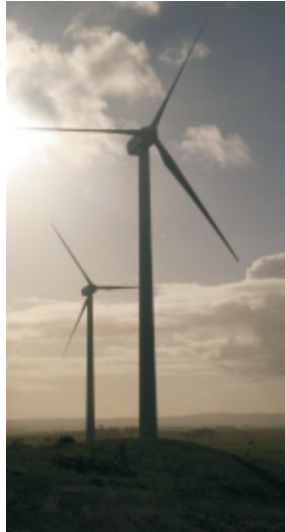


Woodlawn Wind Farm



Telecommunications

11

11. Telecommunications

This chapter of the SEE describes the potential telecommunications interference impacts that have been considered for the amended project and the measures proposed to mitigate the impacts. The effect is also referred to as Electromagnetic Interference (EMI)

11.1 Introduction

As with other large structures, wind turbines have the capacity to interfere with radio frequency signals, by scattering the signal by forward or backward reflections. The services that could theoretically be affected by wind turbines include:

- aircraft navigation systems
- radio signals
- television signals, and
- microwave links.

URS undertook a desktop study for the 2004 EIS to assess the potential for interference to each of these communication systems as a result of the Woodlawn Wind Farm development. The overall conclusion was that no potentially significant impacts on mobile phones, aircraft navigation and survey activities at Sally Trig Station were expected from the wind farm development. An existing fixed radio link was identified as having transmission paths across the wind farm site between the approved locations of turbines 15 and 16. The EIS indicated that a further detailed investigation to assess the potential impact of the wind farm would be undertaken at the design stage.

In 2009, Woodlawn Wind Pty Ltd engaged Lawrence Derrick & Associates (LDA) to further assess telecommunications services likely to be impacted as a result of the variations proposed particularly in relation to the revised turbine sites and changes to heights of structures. A desk top study was undertaken based on relevant International Telecommunications Union (ITU) documents and reports on overseas and Australian experience of wind farm impacts on broadcasting services. The full report is available Appendix F and summarised below.

11.2 Electromagnetic interference (EMI) effects of wind turbines

Bacon (2002) proposes that wind turbines can cause three potential degradation mechanisms:

- **near field effects:** referring to the potential of electromagnetic field being emitted by generator and switching components in the nacelle
- **diffraction:** occurs when the object not only reflects part of the signal but also absorbs the signal
- **reflection or scattering:** occurs when the turbines reflect or obstruct signals between a transmitter and a receiver. The reflection or scattering suggests greater clearance requirements at positions close to the link terminals than the usually applied Fresnel Zone clearance for certain links with low antenna gain.

Towers and electrical systems have also been considered to be potential causes of EMI, however, neither of these has been found to be a significant source of interference. Moving blades are the components of most importance in determining EMI levels.

Spera (1994) had previously indicated that the amount of EMI would depend on a number of parameters, for example:

- location of the wind turbine relative to the transmitter and receiver
- type of wind turbine
- characteristics of the rotor blades
- signal frequency and modulation scheme
- receiver characteristics
- radio wave propagation in the local atmosphere



The nature and extent of any interference to telecommunications signals varies with the form of the communication which may be directional, fixed path signals of various frequencies or radiating signals from a point source. The point source signals vary from radio waves of specific frequency to television signals that have a broader spectrum and where interference may be more critical. The signal strength will also decrease with distance and topographic features may partially or fully block signal transmissions for different directions.

The following sections describe potential for interference to the various types of telecommunications services.

11.3 Review of specific types of services

11.3.1 Broadcasting services

The Australian Communications & Media Authority's (ACMA) RADCOM Database was used by LDA to identify radiocommunication services within a minimum 50 kilometre radius of the wind farm to determine if any of the turbine towers could obstruct line-of-site paths or have any likely detrimental affect on these services. Clearance criteria for ray lines have been indicated for any point to point radio paths crossing or near the wind farm site.

From ACMA TV and Sound Broadcasting Station listings, and from a map survey of the area surrounding the Woodlawn Wind Farm site, the following is a general summary of the broadcast transmitter site locations and radio frequency channels which provide cover of the area.

