

TRAFFIC IMPACT STUDY



**PROPOSED WIND FARM
AT CULLERIN RANGE**

HUME HIGHWAY, GUNNING

Prepared for Taurus Energy

April 2006

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1 INTRODUCTION

1.1 General

Bega Duo Designs was commissioned by NGH Environmental to complete the Traffic Impact Study for the proposal of a wind farm at Cullerin Range. This report has been prepared with an aim of conforming to the *Guide To Traffic Generating Developments* as recommended by the NSW Roads and Traffic Authority. The report provides a preliminary technical appraisal of the traffic and safety implications arising from the wind farm project and develops measures for minimising traffic impacts.

The report covers the construction phase and subsequent operation but does not include any future de-commissioning or re-commissioning phases.

The proposed wind farm is located along the Cullerin Range between Gunning and Breadalbane in the Shire of Upper Lachlan. The site is bordered by the existing Hume Highway in the South and the Old Hume Highway (Cullerin Road) in the north. Lerida Road North is a minor council road which connects the Hume Highway with Cullerin Road along the eastern side of the Cullerin Range. The site is located on Figure 1.1.

The proposal includes up to 16 wind towers, a substation, a control and facilities building and electrical transmission lines. The exact location of the wind turbines has not been determined and the development envelope shown on Figure 1.2 has been assumed for the purposes of this report.

