10.2 Communication Impacts

10.2.1 Background

Wind turbines have the potential to interfere with television and radio broadcasting, mobile phone reception, microwave links and other radio links such as mobile and CB radio. There are three mechanisms by which wind turbines may cause interference: reflection or scattering, diffraction and near field effects.

- Reflection or scattering – occurs when a signal becomes obstructed between the transmitter and a receiver, this could be due to a tower or moving blade component as shown in Figure 10-5.
- Diffraction – occurs when a signal is both absorbed and reflected by an object in the signal path.
- Near field effects – are caused by electromagnetic fields. This is no longer an issue due to advances in wind turbine technology and compliance with Electromagnetic Emission Standards.

A communication impact assessment report was prepared by Epuron. The objectives of this investigation were to identify the potential for impacts from the proposed White Rock Wind Farm on existing telecommunications services in the vicinity of the project, and to identify appropriate mitigation strategies for potential impacts. The full investigation including a glossary of acronyms used in the investigation, maps, footnotes and references is presented in Appendix 6.

The following approach was adopted to identify the potential impact of the project on telecommunications:

- Identify holders of telecommunications licenses (under the Radiocommunications Act 1992) within a 25km radius of the project, as well as point-to-point links in the vicinity of the project, using information provided on the Australian Communications and Media Authority (ACMA) RADCOM database.
- Provide written notification of the project and seek comments from each license holder identified via the ACMA RADCOM database search.
- Record and review all responses received to identify any issues raised by license holders.
- Discuss issues raised with relevant license holders with the aim to resolve or identify mitigation options.
- Carry out an assessment of the "Fresnel zone" associated with each fixed point-to-point communications link in the vicinity of the project.
- Determine appropriate 'exclusion zones' for the proposed turbine layout based on these calculations and advice from license holders.
- Confirm that all turbines (including blades) are located outside the 'exclusion zone'.
- Determine appropriate additional mitigation measures which may be required.

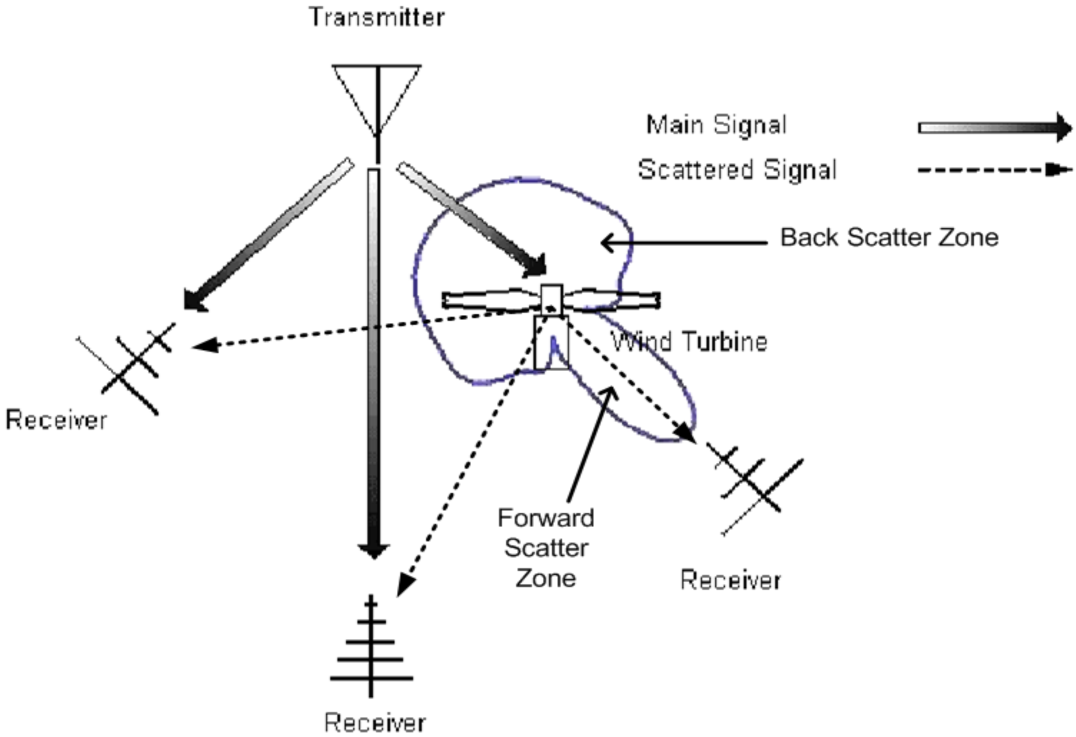

Figure 10-5 Scattering of a signal from a wind turbine

10.2.2 Existing Environment

The potential impacts of the proposed White Rock Wind Farm on the four most commonly used telecommunications services have been investigated separately and are summarised below.

These services include:

- Television and radio broadcast services
- Mobile phone services
- Radio communication services

Television Broadcast

There are four television transmitters in the vicinity of the wind farm that transmit at a range of power levels. They are located at:

- Carpenters Hill, about 4 kilometres north west of Glen Innes;
- Mt Dowe (Mt Kaputar), near Narrabri;
- Inverell; and
- Armidale.

Television Interference (TVI) is dependent on a range of factors including: existing environment factors (topography, direct signal strength, transmitter type, and receiver type) and wind farm design factors (turbine elevation, rotor size and orientation, speed of rotation, blade material and pitch). Due to the variability of local conditions and the characteristics of antennae used in particular installations, there is a degree of uncertainty regarding predicted levels of interference.

A Kordia report commissioned by the Long Gully Wind Farm in New Zealand stated that analogue television would be the most likely transmission service to experience interference from a wind farm development, although only within a limited distance. Very High Frequency (VHF) TV reception at dwellings within approximately 1 km of an installed wind turbines would have some probability of noticeable “ghosting” at times (Kordia, 2009).

Digital TV is not susceptible to visible "ghosting" degradation (Kordia, 2009). For any confirmed wind farm interference problems where TV antenna system improvements are unsuccessful, the use of the digital TV services in the area may be the best solution, requiring the provision of a digital set top converter. The Glen Innes region is also due to cease transmitting analogue TV from the second half of 2012. From this point, digital TV will be the only broadcast option in the region.

It is difficult to assess the likely impact on specific house locations. During the operational phase of the project it is possible that television reception could be affected at some of these locations unless some form of mitigation is introduced. The International Telecommunications Union Recommendation ITU-R BT.805 states that impacts beyond 5 kilometres are unlikely. (ITU, 1997)

Satellite based television services are also received at various locations throughout the area. These services are not subject to the same topographic screening that can affect the land based TV transmissions. Due to the distance of residences from the wind farm it is very unlikely that satellite based television services would be subject to interference due to the wind farm's operation as the wind turbine would have to be within the line of sight from the antenna to the satellite.

Radio Broadcast

The level of radio broadcast interference experienced can be influenced by a variety of factors including abnormal weather conditions, multi-path distortion (reception of a signal directly from a transmitter and also a reflected signal from hills, structures etc.), overloading (when an FM receiver receives too strong a signal) and electrical interference.

The ACMA authorises licenses to operate radio communications devices such as transmitters and receivers. In effect they are licenses to use specific segments of the radio frequency spectrum. On their RADCOM database ACMA list the following broadcasters for radio under post code 2370, Glen Innes NSW:

- Deepwater RA1: 2CBD
- Inverell RA1: 2ABCRN, 2ABCRR, 2GEM, 2GL, 2NZ, 2PNN
- Remote Commercial Radio Service North East Zone RA1: 2ABCRN, 2ABCRR, 2ABCRN, 4ABCRR, 4BRZ, 4JK, 4QCC, 4RBL, 4TI, 4WP and ABC.

Potential wind farm impacts on FM radio are highly unlikely and therefore the stations serving the area have not been listed.

At the time of writing, no other concerns had been raised from the license holders contacted regarding possible impacts to television or radio broadcasting services. The Proponent will work with organisations to resolve issues, should any be identified.

Mobile phone services

A mobile phone network consists of a system of adjoining zones called 'cells', which vary in size with a radius of 2 - 10 km. Each cell has its own base station that sends and receives radio signals throughout its specified zone. Mobile phone antennas need to be mounted clear of surrounding obstructions such as buildings to reduce 'dead spots' and allow the base station to effectively cover its intended cells.

Mobile phone coverage is available in much of the area around Glen Innes but is patchy further away from Glen Innes and the main highways and where topography limits coverage. Mobile phone coverage is particularly poor in locations west of the Waterloo Range and to the west of the White Rock wind farm site.

In view of the separation distance between the base antennas and turbine structures and the wind farm location relative to areas of existing coverage, transmission of mobile phone signals is not expected to be affected by the wind farm.

There is no 3G coverage in the vicinity of the project area.

Radio Communications

The ACMA issues radio communications licenses in accordance with Part 3.5 of the Commonwealth Radiocommunications Act 1992. The ACMA issues licenses to use specific segments of the radio broadcasting frequency spectrum for different purposes and maintains a register (the ACMA RADCOM Database) of all the licenses issued.

License holders operate a range of radio communications services, including fixed link microwave communication and mobile communication systems within a 25km radius of the proposed wind farm. Multiple license holders use some sites, while sole users employ others. Radio communications sites within a 25km radius are listed below.

Organisations identified as operating radio communication licences (including fixed link communications) within 25km of the proposed wind farm were consulted. Each was asked to provide independent comments / advice on the possibility of the White Rock Wind Farm development interfering with their communications links.

A fixed link radio transmission is a point to point transmission path typically between two elevated topographical features. Radio links could make use of a number of transmission frequencies including UHF, VHF or microwave. The transmission path may become compromised if a wind farm is located within the direct line of sight or what is known as the 'Fresnel Zone' around the line of sight between the sending and receiving antennae.

The potential impact zone will vary with the distance between the transmitter and receiver, frequency of transmission and the location of any particular point along its path. The maximum extent of the Fresnel zone occurs at the midpoint along the path of the microwave link as shown in Figure 10-6. Communications are only likely to be affected if a wind farm is in the line of sight between two sending and receiving antennae or within a zone of the line of sight of these antennae. In general, microwave links (which have very narrow Fresnel zones) are more liable to interference as a greater portion of the Fresnel zone can be impacted by the wind turbine.

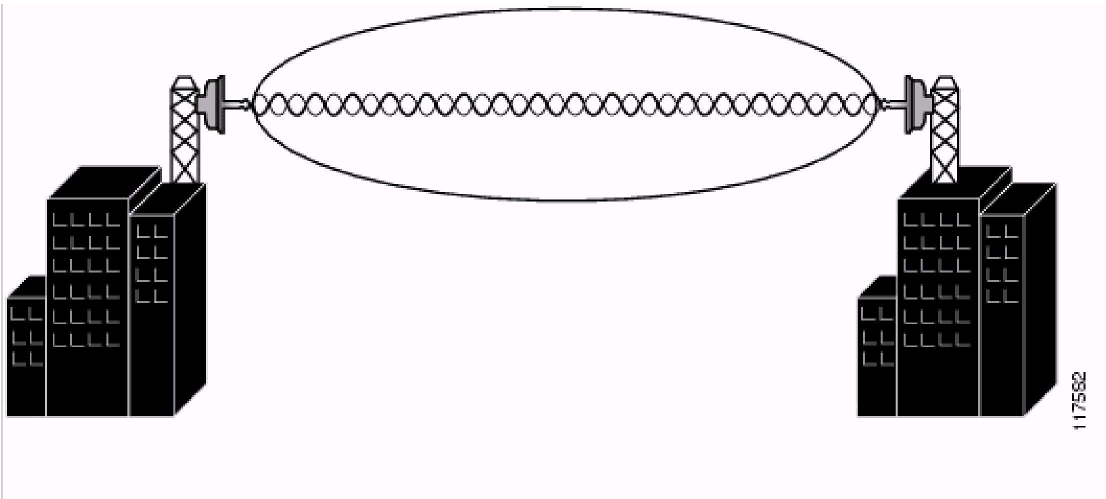

Figure 10-6 The Fresnel zone between a transmitter and a receiver

Where a potential exists for interference to line of sight links, an obstruction analysis can be undertaken to ensure that no part of a wind turbine assembly will enter the Fresnel Zone of the microwave link.

One point to point communication link, operated by TransGrid, was identified as crossing the site. Completion of an obstruction analysis showed that a number of turbines were located within the 2nd Fresnel zone of the link.

10.2.3 Consultation

License holders identified via the ACMA RADCOM database within a 25km radius of the wind farm were notified of the project in relation to potential impacts and asked to provide comments.

Table 10-2 summarises the organisations that were consulted and their comments received. Their responses are provided in full in Appendix 6.

Table 10-2 Consultation with license holders

Organisation	Representative	Contact	Response	Comment
CASA	Byron Sullivan	16/08/2010	17/08/2010	Advised that the site was outside aerodrome authority. Advised on how to assess potential hazard to aviation from the property
NSW Ambulance	Bill Tripcony	16/08/2010	19/08/2010	No issue
NBN TV	Greg Williams	16/08/2010	20/08/2010	Raised concern about link between Mt Dowe and Carpenters Hill. See below.
RTA	John Hong	16/08/2010	23/08/2010	No issue
Singtel Optus	Jayantha Wickramasinghe	16/08/2010	24/08/2010	No issue
Super Air	David Boundy	16/08/2010	24/08/2010	See Section 10.1.4 on Aerial Agriculture
NSW Police	Britto Tam	16/08/2010	25/08/2010	No issue
St Johns	Stephen Carter	16/08/2010	6/09/2010	No issue
Glen Innes Severn Council	Vanessa Menzie	16/08/2010	3/09/2010	No issue
TransGrid	Michael Freeburn	10/08/2010	-	No Response
Telstra	Kham Souksamlane	16/08/2010	-	No Response
Vodafone	Ganesh Ganeswaran	13/08/2010	-	No Response
RFS	Roman Rybak	16/08/2010	-	No Response
Dept. of Defence	John Kerwan	16/08/2010	-	No Response
Broadcast Australia	Emmajane Langridge	16/08/2010	-	No Response
Air Services	Mitchell Sloan	13/08/2010	-	No Response

Consultation with Mr Greg Williams, Broadcast Engineering Manager at NBN Television revealed that the translator site at Carpenters Hill (which services Glen Innes town) receives its input signal from the parent site at Mt Dowe (ACMA site ID 35653). The input signal passes through the area proposed for the White Rock wind farm. However on further investigation, the wind turbines locations proposed were shown to be to the south and clear of the transmission corridor and therefore signal interference to the Carpenters Hill translator by the White Rock project is not expected.

10.2.4 Assessment

It is considered that potential impacts would be confined to the operational phase of the wind farm, as discussed previously in this section.

Television and radio broadcast services

In the event that television interference (TVI) is experienced by existing receivers in the vicinity of the wind farm, the source and nature of the interference would be investigated by the Proponent using a before and after approach as detailed in the mitigation measures.

Should investigations determine that the cause of the interference can be reasonably attributable to the wind farm, the Proponent would put in place mitigation measures at each of the affected receivers in consultation and agreement with the landowners.

Radio communications services

There is one existing link, owned by TransGrid, which has been identified as passing through the site. Mr Michael Freeburn from TransGrid, the corresponding link license holder, was notified and provided with details of the White Rock Wind Farm project for assessment on 10 August 2010. At the time of writing, a response from TransGrid had not been received by Epuron.

An obstruction assessment of this link has been done and shows that interference to this communication link from the proposed wind farm is not expected. Research of recent literature suggests that interference to VHF links (i.e. in the 30MHz - 300MHz frequency range) by wind turbines is not likely. The TransGrid link crossing the site operates with a frequency of 42.7MHz and so falls within this range.

Auswind Best Practice Guidelines states: *"The communications systems most likely to be affected (by wind turbines) are those which operate at super high frequencies (particularly microwave systems operating at frequencies above 300MHz)"* (Auswind, 2006).

This sentiment is also reflected by Garrad Hassan in their "Assessment of Electromagnetic Issues for the proposed Berrybank Wind Farm", where they insist that only frequencies greater than UHF range (300MHZ - 3GHz) may potentially experience interference from wind turbines.

Consultation with the license holder will continue throughout the development process to ensure that the existing service is not affected. Should this link experience any interference from the wind farm mitigation measures outlined in Section 10.2.5 will be implemented.

Mobile radio and other radio communication services in the area are not expected to be impacted by the wind farm or its operation. Conflicts between point-to-point radio systems and the wind turbines are expected to be avoided using a range of mitigation strategies which include:

- Modifications to or relocation of the existing antennae
- Installation of a directional antennae and/or
- Installation of an amplifier to boost the signal

10.2.5 Mitigation Measures

The Proponent will liaise with the owners of existing radio links to relocate services to avoid potential impacts from turbines.

The Proponent will undertake an assessment of the existing quality of television/radio signals within 5km of any wind turbine before the commissioning of the project. If there is a complaint in regards the broadcast signal, the Proponent shall investigate the transmission quality and compare it to the pre-commissioning standard. If the transmission quality can be reasonably attributed to the project, the Proponent will act within three months to:

- modify of replace the receiving antennae;
- have provisions of a land line between the affected receptor and an antenna located in an area of favourable reception; or

- install a digital set top box, or replace with a satellite receiving antenna.

If the interference cannot be overcome by the aforementioned measures, the Proponent will negotiate with the impacted land owner about installing and maintaining a satellite receiving antennae. The Proponent will be responsible for all costs associated with the mitigation measures.

The Proponent will design and construct the project in consultation with the registered communication licensees (including emergency services) to ensure that risks to these services are minimised as far as reasonable and feasible. In the event that any disruptions to these services occur as a result of the project, the Proponent will undertake appropriate remedial measures in consultation with the relevant licensees to rectify the issue as soon as possible. Such measures may include modification to or relocation of the existing antennae or relocate the services.

10.3 Electromagnetic Fields

10.3.1 Background

Electromagnetic fields (EMF) (having both electric and magnetic components) are generated by all electrical devices including household appliances (televisions, lights, electric blankets etc), powerlines, substations and wind turbines.

In general, weak electromagnetic fields do not have adverse human health effects. The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) have produced fact sheets which state that studies to date have consistently shown that there is no evidence that prolonged exposure to weak *electric* fields (such as those found in the home or in most workplaces), results in adverse human health effects. Strong electromagnetic fields have the potential to cause health impacts, and therefore should be avoided.

