

## APPENDIX 12

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Traffic and Transport Study

Bega Duo Designs

# TRAFFIC & TRANSPORT STUDY



## PROPOSED BOCO ROCK WIND FARM

Cooma - Monaro & Bombala Shire Councils

South West of Nimmitabel N.S.W.

Prepared for Wind Prospects CWP Pty Ltd

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By Rodger Ubrihien

Bega Duo Designs

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# 1 INTRODUCTION

## 1.1 Scope of this Assessment

Bega Duo Designs was commissioned by Wind Prospect CWP PTY LTD to complete the Traffic and Transport Study for inclusion in the Environmental Assessment of the proposed Boco Rock Wind Farm.

This report conforms to the *Guide to Traffic Generating Developments* as recommended by the NSW Roads and Traffic Authority and provides a technical appraisal of the traffic and safety implications arising from the proposal. The report also develops measures and makes recommendations for the minimisation of traffic impacts during the construction and operation of the wind farm. This report focuses primarily on the construction phase of the project which would generate the maximum traffic impact.

The requirements of the Director General of the Department of Planning arising from the Preliminary Environmental Assessment have also been taken into consideration. These include:

- details of the nature of the traffic generated
- transport routes
- traffic volumes
- potential impacts on local and regional roads
- potential impacts on bridges and Intersections
- proposed road upgrades and repairs

The primary focus of this report is on the existing public road network and its connections with the proposed site access roads.

This report considers the general impact of the heavy and oversized vehicles on the public road network and immediate surrounds. It does not include a detailed route assessment for the transportation of the over-mass and over-dimension turbine and transformer components along the routes from the major manufacturing centres. This assessment would be required to be produced as part of the permit system by the haulage contractor and approved by the relevant roads authorities prior to the commencement of the construction phase.

An assessment prepared by Connell Wagner PPI for the Capital wind farm which is currently under construction details the available routes from the ports to the Hume Highway in Goulburn, information which is not repeated in this assessment. The Connell Wagner assessment found that the route from the Docks at Port Kembla via Mount Ousley, Picton Road and Hume Highway was suitable for the transport of wind farm components. The haulage contractor for the Capital wind farm provided information on available routes for this report.

It is proposed to construct the wind farm over a three year period. Planning has commenced for submission of an Environmental Assessment to the NSW Department of Planning, for submission in June 2009.

This assessment examines the projected traffic impacts for the construction of up to 127 wind turbines within four clusters, referred to as Yandra, Springfield, Sherwins Range & Boco.

Combined the four clusters would generally be referred to as the 'Boco Rock wind farm' in this report.

The precise location of internal access roads has not been determined at this stage of the planning and therefore assumptions have been made about the most likely access points on to the existing road network based on terrain, existing road condition and cooperation with the relevant property managers. The precise locations will be determined during the detailed design stage however any variations to access locations are not expected to be significant and should not significantly affect the conclusions of this report.

This report does not include details of the hand over requirements of onsite access roads. These details would require the involvement of the local roads authorities and land holders following the preparation of the detailed design plans. These issues are discussed in the on site access section of this report.

## **1.2 Proposal Overview**

The Boco Rock wind farm is located between 7 and 40 kilometres (road distances) south west of Nimmitabel in the south east of N.S.W. (refer to Appendix A).

The northern clusters with access from Springfield road and Avon Lake road are within Cooma Monaro Shire. The southern clusters with access from Snowy River Way (Ando Road) are within Bombala Shire. Most construction would be located in open grazing land.

An indicative layout for a wind farm of up to 127 turbines is shown in Appendix A. It is anticipated the final positions of the wind turbines will be refined through the assessment process. The current layout has been modelled using a wind turbine with a nominal capacity of 2 megawatts however other turbines are under consideration with nominal capacities up to 3.3 megawatts, resulting in a maximum generation capacity of the Boco Rock Wind Farm of 360 megawatts.

Typical dimensions of the wind turbines include a tower height of 80 or 85 metres and blade lengths of 44 to 52 metres, albeit the maximum blade tip height will be in the order of 135 metres.

The wind turbines would be automated to face into the wind and will generate with wind speeds from 4 metres per second. Typically a turbine will shut down at around 25 metres per second to avoid damage to the equipment.

The individual turbines would be connected by underground cables to a new substation constructed on the site. A facilities building would be located adjacent to the substation. Connection via overhead transmission lines would be made to the Country Energy 132kV line near Nimmitabel.

Roads would be constructed connecting the turbine sites and level work areas would be provided surrounding turbines for the safe operation of cranes. These work areas would also provide turning areas for large vehicles. Internal roads would connect to the public road network at a minimum number of locations providing safely designed intersections.

## **1.3 Key Issues and Objectives**

The issues outlined in Table 2.1 of the Roads and Traffic Authority's *Guide to Traffic Generating Developments* are considered in this study. Additional issues have been included because of the unique nature of the development and requirements of the Director General of Planning. These include the impact on the existing road surfaces and bridges as observed during site inspections.

## Key Issues

- Existing road hierarchy and proposals for improvement
- Impact on road safety
- Impact of traffic noise
- Traffic volumes and trends
- Traffic generation
- Safety and efficiency of internal roads
- Impact on bridges intersections and surrounding developments
- Safety and efficiency of access routes (including capacity) between the sites and adjacent road networks

## 1.4 Methodology

- Base project information was obtained from Wind Prospect CWP PTY LTD
- Further information was obtained from the Preliminary Environmental Assessment of 10<sup>th</sup> September 2008
- Existing 1 : 25000 mapping was used to identify features and place names.
- Planning documentation for other wind farm proposals was reviewed.
- All roads were inspected, inventories prepared and photographs taken. Road junctions and intersections were inspected and photographed
- Approximate traffic count information was obtained from observations at all precincts during February 2009. Roads & Traffic Authority data was used to establish the existing traffic volumes (vehicles per day) on the main roads.
- Discussions were held with representatives from Wind Prospect CWP PTY LTD, Roads & Traffic Authority, Cooma Monaro and Bombala Councils.
- Heavy vehicle operators were consulted.
- Methods of wind turbine construction and programming of the works were investigated to estimate the proposed vehicle trips.

### Note:

In accordance with the *Guide to Traffic Generating Developments*, a 'trip' is defined as a one-way vehicle movement from one point to another, excluding the return journey.

The general method of measuring traffic volume is 'vehicles per day'. This is the total of all trips made in either direction per day.

## 2 PROPOSED DEVELOPMENT

### 2.1 Site Description

The Boco Rock site is shown in Appendix A and the diagram in Appendix B shows the location with road distances to nearby towns. The site comprises open grazing land with generally long undulating ridges ranging in height between 900 and 1000 metres above sea level. The site is within the catchment of the MacLaughlin River. The MacLaughlin River intersects the site and flows toward the south west to join the Snowy River.

The site is accessed from the Monaro Highway at Nimmitabel via Springfield Road, Avon Lake Road, Snowy Valley Way, Bungarby Road and Boco Road. The geology of the site is primarily basalt soil and the elevated areas appear to have soil cover to a reasonable depth.

