

Liverpool Range *Wind Farm*

Traffic and Transport Report | February 2017

EPURON

Liverpool Range *Wind Farm*

Traffic and Transport Report | February 2017

Prepared By:

Epuron Pty Ltd
Level 11, 75 Miller Street
North Sydney NSW 2060
AUSTRALIA
02 8456 7400
www.epuron.com.au

© Epuron 2017

With input from:

Zem Energy
Level 1, 31-33 Watt St
Newcastle NSW 2300
www.zemenergy.com.au

Table of Contents

1	INTRODUCTION	6
	1.1 Project Location	7
	1.2 Project Description	7
2	KEY ISSUES AND THEIR ASSESSMENT	8
3	EXISTING CONDITIONS	10
	3.1 RMS Roads	10
	3.2 Local Roads	10
4	PROPOSED TRANSPORT ROUTE	11
	4.1 Road transport via major road network	11
	4.2 Road transport via the local road network	13
	4.3 Access onto the site	16
	4.4 Access within the site	16
5	PREDICTED TRAFFIC AND EQUIPMENT TRANSPORT REQUIREMENTS	18
	5.1 Construction Traffic	18
	5.2 Operational Traffic	21
6	TRANSPORT IMPACTS	22
	6.1 General	22
	6.2 Suitability of Existing Road Layout	23
	6.3 Structural Capacity of Existing Roads and Structures	23
	6.4 Road Upgrades	23
	6.5 Disturbance to Local Community	26
	6.6 Road Safety	27
7	RECOMMENDATIONS AND MITIGATION MEASURES	28
8	CONCLUSION	29
9	REFERENCES	30

Figures

Figure 2-1 Transport of wind turbine nacelle	8
Figure 4-1 Major road transport route to Cassilis from Newcastle	11
Figure 4-2 Golden Highway at Cassilis	12
Figure 4-3 Wind Farm over-dimensional access route via local council roads	14
Figure 4-4 Transmission Area site access via local council roads	15
Figure 4-5 Example assessment of suitability of site access point 9	17
Figure 5-1 Wind turbine service van	21
Figure 6-1 Transport of turbine blades with escort vehicle	22
Figure 6-2 Transport of tower section on steep site access track	22

Tables

Table 1-1 Wind turbine major components	7
Table 4-1 - Over-dimensional and over-mass routes	13
Table 4-2 - Site access point suitability and proposed safety measures	16
Table 5-1 Estimate of peak daily traffic volume	18
Table 5-2 Predicted program of works and traffic generation	20
Table 6-1 Intersections utilised for site access	26
Table 6-2 Accident rates near Coolah and Cassilis	27
Table 6-3 Accident rates on the Golden Highway in Upper Hunter LGA	27

1 Introduction

This report provides an assessment of the traffic and transport issues relevant to the construction and operation of the proposed Liverpool Range Wind Farm. It forms an appendix to the Response to Submissions and supersedes the Traffic and Transport Assessment in the Environmental Assessment.

The Environmental Assessment (EA) was prepared for the project and placed on Public Exhibition in August 2014. There were a number of submissions relating to traffic and transportation from council and the general public. Further assessment and consideration of these submissions has resulted in a number of changes to the project in relation to the proposed roads used for delivery of turbine components.

Key changes to the proposed access route include:

- ▶ A new site access point on Vinegaroy Rd (Warrumbungles Way) 5km south east of the Coolah Creek Rd junction to reduce vehicle movements on Turee Vale Rd,
- ▶ A new site access point on Coolah Creek Rd opposite Oakdale Rd to reduce the vehicle movements on Coolah Creek Rd,
- ▶ Removal of part of Coolah Rd and Rotherwood Rd from the delivery route of over-dimensional components,
- ▶ A Statement of Commitment to avoid Cassilis for the delivery of over-dimensional components,
- ▶ Relocation of two proposed batch plant locations to reduce the number of vehicle movements on local roads.

In order to address issues raised in the submissions, Epuron engaged Zem Energy (in collaboration with icubed) to conduct an assessment of the local road structures and proposed delivery route suitability. Their assessment is provided as Appendix A to this report and includes:

- ▶ A site inspection of the relevant road intersections and waterway crossings,
- ▶ Swept path analysis of intersections for over dimensional vehicle access,
- ▶ Suitability assessment of site access points,
- ▶ A structural engineering assessment of existing water crossing structures (bridges, causeways and culverts),
- ▶ A desktop assessment of the proposed delivery route.

At its peak, the construction phase of the project is predicted to contribute approximately 344 additional vehicle movements (one-way trips) per day including heavy and over-dimensional vehicles. The assessment of local roads concluded that the use of the proposed access route is feasible and recommended some additional assessments once the detailed transport requirements have been finalised.

This report, which was prepared considering relevant local council traffic and road policies, considers the relevant traffic and transport implications for the project, assesses the potential impacts arising from the project and proposes mitigation measures to be incorporated in the Environmental Management Strategy to minimise traffic related impacts.

The relevant local council traffic and road polices considered include;

- ▶ Warrumbungle Shire Council
 - Access Across Road Reserves to Properties
 - Upgrading of Roads Not Constructed or Maintained by Council Policy
- ▶ Upper Hunter Shire Council
 - Maintenance - Dust Seal Criteria
 - Maintenance - Unmaintained Dedicated Public Roads
- ▶ Mid-Western Regional Council
 - Bitumen Sealing of Gravel Roads Policy
 - Road Encroachments on Private Land Policy

1.1 Project Location

The proposed Liverpool Range Wind Farm is located in Central Western New South Wales. The site is located between the rural centres of Coolah to the west and Cassilis to the southeast.

1.2 Project Description

The proposed site is located on freehold, leasehold and crown land within and adjacent to agricultural areas. There are a number of local residences that surround the site; these have been identified through reviews of cadastral and topographic mapping, on-site inspection and aerial imagery.

The project would involve the construction, operation and maintenance of up to 282 wind turbines, together with the associated infrastructure; access tracks and electrical cabling, required to connect the project into the existing electricity network.

To enable construction of the wind farm the project works would also involve:

- ▶ Upgrading road intersections with inadequate pavement width for delivery of over-dimensional components;
- ▶ Upgrading local roads to a standard for delivery of over-dimensional components and construction materials; and
- ▶ Upgrading road structures (culverts and causeways) where necessary for use of over-dimensional vehicles.

This assessment is based on wind turbine models with a generating capacity of between 1.5 and 3.6 MW. Table 1-1 below provides the number and approximate weight of the major components of a typical wind turbine.

Table 1-1 Wind turbine major components

Wind Turbine Component	No. of parts per turbine	Total number of parts for 282 turbines	Approximate component weight (tonnes)
Towers	3 - 5	846 – 1410	Up to 60
Nacelle	1	282	Up to 80
Hub	1	282	Up to 23
Blades	3	846	Up to 12

The construction phase of the project will involve the establishment of temporary construction facilities, compounds, access tracks, crane hardstand areas and concrete foundations at each turbine location, underground electrical cabling, overhead powerlines, erection of wind turbines and the construction of the electrical substations and associated switchgear and control room buildings.

The construction of the wind farm would be over a 3-year period and would involve vehicle movements undertaking the following key activities:

- ▶ Initial site establishment, including installing temporary site facilities, construction compounds, concrete batching plant, access tracks and excavation of the foundations.
- ▶ Installation of the foundations for the wind turbines, including reinforced concrete gravity foundations and potentially rock anchors depending on the geological conditions and final engineering design. Concrete batching plants are proposed on-site and raw materials will be trucked in and stockpiled in certain areas as required.
- ▶ Construction of the electrical infrastructure including the powerline, substations (including transformers) and facilities buildings.
- ▶ Delivery of turbine components, their erection and commissioning.

2 Key Issues and their Assessment

The key traffic and transport implications from the proposal arise from additional vehicle volumes and over-dimensioned vehicles, approximately 344 vehicle movements per day (at the peak of construction), accessing the wind farm site from the public road network during the project's construction and operation phase.

These issues include:

- ▶ The suitability of the existing roads for the type of vehicles that will need to access the site. Aspects affecting suitability include overall width of roads, radius and clearance at bends in the road and the nature of existing traffic use.
- ▶ The structural capacity of existing roads and structures to handle the heavy vehicles for the delivery of turbine and transformer components.
- ▶ Disturbance to the local community as a result of increased vehicle movements.
- ▶ Management of traffic on and off the site including traffic safety, minimising disturbance to any environmentally sensitive areas, minimising erosion and dust.

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



Figure 2-1 Transport of wind turbine nacelle

The wind farm will be constructed during the following standard working hours and out of hours construction activities are not currently proposed.

Monday – Friday: 7am – 6pm

Saturday: 8am – 1pm

Sunday and public holidays: Not currently proposed

These standard hours of construction have been proposed to allow reasonable efficiencies of effort to achieve maximum productivity and to minimise the overall construction duration. However, some activities (including delivery

to site of major equipment, and turbine installation) may occur outside of these standard hours due to logistic, safety or weather related reasons. Likewise, the requirements of NSW Police or roads authorities may limit transport of major equipment to and from the site to outside of standard working hours.

