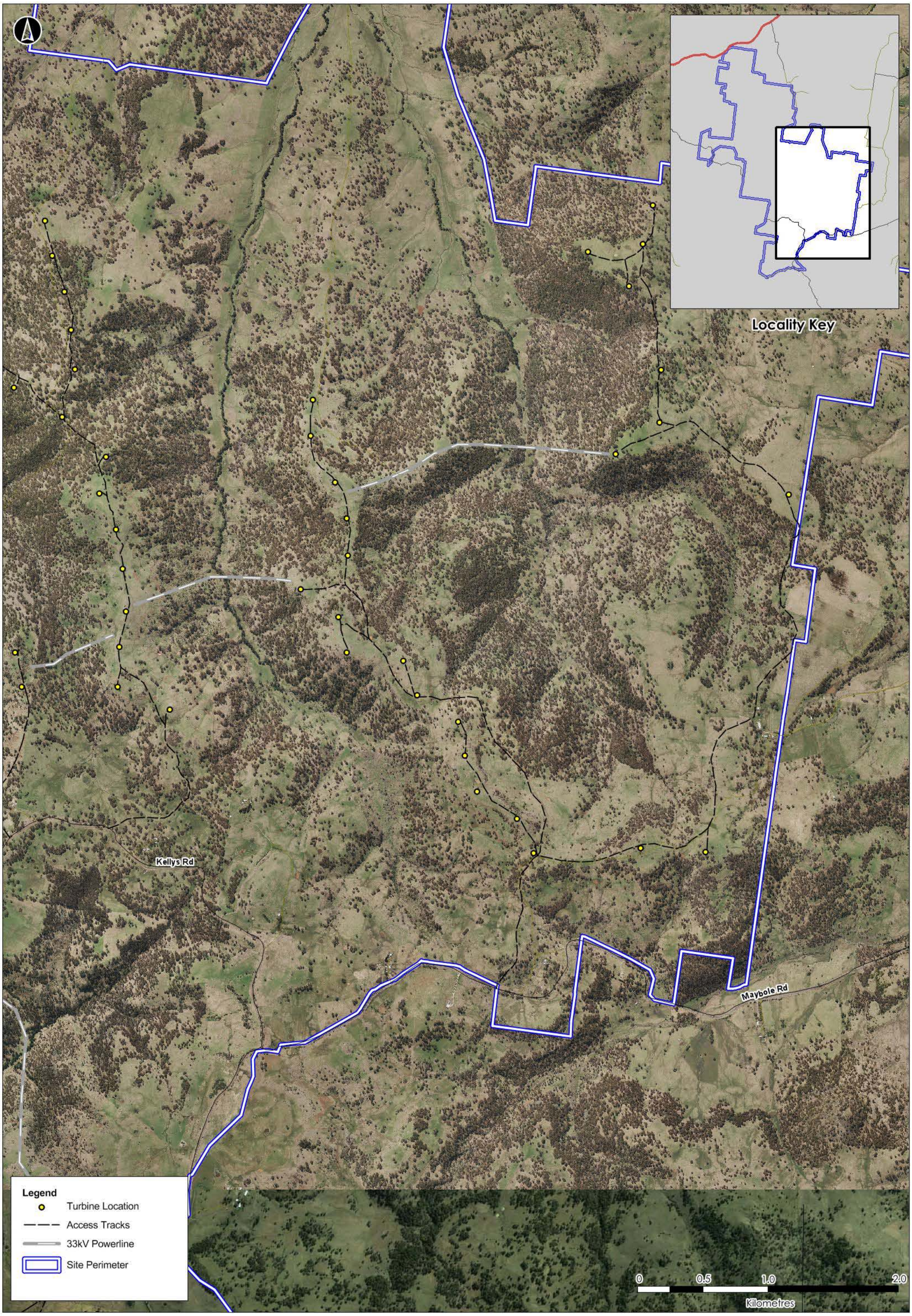


Figure 3-4 Proposed infrastructure for the White Rock Wind Farm (eastern section)

3.3 Wind Turbine Selection

Wind turbines Under Consideration

Epuron has not yet selected the turbine model to be used for this project. A number of turbines are under consideration for the proposal, each with varying characteristics including physical dimensions and attributes, production capacity, and cost.

In general, different characteristics of turbine models require different turbine layouts, however to simplify the environmental assessment of the project, an indicative layout has been developed that reflects the characteristics of a large range of turbine models.

For the purpose of assessing the wind farm impacts, Epuron bases its assessment on understanding both typical and worst-case impacts likely from the range of turbines under consideration. In general, only three impacts are materially affected by the turbine selection:

- Visual impacts are carried out on typical and worst case turbine sizes, using the blade tip height when vertical as the indicator of turbine size;
- Noise impacts are carried out on typical and worst case noise profiles; and
- Energy production (which typically increases with the physical size of the wind turbine).

All other impacts are driven primarily by the turbine layout rather than the selection of the turbine model.

Final wind turbine selection would be carried out based on commercial considerations within the consent conditions stipulated by the DoP. In particular, a final assessment of potential noise impacts would be undertaken prior to construction based on the final turbine selection and layout.

Wind Turbines

The turbines under consideration have a typical hub height of 80 - 100m and a typical blade length of 40 - 55m (or 80 - 110m total diameter). The tallest tip height combination under consideration is 150m, while the likely tip height is expected to be between 125m – 135m.

Each wind turbine would be a three bladed type of the “up-wind” design, meaning that the blades face into the wind and in front of the tower. This design reduces noise levels generated during operation.

Each wind turbine would have a rated power capacity of between 1.5 and 3.4 MW, subject to final turbine selection.

Nacelle

The nacelle is the housing at the top of the tower which encloses the generator, gearbox, and control gear including motors, pumps, brakes and electrical components. This control gear ensures that the wind turbine always faces into the wind, and adjusts blade angles to maximise power output and minimise blade noise. The nacelle also houses winches to assist in lifting maintenance equipment or smaller replacement parts to the nacelle.

The nacelle design takes into account acoustic considerations to minimise noise emissions from mechanical components.

Tower

The tower is a tubular steel tower typically 80-100 metres high, tapering from around 5 metres in diameter at the base to around 3 metres at the top. Exact dimensions would depend on the wind turbine design selected. The tower is constructed in up to five sections, each section bolted together via an internal flange. Within the tower are the power and control cables and an access ladder or lift to the nacelle (with safety climb system).

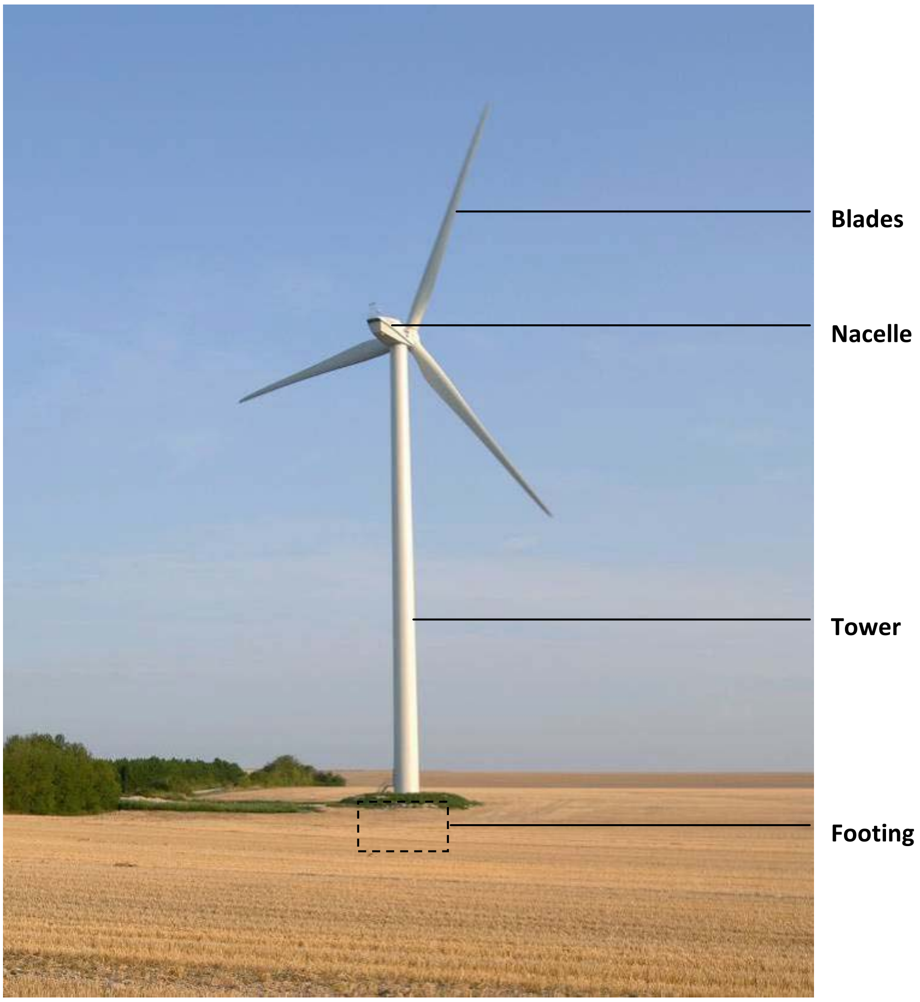


Figure 3-5 Typical wind turbine installed on an 80m tower (Photo courtesy REpower Systems AG)

Access Tracks, Hardstands and Footings

The tower would be mounted on a reinforced concrete footing and would require removal of rock and subsoil at the base of each turbine. A number of footing design options are under consideration including a gravity footing (where subsoil geology is less stable) and a rock-bolted footing (where subsoil geology provides good bedrock). A combination of these footing designs may be used on the site depending on the geology at each turbine location.

Each wind turbine would require an access track and cabling to the site substation. Access tracks would be a minimum of 5 metres wide (wider at bends and passing lanes) and be all weather graded gravel tracks. Hardstand areas required beneath each turbine would be approximately 25m x 45m (1125m^2). The shape and exact size of the hardstand area is subject to final turbine selection and crane requirements. The hardstand area is used for storage of turbine components, assembly of the turbine components and for the turbine installation cranes.

Access tracks and hardstands areas would generally be left in situ after construction to allow for any required maintenance and repairs.

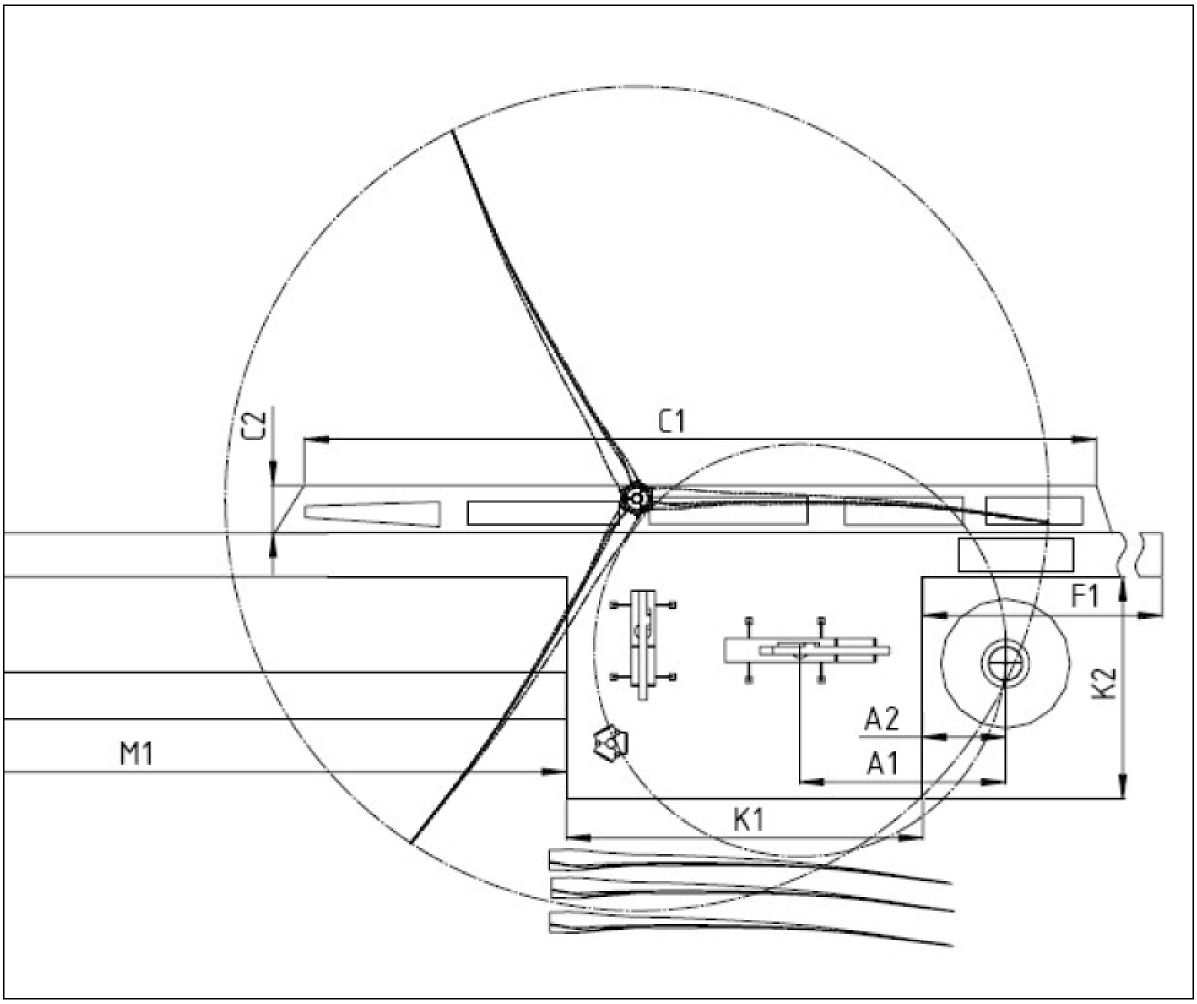


Figure 3-6 Example crane hardstand area (Source: REpower)

Transformer

Each wind turbine generator would produce power at typically 690V, and up to 1,000V. Power is then transformed at each wind turbine to either 22,000V or 33,000V for reticulation around the site. The transformer for each wind turbine would be located either within the base of the tower, in the nacelle, or adjacent to the tower as a small pad-mount transformer, depending on the specific wind turbine model selected. The transformer would be either a dry-type transformer, or would be suitably bundled.

Lightning Protection

Each wind turbine would have a lightning protection system installed. This system includes lightning rods through each wind turbine blade, an earth mat built into the foundations of the wind turbine, and lightning protection around the various electronic components within the wind turbine.

Obstacle Lighting

Depending on the requirements of the aviation authorities including CASA, aviation obstacle lighting of turbines may be required to be installed. This lighting requirement is usually a number of red flashing beacons mounted on the nacelle of some of the wind turbines.

The guidelines in relation to aviation warning lighting are currently changing as described in Section 10.1.

Epuron will not install aviation obstacle lighting unless required to do so by CASA, the consent conditions relating to the project or the requirements or recommendations of any other relevant authority.

Wind Turbine Controls and Operation

Each wind turbine would have its own individual control system, and would be fully automated. Start-up and shutdown (including safety shutdowns) are fully automated, with manual interruption available via onsite control systems and remote computer.

Generally, wind turbines would commence operation at wind speeds around 3 – 5 metres per second (11 – 18 kilometres per hour) and gradually increase in production to their maximum capacity, usually at wind speeds around 12 – 15 metres per second (44 – 54 kilometres per hour). Once at this maximum capacity, the wind turbine would control its output by altering the pitch of the wind turbine blades. Under high wind conditions in excess of 25 metres per second (90 kilometres per hour) the wind turbine would automatically shut down to prevent damage. It would continue measuring the wind speeds during this state via an anemometer mounted on the nacelle, and would restart once wind speeds drop to a suitable level.

Various operating constraints can be programmed into the control system to prevent operation under certain conditions. For example, if operational issues are identified such as excess noise or shadow flicker under certain conditions, these conditions can be pre-programmed into the control system and individual wind turbines automatically controlled or shut down whenever these conditions are present.

3.4 Connecting To the Electricity Grid

Introduction

To export power from the wind farm, it is necessary to connect the wind turbines to the electricity grid. This is achieved through a combination of underground and overhead electricity cables connecting to a site substation, which then connects into the electricity grid via a short 132kV powerline and a switchyard.

Epuron has submitted a Grid Connection Enquiry to TransGrid and carried out a grid connection assessment to confirm that TransGrid's existing transmission line has sufficient capacity to allow export from the wind farm.

The onsite electrical works would include:

- approximately 61km of electrical cabling (53km underground and 8km overhead) at either 22kV or 33kV;
- a substation including a transformer(s) to step the voltage up from reticulation voltage to transmission voltage of 132kV, suitable for connection to the TransGrid 132kV transmission line;
- approximately 8 km of 132kV overhead powerline;
- a 132kV switchyard connecting the on-site powerline to TransGrid's 132kV Glen Innes – Inverell transmission line; and
- an operations and maintenance facility.

Onsite Electrical Reticulation

From each wind turbine, the power voltage is stepped up from generation voltage to either 22kV or 33kV for reticulation from each group of turbines to the substation.

In general, overhead cabling offers benefits as it minimises ground disturbance and is significantly lower in cost. There are practical limitations installing overhead cabling on ridges where turbines are located, as well as a greater visual impact. Typically underground cabling is used to connect turbines along the ridgelines and overhead cabling is used to transport power between adjacent ridges and from groups of turbines to the substation.

Cable trenches would, where practical, be dug within or adjacent to the onsite access tracks to minimise any related ground disturbance. Short spur connections would diverge from the main cable route which would approximately follow the main access route at each group of turbines. Underground cables would require a trench of 0.75 to 1 metre deep and be typically 0.3 – 1 metre wide.

All of the potential options for power reticulation have been assessed. Statements of Commitment accompany this proposal to ensure that micro-siting is used to minimise environmental (particularly ecological) impacts. This would be undertaken with the assistance of an ecologist, especially where routes are located near sensitive environmental features.

Site Substation and Transmission Connection

The site substation requires up to two large power transformers to change the voltage from reticulation voltage (22kV or 33kV) up to transmission voltage (132kV). The transformers are likely to be of the oil-cooled variety, and therefore may contain considerable quantities of oil. Provision would be made in the design of each substation for containment of any oil which may leak or spill. Other equipment in the substation includes circuit breakers and a 132kV busbar.

The substation will include all necessary ancillary equipment such as control room and amenities, communication equipment, control cubicles, voltage and current transformers, and circuit breakers for control and protection of the substation. The substation also requires telecommunications (cable, optic fibre and/or microwave links) and backup electricity connections (415V – 11,000V) from local services.

The substation area would be surrounded by a security fence as a safety precaution to prevent trespassers and stock ingress. The ground would be covered partly by crushed rock and partly by concrete pads for equipment, walkways and cable covers, and would have an earth grid extending outside of the boundary of the security fence.

The substation will include an appropriate bushfire Asset Protection Zone (APZ) that complies with the RFS *Planning for Bushfire Protection* guidelines. This has been evaluated based on the vegetation type and slope. The site parameters (predominantly flat land with limited continuous canopy cover) indicate that a compliant inner protection area (which can be maintained under continued grazing practices) and outer protection area would be achievable.

Typically a 132kV substation would take up an area of approximately 100m x 100m. The proposed location and an alternate location for the site substation have been identified and are shown in Figure 3-2.