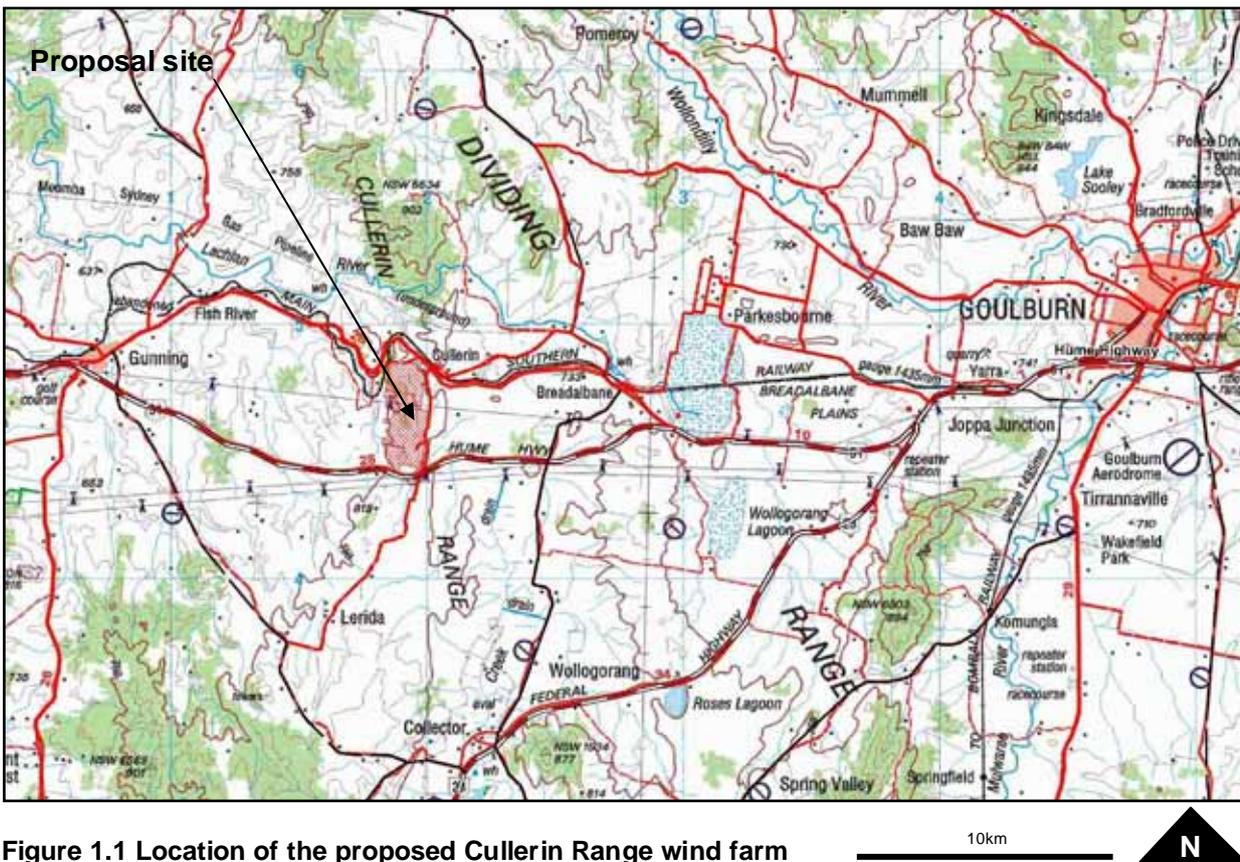


Figure 1.1 Location of the proposed Cullerin Range wind farm

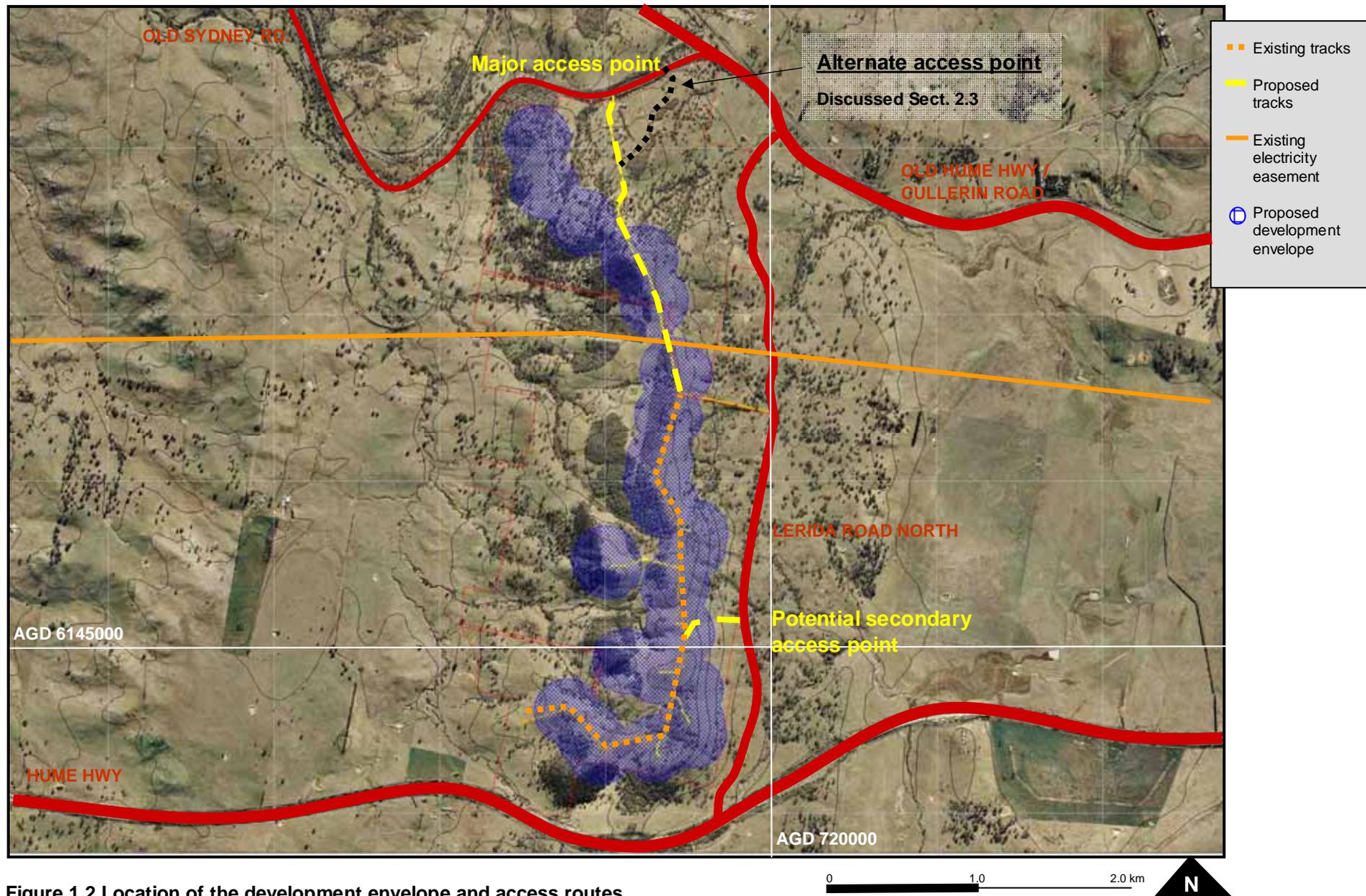


Figure 1.2 Location of the development envelope and access routes

1.2 Key Issues and Objectives

The Road and Traffic Authority has requested that the issues outlined in table 2.1 of the *Guide To Traffic Generating Developments* be included in the study. Additional issues have been included because of the unique nature of the development. These include visual effects and the structural condition of the existing road surfaces as observed at the site.

