximate diameter at the base of 4.5 m and 2.5 m at the top. However it is important to note that the rotor diameter suitable for this wind turbine is 100 m and therefore falls within the maximum proposed blade tip height of 152 m.

Alternative tower heights of 80, 85, 94 and 100 m are also under consideration however this is not an exhaustive list since new models and certified designs are continually entering the market place. The tower will typically be manufactured and transported to site in three to five sections for on-site assembly.

2.1.3 Blade Tip

The blade tip will comprise the highest point of the wind turbine when in a vertical position. Given the turbines under consideration, a blade tip height of 152 m is considered to be the maximum.

2.1.4 Nacelle

The nacelle is the housing constructed of steel and fibreglass that is mounted on top of the tower and can be 10 m long and 4 m high and 4 m wide. It encloses the gearbox, generator, transformers, motors, brakes, electronic components, wiring and hydraulic and lubricating oil systems. Weather monitoring equipment located on top of the nacelle will provide data on wind speed and direction for the automatic operation of the wind turbine.

2.1.5 Turbine Foundations

Three types of foundation for the turbines will be considered pending geotechnical investigation of the ground conditions at the project site.

- Slab (gravity) foundations would involve the excavation of approximately 450 cubic metres (m3) of ground material to a depth of approximately 2 m. Approximately 200 m3 would, if suitable, be used as backfill around the turbine base. Remaining excavation material will be used for the on-site road infrastructure, where necessary.
- If slab plus rock anchor foundations are required, the construction of the foundation for each machine would involve the excavation of approximately 300 m3 of ground material to a depth of approximately 2 m. Slab plus rock anchor foundations require shuttering and steel reinforcement, drilling of rock anchor piles up to a depth of approximately 20 m, concrete pour, after which the rock anchors are stressed and secured once the concrete has cured sufficiently.
- If a single mono-pile foundation is required (rock anchor), approximately 50 m3 of ground material would be removed by a rock drill to a depth of approximately 10 m, of which 30 m3 would, if suitable, be used as back fill. If a mono-pile foundation is used, a tubular section with tower connection flange attached is inserted in the hole and concrete is then poured in situ.

Detailed geotechnical surveys will be carried out during pre-construction work to determine the necessary foundation type per turbine. It is feasible that more than one type of turbine foundation may be required for the Project, following the assessment of the individual turbine locations. New turbines are continually coming on to the market and it is possible that minor variations to these typical dimensions could occur prior to final turbine selection. Impact assessments undertaken for the Project assume the use of the largest foundation footprint for all turbines, i.e. slab plus rock anchor.

2.1.6 Crane Hardstand and Site Access

Site access roads would have areas of hardstand (approximately 50 by 25 m) adjacent to each wind turbine for use during component assembly and by cranes during installation. The clearing of native vegetation for the construction of access roads and hardstand areas will be avoided where possible. If

clearing is found to be unavoidable, this will be appropriately managed and carried out as described in the EA Statement of Commitments. The roads would be surfaced with local stone to required load-bearing specifications. The roads and hardstand areas would be maintained throughout the operational life of the Project and used principally for the periodic maintenance of the wind turbines.

2.1.7 Monitoring Masts

Approximately four permanent wind monitoring masts, up to 100 m high, are proposed to be installed on-site. Locations for these masts are yet to be determined and will be influenced by the final wind turbine selection. These permanent masts may incorporate the existing temporary structures and provide information for the performance monitoring of the wind turbines. The wind monitoring masts would be of a guyed, narrow lattice or tubular steel design.

2.1.8 Electrical Infrastructure

The electrical works, including those incorporated in the wind turbine structures, will involve:

- up to 125 wind turbine generator transformers;
- the establishment of a 100 by 100 m collector substation with 33 kV-to-132 kV transformers, circuit breakers and isolators;
- approximately 64 km of 33 kV entrenched underground cables;
- approximately 14 km of 33 kV overhead electrical interconnection cables;
- approximately 4 km of underground or overhead electrical interconnection cables (decision as to whether this infrastructure will be located under or above ground will be subject to detailed design);
- approximately 68 km of underground control cables (4 km may be underground or overhead); and,
- establishment of a 30 by 6 m operation facilities building to house control and communications equipment.

2.1.9 Generator Transformer

The wind turbine generators typically produce electricity at nominally 0.69 kV which is stepped up to 33 kV by the transformer located in either the nacelle, the base of the tower or close to the base of the tower on a concrete pad.

The generator transformer may be oil-filled or a dry type depending on the wind turbine. Where oil-filled transformers are used, appropriate measures will be incorporated to prevent any oil loss reaching local water courses. The volume of oil used for generator transformers is in the order of 1,000 litres (L). The output from each of the turbines will be directed via 33 kV cables that link to the 33/132 kV collector substation.

2.1.10 Collector Substation

The collector substation location has been chosen to minimise access distance and electrical losses, and to reduce its visibility from surrounding public viewpoints. The collector substation will be 2 km from ‘Boco’, the nearest inhabited dwelling. Following construction, and if warranted, small areas of tree planting could be undertaken to screen any part of the collector substation that are visible from the surrounding country to reduce visual impact. Access to the collector substation site for construction

purposes will be via the new internal access road off Avon Lake Road. Post-construction access would be along the same route or alternatively via Boco Road, which links to the internal road network via the Snowy River Way.

The collector substation will include two 150 megavolt ampere (MVA) transformers to step-up the voltage from 33 kV to 132 kV, together with ancillary equipment. It will occupy an area approximately 100 by 100 m and will be surrounded by a 2 m high security fence, surmounted by strands of barbed wire. The collector substation arrangement will include an array of busbars, circuit breakers, isolators, various voltage and current transformers and a static compensator-capacitor as agreed with Country Energy. A buried earth grid will extend one metre beyond the fence on all sides. The ground surface within the collector substation enclosure will be covered partly with a layer of crushed rock and partly by concrete slabs. As the transformer may contain upwards of 80,000 L of oil, provision will be made in the design for primary and secondary containment of any oil that may leak or spill from the transformers or associated components. This would involve constructed concrete bunds around each transformer and a spill oil retention basin or oil/water separator outside the collector substation compound. The 1 ha area includes a provision for a 20 m buffer of land surrounding the equipment.

Consideration was given to the establishment of two internal collector substations. However, studies indicated that although both options would have similar electrical protection requirements, a single collector substation approach both reduces the land use requirement (and therefore impact area) but in addition offered greater operational flexibility by allowing for full power transfer between the two transformers. Therefore, a single collector substation design results in a lower cost, lower land use and a better level of network reliability so is the preferred and proposed option.

2.1.11 Overhead and Underground Cables

The electrical cables from the Sherwins Cluster will comprise of underground cabling (with the two connections across the Snowy River Way and Avon Lake Road proposed to be either under or above ground), and will connect directly to the collector substation. The Yandra, Springfield and Boco Clusters are over a kilometre or greater from the substation and a double-circuit overhead power line from each Cluster operating at 33 kV is proposed to connect the combined output of the turbines to the substation. These double-circuit 33 kV overhead lines will run approximately east-west for distances up to 6 km. Where feasible the lines to the Springfield and Yandra Clusters will be attached to the same poles and along the same easement leading into the collector substation. The respective routes will be located so that they will not be generally visible from much of the surrounding countryside and to minimise the clearance of trees.

The underground cable routes will generally be between the turbines and follow the route of the internal access roads. The final route will minimise vegetation clearing and avoid potential erosion and heritage sites and will also depend on the ease of excavation, ground stability and cost. Markers may be placed along the route of the underground cables, if agreed by the participating landowners. Placement of these cables below ground will result in minimal visual impact.

Control cables will interconnect the wind turbine generators and the operation facilities building. Computerised controls within each wind turbine will automatically control start-up, speed of rotation and cut-out at high wind speeds. Recording systems will monitor wind conditions and energy output at each of the turbines. Remote monitoring and control of the Project will also be possible. Control cables will consist of optic fibre, twisted pair or multi-core cable and will be located underground within the groups of turbines and above ground between the Yandra, Springfield and Boco Clusters and the facilities building located at the collector substation location within the Sherwins Cluster. Above ground control

cables would be strung from the poles of the internal 33 kV overhead lines located between the Clusters.

The installation of buried earthing conductors and electrodes will also be required in the vicinity of the turbines, the facilities building and the collector substation.

2.1.12 Operation Facilities Building

A facilities building approximately 30 by 6 m will be constructed at the same location as the collector substation. The general location has been chosen to minimise the length of overhead lines and underground cables and also to minimise the visibility of the facilities building and substation. The building will house instrumentation, electrical and communications equipment, routine maintenance stores, a small work area and staff amenities.

The structure is proposed to be a slab-on-ground construction with steel frame, metal or brick walls and a sheet-steel roof or alternatively a transportable type building constructed on piers. It will be of sturdy construction, suitable for the weather conditions it will be exposed to and will be compatible with the rural environment. Roof drainage will collect rainwater for domestic use. A septic or composting toilet system, which complies with Council requirements, will be installed to treat the small amount of waste water produced.

The design of the collector substation, electrical installations and operation facilitates building will be developed in conjunction with Country Energy and comply with relevant technical, electrical and planning standards.

2.2 SITE ACCESS

2.2.1 Site Entry

The Project locality can be reached via the Monaro Highway at Nimmitabel via the existing arterial roads of Springfield Road, Avon Lake Road, and the Snowy River Way.

The deep gullies which join the Maclaughlin River provide an access constraint within the Project site resulting in the proposed layout comprising four Clusters of turbines which require separate access points to the public road network.

Existing access roads can be classified in to three broad categories:

- National Highways: Monaro Highway, which is maintained by the Roads and Traffic Authority, would provide access from Canberra to Springfield Road immediately south of Nimmitabel;
- Regional Roads: Snowy River Way (also referred to as Ando Road) which is maintained by Bombala Council and connects the Bombala area to the Snowy Mountains via Dalgety and Berridale;
- Local Roads: All other roads which are maintained by the Council (either Bombala or Cooma-Monaro Shire). This includes Springfield Road which will be the major access to the Project site from Nimmitabel; and
- The Roads and Traffic Authority (RTA), Bombala and Cooma-Monaro Councils have ongoing maintenance and improvement programmes for the roads and bridges under their control.

Bombala Council has a continuing programme for the reconstruction and sealing of the gravel section of Snowy River Way. Reconstruction is currently taking place from the western end of the gravel section near Boco Road towards the locality of Ando for a distance of 3 km.

There are no current proposals for major road improvements on the other access roads under consideration.

The currently favoured access points for the four Clusters are described below:

- Yandra Cluster: The major access point is from Yandra Road via the access road to "Benbullen" which departs Yandra Road at 1.5 km from Springfield Road;
- Springfield Cluster: The access point under consideration is from Brechnoch Road, approximately 13 km from Nimmitabel, this is in relation to siting the temporary site office, construction compound and a concrete batching plant facility adjacent to Brechnoch Road and subsequently reducing transport distances during the construction phase. An alternative access point off Springfield Road is located approximately 16 km from Nimmitabel, along an existing laneway entry known locally as "Dummy Lane";
- Sherwins Cluster: Access points being considered are at 22.5 km from Nimmitabel on Avon Lake Road and on both sides of Snowy River Way (Ando Road) at approximately 28 km from Nimmitabel; and
- Boco Cluster: Access will be from the same internal access road from Avon Lake Road as required for the Sherwins Cluster, to avoid unnecessary impacts to the Riparian corridor along the Maclaughlin River that would otherwise result from the upgrade of the Boco Road.

Note: 25 km of the arterial road access likely to be used for construction activities are unsealed. This has implications for water usage and dust suppression and is discussed later in this chapter.

All entrances to the project site from the existing arterial roads will be designed to allow long vehicles to safely exit from or re-enter without disrupting traffic. Further consultation will be undertaken with Council and the RTA to confirm the final design.

Onsite Access Roads

Other access consists of new on-site roads between turbines, also comprising hardstand and turning head areas. The on-site roads will follow existing farm tracks where possible that traverse the ridgelines and plateaus. All roads leading from the arterial roads and all on-site access roads are likely to require a full or partial upgrade to accommodate the construction traffic loads, as well as for maintenance purposes during operation.

New internal access roads will consist of either a 12 or 6 m wide design. The 12 m wide design is applicable for a track-mounted 'crawler' crane whereas the 6 m wide design is suited for a more mobile tyre-mounted crane. If a 6 m design is constructed it will incorporate passing bays up to 12 m wide located at intervals of approximately 1 km to allow for the safe passage of vehicles.

Currently crawler cranes are more common within the Australian market place and therefore the assessments undertaken within this EA are based around the greatest impact arising from a 12 m wide design for the 125 layout option. However tyre-mounted cranes are beginning to enter the market and if available will be considered for this Project.

Construction of the internal road network will require earth works that are beyond the limits of the permanent road impact within the study area. This is required to level areas of steep gradient to a design suitable for safely transporting Project components into position. Detailed civil designs have been prepared for the 125 layout option that include impacts associated with permanent road, hardstand and turning head areas in addition to the area considered the extent of the earth works. Designs have been carried out for both a 12 m and 6 m (with passing bays) road, hardstand and turning head network.

If a 12 m wide road design is considered appropriate for construction, then up to 6 m of road width will be rehabilitated after the infrastructure has been installed (post construction phase). If a 6 m road design is constructed then no rehabilitation would occur to the road after the infrastructure has been installed (post construction phase).

The roads will be surfaced with compactable, engineered base material with suitable drainage. Materials will be sourced locally where possible and in consultation with the local Councils. Measures will be taken to minimise the risk of the spread of weeds and disease from materials brought in for construction purposes.

The required on-site access for the four Clusters are described below:

- Yandra Cluster: Approximately 6 km of the existing roads will require full or partial upgrade, whilst a further 17 km of new internal on-site access will be required;
- Springfield Cluster: Approximately 1.5 km of the existing Brechnoch Road will require a partial upgrade and approximately 200 m of the existing laneway entrance (Dummy Lane) will require a full upgrade, if required. A further 11 km of new internal on-site access will be required;
- Sherwins Cluster: No existing roads will require upgrade, although 25 km of new internal on-site access will be required; and
- Boco Cluster: Approximately 1 km of existing farm track will require a full upgrade, with a further 17 km of new internal on-site access required.

Internal Link Road

A link road from the Sherwins Cluster and collector substation site to the Boco Cluster is proposed as the main access point for construction activity to occur between to two sites. Transport distances, the requirement to upgrade the Boco Road and the impact on the Riparian corridor along the Maclaughlin River were the primary drivers for identifying this route as an alternative. The link road forms the steepest section of the road network however detailed civil designs have considered gradient of the slope, potential ecological and ground water impacts, and the requirement to cross the Maclaughlin River at a single point on the valley floor where there is an existing causeway. As a result, the proposed route is approximately 2.5 km long with an average gradient of 6 %.

The existing causeway on the link road under investigation will require reconstruction to provide sufficient width and suitable approach gradients for construction traffic. The causeway if reconstructed would also need to meet the requirements of the Department of Water and Energy (DWE) for watercourse crossings under the *Water Management Act 2000*. These requirements include provisions for the passage of fish as required by the NSW Department of Primary Industries (Fisheries). In its existing form the causeway has one 0.75 m diameter pipe culvert for low-flows which is considered to be insufficient. The guidelines for fish passage require culverts to have a large opening which will

provide light penetration through the structure. The existing outlet is above the natural stream level, which would prevent the upstream passage of fish in low flow conditions.

A reconstructed crossing would be designed and certified by a suitably qualified engineer in accordance with the "*Guidelines for controlled activities Watercourse Crossings*" (NSW DWE 2008) and contain the following elements:

- Box culvert or culverts with wet cells to provide for low level flows. These culverts would have an invert level below the existing pipe at stable stream bed level;
- Elevated dry cells to accommodate higher flows. The invert of these cells could be at the existing causeway level;
- The deck or road surface at a level which would allow approach gradients at less than 14 % with vertical curves accordance with Austroads rural road geometry;
- An available minimum deck width of 4.5 m on a straight alignment;
- Road approach alignment to allow for long vehicles transporting wind turbine blades approximately 50 m long; and
- Minimum disturbance of existing banks and streambed.

It is envisaged that this structure would be constructed at the existing crossing with slight widening on the upstream side. Evidence of flood levels at the causeway and at the crossings downstream indicate that it would be uneconomical to provide a high level structure and that the structure should be designed with a deck level below the high flood level and at a level approximately 1 to 2 m above the existing causeway level.

General Vehicle Movements

Access to turbines located at the end of a spur on a ridge generally requires a T or Y-section of road (referred to as a turning head) close to the hardstand area to allow semi-trailer trucks to turn around. These are graded the same as the proposed internal access roads and are typically 30 to 40 m in length.

Alternatively, semi-trailer trucks can reverse back out of an access route, provided the Project site safety regulations permit, or entrances made wider (bell-mouth) to allow manoeuvring.

Hardstand areas equal 50 by 25 m with additional area equal to 15 by 15 m to accommodate the turbine foundation and roads up to 12 m wide during the construction phase are proposed as maximum impacts. These dimensions would be sufficient to allow for passing and turning vehicles unless obstructed by a component such as a blade laid down on the hardstand awaiting assembly. In such an instance semi-trailer trucks could either turn around in the adjacent turning head, or continue to the next turbine hardstand area to turn around. Construction contractors generally avoid double-handling of components and as such manage the delivery and installation process under a just-in-time management process, thereby reducing the number of components laid down on site at any one time.

The proposed dimensions are sufficient for two cranes per turbine site to lift the components from the semi-trailer trucks, and for the trucks to drive on past to a suitable turning point, as described above.

2.2.2 Ancillary Roads and Remediation

Generally in the pre-approval phase of a wind farm a development is designed at a high level with respect to basic civil engineering design parameters, primarily because the final infrastructure design can change during the consenting process and the cost of undertaking detailed civil design and geotechnical surveys is prohibitive without the security of Planning Consent. Sites are therefore designed to the best knowledge that is available at the time, whilst incorporating avoidance, mitigation and management measures determined by means of the key assessments under taking prior to submission to the relevant authority. Though with regard to the Project, detailed civil designs have been undertaken with respect to the Project components that create the greatest impact (the road, hardstand and turning head areas) to provide accurate information in the assessment of the Project.

However once approvals are obtained, activities are undertaken to reach financial close. Key to this is the selection of a preferred wind turbine supplier and construction contractor which in turn will have specific requirements for road design. For example, each turbine is uniquely different requiring bespoke turning radii, access and exit gradients and crane requirements. As such, it is not until the surveyor of the construction contractor walks the Project site and incorporates the conditions of approval that detail design of the roads and hardstands can be submitted to the turbine supplier for approval. In consideration of the above it is important that some flexibility in design is maintained during the consenting process.

Some additional roads or tracks may also be required for construction of the internal overhead transmission line and for access to erosion control sites. The erosion control sites will benefit from the use of excess rock excavated from turbine footings and will be chosen based on the availability of excess material, the need for erosion repair, and minimising the distance for material transport.

If roads are not required for the ongoing operation and maintenance works of the Project they will be removed and revegetated on completion of the construction phase, and in accordance with landowner preferences and environmental controls.

2.3 UTILITY SERVICES

The Project will be connected to Country Energy's 132 kV transmission network and when not generating will draw a minor amount of electricity from that source. The development of the external 132 kV overhead electrical interconnection will be undertaken separately from the Project.

Water will be provided to the proposed facilities and auxiliary services building from a storage tank designed to collect water from roof drainage. An approved septic system or composting system will be installed to treat minor quantities of waste water. The Proponent will be responsible for the removal of all other wastes from the Project site.

2.4 RESOURCE REQUIREMENTS

Resource requirements are typical of any new development site, including the provision of cement, gravel, and sands, water and road base material.

Cement for foundations will be sourced by the civil construction company awarded to undertake the Project. This may be sourced locally or from alternative suppliers.

Gravel and sands can be sourced locally. There are two known quarries within the area with no ceiling on their annual output and the closest of these is located within 5 km north of Nimmitabel. Both quarries provide basalt based materials which are of the same geology as that comprised across the Project site. Both gravel and sand will be required to mix the high strength concrete to pour the wind turbine foundations. Gravel will also be required to dress the turbine sites and provide a low resistivity apron around the collector substation.

Water requirements will be met by an existing 91 mega litre (ML) spring-fed dam located within the Project site. Water will be used in both concrete batching plant facilities, and road construction and dust suppression activities along both new and existing roads. It is estimated that in the order of 10.5 ML of water would be required to produce the quantity of concrete required for gravity footings for the 125 turbine layout, and as such can be considered the maximum amount of water required for use in concrete batching. By way of comparison, it is estimated that only 3.5 ML of water would be required if standard rock anchors were used for all footings in Layout Option 1.

A current embargo on water usage rights within the Maclaughlin River catchment restricts water supply for activities classified as 'Industrial Use'. Under this heading, the supply of water for use in concrete batching plants is restricted. However, following discussions with the NSW Office of Water (NOW) (the licensing authority) regarding the nature of the Project, NOW have indicated that despite the embargo water from this dam would be permitted for use in the concrete batch plant facilities. Landowner consent has been obtained and it is proposed that a replacement licence application should be lodged with the NOW to seek an amendment to the existing licence (10SL55662) from the current permitted purposes of pisciculture, stock and domestic use, to include 'Industrial Use'. It is important to note that with this amended purpose, there will be no increase in water entitlement under the licence. This process will allow for sufficient water to be sourced from the dam to meet the requirements of the concrete batching plant. It is proposed that the licence will revert back to its original purpose at the completion of the Project.

In addition, approximately a further 13.5 ML of water would be required for road construction and dust suppression activities. This would provide sufficient volume for all new and upgraded internal road construction and dust suppression activities, including those associated with the 25 km of unsealed arterial road. These activities are not embargoed and as such require the Proponent to apply for a permit to the NOW. This will be undertaken pending Development Approval.

The owners of the dam, under their current licence conditions, have the rights to establish a water pump facility to transfer water from the dam to storage tanks located to the east and west of their property. This is primarily to provide water for stock purposes. It is likely two water tanks up to 125,000 L will be installed by the landowner, and both the Proponent and landowner have agreed that, pending Development Approval and the process outlined above, this system can be used and/or upgraded to provide the daily quantities of water required for construction purposes. Moreover, the location of the proposed storage tanks have been integrated in to the road layout design of both Yandra and Springfield Clusters to minimise transport distances during the construction phase.

Road base material will be required for construction of access roads to turbine sites and the substation. Part of the road base requirement may be sourced from material extracted from turbine footings with the remainder imported to the Project site. Where additional material is required, local supplies of the same geological type can be sourced from the two quarries indicated above. Supply constraints are not considered an issue as both quarries have long term permits to quarry and have no annual ceiling on their output.

Given the scale of the Project it is anticipated that there will be no waste material exported from the site during construction. Top soil cleared from surfaces during the construction phase will be used for remediation, and rock excavated for turbine footing preparations will be used for road base, back fill for foundations and/or erosion control purposes as far as practicable. Ancillary waste, such as packaging, associated with component and stock pile deliveries will be disposed of according to local Council requirements and form part of the Construction Environmental Management Plan.

2.5 POTENTIAL DESIGN LAYOUT VARIATIONS

Alterations may be required to the Project layout which could result in the minor relocation of infrastructure (wind turbines, access tracks, cabling, etc) prior to construction. Considerations such as final turbine selection, ongoing energy yield analysis, unforseen environmental constraints, constructability/cost-reduction and pre-construction engineering investigations can impact on the final design and affected area of the Project.

As recently highlighted in the Gullen Range Wind Farm's EA, the NSW Land and Environment Court (Taralga Landscape Guardians v. Minister for Planning NSWLEC 2007) found, in relation to the relocation of wind turbines:

"… that a 250 m relocation of any of the elements is not unreasonable."

Although site-specific, it provides a precedent by which minor alterations to the proposed Boco Rock Wind Farm layouts may occur prior to construction. Furthermore, as indicated in the Gullen Range EA, the *EP&A Act* allows for the relocation of equipment so long as it remains broadly consistent with the proposal as outlined, otherwise an application for the modification of the Development Consent would be required.

In respect of the points outlined above and the Project site-specific avoidance, mitigation and management actions described in the subsequent chapters, it is proposed that an allowance to reposition the wind turbines and other infrastructure within a 100 m radius from the submitted layouts, subject to conditions of approval is issued. Moreover, it is proposed that no additional Development Consent is required where it can reasonably be shown that such repositioning in accordance with the parameters above would not materially affect or notably increase impacts as a whole, and remains broadly consistent with the Project.

2.6 WIND FARM DEVELOPMENT PHASES – DEVELOPMENT APPROVAL TO OPERATION

The following section provides a brief description of the detailed design, pre-construction and construction works, operation/maintenance and refurbishment/decommissioning work required at the Boco Rock Wind Farm site.

2.6.1 Anticipated Project Timeline – Development Approval to Operation

Approval is sought for the final positioning of up to 125 turbines and associated infrastructure within a radius of 100 m of the locations indicated in Figure 3. The Proponent is applying for Development Approval to allow for substantial construction to begin within 24 months of the date of Consent. The actual timing of construction will principally be driven by the length of time taken to obtain other permits and authorisations, attaining Board approval/project financing for commencement and the long lead

times for wind farm components. An indicative Project timeline is presented in Table 6. Staging of the development is also a consideration and some of those factors which may lead to a staged approach are discussed below in Section 2.6.2.

The following provides a guide to the anticipated activities subject to Development Approval for the Project.

Table 6: Anticipated project timeframes

		2009		2010				2011				2012				Onwards	2031/32
		Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4		
Wind Farm related activities	Wind Farm Development Approval																
	Detailed Design and Contract Development																
	Preconstruction Works																
	Construction Works																
	Commissioning (in line with NER *)																
	Operation																
	Maintenance																
	Decommissioning or Equipment Replacement																
	Upgrade of Existing 66 kV line																

2.6.2 Construction Staging Considerations

The following section provides context into aspects that could have a bearing on a staged construction process and as such the Proponent is seeking flexibility in approval conditions to allow for a staged development, subject to Development Approval. These considerations are to be taken with respect to the proposed electrical connection option outlined below.

Project scale: The Project comprises of four discrete Clusters and is estimated to be constructed over a period of 18 to 24 months. Within this time period it is anticipated that activities will occur mainly within one or two of the Project Clusters at any one time. This is subject to commercial considerations and the Conditions placed on the development following Development Approval.

The Proponent requests that, dependent on obtaining Development Approval for the connecting power line, the Project could be either commissioned in stages or as a whole wind farm.

Grid connection: The power generated from the Project will connect into two Country Energy owned lines east of the Project site, currently comprising of a 132 kV line and a 66 kV line. Country Energy are in the process of upgrading the 66 kV line to a double-circuit 66/132 kV to meet their own licensing requirements with respect to security of supply to the South Coast region. The timing of this upgrade is expected to occur in parallel with the anticipated construction timeline for the Project shown in Table 6 above.

Unexpected setbacks to this upgrade could delay the generation output from the Project. In this instance, and subject to obtaining Development Approval for the connecting power line, the Proponent requests that the Project could be commissioned in stages. In this instance, approximately 120 to 130 MW of the overall capacity of the Project could be connected into the existing 132 kV line.

Conservation Outcomes: To minimise impacts of the proposal on sensitive lifecycle stages of endangered species identified in areas of the Project site (i.e. mating, laying and incubation periods), development windows may be constrained. This is discussed in more detail in Section 5.3 with respect to the Earless Dragon (*Tympanocryptis pinguicolla*) (known to be located within the Sherwins and Springfield Clusters.

2.6.3 Detailed Design and Contract Development

Once approvals have been obtained and tenders for the design and construction have been awarded the Project design can be finalised. This stage takes account of updated wind resource monitoring, revised energy modelling and the latest equipment and technology that is available to the Proponent at that time. It is at this stage that final micro-siting of the wind turbines and site infrastructure will occur, subject to Development Approval and the Conditions placed on the development.

Project environmental commitments, including undertakings arising from the impact assessment, consent conditions and any licensing conditions will be compiled and used to prepare the Project Environmental Management Plans (EMP's) as outlined in the Statement of Commitments (SoC). The Project EMP's would also be incorporated into the contract specifications for the required construction works and equipment supply to ensure compliance and achieve the Project environmental objectives.

Tenders will be issued using the abovementioned specifications and tenderers' records of performance will be reviewed as part of the selection process to ensure that they are able to achieve the required specification of works.

The Contractor will also be required to produce a Contractor Environmental Management Plan to address its component of the Project works.

2.6.4 Pre-construction Works

Prior to the main construction commencing, a number of enabling works and further site planning would be undertaken by the selected Contractor, including:

- Detailed site investigation including geotechnical investigations involving a series of trial pits and/or boreholes;
- Upgrading the surfaces of local roads and access roads where required;
- Widening the junctions or corners of local roads, entrance/access points where required;
- Widening the existing gateways, or inserting new gateways as necessary along fence lines;
- Stripping and careful storage of existing soil from the areas which would be affected by construction activities, including the tower bases, the collector substation location, access road areas, crane hardstand and assembly areas;
- The construction of a secure site compound, with Project owner and subcontractors field offices (portables), parking bays, and toilet facilities (temporary);
- Erection of signage on roads;
- Enabling works for the locating of a mobile concrete batching plant (temporary);
- Enabling works for the locating of a rock crushing plant (temporary, if required);
- Environmental survey and refinement (if necessary) of the EMP in line with the Draft SoC, Health and Safety Plan, Traffic Management Plan and any other documentation as required under the planning authorisation;
- Survey of critical boundaries and pegging of infrastructure locations;
- Detailed cultural heritage and flora/fauna surveys across entire site (if required);
- Preparation of works procedures and Project Implementation Plan; and
- Engineering design works and submission for Building Rules Consent.

2.6.5 Construction Works

Construction activities include activities that cross over with pre-construction works and comprise site establishment, earth works for access roads, footings and crane hardstand areas, erection of up to 125 wind turbines, approximately four permanent wind monitoring masts, a collector substation, above and below ground cabling and temporary site facilities. Construction activity is likely to occur over a period of approximately 18 to 24 months with restoration following the completion of works.

Site Establishment and Temporary Site Infrastructure: Site works will require the erection of temporary infrastructure such as a portable field office, toilet facilities, construction compound and parking bays. This infrastructure will be typical of that used at construction sites; however it will not include full accommodation facilities.

Two preferred areas for the temporary site office, toilet facilities and construction compound and parking bays have been considered (Table 7). One is located off Springfield Road, adjacent to Brechnoch Road, the second located close to the intersection of the Snowy River Way and Avon Lake Road (see Figure 3). The temporary site office facilities will be approximately 40 by 100 m and the construction compound approximately 150 by 200 m, with a combined area of approximately 3.4 ha. The area will

be fully fenced with sufficient access to allow vehicle movement, stockpiling of materials, and office facilities.

Table 7: Summary of preferred site office and construction compound locations

No.	Location	Site Features
1	Along Brechnoch Road	An area of flat land comprising non-native vegetation, existing access from the arterial roads, close to turbine Clusters, 800 m from nearest dwelling (associated landowner).
2	Intersection of the Snowy River Way and Avon Lake Road	An area of flat land comprising heavily grazed vegetation, existing access from the arterial roads, close to turbine Clusters, 2.8 km from nearest dwelling (associated landowner). Used recently as a storage compound by Bombala Council during the upgrade to the Snowy River Way road.

Ancillary Construction Activities: On-site Concrete Batch Plant/Rock Crusher: Up to two concrete batching plants are proposed to supply concrete for the wind turbines foundations.

An on-site batching plant facility would occupy an area of approximately 50 by 100 m and likely consist of a trailer-mounted concrete mixer, cement bins, sand and aggregate stockpiles and a storage container for various equipment and tools. Sufficient area will be required for the use of front-end loaders, delivery of materials and entry and exit of vehicles. A batch plant would be powered by a diesel generator and have a production capacity of approximately 40 cubic metres per hour (m^3/h).

Five locations have been identified for concrete batch plants within the Project site, which are summarised in Table 8. .

Table 8: Summary of preferred batching plant locations

No.	Location	Site Features
1	Along Brechnoch Road	An area of non-native vegetation, existing access from the arterial roads, close to turbine Clusters, set back from publicly accessible areas, 800 m from nearest dwelling (associated landowner), close the available water source.
2	Along Yandra Road	An area of non-native vegetation, existing access from the arterial roads, close to turbine Clusters, set back from publicly accessible areas, 1.8 km from nearest dwelling (associated landowner), close the available water source.
3	Within the Yandra Cluster	An area of non-native vegetation, new access road to be built, close to turbine Clusters, set back from publicly accessible areas, 1.8 km from nearest dwelling (associated landowner), close the available water source.