The deep gullies which join the MacLaughlin River provide an access constraint within the site resulting in the current proposed layout which has four clusters which will require separate access points to the public road network. These clusters are referred to as Yandra, (32 turbines) Springfield, (23 turbines) Sherwins, (49 turbines) & Boco (23 turbines).

### 2.2 Site Access General

Existing access roads are shown on the Plan, (Appendix A).

The roads are generally classified as follows:

- National Highways - Monaro Highway which is maintained by the Roads & Traffic Authority and would provide access from Canberra to Springfield Road immediately south of Nimmitabel.
- Regional Roads – Snowy River Way (also referred to as Ando Rd) which is maintained by Bombala Shire 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 Cooma Monaro or Bombala). This includes Springfield Road which will be the major access to the site from Nimmitabel.

The currently favoured access points for the four clusters are shown on the Plan, (Appendix A) and described below:

#### Yandra Cluster

The major access point is from the Yandra is via the access track to “Benbullen” which departs Yandra Road at 1.51 kilometres from Springfield Road.

#### Springfield Cluster

The access point under consideration is from Springfield Road at approximately 16.2 kilometres from Nimmitabel.

### **Sherwins Cluster**

Access points being considered are at 22.45 kilometres from Nimmitabel on Avon Lake Road and on both sides of Snowy River Way (Ando Road) at approximately 28 kilometres from Nimmitabel.

### **Boco Cluster**

Access will be from Boco Road at Boco Station 4.5 kilometres from Ando Road. An access via internal site roads from Avon Lake Road is also under consideration.

## **2.3 Future Road Proposals**

The Roads and Traffic Authority, Cooma Monaro and Bombala Councils have ongoing maintenance and improvement programmes for the roads and bridges under their control.

Bombala Shire 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 Ando for a distance of 3 kilometres.

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

## 3 EXISTING TRAFFIC CONDITIONS

### 3.1 General

Traffic safety is dependant on many variables such as driver behaviour and weather conditions. This section of the report examines the physical constraints which could have an impact on traffic safety, as observed on an inspection of the roads carried out in February 2009. This work included observations of traffic volumes. The expected routes for oversize and over mass vehicles from the major manufacturing centres to Cooma were not inspected and are discussed in Sec. 5.2 of this report.

Inventories for the roads comprising the major routes, as shown on the plan in Appendix A follow in Sec. 3.2. These roads are Monaro Highway, Springfield Rd, Yandra Rd, Avon Lake Rd, Snowy River Way (from Avon Lake Rd to Boco Road) and Boco Road. Some details are also included in Sec. 3.2 for Bungarby Road, Maffra Road and some sections of Snowy River Way which could experience an increase in traffic.

### 3.2 Major Access Routes

#### *Monaro Highway Cooma to Nimmitabel*

The Monaro Highway provides access from Canberra in the north and the Gippsland Area of Victoria in the south. Locally, it provides access between Cooma Nimmitabel and Bombala. It also connects with the Snowy Mountains Highway to provide access to Bega and the south coast.

The Highway is a high standard two lane road with intersections and pavement designed for the passage of heavy vehicles.

The traffic on the highway through Cooma is required to negotiate two roundabouts. Turning radii through these roundabouts can be restrictive for long vehicles. A suitable heavy vehicle by pass is available via Polo Flat industrial area.

The old sawmill site at approximately 1.5km north of Nimmitabel has been investigated as a possible location for a concrete batch plant. The junction with the Monaro Highway has adequate sight distance and turning radii in both directions (refer to Plates 1 & 2). The throat of the junction is unsealed and the shoulder opposite the junction does not have sufficient width to permit the passing of a turning vehicle (Plate 3). Alternate locations for on site concrete batch plants are also being investigated.

The junction with Springfield Road is on the southern approach to Nimmitabel at 0.5 kilometres south of the town centre.

#### *Springfield Road*

The junction with Monaro Highway (0.5 kilometres south of Nimmitabel) has good sight distance and turning radii (refer to Plates 4, 5 & 6). Distances in this section of the report refer to distances from the Monaro Highway.

Springfield Road has a bitumen surface approximately 6.0 metres wide as shown in Plate 7 at 0.95 kilometres. The alignment and grading on the curved sections restrict safe travel speeds to approximately 70 to 80 kilometres per hour.

Yandra Road is on the left at 5.70 kilometres. The sealed surface of Springfield Road is damaged in some locations as shown in Plate 8. Brechnoch Rd to Kydrabah is on the left at 13.06 kilometres and Bobundra Lane on the right at 13.58 kilometres.

The curves on the approach to Bobundra Lane are of a reduced radius compared to the previous alignment and have been provided with a "Reduce Speed" sign at 12.93 kilometres.

The bitumen surface ends at 13.80 kilometres (Plate 9). The gravel surface is generally in good condition and is shown at 15.5 and 17.7 kilometres (Plates 10 & 11). The junction with Avon Lake Road is on the left at 18.85 kilometres.

### *Yandra Road*

Yandra Road Junction is shown in Plates 12 to 14. Distances shown in this report are from the junction of Springfield Road. The road is maintained by Cooma Monaro Council to "Yandra" station at 3.15 kilometres. The major access will most likely follow the access road to "Benbullen" which departs at 1.51 kilometres.

The junction with Springfield Road has good sight distance in both directions. The turning radii are restricted by the proximity of the cattle grid to the edge of bitumen on Springfield Road.

Yandra Road is basically a low speed gravel access road of 3.0 to 4.0 metres width.

Access to "Glenfinnian" is on the left at 0.25 kilometres and trees overhang the road at 0.4 kilometres (Plate 15). The road is not fenced there is a stock grid 3.0 metres wide at 1.43 kilometres.

Plate 16 shows the junction with "Benbullen" access road at 1.51 kilometres. The road continuing to "Yandra" has narrow grids at 2.16 & 3.15 kilometres and gates at 2.57. The general condition of the road deteriorates towards the entry to "Yandra" (Plate 17).

### *Avon Lake Road*

Distances in this section of the report refer to distances from the Monaro Highway at Nimmitabel.

Plates 18 & 19 show the junction with Springfield Road. The junction has adequate sight distance and the turning radii should be suitable for long loads assuming that vehicles use the full width of Springfield Road to commence their turn.

The gravel surface is generally 4.0 metres wide with additional shoulders up to 1.0 metres wide in most locations (Plate 20 shows the commencement of Avon Lake Road). The road pavement requires resurfacing at many locations. Plate 21 shows the surface at 20.74 kilometres.

Proposed access points under consideration are on each side of Avon Lake Road at 22.45 kilometres (see plates 22 & 23). The sight distance to the north is good and the sight distance to the south (Plate 24) is adequate for low travel speeds and could be improved with minor sight benching. The gates and associated boundary on each side of the road at 22.45 kilometres will require relocation to provide an adequate set back from the road edge.