In relation to EMF, the issues associated with wind farms are no different to the issues associated with the electricity industry in general and the use of industry best practice (and in particular the appropriate location of associated powerlines and related easements) ensure EMF risk is adequately managed.

The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) was formed in 1998 as a Federal Government agency charged with the responsibility of protecting the health and safety of people and the environment, from the harmful effects of ionising and non-ionising radiation. ARPANSA is currently developing guidelines on exposure limits to EMFs but in the meantime they still refer to the National Health and Medical Research Council Interim Guidelines (ARPANSA, 2009).

The *National Health and Medical Research Council Interim Guidelines on Limits of Exposure to 50/60 Hz Electric and Magnetic Fields* recommended limit for 24 hour exposure is 1000mG for magnetic fields and 5kV/m for continuous public exposure to electrical fields (ICNIRP, 1998). They note that research suggests that health effects are associated with prolonged exposure; measurements at one point in time do not accurately reflect prolonged exposure levels.

Electric fields can be reduced both by shielding and with distance from operating electrical equipment. Magnetic fields are reduced more effectively with distance from the equipment.

Potential for EMF impacts occurs only during the operational phase of the wind farm when electrical infrastructure is capable of generating electromagnetic fields. The electromagnetic fields produced by the wind farm infrastructure would vary at different locations onsite, as discussed below. No impact mitigation is considered to be required for the construction and decommissioning phases.

10.3.2 Assessment

Powerlines

Underground and overhead powerlines connecting turbines to the substations within the site would be 33 kV. At the substation, the voltage would be stepped up to 132 kV, and transmitted along a short overhead powerline to the switchyard adjacent to the existing TransGrid transmission network, where it would connect into the Glen Innes to Inverell transmission line.

The magnetic fields associated with a powerline at any moment in time depend on a range of factors, including the amount of power flowing in the line and the distance of the measurement point from the conductors. Typical levels of magnetic field under a 132 kV high-voltage powerline range from 2 - 50 mG at a distance of 15 – 35 metres from the centre of the easement. (TransGrid, 2009) The strength of the field falls away rapidly with increased distance. These figures are far less than the 1,000 mG limit recommended for 24-hour exposure (ICNIRP, 1998).

The field strength created by powerlines is dependent upon the height of the wires above the ground and their geometric arrangement. The strength of both electric field and magnetic fields falls away rapidly with distance from the line (TransGrid, 2009).

The effects from the 33kV powerlines are dependent on the type of supporting structure. The electric field for a lattice steel pylon 25 metres from the centreline is typically 21 V/m and 9 V/m at 50 metres, while a wood pole design of 21 V/m and 0 V/m for the same respective distances (National Grid, 2010) .

Any off-site electricity lines will be located and designed in accordance with Country Energy's Easement Requirements (Country Energy, 2006). This guideline provides requirements for how powerlines easements are to be constructed, when they are required and how they are obtained in New South Wales. The electricity cables will be located away from residences, where practical, to minimise magnetic fields from any off-site powerlines.

Substation

The United Kingdom National Grid Company has conducted a survey of suburban substations to determine the level of EMFs produced. Measurements were taken at 0.5 m above ground level within 1m of enclosures. The results revealed mean magnetic flux densities of approximately 19 mG, halving at an average distance of 1.3 m and becoming indistinguishable from the background due to other domestic sources within 5 m (HPA, 2004).

Fencing around the substation and the location of the substation and control buildings would ensure that the EMF exposure to receivers including the public, property owners and workers are well below the 1,000 mG levels determined for public health.

Wind Turbines

The areas proposed for the installation of wind farm infrastructure would have limited public access. Access to these areas by the general public would be restricted, with periodic access by appropriately trained and qualified maintenance staff only. Property owners accessing the sites would have no reason to spend extended periods near the infrastructure, which is not located near frequent use areas such as sheds, yards and residences. Should property owners require access to control buildings or other wind farm infrastructure, they would be accompanied by an appropriately trained and qualified maintenance staff member.

A report investigated the expected magnetic field for proposed wind turbines for Windrush Energy in 2004 (Iravani et al., 2004). The study was based on research and measurements of an existing wind turbine. The measured flux density at the door of the existing turbine was 0.4 mG and the typical value around the wind turbine was 0.04 mG. The acceptable level as stated by the International Commission on Non-Ionizing Radiation Protection is 833 mG (ICNIRP, 1998) The results also concluded that no measurable magnetic field would be expected at a distance of eight metres from the 1,650 kW wind turbine, and hence the magnetic fields produced by generation of electricity from turbines would not pose a treat to public health.

10.3.3 Mitigation

Transmission and powerlines would be located as far as practical from residences and in accordance with the minimum distances set in Country Energy's Procedural Guideline – Easement Requirements

10.4 Shadow Flicker

10.4.1 Background

Due to their height, wind turbines can cast shadows on the areas around them. Coupled with this, the moving blades create moving shadows. When viewed from a stationary position, when the turbine is between the viewer and the sun, the moving shadows appear as a flicker giving rise to the phenomenon of 'shadow flicker'. This is similar to the strobe effect often experienced when driving through scattered trees on a rural highway.

For a particular position, shadow flicker will only occur during periods when the suns rays pass directly through the swept area of the turbine blades to the viewpoint. The extent of the shadow flicker is dependent on the time of day, geographical location, meteorological conditions of the site (i.e. cloud) and local vegetation.

The effect of 'chopping the light' attenuates with distance and is not considered by modellers of shadow flicker to be noticed beyond 500-1000m from a turbine. (Osten & Pahlke, 1998)

In NSW there are currently no guidelines on which to assess shadow flicker generated by wind turbines. The Victorian Planning Guidelines limit the duration of shadow flicker to a maximum of 30 hours per year (Vic Government, 2003). The South Australian Planning Bulletin suggests that shadow flicker is insignificant once a separation of 500m between the turbine and house is exceeded.

Shadow flicker is usually an amenity issue rather than a health risk. Given it is a daytime event, it does not interrupt sleep patterns. However, two issues have been raised as potential health concerns in relation to shadow flicker:

1. Flicker vertigo

   Flicker vertigo is an imbalance in brain cell activity caused by exposure to low frequency flickering or flashing of a light or sunlight seen through a rotating propeller (Rash, 2004). It can result in nausea, dizziness, headache, panic, confusion and – in rare cases – loss of consciousness. Flicker vertigo is usually associated with a light flashing sequence, or flicker frequency, of between approximately 4 hertz (cycles per second) and 20 hertz (Rash, 2004; NASA, 2001).

2. Photosensitive Epilepsia

   Flicker from turbines that interrupt or reflect sunlight at frequencies greater than 3 Hz poses a potential risk of inducing photosensitive seizures. At 3 hertz and below the cumulative risk of inducing a seizure should be 1.7 per 100,000 of the photosensitive population. The risk is maintained over considerable distances from the turbine. It is therefore important to keep rotation speeds to a minimum, and in the case of turbines with three blades ensure that the maximum speed of rotation does not exceed 60 rpm, which is normal practice for large wind farms. The layout of wind farms should ensure that shadows cast by one turbine upon another should not be readily visible to the general public. The shadows should not fall upon the windows of nearby buildings. (Harding et al., 2008)

In both cases, the cause of the health effect is a flashing of light with the flash frequency in the range of 3 – 30 hertz. Therefore, wind turbines would only provide a health risk of the shadow flicker created was within this range.

10.4.2 Assessment

Health effect

Flicker frequency of rotating propellers, including wind farm rotors, is derived by multiplying the hub rotation frequency by the number of blades. Based on the rotation speed of the 3 bladed wind turbines proposed for the project, the maximum shadow flicker frequency would be 1 cycle per second (1 hertz), well outside the frequency range associated with flicker vertigo or photosensitive epilepsy.

The operational wind turbines are not anticipated to produce a flicker frequency high enough to pose a health risk. Comparable turbines have been rated 0.45 to 0.95 Hz, significantly below critical levels of 3-30 Hz for public health. The project is therefore unlikely to represent a health risk to local residents in relation to flicker vertigo or photosensitive epilepsy.

This sentiment is also reflected in a recent public statement by the National Health and Medical Research Council titled *Wind Turbines and Health* has stated that the evidence on shadow flicker does not support a health concern (NHMRC, 2010)

Amenity

A detailed analysis of the potential for shadow flicker and blade glint to affect dwellings has been carried out by Epuron. Modelling of the shadow flicker was conducted using specialist industry software, assessing the largest turbine (maximum tip height) proposed for the project to represent the worst case impact scenario. The maximum number of annual hours at each of the nearby houses where shadow flicker may be experienced was calculated using this model.

To carry out the shadow flicker assessment, the Victorian Planning Guidelines and the South Australian Planning Bulletin discussed earlier were used to determine the inputs to the model. They were:

- a maximum duration of shadow flicker at any residence of 30 hours per year; and
- a conservative assessment distance of 1 km (twice the distance suggested to be affected by shadow flicker).

As can be seen in Figure 10-7 there are a number or residences that are within the 1km radius of a proposed turbine. Due to their position (either north or south) in relation to the nearest turbine, no shadow flicker is predicted to occur at any of these residences.

Blade glint occurs when sunlight is reflected off turbine blades. The concern is that this may affect some motorists or cause annoyance at dwellings.

Turbine manufacturers have acknowledged the possibility of blade glint and use a low reflectivity gel finish to reduce any reflectivity. The turbines proposed for this project would be finished in a matte, non-reflective finish to ensure blade glint impacts do not occur.

10.4.3 Mitigation Measures

- If shadow flicker is found to be a nuisance at a particular residence, conditions would be pre-programmed into the control system so that individual wind turbines automatically shut down whenever these conditions are present.
- Shadow flicker effects on motorists would be monitored following commissioning and any remedial measures to address concerns would be developed in consultation with the RTA and the Department of Planning

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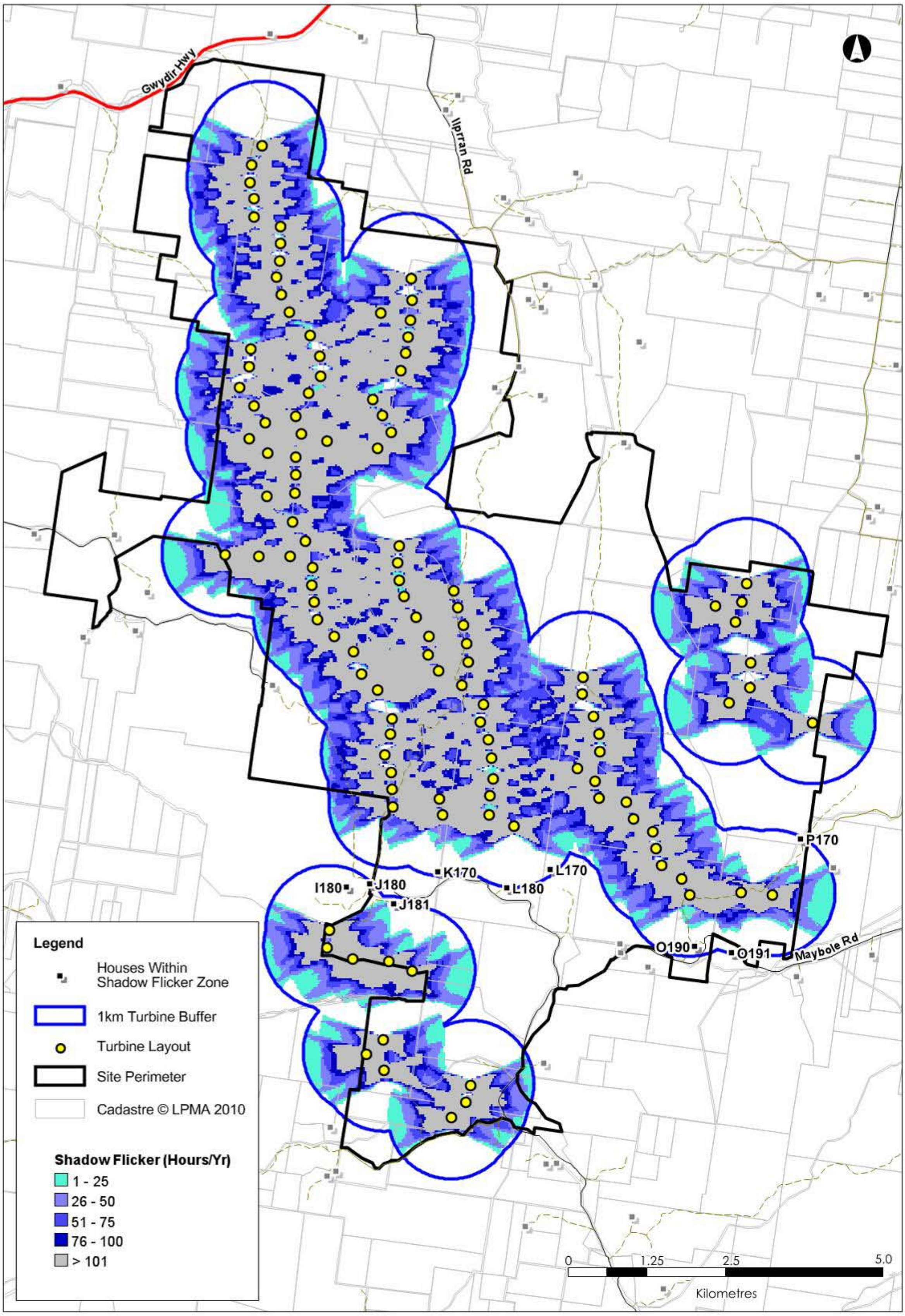

Figure 10-7 Areas potentially impacted by Shadow Flicker

10.5 Fire and Bushfire Risks

10.5.1 Background

A bushfire management plan would be prepared prior to construction and included within the Construction and Operational Environmental Management Plans. Bushfire safety Issues that are associated with wind farms include:

- the potential for wind farm infrastructure to cause a fire that may or may not result in a bush fire;
- the potential for the wind farm to be affected by a passing bush fire and the impact the existence of turbines may have on fire management; and,
- the presence of additional ignition sources as a result of the construction, operation or decommissioning of the wind farm.

10.5.2 Existing environment

The development envelope for the project is predominately pasture with patches of remnant Box Gum Woodlands also present.

The bushfire danger period for the local government areas is generally between 1st October and 31st March, but can vary subject to local conditions. Summer conditions in these LGAs can be dry and hot with high wind speeds. Existing ignition sources include farm machinery and vehicles, hay storage, vehicles stopping in long grass on road verges, cigarette butts thrown from car windows (the northern part of the site borders the Gwydir Highway) and lightening strikes. The elevated position of the sites may increase the frequency of lightning strike. The steep topography and absence of built areas or natural fire breaks such as large water bodies may assist the rate of spread of wildfires.

Factors mitigating fire risks within the site include the sparse and fragmented nature of woodland and forest remnants flanking the development envelope and the continued grazing regimes, which acts to reduce fuel loads. However grass fires can spread rapidly and threaten life and property.

The NSW Fire Brigade has the authority to attend, combat and render safe any land-based or inland waterway spillage of hazardous materials within the State. The NSW Fire Brigade defines hazardous materials as 'anything that, when produced, stored, moved, used or otherwise dealt with without adequate safeguards to prevent it from escaping, may cause injury or death or damage to life, property or the environment'. The fuels and lubricants required to construct and operate the wind farm constitute hazardous materials under this definition, and any fire at the wind farm would come under management of NSW Fire Brigade supported by the RFS.

All NSW Fire Brigade fire stations are equipped with trained personnel and resources for dealing with hazmat incidents. The closest NSW fire brigades to the site are Glen Innes Fire Station (23 km from the site) and Inverell Fire Station (44km from the site).

The Hazardous Materials Response Unit has a 24 hour phone contact (Tel: 02 9742 7155). Intermediate hazardous materials response is delivered by 20 strategically located units, each unit is equipped with detection equipment and has the capability to access chemical databases with information on chemical, biological, radiological and toxic industrial chemical substances. The closest NSW Intermediate Hazardous Materials Response Units are located at Narrabri and Tamworth (both approximately 230km from the site).

10.5.3 Assessment

Construction Activities

Flammable materials and ignition sources brought onto the site, such as fuels, would increase the risk of fire during the construction period. Correct handling and storage procedures would mitigate against the risk of ignition. Appropriate fire fighting equipment would need to be held on site when the fire danger is very high to extreme, and a minimum of one person on site would be trained in its use.

The Rural Fire Service would need to be consulted in regard to the adequacy of bushfire prevention procedures to be implemented on site during construction, operation and decommissioning. These procedures would in particular cover hot-work procedures and response measures to control any incident.

Operational Activities

Being electrical equipment and containing petrochemicals, there is potential for the wind turbines, substations, control buildings and powerlines to start or influence the spread of fire. For the wind turbines themselves, the risk of fire can be associated with malfunctioning turbine bearings, inadequate crankcase lubrication, cable damage during rotation, electrical shorting or arcing occurring in transmission and distribution facilities (AusWEA, 2001).

The ready visibility of the turbines and local presence of RFS equipment and personnel would and assist detection, response time and control. In addition, shut down mechanisms are installed in the wind turbines, and remote alarming and maintenance procedures would also be used to minimise risks.

Lightning conductors are installed in turbines to ground lightning strikes in order to minimise risk of damage to the turbines and risk of ignition of a wildfire. Relatively minor damage to turbines may occur from lightning strike. At the existing Crookwell I site, a direct strike resulted in damage to one of the turbine blades, which was repaired onsite. No wildfire resulted. The risk of turbine ignition is considered to be low, based on the low likelihood of electrical failure or over-heating and a range of factors mitigating the fire hazard.

Transmission and powerlines would be installed to connect the wind farm to the electricity grid. The powerlines are underground across most of the site and overhead to connect strings of turbines to the substation. The overhead lines have been routed to avoid trees and forest fragments where possible, reducing the need for clearing and eliminating ongoing fire risks from tree growth and in the event of a line breakage. Cable routes would be periodically inspected to monitor any regrowth.