No.	Location	Site Features
4	Substation location	An area of native vegetation, new access road to be built for substation, close to turbine Clusters, set back from publicly accessible areas, 1.8 km from nearest dwelling (associated landowner).
5	Intersection of the Snowy River Way and Avon Lake Road	An area of flat land comprising heavily grazed vegetation, existing access from the arterial roads, close to turbine Clusters, 2.8 km from nearest dwelling (associated landowner). Used recently as a storage compound by Bombala Council during the upgrade to the Snowy River Way road.

The location of concrete batching plants will be determined at the construction planning stage and will be strategically sited to minimise impact on the local area.

Under the *Protection of the Environment Operations Act 1997* 'Concrete Works' are considered a scheduled activity requiring a Licence from the Department of Environment, Climate Change and Water (DECCW) if the capacity of production of concrete exceeds 30,000 tonnes per year. A licence for its operation will be applied for to the DECCW following Development Approval.

Site Access Roads and Crane Hardstand/Assembly Areas: Site access roads and crane hardstand/assembly areas require surfacing in order to cater for construction traffic and machinery. This involves the excavation of the roads and hardstand areas to an agreed depth, prior to the laying of a compacted quarry rubble base. It is anticipated that the majority of material retrieved from cuttings and excavations will be used on site or in the immediate vicinity of the Project site. Site access points would be gated and secured, and appropriate warning signs erected.

During construction, site access roads are constructed at a width of up to 12 m to allow for passing construction traffic, large mobile cranes, and other long and wide loads. Once the Project is operational, the access roads will be reduced in size to 6 m in width, acknowledging that traffic from this point onwards will principally involve commercial vehicles. The crane hardstand and assembly areas will be sized at approximately 50 by 25 m.

Dust suppression is a key consideration during the construction and use of roads. A permit will be sought from the NOW for the extraction of the required quantity of water to enable the construction and dust suppression of up to 79 km of new and upgraded internal access roads and up to 25 km of unsealed arterial roads that are likely to be used for site access.

Subject to Development Approval, the Proponent will seek from the NOW permission for a temporary licence to be issued to extract the quantity of water required for road construction and dust suppression purposes from the on-site dam.

Footing Construction: If gravity foundations are required, the construction of the foundation for each wind turbine would involve the excavation of approximately 450 m^3 of ground material to a depth of approximately 2.5 m. Shuttering and steel reinforcement would then be put in place and concrete poured to form the base in-situ. The upper surface of each base would finish approximately 0.5 to 1 m below ground level with either a central reinforced concrete plinth to support the tower, or a base steel tower section set into the concrete.

If rock anchor foundations are required, the construction of the foundation for each wind turbine would involve the excavation of approximately 100 m^3 of ground material to a depth of approximately 2.5 m. The upper surface of each base would finish at ground level with either a central reinforced concrete plinth to support the tower, or a base steel tower section set into the concrete.

On-site Electrical Reticulation: Either prior to or during turbine base construction, the underground site electrical system would be installed. This would involve the cutting or excavation of trenches to a depth of up to 1.2 m for the laying of the underground cabling that links the turbines. All trenches would be marked with warning tape and backfilled once the cables were in-situ.

The majority of the underground cabling will be located adjacent to the access roads within the identified road clearance areas.

Collector Substation Compound: A location for the on-site collector substation has been selected (Figure 3). The total compound area will be in the order of 100 by 100 m incorporating a 20 m Asset Protection Zone (APZ) area extending from the boundary of the installed equipment. The yard will be surfaced with compacted quarry rubble to form a hardstand area. Reinforced concrete footings will then be constructed to support electrical infrastructure and buildings. Infrastructure required within the yard includes a 33/132 kV transformer, switchgear, power conditioning equipment and operation facilities building.

Turbine Erection: The turbine components would be delivered to the Project site on semi-trailers. The method of construction would involve the use of a small mobile crane (up to 100 tonne) for the ground assembly operation. A larger 600-1,000 tonne crane together with the small mobile crane, would be required to erect the turbines once ground assembly is complete. Erection is likely to take approximately 2-3 days per turbine. Depending on the configuration, the crane may require up to 2 days to disassemble and remobilise to a new site.

Overhead Power Line: A 132 kV double-circuit overhead power line will be required to transport the electricity from the Project site to a substation (to be assessed under a separate approvals process). The power line poles will be supported by reinforced concrete piers to a depth determined by an engineer, taking into account the local geotechnical conditions. The poles will be concrete, steel or wooden, approximately 25 m in height as determined by Country Energy. If concrete or steel poles are selected, it is common practice for these to be painted a dark green to reduce their visual impact.

2.6.6 Commissioning

Pre-commissioning checks will be carried out on the high voltage electrical equipment prior to connection to the Country Energy transmission network. The connection to the grid is dependent on the associated transmission works. When the wind farm electrical system has been energised, the wind turbines will be commissioned and put into service.

2.6.7 Operation

Once operational, the Project would be monitored both by on-site staff and through remote monitoring. Aspects of the Project operation to be dealt with by on-site staff would include safety management, environmental condition monitoring, landowner management, routine servicing, malfunction rectification and site visits. Those functions to be overseen by remote monitoring include turbine performance assessment, wind farm reporting, remote resetting and maintenance co-ordination. Pro-active

computer control systems monitor the performance of the wind turbines and ensure that any issues are dealt with by on-site staff or contractors, as appropriate.

2.6.8 Servicing and Maintenance

Maintenance staff are likely to be on-site throughout the year, making routine checks of the wind turbines on an ongoing basis. Major planned servicing would be carried out approximately twice a year on each wind turbine. Each major service visit would potentially involve a number of service vans (two technicians per van) on-site.

Should a problem occur with a wind turbine, then the on-site maintenance staff will attend to the machine to get it operational again. Depending on the situation, a turbine could be non-operational for several hours or days. Significant problems which require the replacement of major components, such as turbine blades, may require the use of cranes and ancillary equipment. This can result in a turbine being offline for several weeks whilst the appropriate equipment and materials are sourced.

2.6.9 Refurbishment

After approximately 20-25 years of operation (or sooner if deemed economically viable) the blades, nacelles (top section of the turbine) and towers could be removed and replaced. Old blades, nacelles and towers are removed from site for recycling and new components installed on existing or new foundations, as appropriate. Refurbishment would extend the life of the Project for a further 20 years.

Any material change to the Project layout, or significant changes to the turbine technology, will be referred to the Department of Planning as an amended proposal. It would also be subject to the regulations and guidelines of the day. Refurbishment requires the transportation and installation equipment and facilities, similar to that used during initial construction.

2.6.10 Decommissioning

At the end of the operational life of the Project, the turbines and all above ground infrastructure will be dismantled and removed from the site. This includes all the interconnection and substation infrastructure. The tower bases would be cut back to below ploughing level or topsoil built up over the footing to achieve a similar result. The land will be returned to prior condition and use. A compressor and rock breaker may be needed to carry out the cutting work.

The access roads, if not required for farming purposes or fire access, would be removed and the Project site reinstated as close as possible to its original condition and use. Access gates, if not required for farming purposes, would also be removed. Individual landowners will be involved in any discussion regarding the removal or hand-over of infrastructure on their property.

The underground cables are buried below ploughing depth and contain no harmful substances. They would be left in the ground and only recovered if economically and environmentally viable. Terminal connections would be cut back to below ploughing levels.

All decommissioning work would be the responsibility of the Project owner and is a provision within the lease arrangement. Experience in Denmark and The Netherlands shows that sale of the scrap metal and other valuable items salvaged from the turbines and electrical components would more than meet the cost of decommissioning.

2.6.11 Fire Management

A fire management plan is an important part of both wind farm planning and the community consultation process. All aspects of the Boco Rock Wind Farm Project will adhere to the *Rural Fire Service (RFS), Planning for Bushfire Protection*, and will be in consideration of the *Auswind Best Practice Guidelines (Fire Management Guidelines) 2006*.

Despite the low risk that wind farms present, fire management is a major concern within the Cooma-Monaro region of NSW, and planning for fire prevention and an effective and informed response is of paramount importance. Planning with regard to fire management not only provides wind farm Proponents with assurance that minimum damage would result from a fire incident, it also reassures the landowners/local community and enables the rural fire service to confidently plan and execute an effective response.

The RFS has been notified of the Project and further consultation will continue. Details of the Project site (such as turbines, access tracks and gate locations) will be provided to assist their internal response planning. Specific fire prevention and response measures are outlined in the Project EMP. Furthermore, an Emergency Response Plan will be developed in consideration of RFS guidelines and further consultation with regional and local rural fire groups, and would include agreed notification protocols, contacts and response actions.

2.6.12 Overview of Connection of the Wind Farm to the Electricity Grid

Grid connection to be assessed under a separate Development Application

To harness the energy produced by the Project, a new transmission line is required to connect it to the existing electricity grid. To meet this requirement the construction of a new double-circuit 132 kV overhead transmission line would be required to connect the Project with two existing Country Energy lines located approximately 25 km east of the Project site. **Image 3.12** shows a typical transmission line construction and alternate pole designs that could be implemented in this project.

The proposed transmission line would become part of Country Energy's network, and as such Country Energy would be the ultimate owner and operator of the new infrastructure. Country Energy is therefore considered to be the Proponent for the proposed transmission line for the purposes of the *EP&A Act*. Design and construction of the transmission line is to be undertaken by the Project Proponent, Boco Rock Wind Farm Pty Ltd (a wholly owned subsidiary of Wind Prospect CWP Pty Ltd), in accordance with Country Energy guidelines, specifications and requirements.

Country Energy will assess and determine the electricity transmission line in accordance with its statutory obligations as a determining authority under Part 5 of the *EP&A Act* and clause 228 of the *EP&A Regulations*.

It is expected that the approvals process for the transmission connection will consist of the following general stages:

- Preparation of a 'Route Options Study' (Completed);
- Preparation of a 'Review of Environmental Factors' for the determining authority (Underway);
- Approval by determining authority, which in this case will be Country Energy; and
- Implementation in accordance with the necessary controls.

An overview of the transmission line connection is provided below to explain the associated infrastructure so that all stakeholders are able to understand the full context of the development.

Country Energy has indicated that the combination of the existing 132 kV and the planned upgrade to the 66 kV network to a 66/132 kV rating will have sufficient capacity to accept the output from the Project without augmentation to other existing transmission lines or substations.

A new easement will be required on all properties affected by the transmission line. Landowners in the locality have been approached and preliminary agreement has been reached. Further discussions and formal consent by each landowner will form part of the separate approvals process for the transmission connection.

Access requirements to the transmission line during construction and operation would largely be catered for through using a combination of the existing road network, internal (farm) vehicle tracks and the transmission line easement itself.

Considering the low volume of expected vehicle traffic during construction and operation, combined with the presence of large areas of existing cleared grazing land along the proposed transmission line route, the establishment of a vehicle access track would require only minimal, if any, civil works.

Large sections of the proposed route traverse existing farmland comprising a mix of grazed native and non-native grasses. These sections are likely to not require clearing for the establishment of the transmission line. Furthermore, these areas are currently trafficable by normal four-wheel-drive-vehicles and are likely to not require clearing or any civil works to facilitate vehicle access for either construction or ongoing operation, however this remains subject to final route selection and detailed design

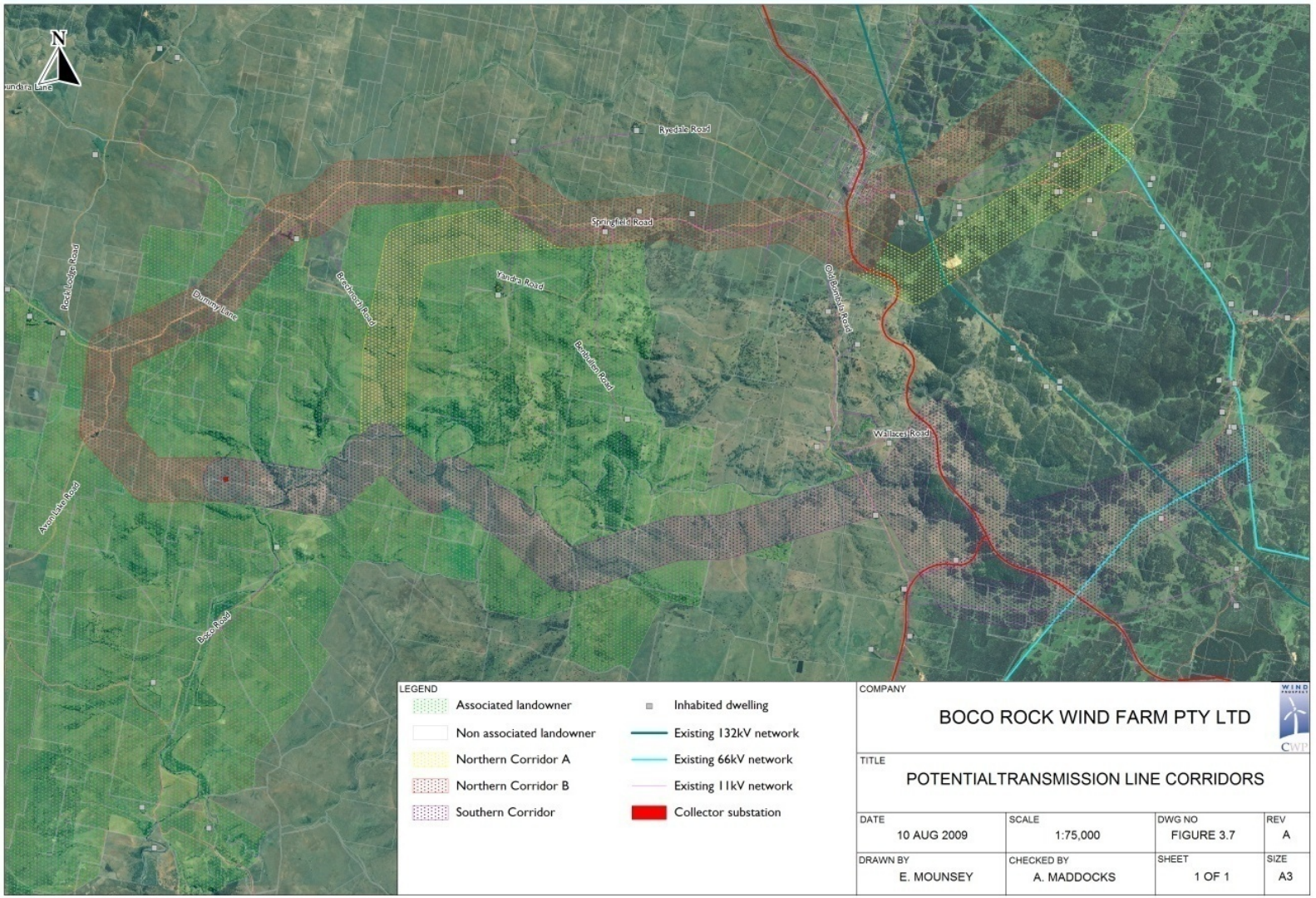
Some clearing of vegetation that has the potential to interfere with transmission line conductors or access to infrastructure may be required. Country Energy has developed vegetation clearing guidelines for power line easements. The key points of these guidelines are as follows:

- a clearing zone corresponding to the width of the easement is required along the length of the transmission line route;
- the easement width and clearing zone shall allow for conductor blow out; and
- all vegetation types except grasses shall be removed from the clearing zone, except as follows:
  - low growing species shall be retained at river or creek crossings;
  - in deep valleys where the conductors will be well above the maximum height of the prevailing vegetation and the clearance space will never be compromised, all vegetation shall be retained (except where it impedes construction access);
  - low growing species may be retained for the first five metres of the corridor adjacent to main roads to provide a visual buffer zone; and
  - stumps shall be retained where there is the possibility of erosion.

The output of the Project will be directed to primarily supply the population of Cooma and the larger electrical load centres to the north, however supplies will also flow to the local area and to the substations at Bega and Bombala for further distribution.

The potential transmission line development corridors (see below) identified were used as a starting point for an environmental constraints and route options identification study.

FIGURE 3.7: POTENTIAL TRANSMISSION LINE CORRIDORS 2009



3 Planning & Assessment Framework

3.1.1 Commonwealth Legislation

Boco Rock Wind Farm is proposed in the context of growing global recognition of the need to mitigate the environmental effects associated with fossil fuel energy generation. The Boco Rock Wind Farm will provide an important contribution to the Federal Government's Mandatory Renewable Energy Target (MRET) of 20% by 2020.

The MRET scheme was introduced in 2001 by the Australian Government with the aim of increasing the uptake of renewable energy in Australia's electricity supply. In 2007 the Government committed to ensuring that 20 per cent of Australia's electricity supply comes from renewable energy sources by 2020. In July 2008, to inform design of the RET scheme, the COAG Working Group on Climate Change and Water released a consultation paper on the key design issues. Exposure draft legislation on the design of the Renewable Energy Target scheme was released for public comment. This exposure draft legislation reflects the design being considered by the COAG Working Group Climate Change and Water.

Environment Protection and Biodiversity Conservation Act 1999

The primary objective of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is to 'provide for the protection of the environment, especially those aspects of the environment that are matters of National Environmental Significance.'

Environmental approvals under the EPBC Act may be required for an 'action' that is likely to have a significant impact on:

- Matters of National Environmental Significance (known as 'NES matters') including:
  - World Heritage Areas;
  - National Heritage Places;
  - Ramsar wetlands of international importance;
  - Nationally listed threatened species and ecological communities;
  - Listed migratory species;
  - Nuclear actions;
- Commonwealth marine areas; and
  - Commonwealth heritage places.
    - Actions taken on Commonwealth land that are likely to have a significant impact on the environment;
    - Actions that are likely to have a significant impact on the environment of Commonwealth land, even if the action is taken outside Commonwealth land; and
    - Any action taken by a Commonwealth agency that is likely to have a significant impact on the environment.

An 'action' is considered to include a project, development, undertaking, activity or series of activities.

Of potential relevance to the site are matters of NES which include nationally listed threatened species and ecological communities and listed migratory species.

The endangered Grassland Earless Dragon (*Tympanocryptis pinguicolla*) has been recorded within the study area and the endangered *Natural Temperate Grassland of the Southern Tablelands (NSW and ACT)* ecological community is also present. Ephemeral wetlands characteristic of the endangered *Upland Wetlands of the New England Tablelands and the Monaro Plateau* ecological community are present within the project site although this community will not be impacted directly or indirectly by the proposal and measures implemented to prevent any potential indirect impacts.

A Referral under the EPBC Act was submitted to DEWHA in May 2009 for the likely impacts of the proposal on the Grassland Earless Dragon and Natural Temperate Grassland. Negotiations were held between the proponent and DEWHA in an attempt to minimise impacts on NTG and threatened species. A decision to deem the proposal a Controlled Action under the EPBC Act was made on 18 August 2009.

In January 2007 the Commonwealth and NSW Governments signed a Bilateral Agreement which allows the assessment regimes under Part 3A of the EP&A Act to be automatically accredited under the EPBC Act. However, in light of recent planning reforms the Commonwealth is reviewing the application of the NSW Assessment Bilateral to projects subject to this part of the Act which have been determined a Controlled Action under the EPBC Act. The review is scheduled for completion and until a decision has been made the NSW Bilateral Assessment will no longer automatically apply to eligible Part 3A projects which have been deemed a Controlled Action.

Consequently, DoP has requested that the assessment for Boco Rock under Part 3A be subject to a one-off accredited assessment process and agreed that the assessment would be subject to the general administrative steps outlined in the NSW Assessment Bilateral administrative procedures.

As a consequence of the one-off accredited assessment process, supplementary DGRs to those issued on 1 June 2009 were issued on 15 September 2009. The supplementary DGRs were prepared in consultation with DEWHA.

Key DEWHA requirements pertaining to the ecological assessment, as outlined in the supplementary DGRs, are listed in Appendix C. The chapter / section where each requirement has been addressed within this report is also noted Appendix C and key matters pertaining to impacts on NTG have been included in Appendix O.

3.1.2 New South Wales Legislation

Environmental Planning and Assessment Act 1979

The NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) is the principal planning legislation for NSW. It provides a framework for land use control and assessment, determination and management of development. Part 3A of the Act facilitates major project and infrastructure delivery of development which is of significance to the State and encourages economic development, while strengthening environmental safeguards and community participation.

On 26 February 2008 the Minister for Planning declared certain power generating facilities to be Part 3A "critical infrastructure projects" if they had capacity to generate at least 250 MW and were subject to an

application lodged pursuant to Section 75E or section 75M of the EP&A Act. The proposal has the capacity to generate more than 250MW of energy and is the subject of an application lodged prior to 1 January 2013 and as such is to be assessed under Part 3A of the EP&A Act as a Critical Infrastructure Project. The NSW Department of Planning (DoP) will be the assessment authority and consent is required from the Minster for Planning.

On 1 June 2009, the DoP issued Director-General's Requirements (DGRs) pursuant to Section 75U(f) of the EP&A Act to Wind Prospect CPW Pty Ltd. Cooma-Monaro, and Bombala Councils and the DECCW were provided with the opportunity to have input into the DGRs for this project prior to their issuing.

An assessment of the potential impacts of the proposal in accordance with the Part 3A requirements and the DGRs was made. For those residual impacts that could not be avoided or mitigated, environmental offsets consistent with the DECCWs Biodiversity Offset Principles were investigated, including application of the Biobanking impact assessment methodology.

Biobanking

BioBanking is a market-based scheme that provides a streamlined biodiversity assessment process for development, a rigorous and credible offsetting scheme as well as an opportunity for rural landowners to generate income by managing land for conservation. BioBanking establishes an 'improve or maintain' test for biodiversity values. Improving or maintaining biodiversity values means avoiding important areas for conservation of biodiversity values, and offsetting impacts on other areas. The offsets are measured in terms of credits, using the BioBanking Credit Calculator Tool.

A Biobank assessment was undertaken across the site to provide guidance on the size / area of the offset requirements in accordance with the improve and maintain principles outlined in the DGRs.

Threatened Species Conservation Act 1995

The TSC Act aims to protect and encourage the recovery of threatened species, populations and communities listed under the Act. The Act is integrated with the NSW EP&A Act and requires consideration of whether a major infrastructure or other project (Part 3A of the EP&A Act), a development (Part 4 of the EP&A Act) or an activity (Part 5 of the *EP&A Act*) is likely to significantly affect threatened species, populations and ecological communities or their habitat.

The following species listed under the TSC Act have been recorded across the study area; Grassland Earless Dragon, Little Whip Snake (*Suta flagellum*), Squirrel Glider (*Petaurus norfolcensis*) and Diamond Firetail (*Stagonopleura guttata*).

Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) aims to conserve, develop and share the fishery resources of NSW for the benefit of present and future generations. The FM Act defines 'fish' as any marine, estuarine or freshwater fish or other aquatic animal life at any stage of their life history, exclude whales, mammals, reptiles, birds, amphibians or species specifically excluded. No threatened fish species, or endangered populations are known to occur within the study area, however, a permit is required if an activity will block fish passage.

In accordance with section 75U of the EP&A Act, applications for separate permits under section 201, 205 or 219 of the *Fisheries Management Act 1994* are not required as these matters are addressed and approved as part of the EP&A Part 3A process.

NSW Catchment Management Authorities Act 2003

Through a network of Catchment Management Authorities, this Act aims to devolve operational, investment and decision – making natural resources functions to catchment levels, to provide for proper natural resource planning at a catchment level, to apply sound scientific knowledge and to involve communities in decision making regarding catchment management.

Under the Act, Catchment Management Authorities have been established and are required to prepare a Catchment Action Plan (CAP). The CAP aims to guide the CMA's investment in sustainable natural resource management and focuses on actions that the CMA can achieve within the scope of its role and capacity. The CAP contains targets for environmental improvement and is a plan for action that the CMA can directly undertake or directly influence. The CAP aims to ensure that future investment by the CMA is put towards key issues in the catchment and is based on the best available knowledge.

The project is located within the Snowy Monaro Sub-region (Part C) within the Southern Rivers Catchment and is, therefore, within land managed under the Southern Rivers Catchment Action Plan (SRCAP). The following targets in the SRCAP are relevant to this project:

> B2: By 2016 through voluntary participation by land managers, the area of land actively managed to conserve priority vegetation types will increase from 11,000 hectares to at least 41, 000 hectares.
>
> B3: By 2016 through voluntary participation by land managers, an additional 10, 000 hectares of native vegetation will be actively managed to build a resilient landscape with good connectivity that conserves biodiversity.
>
> B4: By 2016 the priority recovery actions identified in the Southern Rivers threatened species strategy will have been implemented.

Noxious Weeds Act 1993

The *Noxious Weeds Act 1993* defines the roles of government, councils, private landholders and public authorities in the management of noxious weeds. The Act sets up categorisation and control actions for the various noxious weeds, according to their potential to cause harm to our local environment.

The objectives of the Noxious Weeds Act 1993 (NW Act) include:

- To identify noxious weeds in respect of which particular control measures need to be taken;
- To specify those control measures;
- To specify the duties of public and private landholders as to the control of those noxious weeds; and
- To provide a framework for the State-wide control of those noxious weeds by the Minister and local control authorities.

Under this Act, noxious weeds have been identified for Local Government Areas and assigned Control Categories (eg. 1, 2, 3, 4 and 5). Part 3 provides that occupiers of land (this includes owners of land) have responsibility for controlling noxious weeds on the land they occupy.

3.1.3 State Environmental Planning Policies

State Environmental Planning Policy 44 (Koala Habitat)

State Environmental Planning Policy 44 (Koala Habitat) aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline. SEPP 44 applies to both the Bombala and Cooma-Monaro LGAs.

Koalas have previously been recorded within the locality although there are no records on the project site (DECC 2009b). Schedule 2 of SEPP 44 includes a list of Koala feed tree species. *Eucalyptus viminalis* (Ribbon Gum) is listed on Schedule 2 and is present within the study area.

Under SEPP 44, areas of potential koala habitat are categorised as either core koala habitat or potential koala habitat based on the following criteria:

Core koala habitat: an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population.

Potential koala habitat: areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.

Potential core koala habitat would be present within the Yandra portion of the study area. Given there is no known resident population of koalas on the project site and there are no recent or historical sightings of a population within the project site. Therefore, the study area would not constitute an area of core koala habitat.

Section 75R of the EP&A Act excludes, with respect to critical infrastructure projects, all environmental planning instruments (other than SEPPs that specifically relate to the project) and council orders under Division 2A of Part 6. An assessment under SEPP 44 is therefore not required.

3.1.4 Local Government Plans

Boco Rock Wind Farm falls within the Cooma - Monaro and Bombala Council areas. The proposal is to be assessed under Part 3A of the EP&A Act and therefore the NSW Department of Planning (DoP) will be the consent authority. Both Councils and the DECCW were provided with the opportunity to have input into the Director General's Requirements (DGRs) for the proposal prior to their issuing.

Provisions of the Cooma - Monaro Council LEP relevant to this proposal include the restriction of development in Rural zones which have an adverse effect on the area's water resources.

4 Ecological Site Assessment

4.1 LITERATURE REVIEW

A review of all readily available literature and database records pertaining to the ecology of the study area and surrounding locality were reviewed to provide important background information. Existing vegetation mapping and other available GIS data were also utilised. Information reviewed included:

- DECC Threatened Species Database (10 km radius) (DECC 2009b);
- Department of Environment, Water, Heritage and the Arts (DEWHA) Online search for Matters of National Environmental Significance (Accessed February 2009);
- Australian Museum Fauna Database Records (2008);
- Royal Botanic Gardens Threatened Flora Database Records (2008);
- Birds Australia Threatened and Migratory Species Database Records (2009);
- Aerial photograph (2001);
- *Draft Revision of Monaro Grassland Mapping* (Rehwinkel 2005);
- *The native grasslands of the Monaro region: Southern Tablelands of NSW* (Benson 1994a);
- *Plant communities of the Monaro Lakes* (Benson & Jacobs1994b);
- *A study of the ecosystems of the Monaro Region of NSW* (Costin 1954);
- *Remote sensing mapping of grassy ecosystems in the Monaro* (Walter and Schelling 2004);
- *A Method to Assess Grassy Ecosystem Sites: Using floristic information to assess a site's quality* (Rehwinkel 2007); and
- *Forest Ecosystems, South Coast sub-region (Southern CRA) Vegetation Mapping* (NPWS 1999).

An assessment of likelihood of occurrence was made for threatened and migratory species identified from the database searches or considered to have the potential to occur within the locality. Five terms for the likelihood of occurrence of species are used in this report. This assessment was based on database or other records, presence or absence of suitable habitat, features of the proposal study area, results of the field survey and professional judgement. The terms for likelihood of occurrence are defined below:

- "yes" = the species was or has been observed on the site
- "likely" = a medium to high probability that a species uses the site
- "potential" = suitable habitat for a species occurs on the site, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur
- "unlikely" = a very low to low probability that a species uses the site
- "no" = habitat on site and in the vicinity is unsuitable for the species.

4.1.1 Aerial Photo Interpretation / Past Vegetation Mapping

Aerial photograph interpretation and contour information was used to broadly verify the previous vegetation mapping prior to the site inspection. Any predicted changes to the boundaries based on the aerial photographs were marked and verified during the field surveys. Aerial photography was also used to assist in assigning biometric vegetation types used to determine historical or derived vegetation boundaries used in the Biobanking assessment.

Mapping of native vegetation in the Southern Forests (Gellie 2005) was analysed. This mapping, based on CRA (comprehensive vegetation mapping) from 2000 (CANRI 2000) depicts broad-scale (1:25 000 to 1:100 000) vegetation patterns and does not include the location of native vegetation surveyed for this project. Costin (1954) mapping was also reviewed.

4.2 METHODS

Field surveys were undertaken by a number of ecologists between 19 October 2008 and 4 May 2009. Surveys included vegetation mapping and targeted searches for threatened flora and fauna. Further detail of the methodology used for the project has been provided below and a list of field staff and their qualifications provided in Table 9.

Table 9: Eco Logical Australia field team

Staff Member	Qualifications
Bruce Mullins	Master of Science, University of Technology, Sydney Bachelor of Science, University of Technology, Sydney
Tammy Haslehurst	Bachelor of Environmental Science (first class honours), Macquarie University
Ross Wellington	Bachelor of Arts (Biological Sciences), Macquarie University Diploma of Education, Macquarie University Teaching Certificate, NSW Department of Education and Training Certificate IV Geographic Information Systems, Newcastle TAFE
Robert Brown-Cooper	Bachelor of Science (Biological Science major) Edith Cowan University Postgraduate Diploma of Education, Edith Cowan University
Elizabeth Norris	Bachelor of Science, Macquarie University, Sydney. Biology/Ecology and Palaeontology major Post Certificate in electron microscopy, Sydney Technical College, Transmission and Scanning Microscopy Master of Science, Macquarie University, Sydney
Will Introna	Master of Science, University of Technology, Sydney Bachelor of Science, University of Technology, Sydney
Matthew Dowle	PhD candidate in Biological Sciences and Wildlife Management, UNSW Bachelor of Advanced Science (second class level 1 honours).
Chey Rhodes	Bachelor of Environmental Science, Charles Darwin University
Enhua Lee	PhD in Ecology and Wildlife Management. Bachelor of Advanced Science (first class honours).
Luke Geelan	Bachelor of Environmental Management (honours), University of Adelaide, Roseworthy campus
Alastair Patton	Graduate Diploma in geographic information systems Bachelor of Science degree- Macquarie University (majors in biodiversity and conservation).
Malith Weerakoon	Bachelor of Science, Macquarie University

Staff Member	Qualifications
James Wallace	Bachelor of Science, University of Wollongong
Chris Coombes	Bachelor of Science, Charles Sturt University
Nathan Smith	Bachelor of Science (Resource & Environmental Management), School of Earth Sciences, Macquarie University, Sydney. Certificate II & IV Bushland Regeneration, School of Horticulture, Northern Sydney Institute of Technology and Further Education, Ryde. Statement of Attainment in Spatial Information Systems, School of Surveying, Sydney Institute of Technology, Ultimo.
Simon Tweed	Bachelor of Environmental Science. Honours (Class II, Division 1) University of Wollongong.
Radika Michneiwicz	Bachelor of Science (first class honours), PhD

4.2.1 Survey Conditions

Weather conditions for each survey period are summarised below in Table 10. In general, conditions during the survey period were mild, with very little rainfall and often strong winds. Warm weather was experienced during summer and early autumn.