The road is fenced to the first stock grid at 24.05 kilometres (Plate 25) which is 3.6 metres wide.

Avon Lake Road has a lower standard of alignment for the section from 24.5 to 25.3 kilometres. A second stock grid at 25.38 is 3.6 metres wide (Plate 26).

The junction with Snowy River Way is at 25.45 kilometres. This junction has good sight distance and turning radii (ref. Plates 27 & 28).

### *Snowy River Way (from Avon Lake Rd. to Boco Rd).*

Distances in this section of the report refer to distances from the Monaro Highway at Nimmitabel.

This section of Snowy River Way has recently been reconstructed and sealed up to 8.0 metres wide. The junction with Bungarby Road is on the right at 26.97 kilometres.

An access is proposed to the top of Sherwins Range on the right at 27.97 kilometres. Plates 29 & 30 show the sight distance to the east and west respectively. The sight distance to the east is restricted by the crest and the sight distance to the west is good. An existing access to the northern section of Sherwins Range is at 28.31 on the left. The sight distance to the west (Plate 31) is restricted and could be improved with minor sight benching. The sight distance towards the east (Plate 32) is adequate for the travel speeds expected on this section of Snowy River Way.

Boco Road junction is at 31.31 kilometres (Plates 33 & 34).

### *Boco Road*

Distances in this section of the report refer to distances from the junction with Snowy Valley Way.

Boco Road Junction with Snowy River Way has recently been reconstructed and has good sight distance and turning radii.

A new stock grid 3.6 metres wide has been provided at 0.08 kilometres (Plate 35).

Boco road is a 4.0 metre wide unfenced gravel road maintained by Bombala Shire Council.

Plate 36 shows an old stock grid, 3.0 metres wide at 1.12 kilometres. Plate 37 shows a concrete causeway 4.5 metres wide located at 1.30 kilometres. Stock grids 3.6 metres wide are located at 1.89 and 2.75 kilometres (Plates 38 & 39).

The MacLaughlin River is crossed with a concrete causeway at 2.85 kilometres (Plates 40 to 43). The concrete slab is 4.0 metres wide and appears to be partially undermined on both sides. There is a small radius curve on the northern approach.

A dwelling is located close to the road on the right hand side at 3.37 kilometres.

A stock grid 3.6 metres wide with concrete sides is located at 3.85 kilometres (Plate 44).

A concrete causeway 4.8m wide is located at 3.90 kilometres (Plates 45 & 46).

The stone entrance and stock grid for "Boco" station is located at 4.53 kilometres which is the end of the council maintained road. The stock grid is 3.6 metres wide (Plate 47). It is envisaged that internal access road will depart from this point to give access to the "Boco" cluster of wind turbines.

### *Bungarby Road*

The junction with Snowy River Way has good sight distance and turning radii.

Bungarby road has a 5.0 metre wide bitumen seal for the initial 7.5 kilometres to Ironmungie Road.

The current wind farm proposal extends approximately 5 kilometres southwards on Sherwins Range adjacent to Bungarby Road and safe access points could be established at many locations. Plate 48 shows Bungarby Road looking south with Sherwins Range in the background.

### *Snowy River Way from Boco Road to Monaro Highway at Ando*

Distances in this section of the report refer to distances from the Monaro Highway at Nimmitabel via Springfield Road and Avon Lake Road. Boco Road junction is at 31.31 kilometres.

Ando road is currently under construction up to 34.3 kilometres including a new bridge over the MacLaughlin River. The road remains unsealed to 44.3 kilometres.

A timber bridge 10 metres long and 7 metres wide crosses Peak Creek at 37.88 kilometres. Cambalong Creek Bridge is at 45.62 kilometres. This timber bridge is 7 metres wide and 44 metres long with unsealed approaches.

The junction with the Monaro Highway is at 52.66 kilometres. This junction has good sight distance and turning radii.

### *Maffra Road Route*

The routes from the Boco wind farm to surrounding centres are shown on the diagram in Appendix B. The route to the wind farm from Cooma via Maffra Road and Snowy River Way is considerably shorter than via Nimmitabel.

Maffra road is bitumen sealed council road with a minimum width of 6.0 metres. The standard of alignment varies with the terrain and several hilly sections reduce travel speeds to less than 80 kilometres per hour sections. There are two concrete bridges on the route.

The route via Nimmitabel is of a higher standard of alignment than Maffra Road and the pavement and structures are designed for heavy loads on the Monaro Highway. It is likely that light traffic from Cooma to the western clusters of the wind farm will travel to the site via Maffra Road.

## **3.3 Existing Traffic Volumes**

Traffic observations were made during mornings and afternoons on 11th & 20th of February 2009.

Volumes obtained from RTA counts (Roads and Traffic Authority) are average, annual, daily traffic counts and have been adjusted to represent numbers of vehicles per day. The volumes were based on counts collected in 2006. The figures include vehicle numbers in both directions and can be adjusted if required assuming that the peak hour represents 15% of the daily traffic volumes.

Observations on many of the minor roads revealed hourly counts of several vehicles. The traffic on these roads is generated primarily by the occupied properties. The numbers adopted below have been adjusted based on the number of properties multiplied by traffic generation rates for dwellings given in the RTA Guide to Traffic Generating Developments.

The accuracy of the adopted traffic counts on the minor roads is not significant in the assessment of traffic impacts whilst the volumes remain low. Impacts on these roads are considered based on observed defects in each road.

**Table 3-1 Traffic Volumes (AADTs) for Roads in the Study Area.**

Road	Vehicles per day	Information source
Monaro Highway at Nimmitabel	1907	Obtained from RTA 2006 records
Springfield Road	200	Cooma Monaro Council
Snowy River Way at Jincumbilly	114	Obtained from RTA records
Avon Lake Road	Less than 50	Adjusted from counts taken
Yandra Road	Less than 30	Estimated from observations
Boco Road	Less than 30	Estimated from observations
Bungarby Road	Less than 50	Adjusted from counts taken
Maffra Road	Less than 200	Adjusted from counts taken

\* Volumes represent the total traffic volume in both directions.(they also equate to the number of trips)

### 3.4 Accident Records

Accident records from the Roads and Traffic “Crash” database for the five years prior to June 2008 indicate the following:

- There were four recorded accidents on Springfield Road between Nimmitabel and Avon Lake Road. One of these accidents resulted in a fatal injury. This accident occurred in wet weather and driver fatigue was recorded as a contributing factor.
- There was one non casualty accident on Avon Lake Road.
- Three accidents (none fatal) were recorded on the Snowy River Way between Avon Lake Road and Boco Road. This section of road has been reconstructed and sealed since 2008.
- Three accidents were recorded on Maffra Road including a single fatality. This fatal accident occurred on the curved section near Cooma and speed was recorded as a contributing factor.

These relatively low accident rates result from the low volumes of traffic. The presence of two fatal accidents appears to indicate that there is a risk of severe accidents if traffic volumes are increased.