The transformers located in the substation facilities would contain transformer oil for the purpose of cooling and insulation. These facilities would be bunded with a capacity exceeding the volume of the transformer oil to contain the oil in the event of a major leak or fire and would be regularly inspected and maintained to ensure leaks do not present a fire hazard, and to ensure the bunded area is clear (including removing any rainwater). Transformer oil would be changed regularly at appropriate intervals by qualified staff to minimise the potential for fire caused by contaminated oil. The oil would be removed from the site and disposed of appropriately.

The substations would be surrounded by a gravel and concrete area free of vegetation to prevent the spread of fire from the substation and reduce the impact of bushfire on the structure. The substation areas would also be surrounded by a security fence as a safety precaution to prevent trespassers and stock ingress. An asset protection zone would be maintained around the control room and substation buildings, compliant with the RFS Planning for Bushfire Protection guidelines. Workplace health and safety protocols would be developed to minimise the risk of fire for workers during construction and during maintenance in the control room and amenities.

Impacts on fire-fighting operations

Wind farms have been found to influence temperature and wind speed around turbines and have the potential to influence bushfire behaviour. A distance of up to 1.25km (SEDA, 2002) around each wind turbine is likely to experience warmer night temperatures and faster wind speeds on average, although this attenuates rapidly with distance from the turbine. While the amount of increase is small (approximately 0.7^{o}C increase and approximately 0.6 metres/second increase at ground level; Baidya, et al., 2004) these factors may enhance bushfire conditions, slightly increasing the intensity or rate of spread of a bushfire at the site. This minor increase in fire intensity is not considered likely to noticeably affect the rate of spread or controllability of wildfires. In the event of a fire, the turbines would be shut down.

The turbines have the potential to present a hazard to fire fighting helicopters and planes, however, the access tracks installed to build and maintain the wind farm would increase the accessibility onsite and would therefore have a positive impact on the response time and ability to fight fires onsite or on neighbouring properties.

The RFS have participated in the environmental assessment process of several wind farms in NSW. Representatives of the RFS have stated that, due to the hazardous materials stored onsite (hydrocarbons within turbines and the substation), the local RFS would only ever act in a support capacity to the NSW Fire Brigade, in the event of an infrastructure related fire onsite. The RFS and NSW Fire Brigade would be consulted regarding safety, communication, site access and response protocols in the event of a fire originating in the wind farm infrastructure, and also in the event of an external wildfire threatening the wind farm. They have also stated that wind farm infrastructure is not different with regard to bush fire risk than similar large scale infrastructure developments.

While the risk of bushfires would be increased by the construction and operational activities of the wind farm, the cleared nature of the land and the improvements to site access would aid fire fighters on site.

10.5.4 Mitigation

- Ensure that all project components on the site are designed, constructed and operated to minimise ignition risks, provide for asset protection consistent with relevant Rural Fire Service (RFS) design guidelines (NSW RFS, 2006; NSW RFS 2010) and provide for necessary emergency management including appropriate fire-fighting equipment and water supplies on site to respond to a bush fire
- Regularly consult with the local RFS to ensure familiarity with the project, including the construction timetable and the final location of all the infrastructure on the site. The Proponent will comply with any reasonable requests of the local RFS to reduce the risk of bushfire and to enable fast access in emergencies.
- Prepare a Bushfire Management Plan as part of the Construction Environmental Management plan. The RFS and NSW Fire Brigade would be consulted in regards to its adequacy to manage bushfire risks during construction, operation and decommissioning. As a minimum the plan would establish hot-work procedures, asset protection zones, safety, communication, site access and response protocols in the event of a fire originating in the wind farm infrastructure. All flammable materials and ignition sources brought onto the site, such as hydrocarbons, would be handled and stored as per manufacturers instructions
- During the construction phase, appropriate fire fighting equipment would be held on site when the fire danger is very high to catastrophic, and a minimum of one person would be trained in it use. Fire extinguishers would be stored onsite in the control building and within any substations.
- Substations would be bundled with a capacity exceeding the volume of the transformer oil to contain the oil in the event of a major leak or fire. The facilities would be regularly inspected and maintained to ensure leaks do not present a fire hazard, and to ensure the bundled area is clear (including removing any rainwater).
- Shut down of turbine components would commence if the components reach critical temperatures or if directed by the RFS in the case of a nearby wildfire being declared (all hours contact points would be available to the RFS during the bushfire period. Remote alarming and maintenance procedures would also minimise the risk. Overhead transmission easements would be periodically inspected to monitor regrowth of encroaching vegetation.

11 General Environmental Assessment

11.1 Drainage and Hydrology

11.1.1 Existing Environment

The proposed White Rock Wind Farm is situated within and close to the eastern boundary of the Border Rivers-Gwydir Catchment Area. The catchment occupies an area of approximately 5,000 hectares, which constitutes 4% of the total Murray Darling Basin Area. The catchment is bounded by the Queensland border in the north, the Barwon River in the west, the Great Dividing Range to the east and the Namoi Catchment to the south, as shown in Figure 11-1. The current average surface water availability is 1208 GL/year.

General site features and characteristics that control and influence drainage and hydrology of a region are the topography, geology, surface water movement paths, groundwater movement paths and water quality.

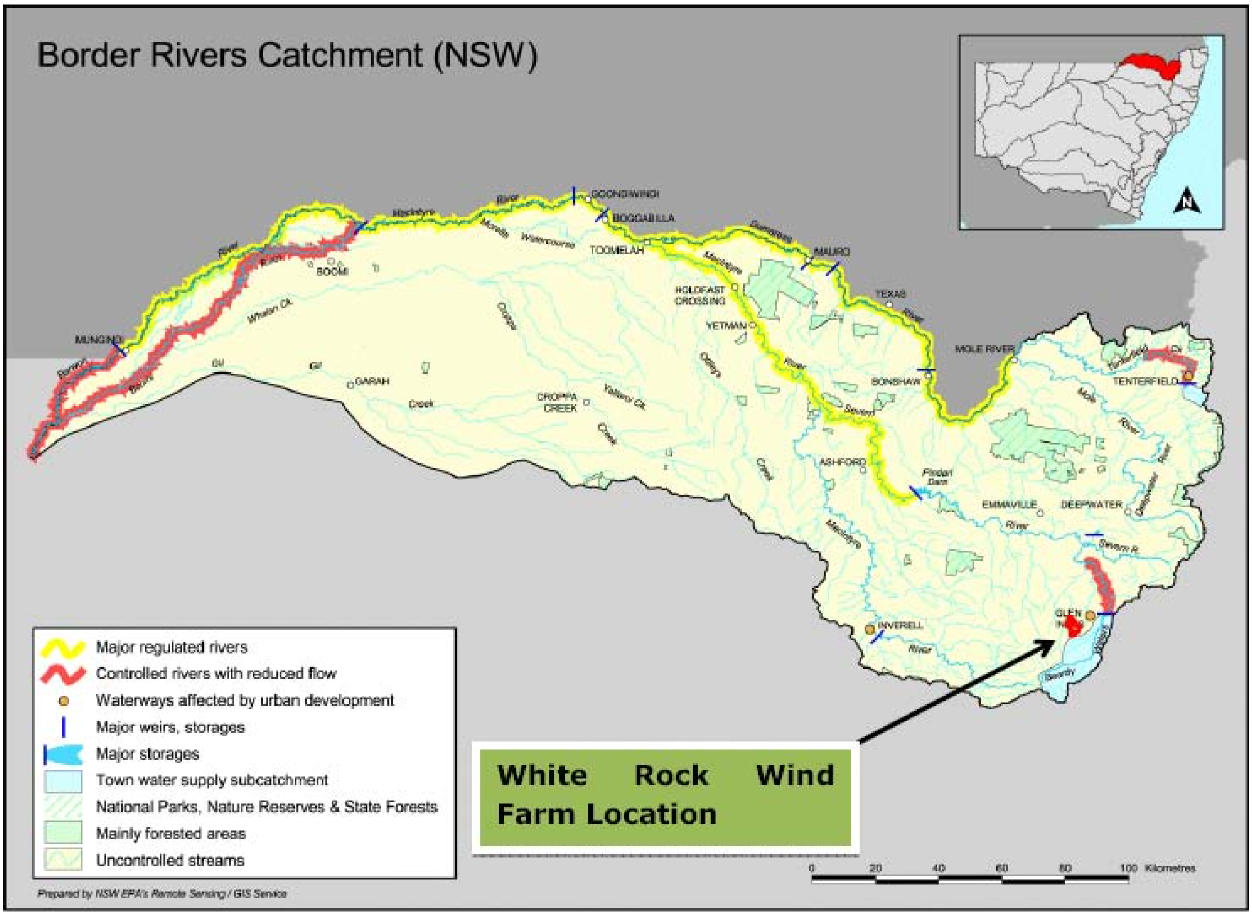

Figure 11-1 Border Rivers Catchment Area NSW

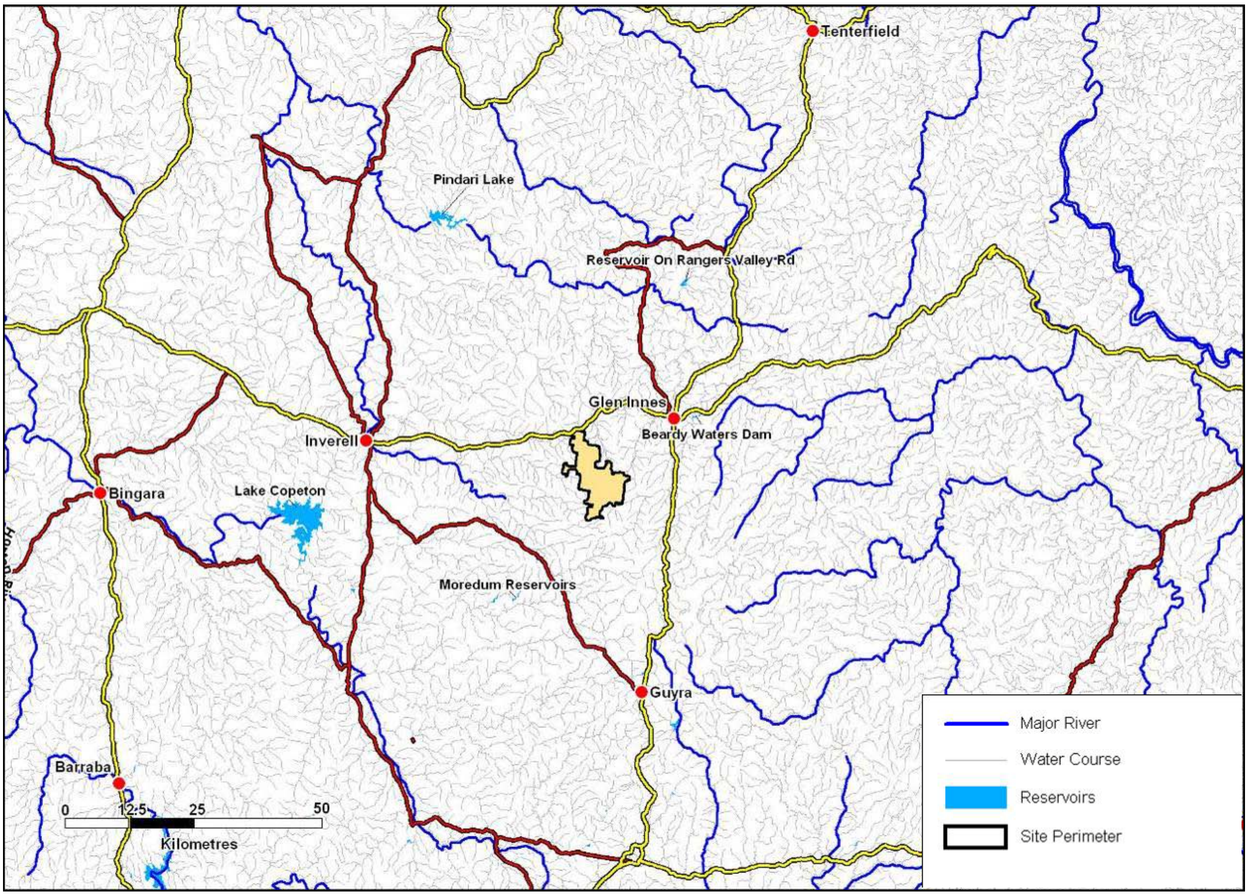

Figure 11-2 Hydrology Map for the Glen Innes – Inverell Area, NSW

Regional Surface Water

The project is situated on the south-eastern edge of the Border Rivers Catchment area, with the principle water courses being the Macintyre River and the Severn River which is located approximately 16km west and 30km north respectively.

Watercourses in the catchment area generally flow in a westerly direction until they form with the principle rivers in the catchment. In the western section of the catchment the Macintyre River and Weir River combine to form the Barwon River which forms part of the Murray Darling Basin.

Major water storages exist on each of the main rivers making river flows highly regulated. These include the Pindari Dam on the Severn River (50km North west), the Queensland Dams Glenlyon Dam on the Dumaresq River (90km North) and the Coolmunda Dam on the Macintyre Brook (150km away).

The closest reservoirs to the site are:

1.	Beardy Waters Dam	18km to the north-east
2.	Moredum Reservoirs	20km to the south-west
3.	Reservoir on Rangers Valley Rd	35km to the north
4.	Pindari Lake	46km to the north-west
5.	Lake Copeton	46km to the south-west

The town water catchment area for Glen Innes is located to the east-southeast of the site along the Beardy Waters River. The catchment area has a major weir located to the east of Glen Innes. The resulting reservoir known as Beardy Waters Dam provides the town water source. The proposed turbines are located just outside the catchment area for the Glen Innes town water reservoir, as illustrated in Figure 11-3.

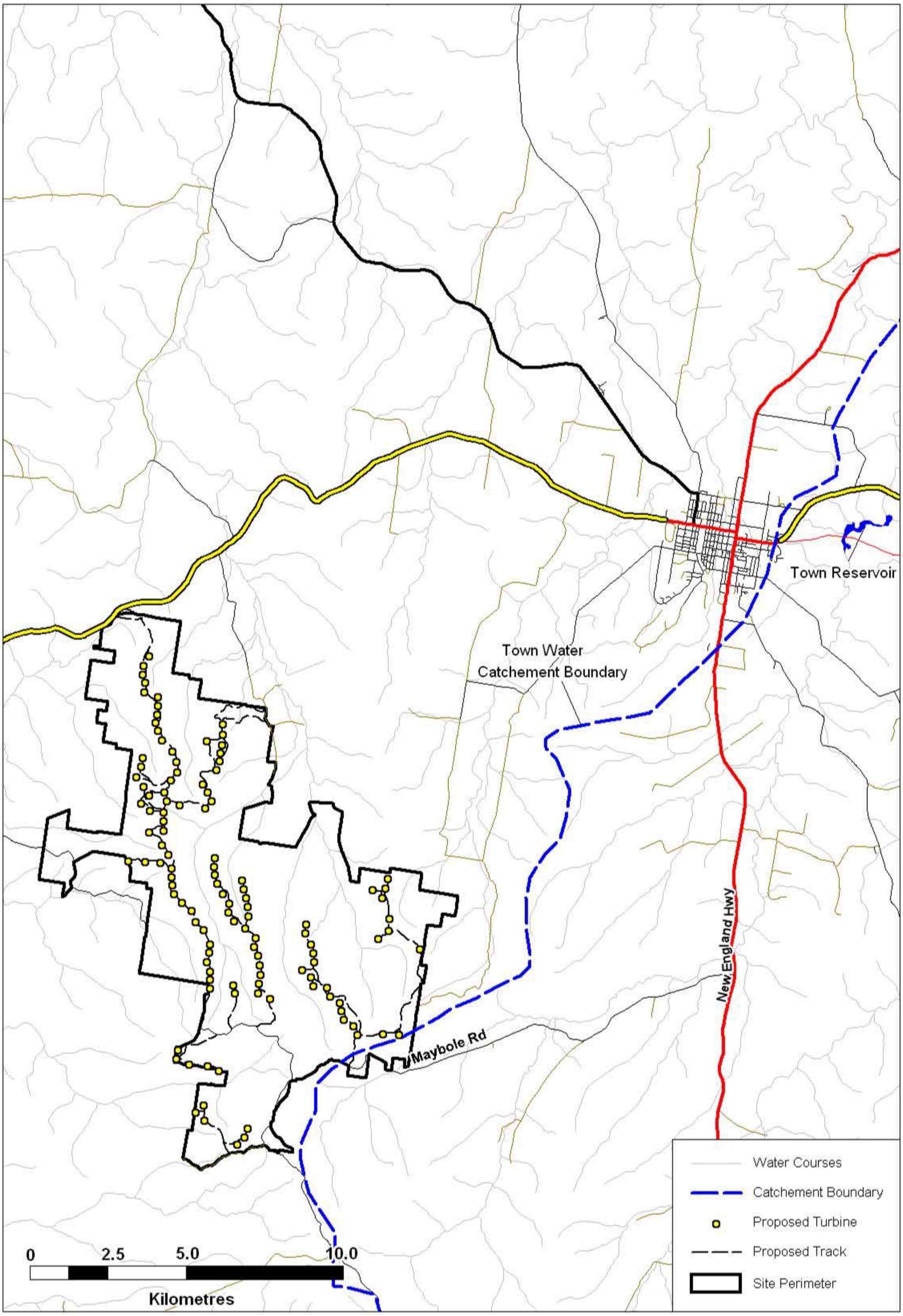

Figure 11-3 Glen Innes town water catchment boundary

Site Surface Water

The use of aerial photographs, topographical and surface water overlays for any creeks, watercourses and wetland areas were utilised to identify any significant watercourses, standing water bodies, lakes and wetland areas within the study area. No significant water bodies or wetlands have been identified within or near the wind farm site. Some small stock dams are interspersed across the site area.

The water courses on site have been assessed based on their stream order. The order of streams was determined based on the Strahler method of stream ordering classification. This method of stream ordering involves labelling all upper tributaries as first order streams, which when two first order streams converge they combine to form a second order stream. Consequently where two second order streams converge they form a third order stream. When a stream of lower order joins a stream of higher order the downstream section of the stream will retain the order of the higher order upstream section (Yang & Lee, 2001).

The site contains a number of water courses which are predominantly first order streams with some second order streams. The turbines are located on the higher ground and the access tracks and underground cabling follows the ridgelines between the high ground locations. The layout of the wind turbines, the access tracks and underground cabling has been designed to avoid any known water courses. No third order water courses are proposed to be crossed for access tracks or cabling.

