

# EPURON

## Telecommunications Impact Assessment

*Rye Park Wind Farm 2016*



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## Executive summary

The objective of this report is to investigate the potential impacts of the Rye Park wind farm on existing telecommunication services in the vicinity of the proposal and to propose appropriate mitigation strategies for any impacts identified. An assessment of possible electric and magnetic fields associated with wind farms and their implications on human health is also presented.

Telecommunication services, including television and radio broadcasts, mobile phone services and point to point microwave radio communication services occur in proximity to population centres and often utilise the same ridgelines that provide optimum locations for wind turbines. Theoretically, as with any large structure, wind turbines have the potential to cause interference with such signals.

In general, VHF frequency band radio signals and digital voice based technologies such as GSM mobile are essentially unaffected by wind turbines. This includes land mobile repeaters, radio, the audio component of analogue television and mobile phones.<sup>1</sup>

For broadcast signals which are usually omni-directional (point to area), interference can generally be avoided by locating wind turbines a certain distance from the broadcast tower. A clearance of at least 500 m is recommended, although a distance of 1 km is preferred.<sup>2</sup>

No broadcast or communications towers have been identified within 500 m of the Rye Park wind farm project. Therefore the development of the proposed wind project is not expected to have any widespread adverse backscatter affect from being near to broadcast or communications towers.

Aviation navigation services such as radar may also potentially be affected by wind turbines depending on the location of the wind farm with respect to the position of radar installations and airports. This issue is likely to be overcome in the future, as aviation authorities across the world increasingly move towards the use of multilateration (MLAT) technology. At the time of writing, no objection to the proposal has been raised by Airservices Australia.

Following a review of the communication services near the wind farm site, the nature of potential interference and consultation with license holders and service providers, it is considered that the proposed wind farm would have minimal impact on existing telecommunications and aviation navigation services. Where applicable, mitigation strategies are proposed to ensure any identified impacts can be managed appropriately.

The electromagnetic fields associated with generation and export of electricity from a wind farm does not pose a significant threat to public health.

Consequently, no adverse electromagnetic interference issues are anticipated from the wind farm.

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1 <http://www.dungog.nsw.gov.au/files/2142/File/GreenpowerEMIAnalysisIssue.pdf>

2 Ibid

## 1 Existing Environment

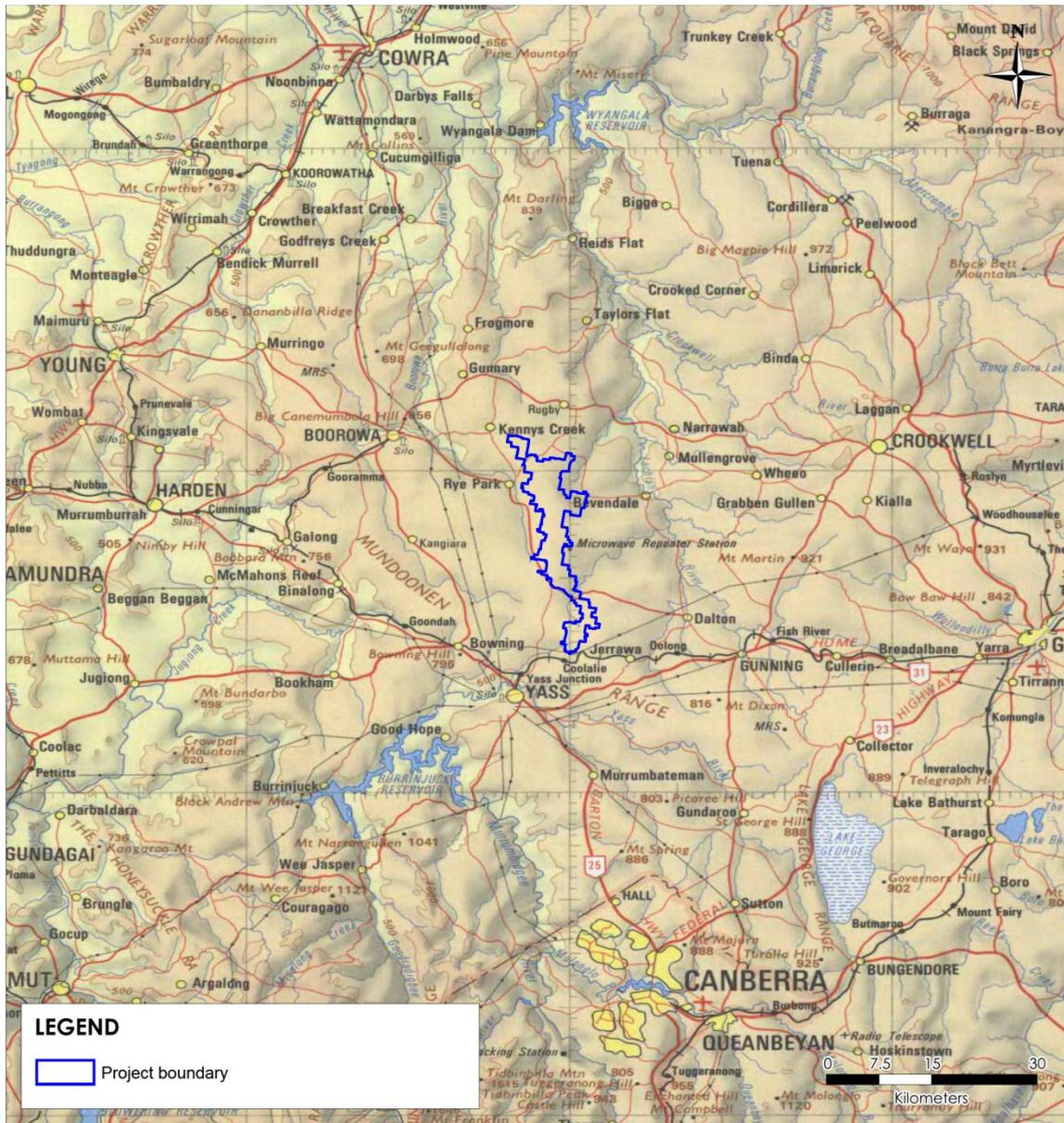


Figure 1-1 – Rye Park Wind Farm Site Locality

The proposed Rye Park Wind Farm is located to the north of Yass and east of Boorowa, New South Wales, on the edge of the Southern Tablelands and the South West Slopes in the vicinity of the township of Rye Park as shown in Figure 2-1. It is approximately 250km south west of Sydney and is located on freehold and leasehold land within and adjacent to agricultural areas, predominantly used for grazing sheep and cattle. A review of the telecommunication technologies in use in the vicinity of the proposed Rye Park wind farm identified the following:

- ▶ TV and radio broadcasting,
- ▶ Mobile phone services provided by telecommunication companies,

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- ▶ Radio communication systems, including point to point microwave links, licensed by the Australian Communications and Media Authority (ACMA),
- ▶ Other radio links including mobile radio, CB radio; and
- ▶ Aircraft navigation systems.

The Australian Communications and Media Authority (ACMA) issue apparatus licences under the Radio communications Act 1992. The ACMA is the federal government authority responsible for regulation and management of the radio communications spectrum. It was formed in July 2005 by the merging of Australian Broadcasting Authority (ABA) and the Australian Communications Authority (ACA).

The ACMA authorises licensees to operate radio communications devices such as transmitters and receivers. In effect, they are licences to use specific segments of the radiofrequency spectrum for particular purposes. A system of apparatus licence types are used to apply common licence conditions and fee structures to categories of radio communications service.

Electromagnetic interference (EMI) has the potential to cause a reduction in the coverage of digital television, mobile phone, radio and aircraft navigation communications in certain instances. There are three principal mechanisms by which wind turbines may cause EMI: reflection, diffraction and near field effects.<sup>3</sup>

### *Reflection & scattering*

When a signal sent between a transmitter and receiver becomes obstructed by an object located within the path of a signal, reflection and/or scattering may occur. If the rotating blade of a wind turbine receives a primary transmitted signal, a scattered time delayed (or out of phase) signal may be produced and transmitted to the receiver. The out of phase signal will be distorted in relation to the primary signal, causing EMI.<sup>4</sup>

### *Diffraction*

In some instances when an object is located in the path of a signal wave front, the object can both reflect and absorb the signal. This phenomenon is commonly referred to as diffraction.<sup>5</sup>

### *Near field effects*

Wind turbines may cause interference to radio signals due to the electromagnetic fields emitted by the generator and the switching components within the turbine nacelle. This is referred to as a near field effect.<sup>5</sup> Due to advances in technology and compliance with the Electromagnetic Emission Standard, EN 61000-6-4 (AS/NZ 4251.2:1999) Emission standard for industrial environments, modern wind turbines will not cause active EMI due to near field effects.