Any construction activities outside of the standard construction hours will only be undertaken in the following circumstances;

- ▶ where construction activities that generate noise are within the NSW Interim Construction Noise Guidelines, or;
- ▶ for the delivery of material required outside those hours by the NSW Police Force or other authorities for safety reasons, or;
- ▶ where it is required in an emergency to avoid the loss of life, property and/or to prevent environmental harm;
- ▶ works as approved through the out-of-hours work protocol outlined in the Construction Noise and Vibration Management Plan as part of the Environmental Management Strategy.

3 Existing Conditions

3.1 RMS Roads

Wind turbine component delivery will be via Newcastle which is well connected to a road network that can accommodate high traffic volumes and over-dimensional loads. The Port of Newcastle is located within a large city and the surrounding road network has significant peak traffic flows. Deliveries will need to be timed to avoid the peak periods where possible.

The New England Highway and the Golden Highway, which will provide the main access route, have been constructed to a high standard and are expected to be suitable for the over-mass and over-dimensional vehicles needed for the construction of the wind farm.

The RMS is responsible for the main highways in NSW. The highways running to Cassilis are included in the RMS's asset register; however the local council is retained to carry out the maintenance on the highways in the vicinity of Cassilis and Coolah.

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. The RMS maintains an interactive traffic volume viewer with different recording locations in various years. The annual average daily traffic (AADT) for the following sections (RTA, 2016) are:

- ▶ 9,353 (2016) vehicles per day on the New England Highway near Muswellbrook
- ▶ 2,749 (2016) vehicles per day on the Golden Highway near Denman;
- ▶ 2,047 (2016) vehicles per day on the Golden Highway near Merriwa;
- ▶ 622 (2008) vehicles per day on the Golden Highway near Uarbry; and
- ▶ 573 (2011) vehicles per day on the Blackstump Way north of Coolah (not part of the proposed access route)

From the Golden Highway the delivery of wind farm infrastructure will turn onto Vinegaroy Rd which is a Regional road on the RMS asset register but maintained by local councils. For the main powerline, access will be via Ulan Rd.

3.2 Local Roads

After vehicles leave the RMS roads they will enter roads managed by either Upper Hunter Shire Council or Warrumbungles Shire Council for wind farm components and Mid-Western Shire Council for components relating to the main powerline.

Local Councils monitor traffic volumes on some local roads and the following figures were obtained from Upper Hunter Shire Council:

- ▶ 40 (2007) vehicles per day on Coolah Rd near intersection of Rotherwood Rd

As indicated by the above data there is a drop off in vehicle volumes as they move further from the New England Highway along the Golden Highway and become significantly lower along the primary routes chosen for wind farm construction as they are local roads compared to the more major thoroughfares monitored by the RMS.

Assuming all wind farm construction traffic enters the site along the primary routes described in Section 4.2, a daily increase of around 344 trips (during peak construction) would be attributed to wind farm traffic. During the operation phase, the predicted 30 vehicle movements per day are not significant as this equates to 3-4 vehicle movements per hour with light (4WD) vehicles.

4 Proposed Transport Route

4.1 Road transport via major road network

The majority of the wind turbine components will be manufactured overseas and delivered to a major Australian shipping port. The closet suitable port to the wind farm site is located at Newcastle. The preferred road transport route from the Port of Newcastle is via the New England Highway and the Golden Highway to the town Cassilis which is approximately 230km from Newcastle. Both of these highways are approved as heavy vehicle routes by the RMS and are suitable for over-mass and over-dimensional loads.



Figure 4-1 Major road transport route to Cassilis from Newcastle

Prior to construction a project specific Traffic Management Plan will be developed in consultation with local stakeholders (including the RMS and Councils) in accordance with regulations and to identify any specific timing and physical constraints on the transport route to the wind farm site.

It is possible that the tower sections for the turbines could be manufactured in Australia rather than delivered to a port by ship. The tower sections would be delivered by road transport following the same route via the New England Highway and the Golden Highway.

The route from port to Cassilis along the New England and Golden Highways is an approved RMS B-Double route and is suitably designed to accommodate over-dimensional and over-mass loads. Where the transport route leaves the Golden Highway on Vinegaroy Rd (Warrumbungle Way), the RMS B-Double route becomes an *'Approved Area with Conditions'* and any road upgrades required for the project will be updated with the local councils.

An upgrade to the Golden Highway in Denman was completed in 2016 removing an intersection with Crinoline St that would have required modification for the delivery of turbine components. The new section of highway now provides a gentle right-hand turn within the turning circle of a typical turbine blade vehicle.

The assessment of the route from port to Cassilis has found that the existing road design capacity is more than sufficient to accommodate the short-term construction impacts.



Figure 4-2 Golden Highway at Cassilis

4.2 Road transport via the local road network

The township of Cassilis is located approximately 1.5 km off the Golden Highway. The proposed route will not pass through Cassilis but will continue west on the Golden Highway past the Cassilis turn off for approximately 12km to the intersection with Vinegaroy Rd (also known as Warrumbungles Way). The access route follows Vinegaroy Rd in a northerly direction until turning on to local roads as described in Table 4-1 and Figure 4-3.

Table 4-1 - Over-dimensional and over-mass routes

Road	Purpose	Start - End	Length (m)	LGA
Vinegaroy Rd	Primary Access Route	Golden Hwy to Coolah Creek Road	31,850	Upper Hunter (UHSC) and Warrumbungles (WSC)
Coolah Rd	Access Point 8	Vinegaroy Rd to Access Point 8	4,010	UHSC
Rotherwood Rd	Access Points 10, 5, 6, 15 & 7	Vinegaroy Rd to Access Point 7	19,580	UHSC and WSC
Yarrowonga Rd	Access Point 14	Rotherwood Rd to Bounty Creek Rd	4,020	UHSC
Bounty Creek Rd	Access Point 14	Yarrowonga Rd to Access Point 14	740	UHSC
Turee Vale Rd	Access Point 12, 4, 3 & 2	Vinegaroy Rd to Access Point 2	13,030	WSC
Coolah Creek Rd	Access Point 11	Vinegaroy Rd to Pandora Rd	18,350	WSC
Cook Drive	Access Point 18	Coolah Creek Rd to Gundare Rd	1,090	WSC
Gundare Rd	Access Point 18	Cooks Dr to Access Point 18	4,660	WSC
Oakdale Rd	Access Point 17	Coolah Creek Rd to Access Point 17	1,620	WSC
Pandora Rd	Access Point 1	Coolah Creek Rd to Access Point 1	3,680	WSC
State Forest Rd	Access Point 13, 16 & 19-26	Coolah Creek Rd to Access Point 26	10,380	WSC
Ulan Rd	Access Point 32	Golden Highway to Access Point 32	29,500	Mid-Western Shire Council