The water courses through the site and the access track layout are illustrated in Figure 11-4. The access tracks join with the existing road network of the area, which removes the requirement to connect all turbine locations via internal access tracks.

The location of the substations and switchyard are also positioned away from any water courses. Overhead powerlines are proposed to connect different segments of the project. The use of overhead powerlines avoids the requirement to place underground cables through existing water courses.

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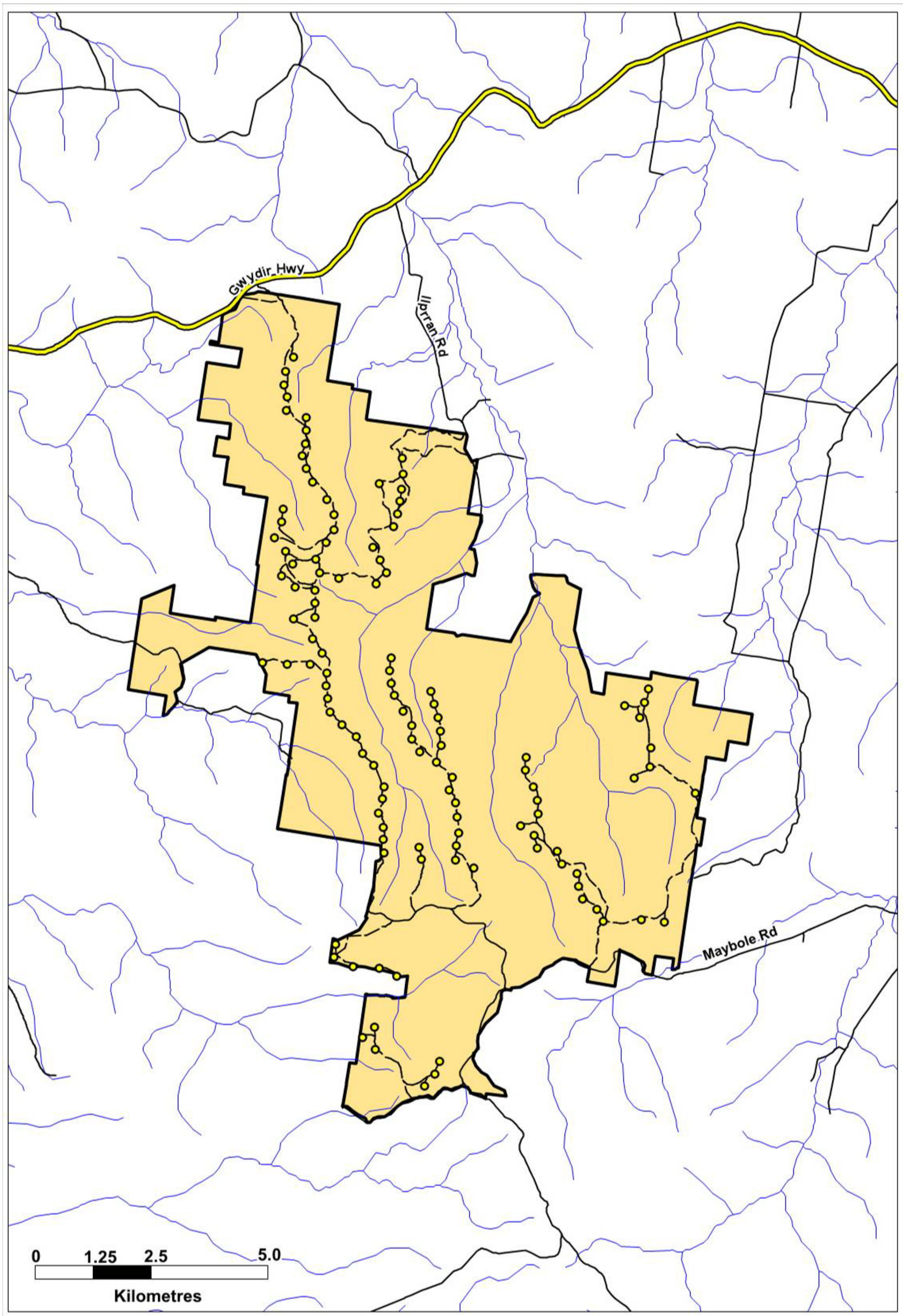

Figure 11-4 Water courses within the site area

Ground Water

Groundwater for the region originated from aquifers in the Queensland and New South Wales highlands, the Great Artesian Basin (GAB), and in alluvial deposits associated with the Macintyre River (NSW) which is a major source of high yielding groundwater.

Groundwater in the general site area is mainly for domestic and stock use. No useable fresh groundwater is available in the immediate study area. Useable groundwater resources are restricted to those areas upstream of Keetah on the Queensland-New South Wales border, fresh ground water downstream of this is associated with raised water levels (CSIRO, 2007).

Groundwater extraction in the Border Rivers region is estimated to be 34.3 GL/year. About 37 percent of this is from the New South Wales and Queensland Border Rivers Alluvium groundwater management units.

Water Quality

Hydrology conditions of the Border Rivers region is considered moderate to good with low salinity levels and small areas at risk of dryland salinity, predominately restricted to the far west areas of the region. Water quality of the catchment is generally considered good with high levels of phosphorus and turbidity present that gradually increases along the basin (CSIRO, 2007).

As the White Rock Wind Farm is located at the most eastern point of the water catchment area water quality levels should be presumed as moderate to fair and should be managed appropriately. Actual water quality results for the site can only be determined by an onsite investigation for surface water.

11.1.2 Assessment

Potential Impacts to Drainage and Hydrology

The construction, operation, maintenance and decommissioning of the project has the potential to impact on the current drainage and hydrological characteristics of the site by:

- installing access roads, on site buildings and other associated infrastructure;
- modifying the landscape with minor-medium earthworks and vegetation clearing;
- altering or disturbing existing watercourses and significant drainage paths if the layout design is amended to include construction in water course areas;
- the pollution of waters by accidental and uncontrollable spills and excavation works;
- sedimentation and erosional transport of pollutants, soils etc. to water courses in the area; and
- unnecessarily traversing or bounding watercourses with access tracks and powerlines in instances where these actions could be avoided.

Any potential impacts are predicted to be most significant during the construction and decommissioning phases, where heavy machinery and vehicles and excavation works are required, large areas of soil and cleared vegetation are exposed, materials are stockpiled and mechanical and construction fluids are stored onsite.

The installation of infrastructure such as foundations, onsite buildings, access tracks, and impermeable hard surfaces can alter and modify the pre-existing flow paths and dynamics of surface and ground water flows as well as impact on the areas general water quality through pollution and sedimentation.

Machinery and on-site storage of fluids and chemicals are another potential source of water pollution and contamination.

The sites altitude is at some of the highest elevations of the Great Dividing Range and forms the divide for water flowing east to the coast and west to the Murray Darling Basin. As the turbines will be located on the highest elevation points within the site area, with the foundations of the turbines only 2m in depth and all access roads typically constructed 300mm thick, it is considered that the development will not encounter or impact on any groundwater reserves.

11.1.3 Mitigation

The following mitigating measures for minimising disturbance and impacts of the sites drainage and hydrology have either been applied during the design phase or will be applied during construction:

- Minimise the amount and degree to which the general topography and landscape is modified and disturbed by infrastructure and associated works through the design phase;
- Where practical upgrade existing access roads as opposed to constructing new access tracks;
- Where practical, restrict access tracks to follow the sites ridge lines and natural contours while avoiding steep hill slopes and vegetated area;
- Prepare a Sediment/Erosion Control Plan to be incorporated into the CEMP. Soil and water management practices would be developed as set out in Soils and Construction Volume 1 (Landcom, 2004);
- Infrastructure would not be sited within 40 metres of a major drainage line or water course, where practical;
- As soon as practical, stabilise exposed or clear areas to minimise erosion and sedimentation that can potential pollute and dam watercourses in the area;
- Design concrete batch plants to ensure concrete wash would not be subjected to uncontrolled release. Bund areas of the batching plant to contain peak rainfall events and remediate after the completion of the construction phase. Waste sludge would be recovered from the settling pond and used in the production of road base manufactured onsite. The waste material would be taken from the batching plant to be blended in the road base elsewhere onsite.
- A Spill Response Plan would be prepared as part of the CEMP and OEMP;
- Stage excavation works to minimised the amount of exposed areas over time to allow for adequate rehabilitation and reduce the potential for erosion; and
- Fuel and oils, materials and soil stockpiles must have designated areas away from any watercourses, with adequate sediment and contamination bunding controls installed to ensure or minimise the impacts of contamination of water sources in the area.

The site plan for the wind turbines and associated infrastructure has been designed with particular emphasise on protecting existing streams and ephemeral watercourses. The layout avoids crossing or interfering with watercourses by any infrastructure. This is to avoid and minimise any adverse impacts to the areas drainage and hydrological regime.

11.2 Soils and Landforms

The project boundary extends from Maybole Road in the south to the Gwydir Highway in the north. This area constitutes part of the Great Dividing Range in northern New South Wales. The tableland consists of stepped plateaus of hills and plains with elevations ranging between 600 and 1500m and consists of tertiary basalts, interspersed rhyolite, alluvium sediments, siliceous sands, Red earths and mellow texture soils. (DECCW, 2010c)

11.2.1 Existing Environment

Geology

The New England tableland is composed of the New England fold belt that is predominantly made up of sedimentary rocks that are of Carboniferous and Permian age. The fold belt was formed by the extensive faulting and associated granite intrusions during a period of rapid continental plate movement, in the Great Dividing ranges late Carboniferous history. Much of the Quaternary alluvium sediments have been overlain by tertiary basalts which show evidence of being inverted at some stage of their history, with former valley floors, becoming ridge crests and hills we see today.

The current geology landform and soils we see today in the tableland region is a result of many years of weathering and erosion. Erosion and weathering over time has led to the eroding of the basalts, which dominates the Glen Innes and surrounding areas, to expose the sedimentary bedrock and river sands or lake sediments in the drainage lines, steep granite ridges and level basalt plains and plateaus.

Basalt dominant areas that are typical within the project site are composed of shallow stony loams in steeper regions and deep red brown to black fertile- structured loams on more small sloped areas. These soils typically are thinly layered and stony on steeper slopes and waterlogged along the valley floors. Yellow texture contrast soils are found on granites and minor sedimentary rocks. (DECCW, 2010c)

The geology of the site is made up of tertiary mafic volcanic and high level intrusive rocks (basalt), Tatarian Wallangarra Volcanic (Rhyolite) and Quaternary alluvium (sediments) which occur in the drainage lines where erosion and weathering processes have exposed the bed rock. The dominant geology of the site is basalt which is centred on the plateaus between Guyra and Glen Innes area. Figure 11-5 illustrates the geology of the area.

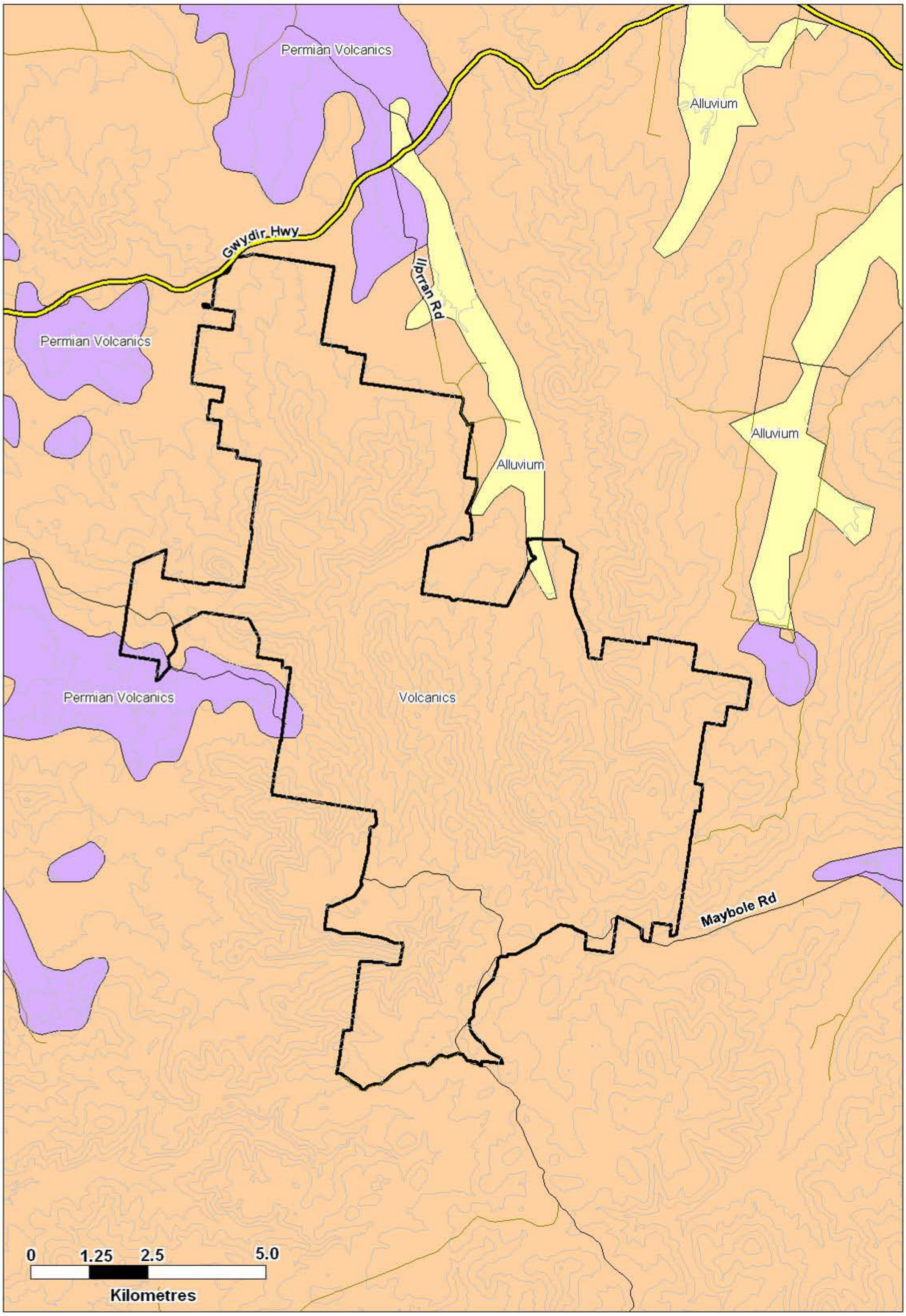

Figure 11-5 Geology of the site area (Source: NSW Department of Industry and Investment)

Topography and Terrain

The eastern edge of the New England Tableland bioregion is at the Great Escarpment where coastal streams have cut deep gorges below the plateau to form steep ridge crests and hills, stepped plateaus and plains that range in elevation from 600 to 1500m.

The site varies from undulating hills with some areas of moderately steep slopes that extend down to small level valleys with numerous saddles and small knolls situated off the main ridgeline. The site has higher elevations in the southern portion with spot heights of 1,421m AHD and decreases in elevation to the north.

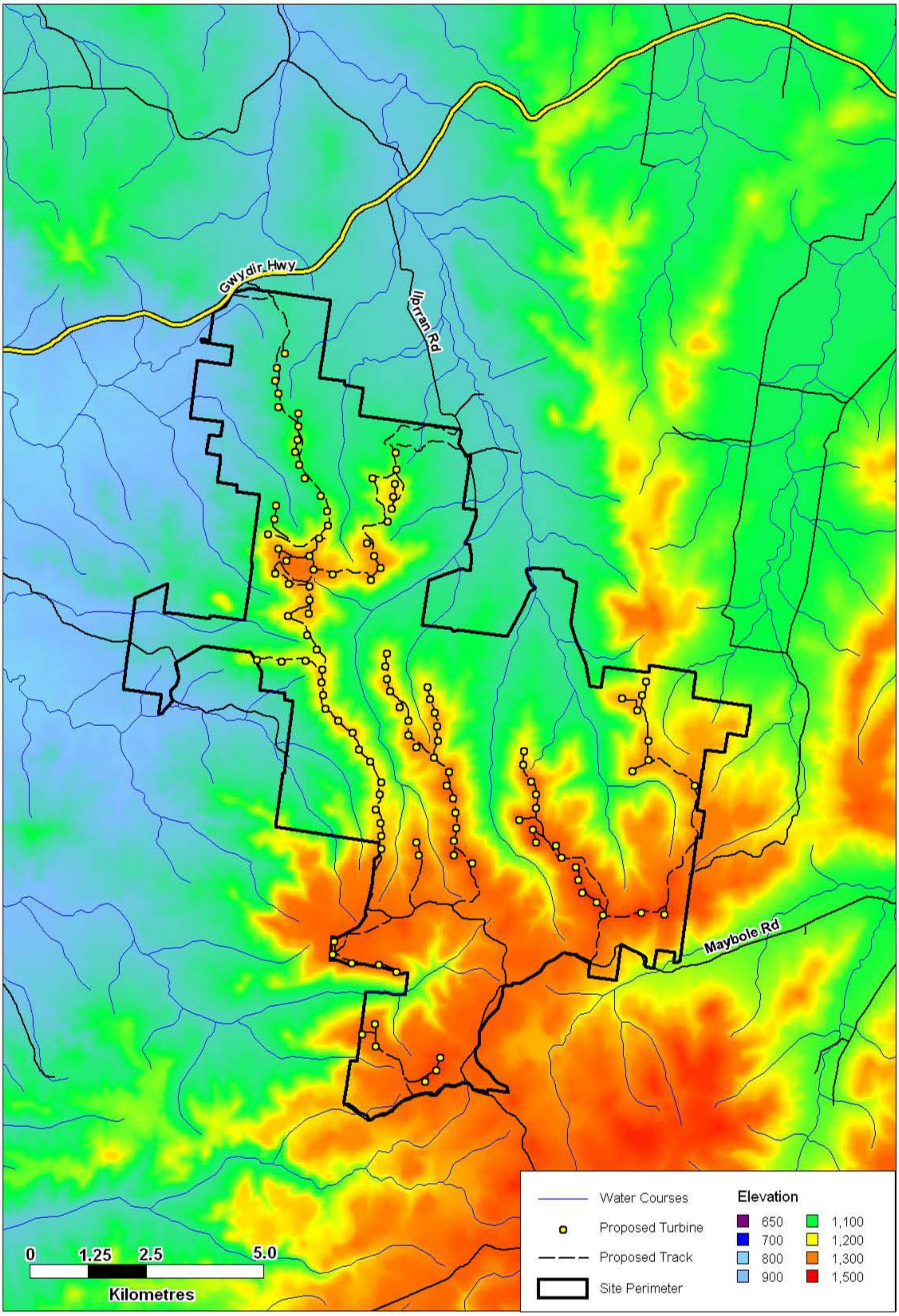

Figure 11-6 Digital Terrain Model of the White Rock Wind Farm

11.2.2 Assessment

The construction, operation, maintenance and decommissioning of the wind farm has the potential to impact on the current soils and landform of the site. The construction phase and decommissioning phase will impact on the sites landform and soils through:

- vegetation clearing;
- excavation and heavy machinery works;
- grading/levelling;
- access road upgrades;
- possible trenching for powerlines;
- vehicle traffic and heavy machinery traffic;
- excavation for turbine foundation breakdown and site building removal;
- re-contouring the surface; and
- revegetation & rehabilitation works.