The level of EMI produced by a wind turbine due to reflection or scattering, diffraction and near field effects is dependent on a number of factors, including placement of the wind turbine in relation to the signal path/s; the signal frequency; the characteristics & composition of the wind turbines rotor blades; the receiver characteristics; and the propagation characteristics of the radio wave in the local atmospheric conditions.<sup>5</sup>

While the site proposed for the development of the wind farm is a rural area, a number of communications links and broadcast networks are present in the surrounding region.

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3 D. F. Bacon, A Proposed Method for Establishing an Exclusion Zone around a Terrestrial Fixed Link outside of which a Wind Turbine will cause Negligible Degradation of the Radio Link, Radiocommunications Agency UK Report Ver 1.1, 28 Oct 2002

4 URS Woodlawn Wind Farm Environmental Impact Statement 2004

5 Ibid.

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As with any large structure, there may be circumstances where wind turbines can cause disruption to the electromagnetic signals used in a variety of commonly used radar, navigation and telecommunications services.

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

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

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

- ▶ Identify radio license holders within a 25 km radius of the proposed wind farm site, and point to point microwave radio links in the vicinity of the site, using information sourced from the ACMA RADCOM database;
- ▶ Provide notification of the wind farm proposal and seek comments from each license holder identified via the ACMA RADCOM database within a 25 km radius of the site;
- ▶ Record and review all responses received to identify any issues raised by license holders;
- ▶ Discuss any issues raised with relevant license holder with the aim to resolve or identify mitigation options;
- ▶ Carry out an assessment of the “Fresnel zone” associated with each fixed point to point microwave communications link crossing the site;
- ▶ Determine appropriate exclusion zones for proposed turbine layout based on Fresnel zone calculations and advice from relevant license holders;
- ▶ Confirm that all turbines (including blades) are located outside the calculated exclusion zone;
- ▶ Determine appropriate additional mitigation measures which may be required.

The possible impact of the proposed wind farm on the most common communications services has been investigated separately in the following sections. These services are television and radio broadcast services, mobile phone services and microwave radio point to point communication services. Various measures are available to help mitigate potential impacts and are discussed below.

## 2 Television and radio broadcast services

### 3.1 Existing services and facilities

The ACMA RADCOM database lists the following broadcasters for television and radio, under postcode 2586, Rye Park, NSW.

#### Television broadcasting

- ▶ Southern New South Wales TV1: ABC, CBN, CTC, WIN and SBS

#### Radio broadcasting

- ▶ Young RA1: 2ABCCRN, 2LF, 2LFF, 2RVR

The closest transmitter of television programs is at Gunning, located about 40 kilometres south east of Rye Park.

Satellite based television or internet services are also received at various locations throughout the area. These services may either be used where local services are not able to be received or may be accessed as additional program content to complement local services. They are not subject to the same topographic screening that can affect the land based TV transmissions. Due to the distance of residences from the wind farm it is very unlikely that satellite based services would be subject to interference due to the wind farm's operation.<sup>7</sup>

### 3.1 Interference and impact analysis

#### *Television broadcasting*

The potential for wind turbines to interfere with analogue TV signals were considered in depth in the initial stages of development, with these factors present in previous communication reports. Since 2014 Australia is "now broadcasting in digital-TV only"<sup>8</sup> and hence these impacts are no longer relevant.

Digital TV is not impacted by ghosting effects, and is largely unaffected in high signal areas. The creation of EMI due to wind turbines may result in the reduction of signal strength at the edge of the digital TV range, where signal strength is already weak.

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7

ibid

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[www.digitalready.gov.au](http://www.digitalready.gov.au)

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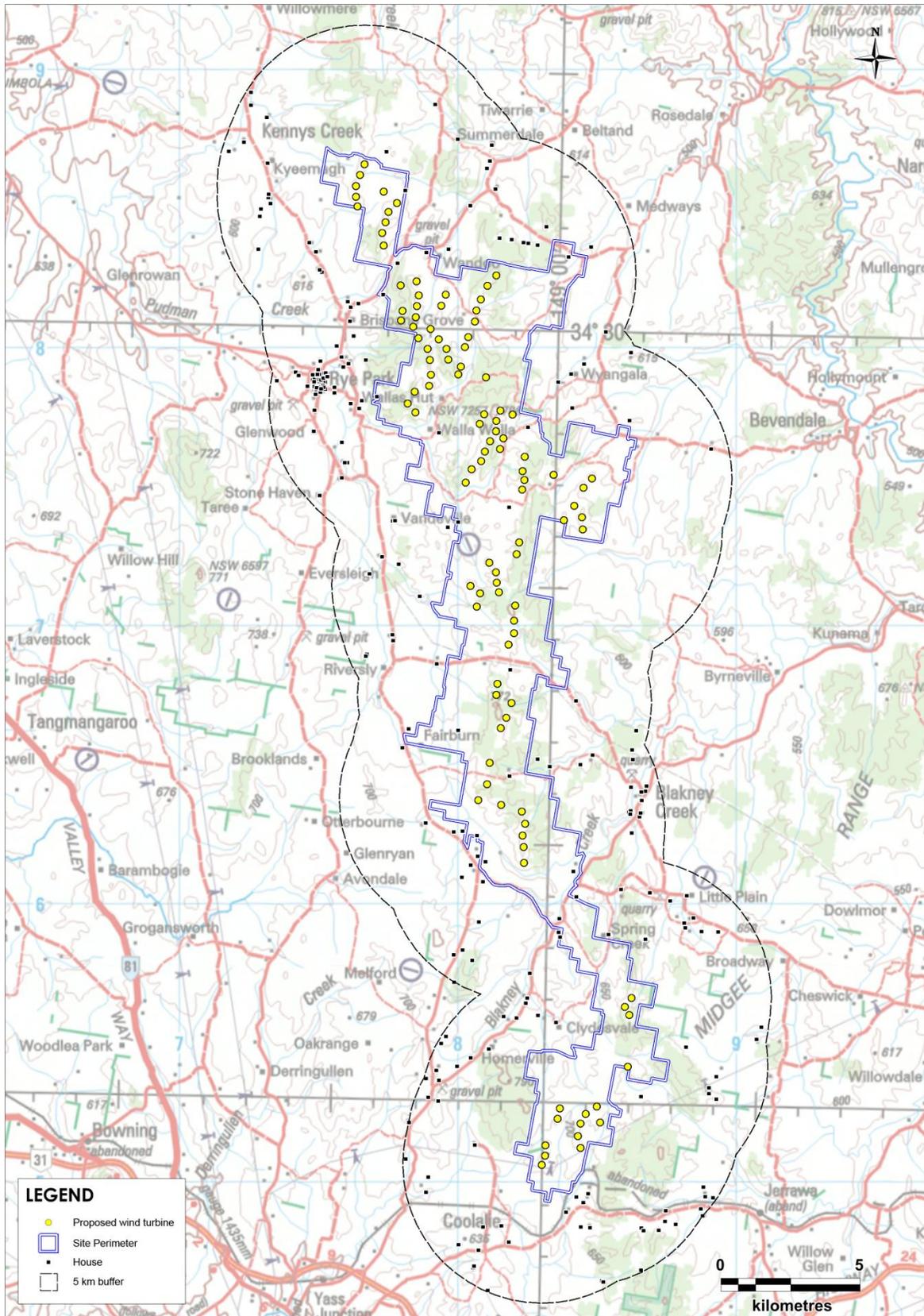


Figure 2-1 – Houses within 5 km of the Rye Park Wind Farm

## *Radio broadcasting*

The level of radio broadcast interference experienced can be influenced by a variety of variables including:

- ▶ Abnormal weather conditions;
- ▶ Multi-path distortion (reception of a signal directly from a transmitter and also a reflected signal from hills, structures etc.);
- ▶ Overloading (occurs when an FM receiver receives too strong a signal);
- ▶ Electrical interference from household appliances etc;

Overseas and recent local experience indicates that radio reception and the audio component of television reception are unlikely to be affected by operating wind farms. In regard to the Blayney Wind Farm that was commissioned in 2000, testing of radio reception for Council and RFS signals in the area around the operational wind farm showed that radio reception was not affected at the locations tested. The locations tested included situations where the radio signal transmission path passed through the operating wind farm.<sup>9</sup>

## *Satellite provided services*

Some homes in the area may have satellite pay TV or internet service antenna installations.