A 132kV on-site powerline would connect the site substation to the 132kV switchyard approximately as indicated in Figure 3-2.

Figure 3-7 Cullerin Range Wind Farm 132/33kV site substation

Switchyard and Connection to TransGrid Transmission Line

The 132kV switchyard used to connect the wind farm into the TransGrid network would be located at the northern extreme of the site, adjacent to the Glen Innes to Inverell transmission line, which is currently under construction. This switchyard would cover a similar area as the site substation.

3.5 Access To and Around the Site

Main Access

The primary access to the project site will be via the Gwydir Highway. This is a major two lane highway between Glen Inness and Inverell and will comfortably handle the additional traffic generated during the construction of the wind farm. The turn off to and from the wind farm will be signposted and designed to allow vehicles to exit and enter the highway safely.

An alternate access to the site from the south would be via Maybole Road and Kellys Road. Maybole Road is partly sealed to near the intersection with Kellys Road. Kellys Road is a gravel road.

A detailed Traffic and Transport study has been conducted and is summarised in Section 11.7.

Access tracks

On site access tracks required for construction and operation would be unsealed formations with a minimum width of 5m. Tracks are required to the base of each wind turbine location and to the location of the site substation and operation and maintenance facility. New gates and possibly new or realigned fences may also be required to protect stock during the construction phase.

Once the construction phase has finished, the crane hardstands and access tracks would be maintained to allow maintenance and repairs to the wind turbines. These tracks can also be used for normal farm access.

In locating access tracks on site, every effort would be made to:

- minimise the number and length of access tracks;
- locate access tracks along the route of existing farm tracks;
- locate access tracks to minimise clearing of native vegetation;
- locate access tracks to minimise impact on sensitive ecological or heritage areas; and
- construct access tracks with due regard to erosion and drainage.

Vehicle management

A Traffic Management Plan (TMP) would be prepared to properly manage traffic impacts in as detailed in Section 11.7. It would be developed in consultation with the roads authorities to ensure that the measures are adequate to address potential safety and asset degradation impacts.

3.6 Additional Permanent Facilities

Operations and Maintenance Facilities

An operation and maintenance facility would be located as shown in Figure 3-8. The facility will include car parking, offices and amenities for the maintenance staff, a control room and storage facilities for spares and equipment needed for the maintenance of the wind turbines.

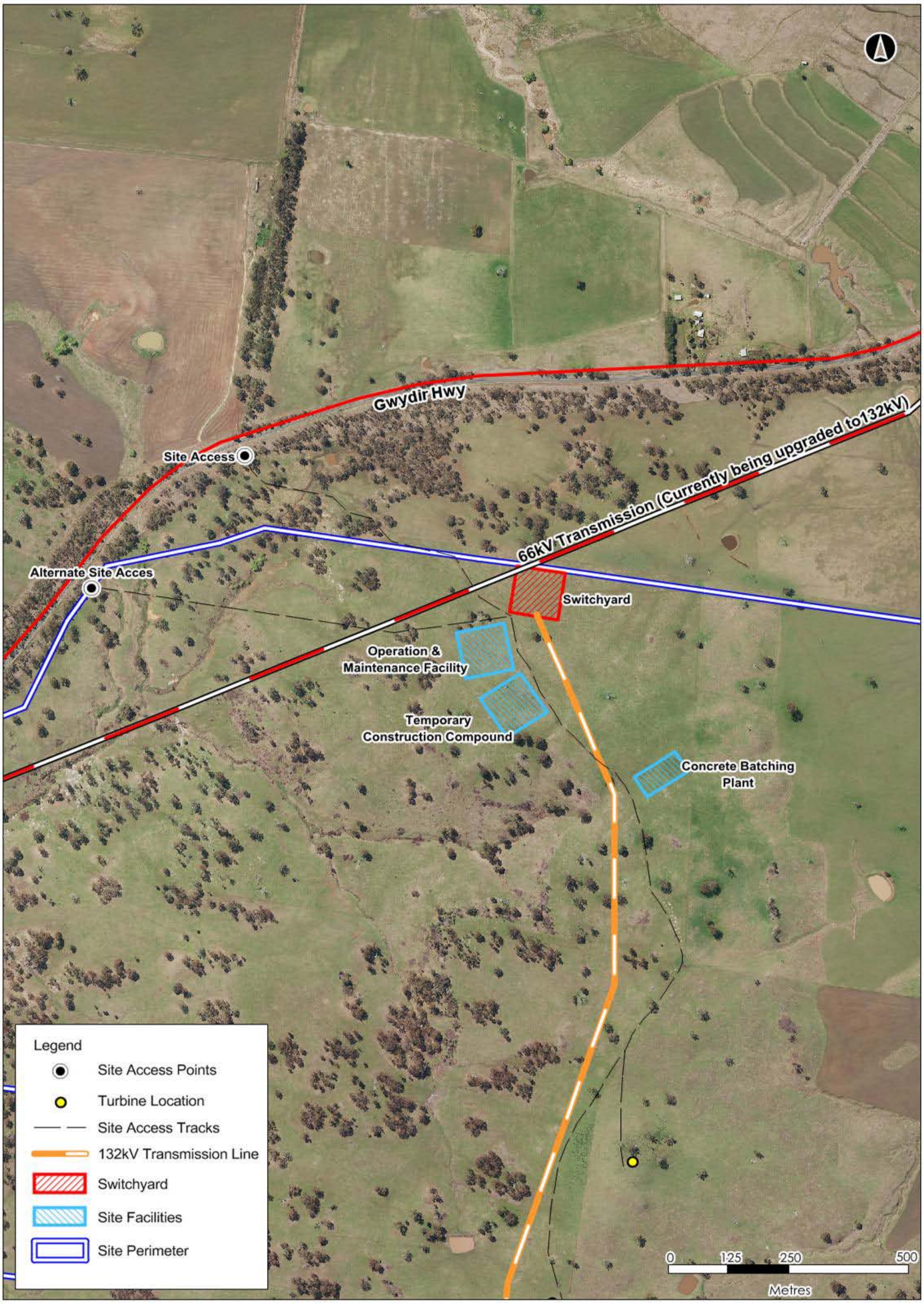


Figure 3-8 Location of site facilities

Control Cabling

In addition to the electrical cabling, control and communications cabling is required from the maintenance facility to each wind turbine, and to the substation. This communication cabling will be optical fibre cable and be installed using the same method and route as the power cabling described above, that is, strung from the same poles as overhead lines, or buried in the same cable trench as the electrical cables.

Wind Monitoring Equipment

Epuron is currently operating a wind monitoring mast on the site to assess wind speeds at proposed turbine locations. Following construction, permanent wind monitoring masts would be required to assist the control and operation of the wind farm. These would be static guyed masts with remotely operated wind monitoring equipment installed at multiple heights on each mast.

Pending final wind turbine placements, it may be necessary to move install additional temporary wind monitoring masts to verify wind speeds across the site.

The temporary and permanent masts would be located within the development envelope assessed in the various studies reported in this document. Epuron will inform CASA and the Department of Defence of the location of any monitoring masts constructed.

3.7 Temporary Facilities

During the construction phase a construction compound will be established on the site. The compound will include car parking, site offices, and amenities for the construction work force, and a lay down area for the temporary storage of construction materials, plant, equipment and wind turbine components. A temporary power supply will be required to be connected to the construction compound.

Site Office

During the construction phase around 100 staff would be working on site at any time. A suitable location for the site office would be selected, avoiding areas that are regarded as having environmental constraints. The site office may include several demountable buildings and an amenities block located on site for the duration of construction. Sufficient parking would be provided for the expected usage.

Rock Crusher

Materials excavated during the construction of wind turbine footings may be able to be reused as road base for the road surface upgrades. For this purpose a mobile rock crusher would be used during construction.

Concrete Batch Plants

A portable concrete batching plant would be required on site. A typical concrete batch plant would involve a level area of approximately 100 metres by 50 metres 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. A proposed location is shown in Figure 3-8.

The concrete batching plant would produce up to 350m^3 of concrete per day when a turbine foundation is being poured. The operational period would be for 14 months and the plant would produce a maximum of 850 tonnes per day. This is equivalent to 100,000 tonnes total during the construction phase. 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. License conditions specified by DECCW are likely to include operational protocols and monitoring.

3.8 Site Disturbance and Impact Area

The proposed wind farm requires the construction of a number of elements including turbines, turbine foundations, underground and overhead powerlines, a substation, control building and access roads on the site.

During the construction activities additional areas of the site would be impacted to provide construction compounds, concrete batching plants and storage areas. These areas can be rehabilitated and restored following the completion of the construction program. Table 3-1 presents the calculated area of the site impacted by the project based on the indicative turbine layout. Some of these impacts would be for the duration of the wind farm operation and some are temporary impacts during the construction phase.

Table 3-1 Development footprint and site disturbance areas

Project Components	Typical Dimensions	Quantity	Total Area (ha)	Impacted Area (ha)
Permanent Infrastructure:				
Footing and Hardstand#	25 x 60 m	119	17.85	0.34
Access and spur roads*#	10m	68.79 km	68.79	4.69
Underground powerlines onsite**	1 m	53.05 km	5.305	-
Overhead reticulation cabling / easement^	25 m	8.18 km	20.45	4.54
132kV Powerline^	40 m	7.88 km	31.52	12.15
Substation and control building	100 x 100m	1	1	0
Switchyard	100 x 100m	1	1	0
Operations and Maintenance facilities	100 x 100m	1	1	0
Permanent habitat loss				**5.03**
Habitat modification				**16.69**
Temporary Infrastructure:				
Concrete batch plant	50 x 100m	1	0.5	0
Construction compound, staging and storage	100 x 100m	1	1	0

* Access tracks around the site are anticipated to be 5 metres in width, however, a 10 metre width has been used to assess the likely impact due to cut and fill operations in order to achieve the required slope.

**The impact area associated with underground cables has been incorporated into the figures for access tracks.

Habitat permanently removed

^ Habitat would be modified for transmission and power line maintenance. This would include clearing vegetation for each power pole and maintaining clearance from electrical conductors between poles.

3.9 Project Implementation

The establishment of the wind farm can be considered as occurring in four phases. These include construction, operation, refurbishment and/or decommissioning of the wind farm. A description of activities under these headings follows.

3.9.1 Phase 1: Wind Farm Construction

The construction phase of the wind farm is likely to occur over an 18-24 month period and would include activities such as:

- transportation of people, materials and equipment to site;

- civil works for access track construction, footings and trenching for cables;
- establishment, operation and removal of any required construction equipment such as rock breaking equipment and concrete batching plants;
- potential use of blasting in foundation excavation, if required;
- installation of wind turbines using large mobile cranes;
- construction of site substation, switchyard, on-site 132kV transmission line, and onsite powerlines and electrical cables;
- construction of additional facilities (temporary and permanent) as required;
- construction, use and removal of temporary offices and facilities;
- temporary storage of plant and equipment; and
- restoration and revegetation of disturbed onsite areas on completion of construction works.

In general, construction would commence with the construction of access tracks and all other site civil works, including preparation of hardstand areas, and laying of cables. This would be followed by preparation of concrete footings, which must be cured prior to installation of wind turbines.

Wind turbine construction can be relatively fast once the footings are prepared, with wind turbines installed at a rate of approximately 2 per week. The towers are erected in sections, the nacelles lifted to the top of the towers, and finally blades lifted and bolted to the hub.

The necessary substation construction and grid connection works would be carried out in parallel.

The commissioning phase would include pre-commissioning checks on all high-voltage equipment prior to connection to the TransGrid transmission network. Once the wind farm electrical connections have been commissioned and energised, each wind turbine is then separately commissioned and put into service.

On completion of construction, disturbed areas would be revegetated and all waste materials removed and disposed of appropriately.

3.9.2 Phase 2: Wind Farm Operation

While the wind farm operates largely unattended, the wind turbines and other equipment would require regular maintenance. It is possible that some equipment may require major repair or replacement. In addition, during the initial operating years, operator attendance may be more regular while wind farm operation is being fine-tuned and optimised.

Once installed, the turbines would operate for an economic life of twenty to thirty years. After this time the turbines may be refurbished to improve their performance or decommissioned and removed from the site.

Routine Maintenance

To ensure the wind farm operates in a safe and reliable manner, it would require regular inspection and maintenance on an 'as needs' basis. This would generally be carried out using standard light vehicles.

In addition, regular maintenance is required, generally at 3, 6 and 12 monthly intervals. As a guide, each turbine requires approximately 7 days of maintenance per year. This does not require the use of major equipment, and could be carried out in a normal utility or small truck and would not require any additional works or infrastructure.

Major Repairs

It is possible that major unexpected equipment failures could take place during the life of the wind farm. While wind turbines and electrical components are designed for a 20 - 30 year life, failures can occur, for example due to lightning strike.

Most repairs can be carried out in a similar manner to routine maintenance, with some exceptions:

- Replacement of wind turbine blades, if necessary, would require bringing new blades to the affected turbine and installation of these blades using large cranes. The requirements are similar to the construction phase, and the access tracks established for construction may need to be brought into operation again.
- Replacement of wind turbine generators or gearboxes may require a crane and low loader truck to access the wind farm.
- Replacement of substation transformers would require a low loader truck to access the site.

Site monitoring program

A post-construction monitoring program would be established to determine any additional impacts resulting from the operation of the wind farm. The Operational Environmental Management Plan would contain specific monitoring programs required and would assess key issues such as noise compliance.

Further details of the monitoring and adaptive management mechanisms are included in Section 12.

3.9.3 Phase 3: Wind turbine refurbishment / replacement

The life of a modern wind turbine is typically 20 - 30 years, at which point individual wind turbines would be refurbished, replaced, overhauled or removed. Individual turbines may also fail at shorter lives for various reasons as discussed above.

Replacement, refurbishment and recommissioning would involve similar road access arrangements to construction, and would require access for large cranes and transport vehicles to dismantle and remove the existing turbines and to install replacement turbines.

Existing substations and cabling would be largely reused. It is also possible that the existing footings and towers could also be reused, subject to the designs of turbine available at the time of replacement / recommissioning. This would allow a significant cost saving for the wind farm.

Any refurbishment or turbine replacement would comply with the requirements of the project approval under this application.

3.9.4 Phase 4: Wind turbine decommissioning

Should a turbine fail and it is not commercially viable to replace the turbine, the turbine would be decommissioned in accordance with the Statement of Commitments; any turbine remaining non-operational for a continuous 24 month period would be decommissioned and removed from the site.

Decommissioning would involve similar road access arrangements to construction, and would require access for large cranes and transport vehicles to dismantle and remove the turbines. All underground footings and cable trenches would remain in situ and all above ground infrastructure would be removed. The decommissioning period is likely to be significantly shorter and with significantly less truck movements than the construction phase.

It should be noted that the scrap value of turbines and other equipment is expected to be more than sufficient to cover the costs of their dismantling and site restoration.

3.9.5 Staging of Works

It is possible that not all turbines, access tracks or other equipment outlined in this EA would be ultimately required for the project. Likewise, market, seasonal, or operational requirements may mean that the actual construction of the wind turbines may occur in stages or groups over a number of years.

3.9.6 Construction hours

In general, construction activities associated with the project that would generate audible noise in excess of the requirements of the NSW Industrial Noise Policy at any residence would be undertaken during the hours of:

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

These working hours have been proposed to allow reasonable efficiencies of effort to achieve maximum productivity and to minimise the overall construction duration.

However, some activities (including delivery to site of major equipment, and turbine installation) may occur outside of these hours due to logistic reasons.

Turbine lifts, for example, can only be carried out during periods of lower wind speeds because of operational limitations with the tall cranes and it is possible that out of hours work would be required for this purpose. This scenario has occurred at other wind farms (for example Cape Bridgewater, Victoria) where night crane operations have been required because of strong winds during the day.

Likewise, the requirements of NSW Police or roads authorities may limit transport of major equipment to and from the site outside of normal working hours.

4 Strategic Justification

This section provides a justification for the project in the context of its local and regional setting. It provides a summary of the energy context and in particular the need for additional electricity supply in NSW. It also outlines the benefits of the project including reducing Australia's greenhouse gas emissions, supporting Federal and Sate renewable energy targets as well as other local and wider community benefits.

The justification for the White Rock Wind Farm development is based on the following forecasts:

- 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[2] under the current system and approximately 743,000 tonnes of CO_2e if CPRS were introduced.
- 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.

In addition to these primary benefits there are also secondary benefits and opportunities for improvement in infrastructure, tourism and ecology.

4.1 Meeting Our Growing Electricity Demand

4.1.1 Energy Context

Electricity consumption continues to grow, and the additional demand must be met by either increased fossil fuel generation or an increase in generation from renewable sources such as wind power.

TransGrid's Annual Planning Report (2010) confirms that growth in electricity demand will soon exceed supply during peak times. Over the past 10 years energy use in NSW has increased at an average of 2% per year (to a total of 75,857 GWh for 2008/09). By 2020 NSW electricity demand is expected to be 95,000 GWh/an, an increase of approximately 20,000 GWh/an over today's consumption (TransGrid, 2010).

Meeting this demand will require our existing electricity generators to increase their annual output, however at some point additional power generators will be also be required. TransGrid has estimated that additional power generating capacity will be required to manage peak periods by summer 2016/17. Options need to be developed to meet this expected demand growth to ensure reliability of supply and evade power outages and blackouts (TransGrid, 2010). This is demonstrated in AEMO's annual Statement of Opportunities report, as illustrated in Figure 4-1.

[2] Calculated using the NSW Wind Farm Greenhouse Gas Savings Tool developed by DECCW

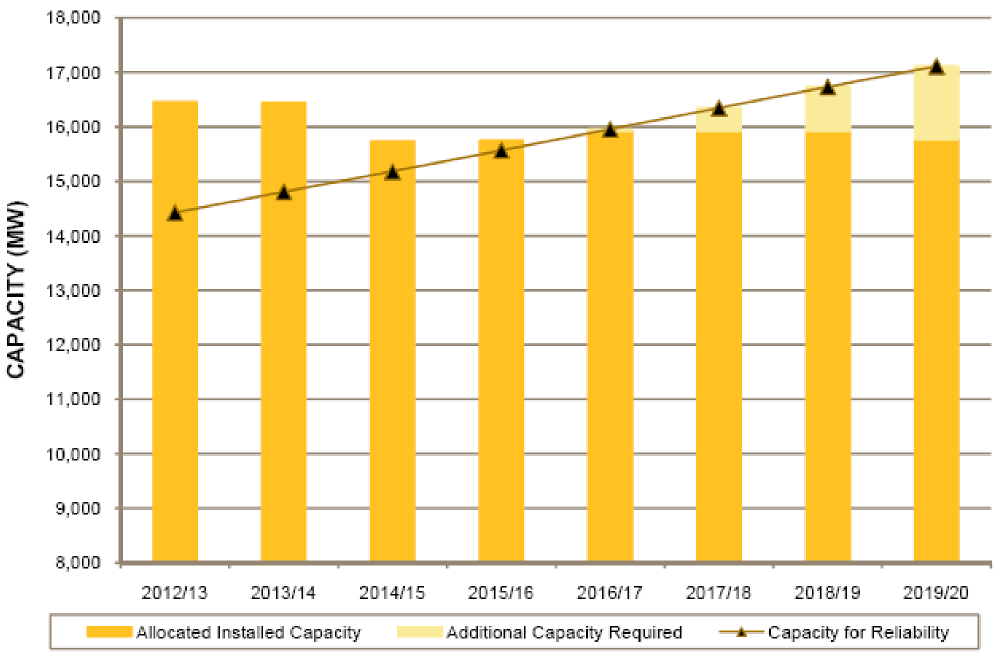


Figure 4-1 AEMO NSW Summer Generation Capacity Outlook (AEMO, 2010)

4.1.2 Quantifying the Electricity Generation from this Project

Electricity production from wind farms is variable. At any point in time a wind farm could be generating anywhere in the range of 0 to 100% of its power output, depending on the local wind speeds.