These works have the potential to alter and degrade the sites natural soils and landform through increasing the possibilities of:

- erosion and weathering processes;
- introducing and or spreading of weed species
- changing hydrology and drainage paths, which can potentially increase the area’s chance of dryland salinity; and
- impact on the ground stability.

Areas at particular risk on the site are areas of steeper slopes and thinner soils. During the design phase, amendments to the infrastructure layout, and in particular access tracks, were made to reduce the overall environmental impact. This meant that access tracks predominantly followed the tops of ridgelines in order to prevent cutting into side slopes. For this reason the project is not expected to cause any significant environmental impacts on the site or its surrounding topography and terrain if standard procedures are undertaken to minimise excavation works and prevent erosion and sedimentation through adequate management and rehabilitation measures.

11.2.3 Mitigation

The extent of ground surface disturbance is expected to be relatively small compared to the total site area. The location of the turbines will be restricted to the ridgelines of the site, with ridges that are generally clear of vegetation. The ridgelines are predominantly on basalt rock just beneath the soil strata making the ridges less prone to erosion risks.

The ridgelines are covered with varying densities of vegetation with the majority of more densely vegetated areas located on along the sides of the ridges into the valleys. These slopes are at particular risk of erosion and will therefore be avoided where practical. The surrounding slopes will be largely unaffected by the project, except in the case where powerlines will be routed through them.

Nevertheless, areas will need to be protected by the installation and maintenance of standard erosion and sediment control measures and by minimising the amount of site excavations, land clearing, immediate stabilizing of exposed areas and restricting traffic to access tracks as much as possible. These measures are taken to avoid exacerbating erosion and weathering processes, changing hydrology and drainage paths of the site and contributing to soil and landform degradation.

At the conclusion of the construction period the disturbed areas of the site would be rehabilitated to a level suitable for the ongoing agricultural use of the land. The topsoil removed for construction activities would be stockpiled and reused for the rehabilitation of the areas around the turbine foundations, lay down and hardstand areas and along the access tracks. The concrete batching plant and other areas disturbed by heavy machinery would be rehabilitated. Pasture grass seed will be used to reinstate the vegetation cover for disturbed areas. The verges of the access tracks would be rehabilitated with topsoil and seed.

The rehabilitation process will be carried out progressively as each section of turbines is established. The rehabilitation of the site to the preconstruction level of vegetation groundcover would be dependent upon the time of year that the works are undertaken.

11.3 Climate and Air Quality

11.3.1 Existing Environment

Climate

The New England bioregion occurs in northern New South Wales in temperate to cool climate. The proposed wind farm site is located in the north eastern section of the tableland and is characterized by a warmer, sub-humid climate and uniform rainfall during summer months. Patches of mountainous climate can occur at higher elevations, and these are characterized by mild summers and no dry season (DECCW, 2010c).

The climatic characteristics outlined in this Section should be regarded as indicative only, as no data has been obtained from the proposed site itself but from weather stations located varying distances from and at different elevations. The statistics provided in this Section are based on historical climate data, future climate trends may differ over long periods due to the potential influences of climate change.

Table 11-1 New England Tableland Climate Summary Table (Source: DECCW)

New England Tableland Bioregion - climate variable information	
Mean annual temperature range	9 to 17°C
Minimum monthly temperature range	-3.6 to 6°C
Maximum monthly temperature range	20.8 to 31.6C
Mean annual rainfall range	653 to 1765mm
Minimum average monthly rainfall	31 to 86mm
Maximum average monthly rainfall	83 to 304mm

Frost and ice are experienced in the colder months and would be taken into consideration when assessing the potential risks of the development.

Air Quality

The site is not located near any major industrial areas, the site is however located adjacent to the Gwydir Highway which is assumed to receive medium to low traffic volumes in any period of time. Due to the consistent rainfall in the region and the sites geographical isolation from industry, the area has low levels of air borne particulate pollution.

A review of the Northern Slopes - Tamworth Air Quality data (DECCW, 2010c) for 2001-2009, showed limited air quality data for this assessment area. Tamworth is approximately 150km south west of the site and is only an indicative estimate of the air quality at the site.

On review of particulate matter from 2001-2009 (only available data) and air pollutant levels for the past eight years shows that air quality of the Northern Slopes are generally very good in terms of particulate and pollutant levels.

Table 11-2 Available DECCW Air Quality Data for the Northern Slopes Region (Tamworth Station)

Date	Average Particle Matter [µg/m³]	AQI Category(0-33=Very Good)
2009	27.3	Very Good
2008	15.8	Very Good
2007	No data	Nil
2006	16.8	Very Good
2005	No Data	Nil
2004	20.8	Very Good
2003	19.7	Very Good
2002	20.8	Very Good
2001	13.6	Very Good

DECCW has classified the northern slopes region to have an Air Quality Index (AQI) of very good. AQI is a representative number that is derived from air quality data readings affecting the air quality and standardises these values to give a consistent representative figure that can then be compared and contrasted to all areas of NSW:

$$AQI_{pollutant} = \frac{\text{Pollutant data reading}}{\text{Standard}} \times 100$$

The existing air quality in the Glen Innes area will vary with the seasons in response to airborne particulate matter associated with windy and dusty conditions and events such as bushfires.

11.3.2 Assessment

The project will have minimal impacts on the air quality of the local region and its surrounds due to the development being a low emission form of electricity generation. Activities that are expected to impact of the air quality of the area are predominately associated with the construction, decommissioning and to a lesser extent the maintenance phases. They could include:

- Very low emissions associated with manufacturing of equipment and materials for the wind farm infrastructure at other locations;
- Emissions from transport of equipment and materials to the site;
- Operational vehicle emissions; and
- Dust generation from excavation and vehicular movement works.

All of these impacts will be relatively minor and can be effectively managed through the implementation of the CEMP.

Wind farms have a positive contribution to reducing total greenhouse gas emissions by providing an alternate source of electricity that is not sourced from fossil fuels.

11.3.3 Mitigation

The CEMP would include measures to ensure that impacts from odour, dust and emissions generated during excavation, road works, and transport of machinery will be adequately controlled through standard industry practices.

The following measures are recommended to reduce the chance of dust and odour issues during the course of the construction, operation and decommissioning phases. These include:

- Minimising the surface area that is disturbed at any one time;
- Confine vehicle and machinery movement to access tracks or hard stand areas;
- The use of a water truck to minimise windblown dust;
- Protect stockpiles from prevailing weather conditions; and
- In the event that remedial measures are found to be ineffective for the control of dust (i.e. prevailing strong winds), work may be suspended as a precautionary measure until conditions are suitable for recommence.

11.4 Mineral Exploration

Geologically, the area proposed for the White Rock Wind Farm lies in the New England Fold Belt, an area consisting of Palaeozoic age sequences (Permian) overlain by tertiary volcanic rocks, primarily basalt. Historically, the area has produced significant amounts of gemstones, mostly sapphires, as well as tin, bauxite, bismuth and molybdenite. The local area also hosts important industrial mineral resources including coarse aggregate and sand.

There are currently two exploration licenses within the wind farm boundary that have the potential to be impacted.

Both EL 7301 and EL 7302 are currently held by Volcan Australia Corporation Pty Ltd. Exploration licenses entitle the holder to carry out exploration and prospecting for minerals within the specified area. Lease boundaries are shown on and overlap a portion of the site perimeter. EL 7301 is for Group 2 non metallic resources and EL 7302 is for Group 1 elemental minerals. Both licenses are due to expire 23 February 2011.

Epuron has consulted with Volcan and provided detailed maps showing the proposed location of wind farm infrastructure. Volcan were not able to confirm the location of their current exploration activities.

A Petroleum Special Prospecting Authority PSPAUTH 34 also overlaps part of the wind farm site. Until recently PSPAUTH 34 was held by Pangaea Oil and Gas Pty. Epuron have consulted with Pangaea who have confirmed that they no longer hold this licence. Epuron is not aware of any new applications for the licence.

11.4.1 Assessment

There is no reason why the exploration of minerals could not occur concurrently with the operation of wind turbines as the direct footprint of the wind farm infrastructure is less than 1 per cent of the site area. The project would not prevent access to the site area for ground based exploration of minerals except in the close vicinity of the infrastructure where there may be safety, structural, operational or engineering limitations.

The access tracks constructed for the proposed wind farm would facilitate easier access to a greater portion of the exploration license. It is possible that the operational wind farm may impede the exploration of minerals within the licensed area, in close proximity to the infrastructure such as turbines and substations. This may be to due to restrictions on the manoeuvrability of exploration machinery, localised sensitivity of magnetic and gravity remote sensing methods and occupational health and safety considerations. In some instances mineral exploration can also be achieved aerially by low flying planes and ground penetrating radar. The operation of the wind farm may limit the use of these methods.

While only two Exploration Licenses occur within the development envelope at this time, if a mineral deposit were discovered then an application for a Mining Lease can be made. There is no certainty that the discovery would be made or a Mining Lease would be granted, or if granted, that mining would be commercially viable. It is likely that the wind farm could impede some mining options (e.g. open-cut) in its immediate vicinity, or that some mine equipment may need to be built in alternate locations. The relatively small land area impacted suggests that alternate mining methods are likely to be available which would prevent sterilisation of any mineral resource. The reversibility of the project suggests that this impact is justifiable. The possible temporary loss of these areas for mining would be offset by the utilisation of a renewable resource during the project's life.

11.4.2 Mitigation Measures

Final wind turbine locations and details of the access tracks and other wind farm infrastructure will be provided to the exploration licence holders prior to construction. Ongoing consultation will be maintained to ensure that the Proponent is aware of any planned exploration activities in the vicinity of the wind farm.

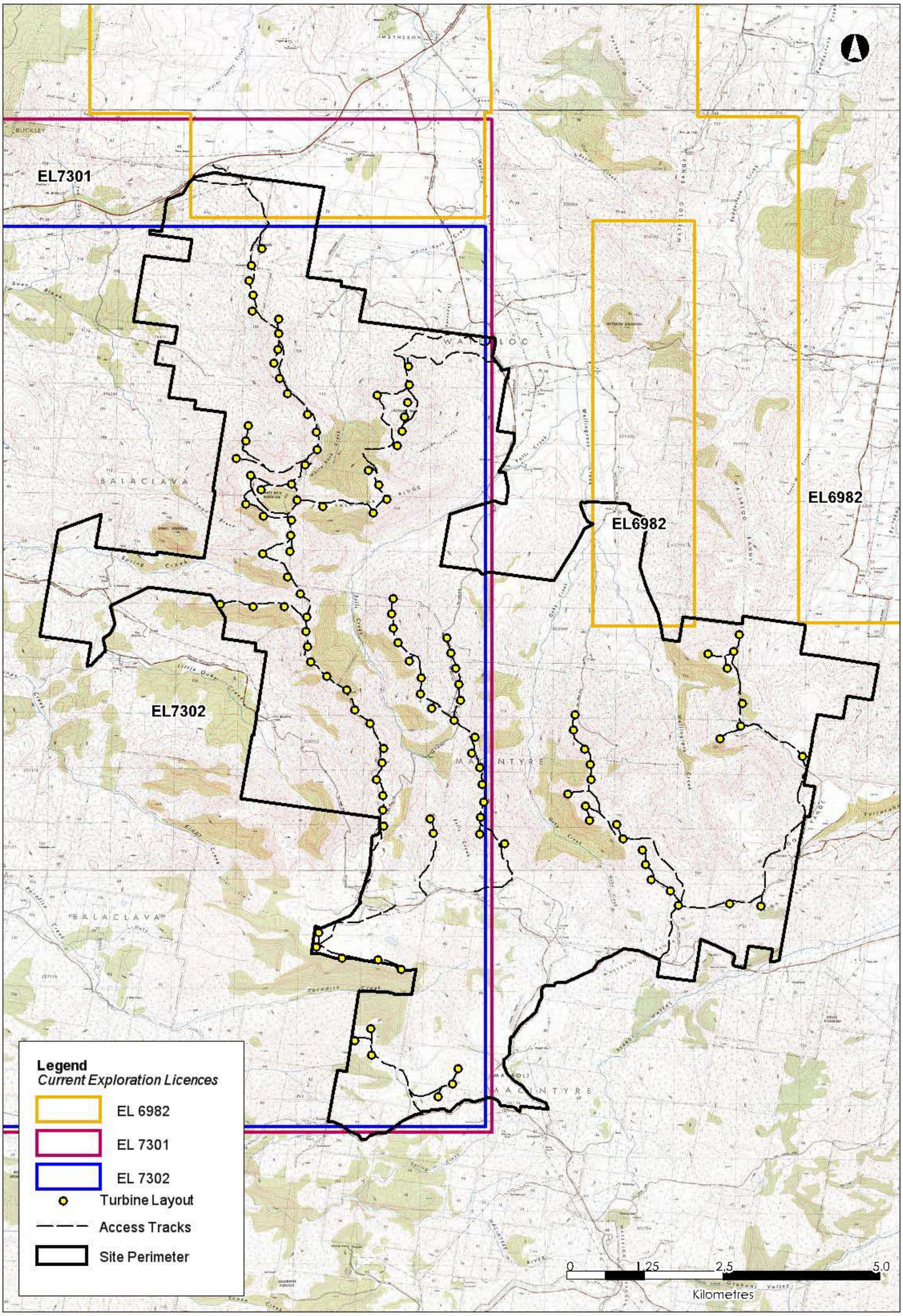

Figure 11-7 Current Exploration Licenses across the project site

11.5 Economic

11.5.1 Existing environment

The project would be located within the Glen Innes Severn Council Local Government Area (LGA) and the Inverell Shire Council LGA. The key statistics pertaining to the LGAs are provided in Table 11-3.

Table 11-3 Key statistics for the two LGAs

	Glen Innes (2009)	Inverell (2009)
Size of the LGA – Area of sq km.	5486.9	8605.9
Population number	9257	16703
% Growth since 2001	0.97% pa	1.24% pa
Median age group	35 – 44 years old	33 - 44 years old
Income and Occupation of Local Population (2008)		
Average income	$31,415	$32,278
Clerical, sales and services	18.9%	10.9%
Labourers and Related Workers	17.2%	18.5%
Professionals	15.9%	14.3%
Tradesperson and related workers	11.0%	11.6%
Gross value of agricultural commodities (2006)		
Value of crops	$6.9m	$20.2m
Value of livestock slaughtering	$48.8m	$53.3m
Value of livestock products	$8.5m	$10.1m

The major industries sectors within the Glen Innes region are agriculture, viticulture, sapphire mining and tourism, which reflect the predominantly rural nature of the area. The Glen Innes region is largely dependent on agricultural profits, with 24% of local industry economic output dependent on livestock produce (GISC 2010). The area supports a wide range of beef cattle, sheep and lambs due to its consistent rainfall levels and fertile land. The Glen Innes LGA economy is also dependent on the input of revenue from tourism. The region features a range of historic buildings, vineyards, world heritage national parks and a wide range of colonial and Celtic inspired heritage attractions.

11.5.2 Assessment

The project would provide temporary employment opportunities during construction and decommissioning. The increased demand for services in the local area, most likely during the construction phase, would also accompany the development, as contractors seek to accommodate and utilise other services in the local area. While it is hard to predict the exact amount of investment that will be injected into the local economy, there have been studies conducted to calculate the likely impacts based on the size of a proposed wind farm. A report by Dr Robert Passey was conducted to estimate the contribution to investment and job creation from the wind industry. The study was conducted in 2002 although projections were made out to 2010 to accommodate for the likely increase in wind farm projects following an increased push for more renewable energy projects. Using the estimations from this report, it is anticipated that around $131 million could be spent within the region as a result of the wind farm over its life.

There is an opportunity for local contracting and manufacturing services to be contacted during the site development. These may include concreting, earthworks, steel works and electrical cabling. As well, other service-related employment would follow, with the provisions for food, fuel, accommodation and other services for the contractors. Based on the construction phase spanning 18-24 months, employment would likely increase by around 100 full time equivalent jobs across the local area. This has again been calculated using the Passey report estimations of the number of jobs created for a wind farm project and assumes that it would be possible to source 40% of the construction jobs from the regional area. It is considered that construction, property and business services and retail trade would make up most of the employment growth. Precise economic benefits would vary on the final site design, turbine suppliers, timing of works and other details. Currently there are no facilities capable of making turbine components (nacelles and blades) in Australia. There may be potential for manufacturing towers in Australia.

There are a number of constraints related to the potential of the socioeconomic impacts described. These include supply-side constraints, primarily the supply of labour. Furthermore, the capacity of local business to service new contracts, together with the quality of local housing, amenities and other physical and social infrastructure are also factors that may affect the ability to attract and retain workers.

The construction and decommissioning phases of the project would take place over a considerable time period (estimated to the 18-24 month for construction and approximately 12 month for decommissioning). There is potential to adversely impact the current grazing activities on the sites that would be developed and for the additional heavy vehicle traffic on public roads to interfere with other economic activities, for example, scenic drives, field days and other tourist related activities. It is anticipated that the grazing impacts would be confined to the involved land holders. Involved land owners would be compensated by the Proponent for allowing the infrastructure to be constructed on the individual properties. It is considered that this compensation would off-set the impacts of grazing.