Key Issues

- Existing road hierarchy and proposals for improvement
- Impact on road safety
- Impact on traffic noise
- Traffic counts
- Traffic volumes and trends
- Existing Parking and demand
- Traffic Generation
- Safety and efficiency of internal roads
- Impact on Intersections and surrounding developments
- Safety and Efficiency of access between the site and adjacent road networks

1.3 Methodology

- Base information was collected from the “Project Application” documents which have been submitted to the Department of Planning (7 December 2005).
- Existing mapping was used to identify features during the site inspection.
- All roads were measured at the site and inventories and photographs taken.
- A survey using a Global Positioning System was used to confirm the location of the Hume Highway carriageways in relation to the proposed wind tower sites.
- Approximate traffic count information was obtained from observations on the site and RTA published data.
- Intersections were measured and/or photographed on the site.
- Discussions were held with representatives from NGH Environmental, Taurus Energy, Upper Lachlan Shire Council and Roads and Traffic Authority.
- Research was carried on the effects of “shadow flicker” and methods for determining the range of the effect.

2 PROPOSED DEVELOPMENT

2.1 Site Description

The site is generally open grazing land with some patches of native bushland. There are some existing fences and access tracks.

The Cullerin Range rises approximately 100 metres above the surrounding landscape and runs in an approximately north to south direction. There is a communications tower and a wind monitoring tower currently on the site.

2.2 Site Access

Existing access is via steep tracks on the eastern side of the range which connect with Lerida Road North. These tracks are only suitable for vehicles with four wheel drive and would be the responsibility of the property owner. The main access track up to the existing communications tower is shown in Figure 2.1.



Figure 2.1 Access track from Lerida Road North to the communications tower.

Lerida Road North (refer to Figures 1.2 and 2.2) is maintained by Upper Lachlan Shire Council and is 4.36 km long. It connects Hume Highway with Cullerin Road and provides access to several houses.



Figure 2.2 Lerida Road North.

Access from Lerida Road North to Gunning or Breadalbane can be gained via Cullerin Road or the Hume Highway. Old Sydney Road connects with Cullerin Road 0.66km west of the Lerida Road North and Cullerin Road Junction. Old Sydney Road can provide access at reasonable gradients to the ridge line which connects with the top of Cullerin Range.

2.3 Major Access Point Alternatives

The Project Application Report identified the major access point as being on Old Sydney Road approximately 500 metres from Cullerin Road.

An alternative access point on Old Sydney Road is at 120 metres from Cullerin Road. This access point would reduce the length of upgrading which may be required on Old Sydney Road including upgrades of a damaged culvert at 360 metres from Cullerin Road.

2.4 Future Road Proposals

The Hume Highway was duplicated in 1993 and has sufficient capacity for many years at current growth rates. The existing (old) Hume Highway was retained and renamed “Cullerin Road” and provides an alternative access in both directions. The area around Cullerin is therefore adequately serviced with access roads. Upper Lachlan Shire Council has no future proposals for Lerida Road North. Funding has been obtained for some repair work on Cullerin Road (K. Reedy pers. comm. 3 Feb 2006).

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 as observed on an inspection of the roads carried out in January 2006. This work included observations of traffic volumes. The inspection was carried out from Hume Highway through Lerida Road North to Cullerin Road, west to Old Sydney Road and on to a possible junction site for a new access road. This is the route that is identified as the most likely route in the Project Application documents (Sec. 3.3.1)

3.2 Hume Highway

The Hume Highway is dual carriageway with two lanes in each direction and a design travel speed of 110 km/h. The lanes are separated by a vegetated median approximately 20 metres wide. All major intersections are grade separated and other junctions have auxiliary lanes to ensure that through traffic has minimum interruption from turning vehicles.

The general layout of the Hume Highway at Lerida Road North is shown in Figure 1.2. This junction was treated as a minor junction by the Roads and Traffic Authority and a right turn auxiliary lane 60 metres long is provided for vehicles travelling from Goulburn.

The sight distance provided is adequate for all directions except for the safe intersection sight distance to the west for vehicles entering from Lerida Road North (Figure 3.1). This sight distance is restricted to approximately 150 metres by roadside vegetation.



Figure 3.1 Sight distance along Lerida Road North.

3.3 Lerida Road North

Lerida Road North is a gravel road ranging between 4 and 6 metres wide. The standard of alignment is variable with very low speeds being necessary when negotiating causeways, grids etc. The road gradient is flat to undulating. The road reserve is not fenced but stock numbers appear to be low. A safe travel speed is estimated to be as low as 40km/hr in its present condition (Figure 3.2).



Figure 3.2 Lerida Road North alignment.