Television reception – analogue, digital and satellite

Based on the ABC's web site, television service area predictions for the Tarago 2580 Postcode indicate that the following transmitter locations could provide coverage for analogue and digital television.

- Black Mountain, Canberra
- Knights Hill, Illawarra
- Mt Gray, Goulburn – (likely to be lower power and less relevant at wind farm locality) due partly to transmission source power and elevated terrain immediately north of the Woodlawn Wind farm locality
- Mt Canobolas, Central Tablelands – (very distant and less relevant at wind farm locality)

It is expected that many residents in the Woodlawn Wind Farm area would be able to receive analogue television from the Canberra National and Commercial main stations located at Black Mountain where not shielded by intervening topography. Black Mountain Tower (previously known as Telstra Tower and Telecom Tower) rises 195.2 metres above the summit of Black Mountain in Canberra. Transmitters are located at various heights on the tower. The transmission source used at receiver locations will depend on distance from the respective transmitters, power of transmission and the least obstructed path to the transmitters. In some locations reception of channels from more than one transmitter location will be possible.

Transition to digital television around Australia commenced in 2001. The Government has announced that digital only transmission in Canberra and other regional NSW markets in this area will be achieved by 30 June 2012. It is therefore considered that any remedial action necessary for interference to analogue TV reception should focus on a digital solution where possible.

Some homesteads in the area may also have satellite television either as a supplement to free to air services or due to poor reception and being the only service available at the receiver location with viewable quality. Unless a particular receiver's antenna reception direction and elevation is closely aligned with a turbine, which is highly unlikely for the Woodlawn Wind Farm project, no impacts on television reception are expected.

Table 11.1 – Television stations and channels potentially receivable in the Tarago locality

Transmitter location/service	Operator	Analog channels	Digital channels	Comment
Black Mountain/ Canberra	SBS	28H	30H	UHF
	ABC	9V	9AV	VHF
	WIN	31H	11V	UHF/VHF
	CBN	34H	12V	UHF/VHF
	CTC	7V	6V	VHF
Knights Hill /Illawarra	SBS	53H	54H	UHF
	ABC	56H	51H	UHF
	WIN	59H	36H	UHF
	CBN	65H	38H	UHF
	CTC	62H	37H	UHF
Mt Gray / Goulburn	SBS	58V	59V	UHF
(assumed low power local service)	ABC	55V	56V	UHF
	WIN	61V	62V	UHF
	CBN	64V	65V	UHF
	CTC	10V	68V	VHF/UHF
Mt Canobolas / Central Tablelands	SBS 30H Reception UHF. Very distant and with intervening topography			

Sound broadcasting – FM and MF

Canberra FM (frequency modulated) Radio Services are radiated from Black Mountain and other FM Radio services are available in the area from Goulburn, Illawarra and other sites.

Wind farm effects on MF (medium frequency) radio are highly unlikely and therefore the stations serving the area have not been listed.