Operation

Wind farms are an economically viable means to generate electricity. The project would be privately funded. There would be no ongoing financial expenses to the community of any government agency.

Turbine rental provides additional revenue for involved property owners while allowing conventional farming activities to continue as usual. This would create an increased value to these properties and contribute to additional investment in the local area.

Additional benefits include direct investment and job creation in the local area as a result of construction activities. These benefits have been outlined in more detail in Section 4 Project Justification. The operational phase of the project is anticipated to create 21 full time equivalent jobs over a 30-year period.

11.6 Resource Impacts

The project would require natural resources from the Glen Innes area in order to construct the foundations, access tracks and required facilities. The following information outlines the resource requirements of the project and also the potential suppliers of the relevant resources.

11.6.1 Existing Environment

Wayne McCarthy Concrete and Aggregate Pty Ltd is located in Glen Innes and Inverell. Wayne McCarthy supplies and delivers aggregates, gabion, gravel, pebbles, rocks, sand, loam and road base that are suitable for concrete, footings, foundations, kerbs, paths, and roads. The quarry is located on Grafton Rd approximately 34km north-east from the proposed wind farm site.

Currently there is a Development Application with Glenn Innes Severn Council for another quarry that is expected to supply sands suitable for concrete at Spring Mountain, which lies adjacent to the proposed wind farm site.

11.6.2 Assessment

Resource requirements for the project would include:

- Gravel and base course for access tracks, crane hardstand areas, and site buildings/infrastructure;
- Concrete for turbine foundations and site building foundations;
- Water for dust control and concrete.

Rock Crusher

To best utilise any existing natural gravel resources resulting from the construction of the wind farm, a rock crusher would be used on site. Materials excavated during the construction of access tracks and wind turbine footings may, if suitable, be able to be reused as road base for the road surface upgrades. Rock crushing does not trigger Schedule 1 of the *Protection of the Environment and Operations Act 1997* if less than 150 tonnes per day is crushed. The daily rock crushing capacity required will be confirmed following a pre-construction geotechnical assessment on the site to determine the extent of suitable construction materials available.

Concrete Batching Plant

In the event that pre-mix concrete is unable to supply for the turbine foundations and other facilities, a portable concrete batching plant would be established on site.

A typical concrete batch plant would involve a level area of approximately 100m by 50m to locate the loading bays, hoppers, cement and admixture silos, concrete truck loading hardstand, water tank and stockpiles for aggregate and sands. The batching plant would include an in-ground water recycling / first flush pit to prevent dirty water escaping onto the surrounding area, and would be fully remediated after the construction phase.

The concrete batching plant would produce around 350m^3 of concrete per day when a turbine foundation is being poured. The maximum operational period would be the construction period of the wind farm.

A total of about 42,000 tonnes of concrete would be produced from the onsite batching plant. The batch plant operations would therefore require a license to be issued by DECCW (under the *Protection of the Environment Operations Act 1997*), given the amount exceeds the license threshold of 150 tonnes per day or 30,000 tonnes per year. License conditions specified by DECCW are likely to include operational protocols and monitoring.

Gravel and Road Base Requirements & Supply

Access tracks are required to be 5m wide and approximately 300 - 500mm in thickness to accommodate the movement of heavy delivery vehicles and cranes. In general all access tracks will be unsealed and constructed from local aggregate. Sealed access tracks will not be used unless safety, geotechnical or economic studies deem them necessary. The final access track design would take into account the traffic loadings and ground conditions relevant to the site and the works.

Sands and aggregate would be sourced from excavation of footings, where possible, or from existing sand and gravel pits within the local area. Every effort would be made to source clean sands and aggregates and to prevent transport of weeds to site.

Liaison with the proprietor of Wayne McCarthy Concrete and Aggregate Pty Ltd has confirmed that the Glenn Innes Quarry has sufficient resource materials to meet the road base, gravel and sand requirements of the proposed wind farm. The addition of the second quarry at Spring Mountain would result in reduced travel requirements to transport sand and aggregate to the site.

The estimated volume of gravel/road base required for the access tracks and other works is listed in Table 11-4.

Table 11-4 Estimation of Road Base Volumes

Description	Dimensions	Quantity	Volume
Access Tracks	5m wide x 400mm	66,520m	133,040m^3
Construction Compound	100m x 100m x 400mm	1	4,000m^3
Hardstand areas	25m x 45m x 400mm	119	53,550m^3
Total volume			190,590m^3
Estimated Rock Extracted from Foundations	512m^3	119	60,928m^3

Turbine Foundation Concrete Requirements

The turbine foundations will be excavated, with formwork and reinforcement prepared before the concrete foundation is poured. Each turbine foundation will occupy an area of approximately 16m x 16m and 2m deep. Smaller foundations will be used where the geotechnical conditions allow rock anchor style foundations.

Preliminary investigations reveal that all of the required concrete materials can be sourced locally within the Glen Innes region. The estimated materials required for the manufacture of concrete are as follows:

Table 11-5 Concrete Materials Required

Component	Approximate composition by mass	Required for a single 350m^3 foundation	Required for 119 turbine foundations
Cement	13%	109 tonnes	12,995 tonnes
Sand	34%	286 tonnes	33,986 tonnes
Aggregate	46%	386 tonnes	45,982 tonnes
Water	7%	59 kL	6,997 kL
TOTAL:		840 tonnes	

Water Supply

The operational phase of the wind farm will require relatively small volumes of water and will be supplied primarily from rain water collected from facility roof drainage. Should additional water be required, it will be sourced from Glen Innes Severn Council and delivered by truck to the site.

It is proposed that concrete for the turbine foundations be either provided from a portable source or a purpose built batching plant (with sufficient capacity to allow an entire foundation to be constructed in one pour). Accordingly, approximately 60kL of water will be needed for each foundation.

Water used in concrete needs to be relatively free of impurities which may adversely react with the cement. As such, water required by construction activities will need to be of a quality commensurate with potable water.

Water Sources

Hydrology conditions of the Border Rivers region is considered moderate to good with low salinity levels and small areas at risk of dryland salinity (predominately far west areas). Water quality of the catchment is generally considered good with high levels of phosphorus and turbidity present that gradually increases the further west in the basin (CSIRO, 2007).

The numerous small farm dams and creek lines throughout the area are generally degraded through clearing, erosion, sedimentation, and pollution from cattle and sheep dung and are unlikely to be of a sufficient quality for concrete needs.

Typical water resources options include supplies from on-site dams, offsite dams, groundwater and purchasing water from local authorities.

Major surface water storages in the Border Rivers Catchment exist on each of the main rivers making river flows highly regulated. These include the Pindari Dam on the Severn river (50km North west), the Queensland Dams Glenlyon Dam on the Dumaresq River (90km North) and the Coolmunda Dam on the Macintyre Brook (150km away). None of these resources are seen as practical due to distance from the site and the possibility of turbid or phosphorus laden waters that is typical of the Border Rivers Catchment.

There are other smaller dams in the general region such as the Beardy Waters Dam (45km away and 500ML capacity) or Tenterfield Creek Dam (90km away with 1,150ML capacity).

The site contains a number of small dams dispersed throughout each property. These dams are used for agricultural purposes and generally are small in size. A larger dam, approximately 300-400ML exists on the south-west portion of the site. The quality of the water is unknown, although this dam could be used for the supply of water for dust suppression during the construction period.

Fresh groundwater of adequate quality is not available in the immediate study area. Useable groundwater resources are restricted to those areas upstream of Keetah (200km northwest) on the Queensland-New South Wales border; fresh ground water downstream of this is usually associated with raised water levels (CSIRO, 2007).

In reviewing the five options for the provision of water to site, having water delivered from Glenn Innes Severn Council appears to be the best option. This is based on cost, reliability and quality of water provided, as well as flexibility of providing water to different locations on site if required.

Preliminary discussions with officers from Glenn Innes Severn Council have revealed that treated effluent water is available for purchase. The water has been UV treated and has low nutrients and should be suitable for use in the concrete foundations. This would require further testing of the water to confirm the quality, prior to committing to this source.

A water truck has a typical capacity of 16 kL. Thus to provide 60kL to site will require approximately 4 trucks.

It is anticipated that in total 6,997 kL of water would be required for the turbine foundations and 8,000 kL for dust suppression (assuming 2 water trucks per day for 250 days). That equates to a total of about 15,000 kL of water for the construction phase. If this water was entirely sourced from Glen Innes the number of truck movements required would be 937 in each direction.

The sourcing of treated water would also ensure that no water will be sourced from the local environment. The erosion and sediment control measures will mitigate the potential for the construction and operational aspects of the wind farm impacting on the areas surface water and/or groundwater quality or quantity.

11.7 Traffic and Transport Issues

11.7.1 Approach

A Traffic Impact Study was prepared by Epuron. A full copy of the study is presented in Appendix 5 The assessment considered the potential impacts of the proposed wind farm and provides mitigation measures to minimising potential traffic impacts associated with the project. The Traffic Impact Study is primarily focused on the construction phase as it is considered that the construction phase would generate the greatest volume of traffic.

The methodology adopted for the assessment included:

- Reviewing the RTA checklist for preparing traffic impact studies
- Mapping of the proposed wind farm site and surrounding area
- Review of planning documentation for other wind farm developments in the area
- Roads were inspected and photographed
- RTA data was reviewed to establish traffic volumes on the main roads
- Personal communication with the RTA
- Consultation with Glen Innes Severn Council and Inverell Shire Council
- Information on road conditions from property owners at the Information Day on 3 November 2010
- Information from turbine suppliers on access track requirements and turbine component transport

11.7.2 Existing Environment

The roads in the vicinity of the project area are generally classified as follows:

- State Highway – New England and Gwydir Highways are owned and maintained by the Roads and Traffic Authority
- Regional Roads – Part funded by a grant agreement administered by the local Roads and Traffic Authority
- Local Roads – All other roads that are owned by the council

The wind farm site is located 20 km west of Glen Innes, a major country town and service centre. Both the New England and Gwydir Highways provide a safe, single carriage way connection with up to 100 km/h travel speed.

Access requirements for the proposed wind farm can be separated into the following categories:

- Standard road vehicles ranging from 2 wheel drive cars to B-Double trucks. These vehicles are required to access the site as far as the construction compound and associated equipment storage area. They represent the largest portion of vehicles. It would be anticipated that light vehicles would be the source of transport within the construction area of the site.
- 4 wheel drive vehicles may be required for most transport to the turbine locations and would provide ongoing maintenance.
- Specialist vehicles may include off-road construction vehicles, for example vehicles with nonstandard axle combinations. These may include tracked vehicles and reconfigured trailers used to tow components into position. This type of vehicle would not generally be able to be used on sealed local roads
- Over-dimension vehicles transporting turbine components and oversize construction machinery. These vehicles would generally be wider and longer but weights of loads would not be excessive (generally up to 70 tonnes carried over 7 axles).

- Over-mass and over-dimensional vehicles transporting electrical transformers of up to 200 tonnes. These vehicles would possibly require the strengthening of bridges and drainage structures because of the close spacing of axles. Only a small number of these vehicles are anticipated during construction.

Expected Construction Access

The New England Highway connects the two ports of Brisbane and Newcastle to Glen Innes and has sufficient capacity to handle the delivery of imported turbine components. The route from Brisbane through Glen Innes to the site is the most likely route to be used.

The major access point being considered for the White Rock development is from the Gwydir Highway at the northern end of the site. A new unsealed track would be constructed to access the temporary construction compound, operation and maintenance facility, switchyard, substation and the turbine locations further south.

The alternate access to the site is from the south via Grahams Valley Road, Maybole Road and Kellys Road. This route includes a narrow bridge and a very steep section on Maybole Road that will be difficult for the delivery of the major turbine components.

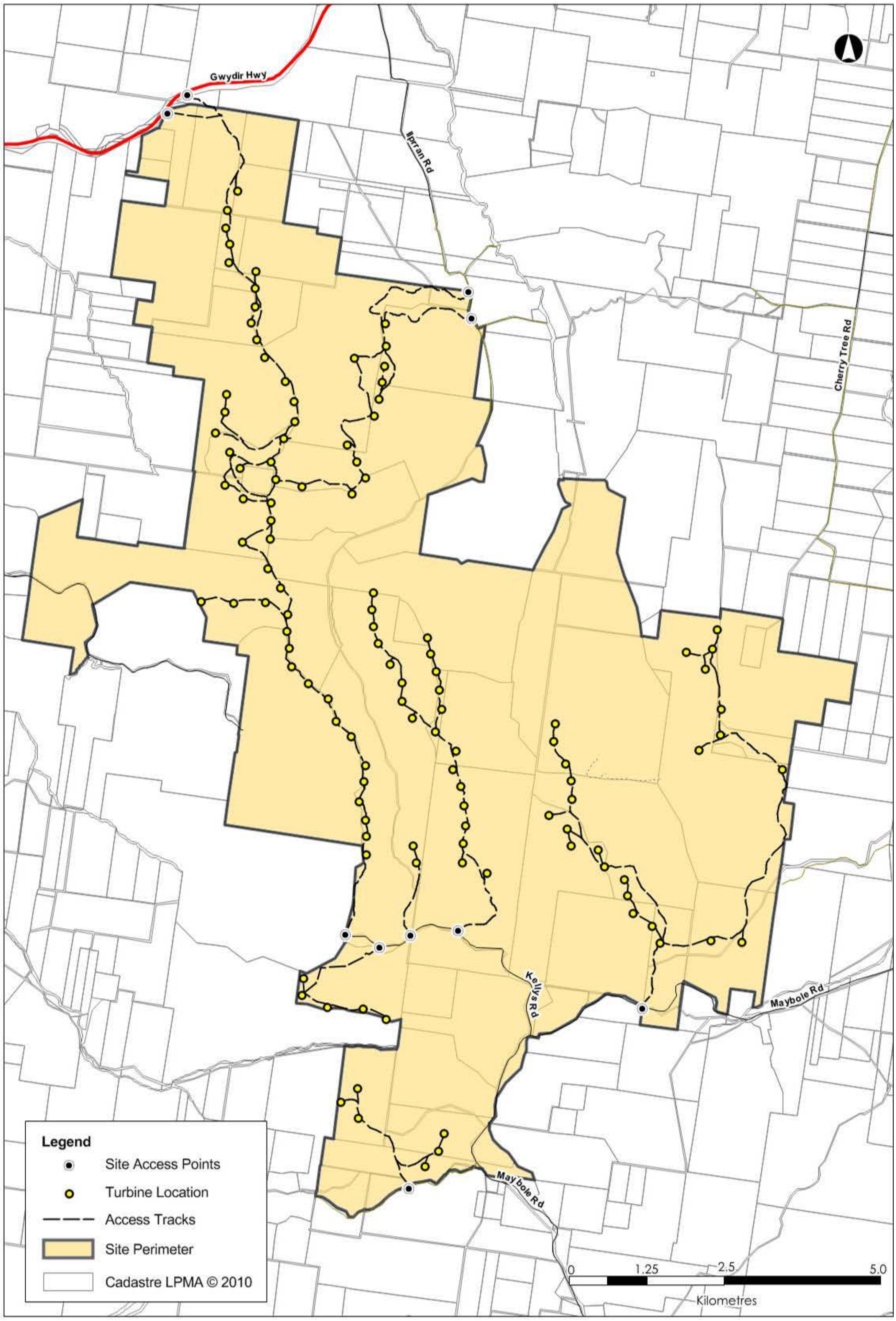

Figure 11-8 Main access from Gwydir Highway and alternate access from Maybole Road

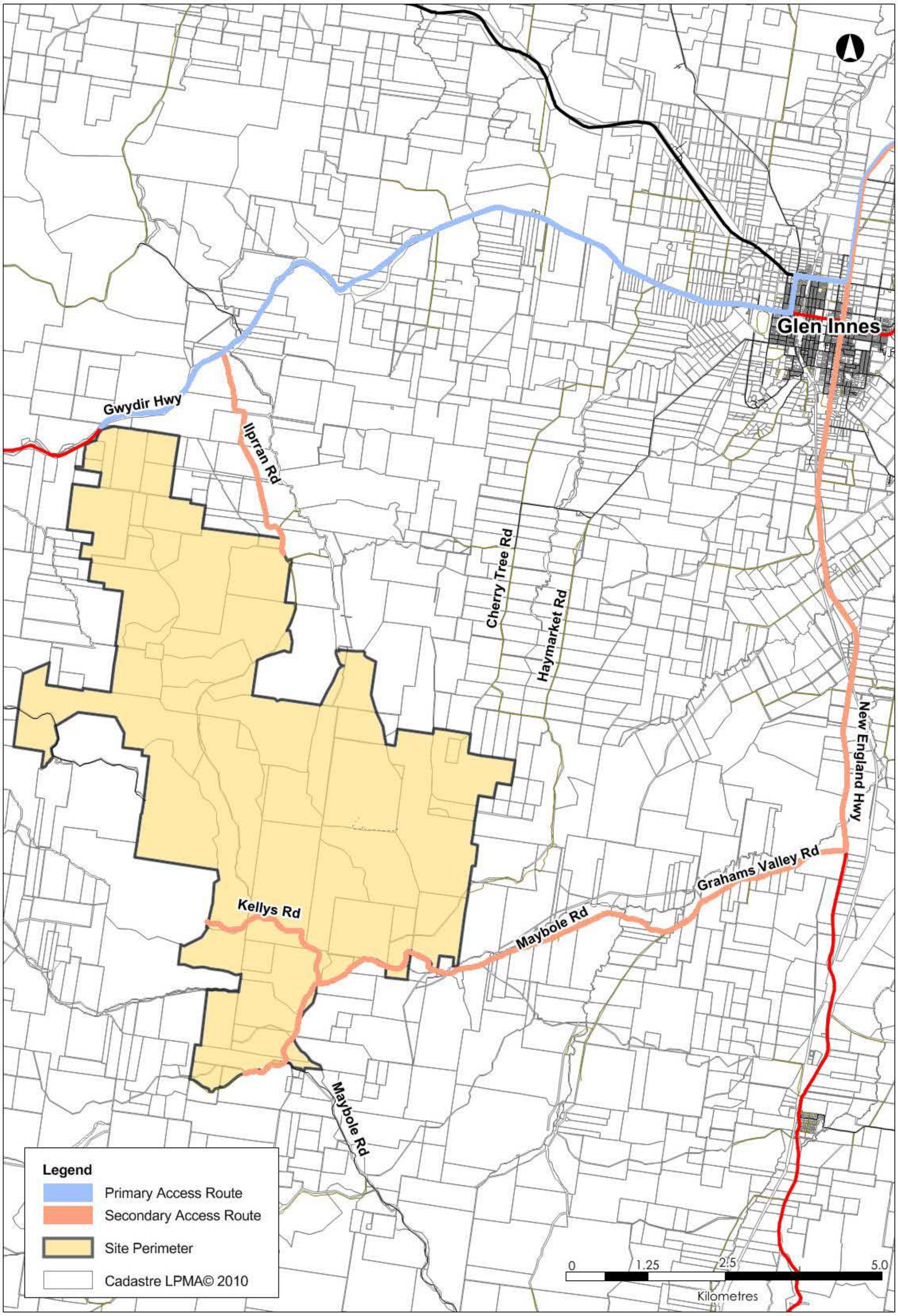

Figure 11-9 Access to the site from New England Highway

11.7.3 Assessment

Construction and decommissioning phase

Table 11-6 Approximate dimensions and weights of the components of a typical wind turbine

Wind Turbine Component	No. of parts per turbine	Total number of parts for 119 turbines	Approximate component weight (tonnes)
Towers	3	357	Up to 60
Nacelle	1	119	Up to 80
Hub	1	119	Up to 23
Blades	3	357	Up to 12

Over-mass and over dimension vehicles

The larger vehicles would occupy most of the width of the roadway at many locations thereby requiring traffic control procedures to ensure safe passage for local road users. For nearby property owners, there is likely to be an increase in traffic noise and dust nuisance in addition to the need to control stock from straying on the roads which are not fenced. Dust generated on unsealed roads could impact visibility and result in the loss of pavement materials. Gravel road surfaces would deteriorate and potholes would form under the increased traffic loads, particularly during wet weather when water ponds or drains across a road. Structural damage may occur to some of the culverts, concrete causeway crossings, stock grids and traffic islands. The location of trees and other roadside objects have the potential to obstruct the passage of long wide loads and high loads. Lack of roadside delineation in some locations may impact traffic safety during periods of poor visibility. Some intersections have inadequate pavement width to safely accommodate the turning manoeuvres of the over-size vehicles.