Cross drainage is achieved with twelve pipe culverts and two concrete causeways. The pipe culverts are generally in good condition but appear to have insufficient gravel cover to withstand heavy loads. The concrete causeways are in poor condition (Figure 3.3) and additional culverts are required in some locations where water is ponding in roadside drains (Figure 3.4).



Figure 3.3 Lerida Road North – concrete causeway.



Figure 3.4 Lerida Road North – water ponding.

The four small cattle grids would be unlikely to withstand wide, heavy loads. The cattle grid on the Hume Highway Boundary is in good condition and may be designed for Highway type Loadings.

Trees overhang the road at several locations (Figure 3.5) and may restrict the width and height of some loads.



Figure 3.5 Lerida Road North – overhanging tree limbs.

Lerida Road North has adequate capacity for its current usage. The residences are located towards the northern end of the road and therefore most of the substandard sections of the road receive little use.

The two dwellings located towards the northern end of the road may be affected by dust and noise. This would be influenced by weather conditions and traffic volumes.

3.4 Cullerin Road (Old Hume Highway)

The old Hume Highway has been retained in its original form since the completion of the new highway in 1993. There appears to have been only minimum maintenance on the pavement recently. The line marking and signposting has deteriorated but the route is providing a good level of service for the small traffic volumes present.

The alignment, grading and width to the east towards Breadalbane (approximately 8km) is approaching a 100km/hr standard. The route to the west towards Gunning (approximately 16km) has a low standard section for approximately 7km with two railway bridges, substandard curves and steeper grades.

The section from Lerida Road North junction towards Old Sydney Road (0.66km) which forms part of the proposed route has an 80km/hr standard of alignment and is at least 7.0m wide. The pavement is showing signs of failure in some locations (Figure 3.6).



Figure 3.6 Cullerin Road – pavement damage.

The junction with Lerida Road North has adequate sight distance and additional pavement area is available for turns from Lerida Road North towards Old Sydney Road because of the presence of an overtaking lane taper (Figure 3.7).



Figure 3.7 Cullerin Road – Lerida Road North junction.

3.5 Old Sydney Road

Old Sydney Road is an old route of the Highway and has an historic railway bridge approx 1.2km from the intersection with Cullerin Road which has a weight restriction. Both access routes considered will depart from Old Sydney at least 500 metres prior the railway bridge. There will be no requirement for any traffic from the proposed development to use the bridge.

The road formation on Old Sydney Road is approximately 6.0m wide and has a gravel surface. The gradients appear to be in the range of 6 to 10 percent. At the junction with Cullerin Road, Old Sydney Road approaches at an acute angle. The junction has adequate sight distance (Figure 3.8) provided that traffic approaches Cullerin Road at a safe angle.



Figure 3.8 Cullerin Road - Old Sydney Road junction.

As indicated in Section 2.3 it may only be necessary to utilise approximately 120m of Old Sydney Road to a new junction with the proposed access road. A junction provided further west on Old Sydney Road may require the replacement of a culvert at 0.36km from Cullerin Road

3.6 Communications Tower Access Track.

This track junctions with Lerida Road 1.2km from Hume Highway and provides a link to the main ridge on Cullerin Range. It has been used for the construction of the communications tower and has grades approaching 20%. It has been subject to erosion. The track has been sheeted with a crushed rock surface on the steep slope but most has been lost due to erosion. It has deep ruts and is unsuitable for 2WD vehicles (refer to Figure 2.1).

3.7 Existing Traffic Volumes

Traffic observations were made during the period 16th to 19th of January 2006 on Cullerin Road and Lerida Road Nth. The traffic numbers were observed during a school holiday period and are likely to increase when the school term commences. It is considered unlikely that the increase in traffic will be significant in the determination of the traffic impacts for this development. Traffic volumes were obtained for the Hume Highway from the Roads and Traffic Authority. The Hume Highway in the Cullerin Area has an average annual daily traffic count of 13094 vehicles per day. This equates to 1964 vehicles per hour in the peak hour (two directions).

The retention of the Old Hume Highway (Cullerin Road) following the completion of the existing route in 1993 resulted in the duplication of access routes for many of the property owners in the Cullerin Area. The new Hume Highway cuts Lerida Road into Lerida Road South and Lerida Road North. Junctions at grade are provided to both legs of the road from the Hume Highway.

The Cullerin area is lightly populated and counts taken for two hours in the morning peak period on 16/01/06 at the northern end of Lerida Road North failed to record any vehicles. Observations for two hours around mid day also failed to record any vehicles. Observations over the morning peak period on Cullerin Road resulted in four vehicles per hour eastbound (towards Breadalbane) and two vehicles westbound (towards Gunning).

