Electromagnetic Interference Assessment

EMI Assessment of Flat Rocks Wind Farm
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Abreviations

ACMA	Australian Communications and Media Authority
BOM	Bureau of Meteorology
CB	Citizens Band
DAB	Digital Audio Broadcasting
DGPS	Differential Global Positioning System
DNWFG	Draft National Guidelines for Wind Farm Development
EMI	Electromagnetic Interference
EPHC	Environmental Protection and Heritage Council
FESA	Fire and Emergency Services Authority
FRWF	Flat Rocks Wind Farm
GPS	Global Positioning Systems
GSM	Global System for Mobile Communications
MHE	Moonies Hill Energy
RTK	Real Time Kinematic
TV	Television
UHF	Ultra High Frequency
VHF	Very High Frequency
WTG	Wind Turbine Generator

1. EXECUTIVE SUMMARY

This report summarises the results of an electromagnetic interference (EMI) assessment conducted in and around the proposed Flat Rocks wind farm site located 20 km south east of Kojonup, 27 km north west of Tambellup, 16 km west of Broomehill and 27 km south west of Katanning in the Great Southern region of Western Australia. An up to date list of radiocommunications sites located in the vicinity of the proposed wind farm was obtained from the Australian Communications and Media Authority (ACMA) (1).

Throughout this report radiocommunications is used as a broad term to encompass all services that rely on electromagnetic or radio waves to transfer information. There are many forms of radio communication services operating in the vicinity of the proposed wind farm, and their susceptibility to interference from wind turbines associated with the proposal are discussed.

VHF and UHF radio signals, GPS and digital technologies are essentially unaffected by wind farm developments. This includes land mobile repeaters, radio, the audio component of analogue television and mobile phones. However, if not properly designed, wind farms can cause interference to analogue television broadcast and microwave signals. Currently analogue broadcast signals are used to transmit domestic television in Western Australia, while microwave signals are used for line of sight connections for data, voice and video. As the interference mechanisms are different for each of these signals, there are different methods used to avoid interference.

Conclusions from this assessment are included in Section 4 of this report.

2. INTRODUCTION

To conduct the EMI assessment for the proposed Flat Rocks wind farm, current radiocommunications sites and licenses in the vicinity of the proposed wind farm were identified from the Australian Communication and Media Authority (ACMA) database (1). The ACMA classifies geographic regions of Australia according to the demand for spectrum. The proposed development site is classified as a “Low Density Area”.

This assessment investigates the impact of the proposed Flat Rocks wind farm on:

- Fixed point-to-point links
- Fixed point-to-multipoint links
- Radiocommunications assets belonging to emergency services
- Meteorological radar
- GPS systems
- Wireless internet
- Broadcast radio
- Satellite television and internet
- Broadcast television

Airspace communications and navigational aids are discussed in a separate Airspace Assessment Report.

2.1 Description of the Site and Project

The proposed Flat Rocks wind farm development is located approximately 20 km south east of Kojonup, 27 km north west of Tambellup, 16 km west of Broomehill and 27km south west of Katanning in the Great Southern region of Western Australia. The general location of the area under investigation is shown in Figure 1. The site comprises predominantly of cleared agricultural land used for broadacre crop and livestock farming with small areas of scattered vegetation. Topography of the site is characterised by gentle slopes and hills which vary in elevation from 290m to 390m.

2.2 Proposed Wind Farm Layout

The proposed wind farm will comprise of up to 74 turbines with a maximum hub height of 84m and maximum blade tip of 140m, corresponding to a maximum rotor diameter of 112m. This EMI analysis has been conducted using wind turbines with the dimensions described above.

A list of co-ordinates of the proposed turbine locations is presented in Table 1 – Proposed 74 turbine layout for the Flat Rocks Wind Farm.

2.3 House Locations

A list of the dwellings located within 2km of the proposed Flat Rocks wind farm boundary is provided in Table 2 - Location of Residences.

2.4 Planning Guidelines

In Western Australia there are no specific guidelines for the assessment of the electromagnetic impact of wind farm developments. For the purposes of this assessment Planning Bulletin No 67 (2) from the Western Australian Planning Commission has been considered, in combination with the Draft National Guidelines for Wind Farm Development (DNWFG) published by the Environmental Protection and Heritage Council (EPHC) in July 2010 (3). These draft guidelines provide advice and suggest methodologies to identify and consult with likely affected parties, assess the EMI impacts and develop mitigation steps to address the likely EMI impacts. The DNWFG are currently in draft form and have not been endorsed by the planning authorities in Western Australia.