However, in the same way that the weather can be predicted hours to weeks in advance, the likely wind farm power output at any point in time can also be predicted with reasonable accuracy. In its role as electricity market operator, AEMO has established a Wind Energy Forecasting System to help it understand the likely wind farm production from minutes to days in advance. This system enables AEMO to reliably operate the electricity market taking into consideration the variability of all components including the constantly changing load, availability of and loading on transmission lines, plant outages at major power stations, and the changing output of wind farms.

In that context, while the output of wind farms is variable, it is also predictable and dependable.

The White Rock Wind Farm represents a medium sized wind farm with an installed capacity likely to be approximately 238 MW (based on 119 wind turbines with a likely capacity of 2MW).

Epuron has carried out significant wind monitoring on the site to confirm expected long term wind regime. Based on Epuron's analysis of wind speeds at the site, the project is expected to produce in the order of 830 GWh of electricity per year over its operating life.

The energy produced from the wind farm would be 100% renewable energy and would be fed directly into the electricity grid and sold on the National Electricity Market (NEM).

In 1999 the average domestic electricity consumed in NSW was 7,399 kWh, growing from the 1990 average of 6,983 kWh (DEUS, 2000). A value of 7,300 kWh on average is applied in this report based on ABS figures. On this basis, and with the wind farm estimated to produce electricity in the order of 830 GWh per annum, this would be equivalent to the average consumption of around 130,000 homes.

4.2 Reducing Greenhouse Gas Emissions

4.2.1 Context

There is scientific evidence that the earth's climate is changing. Observations have shown global increases in air and ocean temperatures, the widespread melting of snow and ice and rising sea levels (IPCC, 2008). It has further been observed that many of the world's natural systems are already being affected by the change of regional climates, in particular temperature increases (IPCC, 2008). Other indicators include altered rainfall patterns and more frequent or intense weather patterns such as heatwaves, drought, and storms (DCCEE, 2010). In Australia, this change in the climate is anticipated to have an impact on water supply and quality, ecosystems and conservation, agriculture and forestry, fisheries, settlements and industry and human health. (DCCEE, 2010)

The drivers for climate change have been identified as being from both natural and anthropogenic forces, however a main contributor is the release of Greenhouse Gases (GHG) into the atmosphere (IPCC, 2008).

The International Panel for climate change (IPCC) has acknowledged that it is very likely that human greenhouse gas emissions have directly influenced global temperatures to increase, as well as lead to other climate impacts. As greenhouse gas emissions stay in the atmosphere for decades, a predicted warming of around 0.2°C per decade is already expected regardless of future emission levels (IPCC, 2008). However, if greenhouse gas emissions continue to be emitted at their current rate then further and more extreme changes to the global climate system will be experienced (IPCC, 2008). Therefore, a reduction in greenhouse gas emissions would reduce the rate and magnitude of climate change. The IPPC recognises that mitigation efforts over the next 20-30 years will be crucial to stabilising the amount of change (IPCC, 2008).

Referring to the Australian context, Department of Climate Change reports (DSEWPC, 2006) show that greenhouse gas emissions from the stationary energy sector, is the largest and fastest growing area in terms of greenhouse gas emissions in Australia. The stationary energy sector accounted for 50 per cent of total emissions in 2006 (DSEWPC, 2006) and within this sector, emissions from electricity generation contributed nearly 70 per cent. Between 1990 and 2005 emissions from electricity generation increased by an average of 3.3% per year. (DSEWPC, 2006) Currently in Australia 54.1% of total greenhouse gas emissions are produced during the generation of electricity (DCC, 2007).

In 2006, 35% of the total Greenhouse gas emissions in NSW were from the generation of electricity. Between 1990 and 2006 emissions from electricity generation grew by 35% to a total amount of 59.3 $MtCO_2$-e (DCC, 2008). This made up 10% of the total GHG emissions in Australia over this period.

4.2.2 Options to reduce our Emissions

The IPCC has identified key technologies and practices for the energy sector that are currently commercially available which could be used to mitigate the effects of Greenhouse Gas emissions. They include:

- improved supply and distribution efficiency (transmission and distribution of electricity);
- fuel switching from coal to gas;
- utilisation of nuclear power;
- utilisation of renewable heat and power (hydropower, solar, wind, geothermal and bioenergy);
- utilisation of combined heat and power technologies; and
- early applications of carbon dioxide capture and storage (e.g. storage of removed CO_2 from natural gas).

In addition the IPCC has also identified policies, measures and instruments shown to be environmentally effective. These include:

- reduction of fossil fuel subsidies;
- an increase of taxes or carbon charges on fossil fuels;
- feed-in tariffs for renewable energy technologies;
- renewable energy obligations; and
- renewable energy producer subsidies.

In 2006 the NSW Government committed to reduce greenhouse gas emissions by 60% by 2050 (DECCW, 2009). In considering this level of reduction to the power generation sector in NSW, we should note:

- By 2050 electricity consumption is expected to more than double compared to 2006 (DPMC, 2006);
- Achieving a 60% reduction in emissions, while increasing our electricity use 2 times over, requires an >70% reduction in greenhouse gas emissions per unit of electricity generated;
- Even if our entire fossil fuel power generation fleet was converted to natural gas, this would not even halve our existing level of emissions, and do nothing to address growth;
- Accordingly, to achieve this target, as a minimum all of our electricity growth over the next 40 years must be met with zero emission power sources;
- Wind energy is currently the most economic zero emission power source.

4.2.3 Contributions to reducing greenhouse gas emissions

During its operational phase, the White Rock Wind Farm would generate electricity without producing greenhouse gas emissions. In addition the wind farm would be displacing electricity produced by fossil fuel sources (coal and gas), and hence, would reduce the overall amount of GHG emissions produced by the stationary energy sector (electricity generation).

To estimate the potential GHG emissions savings that large scale wind farm developments would have in NSW, DECCW commissioned McLennan Magasanik Associates to conduct a study and subsequently developed a tool to calculate the expected savings from the wind farm based on its size and location. This tool can be accessed via the DECCW website at http://www.environment.nsw.gov.au/climatechange/greenhousegassavingstool.htm

The results of the study as they relate to this project showed the following:

- In NSW wind farms would initially almost exclusively displace fossil fuel generation from coal and, to a lesser extent, gas;
- The savings from a wind farm the size of White Rock in the Northern Tablelands would initially reduce GHG emissions by 754,000 t CO_2e per annum;
- If CPRS was introduced in 2015 the overall emissions in the NSW energy sector would be reduced as a result of gas generation replacing coal, therefore reducing the GHG emissions savings directly related to wind generation; and
- The impact on the management of the network due to the variability of wind would be negligible and the emissions savings would greatly outweigh any such impact.

Figure 4-2 presents the results from the study, showing the estimated GHG emissions savings for three different scenarios (a single wind farm of 150MW, 500MW representing future developments in each region, and 3000MW representing the total capacity estimated for wind development in NSW).

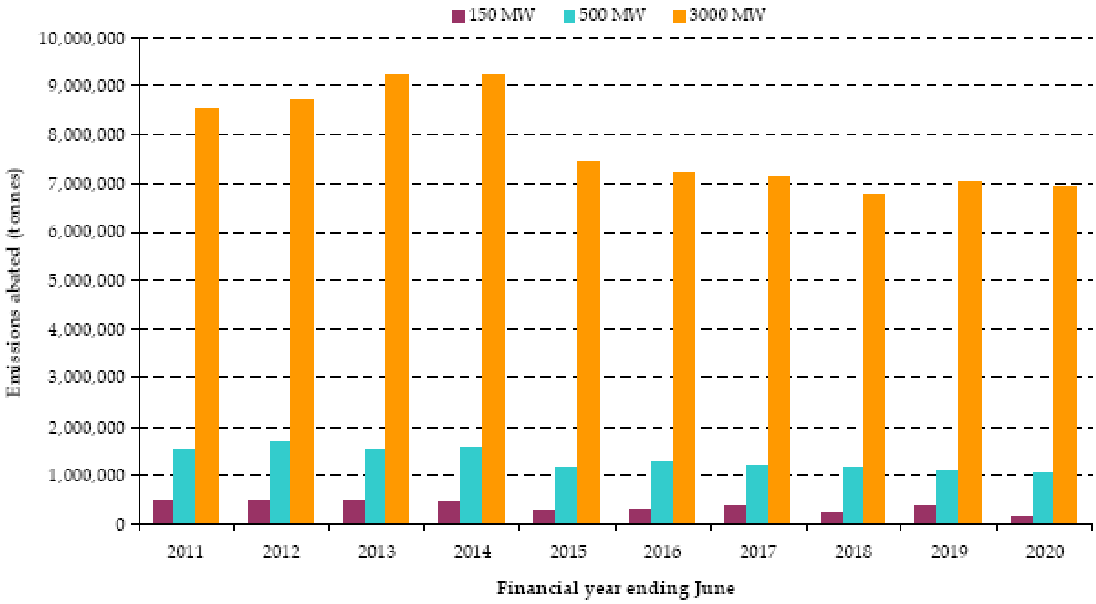


Figure 4-2 Estimated GHG emissions savings for three different scenarios

The greenhouse gas contributing the most to climate change is carbon dioxide (CO_2). Between 1970 and 2004 the amount of CO_2 being emitted from human-based activities increased by 80% and the current level of CO_2 in the atmosphere is now higher than ever measured (IPCC, 2008). This large increase is predominantly due to the burning of fossil fuels, such as coal, gas and oil.

The NSW Department of Environment and Climate Change & Water (DECCW) has forecast that emissions from the stationary energy sector[3] will reach a total of 79 MtCO2-e by 2020 (DECC, 2006) under a 'business as usual' approach.

An indicator used to determine the amount of greenhouse gases emitted per MWh of electricity supplied to the NSW grid in a particular year is the NSW Annual Pool Value (GGAS, 2010). Table 4-1 shows that the Annual Pool Value is calculated by dividing the total energy supplied to the NSW grid by the total NSW emissions in that year.

To account for one-off highs or lows that may be experienced in a particular year the Pool Coefficient is determined. This value is calculated by averaging the five Annual Pool Values from previous years, with a lag of two years (GGAS, 2010). So the NSW Pool Coefficient for 2009 is the average of the Annual Pool Values from 2003 to 2007.

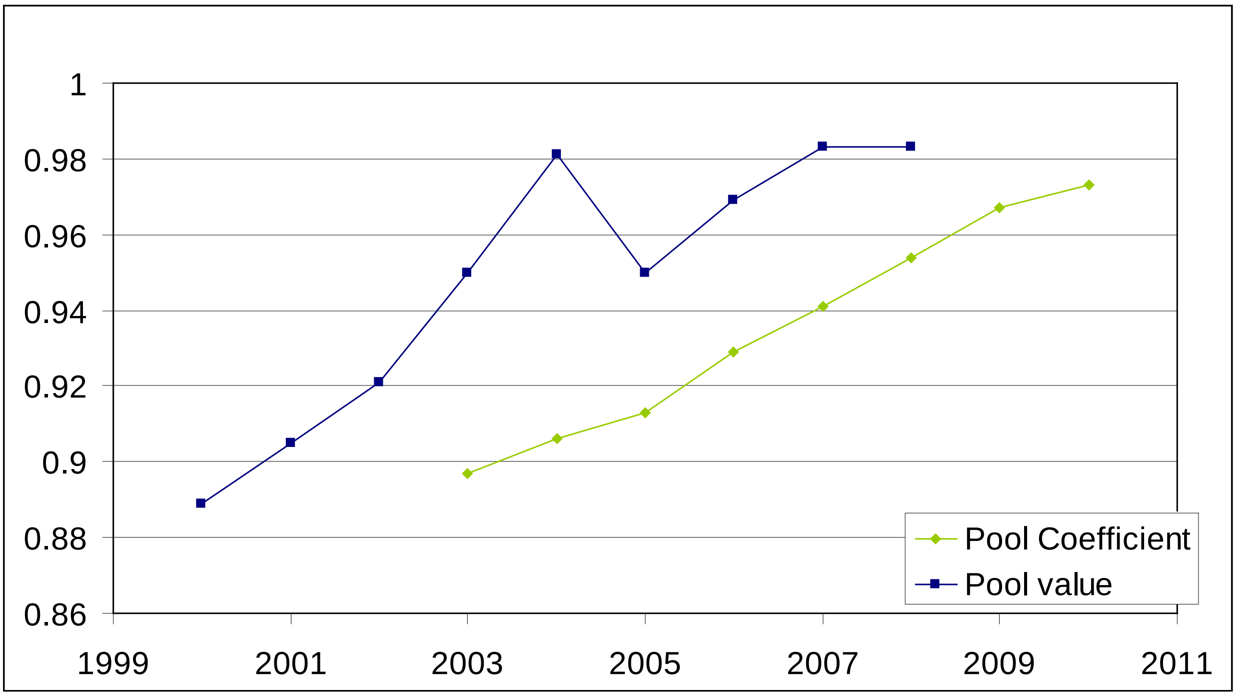
Table 4-1 NSW Annual Pool Values and Pool Coefficients (2003-2009)

Year	Total NSW emissions (tco2-e)	Total NSW sent out generation (MWH)	Annual pool value tco2- e/MWH	Pool coefficient tco2- e/MWH
2003	63,431,793	66,800,866	0.950	0.897
2004	65,979,036	67,276,401	0.981	0.906
2005	65,896,606	69,341,455	0.950	0.913
2006	70,010,515	72,222,646	0.969	0.929

[3] The stationary energy sector includes all sources of energy production and consumption excluding transportation. Electricity generation makes up a large proportion of this sector.

Year	Total NSW emissions (tco2-e)	Total NSW sent out generation (MWH)	Annual pool value tco2- e/MWH	Pool coefficient tco2- e/MWH
2007	69,810,669	71,015,242	0.983	0.941
2008	71,394,801	72,646,917	0.983	0.954
2009	TBA	TBA	TBA	0.967
2010	TBA	TBA	TBA	0.973

Source: GGAS, 2010



Source: GGAS, 2010

Figure 4-3 Historical NSW Pool Value and Pool Coefficient (2000-2010)

The 2010 Pool Coefficient value indicates that presently for every megawatt-hour of electricity supplied to the NSW electricity pool, 973 kg of green house gases are emitted. At this point in time, approximately 90% of electricity in NSW is generated by fossil fuel power stations, primarily coal fired. Therefore it can be assumed that for every megawatt-hour of electricity generated at a coal power station 973kg of green house gases are emitted.

The Annual Pool Value is calculated using the total sent out electricity from all technologies, including that from renewable energy. It is expected that the more electricity supplied to the pool from renewable sources, reducing the amount required from coal power stations, the lower the Annual Pool Value and the lower the Pool Coefficient.

The White Rock Wind Farm will generate 830 GWh/annum and on this basis, would result in a reduction in greenhouse gas emissions of approximately 810,000t of $C0_2$.

Using the DECC model for calculating greenhouse gas emissions savings the figures estimate a reduction by approximately 754,000 tonnes of carbon dioxide equivalent (CO_2e) per annum under the current system and approximately 743,000 tonnes of CO_2e if CPRS were introduced.

4.3 The role of Renewable Energy

4.3.1 Federal Renewable Energy Target

The Australian Government's Mandatory Renewable Energy Target (MRET) scheme was established in 2001 to expand the renewable energy market and increase the amount being utilised in Australia's electricity supply. The MRET advocates that an additional 2 percent, or 9,500 GWh, of renewable energy by sourced by 2010 (DCC, 2009a).

In 2007, the NSW State Government introduced new legislation called the Renewable Energy (NSW) Bill as part of their Greenhouse Policy to encourage additional generation of renewable energy. The NSW Renewable Energy Target (NRET) required 10% of electricity to be sourced from renewable energy by 2010 and 15% by 2020 (DEUS, 2006). This Bill was overtaken by the introduction of legislation at the Federal level and therefore not legislated.

In August 2009 the Federal Government introduced a revised renewable energy scheme. The Renewable Energy Target (RET) is an expansion of the MRET and required an additional 45,000 GWh of electricity (approximately 20 percent of Australia's total electricity supply) to be sourced from renewable projects by 2020 (DCC, 2009). This requires an additional 8,000 - 10,000 MW of new renewable energy generators to be built across Australia in the next decade.

In February 2010 the Federal Government amended the RET scheme by dividing the renewable sources into two categories, the small-scale renewable energy generators and large scale renewable energy generators. The purpose of this move was to ensure continued ongoing investment in large scale renewable energy projects (i.e. those projects greater than 30 megawatts).

Epuron estimates that around one third of the renewable energy generation required to meet this target will need to be built in NSW, and predominantly be supplied by wind generation.

The White Rock Wind Farm would have a generation capacity of 238 MW and would contribute directly to the RET.

4.3.2 State Renewable Energy Targets

The State Plan (NSW Government, 2010) is a Government planning document that provides a comprehensive overview of the strategic direction for the State. The plan outlines a rigid framework which sets priorities and targets for action over the next 10 years.

In The State Plan, electricity has been identified as a key area of State concern, with currently less than 6% of NSW's total energy consumption being provided from renewable energy sources. The Plan sets a target to increase this to 20% by 2020 in light of the Federal Government's expanded Renewable Energy Target, and to achieve a reduction in greenhouse gas emissions of 60% by 2050, also in line with the Federal Government's target.

The proposed White Rock Wind Farm supports the strategic direction of State by providing an on-going renewable energy source with no GHG emissions. The project would assist the Government towards achieving both the targets set out in the State Plan.

4.4 Economic Stimulus

According to a report produced by MacGill & Watt (2002) a project the size of the White Rock development has the potential to inject approximately $300 million into the Australian economy over its life time. This is based on the figure of the injection of $1.1 million per MW for wind farm installations in 2010. This economic injection would also contribute to the local economy through:

- use of local contractors (where possible) in construction of the wind farm;
- use of local services (food and accommodation, fuel, general stores etc) during the construction period;
- ongoing use of these local services during the operation of the wind farm;

- lease payments to local landholders;
- provision of ongoing local jobs in operating and maintaining the wind farm.

MacGill & Watt (2002) forecast that wind farm installations in the year 2010 would create 3.7 job-years per MW for manufacturing and installation and 0.06 on-going jobs per MW for operation and maintenance. By applying these figures, the White Rock Wind Farm would create 880 job years Australia wide and 21 on-going local jobs.

4.5 Secondary Project Benefits and Opportunities

In addition to the increase in renewable energy supply, the proposed White Rock Wind Farm would provide a variety of benefits and opportunities.

4.5.1 Infrastructure

Infrastructure required for development of the wind farm would also benefit the local community. The proponent would fund the upgrading of some local roads as outlined in the Traffic Study. The works that would mainly benefit the region include the reconstruction of segments along Maybole and Kellys Roads. Other infrastructure works would include the provision of traffic signs and guide posts.

