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Glen Innes Wind Farm Traffic and Transport Issues Assessment

Glen Innes Wind Power

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1. Introduction

1.1 Purpose and scope of this assessment

This report provides an assessment of the traffic and transport issues relevant to the construction and operation of the Glen Innes Wind Farm. It forms an appendix to the Environmental Assessment (EA) for the project.

It considers the relevant traffic and transport issues for the project, the potential impacts arising from the project and the mitigation measures to be incorporated in the project environmental management plan to address the identified impacts.

It references likely equipment and material specifications, experience gained from other similar projects and initial consultation undertaken with the Glen Innes Severn Council. Matters identified by the Roads and Traffic Authority (RTA) (Appendix 1) have also been addressed.

1.2 Project location

The proposed Glen Innes Wind Farm site is located in the New England Tableland of NSW, about 12 kilometres west of Glen Innes and about 55 kilometres east of Inverell (Figure 1). Physically, the wind farm is located on the elevated Waterloo Range at approximately 1150 metres to 1275 metres above sea level. The closest main road to the wind farm site is the Gwydir Highway which passes about 1km to the north of the northern end of the wind farm site.

The wind farm is within the Glen Innes Severn Shire and is subject to the Severn Local Environmental Plan (LEP) 2002, which shows the wind farm site and its immediate surrounds as being within Zone 1(a) Rural. Glen Innes Wind Farm will be located on private properties that are primarily used for sheep and cattle grazing. The planning context of the development is further outlined in Chapter 4 of the Glen Innes Wind Farm Environmental Assessment.

1.3 Project description

It is proposed that up to 27 wind turbines will be located along the Waterloo Range, with a substation to be located at the northern end of the wind farm. The distribution of the turbines and site access track options are indicated in Figure 4.

This assessment has been based on the individual turbines having a generating capacity of between 2 MW and 3 MW, a hub height of approximately 80 metres and blades of up to 49 metres in length (max 100 m diameter). The nacelles will each weigh approximately 60 to 70 tonnes and be about 10 metres long by about 3 to 4 metres high. The approximate dimensions and weights of the turbine equipment to be installed are indicated in Table 1. The 80m towers will be likely to be delivered in four sections with the lower sections being shorter but wider in diameter than the upper sections. The rotor hub of the turbine may also be delivered separately.

A 33,000 volt / (132,000 volt or 66,000 volt) substation will be located at the northern end of the wind farm with a connection to the existing 66,000 volt Glen Innes to Inverell line transmission line or the proposed replacement 132,000 volt transmission line.

The construction phase of the project will involve establishment of a temporary construction site office, provision of new site access tracks or upgrading of existing tracks, preparation of turbine sites and associated hardstands, installation of footings for turbines and substation components, erection of the wind turbine structures and construction of the substation and facilities building.

Table 1 – Approximate weights and dimensions of turbine equipment

Item	No. of parts per turbine	Total number of parts (27 turbines)	Approximate weight of each part (tonnes)	Approximate length of each part (m)
Tower	Four sections*	108	40	12 to 25
Nacelle	1 part	27	67	6
Hub	1 part	27	20	8
Turbine blades	3 blades	81	10	44 - 49

* The towers may be manufactured in three or four parts. This assessment has been based on four sections.

2. Key Issues and their Assessment

2.1 Key issues

The key issues with regard to transport and traffic relate to the potential impacts likely to arise from the additional vehicles accessing the wind farm site during its construction, operation and maintenance phases.

These issues include:

- a) Suitability of existing roads - Suitability of existing road layout for the types of vehicles that will need to access the site. Aspects affecting suitability include width of roads, radius of curvature for bends and the nature of existing traffic use.
- b) Structural capacity of the existing roads and structures - This particularly applies to the increased volumes of traffic during the construction stage which will include heavy vehicles and long loads.
- c) Disturbance to local community - The increase in vehicles accessing the site has potential for disturbance if in close proximity to residences and may also affect existing users of local roads.
- d) Road safety - Any change to traffic conditions can impact road safety and project planning has considered where safety risks may potentially be increased and proposed measures to mitigate these.
- e) On-site access management - On-site management issues relate mainly to ensuring safe transport routes, minimising the disturbance to environmentally sensitive areas, minimising erosion and sedimentation and limiting the visual impact of the tracks.

Potential environmental impacts associated with the traffic and transport arising from the project is discussed in other parts of the Environmental Assessment dealing with specific environmental issues.

The Roads and Traffic Authority (RTA) was provided with a copy of material presented at the Planning Focus Meeting and invited to provide assessment requirements for determining the impact of the wind farm development on the local transport network and community. The responses to the issues raised by the RTA are summarised in Appendix 1.

2.2 Process for assessment of key issues

This assessment has relied on available data from RTA and Council web sites, complemented by inspection of route options for public roads and on site access tracks and discussions with Council, RTA officers and the Rural Lands Protection Board.

Appendix 1 sets out the RTA checklist for traffic impact studies together with comments on relevant aspects for the project and the locations of the relevant material within this assessment document.

3. Predicted Traffic and Equipment Transport Requirements

3.1 General

The proposed development will generate significant additional traffic movement during the construction phase and a minor increase for the operational phase of the works. The volume of additional traffic and the types of vehicles involved are described in the following sections.

3.2 Construction traffic

Construction traffic will be generated by the delivery of materials and equipment as well as by the construction workforce of about 40 or more persons travelling to and from the site on a daily basis.

The type of vehicle accessing the site will be dependent upon the equipment or personnel being transported. Due to the size of the proposed turbine equipment it is expected that many of the delivery vehicles will be “oversize”, “overmass” or both (see Photos 1 and 2). These vehicles will generally be regarded as Restricted Access Vehicles (RAVs) and will require special operating permits to allow them to travel on public roads.

“**Oversize**” vehicles are those over 19 metres in length, 2.5 m in width and 4.3 m high and will generally require a permit to use public roads. In certain instances these vehicles will also require one or more escort vehicles to accompany them.

“**Overmass**” vehicles are those with a gross mass in excess of 42.5 tonnes and will require a permit to use public roads.

It is proposed that the on-site tracks will generally be around five metres wide on straight sections but may be wider for bends, intersections and some other track sections to meet road design and drainage requirements. The longest vehicles will be those delivering the blades with the overall length being approximately 50 metres or more depending on the selected turbine size. While the oversize vehicles will have additional steering capability for negotiating bends, special attention will be required to the design of turning circles and road widths at bends and intersections to be used by these vehicles. The vertical curvature of access tracks will also need to be designed to meet specified design criteria.

Longitudinal grades on access tracks of less than 8% (4.6°) will generally be required for ease of access, however grades up to 14% (8°) can be used.

Table 2.1 shows the principal items of material and equipment to be delivered to the site, the estimated quantities of these materials, the number of vehicle movements required for their delivery and the type of vehicle expected to access the site. The vehicle movements shown in Table 2 (a) will occur over the duration of the construction period that is expected to be at least six months and up to twelve months. The types of vehicle movements will vary over the six month construction period as the works progress from earthworks and footing construction to installation of the turbines and substation equipment.