Unless a particular subscriber's antenna reception direction and elevation is aligned with a turbine, no impacts on satellite provided services are likely.<sup>10</sup>

## 3.2 Mitigation measures

In the design of the project, the proponent will carry out the following mitigation measures to help minimise EMI:

- ▶ Use of primarily non-metallic turbine blades;
- ▶ Use wherever practical of equipment complying with the Electromagnetic Emission Standard, AS/NZS 4251.2:1999;

Once the wind farm is operational, the proponent will offer to undertake a monitoring program of houses within 5 km of the wind farm to determine any loss in television signal strength, if requested by the affected resident. In the event that television interference is experienced by existing receivers in the vicinity of the wind farm, the source and nature of the interference will be investigated by the proponent.

Should investigations determine that the cause of the interference is genuinely attributable to the presence of the Rye Park wind farm; the proponent will put in place mitigation measures at each of the affected receivers in consultation and agreement with the residents.

In the event that interference specifically attributable to the wind farm cannot be overcome by other means, negotiating an arrangement for the installation and maintenance of a satellite receiving antenna with the affected landowner may be considered.

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9 Connell Wagner Glen Innes Wind Farm Environmental Assessment – Telecommunications interference October 2008

10 Lawrence Derrick & Associates Bannister Wind Farm – Investigation of possible impacts on broadcasting and Radio communication Services September 2003

### 3.3 Existing services and facilities

This section covers GSM services. High frequency point to point communications links used for mobile transmission networks are discussed in Section 5.3. Figures below show the existing local mobile phone coverage from the three providers at the time of writing.<sup>11</sup>