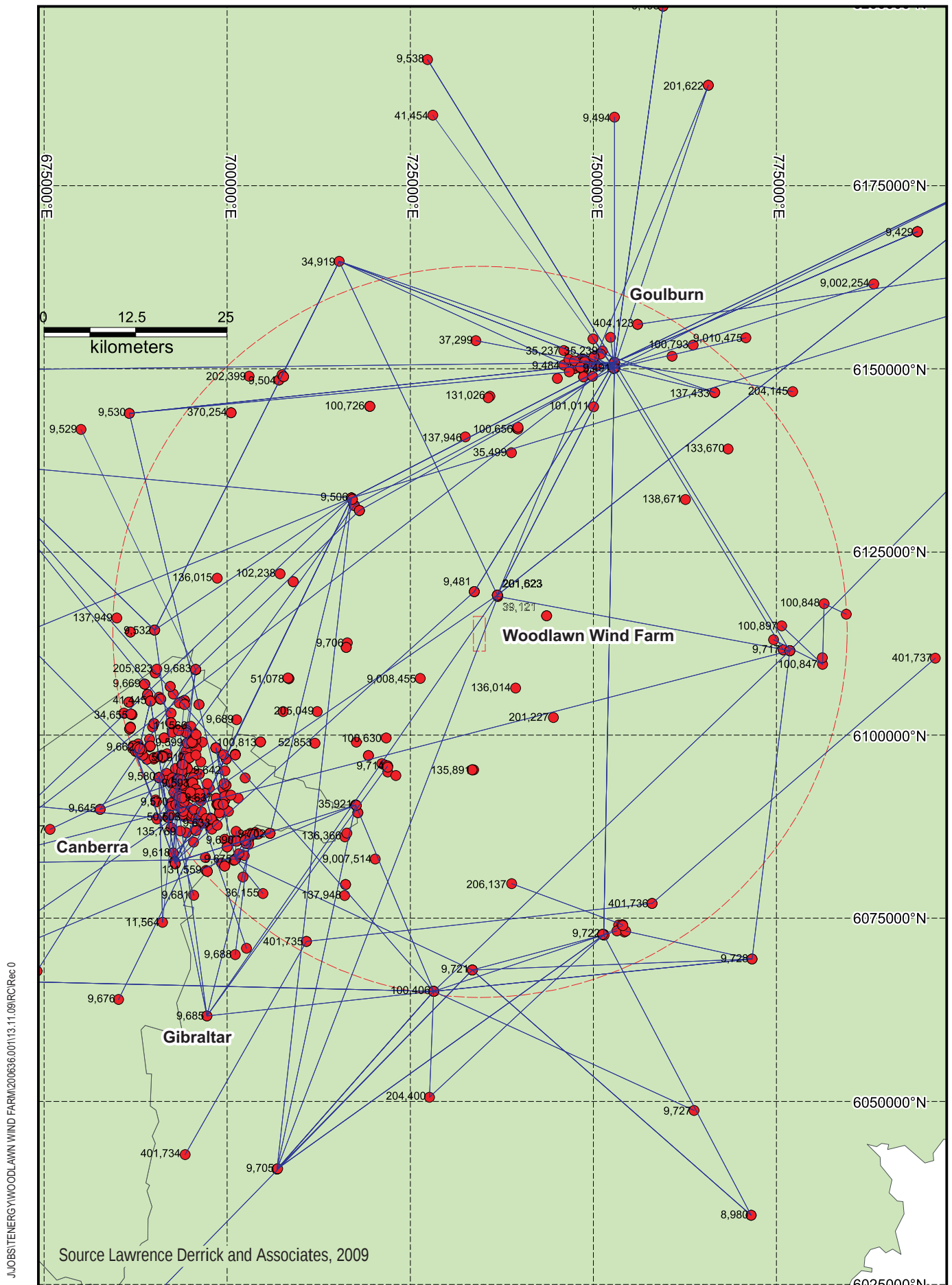
11.3.2 Radiocommunications services

Figure 11.1 shows the radio transmitter sites and point to point links within 50 kilometres for the 40 – 999 MHz operational ranges as reported by LDA. Transmission paths for communications at greater than 1 GHz frequency were also reviewed by LDA but as none are indicated to pass through the project area. A Figure has not been included with this chapter but is available in the LDA report (Appendix G).

Point to Point

A number of point to point links are registered for operation within 50 kilometres of the Woodlawn Wind Farm site. Two links within the 40 – 999 MHz operational range traverse the boundaries of the Woodlawn Wind Farm site as shown in Figure 11.1. More detail of the location of the transmission paths relative to turbine sites is shown together with a path profile. No microwave links occur within the wind farm site.

Clearance requirements in the vertical and horizontal dimensions are required to ensure turbines are not located close to the transmission paths or the associated first and second order Fresnel zones of these two links to avoid any impact on their performance.