Table 2 (b) shows the vehicle movements relative to the concreting operation for turbine and substation footings. Due to the proximity of the wind farm site to Glen Innes it is expected that the concrete will be bought from off site rather than the installation of an on site batch plant. The contractor will be responsible for any necessary assessment and approval requirements should they opt to install an on site batch plant.

3.3 Operational traffic

The wind farm will be designed to operate automatically but will have a small number of on-site staff (two to four persons) during its operational life for the purpose of inspecting and maintaining the wind farm. Operational staff will be based at the facilities building at the substation and will regularly visit all parts of the wind farm using light weight four wheel drive vehicles.

During the initial commissioning and “run-in” phase of its operation the wind farm will require attendance by an additional small number of technical and maintenance staff. Any unscheduled maintenance or repairs may also require attendance at site by additional specialist personnel and equipment. Country Energy and/or TransGrid staff may also periodically visit the substation associated with maintenance of the 66,000 volt or 132,000 volt section of the wind farm’s substation.

The number of vehicles accessing the site during the commissioning, operation and maintenance periods is considered minor relative to the volumes of traffic routinely using the Gwydir Highway.

Table 2(a) – Predicted traffic movements on public roads for deliveries to site

Material	Quantity / Number	One-Way Vehicle Movements	Vehicle Type
Materials			
Concrete	(see Table 2(b) for Batch Plant on-site or delivery of concrete from Glen Innes)		
		745 to 2400	Truck or semi-trailer
Reinforcing steel – footings	1,300 t	75	Semi-trailer
Road aggregate	7,550 m ³	950	Truck
Water for dust control	1-2 trucks per day	150 to 350	Truck
Select fill	650 m ³	44	Truck
Misc equipment	Nominal	60	Semi-trailer
Misc materials	Nominal	25	Semi-trailer
Wind turbine components			
Tower sections (4 per tower)	108	108	RAV
Nacelles	27	27	RAV
Hubs	27	27	RAV
Blades (3 per turbine) 1/truck	81	81	RAV
Generator transformers	27	9	RAV
33kV/(66 or 132)kV substation and 33kV cables			
Substation transformer	1 or 2	1 or 2	RAV
Misc substation items	Various	22	Semi-trailer
33kV transmission poles	4	2	RAV
33kV underground cables	22 km	65	Semi-trailer
Site work activities			
Site establishment	Nominal	5	Semi-trailer
Cranes	2	10	Semi-trailer
Construction equipment	8	15	Various

Material	Quantity / Number	One-Way Vehicle Movements	Vehicle Type
Site disestablishment	Nominal	5	Semi-trailer
Employees (6 months)	40 persons	4,000	Car / 4WD
Total one-way traffic movements during construction		2,426 – 4,282 Trucks; 4,000 Cars	

Table 2(b) – Predicted traffic movements on public roads for concreting footings

Material	Quantity	One-Way Vehicle Movements on Public Roads		Vehicle Type
Option A for batch plant & on-site concrete production				
Cement	1,730 t	82	745	Semi Trailer/Truck
Aggregate	4,695 t	310		Semi Trailer/Truck
Sand	3,560 t	238		Semi Trailer/Truck
Water	1,865 kL	113		Truck
Concrete cartage	12,000 m³	On site only		Agitator Truck
Option B for concrete delivered from Glen Innes				
Concrete – No batch plant on site. Delivery from Glen Innes	12,000 m³	2,400		Agitator Truck

Note: Road aggregate and sand to be supplied from a site to be determined in the vicinity of Glen Innes

4. Transport Alternatives and Assessment

Due to the nature of the turbine equipment to be delivered to site a range of delivery options have been considered including road or rail. Previous reviews however have established that transport of the turbines by rail is generally not feasible due to the vertical and horizontal clearances available on the rail system and given the long loads required to be transported. In addition, rail services to the Glen Innes area have been discontinued.

While the tower structures may be manufactured in Australia, it is likely that the major components of the wind turbine structures will be imported from overseas. Any items that are imported are likely to arrive via the major ports of Brisbane or Newcastle and their delivery will initially be via the main roads from these ports. Brisbane is the closer of the two ports at 370 km from Glen Innes while Newcastle is 490 km away.

Both Brisbane and Newcastle ports have suitable facilities for receiving the wind turbine equipment and the contractor will determine the choice of port after negotiation in respect of temporary storage availability and cost and suitability of the transport route to the site. At this stage Brisbane would appear to be the better option due to the shorter road transport distance.

In either case, the delivery route would be via the New England Highway and subsequently the Gwydir Highway from Glen Innes. The RTA approved heavy vehicle route(s) through Glen Innes are shown in Figure 2. Subject to the necessary permits being obtained, the timing of the deliveries will be the main consideration for transport to the site. The actual timing will be confirmed through the Project Traffic Management Plan developed in consultation with the local regulators and stakeholders and in accordance with applicable permits.

Tower sections for wind turbines have historically been manufactured in Victoria. If this were the case for this project, the likely road transport route from Victoria to Glen Innes would be via the Newell Highway to Gilgandra (western NSW), the Oxley Highway to Tamworth and subsequently the New England Highway to Glen Innes.

4.1 Road transport from Port to Glen Innes

Road access to the New England Tablelands of NSW is primarily by the New England and Cunningham Highways which run from Newcastle and Brisbane. They have been upgraded over a number of years and now form a mostly high standard major highway system linking Brisbane and Newcastle. Parts of the highway are still subject to improvement programs.

Deliveries will be timed to avoid interference with peak traffic flows at Newcastle or Brisbane so as to minimise traffic disruption.

4.1.1 Newcastle to Glen Innes

The route from Newcastle to Glen Innes via the Gwydir Highway is a viable option for heavy vehicles as it is wide and is in good condition. There are several sections of the Highway which will require consideration for passage of the largest oversize vehicles carrying the turbine blades including:

- in Muswellbrook the New England Highway passes under the railway line with steep grades at either end and a tight turn on the south side and a roundabout on the northern side
- steep ascents through Moonbi Moonbi Gap
- several roundabouts to negotiate passing through Tamworth

If the New England Highway from Newcastle to Glen Innes route is to be used these issues will be addressed in the Project Traffic Management Plan.

4.1.2 Brisbane to Glen Innes

Access from the Port of Brisbane will require negotiation of a route around Brisbane CBD and then via the Ipswich Motorway and Cunningham Highway to Warwick and then the New England Highway to Tenterfield and Glen Innes. The route is regularly used by 'B double' vehicles and appears generally suitable. Locations requiring further review include Cunningham's Gap and the route through Warwick. Oversize and overmass vehicles travelling between Tenterfield and Glen Innes may also need to make arrangements with local RTA staff.

4.2 Access via Glen Innes and Gwydir Highway

4.2.1 Exit from New England Highway

The transport route leaves the New England Highway at Glen Innes. From Glen Innes the transport of the turbine components will be on the Gwydir Highway that links Glen Innes and Inverell. The initial passage through Glen Innes could be by several possible routes as described in Section 4.2.2.