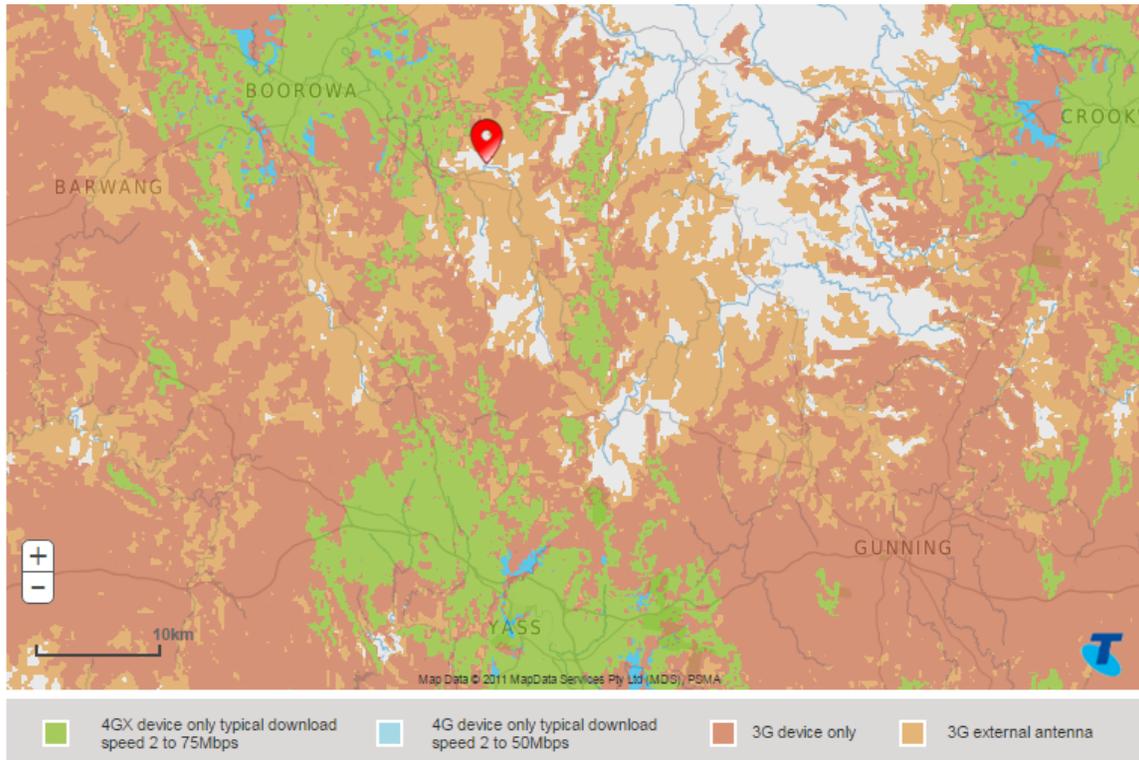


Figure 2-2 – Telstra 3G Network Coverage

<sup>11</sup> Source: company websites

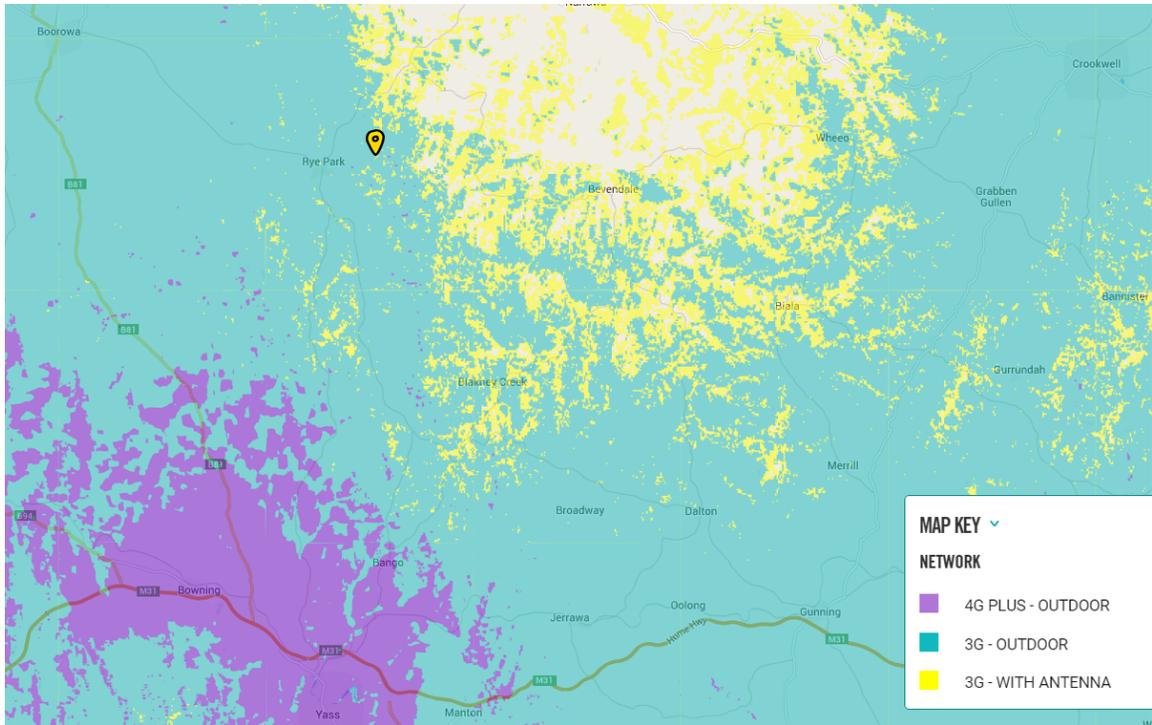


Figure 2-3 – Optus 3G Network Coverage

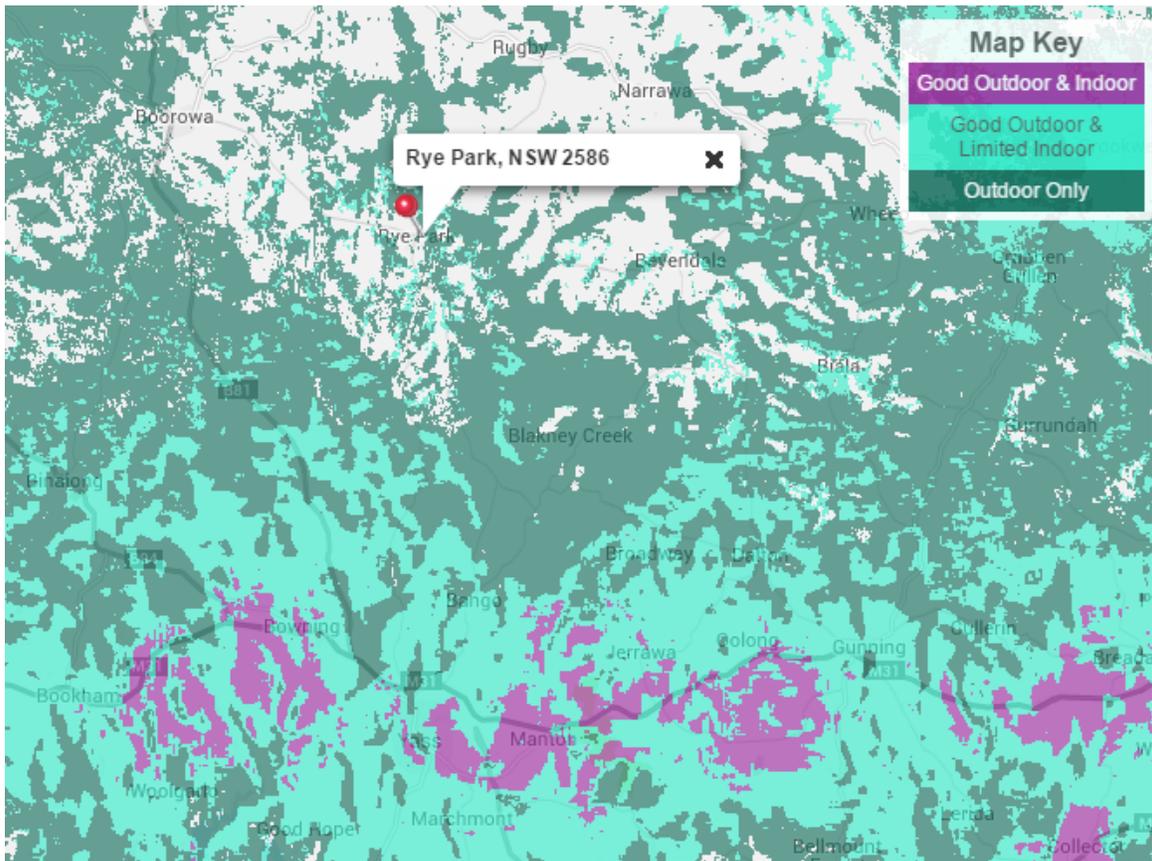


Figure 2-4 – Vodafone 3G Network Coverage

## 3.4 Interference and impact analysis

A mobile phone network consists of a system of adjoining zones called 'cells', which vary in size with a radius of 2 - 10 km. Each cell has its own base station that sends and receives radio signals throughout its specified zone. Mobile phone antennas need to be mounted clear of surrounding obstructions such as buildings to reduce 'dead spots' and allow the base station to effectively cover its intended cells.<sup>12</sup>

Mobile phone coverage is available in some of the area around Rye Park but it is worse further away from Rye Park and the main highways and where topography limits coverage, especially to the north east.

Advice obtained from mobile phone service providers indicates that mobile phone services in these rural areas are mainly focussed on the main transport routes such as the Hume Highway. In view of the separation distance between the base antennas and turbine structures and the wind farm location relative to areas of existing coverage, transmission of mobile phone signals is unlikely to be affected by the operating wind farm.<sup>13</sup>

The ACMA RADCOM database identified three mobile phone companies as using base stations within the vicinity of the proposed wind farm. Telstra, Optus and Vodafone were contacted by Epuron regarding potential impacts and asked to provide feedback as to any potential conflicts with their existing networks. No objections were received.

## 3.5 Mitigation measures

No additional mitigation measures are required.

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<sup>12</sup> URS Crookwell II Wind Farm Environmental Impact Statement ,

<sup>13</sup> ibid

## 4 Radio communication services

### 5.1 Existing services and facilities

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

The register allows the ACMA to create a ‘density’ classification of areas across Australia as high, medium or low depending on the number of licenses in operation in a particular area. According to the ACMA RADCOM database, the area in the vicinity of the proposed wind farm is classified as a “Low Density Area”.

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

Each license holder has been contacted and asked to provide independent comment on the wind farm development with respect to possible impacts to communication links. The Proponent will work with organisations to resolve issues, should any be identified.

*Table 1 - Radio communication license holders within 25km of the Rye Park wind farm site*

ACMA Licence Holder	ACMA Site ID No.
2KY Broadcasters Pty Ltd	151009
Airservices Australia	9530, 49366
Ambulance Service of NSW	9530, 9547, 204072
Australian Rail Track Corporation Limited	40012, 202399
Boorowa Council	9547
Concrete Pty Ltd	36172
Department of Finance and Services	55602, 9006930, 9013320
Dianne Maree Nacson	9504, 9530, 55601, 100903, 137000
Essential Energy	9530, 9547, 36146, 36149, 404038, 9000026
Fire and Rescue NSW	9529, 9547, 34798, 100903
NBN CO Limited	9022577
NSW Gov Telecommunications Authority	9016721, 55602, 525851
NSW Police Force	9547, 55601, 55602
NSW Rural Fire Service	9547, 34887, 34888, 201543, 9013320
Optus Mobile Pty Limited	9525, 9546, 55601, 55602, 202115, 370254
Paul Schofield	141197

ACMA Licence Holder	ACMA Site ID No.
Robinvale District Health Services	304511
Soul Pattinson Telecommunications Pty Limited	55602, 100785, 204072
Stephen Cusack	138528
Telstra Corporation Limited	9531, 9546, 9547, 39130, 55601, 100722, 100785, 130627, 132565, 370254
Transgrid	204072, 9006930
Vodafone Australia Pty Limited	9529, 55602, 370254, 9013911
Vodafone Hutchison Australia Pty Limited	9529, 370254
Wendy Blackmore	199282
Yass Community Radio Association Inc.	9529, 39129, 151009
Yass Valley Council	9529

## 5.2 Interference and impact analysis

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

The potential impact zone will vary with the distance between the transmitter and receiver, frequency of transmission and the location of any particular point along its path. Communications are only likely to be affected if a wind farm is in the line of sight between two sending and receiving antennae or within a zone of the line of sight of these antennae.

Where a potential exists for interference to line of sight links, an obstruction analysis can be undertaken to ensure that no part of a wind turbine assembly will enter the Fresnel Zone of the microwave link. The maximum extent of the Fresnel zone occurs at the midpoint along the path of the microwave link.

## 5.3 Radio communication links

Epuron has identified and mapped all point to point radio communication links existing in the vicinity of the proposed Rye Park Wind Farm site. Table 2 lists the seven radio communication links that travel within the site perimeter, and Figure 5-1 shows an aerial overview of the location of these fixed microwave links.

<sup>14</sup>

*Table 2 – Point to point radio communication links that cross the Rye Park Wind Farm site perimeter*

LINK ID	CLIENT NO	LICENSEE	LICENSE NO	FREQUENCY
108559	115634	Office of Environment and Heritage	1103280	404250000
108559	115634	Office of Environment and Heritage	1103280	413700000
92691	46975	Department of Defence	493596	30700000

<sup>14</sup> Based on data contained in the ACMA RADCOM database, June 2012

411873	115634	Office of Environment and Heritage	1923870	856550000
411878	115634	Office of Environment and Heritage	1923870	932550000
160378	5832	NSW Rural Fire Service	1208625	404350000
160378	5832	NSW Rural Fire Service	1208625	413800000

*Figure 4-1 – Point to point radio communication links in the vicinity of the Rye Park Wind Farm*

In order to ensure that obstruction to the signal transmission path does not occur; calculations of the 2nd Fresnel zone of the point to point communications links crossing the site were undertaken.

It is suggested that beyond the 2nd Fresnel zone, the power of a scattered signal from a structure such as a wind turbine would be small enough such that it would not result in significant interference at the receiver.<sup>15</sup>

Completion of this Fresnel analysis showed that a number of turbines were to be located within the 2nd Fresnel zone or close to the direct line of sight path of the point to point link crossing the site, and therefore these turbines were moved outside of these areas. This mitigated all impacts to six out of the seven radio communication links within the site perimeter. Figure 5-2 below shows the revised turbine layout and Figure 5-3 and Figure 5-4 show details of the movement of turbines outside of the Fresnel zone.