4.5.2 Tourism

Although the operation of a tourist facility is not part of this proposal, the White Rock Wind Farm would provide an opportunity to increase the regional tourism industry, which currently is a main contributor to the economy. In the year ending September 2010, domestic tourism generated $228 million in the New England North West region of NSW (Tourism NSW, 2010). While initial interest is likely to be higher than on-going interest, the wind farm could be utilised as an additional attraction to secure visitors to the local townships. This would lead to further contributions to the local service industry.

4.5.3 Social impacts

Public perception studies have shown that more realistic and positive perceptions accompany actual physical experience of wind farms. Fear of the unknown can exaggerate perceptions of visual and noise impacts particularly (Warren et al., 2005).

While it is certain that not all members of the community will view the proposed development of wind farms favourably, in some communities, investment in clean energy production can become a point of pride to residents. During wind farm community consultation in Berridale, NSW, many participants spoke with pride about the Snowy Hydro Scheme and the appropriateness of similar clean energy developments in their shire. The New England tablelands region looks well placed to become a leader in the Australian wind industry. The results of the NSW DECCW Survey 2010 (DECCW, 2010a - refer to Section 7.1) indicate that support for renewables is high.

4.5.4 Community Enhancement Program

Under the Part 3A process contributions to a community enhancement fund are voluntary. A community fund has not been proposed for the project, however, the proponent would like to encourage submissions on a possible format for a community enhancement program, as well as suggesting useful projects for the local area, so as to maximise the benefit of the project to the wider community.

4.6 Suitability of the Project

A comprehensive assessment of the proposed project has recognised that the development is suitable on a local level in terms of existing and future land use impacts. The following sections outline where this EA discusses the suitability of the project and the reasons behind the justification.

4.6.1 Strategic Land Use

The proposed site and the adjacent land parcels are zoned as land use 1(a) Rural Agriculture under the Glen Innes Severn Council LEP 1987 and the Inverell Shire LEP. This land has been set aside by the local councils for agricultural purposes, and the land is currently used for commercial agriculture (sheep and cattle grazing) and rural residences.

While in operation the proposed wind farm would not impact on the day-to-day farming activities currently being carried out by the existing landowners. The turbine footprint and access tracks would occupy less than 1% of the landowner's property and through strategic planning and consultation infrastructure would not occupy productive land. Normal farming operations may be affected during the construction phase, primarily due to increased traffic. The magnitudes of these impacts are not expected to cause economic loss to the landowners.

When considering the existing and future land uses, the proposed site is suitable for a wind farm. Both local councils have strategically identified the site and its surrounds as being important agricultural land and there is no future intention to modify this zoning. The wind farm would coexist with the existing farming operations without any major disturbances to productivity.

4.6.2 Land of High Agricultural Value, Mineral Reserves and Conservation Areas

As discussed in Section 4.6.1 the site and surrounding land parcels have been strategically zoned for agricultural purposes which are an industry that the local economy depends on. A small percentage of agricultural land will be impacted by the wind farm infrastructure, however, this land is not considered to be of high agricultural value or expected to cause economic losses for the landowner.

4.6.3 Grid Connection

An assessment into the capacity and security of the existing transmission network was conducted to determine the feasibility of the site and the impact that the project could have on the network. Connection strategies for proposed projects in the area have been assessed using publicly available information and best estimates where this information is not available.

The likely timing for construction of the other proposed and approved wind farm projects in the area and the status of their grid connection process is unknown. In accordance with the National Electrical Rules, that control connection of generators to the National Grid, it is likely that whichever project secures a grid connection agreement with the network service provider (TransGrid) first will be less likely to have any potential capacity constraints imposed on the output of the wind farm.

The Sapphire Wind Farm is expected to connect into the Armidale to Dumaresq 330kV transmission line and is not expected to directly influence the capacity of the local 132 kV network.

The Ben Lomond Wind Farm is expected to connect into Glen Innes – Armidale 132kV transmission line, however this project is less advanced that the White Rock Wind Farm.

The Glen Innes Wind Farm is expected to connect into the same Glen Innes – Inverell 132kV transmission line as proposed for the White Rock Wind Farm. A connection assessment completed by Senergy confirmed that the Glen Innes – Inverell 132kV transmission line has sufficient capacity to handle the output from both the Glen Innes wind farm and the White Rock Wind Farm, while some small reductions in output may be required if the proposed Ben Lomond Wind Farm also connected to the 132kV network.

Technical studies required as part of the connection process will ensure that there will be no material impact on the security or performance of the electricity network from multiple wind farms connecting in the vicinity of the White Rock Wind Farm.

5 Consideration of Alternatives

5.1 Site Selection

Site selection is crucial in wind farm development due to the market based structure of the electricity industry. This means that the projects that exhibit the best characteristics for wind farm development (best energy yield with the lowest cost) will be the projects that eventually get built. It is the combination of these characteristics that makes suitable sites for wind farms very rare in NSW. Appropriate locations are found where:

- wind speeds are consistently high (around 7.5-8m/s as an annual average);
- existing transmission lines are available on or near the project site;
- transportation of turbines would be possible with only minor upgrades to roads;
- native vegetation cover is sparse or would be minimally impacted;
- housing in the immediate vicinity is relatively sparse; and
- involved landowners are interested in housing turbines on their land.

To date Epuron has developed six wind farm projects in NSW, five of which have been granted development approval, with the other currently in the assessment phase.

Epuron has developed projects in the Southern Tablelands, the South-West Slopes, and Far West New South Wales, prior to investigating sites in the New England Tablelands area. As a result Epuron has developed a wide network of monitoring masts with 33 currently active across NSW (including one on site). By modelling data from these masts along with other third party data, Epuron holds one of the most extensive wind data sets available in NSW.

After using this modelling to identify the White Rock project area as a potential wind farm site, further investigations were undertaken to assess the feasibility of the project. In addition to having a consistently high wind resource, the project area also featured:

- Cleared ridgelines for suitable turbine locations;
- A low population density (ABS, 2009); and
- An existing transmission network with development of a new transmission line underway (Glen Innes – Inverell).

In addition to these characteristics, the engagement of interested landowners enabled the project development to progress. The selected development envelope for the turbine and infrastructure layout was chosen over earlier alternatives based its commercial viability, landowner consent and reduced environmental impacts.

5.2 Improvements to Infrastructure Layout

The current layout that is presented in this EA has gone through an iterative design process, with turbines locations being repositioned, deleted and in some cases added to areas previously thought unviable. The purpose of this process is to design a layout that efficiently harnesses the energy in the wind with minimal impacts to the existing environment (including ecology, land use productivity as well as visual and noise amenity for surrounding residents).

Figure 5-1 shows the layout initially proposed for the White Rock Wind Farm and presented at the Open House. It contained 121 turbines locations, a switchyard location, and two potential substation locations. This layout was developed using a wind resource map created from existing monitoring masts, along with basic topographic features (contours) and satellite imagery. Experience gained from previous projects was applied to areas such as noise and ecology in determining the exact locations, however, detailed studies would be required to confirm these locations were appropriate.

Figure 5-2 shows the current layout proposed in this EA overlayed onto the initial layout to highlight the amendments that have been made. Figure 5-3 and Figure 5-4 show in more detail the areas that have undergone the most significant changes.

A number of turbines were removed at the south east of the site to reduce both noise and visual impacts to neighbouring dwellings. Turbines were also relocated or removed from the central part of the site to minimise impacts to native flora.

Since the submission of the PEA an additional landowner has been included in the project and subsequently turbines were added to the eastern section of the site.

Along with the relocation or deletion of turbines, the associated access tracks were modified. While the impact of an access track is far less than a turbine, every attempt was made to reroute access tracks away from native vegetation. In some cases, however, it was concluded that the impact caused in clearing a small area of vegetation on the top of the ridge would have a lower impact than relocating the track on the side of the slope where the overall impact of the cut and fill required to construct the track would have an impact over a much larger area.

Powerlines were rerouted or deleted, where possible, to minimise the impact to wooded areas and particularly sensitive species, for example the Yellow Box Woodland to the north of the site.

The layout of the wind farm infrastructure has been improved and amended wherever practical, in particular to reduce the impact on endangered ecological communities. The residual impact on the EEC, estimated to be a total of 22 ha, cannot be reduced any further due to turbine spacing constraints and the topographic features of the site such as the steep slopes on the side of the ridges.

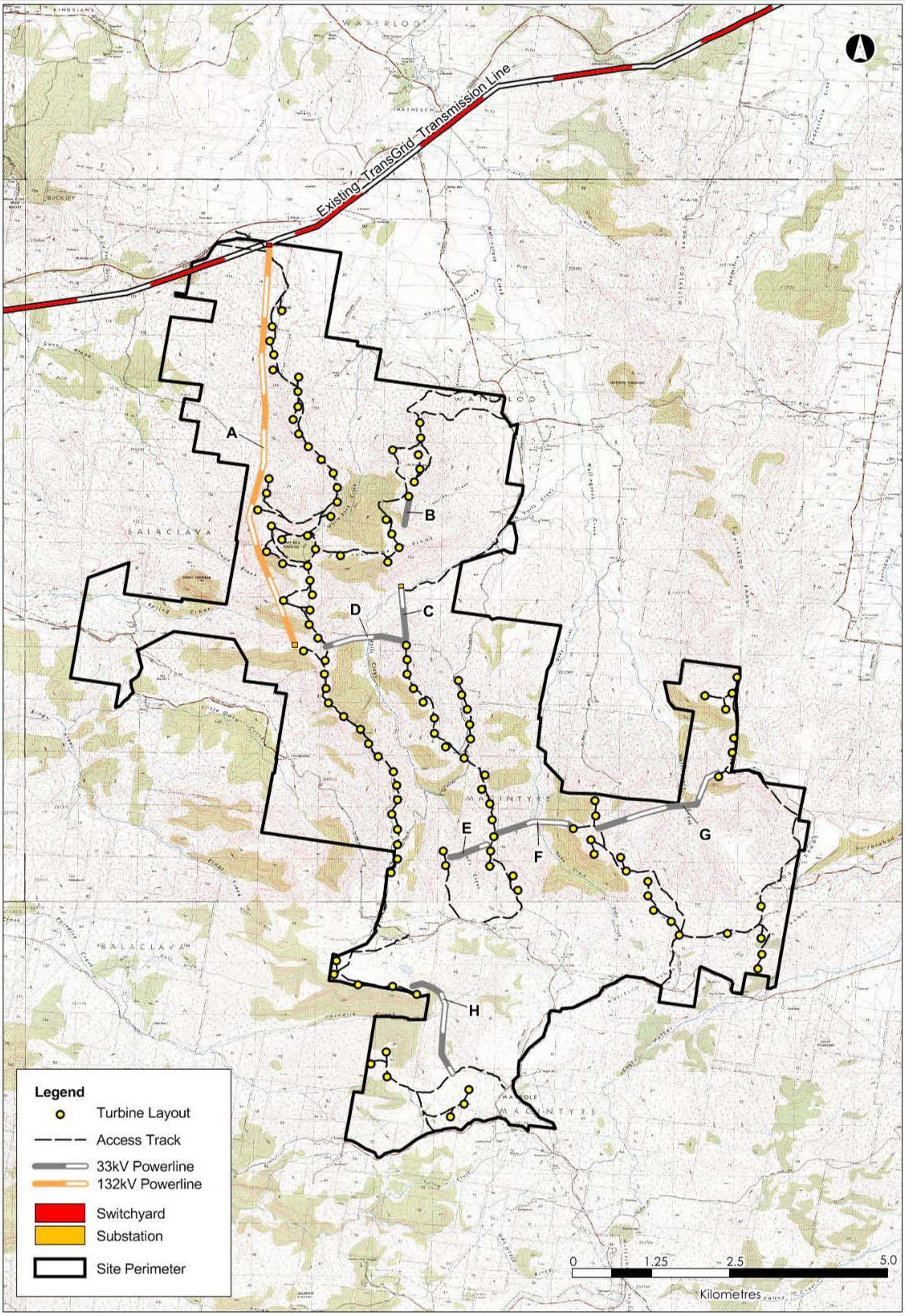


Figure 5-1 Initial infrastructure layout

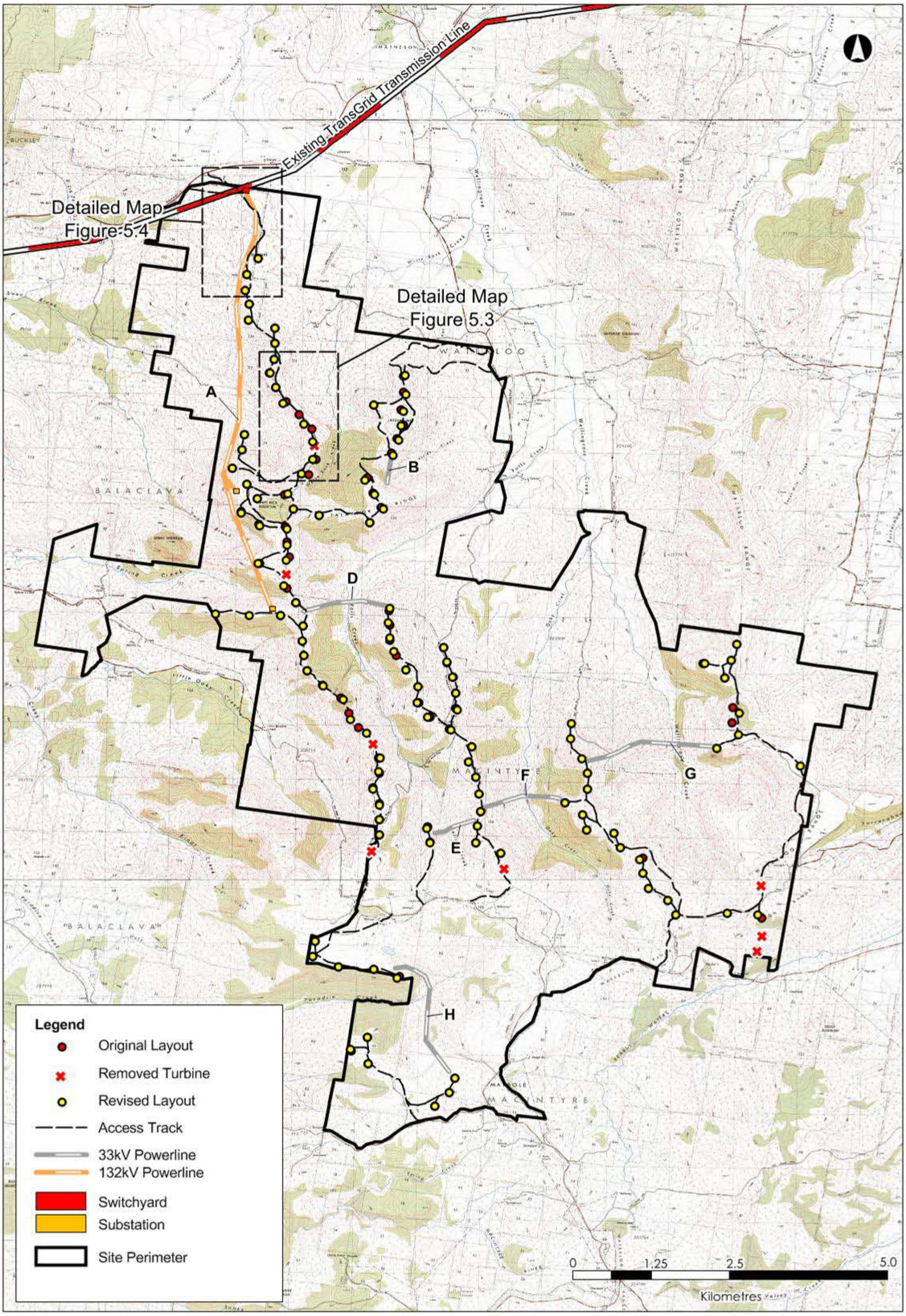


Figure 5-2 Current infrastructure layout

EPURON

Figure 5-3 Example of revisions made to the layout

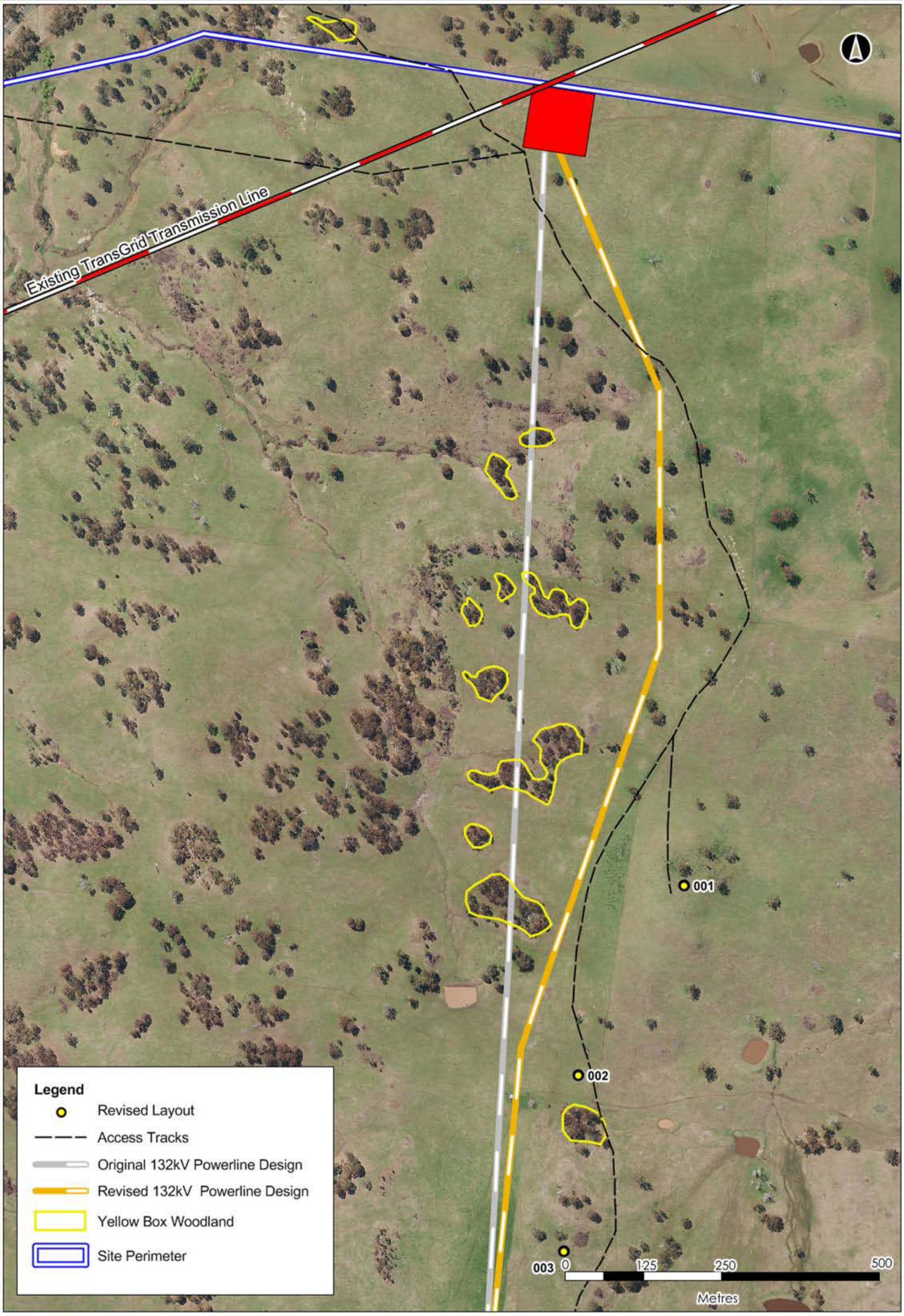


Figure 5-4 Example of changes to the transmission line

Table 5-1 provides a detailed explanation for the movement/deletion of turbines, access tracks and powerlines.