It is considered that these impacts would be temporary, as the equipment haulage is not a continuous program. Most of the heavy haulage would be in the form of convoys and would be managed through a number of specific mitigation measures developed and implemented in conjunction with both RTA and Glen Innes Severn Council. These measures usually include escort vehicles.

Decisions on the final routes for these vehicles would be the subject of negotiations between the haulage contractor and the road authorities.

Traffic impacts at specific location

New England Highway and Gwydir Highway

The route from Newcastle to Glen Innes provides a safe, single carriage highway from port to destination. During the construction phase there would be an increase in traffic travelling along this route including standard road vehicles, B-Double trucks and over dimension vehicles transporting turbine equipment

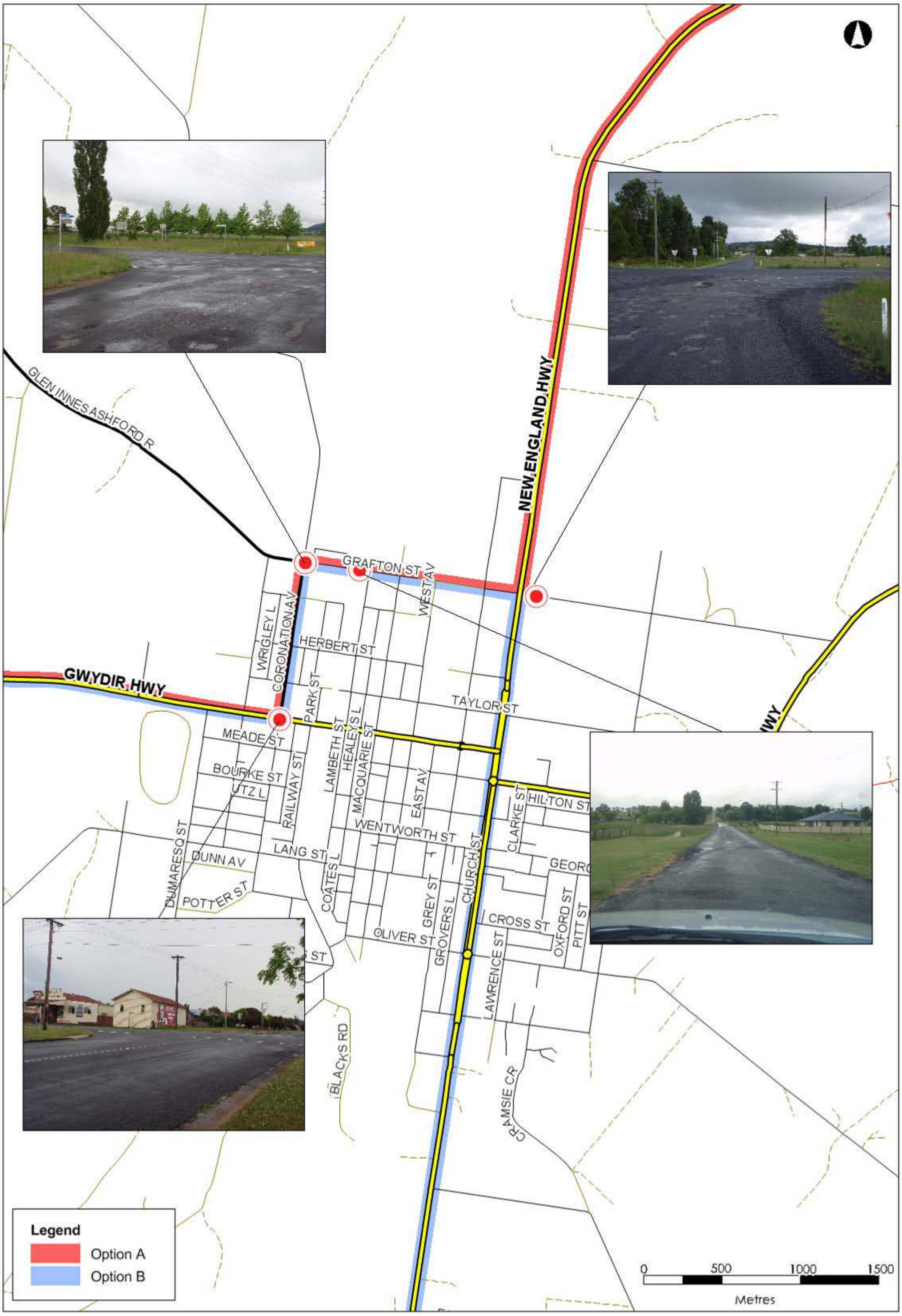

Figure 11-10 Access route through Glen Innes for wind farm infrastructure

Impacts on minor roads

There is potential to impact Kellys Road and Maybole Road. Although it is not anticipated that these minor roads would become access routes, it is probable that some of the routes would experience a small increase in traffic volumes. A relatively small increase in traffic volume would require improvements to ensure the safety of road users particularly in relation to conflicts between vehicles and stock.

Isolated curves and crests on looser gravel surfaces could result in drivers losing control. Several drainage structures may need to be upgraded to ensure continued wet weather access.

Several mitigation measures have been developed to manage traffic impacts during the construction phase; key areas are highlighted in section 7.10.4. These centre around the development of a Traffic Management Plan (TMP) consultation with roads authorities and affected members of the community, to finalise the routes and ensure that safety and protection of assets is managed effectively.

Operation phase

Once operational, the wind farm would be managed and maintained by several crews of technicians, likely to be based at Glen Innes. The proposed wind farm may generate interest as a visual feature in the locality however, it is considered that this would not significantly increase the number of tourists visiting Glen Innes and therefore the increase in traffic volumes and subsequent impacts are likely to be low. No specific mitigation measures are considered warranted to manage operational traffic impacts.

11.7.4 Mitigation Measures

The following measures would be adopted to minimise the impacts from construction traffic:

- Development of a Traffic Management Plan that will identify detail actions such as scheduling of deliveries, managing timing of transport through major centres (Glenn Innes) 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.
- Use of a licensed and experienced haulage contractor, to be responsible for obtaining all necessary permits and approvals from the RTA and Councils and for complying with conditions of consents.
- Escorts for oversize and over-mass vehicles will be provided in accordance with RTA requirements.
- The traffic Management Plan will establish a procedure to monitor traffic impacts during construction such as noise, dust nuisance and travel timings so adjustments can be made to minimise impacts.
- 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

12 Draft Statement of Commitments

Under the Part 3A reforms, Proponents are required to provide a Statement of Commitments on how they propose to implement measures for environmental mitigation, management and monitoring for the project.

Avoidance and mitigation measures have been developed for the design, construction, operation and decommissioning phases of the project within this EA.

The commitments in this section have been developed into a comprehensive set of environmental impact avoidance and mitigation measures which incorporate:

- Specific recommendations contained in the specialist reports; and,
- Additional measures identified during the preparation of this Environmental Assessment (in consultation with the community and government agencies).

In general, these issues will be incorporated and addressed in the proposed CEMP and OEMP.

To avoid duplication in this section, mitigation measures are located under the most appropriate heading only and are not repeated in subsequent sections.

EPURON

SoC	Issue	Impact	Objective	Mitigation tasks	Project phase	Auditing
1	General	Revisions to approved development	No increase in impact	Ensure that any minor changes to the proposed development do not create any material increase in overall environmental impact. In the event of any significant changes to the wind turbine layout, an updated noise assessment and visual impact assessment will be submitted prior to construction.	Design	DoP
2	General	Loss or modification of habitat	Mitigate impact	Implement a Construction Environmental Management Plan (CEMP) and a Operational Environmental Management Plan (OEMP) in accordance with the Best Practice Guidelines for Wind Energy Projects (Auswind, 2006)	Construction	CEMP OEMP
3	Visual	Deterioration of visual amenity at surrounding residences	Mitigate impact	Offer vegetative screening of any residence within 3 km of a wind turbine. The Proponent would write to the owner of each residence outlining the offer and process. A site visit would determine the extent and type of planting required. Species selection would be determined in consultation with landholders using specialist advice. This offer would remain in place for a period of 1 year after project construction, to allow people time to either adjust or to decide that landscape filtering or screening is warranted. Planting would be completed within 2 years of completion of project construction.	Post Construction	CEMP OEMP
4	Visual	Deterioration of visual amenity Blade glint	Mitigate impact	Consider options for use of colour to reduce visual contrast between turbine structures and background, e.g. use of off white rather than white, and use matt finish to avoid reflected sunlight.	Design	CEMP
5	Visual	Deterioration of visual amenity	Avoid Impacts	Avoid use of advertising, signs or logos mounted on turbine structures, except those required for safety purposes.	Design	CEMP
6	Visual	Deterioration of visual amenity	Mitigate impact	Minimise activities that may require night time lighting, and if necessary use low intensity lighting designed to be mounted with the light projecting inwards to the site to minimise glare at night.	Construction & Operation	CEMP OEMP

SoC	Issue	Impact	Objective	Mitigation tasks	Project phase	Auditing
7	Noise	Construction noise	Minimise Impact	Undertake construction activities associated with the project that would generate audible noise at any non-involved residence during the hours: • 7am to 6pm, Monday to Friday, • 8am to 1pm Saturday; and • At no time on Sundays or public holidays.	Construction	CEMP
8	Noise	Construction noise	Minimise Impact	Apply all feasible and reasonable work practices to meet the noise affected level in accordance with ICN Guidelines including the use of temporary acoustic barriers, the use of silencers, improved vehicle noise control and the use of 'quiet work practices' (such as reducing or relocating idling machinery).	Construction	CEMP
9	Noise	Construction noise	Mitigate Impact	Implement a community consultation process to ensure adequate community awareness and notice of expected construction noise.	Construction	CEMP
10	Noise	Construction noise	Minimise Impact	Locate fixed noise sources such as crushing plant at the maximum practical distance to the nearest dwellings and where possible use existing landforms to block line of sight between equipment and the dwelling.	Construction	CEMP
11	Noise	Construction noise	Minimise Impact	Meet ICN Guidelines for control of blasting associated with the construction of the project.	Construction	CEMP
12	Noise	Operational noise	Compliance	Ensure final turbine selection and layout complies with the SA EPA Noise Guidelines of 35 dB(A) or background plus 5 dB(A) (whichever is higher) for all non-involved residential receivers, other than those which have entered into a noise agreement with the Proponent in accordance with the SA EPA Noise Guidelines.	Detailed design	OEMP
13	Noise	Operational noise	Compliance	Ensure final turbine selection and layout complies with the World Health Organisation Guidelines for Community Noise requiring 45 dB(A) or background plus 5 dB(A) (whichever is higher) for all involved residential receivers and all non-	Detailed design	OEMP

SoC	Issue	Impact	Objective	Mitigation tasks	Project phase	Auditing
				involved residential receivers who have entered into a noise agreement with the Proponent in accordance with the SA EPA Noise Guidelines.		
14	Noise	Operational noise	Compliance	Prior to construction, prepare and submit to the Department of Planning a noise report providing final noise predictions based on any updated background data measured, the final turbine model and turbine layout selected, to demonstrate compliance with the relevant guidelines for all residences.	Detailed design	OEMP
15	Noise	Operational noise	Mitigate impact	If operational monitoring identifies exceedance, consideration would be given to providing mechanical ventilation (to remove the requirement for open windows), building acoustic treatments (improving glazing) or using turbine control features to manage excessive noise under particular conditions.	Operation	OEMP
16	Noise	Operational noise	Compliance	Develop and implement an operational noise compliance testing program.	Operation	OEMP
17	Ecology	Loss or modification of habitat	Avoid, minimise, offset	Site all infrastructure entirely within the development envelope assessed in the Ecology Assessment. Where this is not possible, undertake additional assessment and seek any necessary additional approvals.	Detailed design	CEMP DoP
18	Ecology	Loss or modification of habitat	Avoid, minimise, offset	Where areas of native vegetation cannot be avoided, microsite infrastructure to minimise impacts (includes road widening and transmission easement).	Detailed design	CEMP
19	Ecology	Loss or modification of habitat	Mitigate impact	Align roads and cabling along existing tracks where possible to minimise vegetation removal and loss of hollow-bearing trees, number of easements and the spread of weeds.	Detailed design	CEMP
20	Ecology	Loss or modification of habitat	Mitigate impact	Construct powerlines underground and along road infrastructure where possible to minimise the number of easements and the potential for avian collisions	Detailed design	CEMP

SoC	Issue	Impact	Objective	Mitigation tasks	Project phase	Auditing
21	Ecology	Loss or modification of habitat	Avoid, minimise, offset	Prepare and implement an Offset Plan, to offset the quantum and condition of native vegetation to be removed, in order to achieve a positive net environmental outcome for the project. Offset areas would reflect the actual footprint of the development (i.e. footing areas and new tracks) not the maximum impact areas (which include easements and existing tracks). The Offset Plan would be prepared in consultation with DECCW, prior to construction. The offset areas will be provided and maintained in perpetuity.	Prior to construction	CEMP
22	Ecology	Loss or modification of habitat	Avoid, minimise, offset	Implement a post-construction bird and bat monitoring program to determine the impacts of the project on bird and bat populations	Prior to construction	OEMP
23	Ecology	Weed Control	Avoid Impacts	The CEMP would include appropriate weed control protocols such as washing machinery after entering affected areas and spraying road ways to ensure the spread of weeds is restricted during construction and throughout the ongoing operation of the project.	Construction	CEMP
24	Heritage	Disturbance of significant site	Avoid Impact	A 30m buffer zone should be maintained around scarred tree sites RPS WR01A, RPS WR01B and RPS WR04 and demarcated by temporary fencing during construction and associated plant movement.	Detailed design & construction	CEMP
25	Heritage	Disturbance of significant site	Avoid Impact	The locations of sites identified RPS WR01A, RPS WR01B, RPS WR02, RPS WR03 and RPS WR04 should be mapped within the Proponents' environmental management system to ensure their conservation	Detailed design	CEMP OEMP
26	Heritage	Inadvertent disturbance of Aboriginal heritage sites or objects	Avoid Impact	All relevant staff and contractors should be made aware of their statutory obligations for heritage under NSW NPW Act (1974) and the NSW Heritage Act (1977), which may be implemented as a heritage induction.	Construction	CEMP OEMP
27	Aircraft Hazards	Potential hazard	Minimise	Liaise with all relevant authorities (CASA, Airservices, and Department of Defence)	Detailed design	CEMP

SoC	Issue	Impact	Objective	Mitigation tasks	Project phase	Auditing
			Impact	and supply location and height details once the final locations of the wind turbines have been determined and before construction commences.		
28	Aircraft Hazards	Potential hazard	Minimise Impact	Consult with the landowners and appropriate licensed contractors to discuss alternate measures for aerial spreading in areas affected by the turbines	Operation	OEMP
29	Communication	Deterioration of signal strength	Avoid impact	Locate wind turbines to avoid existing microwave link paths that cross each precinct, or liaise with the owners of such links to relocate services to avoid potential impacts from turbines.	Detailed Design	CEMP
30	Communication	Deterioration of signal strength	Avoid impact	Ensure adequate television reception is maintained for neighbouring residences as follows: • Undertake a monitoring program of houses within 5km of the wind farm site to determine any loss in television signal strength if requested by the owners. • In the event that after construction television interference (TVI) is experienced by existing receivers within 5km of the site, investigate the source and nature of the interference. • Where investigations determine that the interference is cause by the wind farm, establish appropriate mitigation measures at each of the affected receivers in consultation and agreement with the landowners. Specific mitigation measures may include: • Modification to, or replacement of receiving antenna • Provision of a land line between the effected receiver and an antenna located in an area of favourable reception • Improvement of the existing antenna system • Installation of a digital set top box or	Operation	OEMP