Table 10: Summary of survey conditions (averages) (BOM 2009)

Survey Period	Maximum temperature (°C)	Minimum wind speed (km/hr)	Maximum wind speed (km/hr)	Maximum average wind speed per month (km/hr)	Unusual weather conditions
Spring / Early Summer fauna surveys *(Nov-Dec)*	23.36	7.3	50.73	November: 51 (with missing entries) December: 52	• 5th November minimum temperature was - 0.2°C • 3rd November had 78km/h winds, 32.2mm of rain • 23rd November had 50% of the total monthly rain • 13th December had 85km/h winds • 20th December minimum temperature was 1.1°C with one of the lowest wind speed for the month of 37 km/h
Late Summer / Autumn fauna surveys (dragon surveys) *(Feb-May)*	23.37	7.99	41.09	February: 46 March: 44 April: 41 May: 33	• 2nd February had 76km/h winds • 26th April had 85km/h winds
Summer (vegetation mapping and threatened flora surveys) *(Jan)*	29.42	10.05	52.95	January: 52	• Extremely strong winds (1st January 78km/h winds) • 18th January had a minimum temperature of 3.8°C

Weather conditions were highly variable throughout the survey period. During October 2008, unusually cold conditions were experienced including snow in mid-October 2008. Conditions warmed towards mid-late December 2008 and coincided with a small amount of rainfall in late December 2008. Warm conditions were experienced from January to March 2009, with conditions beginning to cool again in April 2009.

Wind patterns were highly variable with moderate to strong winds experienced on many days throughout the survey period with very few still days. In some instances, strong winds are likely to have influenced the outcomes of some surveys (eg. bird surveys, owl call playback).

The prolonged drought being experienced throughout the southern tablelands is likely to have influenced the findings of this study. A prolonged period without rainfall may have reduced the activity of some fauna species.

4.2.2 Site Reconnaissance

A site reconnaissance was undertaken 20 - 24 October 2008, prior to the detailed field surveys, to verify site access, the broad vegetation types and condition, fauna habitat present across the study area and to select survey sites for the detailed surveys. This information was then used in conjunction with the DGRs to determine the requirements for the detailed surveys.

4.2.3 Vegetation Mapping

General Vegetation Mapping

Vegetation mapping was undertaken following summer rainfall to maximise the likelihood of detecting the majority of herbs and forbs present within the study area and therefore provide a more accurate assessment of the likelihood of the vegetation meeting the EPBC Act listing requirements.

A number of sources were used to provide background information for the mapping and these included:

- Aerial photographs dated 2001;
- Topographic maps (1:25 000):
  - Teapot 8724-44N
  - Wangellic 8724– S
- *Pre-settlement grassland v2 shape files* (DECC 1999);
- *Remote* sensing *mapping of grassy ecosystems in the Monaro* (Walter and Schelling 2004)
- Rehwinkel, R. (2005) *Draft Revision of Monaro Grassland Mapping*. Prepared for the Southern River Catchment Management Authority. DEC, Southern Branch, Queanbeyan.

The boundaries of vegetation communities were mapped onto an aerial photograph and marked using a GPS. Mapping within the study area was ground-truthed and areas across the project site that fell outside the study area were mapped based on visual observations and predictions based on the findings within the study area.

ArcMap Version 9.2, a Geographic Information System (GIS), was used to map and interpret data in this report. Vegetation communities and records of threatened species were plotted onto geo-referenced aerial photographs and other maps at scales of 1:50 000. This program was then used to calculate areas of each vegetation community and other habitats across the site.

Vegetation Condition / Determining the Presence of EECs

Areas of Natural Temperate Grassland (NTG) were determined using the Rehwinkel (2007) method as outlined in *A Method to Assess Grassy Ecosystem Sites: Using floristic information to assess a site's quality*. This method has been widely used throughout the Monaro and provides a method by which a sites floristic value can be determined and hence provide an indication as to whether the site is likely to meet the criteria for listing as NTG under the EPBC Act.

The method relies on three groupings of species:

- *Common* or increaser species – species which do not add much to the value of a site;
- Indicator *species* (Level 1) – these species indicate the site has value; and
- Indicator species (Level 2) – highly significant species that are the rarest of the grassy ecosystem species (Rehwinkel 2007).

Note: Indicator species are sometime referred to as 'grazing-intolerant' or 'declining' species.

Surveys were undertaken when the grassland diversity was most evident. Due to the current drought conditions, surveys were delayed until the area had experienced a reasonable amount of rainfall, followed by warm weather, to allow for sufficient germination and growth of annual species, and to increase the likelihood that herbs and forbs would be in flower at the time of survey. This season, suitable survey conditions occurred following rainfall during late December 2008, and therefore, vegetation mapping was undertaken in early January 2009 and plots surveyed during late January / early February 2009.

Initially, broad vegetation types present across the site were determined using aerial photography and a broad site inspection. Areas of grassy woodland, derived grassland and NTG were present at the site. The Rehwinkel (2007) decision tree, included in Appendix E, was used to initially categorise the vegetation types across the study area and initial vegetation community boundaries were mapped based on a brief site reconnaissance and aerial photographs. The study area was then traversed and a more detailed list of species collected in each area to confirm the vegetation type, community boundaries and in the case of grassland areas, assess the conservation value of the community and hence whether it met the criteria for NTG under the EPBC Act (Appendix, E).

The Rehwinkel (2007) methodology includes the use of 20 m x 20 m plots to determine the 'floristic value score' of each site. The floristic value score, together with the meeting of a number of site condition criteria, determines if the area is likely to be NTG. Given the size of the study area, it was not possible to undertake quadrats across all areas. Therefore, in areas where plots were not undertaken, a modified version of the Rehwinkel (2007) methodology was used to determine the presence of NTG. This involved a traverse of the vegetation unit to collect a list of the species present. An estimate of the cover for each species across the traversed unit was then assigned using the Braun - Blanquet scale as outlined below:

r	< 5 % cover and solitary (<4 individuals)
+	< 5 % cover and few (4-15 individuals)
1	< 5 % cover and numerous/scattered (>15 individuals)
2	5 % - 25 % cover
3	26 % - 50 % cover
4	51 % - 75 % cover
5	>75 % cover

The 'floristic value score' was then calculated using the Rehwinkel (2007) method. This involved assigning the species type code of 1 or 2 to any 'indicator species' recorded with the plot / traverse, in accordance with the listings provided for the Monaro sub region (Rehwinkel 2007). The data was included into the table below (taken from Rehwinkel 2007) and the 'floristic value score calculated by completing the following.

- Braun-Blanquet scores for each species included in Column A;
- Species type codes (i.e. 1 or 2) included in Column B;
- Braun-Blanquet scores for each species with a type code of 2 included in Column C;
- Braun-Blanquet scores for each species with a type code of 2, with the **exception those with a score of 'r'**, included in Column D;
- Braun-Blanquet scores for all species with a type code of either 1 or 2 included in Column E;
- Braun-Blanquet scores for each species with a type code of 1 or 2, with the **exception those with a score of 'r'**, included in Column F;
- The number of entries in Columns C, D and F respectively were counted and each of the tallies put in the appropriate column;
- The three tallies were then added to get the site's 'floristic value score.'

If the 'floristic value score' was 4 or greater, the site was considered to have moderate to high floristic value. Furthermore, if the site was a natural grassland (i.e. not a derived grassland) and had a score of 4 or greater, it was considered likely to have values consistent with those defined for the NTG EEC under the EPBC Act (Rehwinkel 2007). An example of how the method is applied has been included in Table 11.

For the grassland to be considered to have values consistent with those defined for NTG under the EPBC Act, the following criteria also needed to be met (Rehwinkel 2007):

- The site is in the Southern Tablelands; and
- Trees are absent, or are present but only in densities of <10% projected foliage cover, <5% crown cover, or 2 or fewer mature trees per hectare;
- It is not a secondary grassland; and
- Greater than 50% of the site's perennial cover is native; and
- The site is not a wetland; and
- One of the following are satisfied:
    - The site is dominated by Kangaroo Grass (*Themeda australis*), regardless of how much floristic diversity the site has; or
    - The site is dominated or co-dominated by River Tussock (*Poa labillardieri*), and occurs along a drainage line or on flats associated with drainage features; or
    - The site is dominated by grasses of other species and forbs are present such that its "floristic value score" is 4 or greater.

Table 11: Example for calculating floristic value score

Species name (Native species only)	Braun-Blanquet score	Species type code	Indicator species level 2	Indicator species level 2 with the exception of those with scores of "r"	Indicator species (level 1 & 2)	Indicator species levels 1 & 2 with the exception of those with scores of "r"
	Column A	Column B	Column C	Column D	Column E	Column F
Swainsona monticola	+	2	+	+	+	+
Asperula conferta	4	1			4	4
Desmodium varians	2	2	2	2	2	2
Cullen tenax	r	2	r		r	
TALLY:			3	2		3
SITE'S FLORISTIC VALUE SCORE:						8

In areas where plots were undertaken, these were stratified to vegetation type. Given the study area was mapped using standard vegetation mapping techniques as well as the Biobanking mapping technique, the number of plots to be undertaken across the study area was determined using the Biobanking methodology (DECC 2009c). A total of 40 vegetation quadrats were undertaken across the study area. From within each 20 m x 20 m plot, an inventory of flora species was also created. All vascular plant species within the quadrat were recorded and assigned a cover abundance score using the Braun-Blanquet scale. The methodology outlined above for calculating the floristic value score was then applied to the plot data to determine the presence of EECs.

4.2.4 Flora and Fauna Surveys

Detailed flora and fauna surveys were undertaken across the study area from 3 November 2008 until 4 May 2009 in accordance with DEC's *Threatened Biodiversity Survey and Assessment Guidelines* Working draft (DEC 2004) and with particular reference to the specific surveys requirements for species nominated in the DGRs. Survey periods were designed to target species during the seasons in which they were likely to be most detectable, active or in flower.

Survey effort / timing

Table 12 outlines the survey effort undertaken across the study area and the timing of each of the surveys. Further details of the methodology used have been included in Table 13.

Table 12: Survey effort and timing

Target Species	Sampling Technique	Survey Period	Survey Effort
Endangered Ecological Communities			
Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory	Vegetation mapping, quadrats, traverses	December 2008 – February 2009	40 quadrats and traverses. All turbine locations visited during vegetation mapping.
Upland Wetlands of the New England Tablelands and the Monaro Plateau	Vegetation mapping, quadrats, traverses	December 2008 – February 2009	
Threatened Flora			
Calotis glandulosa	Systematic search across all areas of potential habitat within a 200 m wide corridor (i.e. study area).	January 2009	80 person hours (undertaken simultaneously)
Dodonaea procumbens	Systematic search across all areas of potential habitat within a 200 m wide corridor (i.e. study area).	January 2009	
Rutidosis leiolepis	Systematic search across all areas of potential habitat within a 200 m wide corridor (i.e. study area).	January 2009	
Thesium australe	Systematic search across all areas of potential habitat within a 200 m wide corridor (i.e. study area).	January 2009	

Target Species	Sampling Technique	Survey Period	Survey Effort
Threatened Fauna			
Grassland Earless Dragon	Rock Rolling	November / December 2008 Opportunistic October 2008 - April 2009	53.5 person hours plus opportunistic rolling
	Rock Rolling (potential offset site)	March 2009 April 2009	6 person hours 33 person hours
	Spider Tubes	February – March 2009	500 tubes check 3 times / week for 3 weeks
		April – May 2009	200 tubes removed at end of March due to successful dragon capture, 100 of which were relocated to potential offset site 400 tubes check 3 times/week for 3 weeks
Golden Sun Moth	Hand net	November / December 2008	21.75 person hours
Pink-tailed Worm Lizard	Rock Rolling	November / December 2008 Opportunistic from October 2008 – April 2009	53.5 person hours plus opportunistic rolling
	Rock Rolling (potential offset site)	April 2009	33 person hours
Little Whip Snake	Rock Rolling	November / December 2008 Opportunistic October 2008 - April 2009	53.5 person hours plus opportunistic rolling
	Rock Rolling (potential offset site)	April 2009	33 person hours
Striped Legless Lizard	Snake Funnels	November / December 2008	1500 trap nights 3 funnels per line, 5 lines per site for four

Target Species	Sampling Technique	Survey Period	Survey Effort
			weeks across five sites
	Tiles	November 2008 – April 2009	100 tiles, 20 per site. Checked once a week for four weeks in Spring / early Summer 2008 and then left for approximately 2 months. Checked once a week for 3 weeks in February 2009 and 3 weeks in April 2009.
	Rock Rolling (potential offset site)	April 2009	33 person hours
Birds	Bird census – point method (20 min – 60 min survey)	November / December 2008 Opportunistic October 2008 - April 2009	60 person hours 13 sites on Yandra 6 sites on Sherwins 5 sites on Boco 3 on Springfield Most sites visited on more than one occasion
Owls	Call playback	November / December 2008	8 call playback nights
	Spotlighting	November / December 2008	15.75 person hours
Microbats	Anabat Detection	November / December 2008	30 anabat nights
Mammals	Spotlighting	November / December 2008	15.75 person hours

Flora Quadrats

In accordance with the Department of Environment and Conservation (DEC) (2004) *Draft Survey Guidelines* and Biobanking assessment methodology as outlined in the *Biobanking Assessment Methodology and Credit Calculator Operational Manual* (DECC 2009c), the vegetation was stratified to vegetation community and biometric condition plus ancillary codes (i.e. vegetation zone) and 40 vegetation condition plots / transects were randomly placed within each vegetation zone according to Table 4 of the assessment methodology.

All species present within each quadrat were recorded and a cover abundance ranking assigned to each species. Notes were also taken on the dominant species, the level of weed invasion and any other signs of disturbance. Figure 4 shows the location of each of the vegetation quadrats throughout the study area.

Any specimens unidentifiable in the field were retained and later identified. Any specimens that were thought to be threatened species or for which identification was problematic were sent to the Herbarium at the Royal Botanic Gardens, Sydney for verification.

On the Monaro there appears to be a species of *Poa sieberiana* (*Poa* aff. *sieberiana*) that is different from the other *Poa sieberiana*. This has been borne out by DNA but not by morphological characters. The *Poa* aff. *sieberiana* is similar in characteristics to *Poa labillardierei* and, therefore, some people on the Monaro tend to treat the *Poa* aff. *sieberiana* as *Poa labillardierei* (Surrey Jacobs, RBG, 2009, pers comm.). However, the two occur in different positions in the landscape and, therefore, this characteristic can be used to help distinguish between the two species in the field. This feature has been used to help identify the *Poa* spp. present during the vegetation mapping where detailed flora surveys of all species present are not undertaken. *Poa sieberiana* (Snow Grass) is also present on the Monaro and is more easily distinguishable from *Poa* aff. *sieberiana* and *Poa labillardierei*.

Fauna Habitat

Areas of known and potential habitat for threatened reptiles were mapped across the study area (Figure 10, Figure 11). Habitat mapping was sensitive to the rotational grazing practices that occur on most properties, and while some areas may not have appeared to be suitable habitat at the time of the survey, there was sufficient diversity and habitat features to suggest that when the paddock was rested from grazing, that it may adopt a more suitable structure for threatened reptiles.

For highly mobile species such as birds and bats, habitat was not mapped across the study area although areas of potential habitat are identified within Section 4.3.4 of this report. Habitat for arboreal mammals was also not mapped as the boundaries of woodland vegetation can be clearly seen on the aerial photograph. Given that the majority of trees on the site were hollow-bearing, these have not been mapped.

Criteria used to define areas of potential and known habitat for each threatened species is listed below.

<u>Grassland Earless Dragon</u>

- ‘known’ - recognises the habitat in which the Grassland Earless Dragon has been caught in the immediate area (note: this includes a small area of derived grassland);
- ‘high potential’ - refers to native grassland which is habitat that is consistent with known Grassland Earless Dragon habitat and described habitat but no dragons have been found to date; and
- ‘low potential’ - refers to derived grassland which has a habitat structure and features consistent with the known described habitat structure and features, and is adjacent to areas of NTG but no dragons have been found to date.

Little Whip Snake

All native vegetation across the study area, except where it occurs in gullies or on low lying areas likely to be periodically inundated, was considered potential habitat for this species as this species prefers well drained hillsides mostly associated with scattered rocks.

- Suitable areas of NTG
- Areas of derived grassland that are adjacent to areas of NTG, SGW or RGOF
- All native areas of SGW and RGOF;
- Areas of SGW, RGOF and derived grassland with exotic groundcover provided there is sufficient groundcover vegetation to support their major dietary prey preferences and there sheltering requirements are been met

Striped Legless Lizard

Although this species was not recorded within the study area it was recorded to the north of Springfield Road and therefore there is the potential for this species to inhabit the study area. Given this species can inhabit both native and exotic grassland areas, the following areas were mapped as potential habitat for this species:

- All areas of NTG
- Areas of derived grassland that are adjacent to areas of NTG
- Areas of exotic grassland that are adjacent to NTG

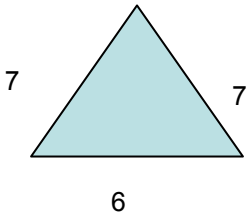
Pink-tailed Worm Lizard (*Aprasia parapulchella*)

This species inhabits sloping, open woodland areas with predominantly native grassy groundlayers, particularly those dominated by Kangaroo Grass (*Themeda australis).* Sites are typically well-drained, with rocky outcrops or scattered, partially-buried rocks.

- Suitable areas of NTG
- Areas of derived grassland that are adjacent to areas of NTG

Table 13: Detailed fauna survey methods (approach agreed to between DECCW and Eco Logical Australia)

Survey Technique	Method
General Fauna Habitat Assessment	▪ Resources recorded: shelter, basking, roosting, nesting and foraging sites for amphibians, birds, bats, arboreal mammals, ground-dwelling mammals and reptiles. ▪ Indirect evidence of fauna recorded: feathers, fur, tracks, dens, nests, scratches, chew marks and owl wash.
Rock Rolling	▪ Rocks were rolled in search of reptiles at proposed turbine sites or along proposed road / reticulation path ▪ Surveys undertaken Spring / Summer 2008 and Summer / Autumn 2009 ▪ Rocks were also rolled at the potential offset sites during March and April 2009
Snake Funnels	▪ Funnels were placed in 5 lines of 3 at each of 5 surveys sites.  ▪ Each trap line was located at least 20 m from another. ▪ Trap lines had varying orientations ▪ Selection of 'best' habitat across the landscape. More intensive surveys in these areas undertaken rather than surveys of sub-optimal areas to cover greater survey area. ▪ Traps left for four weeks and checked daily (i.e. total of 16 days).
Spider Tube	▪ 5 sites with 100 spider tubes per site each tube separated by approximately 10 m ▪ Tube placed in a linear formation ▪ Surveys undertaken during February – April 2009 as population levels were considered likely to be greater at this time due to juveniles being present ▪ 500 tubes checked 3 times/week for 3 weeks February – April 2009 ▪ 200 tubes removed at end of March 2009 due to successful dragon capture, 100 of which were relocated to a potential offset site ▪ 400 tubes checked 3 times/week for 3 weeks during April 2009

Survey Technique	Method
Sun Moth Netting	▪ Areas of potential habitat meandered and any moths caught using a hand net and identified ▪ Surveys were undertaken during warm conditions with as minimal wind as possible given the naturally windy nature of the study area. ▪ The methods followed the DEWHA survey technique guidelines
Tiles	▪ 100 tiles, 20 per site in triangular formation  ▪ Tiles left undisturbed for one week in Spring prior to checking ▪ Checked once a week for four weeks in Spring / early Summer 2008 and then left for approximately 2 months ▪ Checked once a week for 3 weeks in February 2009 and 3 weeks in April 2009 ▪ Tiles rolled wherever possible during the coolest times of the day
Spotlighting	▪ Undertaken within suitable vegetation stratification units (Figure 5). ▪ Listening for vocalisations was undertaken in conjunction with spotlighting. ▪ Stag watching was undertaken for a period of 30 m prior to and after dusk at spotlighting sites.
Anabat Detection	▪ Ultrasonic Anabat Detection recorders placed in suitable flyways across the study area within a variety of vegetation communities including riparian areas and along tracks and adjacent to wetlands (Figure 5). ▪ Z-Caim Anabats were activated just before dusk and retrieved each morning. ▪ Recordings were analysed by Alica Lyon (Eco Logical Australia) and Anna Lloyd (EcoLocation). ▪ Anabats were placed at each site for two consecutive nights.

Survey Technique	Method
Diurnal Birds – Formal Census	▪ Undertaken across the site using 20 minute search of a 1 ha area (DEC 2004) in each vegetation stratification unit during spring (Figure 5). ▪ For a period of 20 minutes (or longer in areas of high bird activity), all birds species observed and heard calling within a 1 ha area were recorded. During the 20 minute period, the observers remained stationary for periods and also moved slowly through the search area. ▪ On most occasions, survey periods were extended for up to 60 minutes to increase the potential of detecting the majority of species present in the area. ▪ A summary of the survey effort for 20 minute bird counts is provided in Table 12 and the survey locations shown in Figure 5.
Nocturnal call playback	Surveys for owls and other nocturnal birds were undertaken at a variety of woodland locations across the study area and were comprised of the following: ▪ Pre-survey listening by observers undertaken for approximately 10 minutes prior to call playback as a number of nocturnal bird species are known to give their distinctive calls at dusk. ▪ Call playback: Pre-recorded calls of nocturnal birds for which potential habitat was present in the area were broadcast through an amplifier after dusk in order to elicit a response. Each species call was broadcast separately, with a gap before commencing the calls of the next species. ▪ Threatened species targeted included Masked Owl (*Tyto novaehollandiae*), Powerful Owl (*Ninox strenua*) and Barking Owl (*Ninox connivens*). ▪ Post-survey listening: After conducting call playback a quiet listening and watching period of 10 minutes was undertaken for any nocturnal birds that may respond to the calls. ▪ Spotlighting: Habitat within approximately 50 m radius of the call playback site was spotlighted by two observers. The aim of spotlighting was to check if any nocturnal birds had quietly flown in without calling and was also used to confirm the identity of any nocturnal birds heard calling within close vicinity. ▪ A summary of the survey effort is provided in Table 12 and the survey locations are shown in Figure 5.
Diurnal and Nocturnal Surveys – Incidental Observations	▪ All incidental records of birds were documented during all survey activities and periods. ▪ Any other indirect signs relating to the possible presence of bird species within the study area were also documented (e.g. feathers, bones, nests, pellets).

4.2.5 Biobanking Surveys

Biobanking Vegetation Mapping

Mapping of vegetation was also undertaken in accordance with the Biobanking methodology. For Biobanking the Revised Biometric Vegetation Type (RBVT) from the relevant CMA region that has the closest resemblance to the vegetation at the site is selected. In some cases where the vegetation types observed in the field do not fit neatly into the vegetation types listed for a CMA area (e.g. where the vegetation lies in an ecotone between two types), the professional judgment of the assessor has been used to select the closest matching vegetation type.

Given the study area has been modified and subject to many years of grazing, the dominant species and vegetation boundaries present today may not accurately reflect the pre-European vegetation types and boundaries. Therefore, Biobanking vegetation types and community boundaries were determined using past literature and mapping of the Monaro (Costin 1954), evidence from less disturbed areas of the Monaro and liaison with experts who have conducted studies of the Monaro. However, considering the difficulty in determining past vegetation community boundaries, there is the potential for some degree of error in this predictive mapping.

Vegetation Zones

Following the determination of the appropriate vegetation type, the vegetation type needed to be broken into a series of 'vegetation zones', areas of the same vegetation type in similar or homogenous condition. This task is separated into two steps:

Step 1: Determining the vegetation condition using the definitions provided in the Biobanking Operations Manual (DECC 2009c).

For operational reasons, the minimum size of a vegetation zone is 0.25 ha. An area of vegetation that is less than 0.25 ha is included in the adjoining vegetation zone, i.e. the smallest area of a vegetation zone is 0.25 ha. Where more than one vegetation zone adjoins an area of vegetation of less than 0.25 ha, then the 0.25-ha area should be included with the vegetation zone with the closest condition and percent cleared value in the CMA (DECC 2009c).

The condition of the vegetation was determined using the following criteria:

Vegetation in low condition was:

- **woody native vegetation with:**
    - native over-storey percent foliage cover less than 25% of the lower value of the over-storey percent foliage cover benchmark for that vegetation type, and
    - less than 50% of groundcover vegetation is indigenous species, or
    - greater than 90% of groundcover vegetation is cleared.

- **native grassland, wetland or herbfield where:**
    - less than 50% of groundcover vegetation is indigenous species[1], or
    - more than 90% of groundcover vegetation is cleared.

Note: [1] Means less than 50% of the percent foliage cover of the groundcover vegetation consists of indigenous groundcover species, not less than 50% of the groundcover species are indigenous species. Groundcover vegetation is herbaceous vegetation including grasses, forbs, herbs and similar low-growing non-woody plants.

If native vegetation was not in low condition, it is in moderate to good condition.

Cleared land is land on which the native over-storey has been cleared, there is no native mid-storey, and less than 50% of the ground cover vegetation is indigenous species, or greater than 90% of the ground cover is cleared. Grassland vegetation with more than 50 % of the ground cover comprising non-native species is classified as cleared.

It is a requirement for Biobanking that the percentages for the groundcover calculations be made in a season when the proportion of native groundcover vegetation compared to non-native groundcover vegetation in the area is likely to be at its maximum. Therefore vegetation mapping and quadrats were undertaken in summer following rain as this was consider the time at which most species were likely to be detectable.

Step 2: Assigning ancillary codes

Vegetation of the same type can be stratified into distinct vegetation zones with a similar broad condition state (i.e. ancillary code). For this assessment the vegetation types have been broken into separate vegetation zones by assigning one of the following ancillary codes:

- Grazed tussocks > 5 cm
- Heavily Grazed – tussocks less than 5 cm

It is important to note that mapping reflects the condition of the site at the time of the survey. Due to rotational grazing practices there is the potential for the ancillary code of each zone to change over time.

Together the vegetation type, condition and ancillary code form a vegetation zone. The boundaries of this zone were then mapped onto aerial photographs using GIS.

Step 3: Assessing the Site Value - Quadrats / Traverses

Transects and plots were established randomly in each vegetation zone. Transects were used to assess the site attributes that are measured by percent foliage cover. Other site attributes (except regeneration) were assessed by plots. Regeneration was assessed for the entire zone.

The amount of each vegetation zone present within the proposed impact area was calculated using GIS and the number of plots / traverses required was determined based on the Biobanking methodology.

A diagrammatic representation of the plot and transect layout is shown below and has been sourced from the DECC *Biobanking Operation Manual* (DECC 2009c). Details of the methods used for the assessment have been provided in Table 32, Appendix M.

Biobanking Target Species

The Biobanking Credit Calculator (Step 4) requires targeted survey for six threatened flora and eight threatened fauna using the Biobanking Assessment Methodology. Note that the species requiring survey under the Biobanking Methodology is generated at Step 4 of the Credit Calculator and covers those species not filtered out by habitat surrogates in Steps 1, 2 and 3. For instance, whilst the Little Whip Snake has known records in proximity to the study area (DECC 2008), survey is not required for the species as it is predicted to occur based on the vegetation types present within the study area.

Given that an application for a formal Biobanking Statement is not being requested for the proposal, more detailed flora and fauna surveys were undertaken across the site in accordance with the DGRs and amendments negotiated with DECCW (Table 30).

The species requiring specific surveys for this project under Biobanking are:

Common Name	**Scientific Name**
Flora	
Creeping Hop-bush	*Dodonaea procumbens*
Rough Eyebright	*Euphrasia scabra*
Baeuerlen's Gentian	*Gentiana baeuerlenii*
Monaro Golden Daisy	*Rutidosis leiolepis*
Silky Swainson-pea	*Swainsona sericea*
Austral Toadflax	*Thesium australe*
Fauna	
Pink-tailed Worm-lizard	*Aprasia parapulchella*
Striped Legless Lizard	*Delma impar*
Green and Golden Bell Frog	*Litoria aurea*
Southern Bell Frog	*Litoria raniformis*
Square-tailed Kite	*Lophoictinia isura*
Eastern Bentwing-bat (Breeding Habitat)	*Miniopterus schreibersii oceanensis*
Pink Robin	*Petroica rodinogaster*
Grassland Earless Dragon	*Tympanocryptis pinguicolla*

Discussions were held with DECCW regarding the likelihood that *Gentiana baeuerlenii* and *Litoria aurea* would occur within the study area and it was agreed that these species were highly unlikely to occur and that targeted surveys would not be required for these species.

4.2.6 Limitations of Vegetation Mapping and Flora and Fauna Survey Methods

General

The survey effort and study design optimised the potential for species to be recorded during a range of climatic situations and over a number of seasons. Nonetheless, it is not possible to record every species that may either be resident or transitory across a site as generally some species may have been inactive, dormant or with cryptic habits, or some may be nomadic or migratory in nature. Additionally, some fauna species are mobile or transient in their use of resources. Consequently, it is

likely that not all species, either resident or transitory, would have been recorded during the study period which extended over 2008 / 2009 and, therefore, the likelihood of occurrence within the study area of some threatened species was assessed based on the presence of potential habitat.

Given the limitations associated with all surveys, this assessment was not intended to provide an inventory of all species present across the site but instead aims to provide an overall assessment of the ecological values of the site with particular emphasis on threatened species, endangered ecological communities and key fauna habitat features.

Vegetation community boundaries

Vegetation mapping of an area seeks to describe the distribution of the plant species in that area at that time by defining a number of vegetation units (assemblages or communities), which are relatively internally homogeneous. This generalised approach can over simplify the real situation as plants rarely occur in well-defined communities with distinct boundaries. Accordingly, vegetation units used for mapping should be viewed as indicative of their extent.

Past vegetation distribution predictions

The long history of grazing on the Monaro has altered the landscape such that the vegetation composition today does not necessarily reflect that of the past. Although literature was reviewed to assist in determining the vegetation types likely to have been present in the past, there are likely to be limitations with the accuracy of this mapping. In general, the boundaries of the Costin (1954) mapping have been used to delineate historical grassland / woodland boundaries and this is consistent with the advice provided by DECCW regarding the past mapping that was likely provide the most accurate reflection of historic woodland and grassland boundaries. However, it is important to note the Costin (1954) mapping was produced at broad scale and, therefore, has the potential to have inaccuracies when applied at finer scales. .

Species composition

Due to heavy and persistent grazing within some parts of the study area, difficulty was experienced identifying some species as specimens were inadequate. In such instances, flora were identified to genus only.

Biobanking ancillary codes

It is important to note that the condition of each vegetation zone across the landscape in terms of grazing intensity is dynamic, with rotational grazing practices changing which areas are subject to more intensive grazing throughout the year. Therefore, our assessment illustrates a snap shot in time that does not necessarily reflect the year round grazing condition of each vegetation zone.

Mapping data limitations

Spatial co-ordinates for features, habitats or species, recorded in the field were captured using a Garmin GPSmap 76 (GPS) and transferred to ArcGIS Geographic Information Systems (GIS) programs. The accuracy of GPS readings varies depending on the number of signals obtained by the GPS unit from satellites. Where possible GPS points were only taken when the accuracy was < 10 m. Sub 10 m accuracy was considered appropriate for this assessment.

4.3 RESULTS

4.3.1 Literature Review

A summary of the vegetation communities mapped across the project site by the various sources is provided in Table 14. Although the *Forest Ecosystems, South Coast sub-region (Southern CRA)* mapping (NPWS 1999) was included in the review, this mapping consisted of a patchy distribution around the study area with only minor occurrences of the mapping falling within the study area and therefore was used primarily for guidance on the vegetation types present within the locality.

Table 14: Vegetation communities mapped within project site

Source of vegetation mapping	Vegetation community	Mapping within study area
Vegetation map of the Monaro region of NSW (Costin 1954)	*Eucalyptus pauciflora / Eucalyptus stellulata* alliance (Savannah Woodland)	✓
	Austrostipa scabra / Austrostipa bigeniculata Alliance (Dry Tussock Grassland)	✓
Forest ecosystems, South Coast sub-region (Southern CRA) (NPWS 1999)	Eastern tablelands dry shrub / grass forest – *Eucalyptus pauciflora / Eucalyptus viminalis / Acacia dealbata / Themeda australis*	✓
	South east tablelands dry shrub/ tussock grass forest – *Eucalyptus rossii / Eucalyptus mannifera / Pultenaea procumbens / Chionochloa pallida*	
	South eastern tablelands dry shrub/ grass / herb forest – *Eucalyptus bridgesiana / Eucalyptus pauciflora / Eucalyptus rubida / Acaena novae-zealandiae*	
	Tableland Tussock Grassland / Sedgeland / Woodland – *Poa labillardieri / Carex appressa*	✓
Remote Sensing Mapping of Grassy Ecosystems in the Monaro (Walter and Schelling 2004)	Grassland high diversity – a	✓
	Grassland high diversity - b	✓
	Grassland med / low diversity – a	✓
	Grassland med – low diversity b	✓
	Low diversity – crops and exotics	✓

Source of vegetation mapping	Vegetation community	Mapping within study area
	Mixed exotic grassland and crops	✓
Native Grassland Mapping for the 'Purple Patches' Sustainable Grazing on the Monaro Project (Unpublished SRCMA, 2008).	Probably high value grasslands	✓
	Probable medium value grasslands	✓
	Low conservation value grasslands	✓
	Pasture and crops	✓

The study area falls within the Southern Rivers CMA Region – Monaro (Part C) sub-region. Three endangered ecological communities have been identified as occurring within this CMA sub-region:

- *Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps;*
- *Natural Temperate Grassland of the Southern Tablelands (NSW and ACT);* and
- *White Box Yellow Box Blakely's Red Gum Woodland*.