Woodlawn Wind Farm Statement of Environmental Effects

Figure 11.1: Radio Link map 40 - 999MHz Frequencies

Cellular mobile base stations

The 2004 EIS identified that three mobile phone network companies use base stations within the broader locality around the wind farm.

LDA identified no cellular mobile base stations are registered at sites in the close vicinity of the wind farm. It is not expected that mobile phone services at the locality will be significantly affected by the wind farm development.

Two-way mobile

A number of private and Public Utility Point to Multipoint and mobile bases exist in the area surrounding the wind farm site. These bases potentially provide cover to mobiles in a 360° arc from their bases.

No significant impact from the wind farm on base coverage beyond normal mobile operational performance is predicted in view of the geographic separation between the base antennas and the turbine structures.

Of course a mobile unit communicating with a base station when the mobile is located within metres of the wind turbine structures (or indeed near any large building, silo, tower etc) may experience some very local performance change, however moving a short distance would restore performance to normal.

CB radio

CB radios are subject to class licensing only therefore no records of location or operators of CB radios exist. 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.

Radar

URS consulted with Australia Airservices and Department of Defence regarding the potential impact of Woodlawn Wind Farm on air craft navigation systems (radar and radio) at Canberra and Goulburn for the original 2004 EIS. The nearest airport at Canberra has radar located at Mt Majura about 40 kilometres south-west of the Woodlawn Wind Farm site.

At the time Airservices Australia confirmed that the distance between the wind farm and the two airport sites would have no impacts on the radio and radar systems. Department of Defence also concluded that the wind farm would not impact on the Department's Radar system. This situation is not expected to change. It is noted that the Capital Wind Farm comprising 67 turbines has been already constructed between the location of Mt Majura and the Woodlawn Wind Farm site and that the Capital Wind Farm site is significantly closer to the radar facility than is the case for Woodlawn Wind Farm.

11.4 Discussion

11.4.1 Fortuitous reception of broadcast signals

On some previous projects, Responsible Authorities have imposed conditions such as:

"if the qualitative survey establishes any detrimental increase in interference to reception or transmission measures must be taken to mitigate the interference to return the affected reception or transmission to pre-construction quality" (Waubra Vic Planning Permit No PL-SP/05/0150),



This raises two issues:

- **criteria for interference assessment**

It is proposed to use the ITU grade 4 ("perceptible but not annoying") of a 5 grade impairment scale as the limit of acceptance for analogue television reception. This is the most vulnerable service for turbine interference

- **protection of reception** of some services outside their designed coverage area - termed fortuitous reception.

ACMA's attitude to protection of reception outside designed service areas is understood to be that the reception is fortuitous and will not be protected. They will therefore plan for reuse of frequencies for new stations which in future may impair reception in areas where it is currently acceptable or useable, often for at least part of the time.

This is, of course, difficult for individuals to accept who, due to their particular location, cannot receive an acceptable service from their planned station. Others may use distant stations to avail themselves of diverse programs. It is not reasonable to attempt to protect these services which are likely to be of low signal level and may vary in quality of reception depending on time of day, weather patterns and season. LDA therefore recommended that no mitigation be required for any adverse effect on reception due to turbine effects where the receivers are clearly outside the ACMA planned coverage area for the particular service being received. Nevertheless the proponent may chose to undertake improvements to a particular receiver's reception on the basis of maintaining good neighbour relations.

11.4.2 Overseas experience

Observations and studies in the USA and the UK on the effects of wind turbines on television and other radio communication services have occurred over many years. Lawrence Derrick & Associates undertook a review of many of the studies and are discussed in more detail in Appendix F and the general conclusions drawn from this review are summarised below:

- (a) No turbine interference effects are expected to MF radio reception.
- (b) There is a very low probability of perceptible interference to FM radio reception
- (c) Analogue television services may experience some interference particularly where:
 - the path to the transmitter for a given receiver location is through the wind turbine blades or
 - where there is a partly obstructed path to the transmitter and there is a clear path to a turbine.

These effects may be restricted up to a distance of about three kilometres from the wind farm in forward scatter directions (receiver on opposite side of the wind farm to the television station).