SoC	Issue	Impact	Objective	Mitigation tasks	Project phase	Auditing
				• In the event that interference cannot be overcome by other means, negotiating an arrangement for the installation and maintenance of a satellite receiving antenna at the Proponents cost.		
31	EMF	Radiation exposure from EMFs	Avoid Impact	Powerlines would be located as far as practical from residences and in accordance with the minimum distances set in Country Energy's Procedural Guideline – Easement Requirements.	Detailed Design	CEMP
32	Shadow flicker	Safety & nuisance	Compliance	If shadow flicker is found to be a nuisance to residents, conditions would be pre-programmed into the control system and individual wind turbines automatically shut down whenever these conditions are present.	Operation	OEMP
33	Shadow flicker	Safety & nuisance	Compliance	Shadow flicker effects on motorists would be monitored following commissioning and any remedial measures to address concerns would be developed in consultation with the RTA.	Operation	OEMP
34	Traffic	Safety and asset protection	Minimise Impact	The Proponent would develop and implement a Traffic Management Plan (TMP) in consultation with roads authorities to facilitate appropriate management of potential traffic impacts. The TMP would include provisions for: • Scheduling of deliveries and managing timing of transport • Limiting the number of trips per day • Undertaking community consultation before and during all haulage activities • Designing and implementing temporary modifications to intersections, roadside furniture, stock grids and gates • Managing the haulage process, including the erection of warning and/or advisory speed signage prior to isolated curves, crests, narrow bridges and change of road conditions • Designation of a speed limit would be placed on all of the roads that	Construction	CEMP OEMP

SoC	Issue	Impact	Objective	Mitigation tasks	Project phase	Auditing
				would be used primarily by construction traffic • Preparation of a Transport Code of Conduct to be made available to all contractors and staff • Identification of a procedure to monitor the traffic impacts during construction and work methods modified (where required) to reduce the impacts • Provide a contact phone number to enable any issues or concerns to be rapidly identified and addressed through appropriate procedures • Reinstatement of pre-existing conditions after temporary modifications to the roads and pavement along the route.		
35	Traffic	Safety and Asset protection	Minimise Impact	Engage a licensed haulage contractor with experience in transporting similar loads, responsible for obtaining all required approvals and permits from the RTA and Councils and for complying with conditions specified in those approvals. This would include the use of escorts for oversize and over-mass vehicles in accordance with RTA requirements	Construction	CEMP
36	Traffic	Safety and Asset protection	Minimise Impact	Prepare road dilapidation reports covering pavement and drainage structures in consultation with roads authorities for the route prior to the commencement of construction and after construction is complete. Repair any damage resulting from the construction traffic (except that resulting from normal wear and tear) as required during and after completion of construction at the Proponent's cost or, alternately, negotiate an alternative for road damage with the relevant roads authority.	Construction	CEMP
37	Traffic	Potential disruption to other road users	Mitigate Impact	Provide a 24hr telephone contact during construction to enable any issue or concern to be rapidly identified and addressed.	Construction	CEMP

SoC	Issue	Impact	Objective	Mitigation tasks	Project phase	Auditing
38	Bushfire	Bushfire risk	Minimise Impact	Prepare a Bushfire Management Plan as part of the Construction Environmental Management Plan. The Rural Fire Service and NSW Fire Brigade would be consulted in regard to its adequacy to manage bushfire risks during construction, operation and decommissioning. The plan would as a minimum include: • Flammable materials and ignition sources brought onto the site, such as hydrocarbons, would be handled and stored as per manufacturer's instructions. • During the construction phase, appropriate fire fighting equipment would be held onsite when the fire danger is very high to extreme, and a minimum of one person on site would be trained in its use. The equipment and level of training would be determined in consultation with the local RFS. • Substations would be bunded with a capacity exceeding the volume of the transformer oil to contain the oil in the event of a major leak or fire. The facilities would be regularly inspected and maintained to ensure leaks do not present a fire hazard, and to ensure the bunded area is clear (including removing any rainwater). • Workplace health and safety protocols would be developed to minimise the risk of fire for workers during construction and operation. • Fire extinguishers would be stored onsite in the control building and within the substation building. • Shut down of turbines would commence if components reach critical temperatures or if directed by the RFS in the case of a nearby wildfire being declared (an all-hours contact point would be available to the RFS during the bushfire period). Remote alarming and maintenance procedures would also be used to minimise risks. • Overhead transmission easements would be periodically inspected to	Construction Operation Decommissioning	CEMP OEMP

SoC	Issue	Impact	Objective	Mitigation tasks	Project phase	Auditing
				monitor regrowth of encroaching vegetation.		
39	Hydrology	Deterioration of water quality (Surface Water)	Minimise Impact	Ensure infrastructure, including turbines, tracks, substations, control buildings, stockpiles, and site compounds and turnaround areas, is not sited within 40 metres of a major drainage line or water course, where practical.	Detailed design	CEMP
40	Hydrology	Deterioration of water quality (Surface Water)	Avoid Impact	Prepare a Sediment & Erosion Control Plan as part of the Construction Environmental Management Plan. Soil and water management practices would be developed as set out in Soils and Construction Vol. 1 (Landcom 2004)	Construction	CEMP
41	Hydrology	Deterioration of water quality (Surface Water)	Minimise Impact	Ensure all vehicles onsite follow established trails and minimise onsite movements.	Construction Operation	CEMP OEMP
42	Hydrology	Deterioration of water quality (Surface and Ground Water)	Minimise Impact	Design concrete batch plants to ensure concrete wash would not be subjected to uncontrolled release. Bunded areas of the batching plant to contain peak rainfall events and remediate after the completion of the construction phase. Waste sludge would be recovered from the settling pond and used in the production of road base manufactured onsite. The waste material would be taken from the batching plant to be blended in the road base elsewhere onsite.	Construction	CEMP
43	Hydrology	Deterioration of water quality (Surface and Ground Water)	Minimise Impact	As soon as practical, stabilise exposed or clear areas to minimise erosion and sedimentation that can potential pollute and dam watercourses in the area.	Construction	CEMP
44	Hydrology	Deterioration of water quality (Surface and Ground Water)	Minimise Impact	A Spill Response Plan would be prepared as part of the CEMP and OEMP.	Construction Operation Decommissioning	CEMP OEMP

SoC	Issue	Impact	Objective	Mitigation tasks	Project phase	Auditing
45	Soils and Landforms	Erosion of disturbed land	Mitigate Impact	At the conclusion of the construction period, where practical, the disturbed areas of the site would be rehabilitated to a level suitable for the ongoing agricultural use of the land. The topsoil removed for construction activities would be stockpiled and reused for the rehabilitation of the areas around the turbine foundations, lay down and hardstand areas and along the access tracks.	Construction	CEMP
46	Soils and landforms	Contamination	Minimise Impact	Consult with involved property owners in relation to areas of land potentially contaminated by past land use and manage impacts in these areas to avoid affecting the any areas of contamination.	Detailed design	CEMP
47	Soils and landforms	Soil quality	Minimise impact	The Proponent would prepare a protocol in the instance that suspected contamination is unexpectedly found. Should contamination or potential contamination be disturbed during excavation works, the area would be assessed by appropriately qualified consultants and DECCW would be notified if warranted.	Construction	CEMP
48	Soils and landforms	Soil loss or stability of landform loss	Minimise Impact	Concrete wash would be deposited in an excavated area, below the level of the topsoil, or in an approved landfill site. Where possible, waste water and solids would be reused onsite.	Construction	CEMP
49	Soils and landforms	Soil loss or stability of landform loss	Minimise Impact	Access routes and tracks would be confined to already disturbed areas, where practical. All contractors would be advised to keep to established tracks.	Construction	CEMP
50	Mineral Exploration	Conflict with mineral exploration	Avoid Impact	Liaise with the current mineral license holder providing a final turbine and infrastructure layout, prior to the construction phase.	Pre-construction	CEMP
51	Economic	Affect on local community	Maximise positive impact	Liaise with local industry representatives to maximise the use of local contractors and manufacturing facilities in the construction and decommissioning phases of the project.	Construction	CEMP

SoC	Issue	Impact	Objective	Mitigation tasks	Project phase	Auditing
52	Economic	Affect on local community	Maximise positive impact	Liaise with the local visitor information centres to ensure that construction and decommissioning timing and haulage routes are known well in advance of works and to the extent practical coordinated with local events.	Construction	CEMP
53	Economic	Affect on local community	Maximise positive impact	Make available employment opportunities and training for the ongoing operation of the wind farm to local residents where reasonable.	Operation	OEMP
54	Agriculture	Impact on current land use	Minimise Impact	Stock would be restricted from works areas where there is a risk stock injury or where disturbed areas are being stabilised.	Construction	CEMP
55	Agriculture	Impact on current land use	Minimise impact	Develop, implement and monitor the effects of a Site Restoration Plan. The plan would aim to stabilise disturbed areas as rapidly as possibly. The Plan would consider: • Appropriate stabilisation techniques across the precincts • Suitable species for re-seeding (native species would be given preference due to their superior persistence and for conservation purposes) • Monitoring for weed and erosion issues.	Construction Decommissioning	CEMP
56	Agriculture	Impact on current land use	Minimise impact	Ensure that the switchyard and substation is appropriately fenced to eliminate stock ingress.	Operation	OEMP
57	Agriculture	Impacts on current activities	Minimise impact	If aerial agriculture activities are disrupted on any property immediately adjacent to the site, due to the operation of turbines, the Proponent would consult with the affected landowner and, where requested by the landowner and taking into consideration the history of aerial agriculture activities, either: - fund the cost difference between the current aerial agricultural activities and a reasonable alternative method; or,	Operation	OEMP

SoC	Issue	Impact	Objective	Mitigation tasks	Project phase	Auditing
				- compensate the landowner for loss of production.		
58	Health and Safety	Safety of persons or stock	Minimise Impact	A detailed Health and Safety Plan would be prepared, as a sub plan of the Construction Environmental Management Plan, identifying hazards associated with construction works, the risks of the identified hazards occurring and appropriate safeguards would be prepared prior to the commencement of construction works. The Plan would include, but not be limited to: • Inductions for all contractors requiring site access. • Ensure all staff are appropriately qualified and trained for the roles they are undertaking.	Construction	CEMP
59	Health and Safety	Safety of persons or stock	Minimise Impact	Site fencing would be installed where there is a risk to the safety of the general public (i.e. when the trench is left open for extended periods).	Construction and Decommissioning	CEMP
60	Climate	Air quality	Minimise Impact	Dust levels at stockpile sites would be visually monitored. Dust suppression would be implemented if required. Stockpiles would be protected from prevailing weather conditions.	Construction	CEMP
61	Climate	Air Quality	Minimise Impact	Should a complaint relating to dust by a resident be received, monitoring at the boundary of the construction site would be undertaken using dust gauges. The Proponent would assess the dust gauges and identify additional mitigation measures, where required.	Construction	CEMP
62	Resources	Waste generation	Minimise waste and maximise recycling of materials	The Proponent would prepare a Waste Management Plan to be included within the Construction Environmental Management Plan. It would include but not be limited to the following: • The scope for reuse and recycling would be evaluated • Provision for recycling would be made onsite	Construction Operation	CEMP OEMP

SoC	Issue	Impact	Objective	Mitigation tasks	Project phase	Auditing
				• Wastes would be disposed of at appropriate facilities • Toilet facilities would be provided for onsite workers and sullage from contractor's pump out toilet facilities would be disposed at the local sewage treatment plants or other suitable facility agreed to by Council • Excavated material would be used in road base construction and as aggregate for footings where possible. Surplus material would be disposed of in appropriate locations on site (on agreement with the landowner), finished with topsoil, and revegetated		
63	Environmental Management	Quality Assurance	Compliance	Appoint a representative as a key contact for all environmental management issues.	Construction Operation	CEMP OEMP
64	Environmental Management	Quality Assurance	Compliance	Site induction for all workers and visitors to include maps of all sensitive areas and availability of CEMP and OEMP on site.	Construction Operation	CEMP OEMP
65	Community Consultation	Project Information	Inform Community	Appoint a community representative to be available for consultation and to provide information to the community about the status of the project.	Construction Operation	CEMP OEMP

13 Conclusion

This Environmental Assessment (EA) has assessed the likely impacts that would result from the proposed White Rock Wind Farm, a project capable of generating around 238 MW of renewable energy.

The project has incorporated the environmental constraints identified during the assessment and demonstrated how these constraints were applied to the design of the wind farm to arrive at the most appropriate site layout. It has also outlined the measures that will be taken to avoid and if necessary address the environmental risks and issues that have been identified for the construction, operation and decommissioning stages. These measures have been converted into a statement of commitments.

The Proponent has prepared detailed studies by independent consultants on the key issues of:

- Landscape and Visual Impact;
- Operational and Construction Noise;
- Ecology (Flora and Fauna); and
- Indigenous Heritage (Archaeology).

Additional studies were conducted in relation to communications, traffic and transport, aviation, existing landscape and community issues such as economic, health and safety and community benefits.

A strategic justification for the project outlined the following benefits at the local, regional and global scales:

- In full operation, it would generate more than 830,000 MWh of electricity per year - sufficient for the average consumption of around 130,000 homes.
- It would improve the security of electricity supply through diversification of generation locations.
- It would reduce greenhouse gas emissions by approximately 754,000 tonnes of carbon dioxide equivalent (CO_2e) per annum.
- It would contribute to the State and Federal Governments' target of providing 20% of consumed energy from renewable sources by 2020.
- It would contribute to the NSW Government's target of reducing greenhouse gas emissions by 60% by the year 2050.
- It would create local employment opportunities and inject funds of up to $300 million into the Australian economy.

The conclusion of the individual key issue assessments is that the proposed White Rock Wind Farm can be constructed with minimal impact to the existing environment.

The success of the project in meeting the environmental requirements of "maintain or improve" relies on the effective implementation of both the Construction and Operational Environmental Management Plans. The Proponent is committed to ensuring the measures developed in these plans are best practice to ensure the best possible outcome for the White Rock Wind Farm as well as the local and wider communities.

14 Glossary and Acronyms

AA	Airservices Australia
ABARE	Australia Bureau of Resource Economics
ABS	Australian Bureau of Statistics
AEMO	Australian Energy Market Operator
AHD	Australian Heritage Database
AHIMS	Aboriginal Heritage Information Management System
AIS	Aeronautical Information Service
An	Annum
APZ	Asset Protection Zone (for bushfire compliance)
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
AusWEA	Australian Wind Energy Association (previously Auswind)
CANRI	Community Access to Natural Resource Information
CAP	Catchment Action Plan
CASA	Civil Aviation Safety Authority
CEMP	Construction Environmental Management Plan
CMA	Catchment Management Authority
CO_2	Carbon dioxide
CPRS	Carbon Pollution Reduction Scheme
dB(A)	Decibels (A weighted)
DCP	Development Control Plan
DEC	NSW Department of Environment and Conservation (now DECCW)
DECC	NSW Department of Environment and Climate Change (now DECCW)
DECCCW	NSW Department of Environment, Climate Change and Water
DEH	Commonwealth Department of Environment and Heritage, now the Department for Environment and Water Resources
DEUS	NSW Department of Energy Utilities and Sustainability (now DECCW)
DEWR	Commonwealth Department for Environment and Water Resources, formerly the Department of Environment and Heritage
DGRs	NSW Department of Planning's Director Generals Requirements.
DoP	NSW Department of Planning
DPI	Department of Primary Industries
EA	This Environmental Assessment report
ECRTN	Environmental Criteria for Road and Traffic Noise
EEC	Endangered Ecological Community
EMF	Electromagnetic fields

EMP	Environmental Management Plan
EPA	Environmental Protection Agency
EP&A Act	NSW Environmental Planning and Assessment Act 1979
EPBC Act	Federal Environmental Protection and Biodiversity Conservation Act 1999
EPS	Environmental Planning Services Pty Ltd
ESD	Ecologically Sustainable Development
FM Act	Fisheries Management Act
GBDLA	Green Bean Design Landscape Architects
GHG	Greenhouse Gas
GWh	gigawatt-hour
ha	hectare (unit of area 100m x 100m)
ICN Guideline	DECC Interim Construction Noise Guideline 2009
IPCC	Intergovernmental Panel on Climate Change
kg	kilogram
km	kilometre
kV	kilovolt
LAeq	Equivalent Sound Power (A weighted)
LALC	Local Aboriginal Land Council
LCA	Landscape Character Area
LEP	Local Environmental Plan
LGA	Local Government Area
LVIA	Landscape and Visual Impact Assessment
mG	milligauss
m/s	meters per second
m	meter
RET	Renewable Energy Target
MW	megawatt
MWh	megawatt-hour
NES	National Environmental Significance
NPI	National Pollutant Inventory
NRET	NSW Renewable Energy Target
NSW	New South Wales
OEMP	Operational Environmental Management Plan
OEM	Original Equipment Manufacturer
OLS	Obstacle Limitation Surface
PEA	Preliminary Environmental Assessment
POEO Act	Protection of the Environment Operations Act 1997

Proponent	Epuron Pty Ltd
REP	Regional Environmental Plan
RFS	Rural Fire Service
RPS	RPS Australia East Pty Ltd (Ecology & Heritage Consultants)
SA EPA Guidelines	South Australian Environment Protection Authority Environmental Noise Guidelines: Wind Farms (2003)
SEPP	State Environmental Planning Policy
SoC	Statement of Commitments
SHI	State Heritage Inventory
TMP	Traffic Management Plan
TSC Act	Threatened Species Conservation Act 1995
TVI	Television Interference
V	volt
W	watt
WHO	World Health Organisation
WTG	Wind Turbine Generator

15 Preparation of Environmental Assessment

This report was prepared by Epuron. Specific sections were drawn from consultants' reports as detailed in Table 15-1 below.

Table 15-1 Preparation of the Environmental Assessment

Section	Description	Author
9.1	Visual Amenity	Andrew Homewood Green Bean Design Landscape Architects
9.2	Operational and Construction Noise Impacts	Jason Turner Sonus
9.3	Ecology	Toby Lambert RPS
9.4	Aboriginal Heritage	Tessa Boer-Mah RPS
11	General Environmental Assessment	Steve McCall Environmental Planning Services

Julian Kasby and Andrew Wilson of Epuron constitute the document's primary authors. The information contained in this document is neither false nor misleading. All information is considered by the authors to be correct at the time of writing.

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