Based on the soil, altitude, topography and field observations, it is considered unlikely that *White Box Yellow Box Blakely's Red Gum Woodland* or *Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps* occur within the study area. Whist ephemeral wetlands are present at the site, it is considered that these are more likely to be characteristic of upland wetlands rather than those described as Montane Peatland and Swamps.

A number of threatened flora and fauna species have previously been recorded within the locality (i.e. 10 km radius). Table 46 lists those species previously recorded within the locality (DECC 2009b, RBG 2008, Birds Australia 2009) or that are considered to have the potential to occur (DEWHA 2009a, DECC DGRs). The likelihood of these species occurring on site has been addressed in more detail in Section 4.3.

Native Grassland Mapping for the 'Purple Patches' Sustainable Grazing on the Monaro Project

The Southern Rivers CMA (CRCMA) has undertaken mapping of the Monaro Grasslands as part of their 'Purple Patches' Sustainable Grazing Project. The SRCMA has bundled the 36 vegetation classes, identified through remote sensing, into six groups to provide a focus for the High Conservation Value classes. Figure 8 shows the areas across the Monaro identified as of potential High Conservation Value (HCV) by the SRCMA and the areas that may be indicative of vegetation and wildlife corridors that should be protected in future years (Wil Allen, SRCMA, 2009, pers. comm.). Impacts on areas identified as HCV and identified have been avoided wherever possible. However, given the extent of NTG across the landscape and the operational requirement to place turbines on ridgetops, complete avoidance was not possible. Nonetheless, it is considered unlikely that the proposal would result in fragmentation of the identified corridor such that adjacent areas of grassland will become disconnected and dispersal pathways inhibited.

4.3.2 Vegetation Communities / Condition

Six vegetation communities were present across the study area and their distribution is shown in Figure 6. Each community is listed below together with a description of the dominant species and general condition. Given that the study area is used for agricultural purposes these vegetation types are impacted by varying degrees of weed invasion, grazing intensity and soil disturbance depending on the land use practices on each property.

The Biobanking vegetation mapping and condition of each vegetation type in accordance with the Biobanking methodology has been included in Figure 7.

Ribbon Gum - Snow Gum Woodland

Areas of Ribbon Gum - Snow Gum Open Forest (RGOF) occur primarily in the eastern part of the site on Yandra with small occurrences on the eastern side of Boco. This community occurs on the basalt soils on the ridges and gullies surrounding the Maclaughlin River.

This community was characterised by the dominance of Snow Gum (*Eucalyptus pauciflora*) and Ribbon Gum (*Eucalyptus viminalis*) to 30 m with the occasional Mountain Gum (*Eucalyptus dalrympleana*) recorded on Yandra. The understorey varied depending on land use practices. Some areas were sown with exotic species such as Phalaris (*Phalaris aquatica*) and Barley Grass (*Hordeum vulgare*) as was the case on large portions of the north east of Yandra. A native understorey was present throughout much of the remainder of this community although grazing intensity varied. This community had been subject to heavy grazing in many parts of the study area. However, it is important to note that the condition of this community across the landscape is dynamic, with rotational grazing practices altering areas subject to more intensive grazing throughout the year and therefore our assessment illustrates a snap shot in time that does not necessarily reflect the year round grazing condition of each area of RGOF.

The shrub layer was primarily absent within this community with minor occurrences of Blackthorn (*Bursaria spinosa*) and the exotic species Sweet Briar (*Rosa rubiginosa*). In areas dominated by native species, *Austrostipa bigeniculata, Austrostipa scabra,* Ringed Wallaby Grass (*Austrodanthonia caespitosa*), *Poa* aff. *sieberiana* and *Carex inversa* were common.

The exotic species Serrated Tussock (*Nassella trichotoma*), Saffron Thistle (*Carthamus lanatus*), Scotch Thistle (*Onopordum acanthium*), Hairy Brassica (*Hirschfeldia incana*), Dwarf Mallow (*Malva neglecta*) were common throughout this community although spraying is undertaken for Serrated Tussock across the project site.

This community supported a large number of hollow-bearing trees although many trees were senescing and dying and there was no evidence of recruitment. Woody debris and fallen logs were also common throughout this community.

This community is likely to be characteristic, although a modified form, of the *Snow Gum, Ribbon Gum, Black Sallee and Candlebark Grassy Woodland of the South East NSW* vegetation community which has been nominated for listing as an EEC under the TSC Act. Given this community has not been formally listed to date, the legislative requirements for EECs under the TSC Act do not apply to the RGOF within the study area. A list of species recorded within this community is included in Appendix G.

This community is characteristic of the biometric vegetation community *Ribbon Gum – Snow Gum Grassy Open Forest on flats and undulating hills of the eastern tableland, South Eastern Highlands* and has been mapped in Figure 6.

Snow Gum – Candlebark Woodland

This community was recorded on the eastern fringes of Springfield and Sherwins on the eastern facing slopes. Most examples of this community fell outside the study area. Snow Gums and Candlebark (*Eucalyptus rubida*) dominated this community, the majority of which were hollow-bearing. Woody debris and fallen logs were less common throughout this community than in areas of RGOF although these features were present in some areas of SGW. The occasional Ribbon Gum was also recorded within this community. This community supported a grassy understorey dominated by native species of similar composition to areas of NTG and RGOF. The shrub layer in this community was primarily absent. A list of species recorded within this community is included in Appendix G.

This community is likely to be characteristic of the *Snow Gum, Ribbon Gum, Black Sallee and Candlebark Grassy Woodland of the South East NSW* vegetation community which has been nominated for listing as an EEC under the TSC Act. Given this community has not been formally listed to date, the legislative requirements for EECs under the TSC Act do not apply to the SGW within the study area.

This community is characteristic of the biometric vegetation community *Snow Gum – Candlebark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands* and has been mapped in Figure 6.

Natural Temperate Grassland

Native Grassland was recorded across the eastern (Springfield and Sherwins) and south-central (Boco) portion of the study area. Areas mapped as Natural Temperate Grassland are those that meet the criteria for *Natural Temperate Grassland of the Southern Tablelands (NSW & ACT)* under the EPBC Act and that obtained a floristic value score of 4 under the Rehwinkel (2007) methodology. Trees were scarce and in most cases absent throughout this community. The shrub layer was generally absent although low *Pimelea glauca* were sometimes scattered throughout and *Melicytus dentatus* was present along some rock walls. The dominant grass species present across areas of NTG varied with topography with drainage lines and low lying areas dominated by Tussock Grass dominating on the slopes and ridge tops. *Austrostipa bigeniculata, Austrostipa scabra*, *Poa* aff. *sieberiana* and Ringed Wallaby Grass were more common on the ridge tops. Other species commonly recorded on the slope and ridge tops included Wallaby Grass (*Austrodanthonia fulva*), *Enneapogon nigricans* and *Elymus scaber*. A variety native of herbs and forbs were also common including Common Woodruff (*Asperula conferta*), *Vittadinia* spp., Common Everlasting (*Chrysocephalum apiculatum*), Small Crumbweed (*Chenopodium pumilio*), Tufted Knawel (*Scleranthus diander*), Stinking Pennywort (*Hydrocotyle laxiflora*), Swamp Dock (*Rumex brownii*), Tough Scurf-pea (*Cullen tenax*), *Brachyscome dentata*, Climbing Saltbush (*Einadia nutans*), *Acaena* spp., *Wahlenbergia* spp. and Blushing Bindweed (*Convolvulus erubescens*). Various weeds, including species similar to those present in the disturbed grassland areas, are scattered throughout the NTG.

The condition of this community across the landscape varied according to the grazing intensity. Therefore our assessment illustrates a snap shot in time. Condition will vary according to the presence or absence of grazing, period of spelling, and rainfall.

Areas mapped as Natural Temperate Grassland correspond to one of the three following Biometric vegetation types. The predicted historical distribution of each is shown in Figure 7.

- *Kangaroo Grass - Snowgrass tussock grassland on slopes and ridges of the tablelands, South Eastern Highlands;*
- *River Tussock - Tall Sedge - Kangaroo Grass moist grasslands of the South Eastern Highlands;* and
- *Speargrass grassland of the South Eastern Highlands*.

Disturbed Grassland

Parts of the study area in the west that would have once supported NTG have been sown, spray seeded or grazed such that herbs and forbs characteristic of NTG no longer remain and therefore received floristic value scores of less than 4 and many were also assessed as being in low condition or cleared vegetation in accordance with the definitions of the Biobanking assessment methodology (Figure 6). These areas have been mapped as disturbed grassland as they no longer support the characteristics of NTG. Species sown into the pastures include Phalaris, Barley Grass and Lucerne (*Medicago sativa*). Native grass species present in the unsown areas were similar to those recorded in areas of NTG although in these areas forbs were either extremely limited or absent. Common weeds throughout disturbed grassland areas included Hairy Brassica (*Hirschfeldia incana*), Dwarf Mallow, Serrated Tussock, Blanket Weed (*Verbascum thapsus*), Sorrel (*Acetosella vulgaris*), Wild Sage (*Salvia verbenaca*) and Common Storksbill (*Erodium cicutarium*) and a variety of thistles. Many of these species are also scattered throughout areas of NTG but in less abundance.

Derived Grassland

Derived grassland areas are those that would have once supported SGW or RGOF but due to historical disturbance, now support vegetation with a structure more characteristic of grassland. These areas occur adjacent to SGW and RGOF and are present primarily within the western and central portions of the study area (Figure 6). Areas of derived grassland are dominated by similar grass, herb and forb species as those found in the areas of NTG. Species commonly recorded in derived grassland in areas adjacent to NTG include *Poa* aff. *sieberiana*, Ringed Wallaby Grass, *Austrostipa bigeniculata, Austrostipa scabra, Vittadinia* spp., Small Crumbweed, Swamp Dock, Tough Scurf-pea and Climbing Saltbush. Exotic species in these areas included Scotch Thistle, Dwarf Mallow, Blanket Weed, Phalaris, Barley Grass and Serrated Tussock. In general, these areas support weed species common also to areas of NTG and disturbed grassland across the study area. Under the Biobanking methodology these areas have been mapped as supporting vegetation type they historically would have supported as derived grasslands within the region are not recognised under this scheme (Figure 7).

Degraded wetland

In lower lying parts of the project site, ephemeral wetlands are present. All are currently dry and many of these have been sown with exotic species such as Barley Grass and Phalaris. Weed invasion by species such as thistles, Hairy Brassica and Great Brome (*Bromus diandrus*) is also common.

The ephemeral wetlands within the study area would not be considered characteristic of the EEC *Upland Wetlands of the New England Tablelands and the Monaro Plateau* listed under the EPBC Act as they have an average cover of introduced species of more than 50% of the plant cover present (DEWHA 2007). It is important to note that only those wetlands within the study area were ground-verified and, therefore, other wetlands areas present across the project site may be characteristic of this EEC.

Furthermore, the wetlands are unlikely to be considered characteristic of the *Montane Peatlands and Swamps* EEC listed under the TSC Act as this community is found on poorly drained flats in the headwaters of streams and on areas of peat. Given the study area supports wetlands that are in depressions in the landscape and not necessarily connected to streams, the soils have limited peat and the wetlands are without free standing water for the majority of the year, it is considered that the wetlands within the study area are more likely to be characteristic of the *Upland Wetlands of the New England Tablelands (New England Tableland Bioregion) and the Monaro Plateau (South Eastern Highlands) Bioregion* community.

Direct impacts to all wetlands have been avoided for the proposal and, therefore, need only to be protected from indirect impacts (see Section 5.5).

4.3.3 Flora

General Flora

One hundred and twenty nine species of vascular plants were recorded across the study area. Of these 90 were native with commonly recorded species including Snow Gum, Ribbon Gum, *Poa* aff. *sieberiana*, *Austrostipa bigeniculata, Austrostipa scabra,* Ringed Wallaby Grass and *Carex inversa*. A list of all species recorded across the study area in included in Appendix G.

Weeds accounted for approximately 30 % 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, Saffron Thistle (*Carthamus lanatus*), Scotch Thistle, Hairy Brassica, Dwarf Mallow, Phalaris, Barley Grass and Common Storksbill.

Threatened Flora

A number of threatened species are known to occur within the Monaro region or are considered to have the potential to occur. Database searches of the locality were undertaken and the results are included in Table 46 (DECC 2009b, RBG 2008, DEWHA 2009a). An assessment of the likelihood of each species being present within the study area has been included in Appendix I together with their conservation status under both state and Commonwealth legislation, habitat requirements and any vegetation communities across the study area that would provide potential habitat for these species.

No threatened flora species were recorded within the study area. However, potential habitat for the following species is present within the study area and all areas of potential habitat within the study area were systematically searched for these species:

- Mauve Burr-daisy (*Calotis glandulosa*)
- Trailing Hop-bush (*Dodonaea procumbens*)
- Monaro Golden Daisy (*Rutidosis leiolepis*)
- Silky Swainson-pea (*Swainsona sericea*)
- Austral Toadflax (*Thesium australe)*

The Monaro Daisy has been recorded in Nimmitabel, approximately 6 km from the study area (DECC 2009d). Habitat for this species is present across the majority of the study area although it was not recorded during the surveys.

The nearest Mauve Burr-daisy record is near Maffra approximately 10 km from the project site (DECC 2009d). Habitat for this species is present across the majority of the study area although it was not recorded during the surveys.

Silver-leaved Gum (*Eucalyptus pulverulenta*) has been recorded within the locality. However, potential habitat for this species was not present within the study area.

No records of Trailing Hop-bush, Silky Swainson-pea or Austral Toadflax have been recorded within a 10 km radius of the study area (DECC 2009d) although potential habitat for these species is present.

Rare or Threatened Australian Plants

Four RoTAP species are known to occur or have the potential to occur within the study area and these are listed in Table 46. None of these species have been detected at the site although habitat for several exists.

One RoTAP species was recorded within the study area, *Discaria pubescens* (3RCa), although this species was on the edge of the slope on Boco and in an area that would not be directly impacted by the proposal.

Regionally Significant Flora

There is no formal list of regionally significant plant species or communities for the Cooma-Monaro or Bombala Local Government Areas (Cooma-Monaro and Bombala Councils, 2009, pers comm.). However, Benson (1994) lists the following species as being regionally rare on the Tableland tract of the Monaro:

- Purple Donkey Orchid (*Diuris punctata*)
- *Swainsona monticola*
- *Swainsona behriana*
- *Austrostipa blackii*
- *Senecio velleioides*
- *Ranunculus sessiliflorus* var. *sessiliflorus*
- *Podolepis hieracioides*
- Lanky *Buttons* (*Leptorhynchos elongatus*)
- *Solenogyne dominii*

Both *Swainsona monticola* and *Swainsona behriana* were recorded within NTG, disturbed grassland and derived grassland within the study area.

Noxious Weeds

Three weed species listed as noxious weeds under the NSW Noxious Weeds Act 1993 (NW Act) for the Cooma-Monaro and Bombala LGAs 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. Those recorded are listed in Table 15 together with their Control Class under the NW Act. Willows were present adjacent to the study area along the Maclaughlin River. Depending on the species present, these may also be classed as noxious weeds in the LGA.

Table 15: Noxious weeds recorded within the study area

Scientific name	Common name	NW Act class	WONS
Nassella trichotoma	Serrated Tussock	4	
Hypericum perforatum	St John's Wort	4	
Rosa rubiginosa	Sweet Briar	4	
Salix spp.	Willows	5*	×*

Key

WONS Weeds of National Significance

NW Act N*oxious Weeds Act 1993*

Class 4 the growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority

Class 5: the requirements in the *noxious weeds act 1993* for a notifiable weed must be complied with

* excludes *s. Babylonica, s. X reichardtii, s. X calodendron*

4.3.4 Fauna and Fauna Habitat

One hundred fauna species were recorded across the site, the large majority of which were native species and these are listed in Appendix H. Based on the vegetation types present within the study area, habitat for species such as ground-dwelling mammals and some arboreal mammals is limited. However, the landscape supports unique features such as grasslands and extensive rocky areas which provide potential habitat for a wide variety of reptile species.

Fauna Habitat

Areas of SGW and RGOF within the study area provide habitat for a variety of fauna including birds, owls, bats, arboreal mammals, reptiles and in areas where dams are present, amphibians. The majority of the trees within the study area supported hollows and Yandra in particular provides potential habitat for hollow-dependant species.

Grassland areas occur primarily on the Springfield, Sherwins and Boco clusters. Depending on grazing intensity, many of these areas support large Poa tussocks. These tussocks provide sheltering habitat for a variety of reptile species. The rocky outcrops present on the ridge tops and mid slopes also provide habitat for reptile species including the Grassland Earless Dragon and Little Whip Snake which have been recorded at a number of locations across the study area.

Table 16 summaries the key habitat features within the study area, identifies the vegetation type in which they are present and the species for which each feature would provide habitat.

Table 16: Key fauna habitat features present across the study area

Habitat feature	Vegetation type	Species
Hollow-bearing trees / stags	SGW, RGOF	Arboreal mammals, microchiropteran bats, hollow-dependent birds including owls, reptiles
Stag	SGW, RGOF	Birds, particularly birds of prey
Rocky outcrops	NTG, SGW, RGOF, DG, DrG	Reptiles
Dams and watercourses	SGW, RGOF, NTG, DG, DrG	Amphibians, birds, reptiles, microchiropteran bats
Wetlands (ephemeral)	DW	Birds, microchiropteran bats and frogs, reptiles
Autumn / winter-flowering eucalypts	SGW, RGOF Ribbon Gum (*Eucalyptus viminalis*) Mountain Gum (*Eucalyptus dalrympleana*)	Birds and bats
Tussock grasses	NTG, SGW, RGOF, DG, DrG	Reptiles and birds
Flowering myrtaceous trees and shrubs	SGW, RGOF	Foraging resources for birds and mammals.
Fallen timber	SGW, RGOF	Small mammals and reptiles
Leaf litter	SGW, RGOF	Amphibians, reptiles, ground-dwelling mammals
Defoliating bark	SGW, RGOF	Microchiropteran bats, reptiles
SEPP 44 Koala feed trees	Ribbon Gum (*Eucalyptus viminalis*)	Koala
Note: SGW = snow gum woodland, RGOF = Ribbon Gum Open Forest, NTG = Natural Temperate Grassland, DG = Degraded Grassland, DrG = Derived Grasslands, DW = Degraded Wetland		

Tree Hollows

Tree hollows are abundant across the woodland areas (SGW, RGOF) of the project site. Almost all trees within the landscape support hollows and therefore potential habitat for hollow-dependant species is abundant. However, many trees are senescing and there little evidence of recruitment in the landscape. Therefore, the protection of hollow-bearing trees and measures to encourage / promote recruitment are imperative. The proposal has been designed such that tree removal has been minimised wherever possible and will be further minimised during the detailed design phase. All turbines have been placed at least 30 m from hollow-bearing trees.

Corridor Values / Movement Pathways

Small areas of woodland are scattered across the landscape. A large proportion of the turbines are located on the western side of the project site within grassland areas and support large areas of extensive grassland to their west. Given the open structure of the woodland and forests 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 Boco and Yandra and from these areas east to more vegetated areas.

Movement between wetlands and waterbodies 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 they have water is unlikely to be impeded by the proposal. There is the potential for species to move from the north (Lake Williams) or east to the wetland areas in the west of the site or to the Maclaughlin River.

4.3.5 Fauna Groups

Avifauna

A total of 76 bird species were recorded within the study area during the surveys. These species are listed in Appendix H. Common species recorded included the Australian Magpie (*Gymnorhina tibicen*), Richards Pipit (*Anthus novaeseelandiae*), Australian Raven (*Corvus coronoides*), Crimson Rosella (*Platycercus elegans*), Red Wattlebird (*Anthochaera carunculata*), Eastern Rosella (*Platycercus adscitus eximius*), Striated Pardalote (*Pardalotus striatus*) and Brown Songlark (*Cincloramphus cruralis*).

The only nocturnal bird species recorded was the Southern Boobook (*Ninox novaeseelandiae*).

The study area supports potential foraging, nesting and roosting habitat for a large variety of bird species. Nesting habitat for hollow-dependent species is abundant in areas of SGW and RGOF as there are numerous hollow-bearing trees. The abundance of native flora provides extensive foraging resources throughout all seasons. The grassland areas provide habitat for common grassland bird species such as the Brown Songlark and Richards Pipit and also provide foraging areas for birds of prey.

Birds of prey were common throughout the study area. Those commonly recorded included the Nankeen Kestrel (*Falco cenchroides*), Wedge-tailed Eagle (*Aquila audax*) and Brown Falcon (*Falco berigora*). The Peregrine Falcon (*Falco peregrinus*) was recorded on one occasion adjacent to the study area.

Habitat for wetland birds was present across the project site as the site comprises wetlands, which were dry during the survey period. However, during wet periods they are likely to be a valuable resource for many birds, reptiles and amphibians.

Ground dwelling and arboreal mammals

Habitat within the study area for ground-dwelling mammals is limited as there is no shrub layer and the groundlayer in many areas has been heavily grazed. However, in those areas where woodland is present and grazing is less intense, tussock grasses and fallen timber / logs provide nesting and shelter resources for ground-dwelling mammals. The Eastern Grey Kangaroo (*Macropus giganteus*) and Echidna (*Tachyglossus aculeatus*) were recorded within the study area. Four introduced mammals were also recorded within the study area including the House Mouse (*Mus musculus*), European Red Fox (*Vulpes vulpes*), European Rabbit (*Oryctolagus cuniculus*) and Domestic Cat (*Felis catus*).

Megachiropteran and Microchiropteran Bats

Habitat for microchiropteran bats is present across the study area and ten species of microchiroptern bats have been recorded foraging across both the grassland and woodland areas although woodland areas were more commonly used. Bat activity was generally low across the site, with 18 calls the average number recorded each night. The low number of calls does not necessarily indicate low numbers of bats within the area but instead indicates the levels of bat activity across the site during census times.

Table 36 lists those species recorded across the study area during anabat surveys as well as those not recorded but that are considered to have the potential to occur and their preferred flight heights. Above canopy foragers are more likely to be impacted by the proposal during operation than those remaining below the canopy. Species that are likely to migrate to and from the site and species with higher flight paths are more likely to be impacted by operational turbines.

Amphibians

The drought conditions and limited water availability across the project site is likely to have influenced the low amphibian activity experience during the survey. No targeted amphibian surveys were conducted although six species of amphibian were recorded as incidental records heard during other nocturnal surveys, trapped in snake funnels or encountered during rock rolling. A list of species recorded is included in Appendix H. All species are common species of which all except Verreaux's Tree Frog (*Litoria verreauxii*) are ground frogs.

Reptiles

The rocky substrate across much of the study area provides ample habitat for a variety of reptile species. In addition, the fallen debris in woodland areas and large tussocks throughout the grasslands provides further habitat for reptiles. Nine reptile species were recorded across the study area and included two threatened reptiles for which NTG and grassy woodlands are key habitat (Appendix H) The most common reptile species recorded across the site included the Southern Grass Skink (*Pseudemoia entrecasteauxii*), Eastern Three-lined Skink (*Acritoscincus duperreyi*) and Blotched Blue-tongue (*Tiliqua nigrolutea*).

4.3.6 Threatened Fauna

A variety of threatened fauna species have been recorded within the locality. Those species previously recorded within the locality (DECC 2009b, Birds Australia 2009) or considered to have the potential to occur (DWEHA 2009) are listed in Table 46 together with their conservation status and an assessment of the likelihood that they would occur at the site.

One threatened bird species, the Diamond Firetail (*Stagonopleura guttata*), has been recorded at a number of locations across the project site (Figure 9). This species is known to inhabit grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum Woodlands, open forest, mallee, Natural Temperate Grassland, and in derived grassland. It is also often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland (DECC 2005).

Other threatened bird species for which the study area is likely to provide potential habitat include:

- Brown Treecreeper (*Climacteris picumnus victoriae*)
- Gang-gang Cockatoo (*Callocephalon fimbriatum*)
- Hooded Robin (*Melanodryas cucullata cucullata*)
- Barking Owl (*Ninox connivens*)

- Powerful Owl (*Ninox strenua*)
- Blue-billed Duck (*Oxyura australis*)

None of these species were recorded within the study area during the surveys. Given the proposal involves the removal of water from a dam that may provide habitat for the Blue-billed Duck, dam levels should be maintained at a level that ensures the dam would continue to function as habitat for this species should it inhabit the dam.

A Squirrel Glider (*Petaurus norfolcensis*) was recorded within the RGOF on Yandra during spotlighting surveys. This part of the Monaro region is not generally considered part of the known range for this species. Given it is often difficult to distinguish Squirrel Gliders from Sugar Gliders (*Petaurus breviceps*) without knowing the weight of the individual and that this was an unusual record for the area, photos of the individual were sent to three glider specialist for verification. All identified the individual as a Squirrel Glider and it has been recorded accordingly in this study.

The Koala (*Phascolarctos cinereus*) is the only other arboreal mammal considered to have the potential to utilise the study area. Ribbon Gum is listed as a Koala feed tree under SEPP 44 and is present across the project site. The Koala has previously been recorded to the east of the project site near Brown Mountain and Glen Allan State Forest (DECC 2009b). However, none were sighted within the study area during the surveys.

Records of Spotted-tailed Quolls have been recorded within the locality including a record to the north of Springfield Road although it is considered unlikely that the habitat on the site would be utilised by this species. Although it is plausible that a Spotted-tailed Quoll may pass through the area, the habitat is considered marginal habitat, as the study area is comprised of a matrix of cleared land, grassland and very open woodland that is poorly connected to more intact stands of vegetation to the east where this species is more likely to occur (James Dawson, DECCW, August 2009).

Although no threatened bat species were listed on the database searches for the area (DECC 2009b, DEWHA 2008), potential habitat for some species is present and two 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 south Sherwins. Although not recorded within the study area, potential habitat is also present throughout the study area for the Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*). All of these species are listed as vulnerable under the TSC Act.

No threatened amphibians are considered likely to occur within the study area.

Habitat for a variety of threatened reptiles is present across the site. The Grassland Earless Dragon is listed as endangered under both the TSC Act and EPBC Act and was recorded on Sherwins south and Springfield within the study area (Figure 9). This species has also been recorded in areas adjacent to the study area and north of Springfield Road. A total of 15 Grassland Earless Dragons were recorded across the study area although a number of these records are likely to be recaptures. It is estimated that about five different individuals were present at the T93a/T81b site and approximately four different individuals were present on proposed offset site 6 (Figure 12) Two individuals were also recorded east of Rock Lodge Road on proposed offset site 5.

Areas of known, high and low potential habitat for this species have been mapped on Figure 10. Habitat features for areas where Grassland Earless Dragons were recorded within the study area are

summarised in Appendix J. Although this species was recorded in areas of NTG, there is also the potential for this species to inhabit areas of derived grassland that are adjacent to NTG as one record is near the edge of NTG and derived grassland.

Where possible, areas of known habitat for this species have been avoided and offsets will be provided for clearing required in areas of potential habitat for this species. All locations where Grassland Earless Dragons were recorded in this study have either been avoided through the removal of turbines or realignment of roads and reticulation.

The Little Whip Snake was recorded at four locations, Springfield (x2), Yandra and Sherwins North and was also recorded north of Springfield Road outside the project site. This species was recorded under large rocks during the spring surveys. The majority of the study area would provide potential habitat for this species including areas of NTG, SGW, RGOF and derived grassland (Figure 6).

Although the Striped Legless Lizard (*Delma impar*) 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 9). Potential habitat for this species is present throughout the study area in areas of NTG and derived grassland (Figure 6). 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.

The Pink-tailed Worm-lizard (*Aprasia parapulchella*) inhabits sloping, open woodland areas with predominantly native grassy groundlayers, particularly those dominated by *Themeda australis* (Kangaroo Grass) and site that are well-drained, with rocky outcrops or scattered, partially-buried rocks. Given the grazing regimes across the open woodland areas of the site, potential habitat for this species is likely to have been reduced as many areas have been sown and others are heavily grazed. Furthermore, *Themeda australis* is no longer present in most areas. Nonetheless scattered rocks are present across open woodland areas of the site and therefore these areas would provide potential habitat for this species.

4.3.7 Migratory Fauna

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.

Three other migratory species have the potential to utilise the study area. These include:

- Great egret (*Ardea modesta*)
- Cattle Egret (*Ardea ibis*)
- Rainbow Bee-eater (*Merops ornatus*)

4.3.8 SEPP 44 – Koala Habitat

The Koala is known to occur on the Monaro although there are no records of this species occurring on the project site (DECC 2009b). Ribbon Gum is listed as a Koala feed tree under Schedule 2 of SEPP 44 and is present in areas of RGOF and SGW. In areas of RGOF, Ribbon Gum would constitute at least 15% of the total number of trees in the upper or lower strata of the tree component and, therefore, would be considered an area of potential koala habitat. Given there are no known resident populations

of Koalas on the project site, the study area does not support core koala habitat as defined under SEPP 44. Furthermore, SEPP 44 does not formally apply to Part 3A projects.

4.3.9 Watercourses and Lakes

Impacts of the proposal on watercourses and lakes have been assessed in a separate section within the Environmental Assessment and, therefore, have not been addressed in this report. The larger watercourses and lakes present within the project site include:

- Maclaughlin River
- Upper Dog Kennel Creek
- Boco Creek
- Gentle Barlow Creek
- Coopers Lake

The proposal involves the crossing of the Maclaughlin River near Boco in the south-central part of the study area. Potential impacts from the proposal on riparian areas are assessed in the separated report and do not form part of this assessment.

5 Impact Evaluation

5.1 INTRODUCTION

This section of the report outlines the anticipated impacts from the proposal on the ecological values of the site. It is structured in order of process as initially impacts have been avoided and minimised wherever possible. A number of mitigation measures were then formulated to further minimise the impacts from the proposal. The residual direct and indirect impacts are then outlined in accordance with each phase of the project (i.e. construction, operation and decommissioning) and cumulative impacts and key threatening processes considered. This approach is consistent with the requirements of the DGRs (i.e. the EA report should describe actions taken to avoid or mitigate impacts and then compensate for unavoidable impacts). For any impacts that cannot be avoided or mitigated, a number of offset options have been provided and these are discussed in Chapter 6.

5.2 AVOIDANCE MEASURES

Environmental Impact Assessment and Biodiversity Offset Principles have been established by DECC and the first of these principles states that impacts must first be avoided using prevention and mitigation measures (DECC 2008). The proponent has made a number of amendments to the proposed layout to minimise and avoid impacts of the proposal 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 the ridge top, the opportunities to avoid all impacts on NTG are limited. Whilst it is also 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.

Detailed below are 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. These include:

- Access paths have been designed around current tracks and roads present within the study area where possible to avoid additional vegetation clearance for access; and
- The reticulation has been placed underground and within the road footprint where possible to allow for temporary rather than permanent disturbance. Reticulation will pass overhead across gullies and waterways to reduce impacts.

5.2.1 Grassland Earless Dragon

Detailed below are the additional avoidance measures that will or have been be implemented to avoid impacts on the Grassland Earless Dragon whilst maintaining the engineering and economic feasibility of the wind farm. 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.

The avoidance measures proposed for the project have been developed in the context of the engineering, project feasibility and turbine location constraints presented within the site area. Within this context a number of measures to avoid impacts on the Grassland Earless Dragon have been implemented / proposed.

Planning Phase / Detailed Design

Removal and relocation of turbines to avoid individuals and known habitat areas
Two turbines (93a/81b, 92a/80b) located in the west of the project site where a number of Grassland Earless Dragons have been recorded have been removed from the proposal. This will prevent the proposal impacting on the largest known population of Grassland Earless Dragon within the site area.

Further removal of turbines from the project (other than the two proposed) will decrease the economic feasibility and energy production of the proposal. As such turbine micro-siting will be used to avoid other known locations of Grassland Earless Dragon, such as those within the Springfield and Sherwins clusters (see Figure 9). For these individuals the road and reticulation design has been altered to allow for a minimum 50 m buffer from the recorded Grassland Earless Dragon location.

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.

Relocation of roads and reticulation in known habitat for Grassland Earless Dragon
The road and reticulation layout has been 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 Grassland Earless Dragon habitat.

Further, where existing tracks do not exist, roads and reticulation have been routed along the edges of the known habitat of the Grassland Earless Dragon 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 Grassland Earless Dragon 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 Grassland Earless Dragon 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 Grassland Earless Dragon 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 Grassland Earless Dragon habitat within this cluster. In these areas pre-clearance surveys will be important to identify any Grassland Earless Dragons that may need relocating.