Table 5-1 List of improvements made to the layout

Original Turbine Number	Current Turbine Number	Reason for re-design
WRK_089 & 78	12 & 13	Moved south to avoid ecology constraint identified in Ecology Assessment
WRK_079	-	Deleted due to movement of WRK_078*
WRK_080, 99 & 100	21, 25 & 24	Minor adjustment (>100m) to avoid ecology constraint**
WRK_083, 85 & 87	26, 27 & 28	Moved south to avoid ecology constraint at WRK_083
WRK_088	-	Deleted due to movement of WRK_087*
WRK_102 & 86	29 & 30	Minor adjustment due to deletion of WRK_088**
WRK_136 & 135	32 & 33	Additional location in unconstrained area
WRK_039-41 & 12	62-64 & 65	Moved north to avoid ecology constraint at WRK_012*
WRK_053-56	45, 41, 42 & 40	Moved to avoid ecology constraint
WRK_044 & 46	43	Moved to avoid ecology constraint
WRK_045	-	Deleted due to movement of WRK_055*
WRK_052	-	Deleted due to noise constraints
WRK_026	-	Deleted due to community consultation and noise constraints
WRK_029-30, 37-38 & 35	75, 74, 68, 69 & 49	Minor adjustment to avoid ecology constraint**
WRK_001, 113 & 121	-	Deleted due to noise constraint
WRK_125	108	New turbine location
WRK_003 & 004	106 & 105	Significant relocation to avoid ecology and side slope constraints
WRK_122-124	85, 86 & 84	New turbine locations
WRK_014	103	Minor relocation to avoid ecology constraint**
Substation (northern option)		The alternate substation location was relocated due to the proximity to a waterway crossing, and other ecology impacts. The new location provides a significantly reduced impact.
Overhead Powerline G		Rerouted to allow poles to be placed in clear areas and the easement to bypass good quality woodland.

Overhead Powerline A	Powerline was rerouted to avoid the Yellow Box Gum woodland found only in the north of the site. This area was completely avoided.
Access Track	Relocated to allow 30 metre buffer around Aboriginal Heritage sites

*Turbine spacing dictates that a certain distance must remain between turbine locations to avoid 'wind shading' by surrounding turbines, which reduces the energy yield and also creates unwanted turbulence causing stress on the turbine blades. In some cases a turbine may need to be deleted because a surrounding turbine has moved to avoid a different constraint.

** Given that a turbine foundation is approximately 15 metres in diameter a minor adjustment of between 50 - 100m may be all that is required to avoid clearing of wooded areas. Although, in some cases there is a trade off as slight adjustments can mean pushing a turbine onto the side slope. The environmental impact of this can often be far greater than a small clearing as cut and fill techniques would be required to create a level surface for the turbine. Where the clearing of woodland has been deemed unacceptable and minor adjustments are not possible, the turbine has been removed.

6 Planning Assessment Process

This Section of the EA provides an outline of the relevant statutory provisions for the planning assessment process at a Federal, State and Local Government level.

6.1 State Government Legislation and Policy

6.1.1 Environmental Planning and Assessment Act 1979

The planning consent process in NSW is governed by the *Environmental Planning and Assessment Act 1979* (*EP&A Act*).

Under Part 3A of that Act, the White Rock Wind Farm is classed as a Major Project. The Consent Authority for this project is the Minister for Planning based on advice received from the Department of Planning.

The Director General of the Department of Planning has issued the requirements for environmental assessment of the project.

Part 3A - Major Project

The project is a Major Project which will be assessed under Part 3A of the EP&A Act. This is due to the fact that it has a capital investment value of more than $30 million and was confirmed to be a project to which Part 3A of the EP&A Act applies by the Director-General of the Department of Planning on 2 June 2010, refer to Attachment 4.

Part 3A integrates the assessment and approval regime for all Major Projects that require the approval of the Minister for Planning, previously dealt with by Parts 4 and 5 of the Act. Projects approved under Part 3A of the EP&A Act do not require authorisations under the:

- *Fisheries Management Act 1994* (sections 201, 205 or 219, stop work orders);
- *Heritage Act 1977* (Part 4 or Section 139);
- *National Parks and Wildlife Act 1974* (section 87, consent under Section 90, interim protection and stop work orders);
- *Native Vegetation Act 2003* (section 12);
- *Rivers and Foreshores Improvement Act 1948* (Part 3A);
- *Rural Fires Act 1997 (*section 100B);
- *Water Management Act 2000* (sections 89, 91);
- *Threatened Species Conservation Act 1995* (interim protection and stop work orders);
- *Protection of the Environment Operations Act 1997* (environment protection notices); and
- *Local Government Act 1993* (orders under Section 124).

Critical Infrastructure

NSW Premier Morris Iemma announced that proposals to build new power stations with a capacity to generate at least 250 MW would be declared Critical Infrastructure under the EP&A Act. The intention of this declaration is to secure the energy future of the state and to allow for sustainable economic development. The Minister for Planning made the formal declaration under the EP&A Act on 26 February 2008.

On 27 February 2009, the NSW Premier announced that the criteria for wind farm projects considered as Critical Infrastructure would be amended to include wind farm development applications that fall within the specified renewable energy precincts and propose to generate 30 MW or more of electricity and would be considered Critical Infrastructure.

The Minister for Planning made the following declaration under the EP&A Act on 11 November, 2009:

"…..projects within that [Schedule 1] *category to be critical infrastructure projects under Section 75C of the Environmental Planning and Assessment Act 1979"*

SCHEDULE 1

Development for the purpose of a facility for the generation of electricity derived from renewable fuel sources (that is, wind energy, solar energy, geothermal energy, hydro energy, wave energy and bio energy), being development that:

> *(a) is the subject of an application lodged pursuant to section 75E or section 75M of the Environmental Planning and Assessment Act 1979 lodged after the date of this declaration; and*
>
> *(b) is the subject of an application that proposes a development with a capacity to generate at least 30 megawatts."*

The proposed White Rock Wind Farm will be capable of generating more than 30MW of electricity from renewable energy resources and is therefore Critical Infrastructure in accordance with this declaration.

Renewable Energy Precincts

In February 2009 the NSW Government announced the creation of six renewable energy precincts in areas where significant future renewable energy development is expected, especially wind farms. The precincts were each assigned a coordinator with the purpose of enabling local communities to have a voice and a stake in renewable energy development. The renewable energy precincts were listed as:

- The NSW/ACT Cross Border Region;
- The Central Tableland;
- Snowy-Monaro;
- The New England Tableland;
- The Upper Hunter; and
- The South Coast.

The proposed wind farm is located within the New England Tableland Precinct.

Director General's Requirements

The Director General of the Department of Planning has issued requirements for the Proponent to consider and address in this EA. These requirements incorporate input from the various government agencies that will provide input to the DoP in the assessment of this project.

The following table summarises the Director General's Requirements (DGRs) and indicates where they are addressed in this EA. The full DGRs are presented in Attachment 5.

Table 6-1 Summary of Director General's Requirements

Director-General Requirement's	Addressed in:
General requirements	
• Executive summary	Section 1

Director-General Requirement's	Addressed in:
• Detailed description of Proposal including construction, operation and decommissioning details along with supporting maps showing details of turbines and all infrastructure	Section 3
• Timeline indicating staging (including decommissioning)	Section 3.9
• Consideration of relevant statutory provisions (including consistency of the project with the objects of the *Environmental Planning and Assessment Act 1979*) and any relevant development control plans.	Section 6
• Assessment of key issues (outlined below) during construction, operation and decommissioning	Section 9
• Draft Statement of Commitments	Section 12
• Conclusion justifying the project taking into consideration environmental, social and economic impacts of the project, suitability of the site and the public interest	Section 13
• Certification by the authors of the EA	Section 15
Key issues	
• Strategic justification	Section 4
• Visual amenity impacts	Section 9.1
• Noise impacts	Section 9.2
• Ecology (Flora and Fauna)	Sections 9.3
• Indigenous heritage (archaeological and cultural)	Section 9.4
• Hazards and Risks (aviation / communications / EMF / bushfires)	Section 10
• Traffic and Transport	Section 11.7
• General environmental risk analysis	Section 11
Consultation requirements	
• Appropriate and justified level of consultation with agencies and community	Section 7

6.1.2 State Environmental Planning Policy No. 44 Koala Habitat Protection

Guyra and the former Severn Local Government Areas are listed in Schedule 1 of SEPP 44, which encourages the conservation and management of koala habitats. The SEPP was therefore considered during the ecology assessment of the study area.

6.1.3 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* ('POEO Act') is administered by the Department of Environment and Climate Change (DECC), Environmental Protection Authority (EPA). Projects approved under Part 3A of the *EP&A Act* do not generally require authorisations under the POEO Act. Matters relevant to this Act have been taken into consideration in the preparation of this EA.

Until recently, general electricity works with the capacity to generate more than 30 megawatts of power required a licence under this Act. Recent amendments to this Act describe "general electricity works" as:

> *the generation of electricity by means of electricity plant that, wherever situated, is based on, or uses, any energy source other than wind power or solar power.*

Therefore, the proposed development of the White Rock Wind Farm does not require a licence under this Act.

Concrete batch plants exceeding production of 150 tonnes per day or 30,000 tonnes per year require a license under this Act. In the event that concrete batching plants are be installed as a result of this project, these plants are likely to exceed these production capacities and therefore are likely to require a license to be issued by DECC.

6.1.4 Ecologically Sustainable Development (ESD)

Ecologically sustainable development (ESD) involves the effective integration of social, economic and environmental considerations in decision-making processes. In 1992, the Commonwealth and all state and territory governments endorsed the *National Strategy for Ecologically Sustainable Development*. In NSW, the concept has been incorporated in legislation such as the *EP&A Act* and Regulation.

For the purposes of the *EP&A Act* and other NSW legislation, the Intergovernmental Agreement on the Environment (1992) and the *Protection of the Environment Administration Act 1991* outline the following principles which can be used to achieve ESD:

(a) The precautionary principle: that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

In the application of the precautionary principle, public and private decisions should be guided by:

(i) Careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment; and

(ii) An assessment of the risk-weighted consequences of various options.

(b) Inter-generational equity: that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations;

(c) Conservation of biological diversity and ecological integrity: that conservation of biological diversity and ecological integrity should be a fundamental consideration;

(d) Improved valuation, pricing and incentive mechanisms: that environmental factors should be included in the valuation of assets and services, such as:

(i) Polluter pays: that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement;

(ii) The users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste; and

(iii) Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, which enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

The precautionary principle has been adopted in the assessment of impact. All potential impacts have been considered and mitigated where a risk is present. Where uncertainty exists, measures have been suggested to address the uncertainty.

The impacts of the project on ecology, including EPBC listed species, have been assessed in detail in the attached Ecology Assessment (summarised in Section 9.3).

The aims, structure and content of this EA have incorporated these ESD principles. The Draft *Statement of Commitments* in Section 12 provides an auditable environmental management commitment to these parameters. Based on the social and environmental benefits accruing from the project at a local and broader level, and the assessed impacts on the environment and their ability to be managed, it is considered that the development would be ecologically sustainable within the context of the above ESD definitions.

6.2 Commonwealth Legislation

6.2.1 Environment Protection and Biodiversity Conservation Act 1999

This *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides for a Commonwealth assessment and approvals system for:

i) Actions that have a significant impact on 'matters of national environmental significance';

ii) Actions that (indirectly or directly) have a significant environmental impact on Commonwealth land, and;

iii) Actions carried out by the Commonwealth Government.

A Proposal requires the approval of the Environment Minister if an action is likely to have a significant impact on a matter of national environmental significance or listed as a matter of national significance which includes:

i) World Heritage Properties;

ii) Wetlands of International Importance (Ramsar wetlands);

iii) Commonwealth Listed Threatened Species and Ecological Communities;

iv) Commonwealth Listed Migratory Species;

v) Nuclear action;

vi) Commonwealth marine areas; and

vii) Commonwealth land.

Threatened Species and Ecological Communities

The EPBC Act aims to ensure the conservation and recovery of flora and fauna species and communities at a state and national level. The requirements of EPBC Act under Part 13 - Species and communities, are that the Minister must establish a list of threatened species, threatened communities and key threatening processes. The list must contain threatened species and communities as contained in Schedules 1 and 2 of the *Endangered Species Protection Act 1992*. Listed species are divided into the following categories: Extinct, extinct in the wild, critically endangered, vulnerable and conservation dependent. Threatened communities are divided into the following categories: Critically endangered and endangered. Key threatening processes are contained in Schedule 3 of the *Endangered Species Protection Act 1992*.

A search for Matters of National Environmental Significance based on the study area and a 50 kilometre buffer was undertaken using the Commonwealth Government's Protected Matters Search Tool. This tool covers World Heritage properties, National Heritage places, significant wetlands, migratory species, nationally listed threatened species and communities and other matters protected by the EPBC Act. The report generated by the Matters of National Environmental Significance Commonwealth Government's Protected Matters Search Tool is provided in full and discussed within the Ecology Assessment, provided in Appendix 3. A summary of the results of the Protected Matters Search Tool is provided in Table 6-2 below.

Table 6-2 Summary of the results of the Protected Matters search tool

	White Rock Wind Farm
Threatened Species	26
Migratory Species	11
World Heritage Properties	None
Australian Heritage Sites	None
Ramsar Wetlands	None
Commonwealth Marine Areas	None
Commonwealth land	None

On the basis of the ecological investigations, the project is not considered likely to have an impact on EPBC listed species. To obtain certainty however, Epuron submitted an EPBC referral to determine whether, on the basis of Matters of National Significance, the project would be considered a 'controlled action'. A referral decision was received from the Department of Sustainability, Environment, Water Population and Communities on 8 March 2011 confirming that the proposed wind farm is not a controlled action and that no further assessment or approval is required under the EPBC Act.

Bilateral agreements

In accordance with subsection 45(4) of the *EPBC Act* and Division 16.1 of the EPBC Regulations 2000, the Commonwealth of Australia entered into a bilateral agreement with New South Wales. One of the aims of the agreement is to minimise duplication of environmental impact assessment processes, ensuring a co-ordinated approach for actions requiring approval from both the Commonwealth and the state. Should the project be considered a 'controlled action' under the *EPBC Act* the referral would be assessed by the NSW DoP, funded by the federal agency.

While it is not considered that the project represents a 'controlled action', as defined by the *EPBC Act 1999*, an EPBC referral for the project has been submitted as a precautionary measure as detailed in Section 6.2.1, above. No other matters pertaining to this project are relevant to the bilateral agreement.

6.2.2 DEH Supplementary Significant Impact Guidelines 2.1.1: Wind Farm Industry Sector 2005

The purpose of these guidelines is to assist operators in the wind farm industry to decide whether or not actions which they propose to take require assessment and approval under the *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*).

These guidelines have been considered in the preparation of this EA, particularly with reference to Section 9.3, Ecology Assessment.

6.3 Local Government Instruments and Policies

6.3.1 Local Environment Plans

The proposed site for the White Rock Wind Farm is located within the Glen Innes Severn and Inverell Local Government Areas and is subject to three Local Environmental Plans (LEPs):

- Glen Innes LEP 1991
- Severn LEP 2002
- Inverell LEP 1988

These LEPs establish the framework for development within the local government area. It contains a planning scheme establishing specific land use zones which guide Council planning. Each land use zone carries specific planning objectives.

The Glen Innes Severn Local Government Area was created as part of a council amalgamation in September 2004, and as a result two LEPs apply to this area. Council is currently preparing a new Local Environment Plan. Until this new plan is Gazetted, the former Glen Innes and former Severn LEPs will remain in use (GISC, 2010).

The project site is located entirely within Zone No 1(a) Rural Agriculture. Wind farm proposals are not prohibited under any of the LEPs, but would require development consent.

Permissibility under the LEP is important because, although Major Projects are approved by the Minister and planning instruments (other than State Environmental Planning Policies) do not apply, the Minister cannot approve projects (other than critical infrastructure projects) which would (but for Part 3A) be prohibited under a planning instrument.

In addition, the Minister is to take into consideration the provisions of any environmental planning instrument that would have (but for Part 3A) substantially governed the carrying out of the project. The Minister would therefore have regard to the provisions of the Glen Innes and Severn LEPs in assessing the wind farm proposal. However, there is no obligation to meet the requirements of the LEPs.

6.3.2 Development Control Plans

The project has been identified as a Major Project and subsequently as Critical Infrastructure, and will therefore be assessed by the Department of Planning. Consideration has however, been given to the current Development Control Plans (DCPs) of Glen Innes Severn and Inverell Shire Councils in the preparation of this proposal. They are titled:

- Glen Innes Severn Council Development Control Plan 2008 Part D Specific Development - Wind Farms, and (GISC, 2008);
- Inverell Shire Council Development Control Plan - Wind Power Generation (ISC, 2009).

The aim of these DCPs is to give the community and the developers guidelines in relation to planning wind farms in the local government area. It acts as a guide to the Council's expectations and accordingly has been considered by the Proponent.

The Wind Power Generation sections of these two DCPs share common objectives and a summary where their criteria have been addressed in this EA are listed in the Table below.

While the project does comply with most of the criteria for these DCPs, it should be noted that there are some exceptions.

The project does not comply with set-back distances suggested in these DCPs, however, it achieves compliance with the SA EPA Guidelines. Furthermore, the layout has been assessed for visual impact. The noise and visual studies are based on an assessment of amenity and consider site specific factors relating to the project design and minimisation of overall impacts. In the recent Gullen Range and Glen Innes Wind Farm court hearings, a similar setback distance was rejected as numerical limits such as this one are less accurate and there is no basis for the setback distance described in the DCP. The project achieves the desired objectives of the DCP and complies with the other requirements, particularly the noise criteria.