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15 D. F. Bacon, A Proposed Method for Establishing an Exclusion Zone around a Terrestrial Fixed Link outside of which a Wind Turbine will cause Negligible Degradation of the Radio Link, Radiocommunications Agency UK Report Ver 1.1, 28 Oct 2002

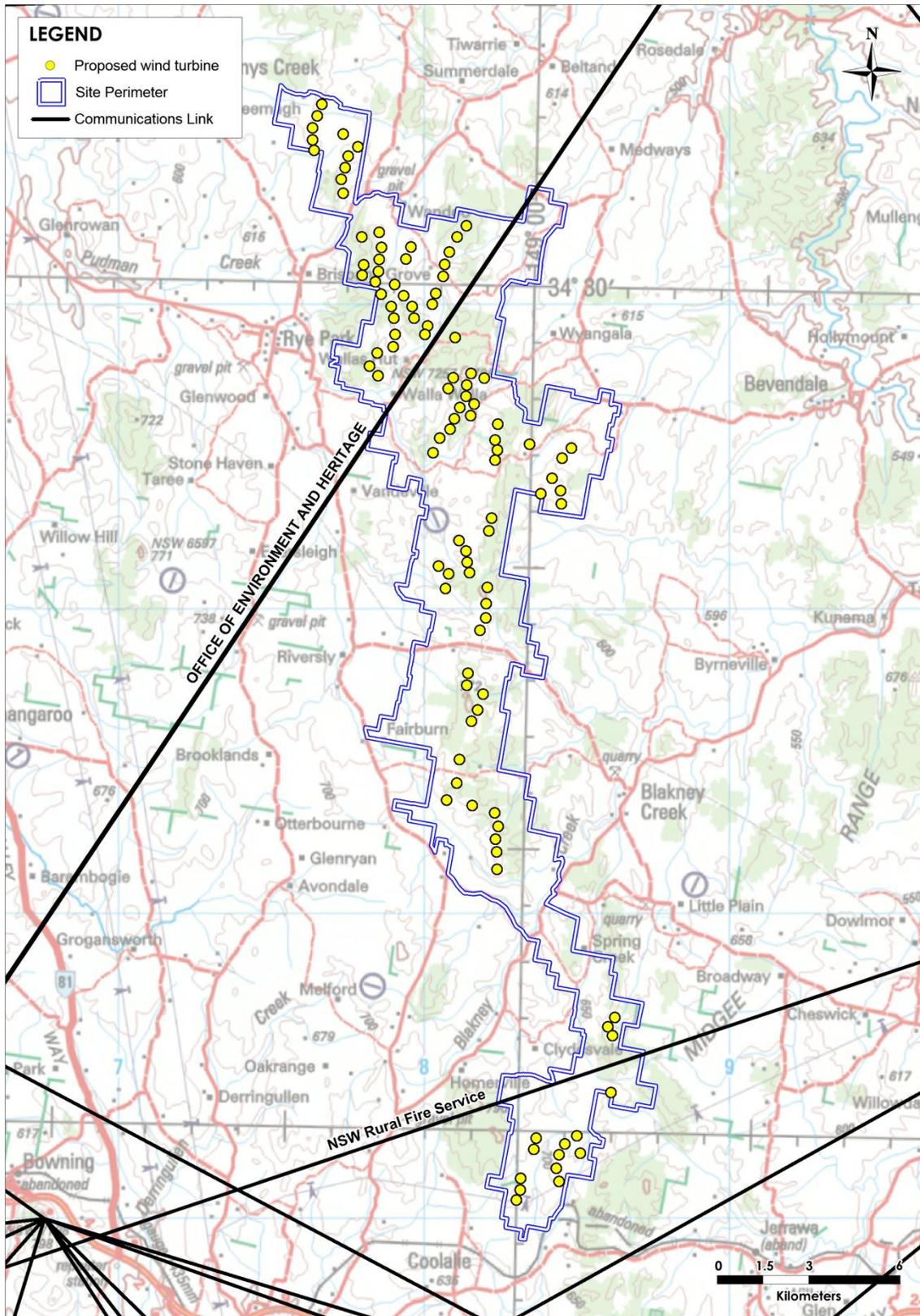


Figure 4-2 Point to point radio communication links in the vicinity of the Rye Park Wind Farm (Revised turbine layout)



Figure 4-3 – Zoomed-in aerial showing radio-communications link from left to right and turbine locations within this Fresnel zone in blue.



Figure 4-4 – Zoomed-in aerial showing moved locations of turbines in yellow, now outside of the Fresnel zone.

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The seventh radio communication link on site is a VHF link registered to the Department of Defence. Research of recent literature suggests that interference to VHF links (i.e. in the 30MHz - 300MHz frequency range) by wind turbines is not likely. The Department of Defence link crossing the site operates with a frequency of 30.7MHz and so falls within this range.

*Auswind best practice guidelines states: "The communications systems most likely to be affected (by wind turbines) are those which operate at super high frequencies (particularly microwave systems operating at frequencies above 300MHz)"*

*Garrad Hassan's "Assessment of Electromagnetic Issues for the proposed Berrybank Wind Farm", insists that only frequencies greater than UHF range (300MHz - 3GHz) may potentially experience interference from wind turbines.<sup>16</sup>*

The same view was also taken by Energreen Wind Pty Ltd in their Black Springs Wind Farm EMI assessment dated 26-7-2006:

*"UHF and VHF voice services have been found not to be affected by wind turbines unless the turbines are in the immediate vicinity of an antenna such that "near field" issues occur. The Blayney wind farm, south west of Sydney, NSW lies directly in the path of a VHF link and there has reportedly been no discernable interference as a result of the development."<sup>17</sup>*

The Department of Defence was contacted in regards to this communications link and the Rye Park Wind Farm and the correspondence is listed below and in full in Section 11.

*"Defence has assessed the proposal for any impacts to operations in the area. This includes safety of low flying military aircraft, as well as affects to Defence communications, and surveillance radars. Defence advises that the Rye Park wind farm **would not** adversely affect military aircraft operations or interfere with Defence communications and radar."*

Therefore, based on:

- ▶ The results of the above literature research,
- ▶ Relocation of turbine layout to avoid 2<sup>nd</sup> order Fresnel zones of UHF links,
- ▶ The frequency of the Department of Defence link being in the low VHF range (30MHz - 300MHz) and
- ▶ The fact that the wind farm is not in the vicinity of an antenna,

Interference to the existing point to point communication links from the Rye Park wind farm is not expected.

Epuron previously contacted all organisations identified as operating radio communication licences (including fixed link communications) within 25km of the Cullerin Range wind farm proposal, which is now operational and without communications issues in the area.

Each license holder was asked to provide independent comment on the wind farm development with respect to possible impacts to communication links. At that time, no organisation within the 25km radius raised concerns.

Optus, Vodafone and Telstra provided general guidelines to assist in the planning of wind farm.

In response to these enquiries, the following comments were noted,

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16 [http://www.unionfenosa.com.au/BB\\_Application\\_Report/BB\\_Appendix\\_9\\_Telecommunications\\_Assessment.pdf](http://www.unionfenosa.com.au/BB_Application_Report/BB_Appendix_9_Telecommunications_Assessment.pdf) (page 3/23)

17 <http://majorprojects.planning.nsw.gov.au/files/1887/Appendix%20G%20Electromagnetic%20interference%20study.pdf>

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*"Provided wind turbines are located well outside the 2nd Fresnel zone of the point to point microwave links, no interference to communications is expected" (pers. comm. Mr. Trong Ho, Optus Mobile)<sup>18</sup>*

*"Clearance criteria is the same for all carriers. Please use the same criteria as proposed by Optus" (pers. comm. Mr. Ganesh Ganeswaran, Senior Engineer / Transmission, AAP Communications Services 22/11/05)<sup>19</sup>*

*"Provided wind turbines are greater than 100m away from Mobile tower (or in the case of directional panel antennae) not in direct line of sight for panel antennas, wind turbines will have minimal effect on existing coverage." (pers. comm. Mr. Ivan D'Amico, Area Team Manager (Country) - NSW&ACT, Telstra Services, Wireless Access Solutions, Mobile Coverage Delivery)<sup>20</sup>*

The above suggestions have been considered in the planning of the Rye Park wind farm proposal.

## 5.4 Other radio communication

### *CB radio*

CB radios are not individually licensed, the equipment being subject to class licensing only. Therefore, no records of location or operators of CB radios exist, and the channels are shared without any right of protection from interference. No impact from the wind farm is predicted except perhaps for very local effects to portable or mobile units in the immediate vicinity of the turbines which could be avoided by a small location change of the unit.<sup>21</sup>

### *Wireless broadband*

From studies in other areas such as Mahinerangi, NZ<sup>22</sup> it is concluded that the minimum separation required between wind turbines and mobile broadband transmitters is approximately 240 m. Turbines will be located outside this distance to avoid any impacts on mobile broadband services where possible.

## 5.5 Mitigation measures

As a result of the exclusion zones established in planning the wind farm, the possibility of impacts to existing point to point communication links is reduced. However, in the unlikely event that interference is observed, the proponent is confident that impacts will be able to be mitigated using the following techniques:

- ▶ Modifications to or relocation of the existing antennae
- ▶ Installation of a directional antennae to reroute the existing signal
- ▶ Installation of an amplifier to boost the signal and/or
- ▶ Utilisation of onsite optical cable to reroute the original signal.