In order to further minimise impacts from the proposal 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 provided there are no major gradient or topographic constraints. 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 proposal of both NTG and Grassland Earless Dragon habitat.

Construction Phase

Construction prohibited from November – January - Springfield and Sherwins clusters

To minimise impacts of the proposal on sensitive lifecycle stages of the Grassland Earless Dragon (i.e. mating, laying and incubation period), development will not occur on the Sherwin and Springfield clusters during this time (November – January). These clusters are considered the most likely to support the Grassland Earless Dragon.

Given Grassland Earless Dragons were not recorded on 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.

A relocation strategy for the Grassland Earless Dragon 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 Springfield and Sherwins 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 Grassland Earless Dragon relocations be required.

For mobilisation reasons, if the Yandra and Springfield clusters are constructed simultaneously it will be necessary for a small section in the northern portion of the Sherwins cluster 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 is shown in Figure 3 as the 'substation cluster.' This area would also be subject to the same constraints as Springfield and, therefore, construction would not take place between November and January.

5.2.2 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 record.

5.2.3 Natural Temperate Grassland

Natural Temperate Grassland 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 wherever feasible;
- Potential locations for concrete batching plants have been located 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 3 shows the options currently being considered.

5.2.4 Snow Gun 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 (and hollow) removal can be avoided. Avoidance measures within woodland areas include:

- Placement of turbines such that tree clearing is minimsed 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; and
- Where possible, turbines have been placed in woodland areas where groundlayer disturbance has previously taken place (eg. sown areas).

5.2.5 Concrete Batching Plant

Five possible locations have been identified for concrete batching plants. Each has been selected with operation 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 (Figure 3).

5.3 MITIGATION / RECOMMENDATIONS

In order to protect the ecological values of the site a number of management and mitigation measures have been recommended. These are outlined in Table 17 together with the project stage during which each should be implemented. A number of species specific mitigation measures have been outlined in Table 18 and it is envisaged that some of these would be implemented at both the proposed impact site and offset site and full details provide in the Construction Environmental Management Plan, Operation Environmental Management Plan and the Weed Management Plan post approval.

Table 17: General mitigation measures

Impact	Relevant Species / Guild	Mitigation Measure	Timeframe	Detailed Design	Pre-construction	During construction	Operation	Decommis - sioning
General construction, and operational impacts	All	Preparation of Construction Environmental Management Plan (CEMP)			✓			
		Preparation of Operations Environmental Management Plan (OEMP)			✓			
		Preparation of a Conservation Management Plan (CMP)			✓			
		Preparation of Weed Management Plan (WMP)			✓			
		Preparation of Soil and Water Management Plan (SWMP)			✓			
Spread of weeds								
Spread of weeds through soil disturbance and vegetation clearance		Piling of soil that may contain seeds of exotic species at least 50m away from the creeks, drainage lines and other areas of native vegetation, where possible, to prevent spread into adjacent areas of ecological significance during rainfall or wind events.				✓		✓
Spread of weeds through movement of vehicles and machinery between sites	All	All machinery, equipment and vehicles are to be washed down before entering and leaving a site.	Wash down area locations to be identified during the detailed design phase			✓	✓	✓

Impact	Relevant Species / Guild	Mitigation Measure	Timeframe	Detailed Design	Pre-construction	During construction	Operation	Decommis - sioning
Spread of weeds through topsoil removal		Topsoil recovery will be undertaken in areas that have a high proportion of native vegetation and few weeds in the ground layer of vegetation. Topsoil is harvested to salvage the native soil seed bank and reintroduce seed bank back into areas where it has been depleted by past land use such as intensive grazing. The site receiving the topsoil has its topsoil including the weed growth stripped and disposed of. The relocated topsoil is spread evenly and mulched lightly using the vegetation and leaf litter removed from the source site.					✓		✓
Spread of noxious weed through soil disturbance and vegetation clearance	All	All onsite staff and contractors will be made aware of noxious weeds present at the site and ways to prevent their spread.	Prior to commencement of construction works		✓			
Spread of weeds through importation of soil, rubble etc	All	It should be ensured that any soil, rubble etc imported to the site is certified that it is free of weeds and weed seed			✓	✓		✓
Spread of weeds through revegetation	All	Revegetation with locally native endemic species characteristic of the cleared vegetation type (i.e. NTG, SGW or RGOF).	Species should be sourced prior to construction to ensure		✓	✓		✓

Impact	Relevant Species / Guild	Mitigation Measure	Timeframe	Detailed Design	Pre-construction	During construction	Operation	Decommis - sioning
		Recommended an aggressive coloniser such as *Austrostipa* spp. is used.	availability.					
Spread of weeds through revegetation	All	Weed management measures implemented to control perennial weed grasses.	3 years following construction.			✓	✓	✓
Spread of weeds through revegetation	All	Management of stock access during periods of vegetation and soil disturbance to prevent weed spread.				✓		✓
Sedimentation, Erosion and Runoff								
Sedimentation, and soil erosion		Before any remediation works that will further disturb the soil, grazing will be removed and the grass sward allowed time to recover and minimise any areas of bare soil. Jute matting or similar should be used to stabilise the soil and prevent weed invasion.				✓	✓	✓
Sedimentation, and soil erosion		All stockpiles should be covered to prevent the loss of material during high wind and rain events. Where practicable stock piles should be placed in areas sheltered from the wind.	Location to be determined during detailed design phase.		✓	✓		✓
Sedimentation, and soil erosion		Implement provisions of SWMP.	Prior to the commencement of construction.			✓		✓

Impact	Relevant Species / Guild	Mitigation Measure	Timeframe	Detailed Design	Pre-construction	During construction	Operation	Decommis - sioning
Sedimentation and erosion		All erosion and sedimentation control devices should be regularly monitored, cleared and repaired, particularly after periods of heavy rainfall.	Monthly and after heavy rainfall.			✓		✓
Sedimentation, and soil erosion through soil disturbance	All	All disturbed soil surfaces shall be stabilised as soon as practicable after works have ceased in the area.				✓		✓
Reduced water quality through uncontrolled runoff and sedimentation	Aquatic species	Management measures implemented to prevent sediment and runoff entering the watercourse in accordance with SWMP.	Prior to the commencement of construction.			✓		✓
Reduced water quality through uncontrolled runoff and sedimentation		Locate roads downstream of natural spring to avoid soil and water quality impacts.		✓				
Sedimentation and erosion	All	All erosion and sedimentation control devices should be regularly monitored, cleared and repaired, particularly after periods of heavy rainfall.	Monthly and after heavy rainfall			✓		✓
Spread of pesticides through runoff		Management measures implemented to prevent sediment and runoff entering the watercourse in accordance with SWMP.				✓		✓

Impact	Relevant Species / Guild	Mitigation Measure	Timeframe	Detailed Design	Pre-construction	During construction	Operation	Decommis - sioning
Vegetation Clearance / Disturbance								
Vegetation disturbance through the movement of vehicles and machinery between site	All	All vehicles are to remain on formed road or tracks designed specifically for the purposes of the wind farm construction / operation.				✓	✓	✓
Damage to surrounding tree roots		Care is to be taken when working near treed areas to prevent damage to adjacent tree roots.				✓		✓
		Where possible, trenches should be dug at least 15 m away from the base of trees				✓		
Vegetation clearance and revegetation for underground cabling		On completion, the cable route will be marked with small marker posts (with landowner agreement) to allow the controlled revegetation with locally endemic species (eg. *Austrostipa* spp.).				✓		✓
Smothering of vegetation by dust	All	Minimise dust during construction via the use of water carts. Due to high winds, stage disturbance areas and ensure sufficient local water supplies are available for the construction period.				✓		✓
Fauna								
Accidental injury to	Grassland Earless	All onsite staff and contractors should undergo a brief site induction regarding the known	Prior to commencement		✓			

Impact	Relevant Species / Guild	Mitigation Measure	Timeframe	Detailed Design	Pre-construction	During construction	Operation	Decommis - sioning
threatened species	Dragon, Little Whip Snake	threatened species at the site and the management protocol should any be encountered during construction works.	of construction works					
Temporary removal of fauna habitat / dead wood	Ground-dwelling species	All logs and large rocks removed from within the proposed development areas are to be returned following the completion of works in temporary clearance areas or adjacent areas to supplement habitat.			✓	✓		✓
Accidental capture of fauna during trenching for reticulation	Ground-dwelling species	Suitable fencing will be erected along trenches to prevent fauna falling into trench.			✓			✓
		Trenches will checked daily by the Environmental Compliance Manager or field officer Any fauna captured at the site, managed in accordance with the provisions of the EMP and if threatened, the TSMP				✓		
Disturbance of nests, dens and roosts through hollow-bearing tree removal	Hollow-dependant species	Pre-clearing surveys undertaken to determine if roosts, nests or dens present in any trees proposed for clearing.			✓			
Death and injury through bird and bat strike	Birds and bats	Should turbine require lighting, select lighting that minimizes the likelihood of attracting insects and foraging bats, subject to CASA requirements.		✓				

Impact	Relevant Species / Guild	Mitigation Measure	Timeframe	Detailed Design	Pre-construction	During construction	Operation	Decommis - sioning
		Monitoring of bird and bat strike should be undertaken and an adaptive management approach implemented whereby additional measures are implemented should significant bird and bat strike at certain turbines be recorded.					✓	
		Monitoring will be undertaken in accordance with the monitoring guidelines provided by the Australian Wind Energy Association (Brett Lane & Associates 2005). If results show that longer term monitoring is required then a monitoring programme will be developed in consultation with DECCW and other departments/agencies as required. Such a programme could include an adaptive management whereby significant impacts are dealt with by using an adaptive approach.					✓	
		Maintaining 'corridors' or wide separation distances between clusters.		✓				
Disturbance of Blue-billed Duck habitat through water extraction for construction	Blue-billed Duck	Water levels during extraction should be maintained as levels such that the dam can continue to be used by the Blue-billed Duck and extraction undertaken in a manner which avoids key habitat areas such as reeds and rushes. The dam is spring fed and is currently over capacity despite drought conditions.				✓		

Impact	Relevant Species / Guild	Mitigation Measure	Timeframe	Detailed Design	Pre-construction	During construction	Operation	Decommis - sioning
Soil								
Soil compaction through the movement of vehicles and machinery between sites	All	All vehicles are to remain on formed road or tracks designed specifically for the purposes of the wind farm construction / operation.				✓	✓	✓
Soil compaction , trampling and weed spread by stock		Management of stock access during periods of vegetation and soil disturbance.	During periods of soil and vegetation disturbance			✓		✓
		Removal of stock access from construction areas for the entire construction periods to allow for regeneration – subject to landowner participation.				✓		
Fire								
Accidental fire resulting in loss of property, life, vegetation and injury to fauna	All	Adherence to all regulations Implementation of fire prevention measures in accordance with Bushfire Emergency Plan (BEP).	BEP to be prepared prior to commencing construction			✓	✓	✓
		Provision of basic fire-fighting equipment at each active site, including fire extinguishers, knapsacks and other equipment suitable for initial response actions			✓			

Impact	Relevant Species / Guild	Mitigation Measure	Timeframe	Detailed Design	Pre-construction	During construction	Operation	Decommis - sioning
		Installation of access tracks at least 5 m wide (7 m for corners) and with appropriate vertical clearance and suitability for all weather conditions				✓	✓	✓
		Maintaining provision for mobile telephone and UHF radio communications			✓			
		Provision of onsite identification of individual turbine locations and access gates for fire-fighting services, and an undertaking to provide local rural fire service groups with access to gates			✓			
		Consideration of total fire ban days in regard to hours within which construction takes place				✓		✓
		Providing the Rural Fire Service (RFS) with: • A construction works schedule • Maps of final turbine layout and identification information for individual turbine sites • Access road plans and locations of access gates • Security information such as location of			✓			

Impact	Relevant Species / Guild	Mitigation Measure	Timeframe	Detailed Design	Pre-construction	During construction	Operation	Decommis - sioning
		locked gates and restricted access areas • Location of any additional water supplies installed for construction activities • Location of potential landing pads for fire-fighting aircraft or helicopters						
Hazardous Materials								
Spills of hazardous material (eg. Oil)	All	Hazardous materials be stored on or off-site in specific lay-down/storage areas, and will be handled and stored according to regulatory requirements and Australian Standards AS1940				✓	✓	✓
		The transformer as part of the collector substation may contain upwards of 20,000 litres of oil. Provisions will be made as part of the design for containment of any oil which may leak or spill. Prevention and containment of any potential spills will be described in detail in the Boco Rock Wind Farm EMP			✓	✓	✓	✓
Others								
Boundary encroachment	All	The boundaries of the construction area will be clearly marked to prevent construction works breaching the boundaries.	Prior to commencement of construction works		✓			✓

Impact	Relevant Species / Guild	Mitigation Measure	Timeframe	Detailed Design	Pre-construction	During construction	Operation	Decommis - sioning
Upgrading of creek crossing causing bank instability	Aquatic species	Measures implemented to ensure bank stability. Jute matting or similar used in any revegetation to prevent weed invasion and increase bank stability.			✓			

Table 18: Species Specific Mitigation Measures

Impact	Mitigation Measure	Timeframe	Detailed Design	Pre-construction	During construction	Operation	Decommis-sioning
Grassland Earless Dragon (GED)							
Impacts on GED sensitive lifecycle stages - mating and laying periods.	Development will not occur on the Sherwin and Springfield clusters during this time (November – January).				✓		
Injury or death of GED present within construction area	Pre-clearance surveys within the construction area boundaries where located within known or potential GED habitat within three weeks of the proposed construction activities commencing. Including: - Spider-tubed sized pitfalls - between late January and April (or until the onset of cold weather); - Systematic searches of tussocks, rolling of all rocks with a diameter greater than 20 cm and the use of an	Pre-clearance surveys within the 3 weeks leading up to clearing		✓			

Impact	Mitigation Measure	Timeframe	Detailed Design	Pre-construction	During construction	Operation	Decommis-sioning
	endoscope to search spider burrows - May to end of October.						
Relocation to avoid Injury or death of GED present within construction area	Survey of distribution and habitat to select relocation sites: - Use aerial photography etc to map areas of potential habitat and likely condition. - Identify areas for relocations and hence field verification. - Field verification will be undertaken well in advance of pre-clearance surveys to ensure relocation sites have been selected prior to pre-clearance surveys. - Gather data from known sites: 1. Rock cover 2. Tussock spacing 3. Spider burrow densities - Undertake field assessment to confirm desktop habitat mapping and use data collected from known sites to assess habitat condition. Map habitat condition for proposed relocation sites. - Simultaneously undertake rock rolling and endoscope surveys for the Grassland Earless Dragon with particular focus on relocation sites to determine the distribution and density of Grassland Earless Dragons and ensure relocations do not occur in areas where	Spring / Summer (2009 / 2010)	✓	✓			

Impact	Mitigation Measure	Timeframe	Detailed Design	Pre-construction	During construction	Operation	Decommis-sioning
	there are already high densities (i.e. assess carry capacity of the land). **Note:** Spider tubing will not be used if any surveys are undertaken between November and January or during winter months.						
Injury or death of GED present within construction area	Relocation of GED from construction area (detailed relocation strategy is included in Appendix J): • GED will be moved to adjacent areas (i.e. outside construction boundaries) within 150 m to 200 m of the construction area. • Relocation sites will support habitat similar to that of where the individual was caught or if this is not possible, within an area currently mapped as potential habitat. An assessment of relocation sites in accordance with Option 3 of the proposed offset packages is proposed. • Individuals caught in pitfall traps will be left in the pitfall traps and moved immediately to the relocation site and placed within one of the three proposed artificial burrows to be installed for each relocated individual. The pitfall will then be re-installed at the pre-clearance survey site. • If individuals are caught during winter, they will be placed in a cloth bag and transported immediately to the release site. They will then be placed in one of the artificial burrows. Individuals in torpor will be			✓	✓		

Impact	Mitigation Measure	Timeframe	Detailed Design	Pre-construction	During construction	Operation	Decommis-sioning
	warmed slightly to assist in getting them to enter the burrow and a flat stone placed over the burrow for protection. • Individuals found active during the warmer months of the year will be placed in cloth bags and immediately transported to the release site where they will be released into a grass sward. • In areas where a group of individuals are found the same approach as that used for individuals would be implemented. However, a greater density of artificial burrows will be established (1000 burrows within a 150 m zone).						
Relocation success / failure - monitoring	Monitoring using radio-tracking (pending advice from DECCW, DEWHA and experts) will accompany relocations to provide information to inform future GED relocations. Whilst it is recognised that the period between relocations of GED on one cluster may not provide comprehensive feedback for implementation on other clusters, it may provide some information that will enable relocations to be undertaken more effectively elsewhere throughout the site. In addition the information collected for this project can be used to inform management options and the likely success of relocations for other projects in areas where the GED is present.			✓	✓		

Impact	Mitigation Measure	Timeframe	Detailed Design	Pre-construction	During construction	Operation	Decommis-sioning
Injury or death of GED that re-enter the-construction area	During the summer months (January to April) in areas where GED habitat (both known and potential) occurs within turbine construction areas, the development zone should be partially fenced off plastic gutter guard to deter individuals from nearby grassland moving back into the area It obviously will only be possible to fence out some sides of the area where machinery and vehicle access is not required.			✓			
Capture within trenches	An Environmental Compliance Manager will be onsite during the civil works phase (including cable trenching and laying) to conduct regular inspections in trenches and excavated areas and manage any incidental Grassland Earless Dragon encounters. A trained field officer or post graduate research student will be onsite a minimum of two days per week and on call to assist in the management of any findings by construction personnel.	Environmental Compliance Officer – civil works phase Field office - minimum two days a week and on call		✓			
	Trenches will be dug and filled in sections and therefore it is not anticipated that any section of trench would remain uncovered for more than a few days.			✓			
Habitat Loss	Rocks removed from the construction area will be scattered throughout designated areas of NTG where past rock removal has been undertaken, during rehabilitation of the track verges. Rocks between 20 cm diameter and 50 cm diameter will be salvaged from earth works and scattered across identified re-rocking areas.				✓	✓	

Impact	Mitigation Measure	Timeframe	Detailed Design	Pre-construction	During construction	Operation	Decommis-sioning
Protection of GED habitat	To assist in the conservation of the GED and to further mitigate impacts of the proposal, the inclusion of funding for research forms part of the proposed offset package options. It is envisaged that this funding would be used to implement some of the key objectives outlined in the GED Recovery Plan or to monitor the relocated dragons to provide important information for future management of the species.			✓		✓	
Little Whip Snake							
Accidental death and or injury	Preparation of Threatened Species Management Plan (TSMP)			✓			
	Pre-clearance surveys within known and potential habitat areas of the snake, inside the construction area boundaries, within three weeks of the proposed construction activities commencing. Systematic searches of tussocks, rolling of all rocks with a diameter greater than 20 cm.			✓			
	Relocation of individuals from construction area. Moved to adjacent areas (i.e. outside construction boundaries) within 150 m to 200 m of the construction area.			✓			
	During the summer months (January to April), the development zone should be partially fenced off with plastic gutter guard to deter individuals from nearby grassland moving back into the area. It will only be possible to fence out some sides of the area where machinery and vehicle access is not required.			✓			

5.4 DIRECT IMPACTS

5.4.1 Construction

Vegetation clearance

Although the proposal 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. The proposal 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.

Table 19 summarises the proposed vegetation clearance for each component of the proposal for each turbine layout option and Table 20 lists the total area of permanent and temporary vegetation loss for each vegetation type and condition. Two road layout options are being investigated in order to reduce the likely vegetation clearance from the proposal:

- 12 m clearance area which will be revegetated back to 6 m following construction;
- Roads 6 m wide with intermittent passing bays 12 m wide.

The most feasible road layout will be determined during the detailed design phase of the proposal and will depend on final turbine selection and crane availability.

Five proposed locations have been identified for the required concrete batching plant. All have been selected based on their proximity to access roads, their limited ecological values and other project construction requirements. Although the exact location is to be determined during the detailed design phase, the likely impacts have been outlined below.

The removal / loss of some vegetation for the proposal is unavoidable. However, all unavoidable native vegetation clearance has been minimised wherever possible and it is proposed that all remaining impacts will be offset in accordance with a quantitative assessment of the 'improve or maintain' principles as determined by the use of the Biobanking credit calculator. Refer to Biobank impact credit calculations report (Appendix M) and proposed offset strategy (Section 6.3).

Table 19: Proposed impact areas for each layout and road 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	0	0	1.93	1.93	0	0
Temporary construction facilities								
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

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								
Total site area (ha)					11750.18	11750.18		
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

[#] 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.

The impact area should not be confused with the area of native vegetation to be impacted (refer Table 20)

Table 20: Estimated clearance of each vegetation type under each road option

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
	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
Note: Grassland vegetation in low condition under the biometric = cleared and therefore has not been included here									

Natural Temperate Grassland

The proposal 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 is impacted by the proposal (1.8 %).

An accurate assessment of the total original extent of NTG is not possible, but estimates range from approximately 386,000 ha or less (Thomas *et al.* 2000) to approximately 480,000 ha or more (Rehwinkel 1997). The pre-European extent of the grassland in the Monaro is estimated to be approximately 250 000 ha (Benson 1994; Benson & Wyse Jackson 1994) although this is thought to an over estimate.

Environment ACT (2005) estimated that probably <3% of the original grassland remains with high ecological integrity. In NSW, at least 7000 ha in moderate to good condition is known to exist and an additional similar amount is thought to exist on private land (Environment ACT 2005). Therefore, assuming approximately 14,000 ha of moderate to good condition NTG remains and that the proposal is impacting on areas of moderate to good NTG, the proposal would result in the removal of 0.3% of the total remaining NTG in NSW.

An additional area of temporary clearance for roads and reticulation is also proposed. At this stage the road layout has not been finalised and impacts will vary depending on whether the 6m or 12 m road option is selected. Table 20 summarises the anticipated temporary loss across all vegetation communities for each layout and road width option.

Flora habitat removal

Habitat for a variety of threatened flora species is also present across the study area and the vegetation clearance outlined below will also result in the removal of potential habitat for threatened plants. However, no threatened flora were recorded across the study area during systematic surveys of areas of potential habitat

Loss of riparian vegetation

The proposal involves the establishment of a formal crossing across part of the Maclaughlin River near Boco. An assessment of the impacts of this upgrade has been included within the Environment Assessment documentation. 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 groundlayer with no overstorey, 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.).

Loss of fauna habitat

The proposal involves the removal of up to approximately 200 ha of potential habitat for a variety of species. Given the proposal is linear in structure and as such does not result in large consolidated areas of clearing, the proposed habitat removal is unlikely to be considered large with respect to the remaining areas of potential habitat present throughout the project site. Furthermore, the proposed clearance will not isolate areas of potential habitat for fauna.

Grassland Earless Dragon

The proposal will result in the removal of known and potential habitat for the Grassland Earless Dragon. This species was recorded at three locations across the study area. The proposal will result in the removal of known, high and low potential habitat for this species. 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 Grassland Earless Dragon. However, measures have been implemented to reduce impacts wherever possible. The proposal will not isolate any areas of potential habitat for this species. A relocation strategy to remove the Grassland Earless Dragon from within the construction zone has been prepared in consultation with Dr Will Osborne from the University of Canberra and is included in Appendix N. This is a draft document that will be finalised in consultation with DECCW and Dr Will Osborne.

Table 21 details the total areas of habitat clearance for the Grassland Earless Dragon. The proposal will result in the permanent removal of approximately 3.60 ha of known habitat (2.25 % of habitat mapped within the project site) from within the study area for both the 107 and 125 layouts, 12 m roads. 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.

Table 21: Impacts on known, high potential and low Grassland Earless Dragon habitat

Earless Dragon Habitat	Area (ha)	107 Layout				125 Layout			
		Permanent clearance (ha)		Temporary clearance (ha)		Permanent clearance (ha)		Temporary clearance (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
Known Habitat									
Within total site area	160.31	-	-	-	-	-	-	-	-
Within study area / development envelope	42.21	-	-	-	-	-	-	-	-
To be impacted by the proposal	-	2.36	3.60	2.30	2.04	2.36	3.60	2.30	2.04
Percentage within **study area** to be impacted	-	5.59 %	8.53%	5.45 %	4.83%	5.59 %	4.83%	5.45 %	4.83%
Percentage within **project site** to be impacted	-	1.47 %	2.25%	1.43 %	1.27%	1.47 %	1.27%	1.43 %	1.27%
High Potential									
Within total site area	2234.46	-	-	-	-	-	-	-	-
Within study area / development envelope	574.73	-	-	-	-	-	-	-	-
To be impacted by the proposal	-	24.29	38.62	25.97	26.60	25.64	39.92	27.63	27.51
Percentage within **study area** to be impacted	-	4.23 %	6.72%	4.52 %	4.83%	4.46 %	6.95%	4.81 %	4.79%
Percentage within **project site** to be impacted	-	1.89 %	1.73%	1.16 %	1.19%	1.15 %	1.79%	1.24%	1.23%
Low Potential									
Within total site area	1647.61	-	-	-	-	-	-	-	-
Within study area / development envelope	273.84	-	-	-	-	-	-	-	-
To be impacted by the proposal	-	10.16	16.05	14.89	15.30	10.37	16.26	15.20	15.40
Percentage within **study area** to be impacted	-	3.71 %	5.86%	5.44 %	1.94%	3.79 %	5.94%	5.55 %	5.62%
Percentage within **project site** to be impacted	-	0.62%	0.97%	0.90%	0.32%	0.63%	0.99%	0.92%	0.93%

Little Whip Snake

Habitat for the Little Whip Snake is present across much of the project site. A small area of habitat would be impacted by the proposal with extensive areas remaining across the project site. Table 22 outlines the anticipated impacts on habitat for this species based on each of the layout options. Measures to prevent impacts on this species will be implemented prior to construction including rolling of rocks within the proposed impact areas to relocate any Little Whip Snakes present.

Table 22: Anticipated impacts on Little Whip Snake habitat

Little Whip Snake	Area (ha)	Permanent clearance (ha)		Temporary clearance (ha)	
		107 Layout	125 Layout	107 Layout	125 Layout
Potential habitat - 6 m Road Option					
Within total site area	6354.47	-	-	-	-
Within study area / development envelope	1554.50	-	-	-	-
To be impacted by the proposal	-	64.54	66.81	86.37	92.55
Percentage within **study area** to be impacted	-	4.15%	4.30%	5.56%	5.95%
Percentage within **project site** to be impacted	-	1.02%	1.05%	1.36%	1.46%
Potential habitat - 12 m Road Option					
Within total site area	6354.47	-	-	-	-
Within study area / development envelope	1554.50	-	-	-	-
To be impacted by the proposal	-	86.9	110.57	86.90	88.13
Percentage within **study area** to be impacted	-	5.59%	7.11%	5.59%	5.67%
Percentage within **project site** to be impacted	-	1.37%	1.74%	1.37%	1.39%

Striped Legless Lizard

The Striped Legless Lizard was not recorded at the site but was recorded on the adjacent lands north of Springfield Road and, therefore, there is a high likelihood that this species may be present at the project site. A small area of potential habitat would be impacted by the proposal with extensive areas remaining across the project site.

Table 23 outlines the anticipated impacts on habitat for this species based on each of the layout options. Furthermore, measures to prevent impacts on this species will be implemented prior to construction including rolling of rocks in proposed impact areas to relocate any Striped Legless Lizards should they be present.

Table 23: Anticipated impacts on Striped Legless Lizard habitat

Striped Legless Lizard	Area (ha)	Permanent clearance (ha)		Temporary clearance (ha)	
		107 Layout	125 Layout	107 Layout	125 Layout
Potential habitat - 6 m Road Option					
Within total site area	4576.97	-	-	-	-
Within study area / development envelope	999.20	-	-	-	-
To be impacted by the proposal	-	42.08	43.60	49.16	51.89
Percentage within **study area** to be impacted	-	4.21%	4.36%	4.92%	5.19%
Percentage within **project site** to be impacted	-	0.92%	0.95%	1.07%	1.13%
Potential habitat - 12 m Road Option					
Within total site area	4576.97	-	-	-	-
Within study area / development envelope	999.20	-	-	-	-
To be impacted by the proposal	-	66.79	67.96	50.81	51.93
Percentage within **study area** to be impacted	-	6.68%	6.80%	5.09%	5.20%
Percentage within **project site** to be impacted	-	1.46%	1.48%	1.11%	1.13%

Eastern False Pipistrelle / Eastern Bentwing-bat

A number of turbines are present within the RGOF in the eastern portion of the site. Where possible, the removal of trees, hollow-bearing or otherwise, has been avoided. However, the removal of a small number of trees may be unavoidable. A calculation of the number of trees to be impacted / removed cannot be made at this stage as micro-siting decisions are to be made during the detailed construction design phase of the project. However, the proposal will be working on the principal of avoiding tree removal and in particular hollow-bearing tree removal wherever possible. Any tree removal would result in a small decrease in potential roosting habitat for the Eastern False Pipstrelle as this species is known to roost in hollow-bearing trees of which there are numerous across the project site.

Squirrel Glider

Impacts from the proposal on Squirrel Glider activity are likely to be minimal as it is not envisaged that extensive tree clearance will be required. This species was recorded in the RGOF in the north-eastern portion of the study area on Yandra. The majority of the turbines have been located such that tree removal has been avoided. However, should the removal of hollow-bearing trees be required, this would result in a small reduction in potential habitat for this species.

Blue-billed Duck

Although potential habitat for the Blue-billed Duck is not present within the direct impact area, water for the proposal is to be sourced from a dam between Yandra and Springfield that may provide habitat for this species. Therefore, water levels should be maintained at a level that would allow the dam to continue to be used by the Blue-billed Duck during extraction and extraction undertaken in a manner which avoids key habitat areas such as reed and rushes.

Diamond Firetail

The Diamond Firetail was recorded at a number of locations across the project site. However, the proposal does not involve clearing of large areas of woodland or grassland such that it would affect feeding or dispersal of this species throughout the study area.

Migratory Fauna

The White-bellied Sea Eagle (*Haliaeetus leucogaster*) was recorded in the south-eastern part of the study area along the Maclaughlin River. Four migratory species have the potential to utilise the study area. These include:

- Great egret (*Ardea modesta*)
- Cattle Egret (*Ardea ibis*)
- Rainbow Bee-eater (*Merops ornatus*)

All of these species travel long distances between sites and therefore have the potential to be impacted by operational turbines. However, impacts in terms of disturbance to potential habitat for these species within the project site are likely to be negligible.

Corridor Values / Movement Pathways

Small areas of woodland are scattered across the landscape. A large proportion of the turbines are located on the western side of the project site within grassland areas and support large areas of extensive grassland to their west. Therefore it is unlikely that these turbines would interfere with any significant aerial movement pathways. However, there is the potential for highly mobile species to move been patches of woodland in the north east of the study area, to land woodland in the south on Boco and also outside the study area to dense bushland areas near Rolts Flat. Impacts on east west movement pathways are likely to be minimal. Given the open structure of the woodland and forests across the project site, the placement of turbines and roads throughout these areas will not result in large breaks in vegetation nor fragmentation.

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 proposal as all species would be expected to cross the proposed access roads and potentially bask on them.

5.4.2 Operation

Collisions with turbines

Impacts of the proposal on bird and bat species are likely to be largely during the operational phase as tree clearance has been avoided where possible and therefore habitat loss will be minimal. Impacts include the potential for birds and bats to accidentally collide with moving turbines. Much literature has been produced regarding potential impacts of wind farms on birds and bats although most of the studies have been undertaken overseas. The impacts appear to be dependent on a number of factors including:

- Proximity to wetlands
- Whether the wind farm occurs along any migratory pathways
- Proximity to bird concentrations (Brett Lane & Associates 2005)
- Wind farm layout (Brett Lane & Associates 2005)
- Type of habitat and surrounding area (Kevin Mills & Associates 2005)
- Spacing (DEH Australian Greenhouse Office 2006)
- Location on the landscape (DEH Australian Greenhouse Office 2006)
- Proximity to forested areas (DEH Australian Greenhouse Office 2006)
- Type of wind turbine used (Brett Lane & Associates 2005)
- Lighting used on turbine (Brett Lane & Associates 2005)
- Turbines located on forested ridges (Arnett 2005)

Bats

The general consensus appears to be that the highest bat fatalities occur on nights when wind speed is low (< 6 m s–1), which is when aerial insects are most active (Ahlén 2003; Fiedler 2004; Arnett 2005, Horn *et al*. 2008, Kunz *et al.* 2007). A significant positive correlation between insect passes and bat passes was also observed by Arnett (2005). A number of studies have also found bats actively foraging around turbines sites rather than passing through and bats approaching both moving and non-moving turbines out of what was thought to be curiosity with bats investigating the various parts of the turbine with repeated fly-bys (Arnett 2005, Kunz *et al.* 2007, Horn *et. al* 2008). Given this behaviour there is the potential for bats to collide with turbines on the proposed wind farm.