3. METHODOLOGY AND RESULTS

If not properly designed wind farms can interfere with both analogue television broadcast signals and microwave signals. Analogue broadcast signals are the common form of transmitting domestic television, while microwave signals are used for line of sight connections for data, voice and video. The mechanisms of interference are different for each of these technologies, and hence, there are different ways to avoid interference.

The methodology for assessing the potential interference to radiocommunications from the proposed Flat Rocks wind farm was to locate all communication towers within a 25-50km radius of the proposed site, and assess the communications licenses that are attached to these towers.

Other services operating within the vicinity of the proposed wind farm such as GPS and meteorological radar, have been identified and the potential for interference to these services is discussed. Relevant stakeholders have been consulted to identify likely impacts. A list of consulted stakeholders and their comments are contained in Appendix 1 – Stakeholder Consultation.

3.1 Communication Towers

Review of the ACMA database (1), identified 31 licensed sites within 25km radius of the proposed wind farm site. Table 3, Radiocommunications sites within 25km radius of the Flat Rocks wind farm from ACMA Database, shows the details of these sites

The closest communication tower to the proposed wind farm boundary is *SEC Site Potts Rd Enter Gate Opposite Bilney Rd* KOJONUP - ACMA Site ID 29045 which is approximately 2.45 km from the nearest wind turbine, WTG 40. Details of the licenses assigned to this communication tower are presented in Table 4. The closest telecommunication tower to the proposed development is located 5.8 km from the nearest wind turbine, WTG 72. This site is operated by Telstra, *Telstra Exchange Lumeah via Cranbrook* - ACMA Site ID 54257.

The DNWFG (3) state that operators of all telecommunication towers within 2km of a wind farm site need to be consulted to assess the likely impact on their services. Despite the proposed wind farm site exceeding these proposed proximity rules, MHE contacted Telstra Corporation Ltd in October 2010. Correspondence was received in November 2010 stating that following a desktop assessment of the telecommunication infrastructure around the proposed Flat Rocks wind farm site there is no potential for undue interference. This correspondence is contained in Appendix 2, Written Responses from Interested Parties.

3.2 Fixed license of point-to-point (microwave) type

Wind turbines can potentially cause interference to point-to-point microwave signals through diffraction, reflection/scattering and near field effects. It is possible to design wind farm layouts to avoid this interference, as the path and interference zone of point-to-point signals is generally well known. ACMA Site ID 29045 - *SEC Site Potts Rd Enter Gate Opposite Bilney Rd* KOJONUP is the nearest communication tower with fixed point-to-point type licenses to the proposed wind farm, located approximately 2.45 km from the closest proposed wind turbine, WTG 40. Figure 2 illustrates the transmission vectors for the fixed point to point type licenses within a 50km radius of the wind farm site. Point-to-point links are often used for line of sight connections for data, voice and video.

3.2.1 Diffraction

Wind turbines can diffract or interfere with point-to-point microwave signals. To avoid diffraction effects of these signals exclusion zones of circular cross-section around the direct path from the transmitter to the receiver are used. The exclusion zone is defined in terms of Fresnel zones. It is

generally accepted that to avoid interference to these signals wind turbines, including blades, should be kept outside the second Fresnel zone (3). The general equation for calculating the Fresnel zone radius at any point P in between the endpoints of the link is the following:

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

F_n = The nth Fresnel Zone radius in metres

d_1 = The distance of P from one end in metres

d_2 = The distance of P from the other end in metres

λ = The wavelength of the transmitted signal

The transmission vectors resulting from the licensed point to point links identified from the ACMA database within a 50 km radius of the development area are shown in Figure 2. Four fixed point-to-point transmission vectors cross the proposed development site, two in an area proposing wind turbines and two in an area without wind turbines. Table 5 and Table 6 present the details of these links and their associated exclusion zones. Three of these links are licensed to Electricity Networks Corporation trading as Western Power, and one is licensed to the Western Australian Police Service. Both operators have been contacted for comment on the wind farm proposal and potential effects to current services. Responses from these operators are documented in Appendix 2.