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18 Taurus Energy - Cullerin Range Wind Farm Environmental Assessment Report 2006

19 Ibid.

20 Ibid.

21 Ibid.

22 Mahinerangi Wind Farm Compatibility with radio services April 2007 - Kordia

## 6 Electric and magnetic fields

### 6.1 What are electric and magnetic fields?

The existence of electric and magnetic fields (EMFs) has been recognised for decades, and their characteristics have been the subject of thousands of scientific studies around the world. Research conducted over the past 25 years has significantly enhanced our knowledge of EMFs.

Electric fields are produced every time a voltage exists across a conductor. The higher the voltage, the stronger the electric field. Electric fields are strongest closest to the conductor and their level reduces quickly with distance. Most materials act as a shield or barrier to electric fields. The level of electric fields is measured in thousands of volts per metre (kV/m).

Magnetic fields are produced by the flow of an electric current through a conductor. The higher the current, the greater the magnetic field. The strength of magnetic fields is measured in milliGauss (mG). Like electric fields, magnetic fields are highest closest to the conductor and their level reduces quickly with distance. Most materials will not act as a shield or barrier to magnetic fields.

### 6.2 When do electric and magnetic fields occur?

Electric and magnetic fields (EMFs) occur both naturally and from man-made sources and are not unique to high voltage power lines. Natural EMFs are associated with such things as lightning, solar activity or the earth's magnetic field. All living organisms, including humans, have natural electric charges, currents, electric and magnetic fields.

Man-made EMFs occur whenever electricity is being used in any form of electrical equipment or wiring. Most people will be exposed to a wide variety of EMF sources throughout their daily lives. As electricity use is so widespread in modern society, questions about its possible effects on health are important to everyone.

Biological and occupational health research on EMFs began in the early 1960s. Since that time many national and international review panels, such as the World Health Organisation, the US National Institute of Environmental and Health Sciences and the UK National Radiological Protection Board have evaluated the research to assess the likelihood of health effects being associated with exposure to electric and magnetic fields. In Australia, the relevant health authority is the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), an arm of the Commonwealth Department of Health. In response to a recent report, the CEO of this agency said:

*“It is also important not to fixate on the location of external power lines, including high voltage transmission lines, as the prime cause of exposure. Exposure to ELF magnetic fields can arise from ground currents, internal household wiring and the use of electrical appliances as much as from exposure to external powerlines.”*

Government Agencies such as ARPANSA have also monitored international research on the topic, concluding that,

*“On balance, the scientific evidence does not indicate that exposure to EMF's found around the home, the office or near power lines is a hazard to human health”<sup>23</sup>*

## 6.3 What are the electromagnetic field implications of wind farms?

There are four potential sources of EMF associated with wind farms. These are:

- The grid interconnection power line
- The wind turbine generators
- Any electrical transformers
- The underground collector network cabling

The interconnection with the existing grid is usually made above ground and is no different from any other power line used in the existing network. The EMF levels are comparable to typical household appliances which are known to be negligible. The electrical generator windings are close together and surrounded by conductive metal housing so the electromagnetic fields are effectively zero.

The switchyard transformer, which will carry the entire output of the wind farm, is generally located in the central part of the switchyard and the protective fencing means it is not possible for members of the public to come close enough to be exposed to significant EMF.

The collector network, which connects the various turbine generators of a wind farm operates at typical distribution voltages and is buried at least 750 mm below ground level. Because of the closeness of the phase conductors within the cables and the screening of the cables, the electromagnetic fields are effectively zero.

The electromagnetic fields associated with generation and export of electricity from a wind farm does not pose a significant threat to public health. Consequently, no serious or adverse EMF or interference issues are anticipated from a wind farm.<sup>24</sup>

## 6.4 Mitigation measures

No mitigation measures are required.

## 7 Conclusion

Conflicts between point to point radio systems and the wind turbines are not expected. The turbine layout has been modified to reduce possible impacts to existing point to point radio systems. Also, mobile radio and other radio communication services in the area are not expected to be impacted by the wind farm or its operation.

Digital TV is not susceptible to visible “ghosting” degradation. Any impact of reflections from the turbines would be a minor reduction of coverage at the limit of the service area.

Interference to AM and FM sound broadcasting is not expected.

Overseas experience indicates that electrical interference from wind farm generators and controls is not a problem with established and reputable wind turbine manufacturers and therefore no electrical noise measurements are warranted.

Obstacle lighting is not expected to be a requirement at this site.

## 8 Glossary and Acronyms

ABA	Australian Broadcasting Authority
ACMA	Australian Communications & Media Authority
CB Radio	Citizens Band Radio
CDMA	Code Division Multiple Access cellular mobile system
EMI	Electromagnetic Interference
FM	Frequency Modulation
Fresnel Clearance	Clearance to obstructions from the ray line on a radio path which does not produce any additional loss above free space loss
GSM	Global Systems Mobiles
ITU	International Telecommunications Union
LF	Low Frequency
MF	Medium Frequency
UHF	Ultra High Frequency (300MHz - 3GHz)
UHF Channels	TV Channels 28 - 69 (526 - 820 MHz)
VHF	Very High Frequency (30MHz - 300MHz)
VHF Channels	TV Channels 0 to 12 (45 - 230 MHz)

## 9 Turbine Coordinates

<i>Turbine ID</i>	<i>Easting</i>	<i>Northing</i>	<i>Height (m) (AHD)</i>
1	676,629	6,186,672	722
2	676,471	6,186,291	716
3	676,320	6,185,897	705
4	676,320	6,185,509	683
5	677,805	6,185,279	715
6	676,377	6,185,158	666
7	677,490	6,184,967	727
9	677,384	6,184,591	719
11	677,266	6,184,203	734
12	677,322	6,183,750	726
16	677,936	6,182,318	716
17	681,368	6,182,678	728
20	681,054	6,182,312	704
21	678,588	6,181,965	746
22	679,549	6,181,989	694
25	679,389	6,181,591	693
26	678,511	6,181,575	710
28	678,484	6,181,184	703
29	678,385	6,180,840	733
30	679,009	6,180,754	755
31	680,367	6,180,463	741
32	678,570	6,180,428	760
34	678,899	6,180,032	737
35	679,581	6,180,032	729
36	680,242	6,180,109	741
37	678,987	6,179,642	740
38	679,645	6,179,648	712
39	680,098	6,179,394	744
41	680,008	6,179,119	719
42	680,994	6,179,015	709
43	679,027	6,179,114	702
44	678,960	6,178,706	714
45	678,438	6,178,498	687

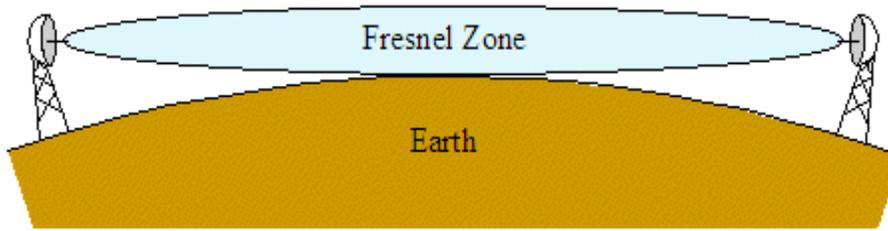
<i>Turbine ID</i>	<i>Easting</i>	<i>Northing</i>	<i>Height (m) (AHD)</i>
47	678,190	6,178,066	668
48	681,515	6,177,825	698
49	681,955	6,177,678	763
50	681,372	6,177,446	723
51	681,355	6,177,078	775
52	681,625	6,176,824	743
53	681,153	6,176,713	723
56	681,509	6,176,441	750
58	682,400	6,176,161	721
61	680,965	6,176,347	723
62	680,830	6,175,999	751
63	682,309	6,175,645	747
64	683,431	6,175,508	712
65	684,812	6,175,374	700
66	682,384	6,175,319	662
67	680,267	6,175,231	708
68	684,506	6,175,044	699
69	682,302	6,174,979	670
71	682,195	6,173,075	718
72	682,099	6,172,655	731
73	681,120	6,172,346	734
74	681,358	6,172,003	710
75	681,388	6,171,634	724
76	680,446	6,171,508	736
77	681,464	6,171,283	714
78	680,782	6,171,250	736
79	680,673	6,170,767	709
80	682,014	6,170,267	703
82	682,004	6,169,806	759
83	681,810	6,169,398	744
84	681,373	6,167,591	737
85	681,917	6,167,300	760
86	681,730	6,166,773	727