## 4 FACTORS RELATING TO TRAFFIC GENERATION AND TRAFFIC IMPACT

### 4.1 Traffic Generation

#### Vehicle Types

The type of vehicles accessing the site depends on the equipment or personnel being transported and their function on the site. Access is expected to be available to depot sites and facilities buildings for conventional two wheel drive vehicles. Access to the wind turbines may be restricted to four wheel drive or multiple wheel drive vehicles.

Due to the size and weight of the wind turbine equipment it is expected that many of the delivery vehicles will be “oversize”, “over mass” or both. These vehicles will be regarded as Restricted Access Vehicles (RAVs) and will require operating permits to allow them to travel on public roads.

“Oversize” vehicles are those over 19 metres in length, 2.5 metres in width and/or 4.3 metres in height and their operating permits will require one or more escort vehicles to accompany them.

“Overmass” vehicles are those with a gross mass in excess of 42.5 tonnes. Each wind turbine generator comprises a nacelle (approx. 75 tonnes), hub (approx. 25 tonnes), three blades (approx. 7 tonnes each), four tower sections (approx. 50 tonnes each).

The components are carried on specially designed trailers with axles which extend up to 4.2 metres total width to carry the hubs and nacelles on N.S.W. roads. The blades which are up to 52 metres long are carried on “jinker” trailers which have steerable rear axles. These trailers can negotiate relatively small radius curves provided that the inside of the curve is clear of obstacles.

#### Construction phase of the project

The maximum traffic volume is expected to occur during the civil construction phase of the wind farm which includes the pouring of concrete for the foundations. Each footing may contain up to 310 cubic metres of concrete to be poured over an eight hour period. This results in a rate of up to 12 mixer truck trips per hour. Mobile batch plants may be provided on site as an alternative to the site at Nimmitabel. Location of the batch plants on site may reduce the maximum traffic generation rate on the major roads. For the purpose of predicting maximum possible traffic generation, the concrete trucks would be included in the number of vehicles generated on all of the major routes.

The location of the four clusters in the current development (see Plan of Access Roads in Appendix A) would result in major access links being along the Monaro Highway, Springfield Road, Avon Lake Road and Snowy River Way.

Major access routes to be established along public roads which presently serve as access roads to several properties include part of Yandra Road and Boco Road. These routes are identified as routes which would be required to carry relatively large volumes of traffic during the construction phase and would continue to carry traffic for the ongoing maintenance of the wind farm.

An internal access road being considered to link the northern section of the Sherwins cluster to the Boco cluster could reduce the volume of construction traffic on Boco road.

### **Operation phase of the project**

Once operational, the wind farm would be managed and operated by several crews of locally based technicians. The clusters would be accessed regularly for operational and maintenance activities. It is estimated that the operational phase would generate up to 8 trips per day on the local road network.

## **4.2 Construction Program**

The project would be constructed over an 18 month to 2 year period. The following major activities are expected to take place at all four clusters except for the substation erection which is currently proposed for the Sherwin Cluster.

- Civil works for upgrading of access roads and establishment of cluster depots and site offices.
- Civil works for construction of internal tracks, excavation for footings and trenching for cables
- Pouring of concrete in turbine footings
- Transportation to precinct, erection and commissioning of wind turbines
- Construction of substation and associated power lines

## **4.3 Working Hours**

Normal construction industry working hours are assumed for the purposes of this report, as specified in the EPA Environmental Noise Control Manual (7am-6pm Mon-Fri, 7am or 8am – 1pm Sat). EPA Guidelines would apply for noise emissions from construction works.

## **4.4 Assumed Design Traffic Volumes**

The traffic volumes contained within this section would be used to design traffic management devices, such as junctions, required for the proposal. They are also used to quantify the traffic impact, for example, on residents living adjacent to the haulage routes, and possible damage to the road pavements.

The daily rate of traffic movements, rather than total number of movements, is the critical factor in determining the level of impact. The daily rate is derived from Table 4.1, which estimates the predicted maximum number of one way traffic movements (trips) per day for the various construction activities.

**Table 4-1 Predicted Daily Rates of Traffic (trips).**

For the purposes of predicting traffic on a major route the following table is based on the construction of 48 wind turbines at one location. This represents the maximum which could occur at any one point on the major access routes shown on the Plan, Appendix A. The table is based on the Sherwins Range Cluster which may require access for the construction of up to 48 turbines from Avon Lake Road.

*Information in the table is based around continuous pouring one footing in a day and installation of approximately 2.5 towers per week.*

Activities	Approximate duration (months)	Maximum number of trips per day	Comments
Construction and management staff	12	<b>54</b>	Assuming approx. 3 employees per vehicle.
Precinct set up	1	10	
Road construction	4	30	
Foundation construction	10	<b>102</b>	Includes reinforcing steel delivery
Dust suppression	12	<b>4</b>	
Substation & Powerline construction	4	<b>26</b>	Includes overmass vehicle deliveries of transformers.
Internal Cabling	4	6	
Turbines erection	5	<b>58</b>	Includes up to 400 oversize and over mass vehicle deliveries.

The trips shown in **bold** could be concurrent, resulting in a maximum 240 trips per day.

This table indicates that the maximum daily rate of traffic at any point on the major access route may increase by 240 vehicles per day during the peak construction period.

The estimated hourly rate during the peak hour (based on 15% of the daily volume) is approximately 40 vehicles per hour. This figure would be used in the design of new junctions and is applicable when estimating the impacts on residents adjacent to the proposed routes.

#### 4.5 Design for Heavy Vehicles

The standard design vehicle for the construction of intersections and the design of parking and turning areas (as a minimum) would be the 'Austroads' Single Unit Truck/Bus 12.2m long. However, provision would be made wherever possible to allow for a 'B-Double' template, which requires a wider path. This wider path would allow for the turning of semi trailers and oversize vehicles.

There is a requirement to transport turbine blades to the precinct, which could be up to 52 metres long. These would be transported on purpose designed steerable trailers making approximately 250 deliveries in total (all clusters). These vehicles would be capable of negotiating relatively small radius curves provided that areas free of obstructions are available on the inside of curves. The transport of tower sections up to 25 metres long and weighing up to 50 tonnes would require a total

of 500 oversize vehicle deliveries. The nacelles would require 130 over-mass (up to 75 tonnes) vehicle deliveries.

The design of access roads and junctions would need to allow for widths of up to 4.5 metres and weights complying with Roads and Traffic Authority maximum loading.

#### 4.6 Traffic Circulation

Hardstand areas would be required around each turbine for the safe operation of large cranes. These areas would also provide turning opportunities for delivery vehicles.

No vehicles would reverse onto the public road network.