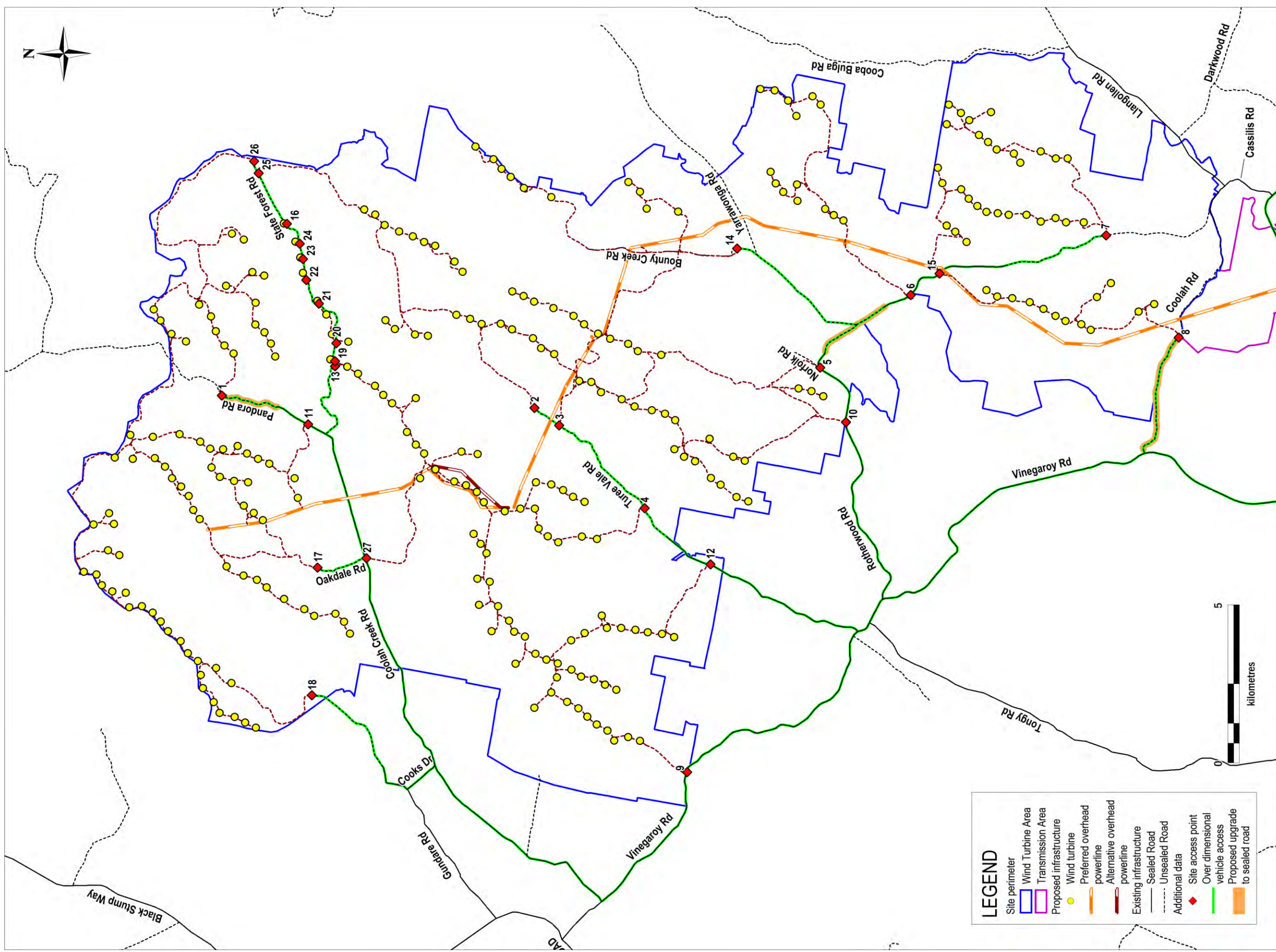


Figure 4-3 Wind Farm over-dimensional access route via local council roads

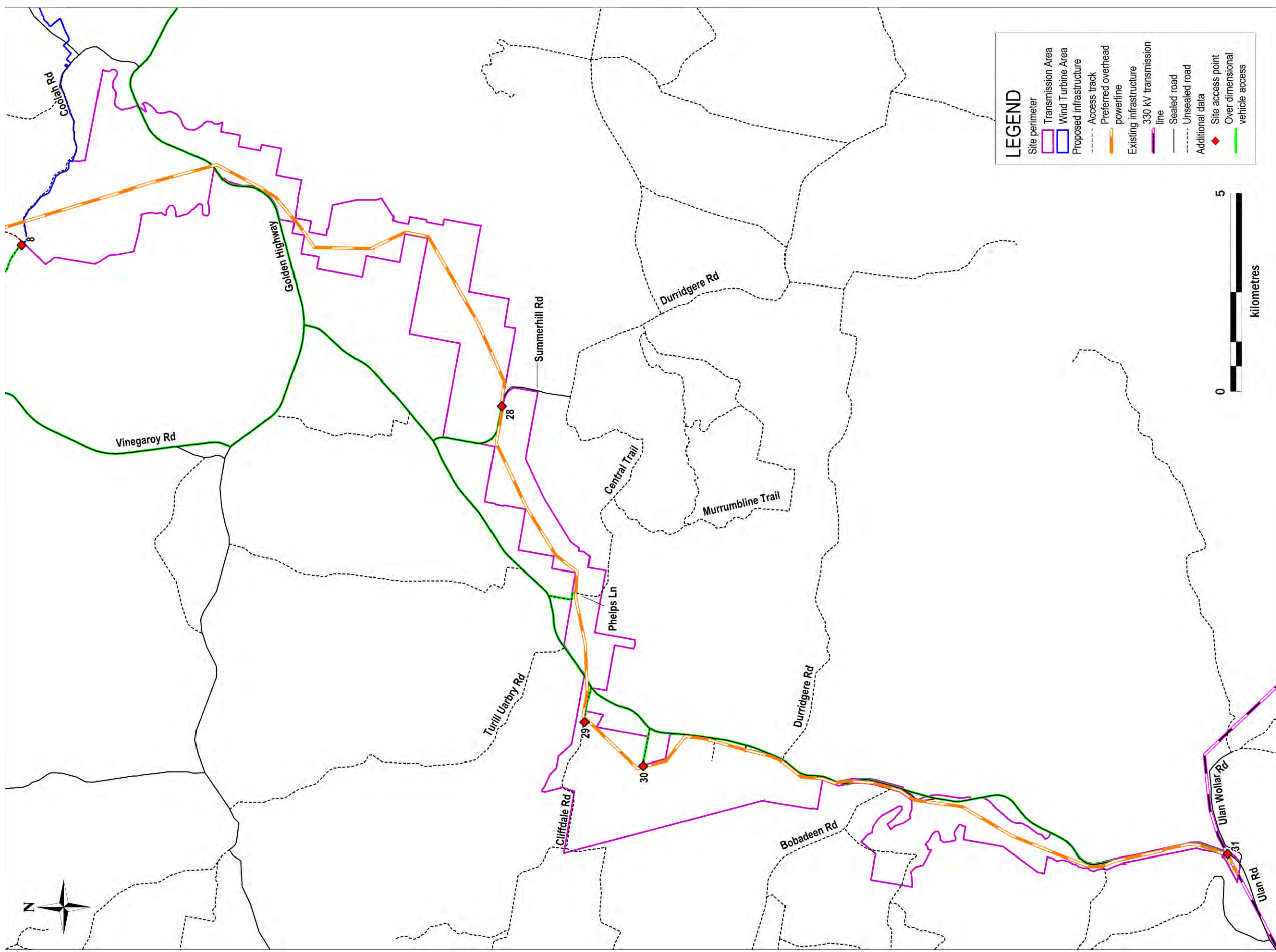


Figure 4-4 Transmission Area site access via local council roads

4.3 Access onto the site

The majority of primary access points will be from local roads directly on to private property of involved landowners. These roads are expected to have very few vehicle movements not related to the construction of the wind farm and their suitability has been assessed taking into consideration sight lines, speed limits and road surface. In total four site access points have been modified as a result of the recommendations of the assessment to ensure the safety of other road users. Refer to Figure 4-5 and Appendix 1 for the full details of the assessment. All measures outlined below to improve the safety of road users would be undertaken in consultation with the relevant road authority.

An additional site access point has been proposed since the project was on public exhibition. Access Point 9 is the only access proposed from Vinegaroy Rd and would reduce the number of vehicles required to use Turee Vale Rd. An assessment of the suitability of this access point has recommended it be relocated slightly to the west (70m) to improve sight lines and for a temporary speed restriction to be applied during construction.

Table 4-2 - Site access point suitability and proposed safety measures

Access Point	Road	Issues	Recommendation
Access Point 8	Coolah Rd	Sight distance inadequate for design speed limit of 100km/h.	Shift access point 70m east to improve sight distances. Conduct traffic monitoring to identify actual average speeds. Amend signposted speed for the duration of construction to 60km/h.
Access Point 6	Rotherwood Rd	Sight distance inadequate for design speed limit of 100km/h.	Shift access point 100m north-west to the existing crest to improve sight distances.
Access Point 9	Vinegaroy Rd	Sight distance inadequate for design speed limit of 100km/h.	Shift access point 70m west to improve sight distances. Conduct traffic monitoring to identify actual average speeds. Amend signposted speed for the duration of construction to 80km/h.
Access Point 1	Pandora Rd	Sight distance inadequate for design speed limit of 100km/h.	Conduct traffic monitoring to identify actual average speeds. Amend signposted speed for the duration of construction to 60km/h.

4.4 Access within the site

Access tracks to each of the wind turbine locations will generally be across open paddocks and be along the ridgelines that the turbines are located on. The location of the access tracks has been selected with consideration for existing environmental constraints and to minimise the overall length of tracks on the site.

The internal site access tracks are generally private roads and there will be no traffic impacts to the general public from vehicle movements within the site.

Empty delivery vehicles will exit the site via the same entry point. The Traffic Management Plan will address and avoid potential scheduling conflicts of vehicles entering and leaving the site. Provision will be made on site for an area that will allow for the turning of semi-trailers and oversized vehicles so no vehicles would need to reverse onto the public road network.



Figure 4-5 Example assessment of suitability of site access point 9

5 Predicted Traffic and Equipment Transport Requirements

The proposed development will generate significant additional traffic movement during the construction phase, approximately 344 vehicle movements per day (during peak construction), and a minimal increase over the operational phase of the project. The anticipated additional traffic type and volume is described in the following section.

5.1 Construction Traffic

Construction traffic will be generated by the delivery of equipment and materials as well as the construction workforce travelling to and from the site on a daily basis. The wind farm will be constructed during the following standard working hours and out of hours construction activities are not currently proposed.

Monday – Friday:	7am – 6pm
Saturday:	8am – 1pm
Sunday and public holidays:	Not currently proposed

The vehicles delivering the main crane, wind turbine components and transformer components will be over-dimensional, over-mass or both. These vehicles will require special operating permits to allow them to travel on public roads and the appropriately licensed haulage contractor will complete a detailed assessment for approval by the NSW Roads and Maritime Services (RMS) (formally the Roads and Traffic Authority) and local council prior to construction. Because of the high quality and suitability of the surrounding main roads, no difficulty in obtaining approval is envisaged. The delivery of these major components are planned to occur during standard working hours unless otherwise required by NSW Police or other authorities.

Over-dimensional vehicles are those over 19 m in length, 2.5 m in width and 4.3 m high and may require one or more escort vehicles to accompany them.

Over-mass vehicles are those with a gross mass in excess of 42.5 tonnes and will require a permit to use public roads.

On-site access tracks will generally be around 5 - 6 m wide, but will need to be wider at bends and intersections. The longest vehicles will be those delivering blades. Typically two blades are delivered in one load and oversized vehicles used to deliver turbine blades can be up to 50-60m long.

There are no turning bays required on public roads, though turning bays may be required within the project site. Placement of turning bays, if needed, will likely be at the end of dead-end on site access roads, and will be organised in consultation with the relevant landowner.