It is difficult to determine whether bat strike at wind farms is due to bats being unable to detect or visualise blades, a consequence of curiosity or due to bats following or being trapped in blade-tip vortices (Kunz *et al*. 2007). As noted by Richards (unpublished) little is known about the likelihood that bats would not visualise a blade. However, bats can detect objects from a range of sizes including tree branches, moving vehicles and flying insects, therefore given the size of the rotor blades the probability that a bat would not distinguish a blade or rotor in the open air is considered by Richards to be low (Richards unpublished). Conversely, others believe that for most bat species, echolocation is ineffective at distances greater than 10 m (Fenton 2004) and therefore bats foraging in the vicinity of wind turbines may miscalculate rotor velocity or fail to detect the large, rapidly moving turbine blades (Ahlén 2003; Bach and Rachmel 2004; Dürr and Bach 2004). Whilst it is unlikely that measures can be implemented to increase the likelihood of blade detection through echolocation, siting of turbines outside obvious potential fly ways will help to decrease the likelihood of bats colliding with turbines. Due the open nature of the project site, identification of potential flyways is difficult. The open woodland structure means that bats may forage relatively unobstructed across the majority of the site and even more so in the grassland areas in the west. Nevertheless, as a precautionary measure, turbines have been situated such that they are at least 30 m from any hollow-bearing trees to minimise the potential for impacts on potential roosting and nesting sites. The White-Striped Freetail Bat (*Tadarida australis*), Gould's Wattled Bat (*Chalinolobus gouldii*) and Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) appear to be at most risk of turbine strike in areas where turbines are in proximity to hollows as these species roost in hollows and forage above the canopy.

Studies have found that on average, greater than 80% of bat fatalities currently recorded at wind energy developments in North America involve migratory species, while only a small proportion of fatalities (up to 25% in some areas) are year-round residents (Arnett *et al.* 2008, Kunz *et al.* 2007). In addition most have been shown to be migratory, tree-roosting species (Kunz *et al.* 2007). The White-striped Freetail

Bat was the only migratory, tree roosting species recorded within the study area. Given that the proposal is to take place in an open landscape where flight pathways are less influenced by canopy density and vegetation structure, it is likely the openness of the landscape would help to reduce the likelihood that the White-striped Freetail Bat would collide with turbines,

Lighting

Studies of the correlation between bat activity and lighting have been conducted. Whilst insect activity was found to be somewhat higher at turbines with Federal Aviation Administration lights, aviation lighting did not appear to affect the incidence of foraging bats around turbines and there was no difference between numbers of bat passes at lit and unlit turbines (Arnett 2005). Preliminary evidence also suggests that bats are not attracted to the lighting attached to wind turbines (Arnett 2005; Kerlinger *et al.* 2006, Kunz *et al*. 2007). Although preliminary studies have shown that bats are not attracted to certain types of lighting, research is in its infancy and therefore as a precautionary measure it is recommended that the use of lighting is avoided where it is not required for safety reasons. Where lighting is a necessity, thought should be given to the type of lighting used on the turbines to minimise the potential for insects and hence bats to be attracted to turbines, subject to requirements of the Civil Aviation Safety Authority.

Tower Height

Tower height has also been identified as a factor in influencing the likelihood of bat strike at wind farms. Arnett *et al.* 2008 found that towers 65 m in height compared to 78 m towers killed fewer bats but more bats per Mega Watt (MW). Taller turbines with greater rotor-swept areas killed more bats [per turbine and per MW compared with smaller turbines (Arnett *et al.* 2008). Although decreasing the height of turbines or rotor-swept areas may not be possible for some projects as it may reduce the feasibility of the wind farm, where turbine heights and rotor-swept areas can be modified and reduced, these measures should be implemented to reduce the potential for bat strike.

Risk Matrix - Bats

A risk matrix has been prepared to assess the likelihood that bats present within the study area would be impacted by the proposal (Appendix K, Table 48). Consideration has been given to bat behaviour, habitat requirements and flight character and the potential for to be impacted has been assessed based on the following criteria:

- **Low** – do not migrate, do not fly above canopy, do not roost in hollows or roost in hollows but fly below canopy
- **Moderate** – do not migrate, fly above canopy, roost in hollows
- **High** – migrate or have large foraging range, fly above canopy, roost in hollows

Affected Species

Based on the results of literature reviews and an understanding of bat behaviour those species considered most likely to come in 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 the trees across the study area. 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 as noted previously, given the landscape is extremely open

and structured fly ways are not present, the likelihood of strike is somewhat reduced linear openings in the landscape will not occur which is often the case with wind farms. Furthermore, the clustered, rather than liner layout of turbines across the woodland areas is likely to help reduce the potential for bat collision.

Bat activity across the study area was assessed over a six week period using anabat detection. Results indicated low levels of bat activity particularly within the grassland areas.

Impacts of the proposal on the Eastern False Pipistrelle and Eastern Bentwing-bat are likely to be largely during operation. Although in areas directly surrounding turbines, bat foraging activity may decrease due to bats avoiding collisions with turbine blades, extensive areas of foraging habitat will remain, extensive tree clearance is not proposed and significant changes to foraging activities are not anticipated. 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 Bentwing-bat does not roost in hollows and therefore the potential for collisions in somewhat reduced. However, given this species forages above the canopy and is migratory and there is the potential for strike during these activities.

The Eastern False Pipistrelle is known to roost in hollow-bearing trees. Hollow-bearing trees 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 from bats foraging across the woodland given this species is an above or just-below canopy feeder or when dispersing to nearby feeding areas should they be roosting in the adjacent RGOF / SGW. To minimise the potential for impacts of bats leaving potential roost sites, turbines have been placed at least 30 m from any hollow-bearing trees where possible.

Barotrauma

Barotrauma as a consequence of rapid decompression due to changes in atmospheric pressure as the turbine blades rotate downward has also been suggested as a threat to bats. Whilst the results of initial studies are inconclusive, some bats killed at wind turbines have shown no sign of external injury, but evidence of internal tissue damage which is consistent with decompression (Dürr and Bach 2004). Potential measures that could be implemented at wind farms to mitigate or reduce the likelihood of barotrauma at this stage remain unknown.

Birds

Impacts from the proposed wind farm on bird species include the potential for collisions with turbines and avoidance of areas where turbines are present. A number of studies have been conducted to assess the impacts of wind farms on birds and it has been founds that those species most commonly impacted include:

- wetland birds that form large flocks;
- birds of prey; and
- species that flock and fly above the canopy (Kevin Mills & Associates 2005).

As suggested by Erickson *et al.* (2001) the vulnerability of a species to collisions is species- and habitat-specific. Many of the studies on bird collision have been conducted overseas in coastal landscapes where bird migration activities are high. Few studies have been conducted in Australia and few have

focused on agricultural landscapes such as those present within the study area. In addition, the many gaps in the literature make it difficult to draw conclusions about the impacts of wind farms on avifauna.

The Diamond Firetail was the only threatened bird species recorded within the study area. However, given this species does not have high flight patterns and feeds exclusively on the ground, on ripe and partly-ripe grass and herb seeds and green leaves, and on insects, it is unlikely that turbine strike would be an issue. Furthermore, the proposal does not involve clearing of large areas of woodland or grassland such that it would affect feeding or dispersal of this species throughout the study area.

Affected Species

Migratory 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). There is also the potential for species such as migratory wetland birds to be impacted by the proposal whilst moving between wetlands within the locality. Although the wetlands within the study area experience long periods without water, when water is present they are likely to attract a variety of waterbirds including ducks. Given the proposed wind farm is located to the east of the majority of wetlands within the locality (i.e. Coopers Lake, Boundary Lake, Dukes Lake and Avon Lake), the likelihood of collision whilst moving between wetlands is considered low. However, there is the potential for species migrating inland from coastal areas to pass above or through the wind farm site when moving to these wetland areas to the west.

Although habitat for the Blue-billed Duck is limited throughout the study area, potential habitat is present for this species at Lake Williams, in nearby Nimmitabel. There are two records of this species in the vicinity of Lake Williams on the DECC wildlife atlas and number of records to the north west of the project site within the Snowy River LGA (DECC 2009). There are no records of this species within the Bombala LGA, and therefore that the majority of Blue-billed Ducks are likely to be approaching Lake Williams from the north. The potential for this species to travel across the site from the south to Lake Williams in the north east is considered low.

Other species for which the site may form part of a migratory route are the Swift Parrot and Regent Honeyeater. Although habitat for these species is not present within the study area, Regent Honeyeater records occur to the west within the Tumbarumba LGA (DECC 2009f) and therefore there is the potential that this species may migrate across the site when moving to coastal areas. Given that birds tend to fly at altitudes well above the turbines when on migratory paths, the potential for accidental collisions when these species are migrating is considered low. Furthermore, the study area does not provide habitat for these species and therefore it is unlikely that they would use it as a stop over during migration which may otherwise increase the risk of collision. There are no Swift Parrot records within the LGAs to the west or south of the study area and therefore the potential for Swift Parrots to pass over the wind farm is considered low (DECC 2009b).

Two Ramsar wetlands were identified on the DEWHA Protected Matters Search (2009). The project site is situated approximately 90 km east of Blue Lake and over 300 km south east of Fivebough and Tuckerbil Swamps. Boco Rock is in the Snowy-Monaro region of the Southern Rivers CMA, while the Blue Lake and Fivebough Tuckerbil Swamps are in the Murray CMA and Murrumbidgee CMA respectively. For these reasons it is highly unlikely that there would be any impact on the species utilising these wetlands from the proposal.

Birds of Prey

Large numbers of Wedge-tailed Eagles were recorded in the western part of the project site and other birds of prey including Nankeen Kestrels were common particularly in the open grassland areas. These species commonly foraged along the roadsides and on the edges of the ridges along Sherwins Range. No nests were recorded within or close to the study area. Given the large numbers of birds of prey using the project site and the location of some of the turbines on the top of Sherwins Range, there is the potential for some individuals to collide with turbines. In general, birds of prey have large home ranges and low reproductive rates and therefore loss of these individuals is likely to have a greater effect on population numbers than it may on other species that are present in greater densities, have greater reproductive rates and have smaller home ranges. Studies have shown that in general, mortality rates for birds at wind farm sites is between 1 and 2 individuals per turbine per year (Illinois Department of Natural Resources 2007, Smales 2005). Studies of the likely cumulative impacts of the eight existing and proposed wind farms in the range of the Tasmanian wedge-tailed eagle were conducted by Biosis Research and it was found that the likely cumulative impacts from wind farms would result in a 0.001 per cent increase in the mortality rate, which is 'not significantly different from that indicated for the population in the absence of those wind farms' or approximately one bird per annum (Smales and Muir 2005). Given the birds of prey within the study area appear to be more commonly using the edges of the ridges and areas to the west of these for foraging, the potential for collisions with turbines is considered to be somewhat reduced given the turbines are located on the ridge tops. However, the potential for collision cannot be ruled out.

One White-bellied Sea-eagle was also recorded along the Maclaughlin River in the south of the project site. It is unlikely that this species would forage across the study area as this species generally remains close to large watercourses when occurring inland. The MaclaughlinMaclaughlin River is the largest watercourse within the locality and therefore is likely to provide a key habitat for this species. It is anticipated that adult White-bellied Sea-eagles are likely to remain in proximity to the MaclaughlinMaclaughlin River and therefore the risk of collision with turbines, which are located on the ridge tops, is considered low.

Although there is the potential for collisions by immature birds when dispersing from natal territories, it is more likely that birds would move towards the coast (east) and therefore avoid most of the turbines. Nevertheless, there is the potential for collisions by White-bellied Sea-eagles with the cluster of turbines at Boco (which lay south of part of the River), but collisions with turbines elsewhere across the study area is considered unlikely.

Owls

Owls are likely to utilise the study area from time to time. Surveys of woodland areas where conducted but despite the presence of numerous hollow-bearing trees and areas of potential foraging habitat the Southern Boobook (*Ninox novaeseelandiae*) was the only nocturnal bird species recorded. There is the potential for owls to collide with turbines although this is considered to be more likely when they are moving between patches of woodland during foraging rather than when foraging amongst a woodland patch. The turbine layout is such that turbines have not been situated between any large stands of woodland and hence the risk of owls colliding with turbines is considered low.

Lighting

There has been suggestion that the use of lighting on turbines increases the potential for avian collisions as some species are attracted to the lighting for navigation purposes or for feeding on the insects that often centre on the light source. However, results from studies are relatively inconclusive with some studies identifying a relationship between lighting and avian collisions (US Department of Interior Fish & Wildlife Service 1993**)** and others identifying no significant difference between turbines lit with L-864 obstruction lights and those without (Jain *et al*., 2007). Many of the species recorded across the project site are not nocturnal and therefore would not be affected by light sources on turbines. However as a precautionary measure, it would be prudent to design turbine lighting that reflects the findings and recommendations of previous studies to reduce the potential for collision with those nocturnal species that do utilise the study area. For safety reasons lighting will need to meet CASA requirements.

Risk Matrix - Birds

A risk matrix anticipating the likelihood of collision with turbines has been prepared for those species most commonly recorded within the study area. 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 a 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 turbine although the risk is considered to be slightly higher for raptors and birds of prey which may collide with turbines whilst hunting prey.

5.4.3 Summary of Direct Impacts

- The 125 turbine layout (with 12m clearance for roads) is likely to have the greatest impacts. Therefore, based on this layout, approximately:
  - 0.66 ha of SGW (0.16ha of temporary removal)
  - 37.63 ha of RGOF (19.57 ha of temporary removal)
  - 72.66 ha of NTG (29.66 ha of temporary removal)
  - 63.12 ha of derived grassland (32.47 ha temporary removal)
  - 26.09 ha of disturbed grassland (11.51 ha of temporary removal)
- Removal of the following areas of known, high potential and low Grassland Earless Dragon habitat based on the 125 layout (with 12m clearance for roads):
  - 5.64 ha of known (2.04 ha of temporary removal)
  - 67.43 ha of high potential (27.51 ha of temporary removal)
  - 31.66 ha of low potential (15.40 ha of temporary removal)
- Permanent removal of approximately 110.57 ha of potential Little Whip Snake habitat, 88.13 ha of which will be temporary removal (125 turbine layout with 12m clearance for roads);
- Permanent removal of approximately 67.96 ha of potential Striped Legless Lizard habitat, 51.93 ha of which will be temporary removal (125 turbine layout with 12m clearance for roads);
- Potential loss of small number of hollow-bearing trees;
- Moderate potential for collisions by birds of prey and raptors; and
- The bat with the greatest potential for collision is the White-striped Freetail Bat.

Table 24: 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
Pardalotus striatus	Striated Pardalote	26	Moderate to low	N	Woodlands	Low
Anthochaera carunculata	Red Wattlebird	35	Moderate to low	N	Woodlands	Low
Gymnorhina tibicen	Australian Magpie	54	Moderate to low	N	Woodlands & grasslands	Low
Anthus novaeseelandiae	Richards Pipit	29	Low	N	Grasslands	Low
Eolophus roseicapillus	Galah	31	Moderate to low	N	Woodlands & grasslands	Low
Cacatua galerita	Sulfur-crested Cockatoo	35	Moderate to low	N	Woodlands	Low
Sturnus vulgaris	Common Starling	33	Moderate to low	N	Woodlands	Low
Platycercus elegans	Crimson Rosella	29	Fast, moderate to low flight	N	Woodlands	Low
Falco berigora	Brown Falcon	2*	High, soaring	N	Grassland	Moderate
Aquila audax	Wedge-tailed Eagle	9*	High, soaring	N	Grassland	Moderate
Falco cenchroides	Nankeen Kestrel	13*	High, soaring	Partially	Grassland	Moderate
Haliaeetus leucogaster	White-bellied Sea Eagle	1**	High, soaring	N	Maclaughlin River	Low - moderate

*these species were encountered on a regular basis and therefore not always documents therefore 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.

5.5 INDIRECT IMPACTS

5.5.1 Construction

Runoff, sedimentation and erosion

The study area is located upslope of the Maclaughlin River, a number of creeks and tributaries pass through or occur adjacent to the study area. The study area is also located in proximity to ephemeral

wetlands. Therefore there is the potential for indirect impacts on these waterbodies during and following construction from runoff, erosion and sedimentation if management measures are not implemented. There is also a high potential for seeds of exotic species present at the site to be spread into adjacent areas and creeks through runoff and to be transported downstream during construction works. Therefore a Construction Environmental Management Plan (CEMP) should be prepared and implemented to prevent such occurrences. Measures to prevent pollutants from being transported from the site into the creek should also be addressed in this plan.

Soils within the study area are highly mobile and therefore will require stringent dust suppression, erosion prevention and sediment control measures to be implemented.

Hydrological changes

The proposal involves the establishment of large impervious surfaces in the form of turbine footings and areas of soil compaction that will have a decreased porosity for roads. Impervious surfaces and changes to natural hydrological processes can have a number of potential effects including:

- limiting groundwater recharge by preventing rainwater from infiltrating through the ground;
- alter the ecology of an area including the vegetation composition and loss of fauna habitat;
- changes in soil moisture content; and
- may create conditions conducive to invasion by exotic species.

Given the mobility of the soils, water will need to be continuously added to areas of bare earth during construction for dust suppression. The runoff produced from this water addition will need to be trapped and managed to prevent changes to the hydrology of the site. Any increases in moisture will be temporary and only occur during the construction phase of the project.

Edge effects / increased weed invasion

Vegetation clearance has been proposed wherever possible in already disturbed areas through the upgrading of existing tracks. However, parts of the reticulation and some turbines will pass through areas of relatively undisturbed vegetation. It is likely that current roads and tracks have already been impacted by edge effects from previous clearing and it is likely that these impacts would be shifted further within the current stands of vegetation as a consequence of the proposal. Areas of less disturbed vegetation throughout the study area often supported some exotic species and there is the potential for this to increase as a consequence of the proposed soil disturbance. In the long-term there is also the potential for these areas to be impacted by edge effects.

Stringent weed management measures need to be implemented during and post construction to ensure weed invasion and edge effects do not increase across the study area. These need to include the control of runoff that may contain weed seeds and the washing down of vehicles to prevent the spread of weeds between areas. Revegetation and ongoing weed management of disturbed areas for a period of 3 years is also required. Two road layout options are currently being investigated in an attempt to minimise areas of temporary vegetation clearance as these areas will be susceptible to weed invasion.

Wildfire

Landscape fire is relatively rare in subalpine environments in Australia (Wahren *et al.* 2002) so the threatened species potentially occurring in study area are likely to be dependent on very low or no fire frequency. The greatest potential for accidental fires due to the wind farm activities is likely to be during construction and maintenance works. Therefore a number of preventative measures would need to be implemented during these phases to reduce the likelihood of accidental fires from the construction and

maintenance activities. Details of these measures are outlined in the mitigation section of this report and include the preparation of a Bushfire Emergency Plan.

Noise

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.

5.5.2 Operation

Displacement of Birds

Devereux *et al.* (2008) conducted a study of the effects of wind turbines on the distribution of wintering farmland birds in Europe. This study showed that turbine location, in a farmland landscape (controlling for other effects such as boundary location and crop type), did not affect the distribution of four groups of farmland birds namely, seed-eaters, corvids, gamebirds and Eurasian skylarks at differing distances from wind turbines ranging from 0–150 m to 600–750 m. Whilst it is difficult to extrapolate results from studies overseas, some common behaviour is likely amongst species such as seed-eaters and corvids and therefore these results may be applicable to Australian farmlands. Given the vegetation types to be impacted by the proposal are extensive across the landscape, it is unlikely that the turbines would permanently displace bird species such that vegetation types that once provided foraging habitat would no longer do so due to turbine avoidance behaviour.

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 displace any local bird species.

Predation by feral animals

The potential for the proposal to increase predation by feral animals across the study area is considered limited. The open nature of the vegetation at the site means that additional openings in vegetation, potentially creating movement pathways for feral animals such as the Red Fox, are unlikely. In heavily vegetated areas, feral animals often use tracks and open areas for movement. However, in the study landscape it is unlikely that restrictions to feral animal movement due to vegetation cover occurs. Furthermore, the linear nature of the proposal, through an open landscape, means large open areas will not result.

Landholders currently implement feral animal control programs across the site, particularly around lambing/calving time.

Wildfire

The risk of fire with wind farms during operation is inherently low (CFA 2007). A low risk is associated with malfunctioning turbine bearings, inadequate crankcase lubrication, cable damage during rotation, electrical shorting or arcing occurring in transmission and distribution facilities (CFA 2007). The location of wind turbines away from tall, dense vegetation in the study area minimises the risk of fire.

Furthermore, the implementation of regular maintenance to ensure turbines are functioning correctly and the implementation of general bushfire preventative measures during maintenance activities will reduce the likelihood that fires would occur due to the wind farm. Such measures have been outlined in the Mitigation section of this report and are outlined in further detail in the Bushfire Emergency Plan, *Auswind Best Practice Guidelines (Fire Management Guidelines) 2006 and Site Environmental Management Plan.*

5.5.3 Decommissioning

At the end of the operational life of the wind farm, the turbines and all above ground infrastructure will be dismantled and removed from the site. This includes all the interconnection and substation infrastructure. The tower bases would be cut back to below ploughing level or topsoil built up over the footing to achieve a similar result. The land will be returned to prior condition and use.

The access roads, if not required for farming purposes or fire access, would be removed and the site reinstated to its original condition and use. Access gates, if not required for farming purposes, would also be removed. Individual landowners will be involved in any discussion regarding the removal or hand-over of infrastructure on their property.

The underground cables are buried below ploughing depth and contain no harmful substances. They can be recovered if economically viable or left in the ground. Terminal connections would be cut back to below ploughing levels.

Indirect impacts anticipated from the decommissioning works 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.

5.5.4 Cumulative Impacts

The output of the wind farm will connect to a new 132,000 volt double-circuit overhead transmission line (easement). 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 non-woody areas, vegetation clearance for the transmission connection is likely to be confined 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 vegetation clearance for the transmission line would be extensive, and hence, would not substantially increase the amount of vegetation clearance required by the proposal.

The majority of the Monaro is used for agricultural purposes. Unsustainable agricultural practices threaten the integrity and survival of some Monaro vegetation communities and species within. The

protection and management of a large parcel of land as part of an offset for the impacts of the proposal will assist in protecting areas of NTG and habitat for threatened species on the Monaro, such as the Grassland Earless Dragon, which may otherwise be degraded and impacted by agricultural practices.

The Boco Rock Wind Farm is not located within any known migratory bird pathways and is not located in proximity to another wind farm. Whilst some cumulative impacts of bird and bat strike from wind farms throughout NSW as a whole are likely, the location of the proposal is such that it is unlikely to substantially increase impacts on and hence loss of migratory species throughout NSW.

5.6 KEY THREATENING PROCESSES

The following key threatening processes are considered relevant to the proposal:

- Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands (TSC Act)

  The majority of the wind farm activities are to occur along the ridgelines and the only anticipated direct impacts on watercourses is the proposed crossing over the Maclaughlin River for the substation access road. Mitigation measures will be implemented to prevent indirect impacts on waterbodies across the project site. Therefore it is unlikely that the proposal would exacerbate this key threatening process.

- Bushrock removal (TSC Act)

  The proposal will result in the removal of bushrock. However, scattering of some of this rock in areas where de-rocking has occurred is proposed and rocks are present across much of the site. Therefore it is unlikely that the proposed rock removal for construction would result in this resource becoming limited across the project site.

- Clearing of native vegetation (TSC Act) / Land clearance (EPBC Act)

  Impacts of the proposal on native vegetation have been outlined in Section 5.4. Whilst some vegetation removal is unavoidable, vegetation clearance has been avoided wherever possible and offsets will be provided to compensate for vegetation loss.

- Competition and grazing by the feral European rabbit (TSC Act) / Competition and land degradation by rabbits (EPBC Act)

  The European Rabbit currently inhabits the site and given that the proposal would not create additional conditions that would favour the European Rabbit it is unlikely that the proposal would exacerbate this key threatening process. Furthermore, management of the proposed offset site will include measures for the management of feral animals and therefore will contribute to reducing the problem of this species.

- Ecological consequences of high frequency fires (TSC Act)

  The potential for fire during the construction and operation phase of the proposal is considered low however, there is the potential for accidental fires during construction, operation and maintenance work. As such a package of mitigation measures have been proposed to reduced the likelihood of fire during these phases. Provided the prevention and mitigation measures are implemented it is unlikely that the proposal would alter current fire regimes across the site.

- Human-caused climate change (TSC Act) / Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases (EPBC Act)

  Wind energy offers a cleaner alternative to current energy generation sources such as coal and will directly displace the greenhouse gas emissions that would otherwise be produced by fossil

fuel energy production. Therefore the proposal will contribute to ameliorating factors that contribute to climate change rather than contributing to climate change.

- Invasion of native plant communities by exotic perennial grasses (TSC Act)

  There is the potential for the proposal to result in the spread of exotic perennial grasses. However, a number of mitigation measures have been proposed to prevent the spread of weeds and in particular species such as Serrated Tussock and thereby protect adjacent areas from weed invasion. Revegetation of temporary disturbance areas with aggressive local native provenance such as *Austrostipa* spp. and a commitment to ongoing weed management within disturbance areas for a period of 3 years will help to reduce the potential for native vegetation to be invaded by exotic perennial grasses.

  Revegetation of disturbed area will be timed to maximise success. Average rainfall is steady thoughout the year with a slightly higher average number of rain days in spring. With spring being the typical growth period of many flora, revegetation is likely to be undertaken at this time. The CEMP will include provide Key Performance Incators to measure the success of the revegetation process and adaptive responses will be applied relative to the observed success. Further details about revegetation techniques and considerations regarding timing will be provided in a CEMP.

- Loss of hollow-bearing trees (TSC Act)

  Based on the current footprint, hollow-bearing tree removal has been avoided. The proposal is to go through a detailed design phase following approval and therefore further avoidance during micro-siting is possible to ensure hollow-bearing tree clearance is avoided. It is important to note that topographic and design constraints may prevent the ability to avoid every tree (eg. where hollow-bearing trees flank the edges the road proposed for upgrading on Yandra), however trees will be avoided during micro-siting wherever possible.

- Predation by feral cats (TSC Act & EPBC Act)

  Feral cats were recorded across the study area during the surveys. Given that the proposal would not create additional conditions that would favour feral cats and all onsite food waste at site offices would be contained in lidded bins, it is unlikely that the proposal would exacerbate this KTP. Furthermore, management of the proposed offset site would include measures for the management of feral animals and therefore will contribute to reducing the problem of this species.

- Predation by the European Red Fox (TSC Act & EPBC Act)

  The European Red Fox is present across the site with a number sighted in both woodland and grassland areas during surveys. Given the inherent open nature of the landscape allows this species to move relatively unrestricted across the site, it is unlikely that the proposed roads would increase the activity of this species across the site. Furthermore, management of the proposed offset site would include measures for the management of feral animals and therefore will contribute to reducing the problem of this species.

- Removal of dead wood and dead trees (TSC Act)

  Dead wood is limited across the project site and is restricted to only small parts of the open woodlands. In areas where dead wood occurs within the proposed construction area, will be moved to adjacent woodland areas prior to construction. Therefore removal of dead wood is not proposed.

Whilst a number of senescing trees are present across the site, dead trees / stags are scarce. The removal of dead trees for the proposal is not anticipated.

- Instream structures and other mechanisms that alter natural flow regimes (FM Act)

  The proposal involves the reconstruction of a causeway over the Maclaughlin River for the proposed substation link road. This matter has been dealt with in more detail in a separate report. However, this would need to meet the requirements of the Department of Water and Energy for watercourse crossings under the Water Management Act 2000. A reconstructed crossing would be designed and certified by a suitably qualified engineer in accordance with the "Guidelines for controlled activities Watercourse Crossings" (NSW DWE 2008).

- Degradation of native riparian vegetation along NSW watercourses (FM Act)

  The riparian areas in proximity to the proposed causeway upgrade are heavily degraded with the riparian zone comprised of a grassed area with no shrub or canopy cover. Therefore impacts on native riparian vegetation are likely to be minimal. Impacts associated with riparian areas have been addressed in a separate report.

6 Offset Strategy

6.1 INTRODUCTION

An outline of the offset options available, an assessment of the potential area of offset required and the allowable location of any offset, using the Biobanking Assessment Methodology, is provided below. Key offsetting principles between the state and Commonwealth generally align and therefore the offsets proposed in this chapter have been designed to meet the requirements of both jurisdictions.

6.2 OFFSETTING OPTIONS

The potential offset options in NSW are shown in Figure 1. Other than the purchase and dedication of a suitable property to the formal reserve network, it identifies a range of "covenanting options" to provide security on title, including the registration of a Biobanking Agreement, which is DECCW's preferred offset mechanism in NSW, followed by less preferable options such the contribution of funds to the management and enhancement of existing secure sites.

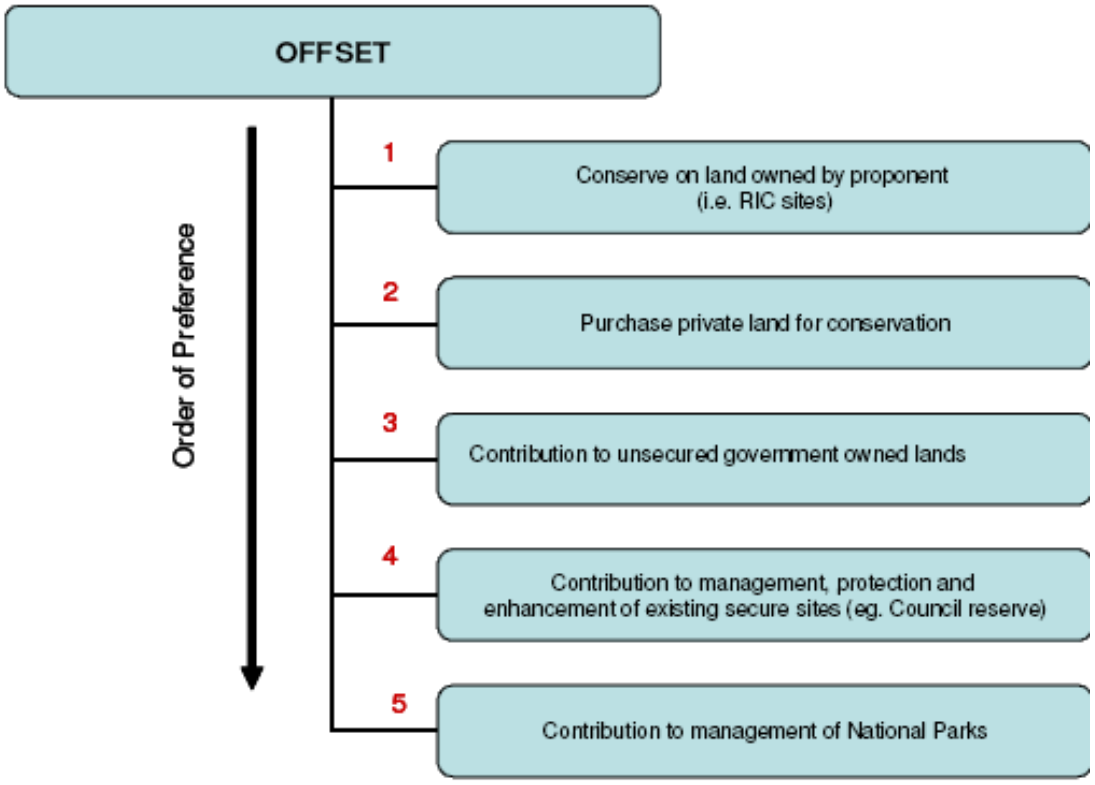


Figure 1: Offsetting Process

As there are no suitable properties currently available for sale that could be purchased and dedicated to a suitable conservation land manager, or any nearby National Parks or Council reserves where additional management funds could be contributed, the available options to Wind Prospect CWP are limiting to those involving negotiations with landowners to enter into voluntary but binding conservation covenants on their properties.

Biobanking is a covenanting option that meets all of the principles of offsets (i.e. it is on title and provides secure funds for active management in perpetuity, but is not the only option available. Wind Prospect have explored the registration of a Biobank site as an option but may still utilise other suitable methods of securing a conservation outcome depending on continued interest by landholders.

Biobanking can be utilised in several ways to obtain the credits required to offset the proposed wind farm including:

- Purchasing and retiring credits from the credit register if a property is already registered as a Biobank site and the correct type and number of credits are available;
- Review of the Biobanking Expression of Interest (EOI) register to attempt to identify landholders who may have the correct type (and number) of credits who may be willing to register their property as a Biobank site if approached by a credit buyer; and
- Identification and purchase of a suitable property to register as a Biobank site or reserve through a traditional offset mechanism.

6.2.1 Purchase and Retire Credits

The Biobanking Scheme allows the trade of credits between interested parties to offset the impact of development. These trades will be conducted through the Credit Register, which will list the type and amount of credits available for each Biobank Site.