4.2.2 Glen Innes township

The township of Glen Innes is located on the New England Highway and is accessible for vehicles travelling from either Brisbane or Newcastle. It is a significant regional centre with many commercial businesses, residences, schools, elements of tourism and varying levels of local traffic. Key considerations for transport of the wind farm plant and equipment through Glen Innes include:

- timing of the vehicle movements to minimise disruption to local Glen Innes traffic and night time noise at residences along the transport route
- access past roundabouts
- avoiding the main street
- utilising streets and intersections that are of sufficient width to allow the transit of the large vehicles involved

An obvious transport route appears to be the direct route from New England Highway to the Gwydir Highway as shown in Figure 2. The New England Highway leading through Glen Innes is in good condition, very wide and presents no perceived problems for the passage of the RAVs. The turn from the New England Highway onto the Gwydir Highway appears to present no significant difficulties with regard to negotiating the corners, roundabouts or traffic islands. The intersection of the New England and Gwydir Highways is shown in Photo 4. Large semi trailers regularly use both highways and negotiate the New England and Gwydir Highway intersection. Nevertheless, use of this intersection by vehicles in excess of 50 metres length may require temporary modification of structures at the intersection.

The Gwydir Highway is also very wide and in good condition. However, there is a roundabout on the corner of Gwydir Highway and the main street, Grey Street, which could be difficult for the 'Oversize' RAVs to negotiate (Photo 7). If using this route the roundabout may require temporary modification during the delivery of the blades to allow for the passage of equipment. These oversize vehicles are also likely to have steerable rear wheels which may allow their passage without any modification. Should modifications be required for this route then it is expected that this would be arranged in conjunction with Glen Innes Shire Council and the proponent will fund restoration of any modified structures.

An alternative route involves the use of Grafton Road about 1 km to the north of Glen Innes. The intersection with the New England Highway appears suitable for the oversize vehicles subject to minor

improvements. The vehicles would continue along Grafton Road, turning into Coronation Avenue which intersects with Gwydir Highway about 1.5 km west of Glen Innes (Photos 5 and 6). Minor improvements may be required at each of these intersections. The oversize vehicles would then continue west along the Gwydir Highway.

4.2.3 Glen Innes to the site

Having negotiated the main roads through Glen Innes the likely access route will use the Gwydir Highway for most of the way to the site. The Gwydir Highway is a two lane sealed road with a general speed limit of 100 kph and is suitable for the proposed vehicle movements. The road is in good condition with good geometry in keeping with its speed rating. No towns occur between Glen Innes and the site, although a small number of residences occur along the route and a number of local roads join the Gwydir Highway.

Access to the site from Glen Innes has considered five possible routes using the Gwydir Highway and local roads as shown on Figure 3 and as listed below (distances are from the intersection of the New England and Gwydir Highways):

Table 3 – Possible routes Glen Innes to site

Distance on Gwydir Highway	Route option after leaving Gwydir Highway (See Figure 3)
1.8 km	Dumaresq Street, East Furracabad Road, Cherry Tree Road and then Hillside Road (access to southern part of wind farm)
5 km	West Furracabad Road, Cherry Tree Road and Hillside Road (access to southern part of wind farm)
11 km	Rose Hill Road and Ross Trig access track (access to middle of wind farm site)
12.5 km	Former Gwydir Highway alignment, Wattle Vale Travelling Stock Route No. 67474 (access to northern end of wind farm during construction period).
14 km	Sinclair Lookout Road (possible light vehicle access to northern end of the wind farm)

While each of the routes can be used to access the site, only Rose Hill Road and the former Gwydir Highway alignment appear to be suitable for delivery of the wind farm equipment involving RAVs. Two of the other possible routes would require improvements to their alignments to enable access for oversize vehicles and another has a creek crossing which would require negotiation, potentially with upgrading of the existing bridge. There are advantages in restricting access to a single site entry close to the Gwydir Highway including improved site security, less disruption to local community traffic and simpler maintenance of access.

A review of each of the five possible routes is provided below.

Access via Rose Hill Road

Rose Hill Road is a 2.5km section of unsealed public road. It is straight and relatively flat and is suitable for use by the RAV vehicles (Photo 12 and 13). It provides access to the "Rose Hill" and "Girrahween" properties. It also connects to an access track to the Ross Telecommunications facility and Ross Trig Station on Waterloo Range located near the middle of the wind farm.

The 'T' intersection of the Gwydir Highway and Rose Hill Road has good sight distances from the eastern and western approaches of the Gwydir Highway (Photo 9). There is adequate turning area for oversize vehicles negotiating this intersection.

If construction traffic used the Rose Hill Road it would have potential to affect the single residence adjacent to the road and traffic management measures would be implemented to address that issue and minimise potential dust and noise impacts. Sealing of Rose Hill Road in the vicinity of Girrahween has been proposed by Council to address the issue of nuisance dust at the residences. Modifications will also be required for existing gates and stock grids.

Access by former Gwydir Highway alignment to northern end of wind farm

The former highway alignment can be accessed from the Gwydir Highway at a point near the top of the Waterloo Range. The location of the existing access point is along a straight section of the Gwydir Highway with a passing lane at the entrance. This entry point may require to be relocated about 150 metres to the east to assist the long vehicles in exiting the Gwydir Highway.

A large cleared area occurs adjacent to the highway with part of the area currently used to store blue metal for highway resurfacing and repairs. Access can be gained to the former highway alignment from this cleared area with minimal additional clearing required.

The former alignment has a wide firm base with suitable clearances and grades for the expected vehicle movements (Photo 14).

The Rural Lands Protection Board (RLPB) has approved its temporary use during construction. As the former alignment is now a Travelling Stock Route, traffic movements will need to give priority to stock movements and comply with RLPB conditions. If this route is used a small number of native trees would need to be removed to provide a path through to the wind farm site. Any clearing would be undertaken in consultation with RLPB.

Access via Sinclair Lookout Road (northern access)

The intersection of Sinclair Lookout Road and the Gwydir Highway is on a fairly tight bend where the Gwydir Highway descends from the Waterloo Range. The intersection is about 1 kilometre north of the wind farm (Photo 11).

The road to Sinclair Lookout is about one kilometre in length and is unsealed, narrow and winding (Photo 17 and 18). Although it has a rough surface it is able to be used by standard two wheel drive vehicles. Usage of the road by the public appears to be low but may increase if the wind farm were installed.

While the intersection with the highway is suitable for RAVs, adjustment of the alignment along the route and some widening would be required for several tight bends between the highway intersection and Sinclair lookout. This would require clearing some native vegetation that has been assessed as having conservation value. Due to these reasons and the availability of suitable alternative access via Rose Hill Road or the former Gwydir Highway alignment it is not intended that this route be considered for use by RAVs.

The road could be suitable for routine access during the operational life and maintenance phases of the wind farm by light vehicles, subject to Council agreement and relatively minor upgrades. Small traffic volumes are expected during these phases. Its use for construction access is not proposed.

Access via West Furracabad Road (southern access)

West Furracabad Road meets the Gwydir Highway approximately 5 kilometres west of Glen Innes (Photo 8). This route continues until it changes into Cherry Tree Road and after a further 1.2 km reaches Hillside Road on the right which continues through to the project site.