Table 5-1 Estimate of peak daily traffic volume

Construction Activities (Many occur concurrently)	Approximate Duration (Months)	Number of trips per day (one way)	Primary type of vehicle	Comments
Construction staff and management	36	235	Light	Assumes site employees travel in standard vehicles and buses
Site establishment and mobilisation	1	12	Light and Heavy	Initial access to site
Internal access track construction	19	74	Heavy	Heavy excavation
Foundation excavation and construction	19	77	Heavy	Using on-site batching plant with all materials delivered to site
Collection substations construction and commissioning	19	4	Heavy	Includes over-mass vehicles

Turbine erection	18	30	Heavy	Includes restricted-access vehicles
Grid connection substation and overhead powerline	18	7	Heavy	Overhead powerline constructed using single pole type structure
General construction and demobilisation	1	12	Light and Heavy	Site completion works

Table 5-1 summarises the predicted daily traffic volumes for each type of construction activity, however, the activities would not all be conducted at the same time so to work out the maximum daily traffic volumes the project schedule must be considered. Table 5-2 presents a program of works with associated traffic generation rates for the various vehicle types. The vehicle numbers represent the number of one-way trips per day. The return journey is included in order to produce total vehicle movements per day on the road network.

It has been assumed that concrete will be produced at the onsite batching plant and all material will be delivered to the site. The number of vehicle movements on local roads could therefore be reduced if suitable aggregate and water is found on site. It has also been assumed that 50% of the required road base would be sourced on site for the creation of new access tracks.

During construction the program of works schedule indicates a maximum of 344 construction vehicle movements per day on the primary access routes.

Table 5-2 Predicted program of works and traffic generation

Liverpool Range Wind Farm Indicative program of works Traffic volume and vehicle use predictions																															
Site activity	Number of turbines	Access roads / routes	Construction period												Predicted vehicle movements				Total movement days	Average vehicle movements per day											
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Semi trailer and large haulage truck	Concrete materials	Restricted access vehicle (RAV)	4WD and commercial vehicle			Total vehicle movements										
Preliminary																															
Site staff, supervision, management and admin																-	-	-	32,760	32,760	936	35									
Construction employees																-	-	156,000	156,000	780	200										
Construction - Wind Farm																															
56 Rotherwood Road and Coolah Road																10	10	5	55	80	30	3									
Site establishment and mobilisation																3,177	-	5	3,182	216	15										
Access tracks and civil excavation																129	3,177	-	3,306	216	15										
Turbine foundations																56	20	10	86	216	0										
Electrical reticulation and power lines																1,264	-	12	1,276	216	6										
Turbine delivery and erection																20	-	10	55	85	30										
General construction and demobilisation																															
63 Rotherwood Road and Bounty Creek Road																10	10	5	55	80	30	3									
Site establishment and mobilisation																3,574	-	5	3,579	216	17										
Access tracks and civil excavation																145	3,574	-	3,719	216	17										
Turbine foundations																63	20	10	93	216	0										
Electrical reticulation and power lines																1,422	-	12	1,434	216	7										
Turbine delivery and erection																20	-	10	55	85	30										
General construction and demobilisation																															
79 Access Point 9 and Turee Vale Road																10	10	5	75	100	30	3									
Site establishment and mobilisation																4,482	-	5	4,487	216	21										
Access tracks and civil excavation																182	4,482	-	4,664	216	22										
Turbine foundations																79	25	10	114	216	1										
Electrical reticulation and power lines																1,783	-	20	1,803	216	8										
Turbine delivery and erection																25	-	10	75	110	30										
General construction and demobilisation																															
84 Coolah Creek Road, Pandora Road, Cooks Road and Gundare Road																10	10	5	75	100	30	3									
Site establishment and mobilisation																4,766	-	5	4,771	216	22										
Access tracks and civil excavation																193	4,766	-	4,959	216	23										
Turbine foundations																84	25	10	119	216	1										
Electrical reticulation and power lines																1,896	-	20	1,916	216	9										
Turbine delivery and erection																25	-	10	75	110	30										
General construction and demobilisation																															
Grid Connection and Powerlines																															
Connection substation - 330kV																50	50	5	150	255	143	2									
Powerline - 330kV															200	200	200	150	750	143	5										
Total turbines	282	Total movements	47	266	268	304	316	344	333	302	283	253	244	48																	

5.2 Operational Traffic

A modern wind farm is designed to operate automatically and unmanned, but a small crew of technicians are based on the site during normal working hours (generally Monday to Friday) to carry out scheduled maintenance on the wind turbines. Unscheduled maintenance will be carried out by technicians, as required, both during and outside normal working hours. Operational staff will regularly visit all of the wind turbine locations on site using light weight service vans or utility vehicles. It is anticipated that operational requirements including scheduled and unscheduled maintenance will generate up to 30 trips per day on the nearby road network.

During operations the on-site access roads would only require minimal maintenance as generally only light weight maintenance vehicles and service vans would require access to the wind farm. The wind farm operator is responsible for the ongoing repair and maintenance of all on-site wind farm access roads during operations. Some access road reinstatement and maintenance works may be required prior to commencement of the wind farm decommissioning phase at the end of its operational life.



Figure 5-1 Wind turbine service van

6 Transport Impacts

6.1 General

The main impact of the proposed wind farm 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 the loads.

The amount of additional traffic generated by the wind farm will be negligible relative to the significant daily traffic volumes on the Golden Highway. Some minor disruptions may be caused by the passage of the oversize vehicles on the highway.

The additional traffic between Cassilis and Coolah has the potential to cause minor disturbance to local users. Further discussion with the local councils and the RMS will be required to finalise the project Traffic Management Plan once detailed transport requirements are known. It is a commitment of the Proponent to fund the necessary local road upgrade works attributed to the construction of the wind farm. These works will be funded by the Proponent which may be in the form of a voluntary planning agreement (or similar) as agreed with council.



Figure 6-1 Transport of turbine blades with escort vehicle



Figure 6-2 Transport of tower section on steep site access track

6.2 Suitability of Existing Road Layout

Prior to the commencement of the project a detailed route survey will be carried out by the transport contractor to ensure safe access and minimise potential impacts to other road users. If there is a need for any temporary modification of any road structures or furniture, then it will need to be discussed and agreed with the local Councils or the RMS as relevant and incorporated into the Traffic Management Plan.

Multiple access points to the wind farm site have been selected to achieve safe access and minimise community disruption during the construction stage as well as reducing the extent of local roads required for delivery of turbine components. Further planning and consultation with local Councils and the RMS 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 increased traffic during construction has the potential to exacerbate any areas of the road network that are showing signs of deterioration. Increased inspection and maintenance will need to be discussed and agreed with the local Council. Discussions are underway with the involved councils on any pre-construction road upgrades required for the wind farm, particularly in relation to the delivery of turbine components.

An initial visual assessment of bridges, culverts and causeway structures has been carried out by a structural engineer. Refer to Appendix 1 of this report for further details. The assessment noted that the use of the proposed access routes is feasible and recommended some additional assessments once the detailed transport requirements have been finalised. It is likely that minor upgrades to some of the structures will be required once the more detailed engineering assessments have been completed. Any upgrades to bridges, culverts or causeways will be undertaken to the appropriate standards for the anticipated weights and traffic volumes.

The major roads have been designed to cater for large over-mass vehicles, but some structures on local roads such as cattle grids may be impacted by the passage of the large construction vehicles. These structures may require monitoring and repair or replacement during the construction period to maintain serviceability for local users and construction traffic. A road dilapidation report will be prepared prior to the commencement of construction so any road damage attributable to the construction of the wind farm can be identified and repaired.

6.4 Road Upgrades

Where any local road upgrades are required as a result of the project, including intersection widening, pavement resurfacing and bridge strengthening, it will be undertaken prior to construction at the cost of the proponent and in consultation with the local councils.

6.4.1 Design Standards

Unless an alternative standard is agreed with the council prior to construction and depending on the availability of local material from local quarries, the Proponent has proposed the below design standards to be implemented on specific road sections where they are to be used for over-dimensional and over-mass construction traffic.

Unsealed roads to be sealed: 200 mm road base topped with double spray seal (14/7 double/double). 4.0 m seal and 6 m formation width.

Unsealed Roads: Construction width minimum 6 metres wide, maximum 8 metres wide. Pavement minimum thickness 100 mm on existing sheeted road.

Where separate roads have been identified for light vehicle operational traffic only, appropriate road conditions and safety measures will be agreed with councils and be implemented in advance of construction.

6.4.2 Road Maintenance

Unless otherwise agreed with the relevant councils the Proponent will be responsible for the costs of maintenance of any upgraded unsealed roads during the wind farm construction period. Where roads have been sealed prior to construction, the maintenance during construction and operation of the wind farm will be by the responsibility of the local Council.

The intention for the development is to provide the community with safe road network conditions during the construction period and to complete the project without damaging the existing road network.