#### 4.7 Road Capacity (Level of Service)

Road capacity is normally described as 'Level of Service' and based on Austroads 'Guide to Traffic Engineering Practice, Part 2 Roadway Capacity'. Capacity is expressed in total vehicles per day. The level of service descriptions are as follows:

**Table 4-2 Level of Service (LOS) Descriptions.**

LOS A :	Free flow condition, high degree of freedom for drivers to select desired speed and manoeuvre within traffic stream.
LOS B :	Zone of stable flow, reasonable freedom for drivers to select desired speed and manoeuvre within traffic stream.
LOS C :	Zone of stable flow, restricted freedom for drivers to select desired speed and manoeuvre within traffic stream.
LOS D :	Approaching unstable flow condition, severely restricted freedom for drivers to select desired speed and manoeuvre within traffic stream.
LOS E :	Condition close to capacity, virtually no freedom for drivers to select desired speed and manoeuvre within traffic stream. Small increases in flow would generally cause operational problems.

Tables contained in Austroads 'Guide to Traffic Engineering Practice', Sec. 3.4 & Sec 4 Roadway Capacity, have been used for the following determinations based on the traffic volumes shown in Section 3.1:

- The Monaro Highway at approximately 1900 vehicles per day (vpd) operates at LOS A and would not reach LOS B until the volume reaches approximately 2400 vpd. The estimated maximum design volume (see Section 4.4 of this report) is 2140 vpd.
- The sealed two lane sections of Springfield Road, Snowy River Way & Maffra Road with approximately 200 vpd are operating at LOS A and the level of service would no drop to LOS B until volumes reach 1100 vehicles per day.

The determinations above show that the increase in traffic volumes of 240 vehicles per day would have a negligible effect on the capacity of the sealed two lane roads shown above.

The single lane gravel roads which comprise the remainder of the roads under consideration perform their function as property access roads however **would not** perform satisfactorily with an increase in traffic of 240 vehicles per day.

The Roads & Traffic Authority design guidelines suggest that roads with volumes between 150 and 500 vehicles per day should be provided with two lanes of 3.0 metres minimum width each (6.0m pavement). This is generally the minimum standard adopted by councils for smaller rural subdivisions.

## **5 POTENTIAL IMPACTS**

### **5.1 Traffic Impacts General**

Traffic generation calculations indicate that the maximum hourly increase in traffic at any location would be approximately 40 vehicles per hour (equivalent to 240 vpd) during the construction phase of the project.

The following impacts have been considered:

- Vehicle collisions
- Vehicles losing control
- Collisions with stock
- Traffic noise
- Dust from unsealed roads
- Obstruction by long loads
- Wet weather
- Road surface deterioration
- Structural failure of road structures

### **5.2 Impacts of Over-mass and Over-dimensional Haulage to Nimmitabel**

The construction has commenced on wind farms at Cullerin and Bungendore (Capital wind farm) in southern N.S.W. Haulage of imported turbine components from Port Kembla has commenced. Haulage of the Australian manufactured tower components has commenced from South Australia and Queensland. Detailed discussion of the impacts relating to over mass and over dimensional routes from the major manufacturing centres to the Hume Highway at Goulburn is not included in this report as these routes are currently operating adequately for the Cullerin and Bungendore wind farms.

Haulage to Nimmitabel from the Hume Highway would most likely be via the Federal Highway, Sutton Road to Queanbeyan, Pialligo Drive to the A.C.T., Monaro Highway to Cooma, Polo Flat bypass of Cooma. Decisions on the final routes for these vehicles would be the subject of negotiations between the haulage contractor and the road authorities however discussions with the haulage contractors for the Capital wind farm indicated that this route would have minimal impacts.

### **5.3 Impacts of Increased Volumes of Traffic on all Routes from Nimmitabel to the Sites**

Because of the potentially large increase in the number of vehicles using these routes there are many impacts to be considered. The larger vehicles would occupy most of the width of the roadway at many locations increasing the chance of 'head on' collisions. For nearby property owners, there would be an increase in traffic noise and dust nuisance and a need to control stock

from straying on the roads which are not fenced. Dust would be generated on the unsealed roads affecting visibility and resulting in the loss of pavement materials. The gravel road surfaces would deteriorate and potholes would form under the increased traffic loads, particularly during wet weather when water ponds or floods across the road. Structural damage may occur to some of the culverts, concrete causeway crossings and stock grids. The location of trees and other roadside objects have the potential of obstructing the passage of long wide loads and high loads. Lack of roadside delineation in some locations may impact traffic safety during periods of poor visibility. Some intersections have inadequate pavement width to safely accommodate the turning manoeuvres of the over-size vehicles.

These impacts would be temporary, as the equipment haulage is not a continuous program. Most of the heavy haulage would be in the form of convoys and would be managed through the mitigation measures contained in this report.

#### **5.4 Additional Potential Impacts at Specific Locations**

##### *Monaro Highway north of Nimmitabel*

Increased turning manoeuvres at the junction with the access to the old sawmill site north of Nimmitabel could result in vehicle conflicts if the site is developed as a concrete batch plant. (onsite batching of concrete is being considered as an alternative to this site).

##### *Springfield Road (15.8km sealed section)*

Increased usage by drivers unfamiliar with the route could result in excessive speed in the curved sections. The junction with Yandra Road is on this section gives access to the “Yandra Cluster”. This junction layout has inadequate turning paths for increased numbers of turning traffic.

Movement toward the side of the road to avoid oncoming heavy vehicles could result in excessive wear of the road shoulders. This edge wear can result in vehicles losing some steering control.

##### *Springfield Road (5.0km unsealed section)*

The junction with Avon Lake Road will have a large proportion of traffic turning into Avon Lake Road compared to the number of vehicles proceeding along Springfield Road. Conflicts with local traffic could occur at this junction.

The alignment of this section of road is conducive to high travel speeds. The condition of the gravel surface could vary significantly with weather conditions. Vehicles could lose control on loose gravel and wet clay surfaces.

##### *Avon Lake Road (6.6km unsealed)*

This road has insufficient width for the passing of large vehicles in safety. The limitations of gravel roads discussed previously in this report also apply to this road. The section from 24.05 kilometres to Ando Road is not fenced and collisions with stock present a potential impact.

Junctions to provide access to the northern section of the Sherwins Cluster are located on both sides of the road and potential impacts could result from crossing traffic.

##### *Yandra Road (3.15km unsealed)*

This road provides access to the “Yandra” cluster at 1.5 kilometres from Springfield Road and the potential impacts discussed previously for unfenced narrow gravel roads apply to this route.

The potential impact of collisions with overhanging trees exists along part of this route.

### *Snowy River Way (from Avon Lake Road to Boco Road)*

This section of Snowy River Way (Ando Road) has been reconstructed to a high standard and travel speeds could be high. Potential impacts exist for collisions at the junctions on both sides of Ando road which could provide access to the internal site roads for the “Sherwins Range” cluster.

### *Boco Road (4.5km unsealed)*

This road provides access to the “Boco” cluster at 4.5 kilometres from Ando Road and the potential impacts discussed previously for unfenced narrow gravel roads apply to this route.

Additional impacts exist for two way traffic from the presence of six stock grids and two narrow causeways. The causeway across the MacLaughlin River at 2.85 kilometres appears to be damaged.