West Furracabad is an unsealed road that serves rural properties (Photo 15). There are several sharp bends in the road, which would require adjustment via alignment and widening. In addition, Hillside Road is winding, has a creek crossing and is not suited to access by RAVs (Photos 19 and 20). These roads would require substantive upgrading.

Due to the modifications required for use of these roads, potential disturbance to adjoining residences and local traffic and the availability of alternative access via Rose Hill Road or the former Gwydir Highway Alignment, it is not intended that this route be used by RAVs. However, its use by light vehicles using the existing roads may occur from time to time.

Were the West Furracabad Road route to be used by light vehicles during construction a number of rural residences along the road could be temporarily affected. Some upgrading and periodic maintenance may be required to improve the suitability of the West Furracabad Road for the use by locals and light weight construction traffic and to maintain it through the six to twelve month construction period. During dry periods and at times of peak construction traffic wetting down of the road on unsealed sections adjacent to residences may be required.

Given the small amount of traffic that uses the West Furracabad Road and the restriction of its use to light construction vehicles only, the impact on the road and the safety of its users could be expected to be minor and limited to the construction period.

Access via East Furracabad Road (southern access)

East Furracabad Road is a sealed road that provides a potential access route to the southern end of the wind farm (Photo 16). East Furracabad Road commences at the outskirts of Glen Innes and can be reached via Gwydir Highway and Dumaresq Street.

At about 10 km from Glen Innes there is a sharp right hand bend where East Furracabad Road meets Haymarket Road. East Furracabad Road then heads west for about two kilometres across Furracabad Creek to a 'T' intersection with West Furracabad Road. The route is then the same as from West Furracabad Road involving about 1.2 km on Cherry Tree Road and then via Hillside Road.

There are several adjustments that would be required, including modification of the abovementioned 'T' intersection and a timber bridge over Furracabad Creek which would not be suitable for use by RAVs. In addition, the route passes a number of residences that are close to the road, in particular on the outskirts of Glen Innes.

After consideration of the matters described above, it is not intended that RAVs use this route.

4.2.4 Preferred RAV access routes to site

Based on the above review, the access route to the wind farm site is initially via New England Highway to Glen Innes and subsequently via the Gwydir Highway with site entry via the former Gwydir Highway alignment or alternatively Rose Hill Road. The other options for site access have been assessed as either inferior with regard to road conditions, impact on conservation values or are longer in length and have the potential to impact more people or the local environment. A summary of wind farm access routes and the alternatives is outlined below in Table 4.

Access via the former Gwydir Highway alignment or Rose Hill Road both provide safe options for existing roads users and vehicles accessing the wind farm. Sight distances for the exits from Gwydir Highway comply with recommended standards. If required, temporary controls such as speed restrictions, warning signs and traffic control could be provided to ensure the safety of the vehicles in the vicinity of the construction vehicle exit from the Gwydir Highway during construction. The intersection geometry for Rose Hill Road is a 90° 'T' intersection with the main road having preference

for through traffic. In the case of the entry to the former Gwydir Highway alignment, there is adequate space to provide for large vehicles to exit or re-enter the highway. The entrance to the site from public roads will be discussed with RTA and Council, as applicable, and implemented in accordance with any agreed conditions.

Table 4 – Wind farm access route options

Wind Farm Turbine Group	Proposed route		Alternative route	
	Potential access route to entrance	Works required	Alternative route entry	Works required
Northern Turbine Group (9 turbines) and substation	Gwydir Highway to former highway alignment on top of Waterloo Range	New exit from highway and minor clearing of trees	Rose Hill Road	As agreed with Council
	Gwydir Highway to Rose Hill Road	Minor road upgrade and entrance works	Former Highway alignment	Widening, realignment and resurfacing
Eastern Turbine Group (4 turbines)	Access from Northern Turbine Group	Steep access track construction T9 to T10 & T20B	From West Furracabad Road	Widening and adjustments to alignment, creek crossings
	New access track from Rose Hill Road along Reddestone Creek	About 3 km of new access track	More direct route from Northern Group	Lesser extent of works
Southern Turbine Group (14 turbines)	From Northern turbine Group	Extension of northern access track	Via Reddestone Creek	
	From Hillside Road	Hillside Road upgraded	From northern Group or via Reddestone Creek	Widening and adjustments to alignment, creek crossings

4.2.5 Operational access to the substation and facilities building

Due to the substation and facilities building being located at the northern end of the wind farm, the most direct access once the wind farm is operational will be from the Gwydir Highway via the former Highway alignment or Sinclair Lookout Road. The operational stage will mainly involve access by light weight vehicles used by the operators and Country Energy or TransGrid.

Use of the former highway alignment has been approved by RLPB as a temporary measure for the construction phase. A further approval would need to be sought for the operational phase.

As described in Section 4.2.3 the Sinclair Lookout Road is a minor road and in good condition for its current use. It is proposed to use this road to gain access to the substation once operational and after subsequent minor upgrade works. The proposed entrance to the substation is about 0.8 km from the intersection of Sinclair Lookout Road with the Gwydir Highway.

The intersection has adequate sight distances and will not be used for the delivery of the long loads such as involved with the wind turbine components. As such, the intersection is suitable, without upgrade works, for light vehicles to safely leave the Gwydir Highway and gain access to the substation site. All semi trailers and RAVs delivering to the substation site would travel via the Ross Trig access road, as discussed.

The existing track that leads from the Gwydir Highway to the substation passes through an area of high conservation status woodland which has been excluded from grazing by the provision of stock proof fencing. No clearing of trees is envisaged for this access but some lopping of overhanging branches may be necessary. Drainage improvements and upgrade of crossings of watercourses may be required to access the substation. These crossings may require minor earthworks.

4.3 On-site access

On-site access for all turbine sites will generally be across open paddocks and along the ridgelines on which the turbines are located via specially constructed, unsealed access tracks as shown on Figure 4. The final location of the access tracks will be determined in consultation with respective landowners to minimise impact on their day to day operations. The design of the wind farm has aimed to minimise the length of access track construction.

In addition, the location of access tracks has been selected with due consideration to existing flora and fauna habitats and areas of identified archaeological sensitivity. The location of the access tracks can be adjusted to minimise impacts on the existing flora or fauna or significant archaeology areas found on the site. Where required, relevant specialist advice will be sought for any adjustments to the final location of tracks.

In a few places along the top of the Waterloo Range track work will need to be located through rock outcrops and woodland to provide access to the tower sites. Strategic siting of these tracks in areas that are less visible to the surrounding public roads together with selective placement of any excavated material where the tracks will be more visible will minimise visual impact and will provide new habitat for reptiles.

The access routes will be sited to provide adequate grades and alignment for the movements of the large vehicles that will be required for the construction phase. Small sections of some tracks in areas where there are steeper grades will require particular attention to road surfacing and drainage to provide safe access and reduce erosion potential. Stormwater culverts will be constructed where access tracks cross over existing creeks and gullies. Several sections of access track on steep slopes may require some cut and fill construction to achieve suitable grades. On the steepest access tracks to turbine sites it may also be necessary to use bulldozers to push/pull heavier equipment transport vehicles up short sections of the steeper grades.