6.4.3 Commitments

The proposed road upgrade commitments and design standards are based on the following assumptions:

- ▶ The proposed design standards and upgrades will only be implemented on the roads or road sections to be actually used for over-mass and over-dimensional construction traffic based on the final wind farm construction layout or staged development construction. Appropriate and adequate safety measures will be agreed with Councils prior to commencement on all access roads, including roads identified for normal light vehicle access only.
- ▶ The proposed road upgrades are based on the current anticipated traffic numbers and proposed access routes for constructing the wind farm. Should the final construction layout and design result in materially different construction traffic numbers or different routes to be considered, the Proponent and the council will negotiate in good faith appropriate alternative standards in conjunction with appropriate traffic management measures to ensure safe construction activities.
- ▶ The dimensions proposed are subject to on-site assessments to ensure there are no significant impacts on sensitive native vegetation within the road reserves or significant physical constructability constraints. Council and the Proponent will negotiate in good faith to agree on appropriate options to avoid or minimise significant impacts where this will be the case.
- ▶ The proposed upgrades are subject to the roads not being upgraded by council or a 3rd party prior to the Liverpool Range Wind Farm construction. The Proponent, in consultation with the councils, will undertake a final review of road conditions and suitability prior to construction to confirm road conditions and upgrade requirements based on the agreed design standards for each road.
- ▶ The Proponent will agree with councils on a suitable method for determining and capturing road conditions before and after upgrades, including how best to undertake any dilapidation report requirements that may be required under the development consent conditions.
- ▶ Any bridge or other structures to be upgraded will be assessed for suitability and upgraded as required to comply with the appropriate standards.
- ▶ These commitments will be reflected in the final Traffic Management Plan which will be developed in consultation with the road authorities prior to the commencement of any construction activities.

6.4.4 Existing road condition and proposed upgrades

Over-dimensional and over-mass construction access roads

The tables below provide a summary of the current road conditions and proposed upgrades for each section of road if they are to be used for over-dimensional and over-mass construction access roads. The Proponent will secure agreement with the respective councils on the final specific upgrade requirements prior to construction and ensure any upgrades are completed prior to substantial construction traffic on the respective roads.

Local Roads

<i>Section</i>	<i>Length (m)</i>	<i>Existing condition</i>	<i>Proposed Action</i>
<i>Coolah Road</i>			
Vinegaroy Rd to Access Point 8	4,010	Currently unsealed Condition: poor	To be sealed in accordance with proposed sealed standard to minimise dust to nearby residents. Creek crossings will require upgrading.
<i>Rotherwood Road</i>			
Vinegaroy Rd to Access Point 10	6,280	Currently sealed Condition: fair	Some sections will require widening and/or strengthening. Creek crossings will require upgrading.
Access Point 10 to Access point 5	2,190	Currently sealed Condition: fair	Some sections will require widening and/or strengthening.
Access point 5 to Yarrawonga Rd	580 1,380	Currently sealed Condition: fair Currently unsealed Condition: average	Some sections will require widening and/or strengthening. Unsealed section to be sealed in accordance with proposed sealed standard to join sealed sections on Rotherwood Rd.

<i>Section</i>	<i>Length (m)</i>	<i>Existing condition</i>	<i>Proposed Action</i>
Yarrowonga Rd to Access Point 6	1,040 890	Currently unsealed Currently sealed	Unsealed section to be sealed in accordance with proposed sealed standard to join sealed sections on Rotherwood Rd.
Access Point 6 to Access Point 15	1,255	Currently sealed	Some sections that will require widening and/or strengthening.
Access Point 15 to Access Point 7	2,210 3,730	Currently sealed Condition: average Currently unsealed Condition: poor	Some sealed sections will require widening and/or strengthening. Unsealed section to be upgraded in accordance with proposed unsealed standard. A number of causeways will need upgrading.
<i>Yarrowonga Road</i>			
Rotherwood Rd to Bounty Creek Rd	4,010	Currently unsealed Condition: fair	Upgrade as required to proposed unsealed standard.
<i>Bounty Creek Road</i>			
Yarrowonga Rd to Access Point 14	740	Currently unsealed Condition: fair	Upgrade as required to proposed unsealed standard.
<i>Turee Vale Road</i>			
Vinegaroy Rd to 6.54km	6,540	Currently sealed Condition: Poor	Road in poor condition and will require upgrading in most sections including widening and pavement strengthening. Creek crossings and causeways will also require upgrading.
6.54km to Access Point 2	6,490	Currently unsealed Condition: Poor	Road in poor condition and will require upgrading in most sections to the proposed unsealed standard. Creek crossings and causeways will also require upgrading.
<i>Coolah Creek Road</i>			
Vinegaroy Rd to Cooks Dr	7,090	Currently sealed Condition: Good	Road is in good condition. Some sections may require widening and pavement strengthening.
Cooks Dr to Oakdale Rd	7,190	Currently sealed Condition: Good	Road is in good condition. Some sections may require widening and pavement strengthening.
Oakdale Rd to Pandora Rd	4,150	Currently sealed Condition: Good	Road is in good condition. Some sections may require widening and pavement strengthening.
<i>Pandora Rd</i>			
Coolah Creek Rd to Access Point 1	1,770 1,880	Currently Sealed Condition: fair Currently unsealed Condition: average	Some sections may require widening and pavement strengthening. Causeway will require upgrading. Unsealed section to be sealed in accordance with design standard.
<i>Cooks Drive</i>			
Coolah Creek Rd to Gundare Rd	1,090	Currently sealed Condition: Poor	Road is in poor condition and will require upgrading including widening and pavement strengthening. The causeway may also require upgrading.
<i>Gundare Road</i>			
Cooks Dr to Access Point 18	1,170 3,480	Currently sealed Condition: average Currently unsealed Condition: average	Road is in average condition and some areas will require upgrading including widening and pavement strengthening. Creek crossings will also require upgrading.
<i>Oakdale Road</i>			
Coolah Creek Rd to Access Point 17	1,620	Currently unsealed	Road alignment acceptable, may require widening in some sections. Concrete causeway might need upgrading.
<i>State Forest Road</i>			
Coolah Creek Rd to Access Point 13	2,810	Currently unsealed Condition: Fair	Road width and alignment generally acceptable. Pavement strengthening may be required in some sections. Cattle grids will need to be relocated or diverted around.
Access Point 13 to Access Point 16	5,320	Currently unsealed Condition: Fair	Road width and alignment generally acceptable. Pavement strengthening may be required in some sections. Cattle grids will need to be relocated or

Section	Length (m)	Existing condition	Proposed Action
			diverted around.
Access Point 16 to Access Point 26	2,250	Currently unsealed Condition: Fair	Road width and alignment generally acceptable. Pavement strengthening may be required in some sections. Cattle grids will need to be relocated or diverted around.

Intersections

A number of intersections on the delivery route will require minor modifications to safely accommodate the over-dimensional vehicles and loads. The modifications will include local widening of the roads, temporary removal of road furniture and signs and trimming of vegetation within the road reserve. The suitability of a number of key intersections on the transport route has been assessed using a swept path analysis based on the longest turbine blade delivery vehicle. See Appendix B to this report for the swept path analysis for each of the intersections listed in the table below.

Table 6-1 Intersections utilised for site access

Road 1	Road 2	Comments
Golden Hwy	Vinegaroy Rd	Temporary widening of Golden Hwy within road reserve.
Vinegaroy Rd	Coolah Rd	Minor upgrade required within road reserve including widening and replacement of road signs.
Vinegaroy Rd	Rotherwood Rd	Intersection widening required to enable access for over-dimensional vehicles. An agreement with the neighbouring landowner may be required on a temporary basis.
Vinegaroy Rd	Turee Vale Rd	Temporary widening southern side of Turee Vale Rd.
Vinegaroy Rd	Coolah Creek Rd	Intersection widening required to enable access for over-dimensional vehicles. An agreement with the neighbouring landowner may be required on a temporary basis.
Coolah Creek Rd	Cook Drive	Intersection widening required to enable access for over-dimensional vehicles. An agreement with the neighbouring landowner may be required on a temporary basis.
Cook Drive	Gundare Rd	Intersection widening required to enable access for over-dimensional vehicles. An agreement with the neighbouring landowner may be required on a temporary basis.
Coolah Creek Rd	Oakdale Rd	Intersection widening required to enable access for over-dimensional vehicles. An agreement with the neighbouring landowner may be required on a temporary basis.
Coolah Creek Rd	State Forest Rd	Intersection widening required to enable access for over-dimensional vehicles. An agreement with the neighbouring landowner may be required on a temporary basis. Relocation of cattle grid and connecting fence will be required.
Rotherwood Rd	Yarrowonga Rd	Strengthening of intersection shoulders will be required. Widening of intersection will be required if northern approach is used.

6.5 Disturbance to Local Community

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

- ▶ movements of vehicles along the Golden Highway and to and from the site entry;
- ▶ increased frequency of vehicle movements on the surrounding roads to the wind farms that would otherwise have low traffic volumes; and

- ▶ potential safety risks arising from increased traffic movements.

The volume of construction traffic indicated in Table 5-1 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 the wind turbine blades may involve up to 6 oversize vehicles per day. Pouring concrete for a turbine foundation can involve around 50 one-way truck movements in a day depending on the location of the batching plant.

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. During construction the timing of vehicle movements will be mostly within the normal site working hours. Night time deliveries will be avoided wherever possible.

The oversize and over-mass vehicles are likely to travel at lower speeds than those normally used by local residents. Some delays may be experienced by local residents due to the nature of the vehicles being used to deliver materials to the site. Special consideration will be provided to routes that pass residential areas, schools, school bus routes and intersections in the transport Management Plan to schedule deliveries outside of peak or important times where possible. Consultation with local stakeholders will be undertaken prior to the finalisation and implementation of the Traffic Management Plan.

6.6 Road Safety

The Cassilis and Coolah townships generally have low accident rates. The 2015 statistics for the Cassilis and Coolah townships can be seen in Table 6-1 and the statistics for the Golden Highway in the local vicinity of the project can be seen in Table 6-2 (RTA, 2015).