- (d) Digital television services are unlikely to suffer degraded picture quality (eg ghosting) where signals have a margin above threshold levels. A reduction in the service area could occur due to time varying reflected signals.

11.5 Potential impact of Woodlawn Wind Farm

Based on the topography of the area, the review of the overseas experience and on calculations using the University of Michigan method, the following potential impacts from the Woodlawn Wind Farm on telecommunication systems and television reception are expected

- No interference is expected to the MF and FM sound broadcasting services in the area.
- Attachment 6 of Appendix F shows the theoretical predicted interference levels to television reception in the vicinity of the Woodlawn Wind Farm. These calculations indicate that there is a possibility some television picture degradation could be experienced where the wind turbines exist within a $\pm 20^\circ$ sector from the television antenna nominal direction of reception, and up to about three kilometres from the turbines. The percentage of time the degradation would be experienced would depend on the direction and speed of the wind.
- Due to the undulating terrain around Woodlawn Wind Farm and the possible multiple television transmitting stations that individual residences will use for television reception it is difficult to predict where interference may occur.
- As indicated above, digital television is not subject to ghosting degradation in high signal strength areas, however some reduction of service area could result from reflected unwanted signals at the limits of the service area. There may be some isolated areas which are shadowed by local hills resulting in reduced signal levels, however it is difficult to predict whether digital reception will be impaired in specific locations.
- There are no television re-broadcast stations listed in the area surrounding Woodlawn Wind Farm. Therefore, no impact on re-broadcast signal quality is expected.
- For satellite pay TV services in the area of the wind farm, no interference to these services is likely to occur unless the required pointing of their dish antennas to the serving satellite is also in line with a turbine.
- Maps derived from the ACMA RADCOM database showing radio transmitters and link paths for services within the frequency range from 40 – 999 MHz and within at least 50 kilometres of Woodlawn Wind Farm are shown in Figure 11.1. Two Radio links have been identified as crossing the boundary of the wind farm site as indicated in Figure 11.2a and 11.2b and the final turbine array design will need to ensure that these services are not adversely impacted.
- The Airservices facility at Mt Majura includes aircraft radar which is about 40 kilometres from the wind turbines. The adjacent Capital wind farm has turbines at a lesser distance. On the basis that the currently operating Capital wind farm is acceptable to Airservices it is unlikely that there would be any objection to the location of the more distant Woodlawn wind turbines.