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<i>Turbine ID</i>	<i>Easting</i>	<i>Northing</i>	<i>Height (m) (AHD)</i>
87	681,536	6,166,404	748
90	681,137	6,165,157	732
93	681,045	6,164,377	736
94	680,716	6,163,813	739
95	681,550	6,163,639	706
96	682,288	6,163,400	746
97	682,410	6,162,959	736
98	682,319	6,162,534	715
99	682,358	6,162,122	729
18	678,502	6,182,471	720
101	682,364	6,161,546	701
102	686,233	6,156,685	744
103	685,997	6,156,377	746
104	686,150	6,156,084	742
119	683,654	6,152,722	743
120	684,987	6,152,789	746
122	683,572	6,152,343	732
124	685,103	6,152,217	730
125	684,396	6,152,175	741
127	684,307	6,151,723	726
128	683,138	6,151,393	702
129	684,402	6,151,298	726

<i>Turbine ID</i>	<i>Easting</i>	<i>Northing</i>	<i>Height (m) (AHD)</i>
131	683,001	6,150,684	700
133	678,003	6,181,399	705
134	677,946	6,181,062	702
135	679,301	6,180,383	714
136	680,809	6,181,821	742
137	680,652	6,181,414	738
138	680,607	6,181,022	727
139	680,934	6,177,688	733
140	680,771	6,177,337	772
141	680,488	6,175,710	725
142	684,592	6,152,523	741
143	681,415	6,167,988	735
144	678,465	6,177,749	757
130	683,127	6,151,016	680
146	684,178	6,174,388	720
147	684,451	6,173,978	690
148	684,474	6,173,545	716
149	683,804	6,173,875	710
150	682,052	6,170,803	716
145	686,104	6,154,215	756
151	677,325	6,185,689	695

## 10 Fresnel zone calculation



The equation for calculating the Fresnel zone radius for a radio communications link is shown below:

$$F_n = \sqrt{\frac{n\lambda d_1 d_2}{d_1 + d_2}}$$

Where:

- ▶  $F_n$  = The nth Fresnel Zone radius in metres
- ▶  $d_1$  = The distance from one end in metres
- ▶  $d_2$  = The distance from the other end in metres
- ▶  $\lambda$  = The wavelength of the transmitted signal in metres

Using this equation, the 2<sup>nd</sup> order Fresnel zone was determined for each link that intersects the RYP Wind Farm site perimeter. The maximum value of the 2<sup>nd</sup> order Fresnel zone was assumed along the whole length of the radio-communication link which is an overly conservative estimation used to decrease any risk to existing radio-communication services. Table 4 below shows the summary of the calculations performed for each radio-communication link.

**Table 3 - Fresnel Zone Calculations**

Link ID	Frequency (MHz)	Licensee	License_No	Length (m)	Midpoint (m)	Max Fresnel Radius (m)
108559	404.25	Office of Environment and Heritage	1103280	86684	43342	179.3
108559	413.70	Office of Environment and Heritage	1103280	86684	43342	N/A <sup>25</sup>
92691	30.70	Department of Defence	493596	247696	123848	N/A <sup>26</sup>
411873	856.55	Office of Environment and Heritage	1923870	86699	43349	123.2
411878	932.55	Office of Environment and Heritage	1923870	86699	43349	N/A <sup>25</sup>
160378	404.35	NSW Rural Fire Service	1208625	60431	30216	149.7

<sup>25</sup> Obsolete due to same Link ID with lower frequency already analysed. The lower frequency link will have a larger Fresnel radius and is therefore used. This often occurs due to the 'in-going' and 'out-going' nature of radio point to point communications.

<sup>26</sup> VHF Link. The frequency used for this link is too low to be obstructed by wind turbines.

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160378	413.80	NSW Rural Fire Service	1208625	60431	30216	N/A <sup>25</sup>
252500	450.575	NSW Police Force	1228509	85471	42736	168.6830622
252500	460.075	NSW Police Force	1228509	85471	42736	N/A <sup>25</sup>

## 11 Correspondence

License holders identified via the ACMA RADCOM database within a 25 km radius of the wind farm were notified of the project in relation to potential impacts and asked to provide comments. Table 11-1 summarises the organisations that were consulted and their comments received. Their responses are then provided in full.

*Table 11-1 Consultation with license holders*

<i>Organisation</i>	<i>Response</i>	<i>Comment</i>
2KY Broadcasters Pty Ltd	No Response	
Airservices Australia	No Response	
Ambulance Service of NSW	No Concern	
Australian Rail Track Corporation Limited	No Concern	Requested more information regarding rail crossings
Boorowa Council	No Response	
Chris Despotakis	Concerns Raised	Discussion with organisation ongoing
Concrete Pty Ltd	No Response	
Department of Defence	No Concern	
Department of Finance and Services	No Response	
Dianne Maree Nacson	No Response	
Essential Energy	No Response	
Fire and Rescue NSW	No Response	
NSW Police Force	No Concern	
NSW Rural Fire Service	No Response	
Optus Mobile Pty Limited	No Concern	
RBA Holdings Pty Ltd	No Response	
Robinvale District Health Services	No Response	
Singtel Optus Pty Limited	No Concern	
Soul Pattinson Telecommunications Pty Limited	No Response	
State Emergency Service (NSW)	No Response	
Stephen Cusack (Yass Taxis)	No Response	
Telstra Corporation Limited (Telstra Wireless Network Engineering 15)	No Concern	
Transgrid	No Response	
Upper Lachlan Shire Council	No Response	
Vodafone Australia Pty Limited	No Response	
Vodafone Hutchison Australia Pty	No Response	

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Limited		
Wendy Blackmore	No Response	
Yass Community Radio Association Inc.	No Response	
Yass Valley Council	No Response	

# EPURON

Tim Lam

Epuron

Level 1 1, 75 Miller St

NORTH SYDNEY, NSW 2060

Dear Mr Lam

RE: Rye Park Wind Farm, New South Wales

Thank you for advising the Department of Defence (Defence) of the proposal for the Rye Park wind farm situated 25km north of Yass in the NSW Southern Tablelands. Defence understands the wind farm is to consist of 123 wind turbines and 4 wind monitoring masts with maximum above ground level heights of 156m and 100m respectively.

Defence has assessed the proposal for any impacts to operations in the area. This includes safety of low flying military aircraft, as well as affects to Defence communications, and surveillance radars. Defence advises that the Rye Park wind farm would not adversely affect military aircraft operations or interfere with Defence communications and radar.

There is an ongoing need to obtain and maintain accurate information about tall structures so that risks associated with inadvertent collision by low flying aircraft can be reduced. The RAAF Aeronautical Information Service (RAAF AIS) is responsible for recording the location and height of tall structures. The information is held in a central database managed by RAAF AIS and relates to the erection, extension or dismantling of tall structures the top measurement of which is:

- ▶ a. 30 metres or more above ground level - within 30 kilometres of an aerodrome, or
- ▶ b. 45 metres or more above ground level elsewhere.

The proposed wind turbines and wind monitoring masts will meet the above definition of a tall structure. The Department of Defence requests that the proponent provide RAAF AIS with "as constructed" details of the wind farm. RAAF AIS has a web site with a Vertical Obstruction Report Form at [www.raafais.nov.au/obstrfornn.htm](http://www.raafais.nov.au/obstrfornn.htm) which can be used to enter the location and height details of tall structures.

Should you wish to discuss the content of this advice further, my point of contact is Mr. Gary Lee on telephone (02) 6266 8 187.

Yours sincerely

Tim Hogan

AlDirector External Land Planning

BP3-]-A052

Department of Defence

CANBERRA ACT 2600

4 April 20 12

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*In July, each ACMA Site Licence holder within 25km of the Rye Park Wind Farm was sent a variation of the following letter informing them of the wind farm.*

**Telstra Corporation Limited (Telstra Wireless Network Engineering 15)  
Locked Bag 3708 (C/- R Preston)**

# EPURON

**BRISBANE  
QLD 4000**

Dear Telstra Corporation Limited (Telstra Wireless Network Engineering 15),

EPURON Pty Ltd is investigating the potential for a new wind farm in the Southern Tablelands of NSW.

The Rye Park Wind Farm site is located in the vicinity of the township of Rye Park, approximately 250km south west of Sydney, NSW. EPURON is monitoring wind speed at the site and indications are that there is potential to construct a wind farm at the location.

Should the wind farm be approved and constructed, it will be capable of generating enough clean, green electricity to match the consumption of more than 65,000 average NSW homes.