The occupants of the dwelling close to the road at 3.4 kilometres from Ando Road could experience the impacts of increased traffic noise and dust.

## **Management of Potential Impacts**

The mitigation measures listed in this section of the report cover four phases of the project operation. These phases being: pre-planning, detailed design, construction, operation and decommissioning.

The potential traffic impacts decommissioning phase are expected to be similar to the construction phase over a shorter time period.

### *Mitigation Measures*

- Contract a licensed haulage contractor with experience in transporting similar loads, to be responsible for obtaining all required approvals and permits from the RTA and Councils and for complying with conditions specified in the approvals.
- Develop a Traffic Management Plan in conjunction with the haulage contractor and road authorities to include but not be limited to the following:
  - Scheduling of deliveries,
  - Managing timing of transport,
  - Limiting the number of trips per day,
  - Undertaking community consultation before and during all haulage activities,
  - Designing and implementing temporary modifications to intersections and roadside furniture,
  - Managing the haulage process, including the erection of warning signs and/or advisory speed posting prior to isolated curves, crests, narrow bridges and changes of road conditions,
  - Placing of speed limits on all of the roads that would be used primarily by construction traffic to reduce the severity of any accidents and reduce maintenance costs,

- Producing a Transport Code of Conduct which would be made available to all contractors and staff detailing traffic routes, behavioural requirements and speed limits.
  - Establishing procedures to monitor the traffic impacts during construction, such as noise, dust nuisance and travel times and work methods modified to reduce the impacts. This procedure would include site access roads.
  - Providing a dedicated telephone contacts list to enable any issues or concerns to be rapidly identified and addressed,
  - Reinstating pre-existing conditions after temporary modifications to the roads and pavement along the route.
- Implement all aspects of the Traffic Management Plan in coordination with the Councils, RTA and property managers.
  - Widen the road shoulder opposite the junction to the proposed concrete batch plant north of Nimmitabel if this location is adopted.
  - Repair the road shoulders on the sealed section of Springfield Road to provide frequent locations for road users to allow for the passage of oncoming loads up to 4.2 metres wide.
  - Consider the reconstruction of gravel pavements to a minimum of 6.0 metre width with trafficable shoulders at least 0.5 metres on each side of Springfield Road, Yandra Road, Avon Lake Road and Boco Road. The decision to provide a seal needs to be balanced against the cost of maintenance on the gravel surface. Sealing would help address dust suppression and sediment control as well as road deterioration. The environmental impacts of this work should also be considered in the decision. (Upgrading proposals for the causeways on Boco road should take into account the requirements of the Department of Primary Industry for fish friendly crossings.)
  - Investigate an on site link road between the northern section of the Sherwin cluster and the Boco cluster to reduce the impacts of oversize and over mass vehicles on Boco Road. The widths proposed above for the reconstruction of Boco road can be reviewed if an on site link road is constructed.
  - Upgrade the layouts and improve signposting of junctions at Yandra Road, Springfield Road/Avon Lake Road.
  - Design in conjunction with council new junctions with internal access roads on Avon Lake Road and Snowy River Way.
  - Discuss traffic impacts with the residents of the dwelling on Boco road and consider mitigation measures.
  - Apply the procedure established in the Traffic Management Plan to monitor traffic volumes and conditions during construction to Maffra Road and the sections of Ando Road and Springfield Road not included as major access routes.
  - Consider establishing a transport pool for employees to minimise traffic volumes.
  - Prepare road dilapidation reports covering pavement and drainage structures in consultation with the Councils for all of the routes prior to the commencement of construction and after construction is complete. Any damage resulting from the construction traffic, except that resulting from normal wear and tear, would be repaired at the Proponent's cost. Alternatively, the Proponent may negotiate an alternative for road damage with the relevant roads authority.

- Establish a procedure to ensure the ongoing maintenance of the site access roads during the operation phase. This maintenance would include sedimentation and erosion control structures.
- Prepare a revised traffic management plan for the decommissioning phase reflecting changes in traffic volumes work procedures.

The management procedures listed in this report have not been discussed in any detail with road authorities or property owners and are presented for further discussion and assessment. The decision on the extent and standard of road improvements to be provided would be subjective and related to the economies of construction for short term use.

## 6 ON SITE ACCESS

On site access for all sites would generally be across open grazing land and along the ridges on which the turbines are located.

The location of the access routes through the properties would be undertaken in consultation with the individual property owners to ensure minimal impact on their management and to avoid areas of identified environmental sensitivity. Tracks would be sited to minimise the impact on existing drainage lines.

The location and layout of junctions with the public roads would be negotiated with the relevant roads authorities taking into account gradients, safe intersection sight distance, set back of boundaries and turning radii to allow for long loads.

The width of turning paths for the vehicles likely to negotiate the individual access tracks would be taken into consideration in the determination of pavement width particularly on the curved sections. Road pavement widths would generally be up to 6 metres wide to allow for the transport of turbine components and cranes used in the erection. Wider track widths of up to 12 metres may be required between turbine locations depending on the width required for the movement of the mobile cranes. Longitudinal grades of less than 8% would generally be required for ease of access however grades up to 14% can be negotiated.

The earthworks required along most of the ridges would be minimal including clearing, filling, grading and drainage improvements. Earthworks would be balanced where possible with material from the higher areas being used as filling in embankments.

Soil and water management plans would be prepared as part of the Environmental Management Plan showing locations of proposed sediment and erosion control measures to be placed and maintained during the construction and rehabilitation of the road drains and exposed earth batters.

The Environmental Management Plan for the site would stipulate which tracks may be used for access around the site in order to prevent unrestricted access of undisturbed sites and minimise erosion.

The Environmental Management Plan should also identify the access tracks which can be rehabilitated, closed or downgraded in width following each specific construction phase

It is expected that some access tracks would be downgraded following the completion of construction as access by the oversize and over mass vehicles may not be required during the operational phase of the project. The rehabilitation of these tracks would be carried out in consultation with the property owner and addressed in the Environmental Management Plan.

The condition of the onsite access roads should be monitored and maintained in accordance with the procedures outlined in the Traffic Management and Environmental Management plans.

The responsibility for the ongoing maintenance of the site access roads during the operational phase should be discussed with the property managers and procedures established which will ensure future access for maintenance and maintain adequate erosion and sedimentation control.

## 7 CONCLUSION

The area proposed for the Boco Wind Farm is sparsely populated and the introduction of an additional 240 vehicles per day during the construction period could have a significant impact on the existing road users on the minor and unsealed roads for approximately 2 years. The impacts during the operational phase are considered to be minimal.

Management strategies required to address the traffic impacts of the proposal are outlined in this report. These strategies should be implemented in consultation with the Cooma Monaro and Bombala Shire Councils. Strategies on the Monaro Highway should be discussed with the Roads and Traffic Authority.

Adoption of all the strategies for minimising traffic impacts outlined in this study should reduce community disruption and the risk of traffic accidents.