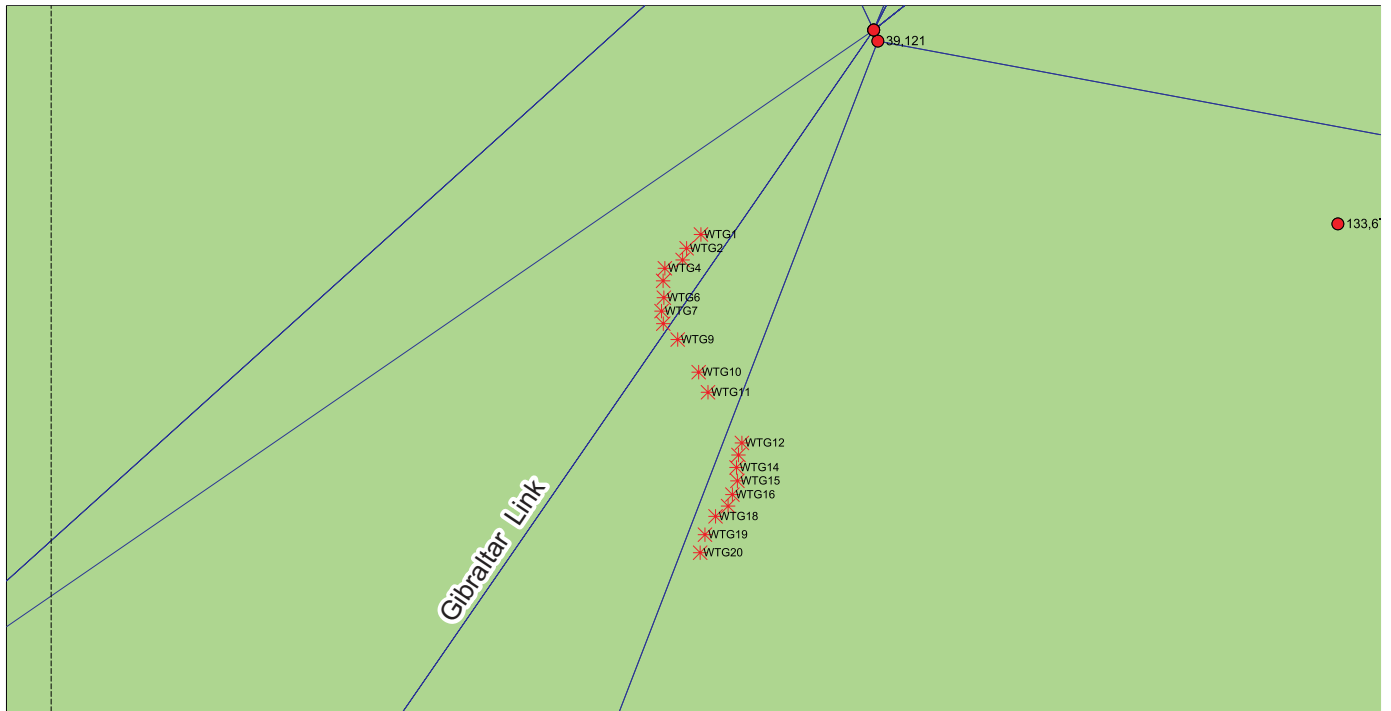


Figure 11.2a: Map of radio link paths near wind turbines

PATH PROFILE COWLEY HILLS TO GIBRALTAR HILL

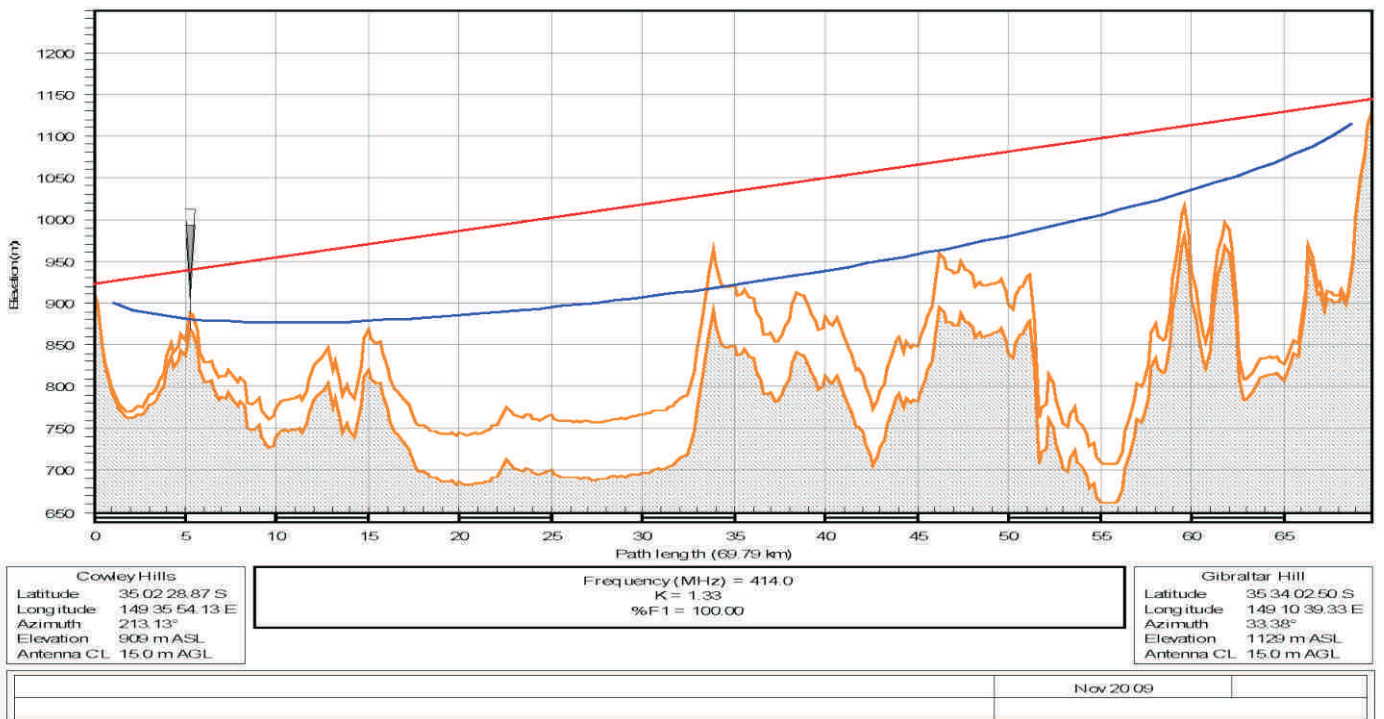


Figure 11.2b: Path profile Cowley Hills to Gibraltar Hill

11.6 Mitigation measures

For individuals experiencing degraded FM or television broadcasting service due to identified interference from the wind farm, possible techniques to reduce the interference to acceptable limits include:

- Replacement of receiving antenna system with a higher gain more directive model
- Repositioning of the antenna in height or horizontally on the dwelling
- Installation of an antenna elsewhere on the property and cable to dwelling
- Change the orientation of antennas to receive an alternative station if available. For example, point the satellite to Illawarra or Goulburn instead of Canberra
- Use available digital television channels instead of analogue. This would require a digital Set Top Box or digital television set
- Provision of an alternative satellite service eg, Free to Air or Austar pay television service.
- Where feasible, consideration could be given to the installation of a television or FM repeater station to provide service to groups of residents in a shadow zone.

Potential point to point system and mobile base coverage conflicts are not predicted with turbines being located with recommended clearance zones from radio sites or point to point ray lines. There is only one identified link passing the turbines and final micro siting adjustments of one turbine would avoid any impacts. Final micro-siting will be determined prior to construction.

Any minor near field effects to medium frequency broadcasting would occur within tens of metres of the turbines only and with a buffer zone of at least 500 metres to any dwelling, no corrective action will be required.

11.7 Conclusion

- Interference to MF and FM sound broadcasting is not expected.
- Potential conflicts between point to point radio systems and the wind turbines which have been identified can be avoided by using adequate clearances to be incorporated in final turbine positioning.