According to the ACMA's radio communications license register, Telstra Corporation Limited (Telstra Wireless Network Engineering 15) operate radio communications services within 25km of the proposed wind farm site. The ACMA site ID number(s) have been identified as 9531, 9546, 9547, 39130, 55601, 100722, 100785, 130627, 132565, 370254 and the site name(s) as Telstra Site 12 km E of Yass MT MUNDOONEN and Australian Space Office Site Mt Canemumbola BOOROWA and Radio Hut Mt Canemumbola BOOROWA and Telstra Site Raw Water Pumping Station YASS and Bowning Hill Trig YASS and Telstra Site 5.5 km E of Yass MOUNT MANTON and Telstra Exchange cnr Comur and Polding Sts YASS and Telstra Site CONROYS GAP and Telstra Site Yass Yellow Yellow Creek Rd YASS and Vodafone/Optus Site Oakhurst Trig GUNNING.

Epuron is currently conducting a radio-communications impact study in relation to the proposed Rye Park Wind Farm to ensure the proposal does not impact on your services.

Please feel free to contact me at the office on (02) 8456 7408, should you have any concerns or if you need any further information. Alternatively, my e-mail address is [d.gilbert@epuron.com.au](mailto:d.gilbert@epuron.com.au).

Thanks & kind regards,

**DANIEL GILBERT**

Epuron Pty Ltd

# EPURON

25 July 2012  
Daniel Gilbert  
EPURON Pty Ltd  
Level 11, 75 Miller St,  
NORTH SYDNEY, NSW 2060

Network and Technology  
Forecasting and Area Planning  
L4/52-54 Railway Pde Burwood 2134  
Telephone (02) 8576 9853  
Facsimile (02) 9397 2030  
Kham.Souksamlane@team.telstra.com

Re: PROPOSED RYE PARK WIND FARM - IMPACT ON TELSTRA COMMUNICATIONS ASSETS

Dear Daniel,

In response to your letter dated 12 July 2012, a desk top study was undertaken of the area and nearby telecommunications infrastructure.

Based on the provided information relating to the proposed wind farm located approximately 250Km South of Sydney, NSW, results of Radio rayline analysis investigation reveals that there is no potential for undue interference from the proposed wind farm. However, results of Optic & Copper cable investigation reveals that there are optic and copper cables within the Rye Park site boundary. There is potential for undue interference from the proposed Wind farm, and the ongoing servicing and maintenance of these cables. The proposed Turbine layout and the existing Telstra cable network are provided in the attached files.

Telstra has no objection to development application in relation to the proposed wind farm subject to EPURON Pty Ltd confirming its agreement to the conditions and matters set out in this letter.

Telstra requires EPURON Pty Ltd to bear any cost of cables relocation, and to notify of any additional turbines, or any change to the proposed location of the Wind Turbine, so that impacts on Telstra's Network can be re-assessed.

Telstra will require the protection of/relocation of its fixed telecommunications infrastructure that may be impacted by activities on this site. To minimise risk of liability due to any damage, the DialBeforeYouDig1100 Inquiry number should be contacted to obtain location of Telstra plant before commencement of construction work.

For future correspondence and enquiries regarding this matter, please contact the undersigned on (02) 8576 9853.

Yours faithfully,  
Kham Souksamlane

# EPURON

Daniel Gilbert

Epuron Pty Ltd

Level 11, 75 Miller St

NORTH SYDNEY, NSW 2060

Dear Daniel,

Thank you for your letter and time this morning.

As discussed, I am concerned about the possibility of future interference by your wind farm to my proposed AM NAS license operation in Bowning, whether operated by me or a purchaser,

I request that you consult both with the ACMA and a radio engineer prior to the establishment of your operation.

The remedial costs for interference can be quite considerable as it would include extensive relocation costs, loss of advertising revenue, reduced audience figures and legal costs. It may also lead to the transmission facility being totally inoperable and non-viable.

As this license is currently for sale, I am also concerned that your proposed wind farm may impact on its value.

I require that an assurance is provided in writing that all the above concerns will be acted upon and remedied at your cost should interference occur at any point in the future.

Failure to provide such an assurance will necessitate in me obtaining legal advice with a view to restricting any operation until such an assurance can be provided.

Please feel free to contact me on 0417824878 for any clarification on this matter.

Yours faithfully,

Chris Despotakis

# EPURON

Hi Bill,

Thanks for giving me a call this morning.

See attached excel doc for turbine coordinates.

If you need it in another format just let me know, and if you have any concerns about our development effecting your telecommunications links give me a call.

My 2nd order Fresnel analysis of comms links from ACMA showed a few links going across the site, so we have moved turbines. I don't think there are any Ambulance Service of NSW comms links though.

Thanks,

Daniel Gilbert

Project Manager

Epuron Pty Ltd

(02) 8456 7408

Test

Bill Tripcony

Telecommunications Manager | Telecommunications Unit

Ambulance Headquarters, Balmain Rd., Rozelle, NSW. 2039

Tel. 02 9320 7830 | Fax. 02 9320 7801 | [bttripcony@ambulance.nsw.gov.au](mailto:bttripcony@ambulance.nsw.gov.au)



Gilbert,

Thanks for the information and confirmation that our p-p paths will not be impacted by your proposed development.

Regards,

Brett Dawson

Radio Manager

National Parks and Wildlife Service  
Office of Environment and Heritage  
Department of Premier and Cabinet

T: (02) 4972 9017

F: (02) 4972 9055

M: 0408 242 206

E: [brett.dawson@environment.nsw.gov.au](mailto:brett.dawson@environment.nsw.gov.au)

---

From: Daniel Gilbert [<mailto:D.Gilbert@epuron.com.au>]

Sent: Wednesday, 1 August 2012 11:38 AM

To: Dawson Brett

Subject: RE: Rye Park Wind Farm

Hi Brett,

As part of our development for the Rye Park Wind Farm we are completing a Communications Impact Assessment.

This will assess all kinds of communication in the vicinity of the proposed wind farm including radio, TV and microwave communication links.

OEH have a point to point comms link that goes through the north of the wind farm site perimeter. To ensure that our development will not impact on your communications link, and as part of our Communications Impact Assessment, we have completed 2nd order Fresnel analysis of all point to point communications links that travel through the site perimeter.

The 2nd order Fresnel analysis gives a radius from the centre line of the communications link where physical objects would disrupt communication. The maximum value which occurs at the midpoint of the link can be mathematically determined depending on link length and wavelength. In order to be

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conservative, Epuron has assumed that the maximum radius exists for the entire length of the communications link.

OEH's comms link has four ACMA registered links between the same coordinates, with the lowest frequency at 404.25MHz giving the largest Fresnel radius of 179.3 metres. We have used this analysis in the most recent design of our turbine layout and have ensured that no turbine (or blade length) is placed within the radius of that link. See image attached.

I am happy to provide turbine coordinates for you to do your own analysis if you would like to.

Any other questions feel free to give me a call.

Thanks,

Daniel Gilbert

Project Manager

Epuron Pty Ltd

(02) 8456 7408

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From: Brett Dawson [mailto:[Brett.Dawson@environment.nsw.gov.au](mailto:Brett.Dawson@environment.nsw.gov.au)]

Sent: Monday, 30 July 2012 11:18 AM

To: Daniel Gilbert

Subject: RE: Rye Park Wind Farm

Daniel,

Paul Barnes has passed on details of the wind farm development near Yass.

As one of our radio links is potentially impacted, please advise what assessment is done by you to assess the likelihood of link blockage, fading or other problems (eg RF noise, multi-pathing).

Thanks and Regards,

Brett Dawson

Radio Manager

National Parks and Wildlife Service

Office of Environment and Heritage

Department of Premier and Cabinet

E: [brett.dawson@environment.nsw.gov.au](mailto:brett.dawson@environment.nsw.gov.au)

# EPURON

Daniel,

NSWPF used to have a link path which would have any effect on NSWPF is Mt Bowring to Mt Gray.

This link was removed from service 26th July 2012.

Regards

Radio Site Facilities Management - Wireless Technology

Communications Group - NSW Police Force

EN 54868 TEL (02) 9265 4868

#RADIOSITES (NSWPF Internal)

RADIOSITES@police.nsw.gov.au (External)

# EPURON

From: Maxi Victoria <Maxi.Victoria@optus.com.au>

Sent: Wednesday, 5 September 2012 1:15 PM

To: Daniel Gilbert

Cc: Jayantha Wickramasinghe; Vipul Beri; Norman Mariano

Subject: Rye Park Wind farm

Attachments: EPURON\_Rye Park.pdf; OptusAsset\_RyePark\_WindFarm.pdf

Good Afternoon Daniel,

Further to your letter dated the 12th of July 2012 addressed to SingTel Optus and marked to the attention of

Brendan Jones, we have had an analysis of the wind farm turbines undertaken and the feedback is that there will be

no impact on Optus assets in the area.

Regards

Maxi Victoria

Snr Engineer | Radio Access Engineering - NSW/ACT | Networks | Optus