Table 6-2 Accident rates near Coolah and Cassilis

Township	Fatal Crashes	Injury Crashes	Non Casualty Crashes	Total Crashes	Killed	Injured
Cassilis	0	1	0	1	0	1
Coolah	0	1	2	3	0	1

Table 6-3 Accident rates on the Golden Highway in Upper Hunter LGA

Fatal Crashes	Injury Crashes	Non Casualty Crashes	Total Crashes	Killed	Injured
0	3	7	10	0	4

The transport of large items of equipment on oversize and over-mass 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 frustrated by delays behind slow moving vehicles;
- ▶ normal traffic expectation by local road users not allowing for the presence of large vehicles; and
- ▶ an increase in traffic numbers on the roads.

These potential safety impacts will be minimised by the use of escort vehicles that will accompany the oversize and over-mass vehicles. The Traffic Management Plan will be used to control the movement of vehicles between Cassilis and the site.

7 Recommendations and Mitigation Measures

A number of measures will be incorporated during the construction and operation of the proposed wind farm to ensure that traffic and transport impacts arising from the development are managed and minimised. These measures will be incorporated into a Traffic Management Plan for the project and developed in consultation with the RMS and the local councils to ensure that applicable safety standards are achieved and disruption to local traffic is minimised.

An important mitigation measure during the construction period will be the implementation of a community information and awareness program. This will ensure that the local residents are fully aware of the planned construction activities and construction traffic. The program will include notices in the local newspapers, newsletters to local residents and regular updates via the project website.

Temporary signage will be erected during the construction period in consultation with the RMS and Councils to provide specific warning of construction traffic. Other mitigation measures will include:

- ▶ Use of a licensed and experienced haulage contractor, to be responsible for obtaining all necessary permits and approvals from the RMS and Councils and for complying with conditions of consents.
- ▶ Escorts for oversize and over-mass vehicles will be provided in accordance with RMS requirements.
- ▶ Development of a Traffic Management Plan that will identify detail actions such as scheduling of deliveries, managing timing of transport through major centres to avoid peak times (beginning / end of school), consultation activities during haulage activities, designing and implementing modifications to intersections and street furniture and managing the haulage process.
- ▶ Sealing sections of the over dimensional access route, as described in Section 6.4 to minimise dust disturbance to nearby residents.
- ▶ Improvements to any public roads impacted by the project in consultation with the RMS & Councils. The improvements may include upgrades to the intersection at the site entrance, provision of entry/exit lanes and upgrades to gates and cattle grids.
- ▶ Re-instating pre-existing conditions after temporary modifications, if required.
- ▶ Providing a 24hr telephone contact during construction to enable any issue or concern to be rapidly identified and addressed.
- ▶ Prepare a road dilapidation report prior to the commencement of construction and following completion of construction to determine any damage attributable to the project. Any damage would be repaired by the Proponent.
- ▶ Should deterioration of roads occur during construction activities, an inspection and maintenance program would be established, if required by the Council.
- ▶ Implementation of appropriate erosion and sediment control measures for new access tracks within the site.
- ▶ Implementation of appropriate dust control measures for unsealed tracks within the site.

8 Conclusion

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

During the construction phase there is potential for temporary impacts on the local traffic. The construction phase is expected to last for approximately up to 36 months. In particular the delivery of the over-mass and oversize wind turbine equipment components 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 and safety and protection measures will be implemented to reduce the risks of accidents to an acceptable level.

The proposed access route to site via the New England Highway, Golden Highway and Vinegaroy Road together with the mitigation measures proposed in this report will minimise the impact of traffic impacts during the construction phase and ensure that the road network can be maintained to a satisfactory standard. Considering the high quality of the access roads to the site and the mitigation proposed, likely traffic impacts are considered acceptable and manageable.

A Traffic Management Plan developed and implemented in consultation with the RMS and Councils will ensure that any traffic and transport issues arising as a result of the project are appropriately addressed and have minimal impact on the local community and the local environment.

9 References

RMS (2016) "Traffic Volume Viewer" Roads and Maritime. Retrieved November 2016, from

<http://www.rms.nsw.gov.au/about/corporate-publications/statistics/traffic-volumes/aadt-map/index.html#/?z=6>

Appendix 1 - Transport Route Assessment



Liverpool Range Wind Farm

Transport Route Assessment

Revision History

<i>REV.</i>	<i>DESCRIPTION</i>	<i>PREPARED</i>	<i>CHECKED</i>	<i>APPROVED</i>	<i>DATE</i>
A	Draft Report	MG/ZB	CK	-	23/12/2017
0	Report	MG	ZB	-	13/01/2017
1	Report with minor changes	MG	ZB	CK	17/01/2017
2	Updated for received comments and to include site entry assessments	MG	ZB	CK	31/01/2017

Document Control

Checked signature: Approved signature:

TABLE OF CONTENTS

1	PURPOSE AND SCOPE	3
1.1	BACKGROUND	3
1.2	PURPOSE	3
1.3	SCOPE	3
2	SITE VISIT	3
3	DESIGN VEHICLES	4
4	EXTERNAL INTERSECTION ASSESSMENTS	5
4.1	M002 – GOLDEN HIGHWAY/VINEGARROY ROAD	5
4.2	M003 – VINEGARROY RD – COOLAH RD	8
4.3	M004 – VINEGARROY RD – ROTHERWOOD RD	10
4.4	M005 – VINEGARROY RD - TUREE VALE RD	13
4.5	M006 – VINEGARROY RD – COOLAH CREEK RD	15
4.6	M007 – COOLAH CREEK RD – COOKS DRIVE	18
4.7	M008 – COOKS RD – GUNDARE RD	20
4.8	M009 – COOLAH CREEK RD – OAKDALE RD	22
4.9	M010 – COOLAH CREEK RD – STATE FOREST RD – PANDORA RD	24
4.10	M011 – COOLAH RD – ROTHERWOOD RD	26
4.11	M012 – ROTHERWOOD RD – YARRAWONGA RD	28
4.12	M013 – ROTHERWOOD RD INTO YARRAWONGA RD	28
5	SITE ENTRY LOCATIONS	30
6	CULVERT AND WATERWAY CROSSING ASSESSMENT	32
	APPENDIX 1 – DRAWINGS	33
	APPENDIX 2 – DRAINAGE STRUCTURES	34

1 PURPOSE AND SCOPE

1.1 BACKGROUND

Epuron are developing a 282 turbine wind farm named Liverpool Range Wind Farm (LRWF) near the townships of Coolah and Cassilis in New South Wales, Australia. Epuron have engaged ZEM Energy Pty Ltd (ZEM) to assess the local road network, namely the intersections, site entry locations and waterway crossings, around the site.

1.2 PURPOSE

The purpose of this assessment is to examine, with respect to over dimensional loads, the suitability of the existing intersections and waterway crossings along the routes proposed by Epuron and assist Epuron in identifying significant issues, risks and possible solutions.

1.3 SCOPE

To undertake the abovementioned assessment, Epuron engaged ZEM to:

- Carry out a desktop review of the routes,
- Conduct a site visit to gather the required information to make the assessment,
- Model the swept path of over dimensional vehicles through the nominated intersections; and
- Provide a Structural Engineers assessment of the waterway crossings
- Suitability of the site entry locations

ZEM in turn engaged iCubed Consulting to provide the structural engineering component of the work.

2 SITE VISIT

In December 2016, representatives of ZEM conducted a site visit to the area.

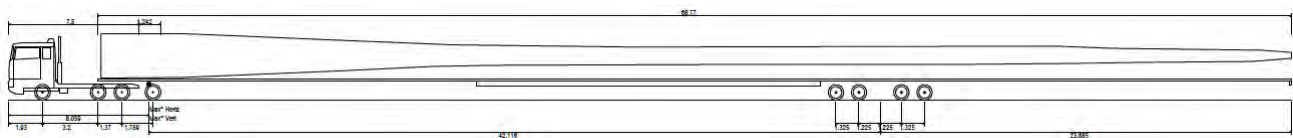
Selected routes were driven and assessed from locations accessible by car. No private property was accessed during the site visit.

12 intersections, a section of road and 258 waterway crossings were inspected.

3 DESIGN VEHICLES

Specialised transport equipment is used for the delivery of wind turbine components. The final details of the wind turbine to be adopted for the LRWF is not known at this time, however, there is a trend by the industry for larger diameter rotors up to 140m. Taking into consideration the size of the blade attachment hub, such a turbine if used, would comprise three blades, approximately 69m in length and a mass of approximately 18 tonnes, (inclusive of transport frames). It is noted that the proposal has sought approval of blades up to 65m in length only. The heaviest component loads for the project would be either the nacelle which is approximately 13m long with a mass of approximately 120 tonnes, or the substation main transformer, which would likely be of a similar size and mass.

Typically, the intersection geometry will be controlled by the blade trailers. This vehicle is depicted below in Figure 3.1 and comprises a Prime Mover, Dolly and Steerable Jinker.