Generally, only minor works will be required in the open paddock areas. These works will include clearing, filling, grading and drainage construction. Where possible, road improvements will be undertaken using excess fill material from on-site earthwork operations. Even in areas having scattered trees it is possible to provide access through these areas with minimal impact.

As only limited light vehicle access is likely to be required to each tower during most of the operational phase of the project it is expected that once construction has been completed that a road width of only 5 metres will be required. This may allow the edges of some access tracks to be rehabilitated.

Empty RAVs and other heavy vehicles from the site will exit via the entry route. Protocols may need to be included in the Traffic Management Plan to avoid conflict between large vehicles entering and exiting the site. The benefits of this traffic management measure include:

- single site entrance off Gwydir Highway for proposed access by RAVs into the site via either the former Gwydir Highway alignment or Rose Hill Road
- No access by RAVs via Sinclair Lookout Road, West Furracabad Road or East Furracabad Road

The Environmental Management Plans (EMPs) for the site will address all the above mentioned issues and will stipulate that only the defined tracks be used for access around the site. This will prevent unrestricted access across the paddocks and will minimise the impacts of construction traffic to the defined tracks.

5. Existing Traffic Flows

5.1 Access via main highways

Both Brisbane and Newcastle ports are within large cities and the surrounding roads have considerable peak traffic flows. Accordingly, it is likely that deliveries from these locations will be timed to avoid the peak periods.

The New England Highway which will be the main access to the site from the ports or manufacturing and supply facilities carries a significant volume of daily traffic in the form of cars and heavy vehicles. It has been constructed to a high standard and subject to suitable arrangements with relevant authorities is expected to be suitable for the movement of the 'Oversize' and 'Overmass' vehicles associated with the construction of the wind farm.

The RTA has responsibility for the main State highways. The highways running through Glen Innes are included in the RTA's asset register, however Glen Innes Severn Council is retained to carry out the road maintenance on the highways in the vicinity of Glen Innes.

The highways are used by local traffic and commercial vehicles to access or pass the town centre. They have moderate levels of use during peak periods. In a two-way count survey conducted by the RTA in 2004 the annual average daily traffic (AADT) volumes shown below were observed on relevant sections of the proposed transport route. These figures may have increased slightly since the survey was undertaken but are nevertheless expected to be representative of the order of local traffic volumes.

- 6,480 vehicles per day on the New England Highway, just south of Meade Street
- 4,272 vehicles per day on the Gwydir Highway, just east of Lambeth Street
- 1,512 vehicles per day on the Gwydir Highway, at the Furracabad Creek Bridge

As indicated by this data, there is a significant drop off in vehicle volumes along the Gwydir Highway away from Glen Innes and towards the proposed wind farm site. Nevertheless, the Gwydir Highway does provide an important transport link for local, tourist and light commercial traffic between the neighbouring townships of Glen Innes and Inverell and for residents and workers in the area in between.

5.2 Usage of the Glen Innes Severn Council local roads

While RTA has responsibility for the main highways Council is responsible for local roads and traffic routes within the Glen Innes locality. In general terms, formed Public or Crown roads are included in Council's asset register if they meet the following criteria:

- they are maintained by Council at the time
- they formed the primary access for a property holding
- the section of road was the closest point on a Public Road to the boundary of the property holding
- Council accepted the road for conversion (where necessary) from Crown to Public Road

The maintenance grading of unsealed roads throughout the Shire is undertaken according to a road hierarchy and frequency of maintenance that could be provided by Council is set out below in Table 5. The possible site access roads that are maintained by Council and their hierarchy classification are also shown in Table 5 (GIS, 2007 – Discussion Paper).

Table 5: Road hierarchy of unsealed roads in Glen Innes Severn Shire

Class	Hierarchy	Frequency of Service *	Description	Road No.	Unsealed Rural Road
A	Primary	Twice / year	Roads of highest priority to Council – through traffic and local traffic	None required for access	
B	Secondary	Twice / year	Rural local road. Local traffic and property access	None required for access	
C	Collector	Twice / year	Rural local road, access to abutting properties by way of a no through road	R368-020 R352-020	West Furracabad Cherry Tree Road
D & E	Access	Once / year	Access to dwelling - no through road. Service at least one dwelling	R365-020 R356-010	Rose Hill Road Hillside Road
F	Urban	Three times / year	Access to abutting properties in towns and villages	None required for access	

Note: * - Proposed frequency of service as per GISC discussion paper, 2007.

It is acknowledged that an increase in intensity of usage of any of Council's unsealed roads by construction vehicles would be likely to require increased maintenance. The management of this issue will be discussed with Council. The Council and RTA's road works schedule will be examined at a date closer to construction to ensure avoidance of any conflict in this regard.

The main access point for the site during the construction stage is likely to be via the former highway alignment or the Rose Hill Road. Both are accessed directly off the Gwydir Highway. The Rose Hill Road is also used by rural residents to gain entry to three residences with entries adjoining this road, as discussed in Section 4. Any access by larger vehicles along Rose Hill Road will be managed to minimise the impact on these local residents. They will also be kept informed of the construction program and vehicle movement arrangements. This will also be addressed in the Project Traffic Management Plan.

5.3 Pedestrian movements and public transport

The RTA has required that the assessment address any potential pedestrian or public transport issues.

The majority of the pedestrian routes in the area are confined to the main street and residential areas of Glen Innes. As the transport of equipment may occur on the two existing main heavy vehicle transport routes through Glen Innes it is unlikely that the construction traffic will have a significant impact on pedestrian routes and movement. Adequate precautions such as signage, escort vehicles and traffic controllers will be in place to minimise any risks present to pedestrians when the RAVs are moving through Glen Innes and will be addressed in more detail in the Project Traffic Management Plan.

Rail and bus services will not be used for the project and the construction works are not expected to disrupt the timetables for the currently operating services.

The Glen Innes Train Station is located off the Gwydir Highway on Lambeth Street. The historical station and the associated trackwork are no longer in use as part of the transport network. The station has consequently been turned into a tourist attraction and a hotel. The New England railway line now terminates in Armidale and Countrylink and Greyhound provide connector buses between Glen Innes and Inverell, Armidale, Moree, Tenterfield, Grafton and Tamworth.

Long distance bus services (running from Sydney to Brisbane and vice versa) also pass through Glen Innes. The frequency of bus services passing through Glen Innes is outlined in Table 6 below. The pick up and drop off point for the bus services in Glen Innes is at the Glen Innes Tourist Information Centre on the New England Highway. With such infrequent services, the transporting of the required equipment is unlikely to disrupt them but if necessary could be organised to avoid any disruption to these services.

Table 6 - Bus services passing through Glen Innes

Service	Frequency of service / day	Number of days / week
Sydney to Brisbane and vice versa	2	7
Armidale to Tenterfield and vice versa	2	7
Grafton to Moree and vice versa	1	5
Tamworth to Brisbane and vice versa	2	7
Glen Innes to Inverell	4	5

There are a number of School Bus services within Glen Innes and its surrounds. Two schools are located on the New England Highway close by to the Gwydir Highway junction. The transporting of the required equipment will be organised outside the peak traffic period associated with the schools. The proposed construction vehicle access via the former highway alignment avoids use of local roads and potential conflicts with school bus services.