As the Scheme is still in its infancy, and no Biobanking Agreements have been commenced, there are currently no credits available for purchase by Wind Prospect CWP. While future developments will be able to utilise the Credit Register for the purchase and transfer of credits, the proposed Boco Rock wind farm will not be able to employ this method.

6.2.2 Review Expression of Interest (EOI) Register

While no Biobanking Agreements are currently in place, several landholders have expressed interest in the Scheme. DECCW currently administers an EOI register which has captured the details of all landholders who have registered their interest in signing a Biobanking Agreement. Details such as size, vegetation type and location are provided on the EOI.

There are currently 28 properties included on the EOI register (as of 30th June 2009), none of which provide the right number and type of credits that the Boco Rock proposal requires. Wind Prospect CWP could review the information on the EOI register post approval to determine if any offset sites are available that meet the offset requirements for the project as outlined in Appendix M and summarised in Section 6.3). Should any potential properties be identified, Wind Prospect CWP could then enter into negotiations with the landholder, with the aim of the negotiations being agreement on the price of the credits generated, a Biobanking Agreement signed by the landholder and the transfer of these credits to Wind Prospect CWP for subsequent retirement.

This is the method that has been employed by Wind Prospect CWP following extensive consultations with interested land owners.

6.3 POTENTIAL OFFSET SIZE

6.3.1 Biobanking Offset Calculations for Impact Site

An assessment of the offset required for the proposed wind farm has been undertaken in accordance with an indicative Biobank assessment of the impact site, the results of which are included as Appendix M.

A number of mitigation measures will also be implemented to minimise impacts from the proposal on the ecological values of the site. For those impacts that cannot be mitigated, offsets have been proposed. An assessment of the offset required for the 125 layout and both 12 m and 6 m road options has been undertaken in accordance with an indicative Biobank assessment of the impact site. A summary of the credits required to offset the impact of the proposal is included below.

Approval is being sought for the proposal based on an assessment of the impacts and offset requirements based on the understanding of impacts at the time of approval. The credit calculations will be repeated post approval following final micro-siting of turbines and road design and any other modifications or impacts as a result of the approval.

6.3.2 Ecosystem Credits Required at Offset Site

When utilising Biobanking the amount of offset required for ecosystem credits is determined by both the condition of the development site and the condition of the offset site. Generally a development site in good condition will require a larger offset than a site in moderate or low condition. In addition, due to the way the methodology assesses improvement in vegetation condition, an offset site in moderate condition will produce more credits than a site in low or good condition, as the improvement expected by a site in moderate condition is expected to be larger than that achieved on a good or low condition site. Therefore, the offset required will be smaller if a moderate condition site is biobanked, rather than a low or good condition site.

Biobanking calculations have been undertaken to give an indication of the size of the offset required should the potential offset site be in moderate or benchmark (good) condition. The credits generated by moderate and good condition sites have been calculated using the observed (but not formally measured) condition of the potential offset sites and knowledge of the likely increase in condition at Biobank site, but have not yet been confirmed through formal Biobanking field assessment. The results, however, provide a relatively accurate figure of the offset required for the project.

6 m road option

The 6m layout requires a total 3,898 credits to offset the impact on the five impacted vegetation types. Two offset scenarios have been tested, including an offset site in benchmark condition and an offset site in moderate/good condition. Table 25 outlines our findings, with between 390-557 hectares of offset required to fully offset the impact of the 6m layout.

12 m road option

The 12m layout requires a total 4,991 credits to offset the impact on the five impacted vegetation types. Two offset scenarios have been tested, including an offset site in benchmark condition and an offset site in moderate/good condition. Table 27 outlines our findings, with between 499-713 hectares of offset required to fully offset the impact of the 12m layout.

6.3.3 Species Credits Required at Offset Site

Species credits can be obtained from the same Biobanking site as the ecosystem credits, and where possible Wind Prospect CWP will aim to obtain the credits from the same site.

As with ecosystem credits, the area of offset required for species credits is determined by the condition of the offset site, however the Biobanking Assessment Methodology allows a "default" increase (60%) for species credits which has been utilised to determine the offset required for each species.

The area required to offset the Grassland Earless Dragon has been calculated for both road options and is outlined below. As with the analysis for ecosystem credits, the amount of offset required has been determined through a desktop analysis and requires field confirmation.

6 m road option

In addition to the 390-557 hectares of offset required for the ecosystem credits, approximately 185 hectares of offset is required for the Grassland Earless Dragon habitat impacted by the proposal (amalgamating the impacts of known, high and low potential habitat). Under Biobanking these credits can be obtained from the same Biobank site as the ecosystem credits, or a different Biobank site should that be required. The results can be seen in Table 26.

12 m road option

In addition to the 499-713 hectares of offset required for the ecosystem credits, approximately 230 hectares of offset is required for the Grassland Earless Dragon habitat impacted by the proposal (amalgamating the impacts of known, high and low potential habitat). Under Biobanking these credits can be obtained from the same Biobank site as the ecosystem credits, or a different Biobank site should that be required. The results can be seen in Table 28.

It is noted that all of the vegetation communities being impacted are "Red Flagged " due to either being listed as endangered ecological communities (NTG under the EPBC Act) or vegetation types in moderate-good condition that are greater than 70% cleared in the Southern Rivers CMA region. The GED is not red flagged. Consistent with the principles for varying red flags, it is proposed that additional credits will be purchased and retired including surplus credits generated for the Grassland Earless Dragon and Striped legless Lizard. For example, a 500 ha NTG offset site in moderate-good condition could generate at least 3000 GED credits but only 1,396 are required to offset the proposal with a 12 meter road option. Similarly, the same NTG offset site with known records of Striped Legless Lizards would generate a similar number of credits although none are required to be retired to offset the proposal as there are no confirmed records of SLL in the impact area. A proportion of these additional credits could be retired to "compensate" for impacts to Red Flag ecosystems thereby making these credits unavailable as offsets for other projects.

Table 25: Ecosystem credit requirements for 6 m road option

Vegetation Type Name	Credits Required	Area (ha)	Credits/ha	Average No. Credits Generated/ha- M/G Site	Offset Required (ha)	Average No. Credits Generated/ha- Benchmark Site	Offset Required (ha)
Kangaroo Grass - Redleg Grass - Speargrass dry grasslands of the South Eastern Highlands	196	9	21.8	10	19.6	7	28.1
Ribbon Gum - Snow Gum grassy open forest on flats and undulating hills of the eastern tableland, South Eastern Highlands	2,251	80	28.1	10	225.1	7	321.6
River Tussock - Tall Sedge - Kangaroo Grass moist grasslands of the South Eastern Highlands	15	1.2	12.5	10	1.5	7	2.1
Snow Gum - Candlebark Woodland on Broad Valley Flats of the Tablelands and Slopes, South-Eastern Highlands	64	2.1	30.6	10	6.4	7	9.2
Speargrass grassland of the South Eastern Highlands	1,372	51.6	26.6	10	137.2	7	195.9
Total	**3,898**	**143.9**	**27.1**	**10**	**389.9**	**7**	**556.9**

Table 26: Species credits required for 6 m road option

Habitat Type	Area Impacted by 6 m Layout (ha)	Credits Required	Average No. Credits Generated/ha	Offset Required (ha)
Known	4.7	62.7	6	10.4
High Potential	53.3	710.9	6	118.5
Low Potential	25.6	341.4	6	56.9
Total	**83.6**	**1,115**	**6**	**185.8**

Table 27: Ecosystem credit requirements for 12 m road option

Vegetation Type Name	Credits Required	Area (ha)	Credits/ha	Average No. Credits Generated/ha- M/G Site	Offset Required (ha)	Average No. Credits Generated/ha- Benchmark Site	Offset Required (ha)
Kangaroo Grass - Redleg Grass - Speargrass dry grasslands of the South Eastern Highlands	277	11.8	23.5	10	27.7	7	39.6
Ribbon Gum - Snow Gum grassy open forest on flats and undulating hills of the eastern tableland, South Eastern Highlands	2830	96.7	29.3	10	283.0	7	404.3
River Tussock - Tall Sedge - Kangaroo Grass moist grasslands of the South Eastern Highlands	20	1.6	12.8	10	2.0	7	2.9
Snow Gum - Candlebark Woodland on Broad Valley Flats of the Tablelands and Slopes, South-Eastern Highlands	86	2.7	31.8	10	8.6	7	12.3
Speargrass grassland of the South Eastern Highlands	1777	64.2	27.7	10	177.7	7	253.9
Total	**4991**	**177**	**28.2**	**10**	**499.1**	**7**	**713.0**

Table 28: Species credits required for 12 m road option

Habitat Type	Area Impacted by 6 m Layout (ha)	Credits Required	Average No. Credits Generated/ha	Offset Required (ha)
Known	5.6	74.7	6	12.4
High Potential	67.4	898.7	6	149.8
Low Potential	31.7	422.7	6	70.4
Total	**104.7**	**1,396**	**6**	**232.7**

6.4 PROPOSED OFFSET PACKAGES

Three alternative offset packages have been proposed, based on the indicative calculations undertaken, to compensate for the residual impacts of the proposal that cannot be ameliorated through avoidance and mitigation measures. There is also the potential for these to be modified and a combination of options to be provided if preferable. Further details regarding each of the proposed offset options are outlined below and have been discussed with DECCW. Some of the proposed offset options were also discussed with DEWHA whilst the EPBC Referral was being assessed. Offsets have been designed and selected to meet both Commonwealth and state offset requirements

DECCW has advised that their preference would be **Option 2** due to the recent decline of the Grassland Earless Dragon which would afford greater priority to the protection of a larger area of known habitat for this species than the proposed areas of SGW and RGOF. This option is likely to be considered favourably also by DEWHA as under this option the greatest amount of NTG and Grassland Earless Dragon habitat would be conserved.

Option 1: Biobank Agreements with adjacent landowners to protect;

- 160-250 ha NTG (includes the GED offset requirement)
- 225 - 285 ha RGOF
- Up to 10 ha SGW

The aforementioned offset areas have been calculated using the Biobanking Tool and details of how these calculations have been undertaken are summarised above and provided in more detail in Appendix M. Under Biobanking, the Little Whip Snake and other threatened species recorded across the study area (i.e. Squirrel Glider, Diamond Firetail, Common Bentwing-bat and Eastern False Pipistrelle) are accounted for in ecosystem credits and therefore are not addressed individually here. Nonetheless, the protection of the above vegetation communities would ensure habitat for all of these species is included in the offsets.

Figure 12 illustrates those lands within which offsets could be provided to ensure the in perpetuity protection of each of these vegetation types. Initial consultations with landowners interested in entering into Biobanking Agreements have taken place. The Yandra cluster and the eastern portion of the Sherwins and Springfield clusters could contribute to meeting the SGW and RGOF offset requirements whilst those properties in the west would meet the NTG offset requirements.

It is anticipated that under this option all areas would be protected under a Biobanking Agreement. Given the proposal is still to undergo a detailed design phase and micro-siting and the proposed offset sites require formal Biobanking assessments, changes to the anticipated impacts and offset requirements are possible. Whilst there is more likely to be decreases in impacts, it is envisaged that the Biobanking Tool would be re-run following the detailed design phase and the proposed offset areas for each vegetation type amended in accordance with the revised Biobanking calculations.

Option 2: Biobank Agreement with adjacent land owner to protect up to 500 ha of NTG

Option 2 refers specifically to the lands in the west of the site primarily outside the study area but does include a portion of land on the Sherwins cluster. All of these areas support known NTG and Grassland Earless Dragon habitat although some may be preferable due to the suite of threatened species they support and / or the presence of a cluster of Grassland Earless Dragons.

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 12):

- 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 Grassland Earless Dragon, Little Whip Snake and Striped Legless Lizard, this site is considered the highest priority for conservation and discussions have taken place with landowner who has expressed interest in entering into a Biobank Agreement and thus making credits available for Wind Prospect CWP. In addition, areas where clusters of dragons have been recorded should be incorporated wherever possible.

Option 3: Three year monitoring program

It is believed that the research proposed below would contribute valuable information to the body of knowledge that informs regional land management practices, particularly in areas containing Grassland Earless Dragons. The proposed research is outlined below and links between the proposed research and the key objective in the National Recovery Plan for the Grassland Earless Dragon identified. The University of Canberra has expressed interest in conducting the research should this option be incorporated into the offset package.

Details of each of the proposed research options have been outlined below and links between the proposed research and the key objective in the National Recovery Plan for the Grassland Earless Dragon identified.

Survey of distribution and habitat:

- Use aerial photography etc to map areas of potential habitat and likely condition.
- Identify areas for relocations and hence field verification.
- Field verification will be undertaken well in advance of pre-clearance surveys to ensure relocation sites have been selected prior to pre-clearance surveys.
- Gather data from known sites:
  - Rock cover
  - Tussock spacing
  - Spider burrow densities
- Undertake field assessment to confirm desktop habitat mapping and use data collected from known sites to assess habitat condition. Map habitat condition for proposed relocation sites.
- Simultaneously undertake rock rolling and endoscope surveys for the Grassland Earless Dragon with particular focus on relocation sites to determine the distribution and density of Grassland Earless Dragons and ensure relocations do not occur in areas where there are already high densities (i.e. assess carry capacity of the land). **Note:** Spider tubing will not be used if any surveys are undertaken between November and January or during winter months.

Links to National Recovery Plan

The aforementioned research relates to the distribution and abundance of the Grassland Earless Dragon across the study site. Whilst the initial research will relate specifically to the areas proposed for relocations, it will provide valuable information regarding the abundance of the Grassland Earless Dragon and its habitat across part of the Monaro.

This option contributes to the following key recovery objectives:

- *3.2 – Survey to determine the distribution and abundance of the Grassland Earless Dragon*
  - ACTION: Determine the broad distribution and status of potential Grassland Earless Dragon habitat by referencing existing vegetation management information, or, if these data are inadequate, gather the information required.
  - ACTION: Define the extent of potential Grassland Earless Dragon habitat, based upon detailed vegetation information from field surveys targeting the areas identified in the above action.
  - ACTION: Determine the current distribution of the Grassland Earless Dragon in Vic, NSW, Qld and ACT, by undertaking extensive targeted surveys in areas of potential habitat identified through the above action.
- *3.3 Ecological Research to understand those aspects of the biology of the species which will enable effective management for the species to survive, flourish and maintain its potential evolutionary development.*
  - ACTION: Determine the relationship between the vegetation structure and floristics of grasslands and the distribution of the Grassland Earless Dragon microhabitats.

Relocation studies

- Grassland Earless Dragon behavioural studies will be undertaken during periods in which the Grassland Earless Dragon is active (i.e. spring, summer, early autumn). These studies will be conducted primarily on lands on which Grassland Earless Dragons have previously been recorded to gather data regarding densities and movement patterns that can then be used to inform the relocations.
- Relocated individuals will be monitored and other areas where Grassland Earless Dragons have previously been recorded will also be monitored to allow for adaptive management.

Links to National Recovery Plan

The aforementioned research relates to relocation of the species and will provide important information that will assist in preparing protocols and assessing the feasibility of relocations which are key recovery objectives.

- *3.3* Ecological *Research to understand those aspects of the biology of the species which will enable effective management for the species to survive, flourish and maintain its potential evolutionary development.*
  - ACTION: Determine movement and habitat use of the Grassland Earless Dragon.

- *3.8* Salvage *and Translocation to determine if there is a need for salvage of individuals from doomed sites, to determine the feasibility of such measures, and to develop a protocol.*

- ACTION: Determine the potential objectives, feasibility and appropriateness of translocation.
- ACTION: Determine the circumstances under which the Grassland Earless Dragon may be translocated, and develop agreed protocols for each State and Territory.

6.5 CONCURRENCE OF OFFSET PACKAGE WITH OFFSET PRINCIPLES

DECC (2008) has outlined a number of offset principles that should be met for all offsets. Each of the principles has been addressed below with respect to the proposal. The offset strategy is generally consistent with principles of the 'maintain and improve' test other than some of the unavoidable impacts on endangered communities (Biobanking red flags). Under Section 75JA of the EP&A Act the minister can approve a proposal regardless of whether a Biobanking Statement is obtained (i.e. even if Red Flag areas are impacted). However, consistent with the principles to vary Red Flags, larger offsets than required are being proposed (i.e. the retirement of additional credits including Grassland Earless Dragon credits) to compensate for impacts to endangered communities.

Key offsetting principles between the state and Commonwealth generally align and therefore the offsets proposed in this chapter have been designed to meet the requirements of both jurisdictions.

1. Impacts must be avoided first by using prevention and mitigation measures.

Chapter 5 outlines the measures implemented to avoid impacts from the proposal on threatened species and EECs. Given NTG covers much of the western ridge top and there is a requirement for the wind turbines to be placed on the top of ridges for maximum efficiency, it is not possible to avoid all impacts on NTG and the habitat it provides for threatened species. However, modifications to the turbine and road layouts have been undertaken to avoid areas where GED and Little Whip Snakes have been recorded to minimise impacts.

Furthermore, whilst it is also not possible to completely avoid 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.

2. All regulatory requirements must be met.

The proposed offsets are not being used to satisfy approvals or assessments under other legislation with the exception of the EPBC Act. It is expected that there will be some synergies between the NSW and Commonwealth offset requirements for the project and it is possible that the same site(s) may be used to meet both Commonwealth and State offset requirements.

3. Offsets must never reward ongoing poor performance.

The proposed offset sites are currently grazed but managed such that the grassland and associated habitat remains in relatively good condition. The proposal to establish a Biobank Site on the proposed offset site will ensure the offset is protected in perpetuity and sustainable and beneficial management practices are implemented. Under the Biobanking Scheme, landowners who do not meet their agreed requirements for management of their Biobank Site do not receive their annual payment from the trust

fund and in the event that the landowner continues to breach their Biobanking agreement, DECCW have the ability to seize the land and funding to continue to manage the land in perpetuity.

4. Offsets will complement other government programs.

Although a formal Biobanking Statement will not be sought for the proposal, the Biobanking methodology has been implemented to allow for a more transparent calculation of offset requirements. A summary of the Biobanking offset calculations has been provided in Section 6.3 and further details of the methodology employed to calculate offset requirements is outlined in the Biobanking report in Appendix M. Biobanking is a new scheme being implemented by the NSW Government and therefore the methods used for this project will be consistent with the scheme.

A National Recovery Plan has been prepared for the GED. The objectives of this recovery plan have been considered in the proposed offset packages. One of the proposed offset options is the contribution of funding to research that would contribute to meeting to objectives of the National Recovery Plan.

5. Offsets must be underpinned by sound ecological principles.

Surveys of the proposed offset sites shown in Figure 12 have been undertaken to verify the presence the required vegetation types and threatened species habitat on the proposed offset site. It is envisaged that further surveys would be undertaken to assess the condition of these site in more detail as part of the Biobanking site establishment.

Given the only area where GEDs are protected within the Cooma-Monaro region is within the Kuma Nature Reserve (182 ha), the protection of up to 500 ha of land for this species will almost triple the total amount of habitat for this species protected in the region.

Kuma Nature Reserve has been used as a guide to the approximate minimal size of land considered for the offset for this species. The majority of offset areas proposed are greater than 182 ha with the exception of offset site 5. Although this area is less than 182 ha, the presence of both NTG and GED has been confirmed on this site as well as the presence of the Little Whip Snake and Striped Legless Lizard. Therefore this site is considered a key area for the conservation of a number of threatened species on the Monaro and it is likely that an offset combining this site with one of the larger proposed sites will be part of the final offset package. Furthermore, this area adjoins large areas of potential habitat to the east.

The proximity of the offset site to the proposed impact area has been considered. Where the proposed offsets cannot be achieved within the direct project site, sites as close as possible to the project site have been selected. Furthermore for ease of management, offset sites have been selected to cover as few landowners as possible and to ensure there is only minor fragmentation between proposed parcels where combinations of parcels would be required to achieve the 500 ha offset.

To ensure the in perpetuity protection of the proposed offset sites(s), the establishment of a Biobank Site is proposed. This will ensure the long viability of the land is protected, monitored and ongoing management measures implemented. The proposed offset will result in the in perpetuity protection of up to 500 ha of EEC and habitat for number of threatened species on the Monaro.

6. Offsets should aim to result in a net improvement in biodiversity over time.

Although the proposal will result in the loss of approximately 107 ha (plus 93.37 ha of temporary clearance) of vegetation and associated habitat, the current offset proposal would result in the improvement over time to an offset area approximately 5 times as large and therefore will ensure that the biodiversity offset area will be much greater than the loss of biodiversity of the impact site. This will be further enhanced through a commitment under a Biobanking Agreement to in perpetuity management of the land for which funding will be provided in at trust fund and issued annually following evidence the landowner has meet all of the commitments outlined in the Biobanking Agreement.

Given the presence of NTG in relatively good condition and a number of threatened species on the proposed offset site, it is believed that initially no changes or minimal changes to grazing should take place. However, as further information becomes available or if any of the species appear to be adversely affected by the grazing regimes over time, a commitment to alter grazing regimes and if necessary remove grazing altogether will form part of the Biobanking Agreement. Current research shows that some grazing is beneficial to NTG and is likely to sustain habitat in a condition suitable for species such as the GED. However, it may be that grazing is prevented during Spring and Summer when the grassland is likely to be in flower to allow the grassland diversity to be maintained and potentially enhance over time.

Grazing trials are one of the options under the proposed research funding and may be beneficial in providing guidance on the most suitable grazing practices on the offset sites.

Given the EECs across the project site would under normal Biobanking requirements result in red flags and therefore development would be prohibited without the submission of a red flag variation to the Minister, the proponent has increased the size of the offset area to 500 ha when a minimum of approximately 395 ha would formally be required under Biobanking and is also prepared to purchase the Striped Legless Lizard credits that would be generated from offset site 5.

7. Offsets must be enduring and they must offset the impact of the development for the period that the impact occurs.

The establishment of a Biobank Site for the proposed offset will ensure offsets are enduring as the agreement is in perpetuity.

8. Offsets should be agreed prior to the impact occurring.

Whilst formal offset agreements have not been entered into at this stage. Landowners of all of the proposed offset sites have shown interest in establishing a Biobank Site and have been advised of their likely obligations should a Biobank Site be established on their site.

Detailed studies of some of the proposed offset sites have not been undertaken at this stage, however following project approval, legally binding agreements will be entered into with the relevant landholders and formal Biobank assessments. The identification of a number of sites and extensive liaison with landowners is likely to assist in preventing extensive time-lags between project approval and the establishment of a Biobank Site.

9. Offsets must be quantifiable and the impacts and benefits must be reliably estimated.

The Biobanking Scheme was designed to provide a standardised measure for assessing the condition of a site, quantifying the biodiversity impacts and thereby calculating offset requirements. The proposal involves both temporary and permanent vegetation removal and both can be accounted for using the Biobanking Scheme. Temporary loss includes some of the internal roads that will be revegetated although for the purpose of the Biobanking calculation, whilst considered a temporary loss, a return to pre-clearance state is not anticipated (or allowed by the Biobanking tool) and only a partial return of native grass cover has been used in the calculations.

The impacts from the proposal have been quantified using GIS and the Biobanking calculator which includes the following key factors:

- the area of impact
- the types of ecological communities and habitat/species affected
- connectivity with other areas of habitat/corridors
- the condition of habitat
- the conservation status and/or scarcity/rarity of ecological communities
- management actions

Offsets have been selected based on attributes such as:

- The proximity to the impact site
- Size
- The EECs and threatened species present
- Overall condition.

Offset requirements have been calculated using the Biobanking Tool and a formal assessment of the proposed offset site will be conduction to further assess the site condition prior to the establishment of the Biobank Site.

10. Offsets must be targeted.

A number of offset options have been provided one of which has been designed to include offsets that incorporate all of the vegetation types likely to be impacted by the proposal. All offset sites have been selected due to their proximity to the impact area as they support ecological values similar to those of the proposed impact area. The proposal to secure up to 500 ha of land for in perpetuity protection will ensure that a sound ecological outcome is achieved. Furthermore, the protection of threatened species (i.e. Striped Legless Lizard) not recorded within the impact area but found on one of the proposed offset sites will increase the ecological outcomes of the proposal. Kuma Nature Reserve is currently the only known Striped Legless Lizard and Grassland Earless Dragon site protected under formal conservation agreements within the region, therefore securing an area of known habitat for these species will contribute to their long-term conservation on the Monaro and as a species.

The option to combine parcels of land in proximity to the north and south of Springfield to achieve a total conservation area of 500 ha would ensure the components of the offset site are relatively well connected given the constraints of landowner boundaries and the current surrounding infrastructure (eg. roads).

11. Offsets must be located appropriately.

A number of offset options have been provided and all have been selected due to their proximity to the impact area and as they support ecological values similar to those of the proposed impact area. The confirmed presence of the threatened species likely to be impacted by the proposal (eg. Grassland Earless Dragon and Little Whip Snake) on the offset sites was also a prerequisite for potential NTG offset site selection.

12. Offsets must be supplementary.

The proposed offset sites are not currently protected under conservation agreements although parts of some of the properties under consideration have Purple Patch Agreements with the Southern Rivers CMA. These agreements generally covering a 10 year period and are at various stages of completion. Under Biobanking, if there is already an obligation to manage land for biodiversity conservation, credit discounting will be applied to these sites using the Biobanking Tool thus reducing the number of credits generated. However this discounting will only be applied for the remaining period that the land still has an obligation for under the existing agreement and will only be applied for those management activities that are required by both agreements. The extent of this credit discounting has not been incorporated into the credit estimates at this stage as the boundaries of the final offsets sites have not been determined and therefore the proportion that is subject to the Purple Patch Agreement and Biobanking Agreement. DECCW is also currently revising its policy on how this discounting will be applied, particularly for landholders who have entered into short terms agreements (1,3, 5 or 10 years for example) as the credit discounting rate may be negligible compared to an in perpetuity obligation (David Nicholson pers. comm., Manager Biodiversity & Vegetation Programs, DECCW).

13. Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or a contract.

The proposed offsets will be formally secured following project approval and Biobank sites established. This will mean landowners are audited to ensure that the proposed management actions have been carried out, and the outcomes of their actions monitored to determine that the actions are leading to positive biodiversity outcomes.

7 Conclusion

Under Part 3A of the EP&A Act, the DGRs require the EA to provide details of the measures to avoid, mitigate or offset impacts associated principles of the 'maintain and improve' test. The Boco Rock proposal is subject to a one-off accredited assessment process and subject to the general administrative steps outlined in the NSW Assessment Bilateral administrative procedures. Therefore the principles of the Part 3A maintain and improve have also been applied to Matters of National Environmental Significance and in particular NTG and Grassland Earless Dragon. Furthermore, key offsetting principles between the state and Commonwealth generally align and therefore the offsets proposed have been designed to meet the requirements of both jurisdictions.

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, stringent mitigation measures will be implemented as part of the proposal and will further reduce potential impacts from the proposal.

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 EECs, threatened species and their habitat on the Monaro through in perpetuity protection of large, viable offset areas.

The suite of avoidance, mitigation and offset measures outlined in this report are consistent with principles of the 'maintain and improve.' However, given impacts on red flag vegetation communities and the Grassland Earless Dragon are unavoidable; the requirements of the 'maintain and improve' test under the EP&A Act cannot be fully met. Therefore, a commitment to retire additional credits in acknowledgement of impacts on red flag communities and to compensate for such impacts has been proposed.

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Appendix A – Figures

Figure 2: Project site in a regional context

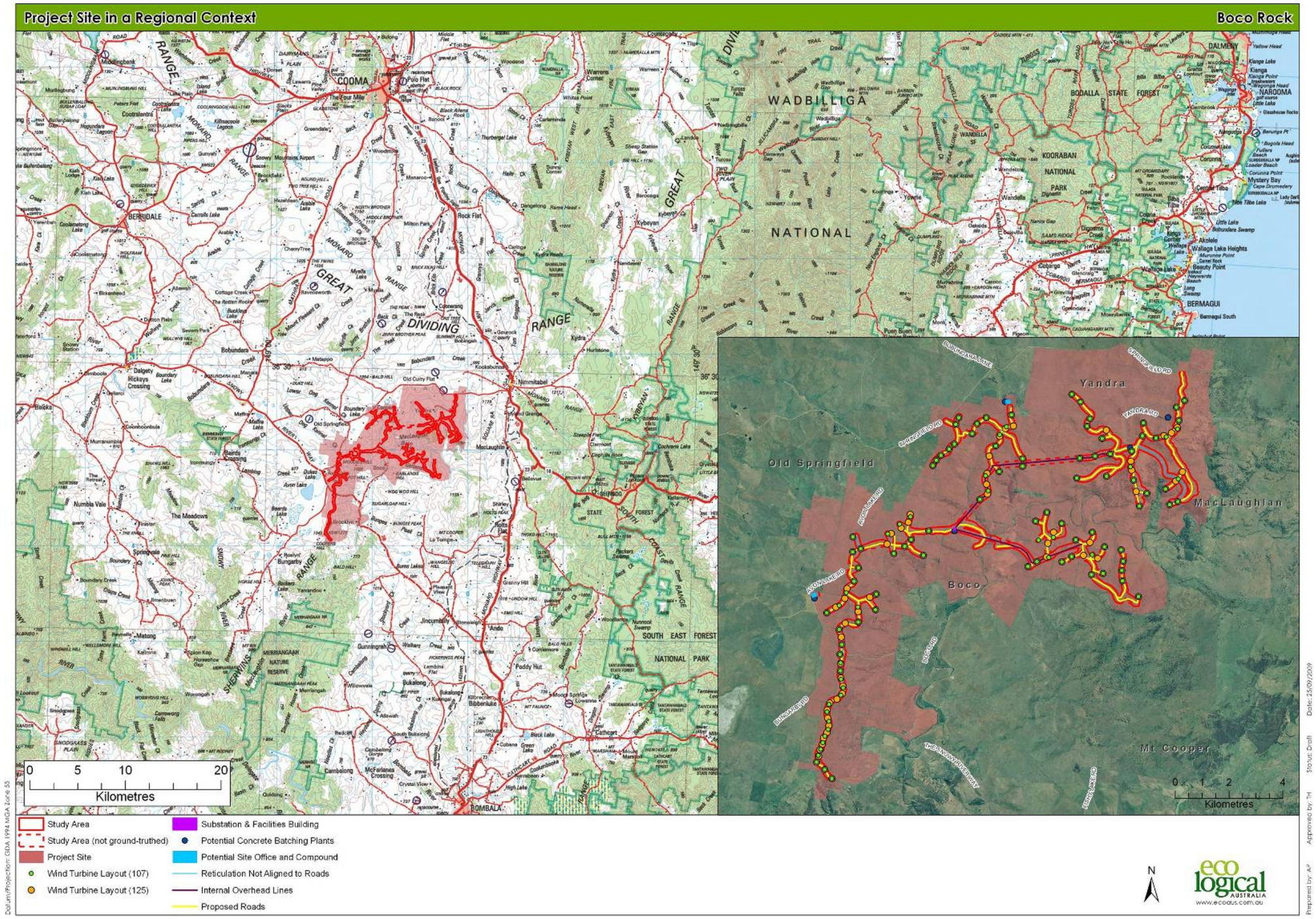

Figure 3: Study area and proposed turbine, reticulation, road and associated facilities layout