No vehicles were observed entering or departing Old Sydney Road during the above period.

4 FACTORS RELATING TO TRAFFIC GENERATION

4.1 Traffic Generation General

For the purposes of this report it is assumed that the likely access route for the majority of traffic will be as indicated in the "Project Application Report" ie: Hume Highway from Goulburn or Yass, Lerida Road North, Cullerin Road to Old Sydney Road and Old Sydney Road to proposed access (refer to Figure 1.2).

It is proposed that the wind farm will operate unattended, with maintenance by a small crew every three months. Traffic Generation therefore will be at the maximum during construction and ongoing generation from maintenance operations is considered to be negligible.

The maximum volume is expected during the concrete pouring phase. Each footing may contain up to 250 cubic metres of concrete to be poured over an eight hour period. This results in a rate of up to 12 mixer truck movements per hour (to and from the site). It is proposed to establish a concrete batching plant adjacent to Lerida Road North approximately 0.4km from the Hume Highway.

4.2 Construction Program

The following major activities are expected to take place in sequence over a six month period:

- Civil works for upgrading of access roads and establishment of site office.
- Civil works for construction of internal tracks, excavation for footings and trenching for cables.
- Establishment and operation of a concrete batching plant and pouring of footings.
- Transportation to site and installation of wind turbines.
- Construction of substation, lines ,cables and facilities building
- Restoration of site and completion of on site buildings.

4.3 Working Hours

Normal construction industry working hours are assumed for the purposes of this report.

4.4 Assumed Design Traffic Volumes

4.4.1 Peak hourly traffic

As most of the work will be carried out by specialised crews consisting of less than 10 workers it is assumed that the maximum volume of vehicles entering the proposed development will be 10 vehicles per hour from any direction during the peak hour. During the concrete pouring phase an additional 12 concrete trucks movements per hour can be included on the Lerida Road/Cullerin Road/Old Sydney Road Route.

4.4.2 Volumes per day

The traffic volumes below are estimates only however, they indicate that traffic volumes on some of the roads surrounding the site could increase by approximately 50 vehicle movements per day.

Table 4.1 Total predicted traffic movement on roads to the site (one way movements)

	Approximate time period (weeks)	Number of traffic movements (one way)		
		Light vehicles	Heavy vehicles	Oversize and overweight vehicles
<i>Civil works including trenching for cables</i>	6	600	800	
<i>Establish batch plant and pour footings</i>	4	400	550	
<i>Installation of turbines</i>	4	400	200	230
<i>Construction of substation, cables and facilities building</i>	8	800	300	2
<i>Restoration of site and completion of buildings</i>	6	300	200	
Totals		2500	2050	232

4.5 Design Vehicles

The design vehicle for the construction of intersections and design of parking and turning areas generally will be the "Austroads" Single Unit Truck/Bus 12.2m long. Provision will be made on site at an area for the turning of semi trailers.

There is a requirement to transport turbine blades to the site, which could be up to 46 metres long. These will be transported on purpose designed steerable trailers making 24 trips to the site. These vehicles will be capable of negotiating small radius curves provided that areas free of obstructions are available on the inside of curves. It is also proposed to transport tower sections of up to 30 metres long weighing up to 36 tonnes (estimated as approximately 80 trips to transport all turbines).

The remaining wind tower components are up to 10 metres long weighing up to 75 tonnes. These loads would be transported as platform loads with trailers up to 4.2 metres wide to spread the load. (estimated as 40 trips).

It is assumed that most of the heavy and oversized deliveries will take place over eight weeks, at a rate of 4 vehicles per day.

Design of access roads and junctions will need to allow for widths of up to 4.2 metres and weights complying with Roads and Traffic Authority maximum loading.

4.6 Traffic Circulation and Parking

Level areas will be provided around the site of each turbine for the safe operation of large cranes. These areas will provide turning opportunities for delivery vehicles. Four wheel drive vehicles may be able to access the main ridgeline via the secondary access off Lerida Road North (see Figure 1.2).

5 TRAFFIC IMPACTS

5.1 Safety Considerations

The following safety issues have been considered:

- Risk of collisions
- Traffic noise
- Shadow flicker from Turbines
- Risk of collision due to fog
- Driver distraction
- Obstruction by long loads
- Wet weather
- Road surface deterioration
- Structural failure of bridges and culverts

The impacts of these issues are discussed for key locations, below.