Any identified potential conflict between the construction traffic associated with the proposed wind farm site and the Glen Innes public transport system will be addressed in the Project Traffic Management Plan.

6. Transport Impacts

6.1 General

The main impact of the development with regard to traffic and transport is the additional number of vehicles on the roads during the construction period and the size of some of those vehicles.

The New England Highway between Brisbane and Newcastle carries a significant amount of traffic daily. The amount of additional traffic generated by the proposed wind farm development will be negligible relative to existing traffic volumes but the restricted access vehicles (RAVs) will require escort vehicles. Some minor disruption may be caused by the passage of RAVs where the highway does not have multiple lanes to provide adequate passing opportunities. This however, as a part of the total length of the highway and with appropriate timing of vehicle movements, should only be a minor impact on the normal flow of traffic.

Notwithstanding the above, it is expected that the wind farm development will not have any significant impact on traffic on the New England Highway.

The movement of RAVs through Glen Innes and along the rural roads has the potential to cause minor disturbance to local users. This matter will be discussed with Glen Innes Severn Council including aspects such as Council's preferred vehicle routes and any modifications to the existing Glen Innes road infrastructure to permit a safe and controlled passage through and around the city. Beyond Glen Innes, the Gwydir Highway and the former Gwydir Highway alignment, or Rose Hill Road, all have suitable capacity for transportation of wind turbine components to the wind farm site.

The following sections outline the factors to be considered for the key issues identified in Section 2.

6.2 Suitability of existing road layout

Given the nature and volume of the traffic likely to be generated by the development, in particular the RAVs, a key issue is the route for delivery of large items to site to ensure safe access and to mitigate impacts.

The delivery of the blades using RAVs that may be in excess of 50 m long is likely to be the critical item in terms of the suitability of the existing road geometry with respect to adequate turning circles and road widths.

Prior to construction the contractor will undertake a detailed assessment of the transport route(s) to be used and in particular the access through towns and over bridges. The existence of steep grades, tight curves and restricted sight distances will be assessed in detail. Should any need be identified for temporary modification of road structures these will be discussed with the relevant authority, RTA or Council and only undertaken in accordance with agreed arrangements.

Movement of RAVs along local rural roads used by the public other than the New England and Gwydir Highways is limited to the former Gwydir Highway alignment or Rose Hill Road. A Traffic Management Plan will be developed for controlling the access of long and heavy construction vehicles along the highways, roads and on the site and to minimise disruption to rural residents during the construction period. Such access arrangements were discussed in detail in Section 4.

The single access point to the wind farm from the public roads has been selected to achieve safe access and minimise community disruption during the construction stage. Further planning and consultation with Council and the RTA will be undertaken to ensure the safe passage of vehicles entering and leaving the site.

6.3 Structural capacity of existing roads and structures

The existing roads that provide the feasible access to the site are generally in good condition. The unsealed former highway alignment appears well constructed with a raised rock base and formed drainage. The Rose Hill Road was constructed many years ago and, although unsealed, is generally well maintained for its existing purpose. While both are suitable for the type of traffic proposed any increase in design traffic may negatively impact the overall condition and performance of these local roads.

The increased traffic generated by the construction stage of the proposed development can exacerbate areas already showing signs of deterioration and such deterioration can be accelerated by the passage of overmass vehicles. It is therefore likely that increased inspection and maintenance will be required during the construction stage for the selected access route, whether the former Gwydir Highway alignment or Rose Hill Road.

Whilst major roads have been designed to cater for large overmass vehicles, it is possible that for local roads some minor structures such as existing cattle grids may be impacted by the passage of the large construction vehicles. Such structures may require monitoring and repair or replacement during the construction period or replacement prior to the works commencing so as to maintain serviceability for local users and construction traffic. Given that the former highway alignment passes through the Wattle Vale Travelling Stock Route which is currently leased for grazing, large cattle grids would need to be installed if this route is used for delivery of the large equipment using RAVs. One grid would be required at the entry from the Gwydir Highway and a second would need to be installed at the exit from the Travelling Stock Route to the wind farm site.

6.4 Disturbance to local community (including road users)

The main impacts of wind farm construction traffic on the local communities will involve:

- movement of the RAVs through Glen Innes and along the Gwydir Highway to and from the site entry
- increased frequency of vehicle movements on the former Gwydir Highway alignment or Rose Hill Road that otherwise would have low traffic volumes
- temporary increased traffic noise and airborne dust for the Girrahween residence adjacent to Rose Hill Road if Rose Hill Road is used as the main site access
- potential safety risks arising from increased traffic movements
- increased deterioration of the surface of the Rose Hill Road or the former highway alignment whichever is used and the consequent need for maintenance works during construction

The movement of RAVs along the other roads, such as East and West Furracabad Roads, involving vehicles up to 50m in length if implemented would be a significant traffic management issue. Even with the use of escort vehicles, timing of movements scheduled to minimise their impact, modification to the road width particularly on bends and attention to the grades through dips; there could still be disturbance for local residents on these local roads. Use of Rose Hill Road or the former highway alignment simplifies the management of site access and maximises road safety.

The volume of construction traffic indicated in Tables 2 (a) and 2 (b) will be spread over the construction period but on a daily basis the frequency of vehicle movements would fluctuate depending on the construction activities occurring at the time. Deliveries of long loads such as turbine blades may involve up to 5 or 6 RAVs per day. Concreting operations for the individual tower footings can require approximately 70 one-way truck movements over a period of 10 hours. The movement of concrete

agitator trucks will be mostly on the Gwydir Highway and access tracks on wind farmer properties with low impact on neighbouring residences.

A temporary concrete batch plant could be established to provide concrete to the turbine sites so that concrete delivered on public roads will be minimised. However, concrete may also be sourced from existing Glen Innes batching plants due to the short travel distance from town to the wind farm site.

The use of an on-site batch plant would depend on the contractor's plan of operation. The plan will consider the distance from local concrete suppliers to the turbine sites, the impact of the concreting operations on local traffic movements and neighbours to the wind farm and costs of the on-site option versus supply from Glen Innes. Any on-site batch plant would be situated local to where concrete operations are being undertaken resulting in concrete delivery truck movements predominantly being restricted to the on-site tracks. Whilst delivery of constituent materials will still be required, the number of deliveries will be less than that required for the delivery of concrete produced off-site and can be spread more evenly over time (Table 2 (b)). Should the contractor wish to install an on site batch plant, it is expected that they will make the necessary assessment of options and obtain the necessary approvals.

The general increase in daily traffic has the potential to increase the short-term traffic noise levels along the proposed access route. The level of disturbance to residents will be directly related to the proximity of the existing premises to the access roads. As for the construction works, the timing of vehicle movements will be within the site working hours and will mostly avoid night time deliveries. Concrete deliveries may be required in the early evening if pouring of a turbine footing has not been completed at the end of the day and the pour needs to be completed as a single event.