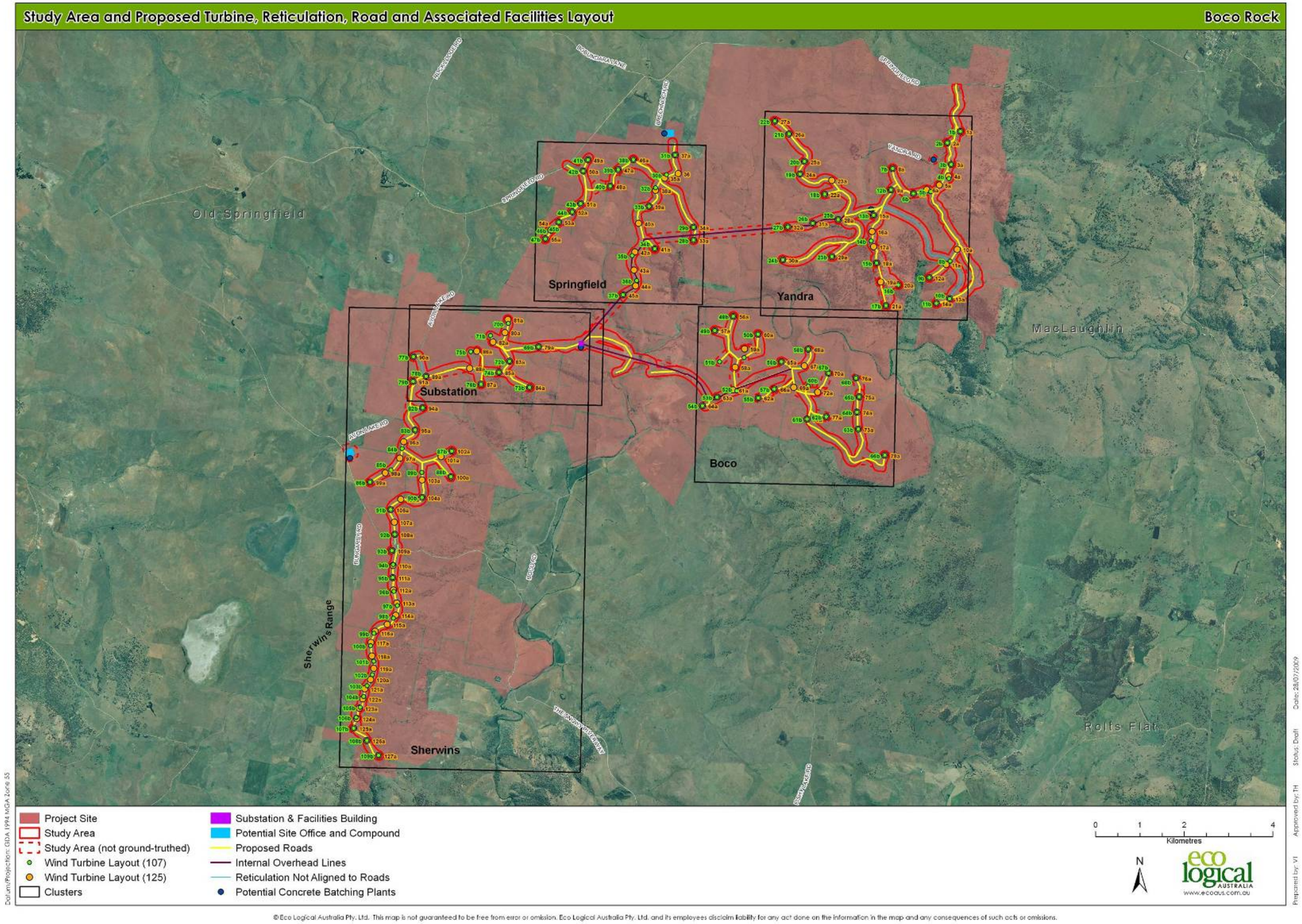

Figure 4: Vegetation quadrat locations

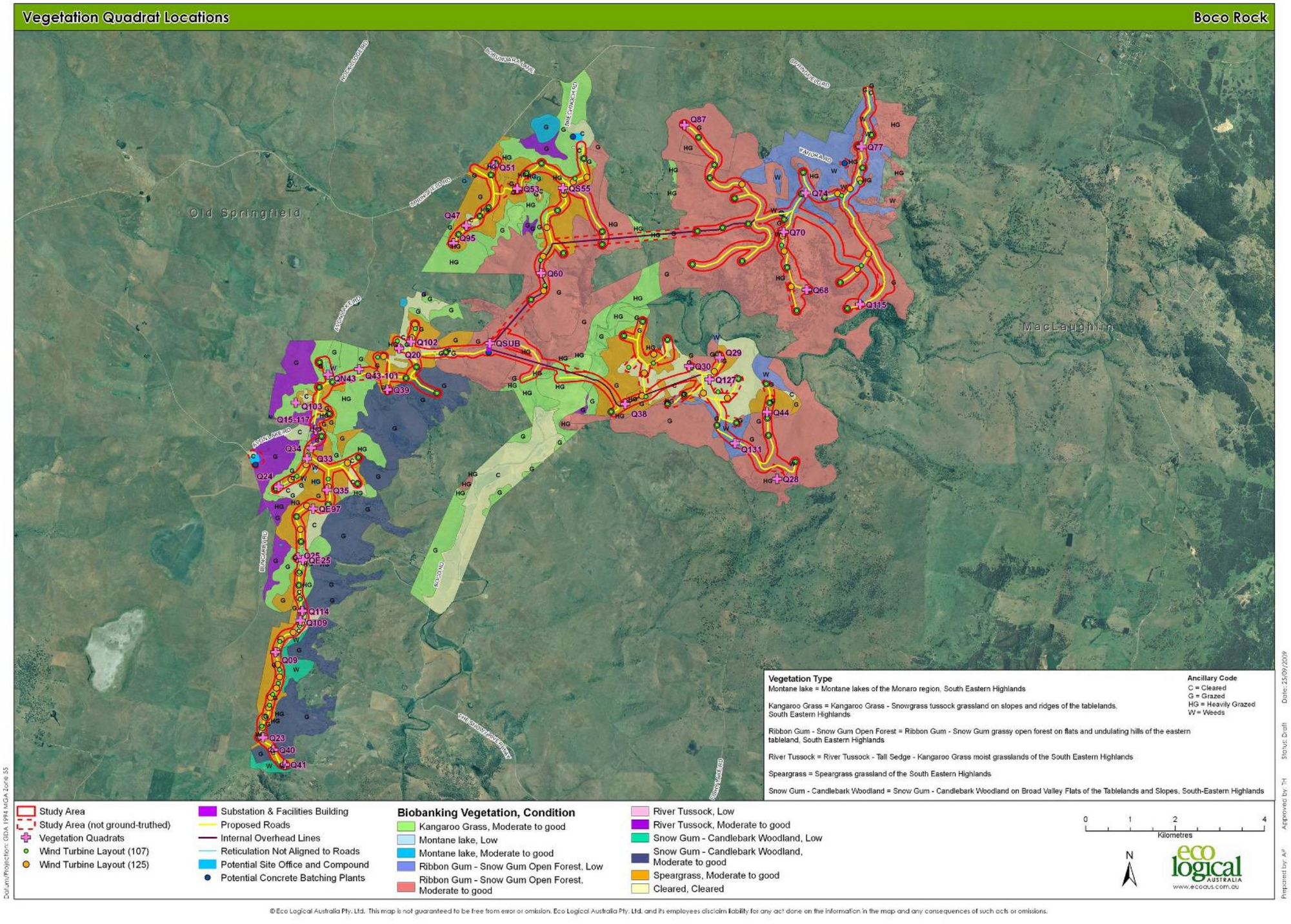

Figure 5: Survey locations

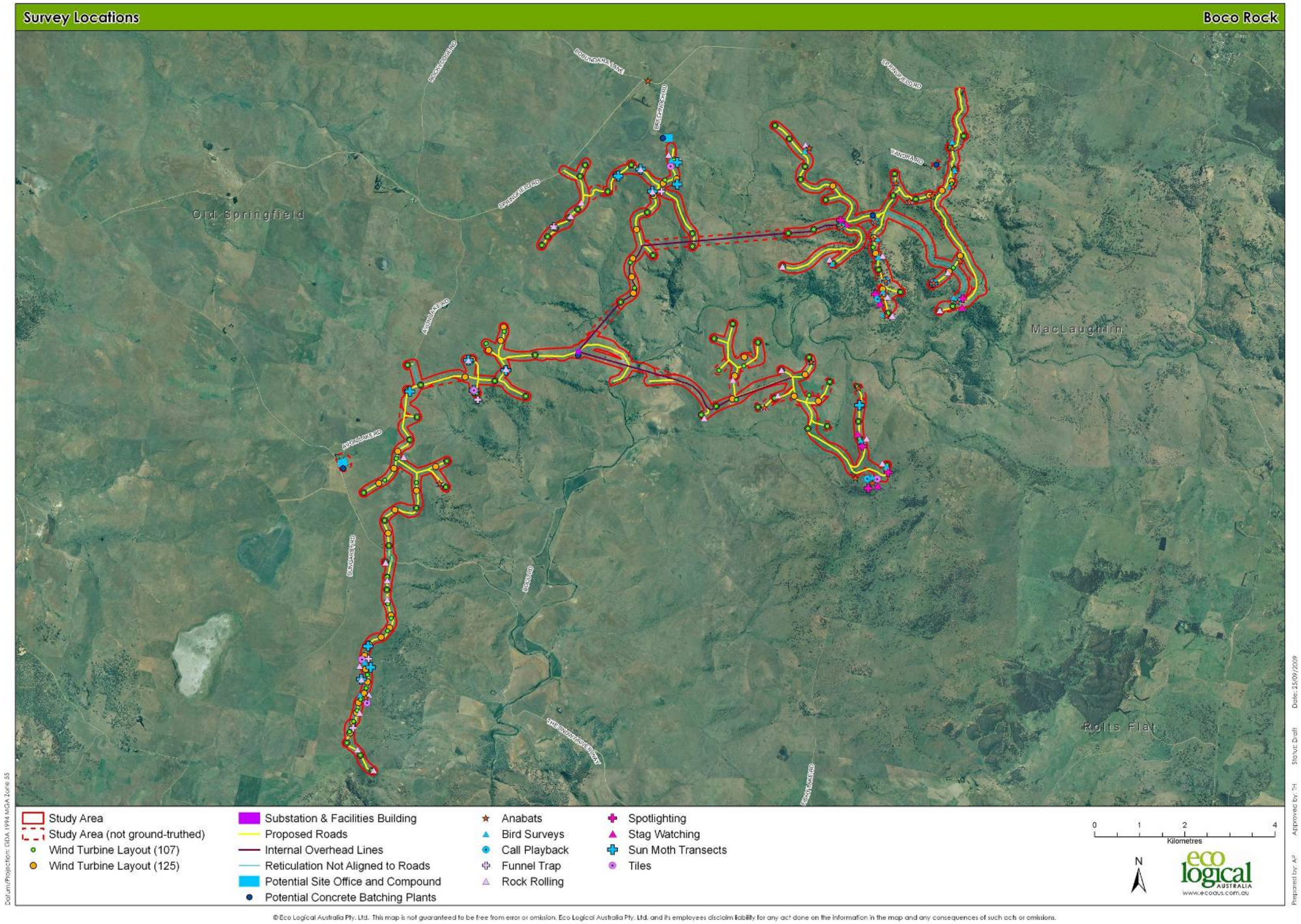

Figure 6: Vegetation mapping

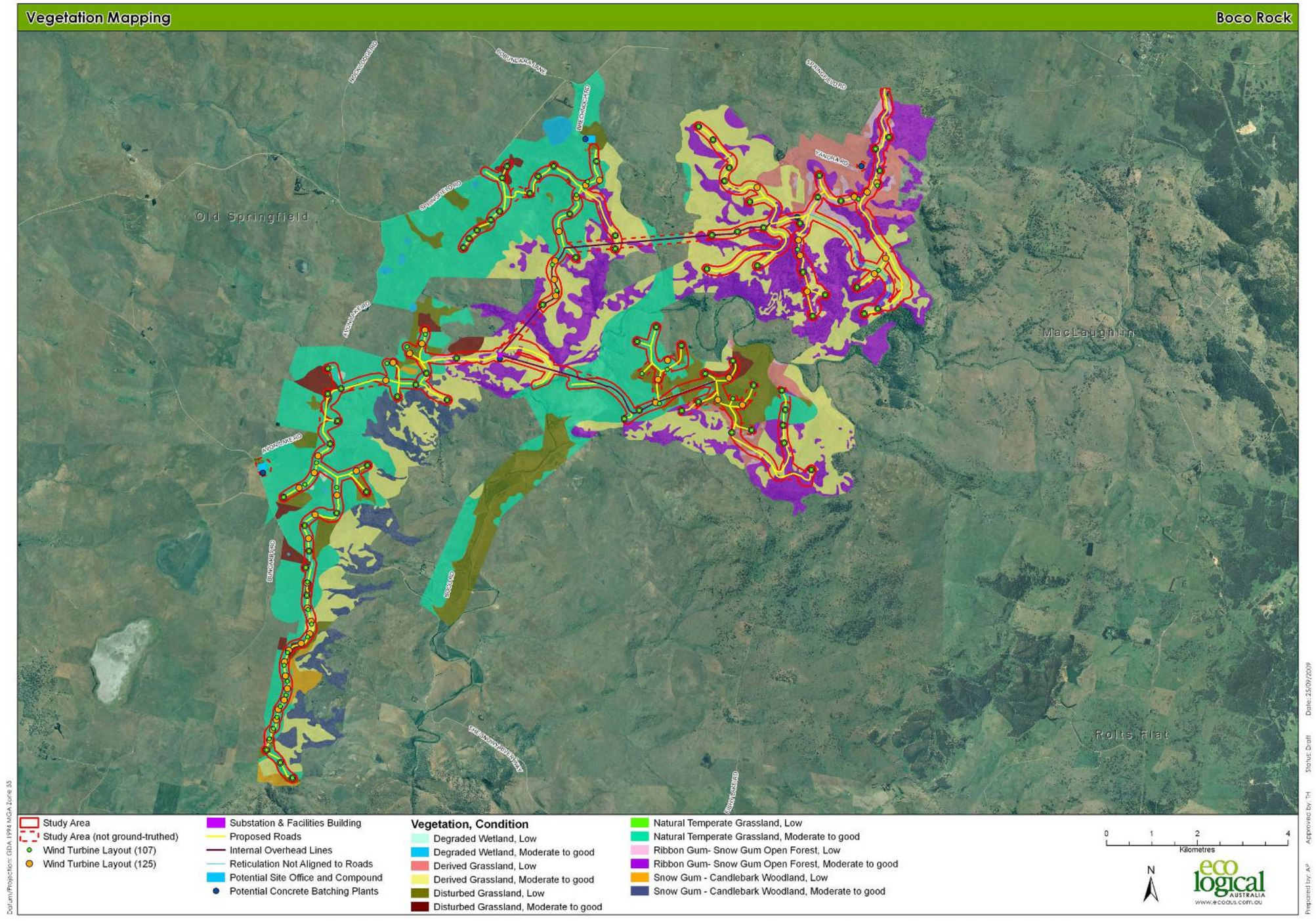

Figure 7: Biobanking vegetation type and condition mapping

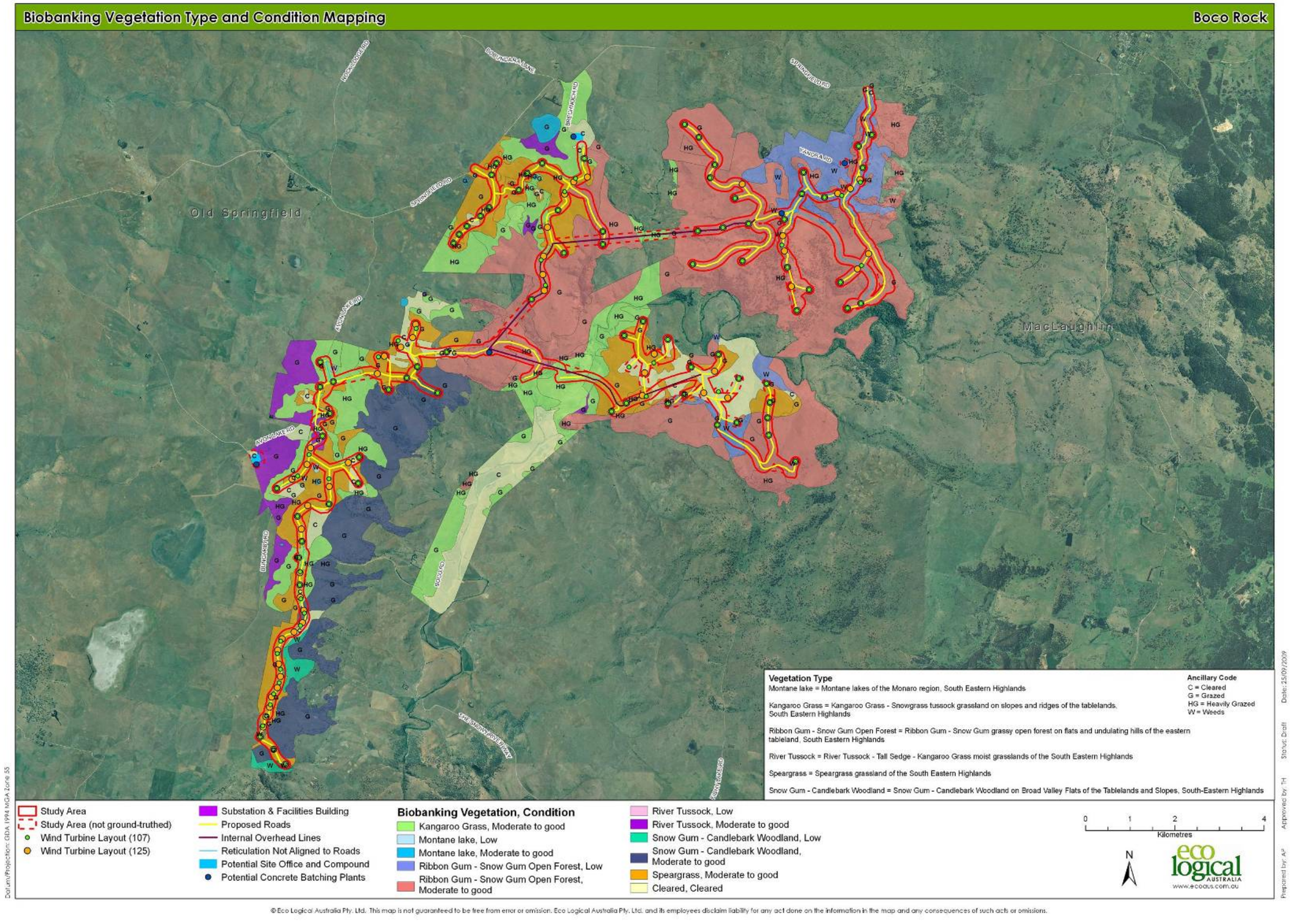

Figure 8: Native grassland in Boco area – priority groups (unpublished SRCMA, 2008)

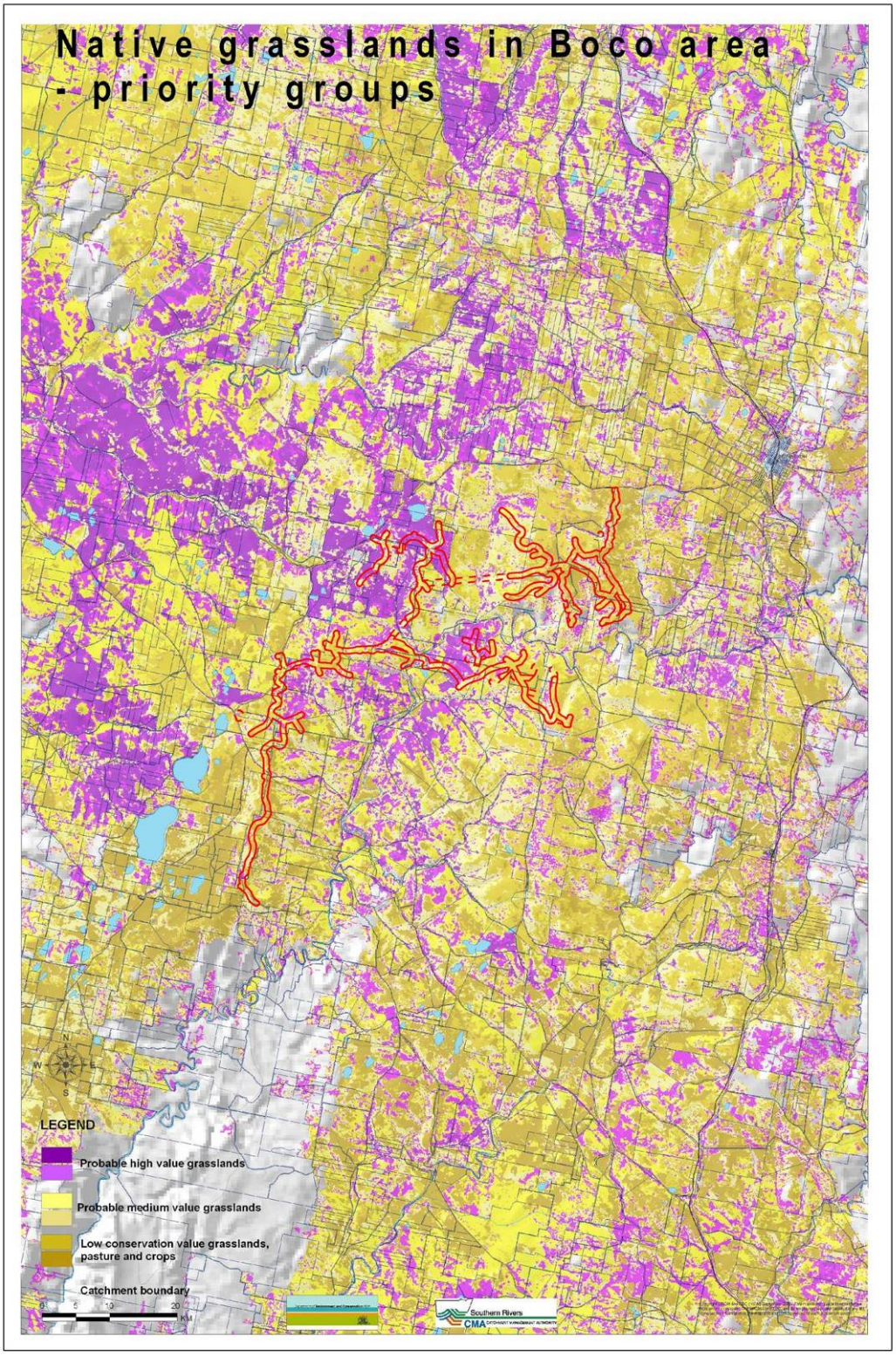

Figure 9: Threatened species records

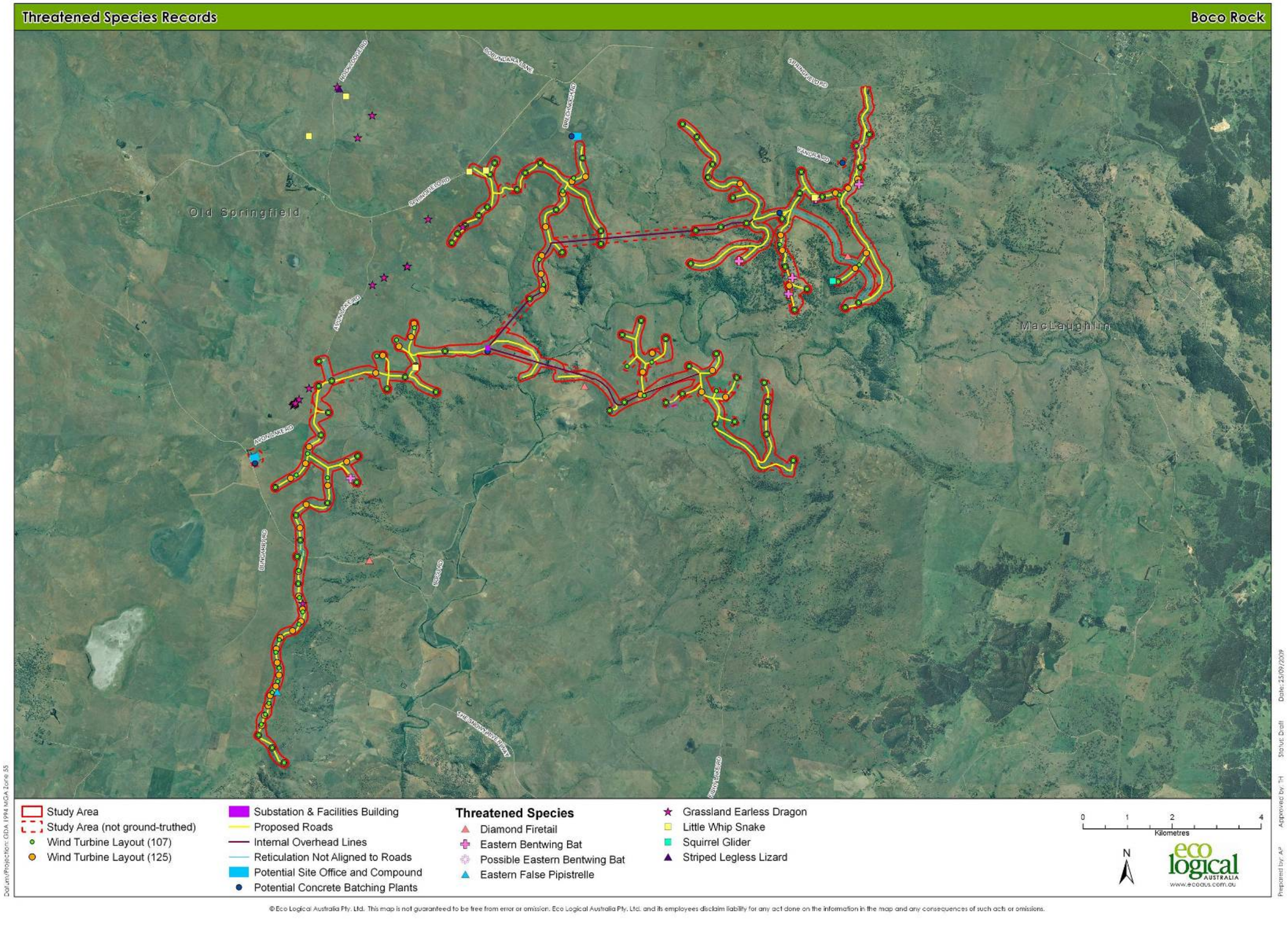

Figure 10: Grassland Earless Dragon habitat

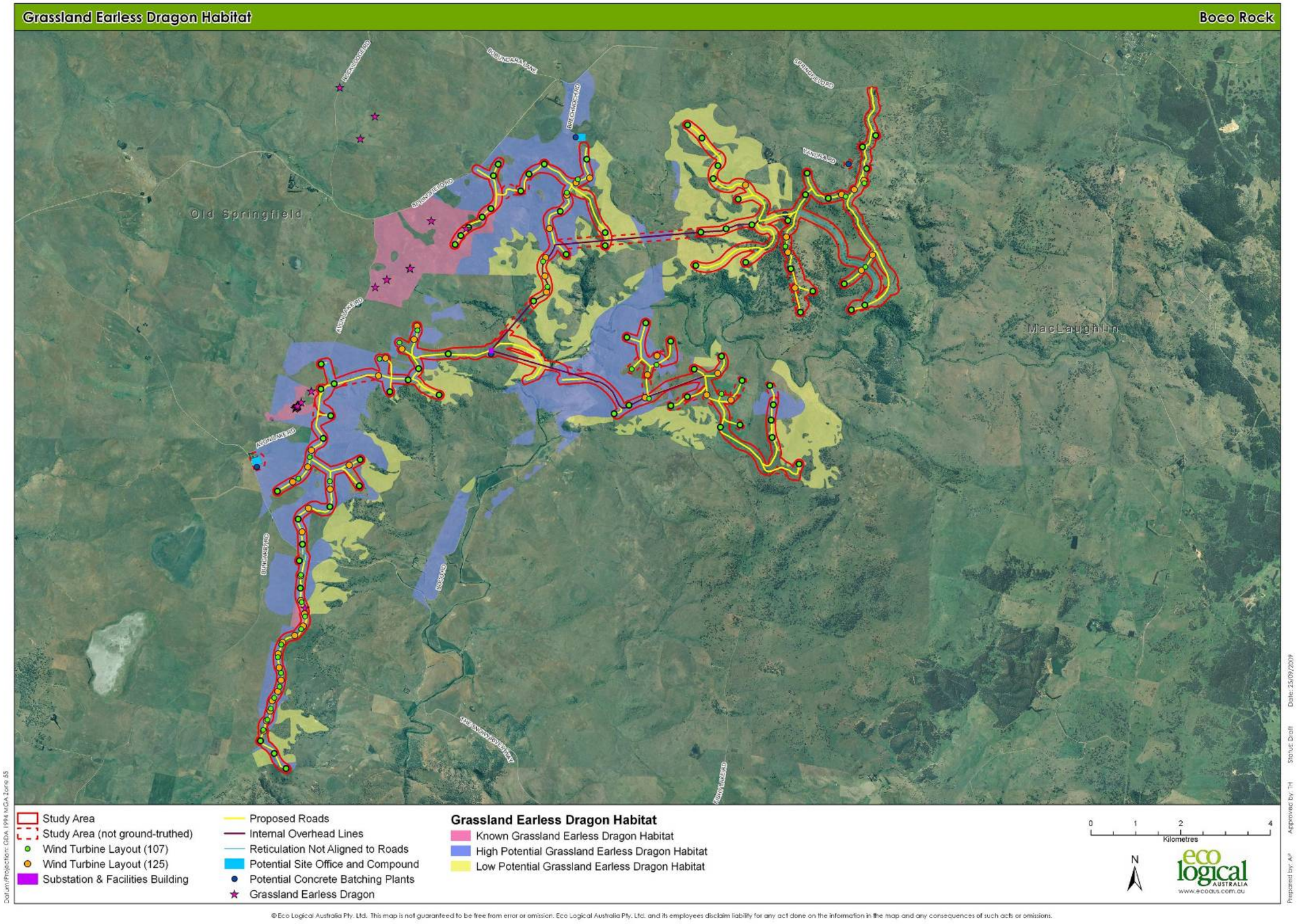

Figure 11: Fauna habitat

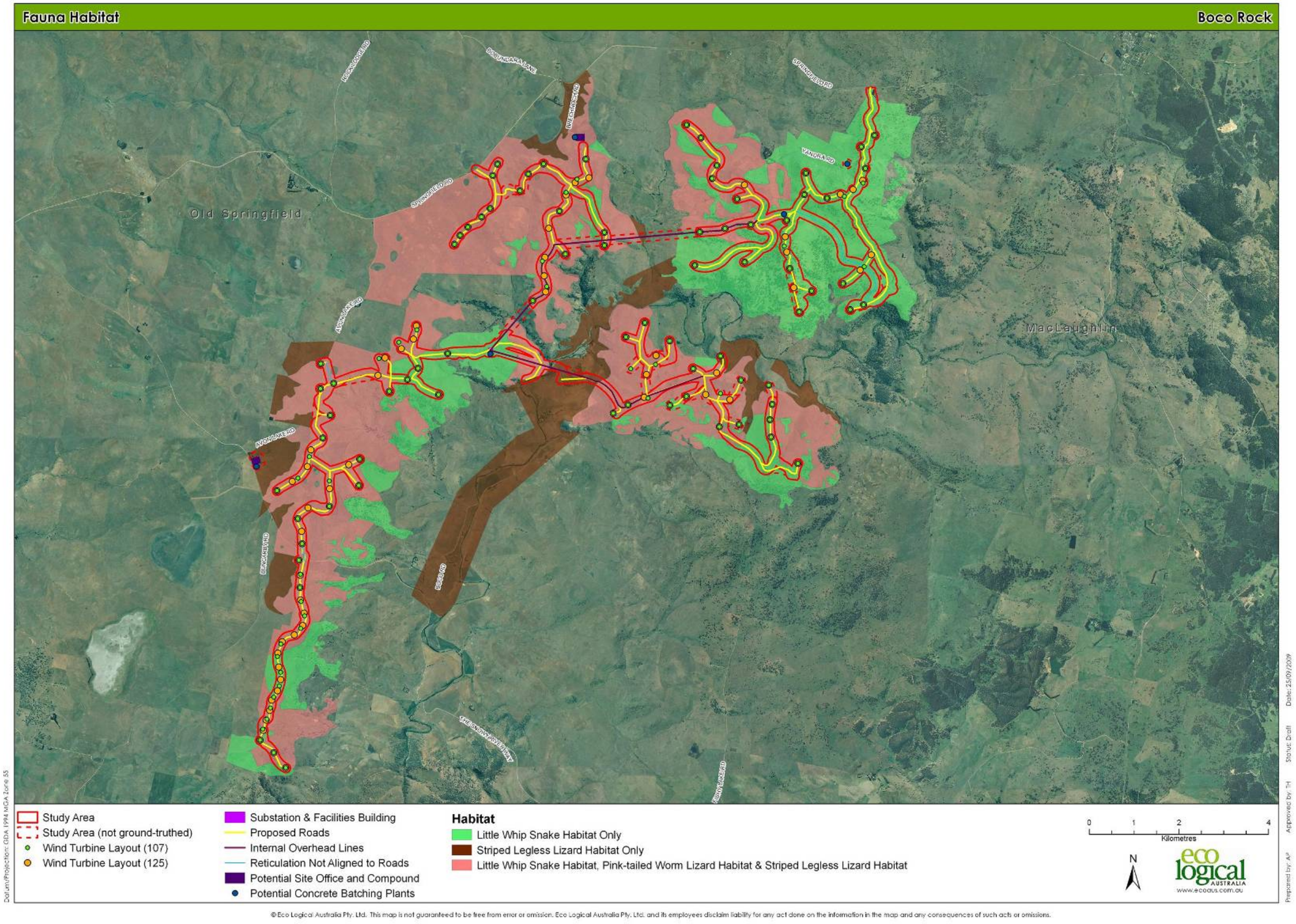

Figure 12: Potential offset sites