Table 6-3 Criteria from both the Glen Innes Severn and Inverell Wind Power Generation DCPs

Wind Power Generation DCP Criteria	Relevant section in this EA
Any EIS (EA) as a minimum to contain:	
The location details of all wind farm infrastructure with accompanying maps at 1:25,000 scale including a site plan for turbines, access points, powerlines and native vegetation.	Section 3
Specifications of the proposed wind turbines	Section 3
Description of land use of the adjoining land	Discussed in Section 4.6
A detailed noise assessment of the noise impact of the proposal, including construction and operation of the wind turbines.	Section 9.2
An assessment on the visual impact for a distance of at least 10 kilometres	Section 9.1
Evaluation of electromagnetic radiation from the proposed infrastructure	Section 10.3
A construction program and environmental management plan	Discussed in Section 8
Evaluation of flora and fauna impacts	Section 9.3
The heritage significance of the site and surroundings	Section 9.4
A decommissioning and site restoration plan and program	Section 12
Demonstration that adequate consultation has been conducted with all issues addressed	Section 7
A post construction and commissioning program	Section 12
Project design and development application guidelines:	
Development to be sited to minimise impacts to farming, grazing, forestry practices and tourism as well as adjoining land	Discussed in Section 3 and Section 10.1
Assess the cumulative impact of the proposal in relation to existing	Section 9.1.4 and 9.2.3

Wind Power Generation DCP Criteria	Relevant section in this EA
or proposed wind farm developments	
Comply with the SA EPA noise criteria guidelines	Section 9.2
Locate the development 15 times the tip height, or 2km (which ever is greater) from any non-associated dwelling.	Section 6.3.2
Locate the development more than 2 times the tip height from a formed public road	Section 6.3.2
Locate the development more than two times the tip height from a non-associated property boundary	Section 6.3.2
Turbine locations to be sensitive to existing associated dwellings	Section 9.1 and Section 9.2
Turbine locations should not surround a non-associated residence	Section 3.2
A communications study should address any potential interference and mitigation measures	10.2
Construction to only occur on identified roads/routes	11.7
Substantial investigation to be undertaken into the roads chosen for the preferred route, with bonds required for any potential damage to roads during construction. Internal roads to be adequately designed by the developer.	Section 11.7 and Section 12
Recommended that a safe viewing area for the public be provided	Not considered necessary
Turbines to be dismantled and removed within six months of becoming redundant, as well as rights of carriageway becoming extinguished.	Section 3
A bushfire risk assessment to be provided	10.5
Contributions to be made in accordance with section 94 contributions plan	4.5.4

6.4 Border Rivers-Gwydir Catchment Action Plan

The Border Rivers – Gwydir Catchment Management Authority (BR-GCMA) has developed a ten-year Catchment Action Plan (CAP) to manage the competing demands from the users. It aims to develop sustainable communities and industries which support the natural and cultural environment for future life (NSW Government, 2006). The plan is structured around four themes:

- Community;
- Biodiversity;
- Water and soils, and;
- Land use.

Under each theme the plan provides an indication of the resources current condition, the pressure or challenges faced by the resource and how the targets determined by the board will achieve improvements in the resource.

The Border Rivers – Gwydir Catchment occupies an area of approximately 50,000 square kilometres in northern NSW, neighbouring Queensland and forming the upper parts of the Murray-Darling Basin. The proposed site is near the eastern edge of the catchment area near the Macintyre and Beardy Rivers. The CAP has been developed in conjunction with NSW state government standards and targets under the Natural Resource Commission Act 2003.

Overall, the White Rock Wind Farm will have little effect on the key principles of community, ecology, water and soils and land use on which the plan is built. The site location will not cause alternations to the natural flow regimes of the rivers or introduce any foreign biological species into the region. Mitigation measures have been identified to reduce the potential impact to erosion, which will be implemented, using best practice, into both the Construction and Operational Environmental Management Plans. While vegetation clearing would be required on site, the amount required would be relatively small in size. The impact to this native vegetation has been assessed as part of the proposal and was concluded to be manageable with effective implementation of the Construction Environmental Management Plan.

7 Public consultation

7.1 Community Attitudes

The NSW Government recently commissioned the report *'Community Attitudes to Wind Farms in NSW'* to assess residents attitudes towards targets set to achieve 20% renewable energy consumption by 2020 (DECCW, 2010a). The survey was conducted by telephone of 2022 residents aged 18 years and older and 300 businesses across the 6 Renewable Energy Precincts, including the New England Tablelands and a control area in regional NSW.

The outcomes of the study are as follows:

- Of the total surveyed 81% believed wind power was acceptable for power generation;
- General awareness of turbines was very high, with 97% of people having heard about wind farms or wind turbines generating electricity and 81% of the population had seen a wind farm or wind turbine;
- On average, over half (61%) of the population living in these precincts knew about wind farms currently operating in NSW. However, the average of the New England Tablelands Precinct was well below the state at only 38%;
- Eighty five percent (85%) of the population across the precincts support wind farms in NSW, with 80% supporting them within their local precinct, and 79% support for a wind farm being built 10 km from their residence;
- A similar trend occurs with business opinion with 88% support for wind farms within NSW, 83% support for a wind farm in the precinct, 82% support for a wind farm 10 km from the residence and 60% support for a wind farm within 1-2 km of the residence.

This study provides very similar results to a specialist report, *Report on Community Perceptions of Wind Farms in the Southern Tablelands, New South Wales* prepared for Epuron in October 2007.

The NSW Government study concludes that the general adult residents of the survey area are well aware of the potential of wind farms or wind turbines to generate renewable energy. Additionally, the respondents were generally aware of wind turbines and how wind turbines appear within the landscape and are generally supportive. The results further indicated that the respondents were generally not adverse to the development of wind farms in the immediate locality.

Based of this survey, it is reasonable to assume that the communities within the New England Tablelands are generally supportive of wind farms. However, the survey showed that a majority of the population did not feel like they had adequate information about wind farms, even in areas where general wind farm awareness was much greater.

7.2 Community Consultation

Wind farm developments and approvals in Australia have elicited polarised responses from the community, highlighting the need to appropriately identify and consult with community stakeholders early in the development process.

Prospective wind energy projects in NSW are limited to sites with elevated land, good wind speeds, usually in rural areas, and with good transmission line access. Such sites are relatively rare, and often, these sites are located in the vicinity of rural dwellings and in some cases in the vicinity of small to medium sized regional communities. This can cause conflict where local community members feel impacted by the development and yet do not see any direct benefits from the development.

While unfortunate, the limited number of appropriate wind farm sites means that this conflict is often unavoidable and cannot be eliminated by simply moving the wind farm to a different location.

Accordingly, community consultation is focussed on understanding and mitigating the impacts of the wind farm, and on showing and maximising its benefits to the local community.

7.2.1 Community Consultation Plan (CCP)

A Community Consultation Plan was prepared by Epuron for the proposal (Attachment 6). This plan highlights the key objectives of consultation, which are:

- To ensure the community is fully informed about the project, its likely impacts, and its likely benefits;
- To ensure that Epuron fully understands the local context for the project, including any local impacts that the project may have or opportunities that it could provide;
- In that context, to provide multiple opportunities for dialogue in various forms to allow the community to receive information and provide feedback about the project;
- To incorporate the feedback into the design of the wind farm where possible;
- To explain where and how this feedback can be and has been incorporated; and
- To build positive, trust-based relationships with members of the local community.

The approach taken to the community consultation plan was to use a variety of means to achieve the desired objectives. These included:

- Newsletters;
- Media opportunities;
- Community Open House in the local area;
- Letters to identified residents within 5km of the proposed site; and
- Phone calls and/or individual meetings with landowners within 4km of the site.

The plan was used to guide consultation during the development of the project. The intention of the plan was that it be adapted as community feedback was received so that consultation activities were a pragmatic response to the issues raised by the community.

Key consultation activities included an open house session attended by a range of specialists working on the project, follow-up phone calls and correspondence, face-to-face meetings with neighbouring and concerned landowners.

7.2.2 Implementation of the Community Consultation Plan

While the majority of the consultation process focussed on informing the community about issues relating to the project, activities to engage the community in two-way dialogue were also undertaken for the purpose of incorporating community concerns, local knowledge and thereby maximising the suitability of the project to the site and the community's acceptance of the project. An example of this is the open house event.

7.2.2.1 Open House

The open house forum allowed the opportunity for members of the community to speak individually or in small groups to the Proponent representatives and to persons undertaking parts of the EA. The open house format is helpful in avoiding potential conflict in a public meeting for contentious issues, allowing a flow of stakeholder dialogue throughout the event rather than a more constrained discussion that can be hijacked by the most vocal individuals. It allows for a larger proportion of stakeholders to voice their individual concerns with the relevant representatives in a less confrontational situation. It also allows the presentation of issues and information to be tailored to individual queries.

The open house session was held on 4 November 2010 at the Learning Centre in Glen Innes. A community newsletter, distributed to residents within 5km of the project, preceded the event which was also advertised in the local newspaper. The event ran from 2:00-7:00pm.

Representatives from the Proponent, RPS (ecology and heritage consultants) and Sonus (noise consultants) were present to discuss the project specifics (including general questions about wind farms and wind farm development) and the environmental planning process.

An estimated 40 - 60 people attended the event, primarily local residents within the vicinity of the wind farm, as well as key stakeholders including government and council representatives.

Details of the proposed wind farm project were on display and included:

- Maps showing the planned locations of wind turbines and other associated infrastructure including substations, powerlines and access tracks;
- Photomontages showing the likely view of the completed wind farm from a number of locations around the site were on display; and
- A slide show of Australian wind farms during construction and in operation was displayed to provide the community with an indication of the potential impact of the proposed wind farm during construction and subsequent operation.

Notable observations made on the day included:

- Some attendees were interested in the flora and fauna work and also the construction management plan in relation to weed and erosion control;
- Most people were interested in viewing the photomontages to gain an understanding of the visibility of the project from common routes such as Inverell to Glen Innes;
- Some people were concerned about the potential noise impacts that may result from operation of the wind farm; and
- A number of people expressed their support for renewable energy and wind farms.

Epuron was pleased with the positive response and feedback received during the information day. The opportunity to engage with the local community as well as representatives from local council and government departments was greatly appreciated.

7.2.2.2 Face-to-face consultation

A common criticism of major project developers is a lack of consultation with surrounding neighbours. While newsletters and open houses are effective at engaging with the wider community, there is no guarantee that this information will be received by everyone.

Epuron has taken this on board in designing the community consultation program and has placed an importance on consultation with the immediate neighbours of the project. During the feasibility phase of the project representatives from Epuron made contact with all landowners that reside within a 4 kilometre radius of the project. In all cases this involved an initial phone conversation to introduce the proponent and the project, and in most cases a face-to-face meeting followed to provide additional detail about the project and to answer any questions.

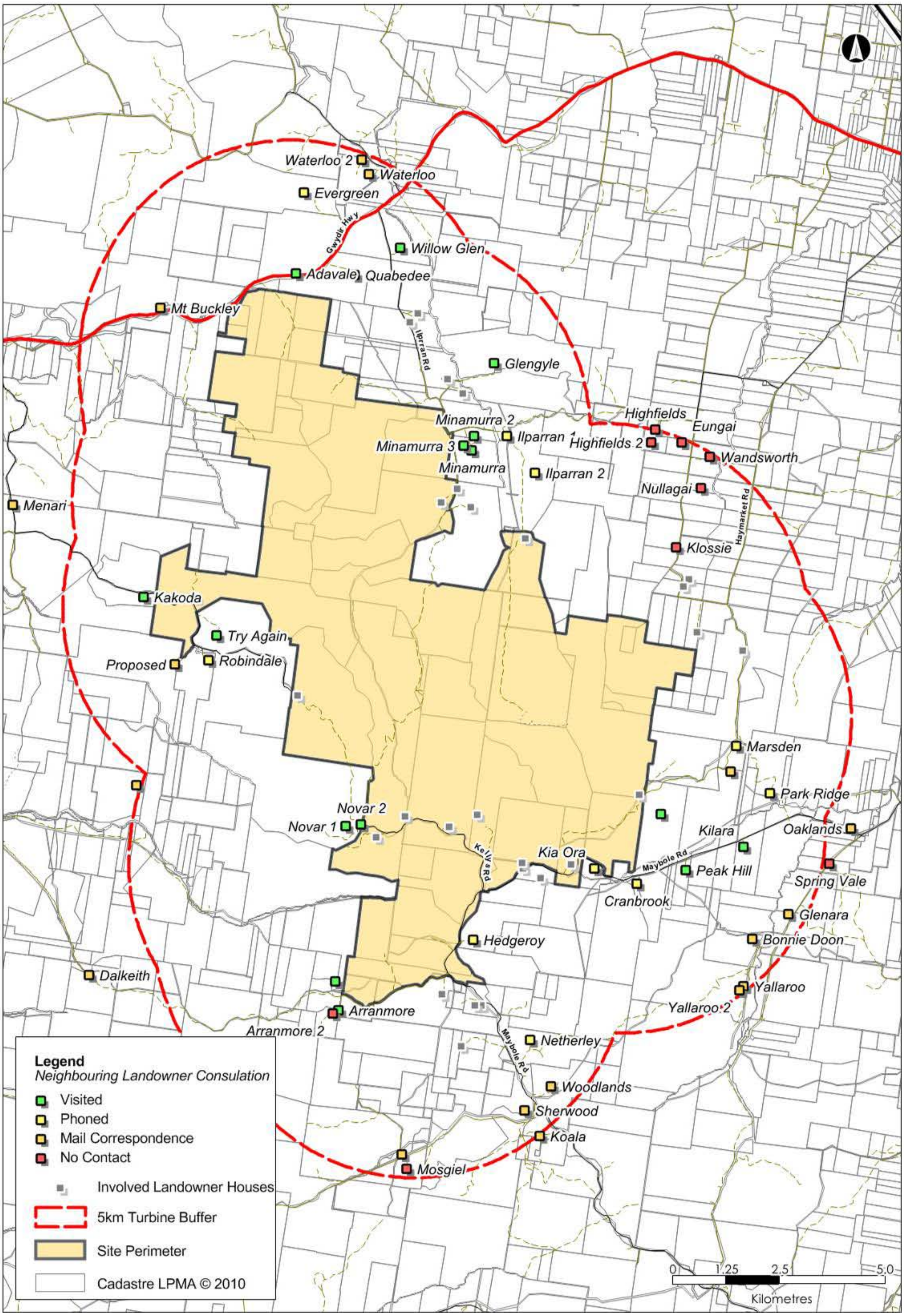


Figure 7-1 Community consultation

7.2.2.3 Newsletters

Newsletters have been used throughout the development process as a means of informing the local community about the project and development phases, as well as any status updates that may be relevant. Newsletters were also used to advertise events such as the open house information day, where people were invited to come and ask questions and provide feedback on the project.

The first newsletter introduced the project in October 2010, outlining an indicative time frame for submission to the consent authority and advising of opportunities for receipt of community input. It was distributed to all residents within 5km of the site.

Shortly after the first newsletter was distributed an Open House event was planned in Glen Innes. Invitations were sent out to all landowners within 5km of the proposed development, informing them of the time and location of the event.

The second newsletter in November 2010 provided updated project information (regarding the number of turbines) and thanked the community for attending the open house session in Glen Innes. It was distributed to all residents within 5km of the site & provided an updated map of proposed turbine locations and wind farm property boundary.

A third newsletter will advise the Community of the submission of the EA, and indicate where the reports can be viewed by the public and to thank the community for their participation to date.

Ongoing newsletters will continue to be provided to the community.

Copies of all community consultation material including the community consultation plan, broader perceptions survey, community newsletters, media releases and letters received from key stakeholders are included within Attachments 6 & 7.

7.2.2.4 Media

Preliminary details about the wind farm project were published in the Glen Innes Examiner as part of the formal notification required prior to conducting the heritage assessment field studies and the invitation to the Open House was also published in the Glen Innes Examiner over a two week period.

Epuron contributed to a newspaper article in August 2010 relating to planned wind farms in the greater Glen Innes area.

7.3 Government Consultation

7.3.1 Initial meetings

The proponent began consultation with the consent authority, the NSW Department of Planning, in September, 2010, introducing the project and seeking advice in the assessment process.

Meetings were also conducted with:

- Paul Cruikshank, DECCW Regional Coordinator for Renewable Energy Precincts on July 29 2010 regarding the proposed White Rock project and future consultation with DECCW;
- Stephen O'Donaghue, DECCW Armidale on September 3, 2010 via telephone and email by RPS in relation to possible EECs that may be present during field studies;
- Representative from Local Council on July 29 and August 25 to discuss the proposed wind farm and any concerns councilors may have; and
- The Department of Lands and Property Management on November 4, 2010.

7.3.2 Key Stakeholders

Planning for the development of the White Rock Wind Farm has included specific consultation with the stakeholders listed in Table 7-1.

Table 7-1 Key stakeholders

Sector	Organisation or Group
Local Community	• The local community and landowners • Local media
Local Industry	• Superair
Local Government	• Glen Innes Severn Shire Council • Guyra Shire Council • Inverell Shire Council
NSW Government Agencies	• Department of Environment, Climate Change and Water • Country Energy • TransGrid • NSW Roads and Traffic Authority (RTA) • NSW Rural Fire Service • Land and Property Management Authority • Industry and Investment NSW • Border Rivers-Gwydir CMA
Federal Government Agencies	• Civil Aviation Safety Authority

Consultation with stakeholders has occurred through a variety of means including phone conversations, face-to-face meetings, email and letter correspondence and in some cases attendance at local information days.

Through the feasibility and design stages of the project, consultation has involved the proponent informing the relevant stakeholders of the project details and seeking advice to enable the design of the wind farm and to reduce potential impacts to the existing environment. Specific issues raised by these stakeholders have been discussed within the relevant Sections of this EA. The consultation process will continue through the development and operation of the wind farm.

8 Approach to Environmental Assessment

The approach to this Environmental Assessment was developed and submitted for the Preliminary Environmental Assessment (PEA), which accompanied the project application sent to the Department of Planning on the 10 September 2010. During the assessment the approach was expanded to include a wider range of issues as they were identified, however it has largely remained as described in the PEA.

8.1 Initial Environmental Risk Analysis

The following section outlines the key issues in relation to the White Rock Wind Farm, and summarises Epuron's approach to addressing each issue. As a general rule, in undertaking this assessment:

- Issues identified as "Key Issues" will be addressed through use of an independent expert assessment together with specific on-site assessment and field work; and
- "Additional issues" will be addressed, where necessary, via desktop assessment, precedent and consultation.

The focus on this delineation is to ensure that every issue is adequately addressed considering the potential risks and impacts associated with the issue, and without burdening the EA with details which are unlikely to affect the ultimate assessment of the project.

Epuron has carried out a risk assessment based on information collected to date on site, at nearby sites, generally within the region and based on similar proposals in other regions.

In relation to each risk, Epuron has established a priority which takes into consideration:

- The level of information already available about that issue;
- The extent to which site specific assessment is required to define that issue;
- The likelihood of that issue occurring, and potential impacts of that issue if it did occur; and
- The extent to which standard industry practice, statutory requirements, and standard consent conditions adequately address the issue.

The benefit of this approach means that the assessment can be tailored around the likely impact, in other words, the significance of an issue determines the level of assessment required.

An environmental risk analysis model (Refer to Table 8-1 on the next page) was used to identify and assess the additional issues over and above the key issues specified in the DGRs. The model considers the nature of the potential impact (i.e. is it temporary, reversible, likelihood of secondary impacts), the receiving environment and the likelihood of the impact occurring. The assessment strategy was then determined based on the overall risk rating for each issue.

Where the overall risk rating was very low and where the issues have previously been assessed in relation to wind farms in general and have been demonstrated to not affect the assessment or the consent conditions, no further assessment was carried out.

Table 8-1 Risk analysis of additional issues

The risk rating ranges from 1 to 5: 1 = low anticipated impact / sensitivity / likelihood of occurrence

5 = high anticipated impact / sensitivity / likelihood of occurrence

ADDITIONAL ISSUE	NATURE OF IMPACT	SENSITIVITY OF RECEIVING ENVIRONMENT	LIKELIHOOD OF OCCURRENCE	RISK RATING (Scale 0 – 50)	ASSESSMENT & MITIGATION
Electromagnetic interference (Telecommunications)	3	1	3	9	EA Chapter 10.2
Soils and Landforms	3	4	3	27	EA Chapter 11.2
Water & Groundwater	3	4	2	24	EA Chapter 11.1
Climate and air emissions	2	2	2	8	EA Chapter 11.3
Safety (including aviation & bushfire risks)	4	2	2	16	EA Chapter 10.1 & 10.5
Property values	2	3	1	6	Previously demonstrated not to affect wind farm assessment - no further assessment required
Health (electromagnetic fields & epilepsy)	4	2	1	8	EA Chapter 10.3 & 10.4
Mineral Exploration	2	2	2	8	EA Chapter 11.4
Social & Economic	3	3	5	45*	EA Chapter 11.5
Tourism	4	2	4	32*	Previously demonstrated not to affect wind farm assessment - no further assessment required
Community & lifestyle	2	3	1	6	Previously demonstrated not to affect wind farm assessment - no further assessment required
Agricultural (aerial spreading)	2	2	4	16	EA Chapter 10.1 & 12 SOC 57
Resource Impacts	2	2	5	20	EA Chapter 11.6

* Denotes a positive impact

8.2 Classification of Issues from Preliminary Environmental Assessment

Epuron has used both a quantitative and qualitative (using experience from past projects) analysis to rank the issues in order of likely impact. The classification of each issue and the assessment strategy is outlined in Table 8-2. The classification of issues has remained the same as outlined in the PEA.