5.2 Traffic Impacts at Key Locations

5.2.1 Hume Highway West of Lerida Road North

The section of Hume Highway approaching Cullerin Range from Goulburn has unobstructed views of the range between 2 and 4 km from Lerida Road North (Attachment 1). The construction of many of the wind towers will be highly visible from this section of the highway for westbound motorists. Some motorists could be distracted or might stop on the road shoulder to view the construction.

Shadow flicker may have an impact on traffic safety. Information from the Danish Wind Industry Association suggests that this effect diminishes beyond 500 metres from the wind tower site and is not noticed beyond 1000 metres. The effect is only present when the sun is directly behind the wind turbines. The diagram (Attachment 2) demonstrates the location of the perceived effects in

relation to the location of the highway. The normal cone of vision for a vehicle travelling at 100km/hr has been shown at the critical points (100km/hr is the estimated 85th percentile speed for this road). The diagram demonstrates that road users within 1000 metres of the roadside towers will not be looking in a direction which will expose them to shadow flicker irrespective of the sun's location. The diagram has not taken into account the roadside vegetation and obstructions due to cuttings which will reduce the "flicker" effects by masking the view of the towers at many locations.

Safeguards

- A signposting plan would inform motorists of the approach of the access to the Wind Farm Construction Site to avoid late manoeuvres.
- Information bays could be provided on each approach to the wind farm on the Hume highway with appropriate advance signposting. Truck parking areas are provided on both sides of the Hume highway at Cullerin Range, approximately 200m west of Lerida Road North. The locations of these areas are shown on the bottom of the Shadow Flicker diagram (refer to Attachment 2) and these could be utilised as interim information bays during wind farm construction.
- Following completion of construction the effects of shadow flicker should be monitored from Hume Highway determine the degree of impact on westbound motorists.

5.2.2 Hume Highway East of Lerida Road North

Because of the road alignment and vertical grading of the Hume highway the wind towers will not be as visible on the approach for eastbound traffic as compared to westbound. Driver distraction and shadow flicker may impact on traffic safety.

Safeguards

- A signposting plan would inform motorists of the approach of the access to the Wind Farm Construction Site to avoid late manoeuvres.
- Information bays could be provided on each approach to the wind farm on the Hume highway with appropriate advance signposting. Truck parking areas are provided on both sides of the Hume highway at Cullerin Range, approximately 200m west of Lerida Road North. The locations of these areas are shown on the bottom of the Shadow Flicker diagram (refer to Attachment 2) and these could be utilised as interim information bays during wind farm construction.
- Following completion of construction the effects of shadow flicker should be monitored from Hume Highway

5.2.3 Lerida Road North/Hume Highway Junction

A sketch of this junction is shown in Attachment 1. As indicated in Section 3.2 of this report, the sight distance to the west for vehicles entering from Lerida Road North is severely restricted (Figure 3.1). The Roads and Traffic Authority design guidelines indicate that the "Safe Intersection Sight Distance" for 110km/hr is 330 metres. The safe intersection sight distance presently at the site is reduced to approximately 150 metres. Any increase in traffic leaving Lerida Road north and entering the Hume Highway will impact further on road safety.

The right turn from the direction of Goulburn into Lerida Road North has been provided with an auxiliary lane 60 metres long (Figure 6.1). This lane would have been the standard length for minor junctions at the time of construction. The increase in traffic movements will have an impact on the safety of the high speed lane and the two lanes of opposing traffic from the west. No acceleration or deceleration lanes provided at the junction for the traffic to and from Lerida Road for traffic eastbound on Hume Highway. The junction will not have been designed for the long loads

expected to turn into Lerida Road from both directions. These turns have the potential of causing the through traffic travelling at 110km/h. to slow in order to avoid a conflict.

Safeguards

An increase in the number of potential vehicle conflicts will have an impact on the safety of junctions, generally. The conflict would be minimised by providing safe intersection sight distance compatible with travel speed. In fog conditions on the Hume Highway safe travel speeds are often exceeded and the potential impacts of additional vehicle movements are multiplied. To address this issue, the following safeguards are recommended:

- The roadside vegetation should be cleared on the verge of Hume Highway on the eastbound carriageway between the truck stop and Lerida Road North to increase the safe intersection sight distance to 330 metres
- The Roads and Traffic Authority are generally not in favour of speed restrictions on the Hume Highway because of the loss in efficiency of the route. The use of speed controls for specific short term activities would be included in a traffic control plan.



Figure 5.1 Lerida Road North – Hume Highway auxiliary lane.

5.2.4 Lerida Road North

Because of the potentially large increase in the number of vehicles using this route there are many impacts to be considered. The volumes are likely to increase from several vehicles to over 100 per day during concrete pouring operations. The low standard of horizontal and vertical alignment will assist in controlling speed on many sections of the road thereby reducing the severity of any collisions. The larger vehicles will occupy the full width of the roadway increasing the chance of “head on” collisions. The road reserve is not fenced and an increase in traffic will increase the

chance of collisions with stock. There will be an increase in traffic noise and dust nuisance for property owners.