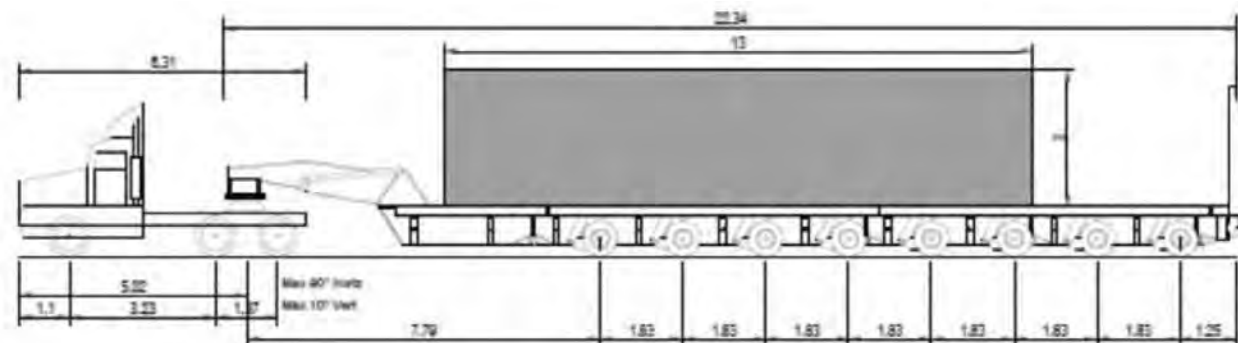


69 m Blade Truck and Trailer (With Dolly)	
Overall Length	73.860m
Overall Width	2.591m
Overall Body Height	3.628m
Min Body Ground Clearance	0.348m
Max Track Width	2.591m
Lock-to-lock time	6.00s
Max Steering Angle (Virtual)	30.00°

Figure 3.1 – Typical blade trailer arrangement

This design vehicle has been used to evaluate the intersection requirements at a number of locations indicated in table 3. The structural capacity of the bridge and culverts will be controlled by the heaviest component loads and the final configuration of the Heavy Load Platform (HLP), of which there are a number of options. The HLP will comprise 4 dual tyres per axle and an axle spacing of 1.8m. The final row, (or axle), configuration will depend upon the equipment used and the approved maximum load per axle, (typically 18 tonnes). The vehicle is indicated below in Figure 3.2 and comprises a Prime Mover and Steerable 8 Row Float.

Figure 3.2 – Typical nacelle trailer arrangement



Overall Length		20.34m
Overall Width		2.591m
Overall Body Height		3.628m
Min Body Ground Clearance		0.348m
Max Track Width		2.591m
Lock-to-lock time		6.00s
Max Steering Angle		30.00°

The steerable axles used in this configuration result in a tighter swept path than the configuration depicted in Figure 3.1. Care will need to be taken when traversing drainage causeways with small

vertical curves as they can consume all of the available suspension travel and cause the trailer to bend. Geometric checks on all causeways will need to be completed, prior to finalising the transport route to avoid this potential problem.

4 EXTERNAL INTERSECTION ASSESSMENTS

Manoeuvring assessment for the Typical Blade Transport Vehicle indicated in Figure 2.1 has been completed at a number of intersections and tight bends along the transport route advised by Epuron and presented in the following sections 4.1 to 4.12. Also included are photographic records of each intersection. Plan drawings for each assessed location have been provided in Appendix 1 of this report and have been completed using the following methodology;

- Obtain Aerial Photography of Intersection Location
- Confirm Intersection Scale using site measurement of Pavement Width
- Complete Swept Path Analysis using AutoDesk, Vehicle Tracking

It is apparent that at number of locations the swept path of the blade body and / or blade tip will require a number of alterations to the existing council roads and other infrastructure to enable the required manoeuvre to be made. Alterations may include;

- Local widening of pavement wearing course
- Temporary removal/relocation of street furniture
- Relocation of electrical poles and stays
- Removal/trimming of vegetation
- Removal of fences

At a number of locations, it is also apparent that the manoeuvres will encroach private property. Provision of a temporary easement or licence area will be required to complete this manoeuvre. Readily available cadastral data on boundaries in the region, (<http://globe.six.nsw.gov.au/kml/nswglobe.kml>) does not align particularly well with the aerial photography. It is recommended that all intersections be surveyed by a Cadastral Surveyor to confirm the position of all features, levels and boundaries such that appropriate agreements can be made with the affected land owners.

4.1 M002 – GOLDEN HIGHWAY/VINEGARROY ROAD

Description: Sealed T-intersection. Right turn into Vinegaroy Rd required. Road signs are present in the wide road reserve.

Issue/s: As shown in drawing M002, the intersection lacks adequate turning space for the over dimensional vehicles.

Recommendation: Temporary widening of the Golden Highway as shown by the swept path. Typically this would involve an unsealed shoulder that is trafficable for the blade trailer configuration.



Figure 4.1.1 – View to South from Vinegaroy Road



Figure 4.1.2 – View to West towards Golden Highway



Figure 4.1.3 – View to East towards Golden Highway

4.2 M003 – VINEGARROY RD – COOLAH RD

Description: Sealed T-intersection. Right turn into Coolah Road. Spray sealed pavement with road signage and vegetation in the road reserve.

Issue: As shown in M003, the intersection lacks adequate turning space for the over dimensional vehicles. A single road sign along with vegetation exists inside the illustrated swept path.

Recommendation: Clearing, sign replacement and intersection widening works will be required to facilitate blade trailer access. The extent of the road reserve should also be confirmed by way of a cadastral survey.



Figure 4.2.1 – View to South towards Vinegaroy Road



Figure 4.2.2 – View to North towards Vinegaroy Road



Figure 4.2.3 – View perpendicular to intersection towards Coolah Road



Figure 4.2.4 – View to West from Coolah Road

4.3 M004 – VINEGARROY RD – ROTHERWOOD RD

Description: Sharp right hand turn from Vinegaroy Rd into Rotherwood Rd. Both roads are sealed.

Issue: As shown in M004, the intersection lacks adequate turning space for the over dimensional vehicles. Road signs and private property boundaries are within the swept path.

Recommendation: Confirm cadastral boundaries by cadastral survey. It may be possible to avoid private property leasing or acquisition by utilising the road reserve area to the north of the intersection, it appears to be considerably wider than the southern approach.



Figure 4.3.1 – View perpendicular to intersection towards Rotherwood Road



Figure 4.3.2 – View to South towards Vinegaroy Road



Figure 4.3.3 – View to West from Rotherwood Road



Figure 4.3.4 – View to North-West towards Vinegaroy Road

4.4 M005 – VINEGARROY RD - TUREE VALE RD

Description: Right hand turn from Vinegaroy Rd into Turee Vale Road

Issue: As shown in M005, the intersection lacks adequate turning space for the over dimensional vehicles on the south side of Turee Vale Rd. The swept path analysis also suggests impacts on vegetation for blade overhang on the western side of Vinegaroy Rd.

Recommendation: Temporary widening on the southern side of Turee Vale Rd and selective vegetation clearing on the western side of Vinegaroy rd.



Figure 4.4.1 – View to South towards Vinegaroy



Figure 4.4.2 – View perpendicular of intersection towards Turee Vale Road



Figure 4.4.3 – View to North-West towards Vinegaroy Road

4.5 M006 – VINEGARROY RD – COOLAH CREEK RD

Description: Right hand turn from the sealed Vinegaroy Rd into the sealed Coolah Creek Rd.

Issue: The intersection and road reserve lacks adequate turning space for the over dimensional vehicles. Vegetation removal and private land is shown inside the swept path.

Recommendation: The wheel swept path and blade tip overhang both pass into private propert. A cadastral survey of the intersection and the road is recommended to allow for detailed assessment and design. As a minimum, intersection widening and minor vegetation clearance will be required.



Figure 4.5.1 – View to South-West from Coolah Creek Road



Figure 4.5.2 – View North-West towards Vinegaroy Road



Figure 4.5.3 – View to South-East towards Vinegaroy Road



Figure 4.5.4 – View to South-East towards Vinegaroy Road



Figure 4.5.5 – View perpendicular to intersection towards Coolah Creek Drive

4.6 M007 – COOLAH CREEK RD – COOKS DRIVE

Description: Very sharp left turn from Coolah Creek Rd into Cooks Dr. Both roads and the intersection are sealed pavements.

Issue: The width of both roads and also the intersection results in a swept path with a considerable footprint. The swept path is well beyond the existing road and consists of grassed road reserve.

Recommendation: Whilst this intersection cannot be avoided, it is recommended that only the southern approach to this intersection be used and upgraded to facilitate the right hand turn.



Figure 4.6.1 – View North-East towards Coolah Creek Road



Figure 4.6.2 – View South-West towards Coolah Creek Road



Figure 4.6.3 – View perpendicular to intersection towards Cooks Drive

4.7 M008 – COOKS RD – GUNDARE RD

Description: Right turn from Cooks Dr into Gundare Rd. Both sealed roads.

Issue: Intersection lacks adequate turning space for the over dimensional vehicles. Road reserve is narrow with the swept path analysis extending into private property either side of Cooks Dr.

Recommendation: Cadastral survey of the intersection and the road is also recommended to allow for detailed assessment and design. Widening of the inside of the intersection is expected to extend into private property, however the cadastral survey will give an accurate indication of much land will be required.



Figure 4.7.1 – View perpendicular to intersection towards Cooks Drive



Figure 4.7.2 – View South-West towards Gundare Road



Figure 4.7.3 – View North-East towards Gundare Road

4.8 M009 – COOLAH CREEK RD – OAKDALE RD

Description: Left turn from the sealed Coolah Creek Rd into narrower unsealed Oakdale Rd.