The oversize and overmass vehicles will by their nature travel at lower speeds than those normally used by local residents along the access route. Some delays may be experienced by local residents due to the nature of the vehicles being used to deliver materials to the site. The timing of vehicle movements will be subject to consultation with the Council and local police if required and as far as possible will seek to minimise disruption to local road users during the construction period.

6.5 Road Safety

The New England Highway, Gwydir Highway and Glen Innes township all have low accident rates and no fatalities during 2004 and 2005 as shown below in Table 7.

Table 7 - Accident rates in Glen Innes and surrounds in 2004 – 2005 (RTA)

Roadway	Fatalities		Injury crashes		Non casualty crashes		Total crashes	
	2004	2005	2004	2005	2004	2005	2004	2005
Glen Innes Township	0	0	7	7	8	8	15	15
Gwydir Hwy	0	0	2	0	1	3	3	3
New England Hwy	0	0	1	3	1	2	2	5
TOTAL	0	0	10	10	10	13	20	23

Access through towns may require the construction traffic to negotiate intersections where traffic will need to be halted for short periods of time.

The transport of large equipment on oversize and overmass vehicles as well as an increase in traffic using a road network has the potential to have some impact on road safety. Such potential safety impacts may result from:

- other road users becoming increasingly frustrated by delays behind slow moving vehicles
- normal traffic expectations by local road users not allowing for the presence of such large vehicles
- an increase in traffic numbers on the roads

However, any potential safety impacts relating to the presence of RAVs will be minimised by the use of escort vehicles that will accompany the RAVs. As discussed previously, a Traffic Management Plan will control the traffic movements RAVs and heavy construction traffic between Glen Innes and the site.

6.6 On-site management

The on site earthworks associated with the construction of access tracks and equipment laydown areas have the potential for environmental impacts if not appropriately managed. As far as possible, the site layout and arrangement of access tracks have been designed to simplify access, minimise the extent of tracks required and avoid environmentally sensitive areas.

The on-site management of traffic and the establishment of an access track network will be managed to ensure minimal impact to the environment. The specific issues arising are identified in other parts of the Environmental Assessment and the project Environmental Management Plan will incorporate controls to mitigate the potential identified impacts.

The basic philosophy to be adopted is to minimise any impact by ensuring that an effective access track network is established and as far as possible restricting access to the defined tracks and avoiding areas of environmental sensitivity. This process will be undertaken in consultation with the landowners and where necessary particular specialists. By clearly defining the access network it will allow drainage works to be planned so as to control runoff onto and from affected areas and to install necessary erosion and sediment control measures.

Several sections of steep grades have been identified that will require particular attention to drainage and erosion control. These include:

- the access track between Turbine Site 9 and site 10B
- the section of track from Turbine Sites 16C to 17
- the section of track leading up to Turbine Site 19
- the track leading up to Turbine Sites 20B to 22B
- the track leading to Turbine Site 10

At these locations constructed drainage will be installed to manage stormwater runoff on the steep grades. This will include the incorporation of flow control and energy dissipation devices.

Laydown areas adjacent to the individual wind towers will be required for the temporary storage of equipment and access by delivery and erection vehicles. In most cases, turbine equipment will be delivered directly to the laydown area to avoid double handling. This may be varied for one or more sites with limited cleared area is available for lay down of component parts.

In the event that existing fences and gates are required to be removed for access to the site suitable alternative arrangements will be made with the landowners to safeguard stock.

7. Mitigation Measures

A number of measures will be incorporated during the construction and operation of the wind farm to ensure that transport and traffic impacts arising out of the development are minimised. These measures will be incorporated into a Traffic Management Plan for the project and shall be developed in consultation with the Glen Innes Severn Council and the RTA to ensure that applicable safety standards are achieved and disruption to local traffic flows is minimised.

Measures incorporated in the Traffic Management Plan will include controls on access arrangements by RAVs and heavy vehicles to define the routes to be used and timing of vehicle movements so that they use the road access in a safe and considerate manner.

An important mitigation measure during the construction period will be the implementation of a community information and awareness program. Prior to construction commencing and during the construction period a program will be initiated to ensure the local residents are fully aware of the construction activities with particular regard being given to construction traffic using local roads to access the various sections of the site. This program will include press releases in the local newspapers and newsletters and individual letter drops to residents along the access route to the site. Regular project updates will be made and the use of specific updates shall be reviewed during the construction phase on an ongoing basis.

General signposting of the access roads with appropriate heavy vehicle and construction warning signs will also be undertaken in consultation with Council and RTA. Specific warning signs will be located adjacent to the site entrance to warn existing road users of entering and exiting traffic. The use of day warning notices where signs are activated on a specific day to warn local road users of construction activities will also be considered.

On-site access will be restricted to defined tracks to ensure minimal environmental impact.

Further mitigation measures will include the following:

- improvements to any public roads impacted by the project in consultation with the Council and the RTA. Improvements may include provision of exit lanes, upgraded grids and gates
- provision of traffic control personnel where large vehicles are required to execute difficult or potentially unsafe manoeuvres on public roads
- concurrence with permit requirements for oversize and overmass vehicles including the use of escort vehicles as required
- restrictions on the timing of some large equipment and materials deliveries to site to mitigate specific impacts. In particular the following measures will be adopted:
 - restriction of traffic movements to avoid RAVs passing schools at Glen Innes during the school zone periods and to avoid RAV movements conflicting with school bus operations
 - local deliveries to the site during daylight hours only to mitigate safety problems on local roads and to reduce disturbance for residences near to the access roads
- confirmation of access track routes in proximity to environmentally sensitive areas to be guided by relevant specialists
- if required by Council, establishment of an inspection and maintenance program for the local road access network to ensure condition of roads are maintained in safe state
- maintenance program for on-site access tracks to ensure safe access
- implementation of a pro-active erosion and sediment control plan for on-site roads and laydown areas

8. Conclusion

The operational wind farm will require low levels of vehicle access to the site via local roads and will accordingly have little impact on local traffic.

However, there is potential for temporary impacts on the local traffic during the construction period that may extend over at least six months and perhaps up to 12 months. In particular, the delivery of long turbine components such as blades and tower sections that involves oversize vehicles of the order of 50 metres long may at times affect the flow of local traffic. Traffic management procedures will be implemented to ensure that the impacts of the oversize vehicles are minimised.

Provision of an on-site concrete batching plant to service the construction requirements could minimise the need for movement of concrete trucks between Glen Innes and the site. However, due to the close proximity to Glen Innes an existing off-site batching plant in Glen Innes may be used. The contractor will determine the best option for their operations and will be required to make the necessary assessments and required approvals should an on site concrete plant be required.

The preferred access route via the New England Highway, Gwydir Highway and the former Gwydir Highway alignment or Rose Hill Road, together with the implementation of the mitigation measures contained in this report, will mean the traffic impacts during the construction phase will be minimised and road safety on the access road network can be maintained to a satisfactory standard.

On-site access track routes and construction formations will be subject to controls, as documented in the Project Environmental Management Plan, to address the site environmental sensitivities identified in the Environment Assessment and ensure minimal environmental impact from these works.