The gravel road surface will deteriorate and potholes will form under the increased traffic loads particularly during wet weather when water ponds in drains and potholes. The broken concrete in the causeways may displace under heavy loads. Structural damage may occur to some of the culverts and the stock grids. The location of trees and other roadside objects have the potential of obstructing the passage of long wide loads. Lack of roadside delineation may impact traffic safety during periods of poor visibility.

Safeguards

- The pavement, drainage structures and stock grids on Lerida Road North require inspection and possible upgrading. The decision to provide a seal needs to be balanced against the cost of maintenance on the gravel surface. Also to be considered is the cost of dust suppression and sediment control. The environmental impacts of this work should also be considered.
- There are no speed restrictions on Lerida Road North and excessive speed will increase the impacts of additional traffic. A speed limit should be placed on the road at least for the period of construction. The speed restriction would be included in the traffic management plans to be submitted to the Roads and Traffic Authority.
- Traffic Control Plans and Oversize Vehicle Permits will be required to be prepared and submitted to the Roads and Traffic Authority for all the operations of over size and over weight vehicles.

5.2.5 Lerida Road North/Cullerin Road Junction.

There will be a significant increase in the movement of vehicles turning to and from Lerida Road North towards the west. For the period of construction the relatively few users of Cullerin Road will experience a significant change in conditions due to the increase of traffic. Drivers who are unaware of the changes will be more likely to be involved in collisions.

There is insufficient shoulder width on the northern side of Cullerin Road opposite Lerida Road North to permit a vehicle to pass beside a turning vehicle (refer to Figure 3.7).

Safeguards

- A signposting plan for Cullerin Road would inform motorists of the change of traffic conditions due to the wind farm construction as they approach the section of Cullerin road between Lerida Road and the Old Sydney Road.
- Road shoulder widening could be provided on Cullerin Road at the junction with Lerida Road North in accordance with the Roads and Traffic Authority design guide.

5.2.6 Cullerin Road

A short section of Cullerin Road (0.66km) will experience an increase in traffic volumes and loads. There is a risk of further pavement failures due to heavier and more frequent loads. These failures may be due to poor drainage of the pavement layers. Drainage structures may be damaged or blocked on this section of Cullerin Road. The risk of accidents in periods of poor visibility is increased by the lack of maintenance of line marking and signposting.

Safeguards

- Pavement and drainage repairs will be necessary in the low area 0.28km west of Lerida Road North.
- Clearing of vegetation and mowing to increase sight distance is required on the road verges of Cullerin Road.
- The line marking on Cullerin Road has deteriorated and requires re- marking.

5.2.7 Proposed Junction with Old Sydney Road

Increased traffic will impact on the safety of turning movements because of the lack of pavement markings on this junction. The existing loose gravel surface will increase stopping distances.

Safeguards

- Sealing and line marking is required on this junction. The layout should comply with Roads and Traffic Authority design guidelines for rural junctions which would require an angle of approach between 70 and 90 degrees.

5.2.8 Old Sydney Road

The safety and amenity of this section of road is compromised primarily by the lack of a sealed surface.

Safeguards

- Sealing of the section of the Old Sydney Road between Cullerin Road and the proposed access point is desirable to reduce dust and gravel mobilisation.
- If the sealing is not undertaken, dust suppression and sediment / erosion controls will need to be rigorous and reduced travel speeds should be implemented to ensure safe stopping distances are achievable.

5.3 General Safeguards

The aforementioned safeguards have not been discussed in any detail with road authorities or property owners and are presented for further discussion. The decision on the extent and standard of road improvements to be provided will be subjective and related to the economies of construction for short term use. Additional general safeguards are outlined below.

5.3.1 Traffic Control Plans and Oversize Vehicle Permits.

Traffic Control Plans and Oversize Vehicle Permits will be required to be prepared and submitted to the Roads and Traffic Authority for all the operations of over size and over weight vehicles on all the public roads involved in the transport of materials to the site.

5.3.2 Monitoring of Traffic Impacts

A procedure should be established to monitor the traffic impacts during construction, such as noise, dust nuisance and travel times and work methods modified to reduce the impacts.

5.3.3 Maintenance During Construction

Regular scheduled maintenance of gravel pavements such as grading, watering and drainage control should take place during the construction period.