Table 8-2 Classification of issues

Issue	Assessment strategy
Key Issues:	
Visual	Specialist report including photomontages of turbine layout (Green Bean Design)
Noise	Specialist report including predicted noise level modelling (Sonus)
Ecology (Flora and Fauna)	Specialist report and field surveys (RPS)
Heritage	Specialist report with field surveys and consultation (RPS)
Additional Issues:	
Communications	Desktop review of license holders and consultation (Epuron)
Socio-Economic	Desktop review (Epuron)
Hydrology	Desktop review and consultation with key government departments (EPS)
Soils and Landforms	Desktop review and consultation with key government departments (EPS)
Cumulative Impact	Review specialist reports and apply assessment criteria (Epuron)
Climate and air quality	Desktop review and consultation with key government departments (EPS)
Traffic and Transport	Review of haulage route including site visit and consultation (Epuron)
Resource	Desktop review and consultation with key government departments (EPS)
Bushfire	Desktop review (Epuron)
Aviation	Desktop review (Epuron)
Electromagnetic Fields	Desktop review (Epuron)
Mineral Exploration	Desktop review of license holders with consultation (Epuron)

8.3 Assessment Approach

8.3.1 Director General's Requirements

The DGRs are compiled by the DoP, with consultation from various government departments in order to identify the issues that the proponent must be addressed in their Environmental Assessment.

Epuron has used these DGRs to structure this EA and has ensured that all issues raised have been individually addressed and consultation requirements have been met. A copy is found in Attachment 5.

8.3.2 Best Practice Guidelines

Epuron's assessment has in general followed the advice provided in a number of guidelines, including:

- Auswind's Best Practice Guidelines for the Implementation of Wind Energy Projects in Australia (Auswind, 2006); and
- Wind Energy Facilities draft Environmental Impact Assessment Guidelines (Planning NSW, 2002).

The guidelines were developed to establish the process for identifying, developing and implementing wind energy projects, recognising that each project would require assessment on its individual merits. They are focused primarily on technical and planning issues.

These guidelines have been considered in the preparation of this EA, particularly with respect to the chronological flow of the project phases.

8.3.3 Consultation

Epuron's assessment makes use of all information in relation to environmental issues which were identified though the consultation processes outlined in section 7. This includes consultation with stakeholders and their input and which was used to refine the design of the project.

8.3.4 Specialist Studies

Independent consultants were engaged to complete specialist reports on the following key issues:

- Landscape and Visual – summarised in Section 9.1 and in full in Appendix 1;
- Environmental Noise – summarised in Section 9.2 and in full in Appendix 2;
- Ecology – summarised in Section 9.3 and in full in Appendix 3; and
- Aboriginal Heritage – summarised in 9.4 and in full in Appendix 4.

8.3.5 Wind Turbine Selection for Assessments

Some impact assessments require an understanding of specific wind turbine characteristics which are not known until the final wind turbine model has been selected. An approach is therefore required to carry out an assessment based on reasonable assumptions, and ultimately confirming that these assumptions are valid.

The majority of issues identified with respect to this proposed development are not impacted by specific turbine model selection. For example, the assessment of ecology and archaeology constraints is based on a development envelope, that is, the entire geographic area where infrastructure may be located. This approach allows ecological and archaeological constraints to be defined within the development envelope and as a consequence allows for minor relocation of infrastructure within the development envelope without further assessment.

However, the final turbine selection could have a material impact on some issues and in these cases the decision as to whether to present a representative or worst case turbine must be considered.

The approach taken is to present the worst case impact assessment for specialist studies where physical dimensions and technical characteristics of turbines are related to the extent of the potential impact. Examples of this are visual impacts and noise propagation. However as discussed in Section 3.1, the most likely turbine model to be ultimately selected for the project are not the largest and sit in the middle of the turbine size range (physical size and generation capacity). Therefore in this context, the EA also considers and presents the indicative or likely impacts.

Wind Farm Layout

The wind turbine layout design is based on a REpower MM92 turbine.

Layout design is impacted by the minimum required spacing between turbines, which is a function of their rotor diameter. Therefore an assumption of the likely rotor diameter must be made at the time of the assessment.

The REpower MM92 is a mid range turbine, known to be suitable for the site. If a larger physical turbine is selected, fewer turbines may be installed, a consequence of the requirement for larger separation distances between turbines. In this scenario, some associated impacts may be reduced (such as visual impacts). Conversely, a layout using the smallest turbine option would represent the worst-case scenario in terms of the number of turbines able to be developed but may overstate other impacts. Use of the REpower MM92 is therefore considered a likely and representative turbine for the purposes of assessment.

Energy and Greenhouse Gas Calculations

The energy production and greenhouse calculations are based on an indicative 2.0MW turbine.

Energy production calculations are most important for determining the options for connecting the wind farm into the transmission network. A wind farm output may be restricted by the size of the transmission line running through the site, or if other generators are already attached to the line. Energy production is also used to calculate the potential greenhouse gas emissions that would be reduced by the project.

A turbine with a name plate rating of 2.0MW sits in the middle of the range of turbines under consideration and is a likely turbine size to be ultimately selected. It is therefore considered representative of the energy production and greenhouse abatement benefits from the project.

Visual Impacts

The photomontages, Zone of Visual Influence, and Shadow Flicker analysis are prepared using the Vestas V112, which is a turbine with a 112m rotor diameter on an 84m hub height.

Photomontages, Zone of Influence and Shadow Flicker maps are created to assess the potential impact to visual amenity. Using a turbine with a large rotor diameter (blades) and a large overall tip height allows for the worst case scenario to be assessed. While there are turbines that have a tip height in excess of 140m it is unlikely that these configurations would be used on this site.

In some cases, the worst case presents an unrealistic portrayal of impacts when compared to the most likely turbines to be selected for the project. Therefore, in some areas, the EA also considers and presents the indicative or likely impacts for comparison. Noting that the layout would require review and likely removal of a number of turbines to accommodate the physically largest turbine, this assessment would overstate the visual impacts. The photomontages were prepared using the likely turbine sizing of an 84m hub height with a 112m rotor diameter (tip height of 140m) to present the likely and representative scenario.

Noise Impacts

The noise assessment was conducted using the Vestas V90 3.0MW (the worst case scenario) and the REpower MM92 (the representative scenario).

Each turbine has a slightly different noise curve, and must be individually assessed prior to construction taking place to ensure that compliance will be achievable. Rather than testing every turbine model available, a worst case (noisiest turbine) is selected to demonstrate that compliance is achievable. Thus every other turbine would theoretically comply with the same criteria. A representative turbine is also chosen to demonstrate the likely noise impacts. Once the final turbine model is selected a simulation of the wind farm noise would be required to test against compliance levels.

The noise assessment presents the modelling of the REpower MM92 turbine as a likely and representative impact from the project, and the Vestas V90 as the worst case impact for the project. The MM92 presents the representative impacts as it has noise characteristics typical of modern wind turbines and therefore offers a good approximation of the likely noise impacts of the project. The physical and noise characteristics of these turbines are considered to be indicative of the wind turbines available. The V90 presents worst case impacts as it has noise characteristics higher than any other turbine considered for this project. The analysis demonstrates that it is possible to achieve the noise limits set by the SA EPA guidelines and WHO guidelines using both the MM92 and the Vestas V90.

The current layout, as presented in this EA, has been prepared to demonstrate that compliance can be achieved across a wide range of turbine models. Accordingly by contemplating that turbines can be relocated within a reasonable distance of their proposed location or removed to achieve the SA EPA Guidelines, a single flexible indicative layout can be presented and assessed. Additional analysis of the sensitivity of the physical dimensions (hub height and maximum tip height) on noise propagation and a worst case scenario, requiring mitigation, is presented in the noise assessment.

The approach undertaken simplifies the noise assessment process by avoiding a different layout for each proposed turbine model. The Statement of Commitments affirms that modelling of the final turbine on the final layout would be undertaken to ensure compliance with the SA EPA guidelines.

8.4 Environmental Management Plans

A Construction Environmental Management Plan (CEMP) and Operational Environmental Management Plan (OEMP) will be prepared to manage and mitigate environmental impacts on the wind farm site. The CEMP will incorporate all relevant processes and mitigation measures for development. It will include:

- Soil & Water Management;
- Fuel and Chemical Storage - to avoid the pollution of surface and ground waters;
- Erosion & Sediment Control Plan;
- Landscape Management Plan;
- Traffic and Transport;
- Fire Management;
- Waste Generation and Disposal; and
- Additional measures mentioned in the Statement of Commitments.

The CEMP and the OEMP will follow the philosophy of adaptive management. The philosophy of adaptive management is followed when policies and practices are continually improved by learning from the outcomes of previous work. As part of the adaptive management process the management measures provided by the EMP will also include a review and assessment program where works and monitoring are regularly reviewed and reassessed to ensure the environmental outcomes are achieved. This process is illustrated in Figure 8-1.

During construction, the site will be protected from erosion and sedimentation by the installation and maintenance of standard erosion and sediment control measures, such as sedimentation fences and swales in accordance with *Managing Urban Stormwater: Soils and Construction 4th Edition* – Vol 1 (the “Blue Book”) Landcom, 2004, Managing Urban Stormwater: Source Control (EPA 1998) and Managing Urban Stormwater: Treatment Options (EPA, 1998).

Surface water management procedures will be maintained in accordance with an Erosion and Sediment Control Plan. This plan will detail the use of sedimentation fences, and drainage controls to direct surface water into appropriate sediment basins and through a filter before being discharged into the site drainage system.

Specific environmental management measures will be used around the batching plant area and other temporary facilities. The temporary concrete batching plant will have a bunded storage area and a temporary concrete slab beneath the loading area. To capture surface water, sediment runoff (including any imported materials which may influence the pH and water quality) a swale drain is anticipated around the perimeter of the batching plant. This will be channelled into an enclosed retention pond, where water will be evaporated off and any solid waste disposed of at landfill. To ensure water pH levels remain at a reasonable level as a result of the potential of mixing with imported materials, monitors will be set up and if deemed appropriate acid dosing (anticipated to be hydrochloric) will be added to ensure pH is controlled or alternatively the contaminated water would be transported by tanker off site. This type of approach is common in the construction industry.

Controls to avoid spillage of oil or erosion and sediment loss from the site will be supported by emergency response procedures where required.

These management procedures will remain in place until the site is rehabilitated suitable for the intended land use. This will effectively protect the site and its surrounding areas from any significant impacts on topography, surface water and water quality.

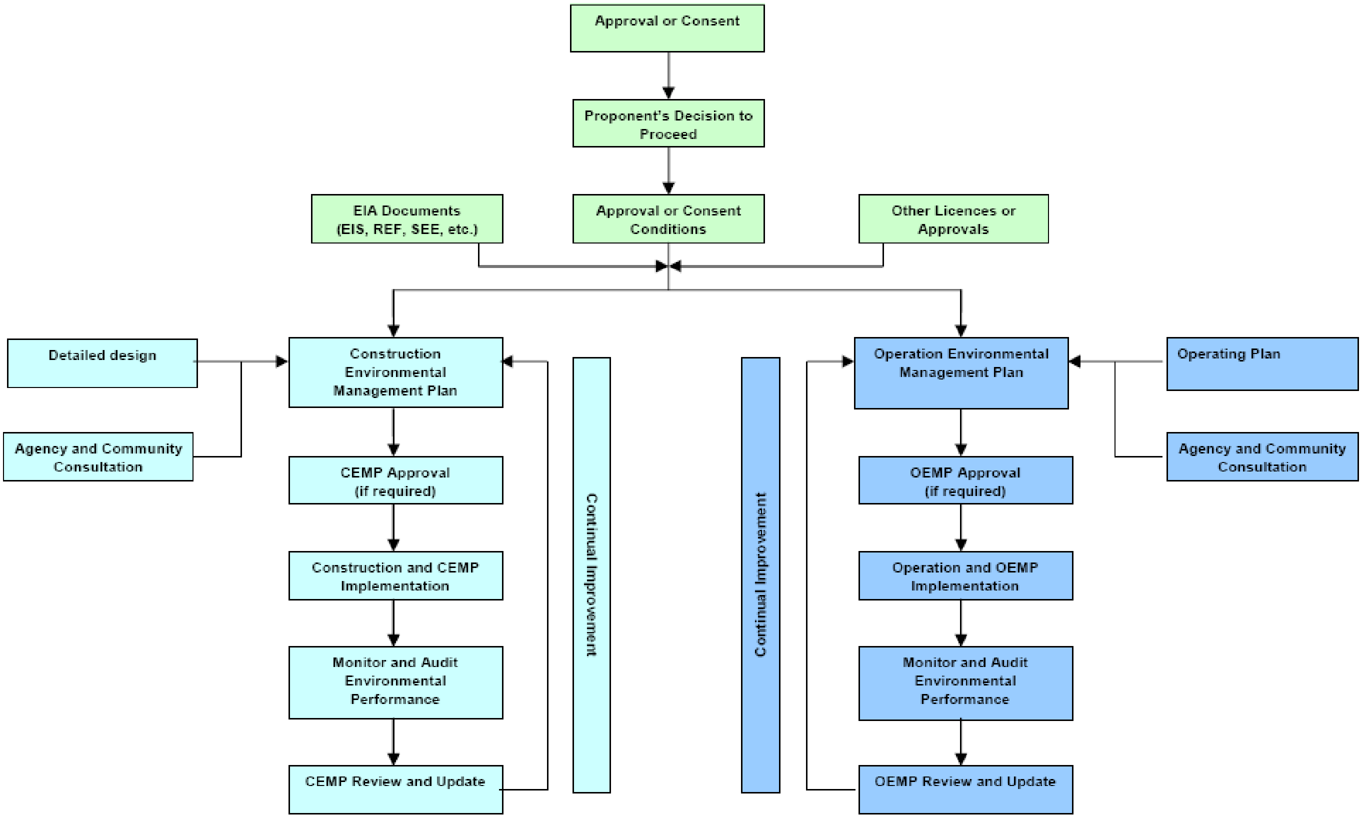


Figure 8-1 Post approval Environmental Management Plan process

9 Assessment of Key Issues

9.1 Visual Amenity

The White Rock Wind Farm Landscape and Visual Impact Assessment (LVIA) has been prepared by Green Bean Design Landscape Architects (GBDLA). The LVIA involved a comprehensive evaluation of the visual character of the landscape in which the wind farm would be located, and an assessment of the potential landscape and visual impacts that may result from the construction and operation of the wind farm, taking into account appropriate mitigation measures.

This Section presents a summary of the LVIA methodology as well as the key results and findings arising from the assessment. The detailed LVIA is included in Appendix 1.

9.1.1 Methodology

The LVIA was undertaken in accordance with the DGRs and, although not directly applicable to the assessment process, is cognisant with Glen Innes Severn Council's DCP for Wind Power Generation (May 2008) and the Inverell Shire Council's DCP for Wind Power Generation (April 2009).

The LVIA addresses key issues outlined in the Australian Wind Energy Association and Australian Council of National Trust's publication *Wind Farms and Landscape Values National Assessment Framework* (AusWEA, 2007), and encompasses the general assessment framework outlined in the National Assessment Framework. The LVIA has also considered a number of issues contained in the Commonwealth Environment Protection and Heritage Council's National Wind Farm Development Guidelines (EPHC, 2010).

As well as existing guidelines, the LVIA methodology has been applied to a number of similar Part 3A Major Project wind farms prepared by GBDLA, for assessment by the NSW Department of Planning (DoP).

The LVIA methodology included the following key activities and assessments:

- Describing the significant visual components of the wind farm infrastructure;
- Desktop study addressing visual character and identification of receptor locations surrounding the wind farm;
- Fieldwork and photography;
- Preparation of Zone of Visual Influence diagrams;
- Assessment and determination of landscape sensitivity;
- Assessment and determination of visual impact;
- Preparation of photomontages and illustrative figures;
- Describing the potential impact of night time lighting; and
- Determining the potential for cumulative visual impact of the wind farm against other approved and proposed wind farms in the area.

9.1.2 Assessment

Visual components of the wind farm

The key visual components of the wind farm that are likely to be visible from surrounding areas include, but are not limited to:

- wind turbines;
- wind monitoring masts;
- on site access tracks;

- crane hardstand areas;
- operations and maintenance facility including parking facilities;
- an on-site substation and switch yard;
- 33kV overhead powerlines; and
- 132kV powerline.

Temporary works associated with the construction of the wind farm that may be visible during construction and operational phases include a mobile concrete batching plant and rock crushing facilities.

The wind turbines would be the most visible element of the wind farm from the majority of surrounding view locations. The final selection for the turbine model will be made closer to construction, however, a turbine representative of the larger options was selected for the visual assessment. Although a maximum tip height of 150 meters has been sought for this project, the most likely larger turbine option reaches only 140 meters to the blade tip. The design parameters for the wind turbine used in this assessment are summarised in the following table.

Table 9-1 Wind Turbine Parameters (based on Vestas V112)

Element	Description
Tower height	84m
Rotor Diameter	112m
Overall height from ground level to tip of blade	140m
Proposed number of wind turbines	119

Community Perceptions and Public Consultation

Individual perception is an important issue to consider in any visual impact assessment, as the attitude or opinion of an individual receptor adds significant weight to the level of potential visual impact. These attitudes or opinions of individual receptors toward wind farms can be shaped and formed through a multitude of complex social and cultural values.

It should be noted that the LVIA simply assesses the area that is likely to be impacted and does not judge whether the impacts are positive or negative as that will depend on the individual. It is unlikely that wind farms will ever conform, or be acceptable to all points of view. Some people accept and support wind farm development in response to global or local environmental issues, whilst others support the environmental ideals of wind farm development as part of a broader renewable energy strategy, but do not consider them appropriate for their regional or local area. Some people believe that the wind farm development is unacceptable in any situation.

Whilst published research into the potential landscape and visual impacts of wind farms is limited in Australia, there are general corresponding results between the limited number that have been carried out when compared to those carried out overseas.

A recent survey conducted by AMR Interactive on behalf of the NSW Department of Environment, Climate Change and Water (DECCW, 2010a) polled 2022 residents across six Renewable Energy Precincts established by the NSW Government. The key findings of the survey indicated that:

- 97% of people across the Precincts had heard about wind farms or turbines, and 81% had seen a wind farm or turbine either in person or through the media;
- 85% of people supported the construction of wind farms in New South Wales, and 80% supported the construction of wind farms within their local region;

- 79% supported wind farms being built within 10km of residences and 60% of people surveyed supported the construction of wind turbines within 1 to 2km from their residences. This level of support for wind farms within 1 to 2km was 54% in the New England Precinct.