Close liaison between Glen Innes Wind Power, its contractors, Council, RTA and local residents along with the implementation of a Traffic Management Plan and a Project Environmental Management Plan will ensure that transport and traffic issues arising out of the proposed development are appropriately addressed and have minimal impact on the local community and the local environment.

Appendix 1 - RTA checklist in preparing traffic impact studies

Procedures and Key Parameters	Source / Comments	Check
Brief description of the development	Sections 1 and 3	✓
Application and study process	Section 2	✓
Introduction		
Background	Section 1	✓
Scope of report	Sections 1 and 2	✓
The key issues and objectives of the traffic impact study	Section 2	✓
General Data collection / Existing Conditions		
Description of the site and proposed activity	Sections 1 and 3	✓
Site location	Section 1	✓
Current land use characteristics (zoning) of the proposed site and land use in the vicinity	Severn LEP 2002 – Rural 1(a) – Pastoral land use	✓
Site access	Section 4	✓
Existing traffic conditions		
Road hierarchy; including the identification of the classified road network (major and minor roads) which may be affected by the development proposal	Sections 4 and 5	✓
Inventory of road widths, road conditions, traffic management works and bikeways	Details of roads affected provided, bikeways NA	✓
Current and proposed roadworks, traffic management works and bikeways	Sections 4, 5 and 6 Bikeways NA	✓
Traffic flows		
Selection of key streets – possibly divided into the major and minor road network; selection of key assessment periods, chosen to cover the times at which the development would be expected to have its major impacts	Sections 4 and 5	✓
AADT on key streets	Reference to 2004 data	✓
Daily traffic flow hourly distribution, particularly in or near residential areas	Strategy to avoid peak periods	✓
Estimate of the speed of traffic on the road to which vehicular access is proposed	Gwydir Highway 100 kph.	✓
Current traffic generation of site	Minor once operational	✓
Daily and peak period heavy vehicle flows and percentages	Section 3 – Vehicle details	✓
The adaptation of appropriate computer models or techniques for assessing levels of traffic congestion and queuing conditions	Computer modelling not utilised	NA
Traffic Safety		
Accident history of road network in the area	Section 6	✓
Parking Supply and Demand		

On-street parking provisions	No effect on parking anticipated	NA
Off site parking provisions	No effect on parking anticipated	NA
Current parking demand, including utilisation by time of day and turnover rates	No effect on parking anticipated	NA
Short term pick up and set down areas	No effect on parking anticipated	NA
Modal Split	As the majority of the construction traffic will be travelling on rural roads and Highways, the majority of road users will be using vehicles. A study to determine the modal split of the area was not identified as being of significance.	
Public Transport		
Rail Station locations	No rail services in area	✓
Bus routes and bus stop locations; Pedestrian access to bus stops; Constraints and conflicts	Section 5	✓
Rail and bus service frequencies, ideally separated into Monday to Friday, Saturday and Sunday, for both peak and off peak times	Section 5	✓
Commuter parking provisions	NA	NA
Pedestrian Network		
Identify major pedestrian routes	Section 5	✓
Pedestrian flows and potential conflicts with vehicles, particularly where such conflicts cause capacity constraints on either vehicular or pedestrian movement	Section 5	✓
Pedestrian infrastructure	Section 5	✓
Proposed developments in the vicinity	Pastoral activities only	✓
Proposed Development		
The Development		
Plan reference, if plans not contained in study report	Figures 1 to 4	✓
Nature of development	Section 1	✓
Gross floor plan areas of each component of the development	Figure 4	✓
Projected number of employees/users/residents	Up to 40 persons during construction.	✓
Hours and days of operations	Normal construction operating hours – Operations continuous	✓
Staging and timing of development	Section 3	✓
Selection of appropriate design vehicles for determining access and circulation requirements	Section 3	✓
Access		

Driveway location, including review of alternative locations	Section 4	✓
Sight driveways and comparisons with stopping and desirable minimum sight distances	Section 4	✓
Service vehicle access	As for other vehicles	✓
Analysis of projected queuing at entrances	No queuing at entrance	✓
Current access to site and comparison with proposed access	Sections 4 and 5	✓
Provision for access to, and by, public transport	No Public transport to the site is proposed	N/A
Circulation		
Proposed pattern of circulation	Section 4	✓
Internal road widths	Up to 8 metres	✓
Provision for bus movements	No Public transport to the site is proposed	N/A
Service area layout	Figure 4	✓
Parking		
Proposed supply	No Parking Proposed	N/A
Parking provision recommended by State Government policy	No Parking Proposed	N/A
Council code and local parking policies and plans	No Parking Proposed	N/A
Parking layout	No Parking Proposed	N/A
Projected peak demand, based where appropriate on similar research reports and on surveys of similar developments	No Parking Proposed	N/A
Parking for Service / courier vehicles and bicycles	No Parking Proposed	N/A
Impact of Proposed Development		
Traffic generation during design periods		
Daily and seasonal factors	Daily movements	✓
Pedestrian generation and movements	No pedestrian access proposed	N/A
Traffic Distribution and Assignments		
Hourly distribution of trips	Peaks avoided	✓
Assignments of these trips to the road system, based where possible on development feasibility studies or on origin/destination surveys undertaken at similar developments in the areas	No similar developments at this locality	✓
Impact on Traffic Safety		
Assessment of Road Safety Impact	Section 6	✓
Impact of Generated Traffic		
Daily traffic flows and composition on key streets and their expected effect on the environment, particularly in residential areas	Section 3, 4 and 5	✓
Peak period volumes at key intersections and effect of generated traffic on congestion levels	Peaks avoided	✓

Impact of construction traffic during construction stages	Sections 3, 4, 5 and 6	✓
Other proposed developments in the vicinity, their timing and likely impact, if known	No known other significant developments	✓
Assessment of pedestrian movements	No pedestrian access proposed	N/A
Assessment of traffic noise	Separate report in EA	✓
Public Transport		
Options for extensions and changes to bus routes and bus stops, following discussions with the STA and or private bus operators	No Public transport to the site is proposed	N/A
Provision for pedestrian access to bus stops	No Public transport to the site is proposed	N/A
Recommended Works		
Improvements to site access and circulation	Upgrades proposed	✓
Improvements to roads, signals, roundabouts and other traffic management measures	Localised	✓
Improvements to pedestrian facilities	No pedestrian access proposed	N/A
Effect of recommended works on the operation of adjacent developments	Nil	✓
Effect of recommended works on public transport services, including bus routes, bus stops and access thereto	Nil	✓
Provision of LATM measures		✓
Funding of proposed improvement projects	To be discussed with relevant authorities	TBD
Noise attenuation measures	Use of registered vehicles and timing of vehicle movements to avoid disturbance.	✓

Figures

- Figure 1: Location of wind farm, ports and supply routes
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- Figure 3: Glen Innes to Wind Farm Transport Route Options
- Figure 4: Glen Innes Wind Farm – Site Access Tracks
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Photos

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- Photo 7: Looking east to roundabout at the intersection of Gwydir Highway and Grey Street
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