5.3.4 *Timing of Works*

Traffic Impacts can be significantly reduced by the scheduling of high impact movements to account for varying traffic flows on the Hume Highway. These movements if possible should be scheduled to periods when heavy fogs are unlikely.

6 CONCLUSION

The traffic impacts outlined in this should be discussed with Upper Lachlan Shire Council and the Roads and Traffic Authority.

Adoption of all the measures for minimising traffic impacts outlined in this report should reduce the risk of traffic accidents to an acceptable level and minimise structural and environmental damage.

7 REFERENCES

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-

8 AUTHOR

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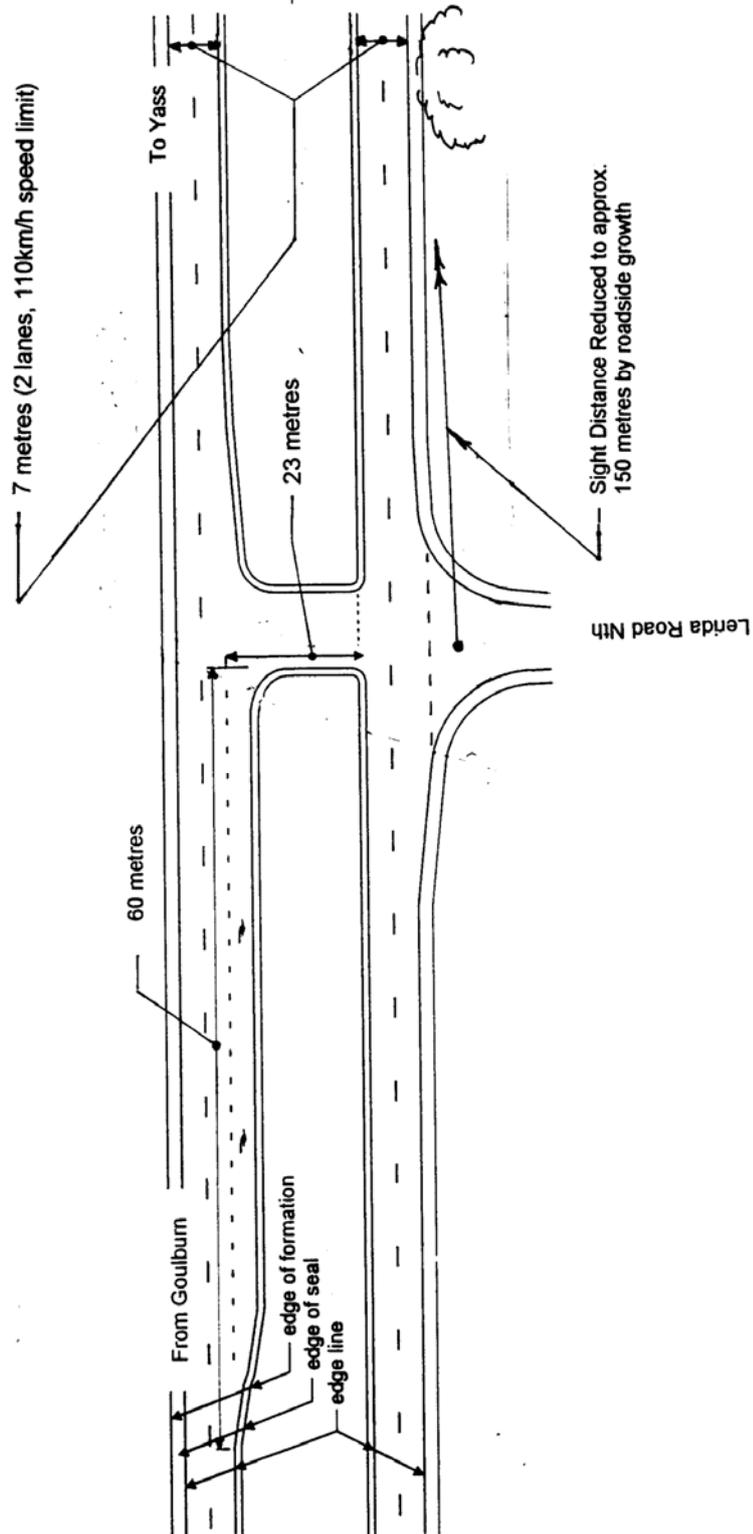
Member of the Institute of Engineering and Mining Surveyors NSW.

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.

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ATTACHMENT 1:

LERIDA ROAD NORTH AND HUME HWY JUNCTION



LERIDA ROAD JUNCTION
WITH HUME HIGHWAY
(Diagrammatic Sketch Only, Not to Scale)

ATTACHMENT 2:

PLAN SHOWING INFLUENCE OF SHADOW FLICKER