Issue: Intersection inadequate for turn. The swept path and blade over hang extends into private property either side of Coolah Creek Rd.

Recommendation: As well as land acquisition/leasing and widening will be required here. Cadastral survey of the intersection and the road is recommended to allow for detailed assessment and design.



Figure 4.8.1 – View to North-East towards Coolah Creek Road



Figure 4.8.2 – View perpendicular to intersection towards Oakland Road



Figure 4.8.3 – View to South-West towards Coolah Creek Road

4.9 M010 – COOLAH CREEK RD – STATE FOREST RD – PANDORA RD

Description: Sharp right hand turn from Coolah Creek Rd into State Forest Rd.

Issue: Intersection width is inadequate for an over dimensional turn. The sharp right hand turn is inadequate for the blade trailer. A fence line and a cattle grid is present and will be impacted.

Recommendation: Intersection widening on the southern side of the intersection will be required. Relocation of the cattle grid and connecting fence will also be required.



Figure 4.9.1 – View South-East towards State Forest Road



Figure 4.9.2 – View to South-West towards Coolah Creek Road

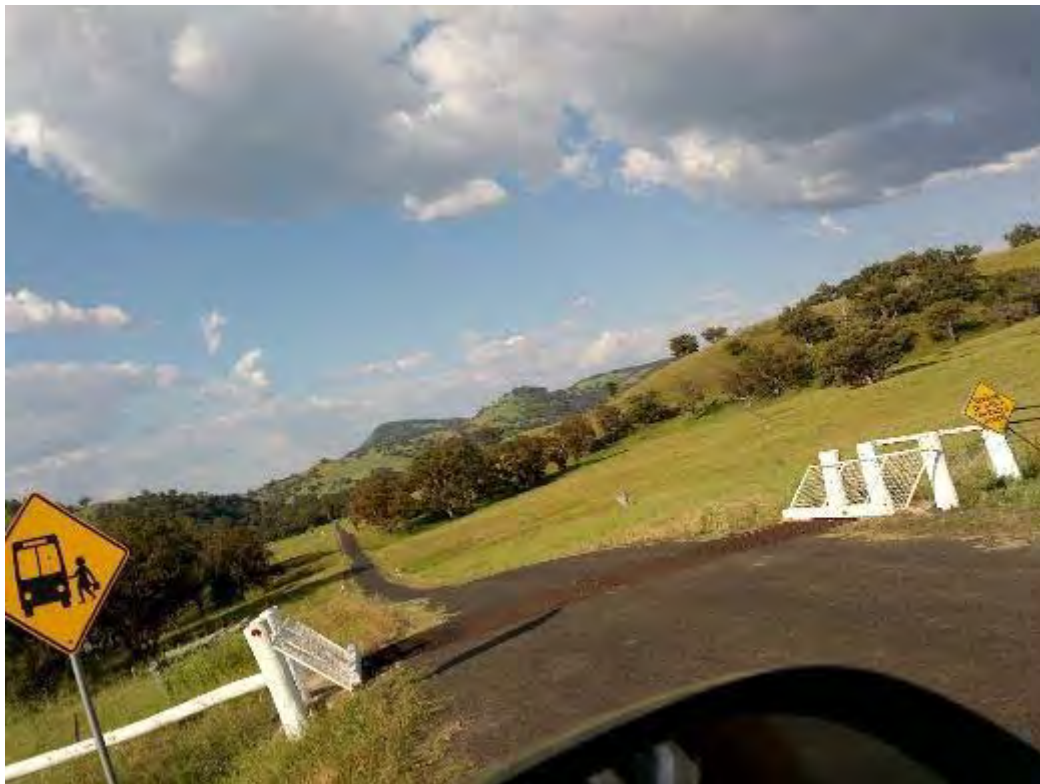


Figure 4.9.3 – View to North towards Pandora Road

4.10 M011 – COOLAH RD – ROTHERWOOD RD

Description: Left turn from the sealed Coolah rd into the unsealed Rotherwood Rd

Issue: Sharp left hand turn that encroaches private property, the associated fencelines, significant vegetation and an existing cattle grid.

Recommendation: A substantial amount of work and approvals will be required to upgrade this intersection. A cadastral survey is required to identify the extent of the public road reserve and facilitate design.



Figure 4.10.1 – View to East towards Coolah Road



Figure 4.10.2 – View to West towards Coolah Road



Figure 4.10.3 – View North-West towards Rotherwood Road

4.11 M012 – ROTHERWOOD RD – YARRAWONGA RD

Description: Unsealed right hand turn from Rotherwood Rd into Yarrawonga Rd.

Issue: Turn geometry just suitable for the blade trailer. Possible impact on loose/soft unsealed shoulders. Blade over tip will over hang the intersection.

Recommendation: Assess the shoulders of the intersection for strength, potholing and subgrade strength testing or load testing prior to deliver to confirm suitability. Recommended to be completed immediately after a rain event. The widening required to facilitate the turn shown and discussed as M013 will more than accommodate this turn.



Figure 4.11.1 – View to North-West of Rotherwood Road from Rotherwood Road

4.12 M013 – ROTHERWOOD RD INTO YARRAWONGA RD

Description: Sharp left hand turn from Rotherwood Rd into Yarrawonga Rd. Both roads are unsealed.

Issue: Turn geometry unsuitable for the blade trailer. Swept path analysis shows the swept path encroaching onto private land adjacent to the road reserve. As well as the blade tip over hang encroaching into the private land to the south of the intersection.

Recommendation: If feasible, restrict over dimensional vehicles from turning left here. Access from the southern approach of Rotherwood Rd is preferable. If it is not feasible, widening the intersection into private property will be required.



Figure 4.12.1 – View to North-East towards Yarrawonga Road from Rotherwood Road

5 SITE ENTRY LOCATIONS

Similar to the manoeuvring assessment for the external intersections, an assessment of the proposed Site Entry Locations was undertaken.

The typical blade transport vehicle illustrated in Figure 2.1 was used to assess the location for suitability. Plan drawings for each assessed location have been provided in Appendix 1 of this report and have been completed using the following methodology;

- Obtain aerial imagery of site entry location
- Confirm scale using site measurement of pavement width
- Complete Swept Path Analysis using AutoDesk Vehicle Tracking

The assessment is limited to extent of the aerial and topographical information available.

Table 5.1 summarises the assessment and recommendations for each site entry location. Referenced drawings can be found in Appendix 1.

Table 5.1 – Site entry assessment summary

Site Entry (Drawing Ref)	Issues	Recommendation
Coolah Rd (M020)	Sight distance inadequate for design speed limit of 100km/hr. Blade overhang extends over existing fence line and into existing vegetation.	Shift the entry point west to improve sight distance, Refer LRWF-C-M040. Conduct traffic monitoring to identify actual average speeds. Amend signposted speed for the duration of construction to 60km/hr (in Consultation with the relevant Road Authority) Consultation with the relevant Road Authority to determine the suitability of the entry point for operational traffic. Selective vegetation trimming Further assessment of the height of the existing fence line.
Rotherwood Rd 1 (M021)	Nil.	Proceed with development of the site entry location.
Rotherwood Rd 2 (M022)	Nil.	Proceed with development of the site entry location.
Rotherwood Rd 3 (M023)	Sight distance inadequate for design speed limit of 100km/hr.	Shift the entry point west to the existing crest to improve sight distance, Refer LRWF-C-M041.
Rotherwood Rd 4 (M024)	Blade overhang extends over existing fence line, a grid/gate structure and into existing vegetation.	Trimming/clearing of affected vegetation. Relocation of fences, grids and gates as required.

Site Entry (Drawing Ref)	Issues	Recommendation
Vinegory Rd (M025)	Sight distance inadequate for design speed limit of 100km/hr.	Shift the entry point west to improve sight distance, Refer LRWF-C-M042. Conduct traffic monitoring to identify actual average speeds. Amend signposted speed for the duration of construction to 80km/hr (in Consultation with the relevant Road Authority) Consultation with the relevant Road Authority to determine the suitability of the entry point for operational traffic.
Turee Vale Rd 1 (M026)	Nil.	Proceed with development of the site entry location.
Turee Vale Rd 2 (M027)	Blade overhang extends over existing fence line, a grid/gate structure and into existing vegetation.	Trimming/clearing of affected vegetation. Relocation of fences, grids and gates as required.
Turee Vale Rd 3 (M028)	Nil.	Proceed with development of the site entry location.
Turee Vale Rd 4 (M029)	Nil.	Proceed with development of the site entry location.
Coolah Creek Rd 1 (M030)	Nil.	Proceed with development of the site entry location.
Coolah Creek Rd 2 (M031)	Sight distance inadequate for design speed limit of 100km/hr.	Conduct traffic monitoring to identify actual average speeds. Amend signposted speed for the duration of construction to 60km/hr (in Consultation with the relevant Road Authority) Consultation with the relevant Road Authority to determine the suitability of the entry point for operational traffic.
State Forest Rd (M032)	Nil.	Proceed with development of the site entry location.

6 CULVERT AND WATERWAY CROSSING ASSESSMENT

At all the investigated roads and intersections covered in the previous sections of this report, additional investigations were conducted at every culvert/water way crossing of the roads.

The location of the drainage structure was recorded using a hand held GPS and photos of the structure recorded. The location was then added into google earth for the purpose of illustrating the location.

Appendix 2 provides the photos graphs and illustrated locations.