A summary of key issues follows :

### *Road Improvements*

The road improvements required would allow for the passage of vehicles up to 4.2 metres wide carrying loads of up to 90 tonnes. All of the oversize and over mass vehicles would be provided with escort vehicles on the public road network. Sufficient width of road pavement and trafficable shoulder would remain at most locations to permit an opposing vehicle to park on the road shoulder. The intersections would be required to permit the turning of a steerable trailer carrying blades up to 52 metres long.

Road surfaces would be improved to permit safe passage in all weather conditions.

Road signposting and guideposts would be upgraded to provide increased guidance for all road users.

### *Traffic Management*

Existing vehicle speeds on the local roads providing access to the proposed site are relatively high. Accidents rates are low due to the low volumes and local knowledge of the road conditions by the majority of users.

The introduction of a large number of road users unfamiliar with the conditions would require the implementation of a Traffic Management Plan which can be sufficiently flexible to adapt to the changing conditions.

Regular monitoring of the traffic volumes, travel speeds and accidents is considered to be essential. A commitment to carry out road repair works at short notice is critical to the continued safety of the access routes during the construction phase.

## 8 REFERENCES

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Rex J Andrews Pty Ltd, [www.rja.com.au](http://www.rja.com.au)

The assistance of the following in obtaining information for this study is recognised:

Cooma Monaro Shire Council Director of Engineering, *Arthur Wilkins*.

Bombala Shire Council Engineer, *Ron Crawford*.

Roads and Traffic Authority Traffic Manager, *John Harper*

Rex Andrews Pty Ltd Manager, *Warwick Andrews*

## 9 AUTHOR

Rodger John Ubrihien

Road Design Consultant,

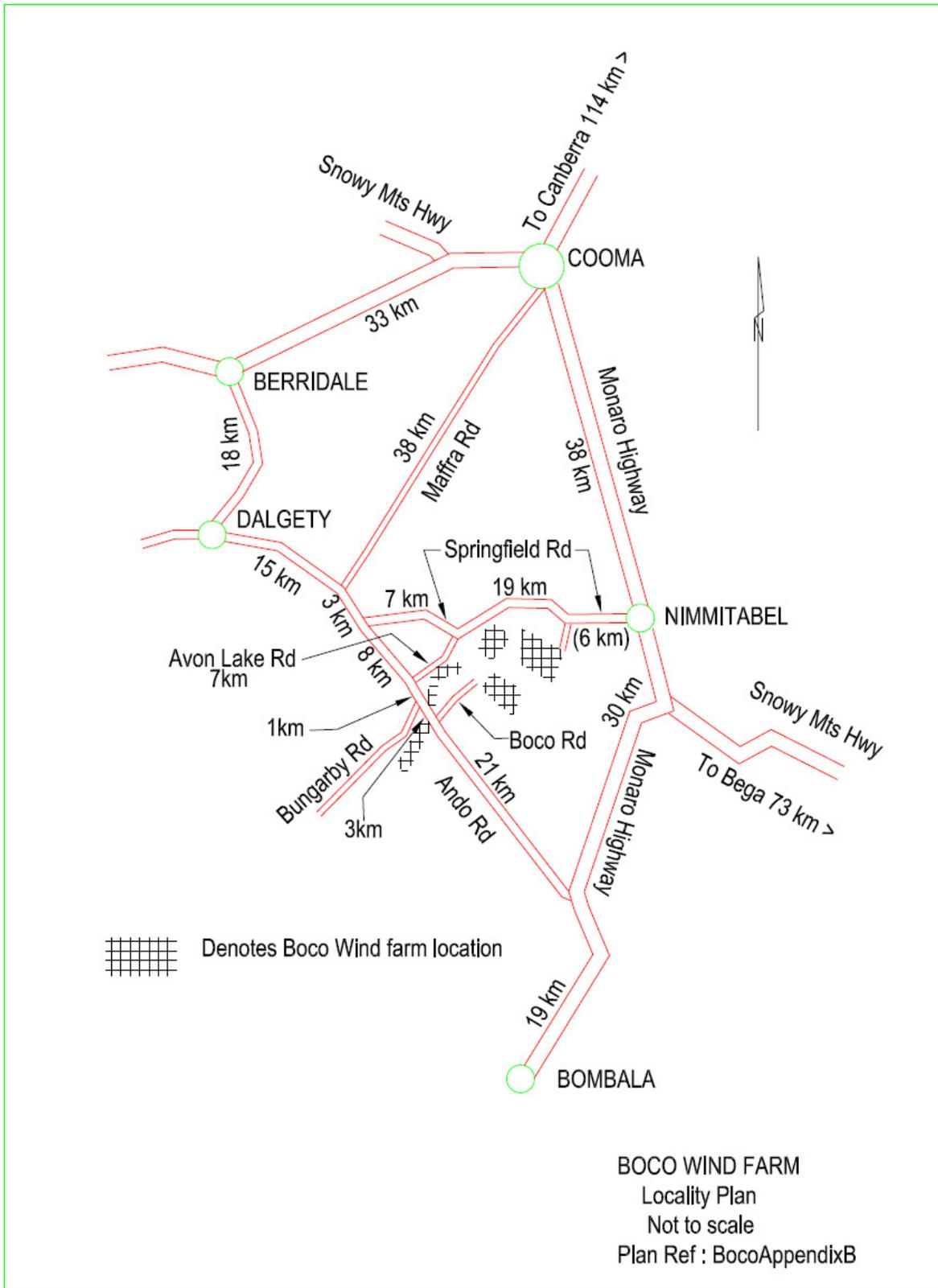
Cert. Engineering Surveyor

Rodger has been involved in the survey, planning and design of road projects since commencing work with the Department of Main Roads NSW in 1966. Rodger gained knowledge in Traffic Engineering with the Roads and Traffic Authority Traffic Section in Sydney. Since opening his own business 'Bega Duo Designs' in 1993, Rodger has completed the planning of a wide variety of civil engineering and related projects throughout NSW and ACT including wind farms at Goulburn, Crookwell, Yass and Silverton.