- Mobile radio and other radio communication services in the area are not expected to be significantly impacted by the wind farm or its operation.
- There is a small probability that television reception at dwellings within ~three kilometres of the wind farm turbines and with antennas having turbines located with $\pm 20^\circ$ angle of their reception direction will experience some noticeable ghosting at times. This may be time variant depending on wind direction and speed. For residences surrounding Capital Wind Farm that indicated impacts to TV reception following the wind farm construction a serviceman was able to review their reception systems and make adjustments to restore suitable reception.
- Digital television is not susceptible to visible ghosting degradation where the signal level is above a minimum threshold. The area surrounding the wind farm is expected to be a high to medium level signal area however there may be individual houses located in shadow areas that will require other mitigating technique to be applied.
- For any analogue interference problems confirmed to be related to the wind farm turbine and where television receiving antenna system improvements are unsuccessful, the use of a set top box with reception of the available digital channels may be the best solution. As previously indicated, Australia aims to cease analogue transmissions by mid 2012. In view of this the provision of digital television solutions to any degraded analogue reception is simply advancing an inevitable transition to digital reception.

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- A satellite service could be considered if digital television reception is considered to be unsatisfactory in individual cases.

Overseas experience indicates that EMI produced by the wind farm generators and controls is not a problem with reputable world class wind turbine manufacturers and therefore no electrical noise measurements from the electrical generators are warranted.