These results are reflected in other surveys including the community perception survey commissioned by Epuron for the Gullen Range Wind Farm Environmental Assessment in (REARK, 2007). The results of the survey, which targeted a number of local populations within the Southern Tablelands, suggested that around 89% of respondents were in favour of wind farms being developed in the Southern Tablelands, with around 71% of respondents accepting the development of a wind farm within one kilometre from their residential dwelling.

Whilst individual perception and local community attitudes toward wind farm development are an important issue, these need to be considered in terms of potential landscape and visual impacts from a broad community perspective.

Proximity to Urban Areas

Larger urban centres surrounding the wind farm include:

- Glen Innes – approximately 20km east of the wind farm
- Inverell – approximately 40km west of the wind farm

There are a number of smaller localities surrounding the wind farm which comprise rural dwellings and structures.

Existing Landscape

The landscape surrounding the wind farm is predominantly rural in character and occupied by medium sized landholdings as well as larger commercial pastoral operations. Areas of cultivated farmland and livestock pasture are interspersed with occasional rural homesteads surrounded by cultural planting and windbreaks.

Human modifications within the broader landscape are consistent with common adaptations to rural life and include roads (sealed and unsealed), drainage structures, agricultural buildings, electrical transmission infrastructure, and communication structures.

A series of hills are joined by ridgelines extending north to south across the wind farm site with areas of timber located on hillside slopes. The undulating topography within and surrounding the wind farm also creates a series of valleys from which views are largely contained and restricted.

Viewshed, Zone of Visual Influence and Visibility

A core component of the LVIA is defined by the description, assessment and determination of the viewshed, zone of visual influence and visibility associated with the wind farm. The relationship between viewshed, zone of visual influence and visibility is outlined in the following table. Extended descriptions are found in the full report in Appendix 1.

Table 9-2 Definitions used in Landscape and Visual Impact Analysis

Term	Definition	Relationship
Viewshed	An area of land surrounding (up to 20km) and beyond the wind farm area which may be potentially affected by the wind farm from a visual impact perspective.	Identifies the majority of the LVIA study area that incorporates receptors that may be subject to a degree of visual impact.
Zone of Visual Influence (ZVI)	A theoretical area of landscape from which the wind farm structures may be visible.	Determines areas within a viewshed from which some or all wind turbines may be visible.
Landscape Character	Defined as 'the distinct and recognisable pattern of elements that occur consistently in a particular type of landscape' (SNH, 2009).	Determines the ability of the landscape to accommodate change.
Landscape Sensitivity	The British Landscape Institute describes Landscape Sensitivity as 'the degree to which a particular LCA can accommodate change arising from a particular development, without detrimental effects on its character'.	Quantifies the level of impact that a development would have on the landscape.
Visibility	A relative determination at which a wind turbine or group of turbines can be clearly discerned and described.	Describes the likely number and relative scale of wind turbines visible from a receptor location.

The Visibility within the Zone of Visual Influence is outlined in the following table. This Visibility definition is not site specific and can be applied consistently to any wind farm based on the size and distance of turbines to the viewer. Note, in all cases visibility is Nil where influenced or screened by surrounding topography and vegetation.

Table 9-3 Visibility based on distance from wind turbines

Distance from turbines	Visibility
<1 km	Wind turbines would dominate the landscape in which they are situated due to large scale, movement and proximity. Dominant and significant within viewshed potentially resulting in High level visibility.
1 – 5 km	Wind turbines would generally dominate the landscape in which the wind turbine is situated. Potential for high visibility depending on the category of receptor, their location, sensitivity and subject to other visibility factors. Potentially dominant within viewshed resulting in Moderate to High level visibility.
5 – 10 km	Wind turbines clearly visible in the landscape but tending to become less dominant with increasing distance. Movement of blades discernable. Noticeable but less dominant potentially resulting in Moderate level visibility.
10 – 15 km	Wind turbines visible but tending to become less distinct depending on the overall extent of view available from the potential receptor location. Movement of blades

Distance from turbines	Visibility
	may be discernable where visible against the skyline. Potentially noticeable resulting in Low to Moderate level visibility.
15 - 20 km	Wind turbines become less distinct. Some blade movement visible but less discernable with increasing distance. Partially discernable but generally indistinct within viewshed resulting in Low level visibility.
>20km	Wind turbines become indistinct with increasing distance. Some blade movement visible but are usually not discernable. Turbines may be discernable but generally indistinct within viewshed resulting in Low level visibility.

Landscape Character Areas and Landscape Sensitivity

Landscape character is defined as 'the distinct and recognisable pattern of elements that occur consistently in a particular type of landscape' (SNH, 2009).

The LVIA identified five Landscape Character Areas (LCAs), which generally occur within the viewshed of the project and include:

- LCA 1 – Gently undulating to flat cultivated/pastoral farmland;
- LCA 2 – Steep sided valleys;
- LCA 3 – Drainage lines;
- LCA 4 – Forested hills and ridgelines; and
- LCA 5 – Rural dwellings.

The British Landscape Institute describes Landscape Sensitivity as 'the degree to which a particular LCA can accommodate change arising from a particular development, without detrimental effects on its character'.

In terms of overall landscape sensitivity, the LVIA determined that in aggregate each of the five LCAs within the 10km wind farm viewshed had a Medium sensitivity to accommodate change, and represented a landscape that is reasonably typical of other landscape types found in surrounding areas of the New England Tablelands.

With a Medium sensitivity to accommodate change, some characteristics of the landscape are likely to be altered by the wind farm development; however, the landscape is likely to have some capability to accommodate change. This capability is largely derived from the presence of predominantly large scale features within the landscape character areas and portions of the wind farm area, together with the relatively low density and dispersed nature of human settlement patterns and potential receptors located within the wind farm viewshed.

Table 9-4 Landscape Character Areas and Landscape Sensitivity

Landscape Character Area	Description	Landscape Sensitivity
LCA 1	Gently undulating to flat cultivated/pastoral farmland	Medium
LCA 2	Steep sided valleys	High
LCA 3	Drainage lines	Medium
LCA 4	Forested hills and ridgelines	Medium
LCA 5	Rural dwellings	Medium

Typical view across undulating to flat cultivated land (LCA 1)

Typical view across steep sided valleys (LCA 2)

Typical view across drainage lines (LCA 3)

Typical views across forested hills and ridgelines (LCA 4)

Typical views across rural dwellings (LCA 5)

Figure 9-1 Example of Landscape Character Areas

Zone of Visual Influence Diagrams (ZVI)

The ZVI diagrams are used to identify theoretical areas of the landscape from which a defined number of wind turbines, or portions of turbines, may be visible within the viewshed. They are useful for providing an overview as to the extent to which the White Rock Wind Farm may be visible from surrounding areas.

Three ZVI diagrams have been prepared to demonstrate the extent to which the wind turbines would be visible at a distance up to 15km from the site. Three different ZVI diagrams have been prepared to show the zone of visual influence from:

- the entire turbine structure (i.e. ground to tip of blade);
- half the swept path of rotor (i.e. hub height to tip of blade); and
- any part of the wind turbines (i.e. tip of blade).

The ZVI diagrams are illustrated in Figure 9-2 to Figure 9-4, which show from each location the number of turbines visible in each category.

The ZVI methodology is conservative as the screening effects of any structures and vegetation above ground level are not considered in any way. Therefore the wind farm may not be visible at many of the locations indicated on the ZVI diagrams due to the presence of trees or other screening elements. A summary of the ZVI analysis in included in Appendix 1.

The level of wind turbine visibility within the viewshed can result from a number of factors including the distance between a receptor and the wind farm, static or dynamic receptor locations (e.g. residents or motorists) or the relative position of the receptor to the wind turbines. Whilst the distance between a receptor and the wind turbines is a primary factor to consider when determining potential visibility, there are other issues, for example the level of tree cover, which may also affect the degree of visibility.

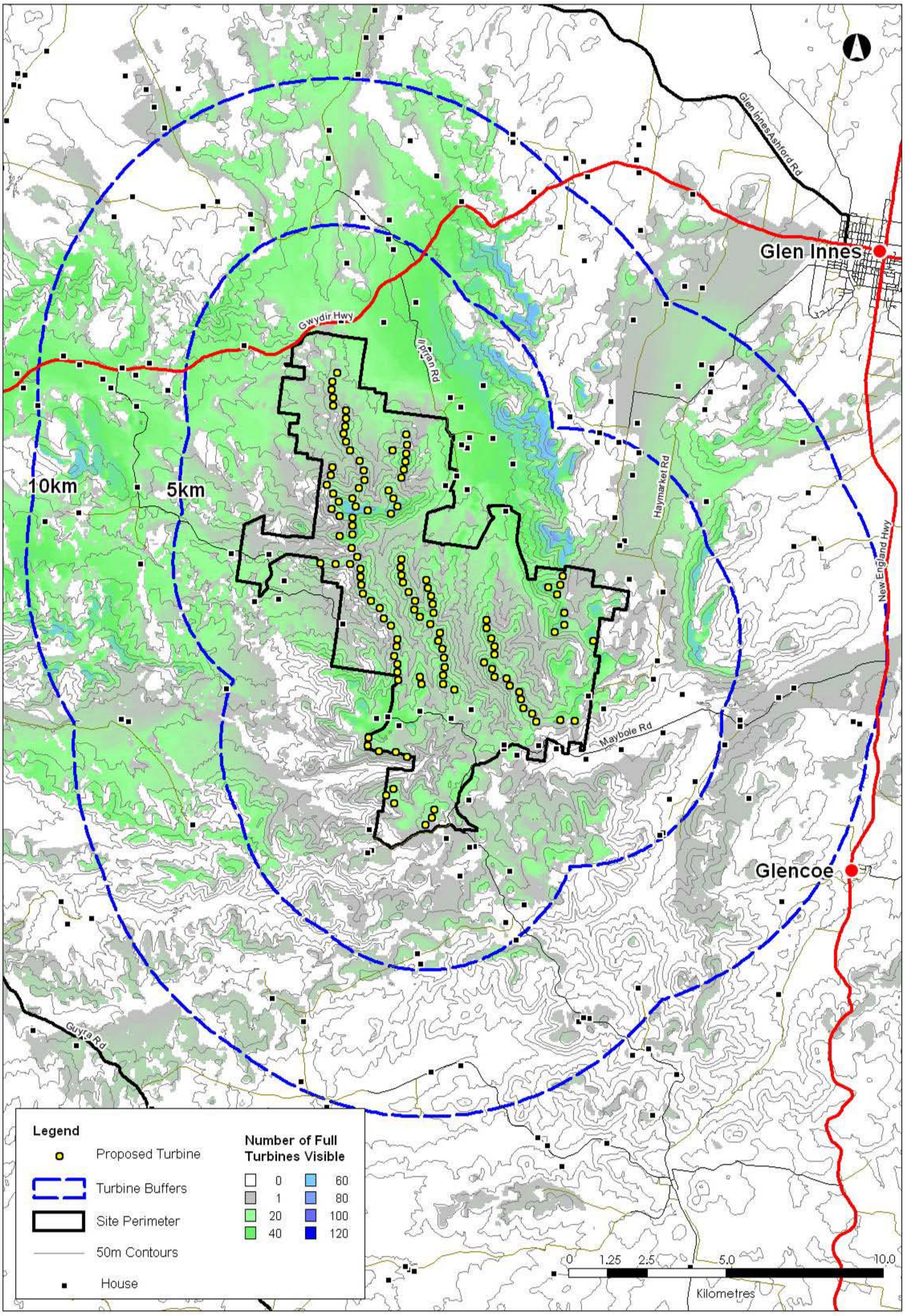


Figure 9-2 Zone of Visual Influence (entire turbines visible)

EPURON

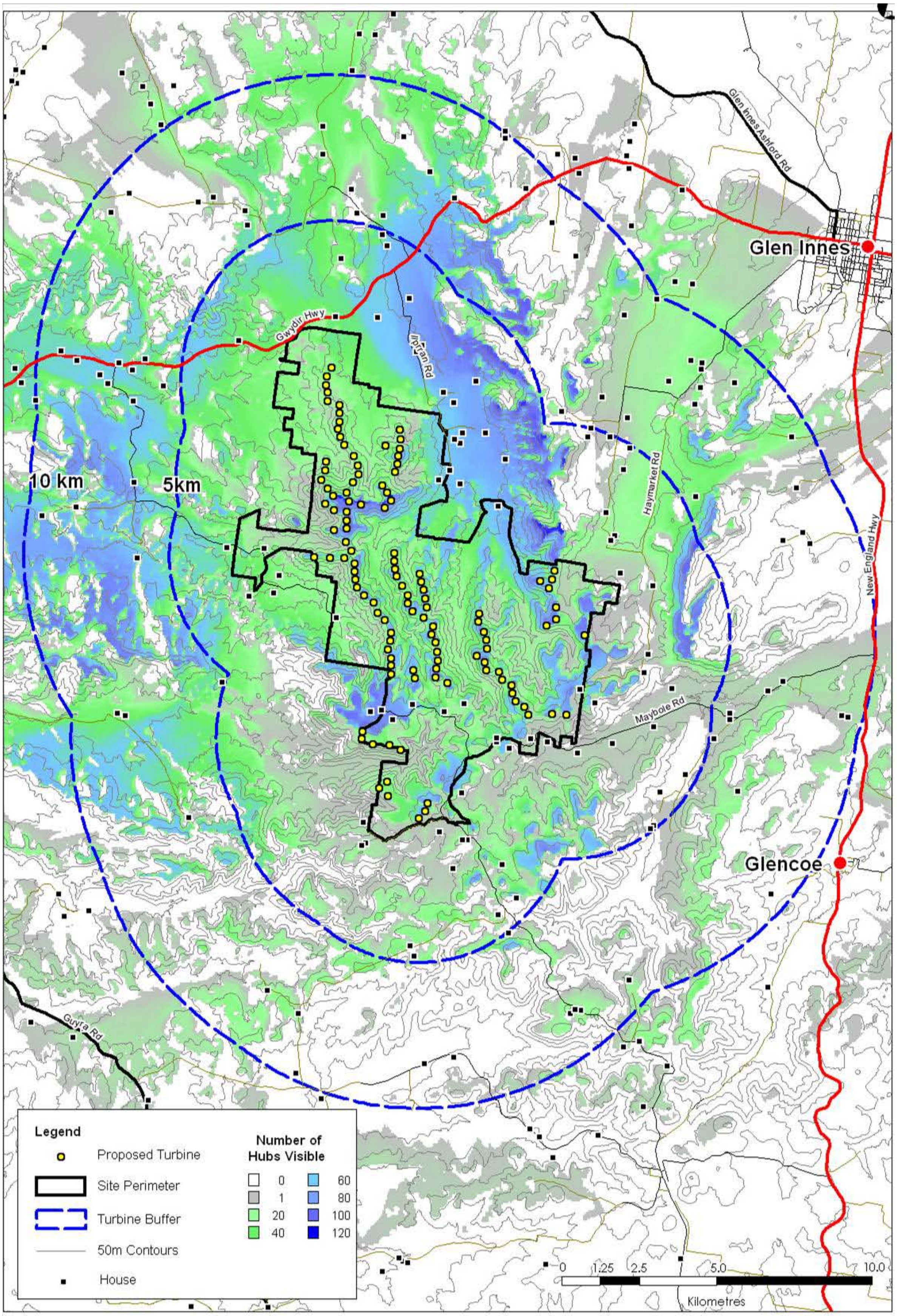


Figure 9-3 Zone of Visual Influence (turbine hubs visible)

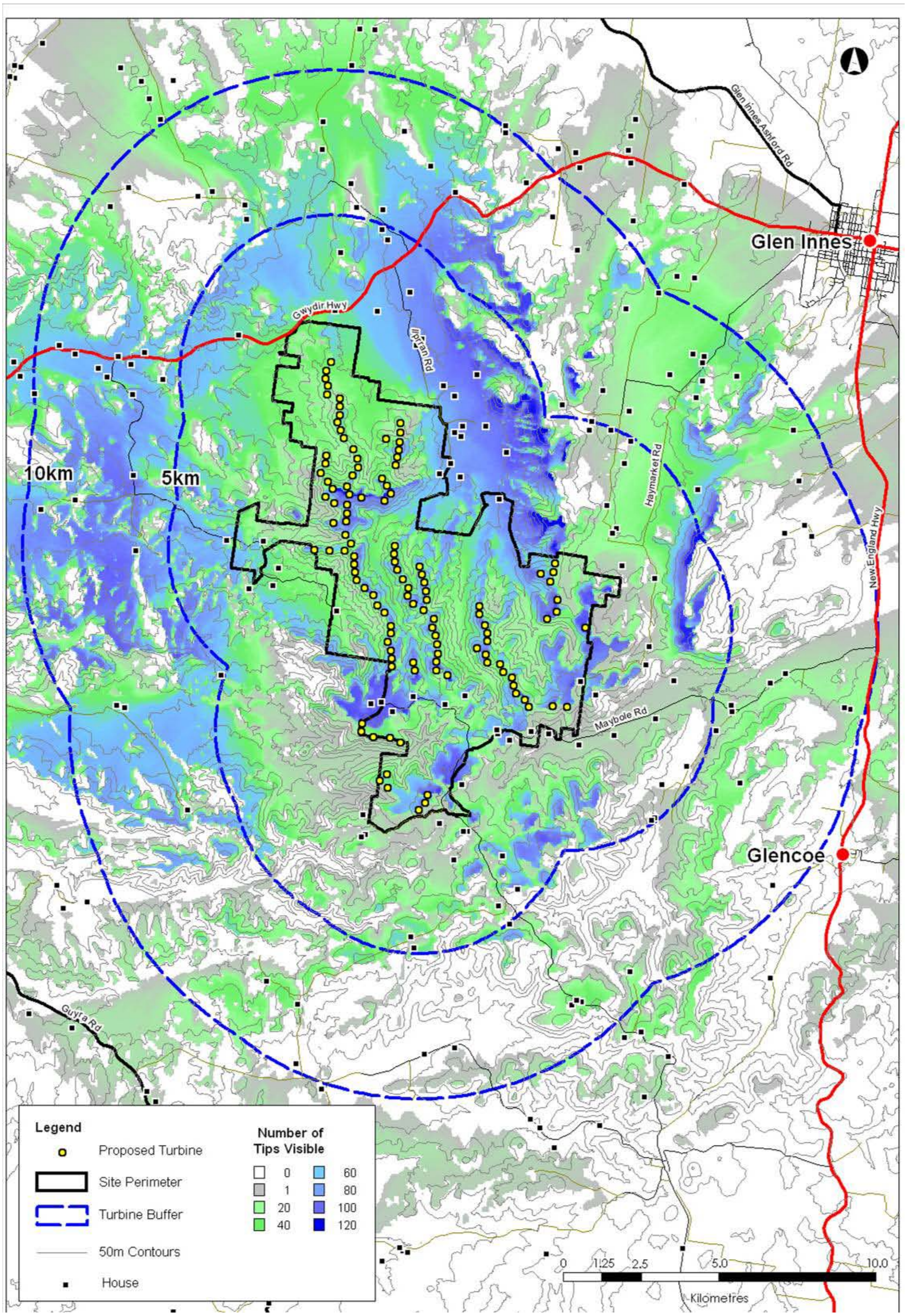


Figure 9-4 Zone of Visual Influence (turbine tips visible)