Contact:       Bega Duo Designs  
                  Office 1 Main Street  
                  Merimbula NSW 2548  
                  Ph Fax 02 64945456  
                  Mobile 0417292170



### Appendix B: Plan showing details of access roads



## Appendix C: Photographic Plates



**PLATE 1**  
Junction at Old Sawmill Site looking west.



**PLATE 2**  
Junction at Old Sawmill Site looking east.



**PLATE 3**  
Junction at Old Sawmill Site looking north west.



**PLATE 4**  
Monaro Highway Junction with Springfield Road.



**PLATE 5**  
Monaro Highway Junction with Springfield Road.



**PLATE 6**  
Monaro Highway Junction with Springfield Road.



**PLATE 7**

**Springfield Road at 0.95 km.**



**PLATE 8**

**Springfield Road showing surface damage.**



**PLATE 9**

**Springfield Rd. showing end of bitumen at 13.80 km.**



**PLATE 10**

**Springfield Rd at 15.5 km.**



**PLATE 11**

**Springfield Rd at 15.5 km.**



**PLATE 12**

**Yandra Rd. Junction looking east.**



**PLATE 13**

**Yandra Rd. Junction looking west.**



**PLATE 14**

**Yandra Rd. Junction.**



**PLATE 15**

**Yandra Rd. at 0.4 km.**



**PLATE 16**

**Yandra Rd. at Benbullen access.**



**PLATE 17**

**Yandra Rd. at approx. 2.9 km.**



**PLATE 18**

**Avon Lake Rd Junction with Springfield Rd.**



**PLATE 19**  
**Avon Lake Rd. Junction with Springfield Rd.**



**PLATE 20**  
**Avon Lake Rd. near the Junction with Springfield Rd.**



**PLATE 21**  
**Avon Lake Rd. showing surface at 20.74 km.**



**PLATE 22**  
**Avon Lake Rd Access to east at 22.45 km.**



**PLATE 23**  
**Avon Lake Rd Access to west at 22.45 km.**



**PLATE 24**  
**Avon Lake Rd looking south at 22.45 km.**



**PLATE 25**

**Avon Lake Rd Stock Grid at 24.05 km.**



**PLATE 26**

**Avon Lake Rd Stock Grid at 25.38 km.**



**PLATE 27**

**Avon Lake Rd. Junct. with Snowy River Way looking West.**



**PLATE 28**

**Avon Lake Rd. Junct. with Snowy River Way looking East.**



**PLATE 29**

**Snowy River Way possible access both sides at 27.97 km.**



**PLATE 30**

**Snowy River Way possible access both sides at 27.97 km.**



**PLATE 31**

**Snowy River Way access at 28.31 km looking West.**



**PLATE 32**

**Snowy River Way access at 28.31 km looking East.**



**PLATE 33**

**Snowy River Way & Boco Rd. Junct. looking west.**



**PLATE 34**

**Snowy River Way & Boco Rd. Junct. looking east.**



**PLATE 35**

**Snowy River Way & Boco Rd. Junct. looking along Boco Road to new grid at 0.08 km.**



**PLATE 36**

**Boco Road stock grid at 1.12 km.**



**PLATE 37**  
Boco Road causeway at 1.30 km.



**PLATE 38**  
Boco Road stock grid at 1.89 km.



**PLATE 39**  
Boco Road stock grid at 2.75 km.



**PLATE 40**  
Boco Road Causeway at 2.85 km.



**PLATE 41**  
Boco Road Causeway at 2.85 km.



**PLATE 42**  
Boco Road Causeway at 2.85 km.



**PLATE 43**  
**Boco Road Causeway at 2.85 km.**



**PLATE 44**  
**Boco Road stock grid at 3.85 km.**



**PLATE 45**  
**Boco Road Causeway at 3.90 km.**



**PLATE 46**  
**Boco Road Causeway at 3.90 km.**



**PLATE 47**  
**Boco Road entry to "Boco" at 4.53 km.**

# *BEGA DUO DESIGNS*

45 Wildlife Drive Tathra 2550

Phone / Fax 02 64945456 Mob 0417292170

30/04/09

Subject: Traffic Impact Study Boco Rock Wind Farm  
Report on Link from Substation to Boco  
Attn : Ed Mounsey

I refer to my email of March 13, 2009 and meeting on site on March 26, 2009.

During investigations for the Traffic and Transport Study it became obvious that the existing access to the Boco Cluster had the following constraints

- A long distance (35km) from Nimmitabel.
- Boco Road (from Snowy River Way to Boco station) has six narrow stock grids and three narrow causeways.
- The road passes close to a residence.
- The causeway at 2.85 km from Snowy River Way appears to be in need of reconstruction or major repair.

Of the constraints listed above, the most significant appeared to be the causeway crossing over the Maclaughlan River.

## **Existing Causeway on Boco Rd at 2.85 km**

This causeway (plate 1 & 2) appears to be undermined along both edges and the width of 4.0 metres is insufficient for the passage of large vehicles carrying heavy loads. (an absolute minimum of 4.2 metres is required). The turning radius on the northern approach is inadequate for long vehicles. The causeway if reconstructed would need to meet the requirements of the Department of Water and Energy for watercourse crossings under the Water Management Act 2000. These requirements include provisions for the passage of fish as required by the NSW DPI (Fisheries).

## **Alternative Road Link**

The possibility of providing a direct road link crossing the Maclaughlan River from the other northern clusters to Boco was investigated and the most practical route appeared to be a connection between the proposed substation site (on the northern section of Sherwins cluster) and one of the Boco internal roads via an existing causeway over the Maclaughlan River (as shown on the drawing in appendix B).

The road link was investigated initially on the 1/25000 topographic map followed by a field inspection with the lessee of the property and owner of "Boco" (Bill Garnock). The plan in appendix C shows the route investigated.

The route shown in green is approximately 2.6 kilometres long and has an average gradient of approximately 6.0%. The lessee (Mr Garnock) suggested a steeper

alternative, which is shown red on the plan in appendix C. Further investigation involving a topographic survey to produce more accurate contours is required before the final route and extent of earthworks required can be determined. Both routes would avoid disturbance of a natural spring identified as a constraint by the lessee.

### **Maclaughlan River Crossing on Alternative Road Link**

The existing causeway on the road link under investigation (see plates 3 & 4) 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 for watercourse crossings under the Water Management Act 2000. These requirements include provisions for the passage of fish as required by the NSW DPI (Fisheries). This causeway is provided with one 750 mm 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 all low flow conditions.

A reconstructed crossing should be designed and certified by a suitably qualified engineer in accordance with the “Guidelines for controlled activities Watercourse Crossings” (NSW DWE Feb 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 metres on straight alignment.
- Road approach alignment to allow for long vehicles transporting wind turbine blades up to 50 metres long.
- 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 site 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 1.0 to 2.0 metres above the existing causeway level.

## **Conclusion**

The construction of a road link as proposed will have significant environmental benefits:

- Travel distances from Nimmitabel to the Boco cluster will be reduced by 7.0 kilometres by the construction of approximately 2.6 kilometres of additional internal road from the proposed substation to the Boco Cluster.
- Upgrading works on Boco road can be significantly reduced as the existing causeways are of an acceptable standard for light traffic.
- The reconstruction of the causeway across the Maclaughlan River at 2.85 km will not need to be upgraded for large vehicles.
- The improvements to the existing stream crossing at Boco will restore the passage of fish species at all water levels in this section of the Maclaughlan River.
- The passage of heavy vehicles past the residence on Boco Road will be eliminated.

Rodger Ubrihien  
Road Design Consultant



Plate 1 Showing Causeway at 2.58km on Boco Road  
Looking Nth



Plate 2 Showing Causeway at 2.58km on Boco Road  
Looking Nth



Plate 3 Causeway on Link Road looking West



Plate 4 Causeway on Link Road looking east showing drop from outlet of culvert