Generally interference to point to point links occurs at frequencies operating above 1 GHz (4). At frequencies below 1 GHz, point to point links are less reliant on line of sight as the signal is more able to propagate around objects. Link licenses *1624134* and *331238* have the greatest potential for interference by the proposed turbine layout. WTG 40 is located 50m from the vector 1624134 and WTG 67 100m from link license 331238. Table 5 shows the calculated exclusion zones are 111.98m and 148.9m respectively including the turbine blade. Both links operate on frequencies less than 1GHz at 451.05 MHz and 450.6 MHz, meaning they are less reliant on line of site. MHE has contacted Western Power, the operator of these links, requesting comment on the proposal. At the time of writing this report, no formal response had been received.

It is therefore recommended that MHE contact Western Power prior to finalisation of the layout and consider micrositing WTG 40 and WTG 67 by 60m and 50m, respectively. All other turbines are outside the exclusion zones.

3.2.2 Near –field effects and scattering

The DNWFG (3) mention the possibility of interference from wind turbines to point-to-point microwave links via two additional mechanisms, near field effects and scattering.

All transmitting and receiving antennas have a “near-field” zone, which requires freedom from any object that can conduct or absorb radio waves. If a wind turbine is located in close proximity to an antenna it can change the characteristics of that antenna resulting in near-field effects. The near field zone is easily

calculated using various antenna characteristics. Below are typical "near field" zones of common point to point microwave links:

- High Band Ultra High Frequency (UHF) signals, such as cellular telephones (800MHz to 1900MHz) approximately 20m.
- For point-to-point Microwave links approximately 720m.
- For Low Band VHF paging systems approximately 4m.

The above examples provide a conservative criterion for assessing potential impacts due to near-field effects from wind farms. The draft wind farm guidelines state that near field effects are usually limited to approximately 720m from a telecommunication tower or facility and it is recommended that consultation occur with the service operators should a wind turbine be proposed within 1km from a telecommunication facility.

Scattering is interference to radio signals which can be caused by the reflection of the signal by the blades of the wind turbines (3). The DNWFG state that scattering is best avoided by placing wind turbines more than 2km from telecommunication towers. The closest proposed wind turbine to a telecommunication tower in the Flat Rocks wind farm development is 5.8 km, which is outside the recommended distance of 2km, thereby making interference to the signals unlikely. Despite this, MHE has contacted the service provider, Telstra Pty Ltd, requesting feedback on the potential interference of the wind farm on current services. A letter was received from Greg Parker, Area Planner, Network and Technology Forecasting and Area Planning, stating that "based on the information provided, the proposed wind farm has no potential to produce undue interference." This correspondence is attached at Appendix 2 - Written Responses from Interested Parties.

3.3 Fixed licenses of point-to-multipoint type

Fixed point-to-multipoint type licenses are a variation of the point-to-point license. Whilst a point-to-point license permits communication between two static sites, where the locations of the sites are detailed in a licence register such as the ACMA Radiocommunications Database, a point-to-multipoint license allows communication between one or more static sites and multiple points, or between the points. The point-to-multipoint type is usually licensed for a defined operational area.

The ACMA database (1) details the location of the static station for fixed point-to-multipoint licenses only, not the multipoint or operational area, thus making identification of transmission vectors difficult. Review of fixed point-to-multipoint type licenses on the ACMA database identified two static points in the vicinity of the proposed Flat Rocks wind farm. The *Telstra Microwave Site Fairfield Road 9km S from Kojonup Katanning Road* –- ACMA Site ID 28315 and the *Wawa Site Fairfield Road KATANNING* – ACMA Site ID 28330. Site 28315 is located approximately 16.85 km north east of the closest wind turbine (WTG 2) whilst site 28330 is located approximately 16.7 km north east of the closest wind turbine (WTG 2). The details of the license holders associated with these sites are provided inTable 7 and the location of licensed static stations are displayed in Figure 3 - Location of Point-to-Multipoint licenses. MHE has contacted the license operators seeking feedback in regards to potential interference from the wind farm on these services. No formal response had been received to date from either operator.

3.4 Other License Types

The ACMA database (1) was reviewed for other license types in the general vicinity of the proposed Flat Rocks wind farm. Those identified can generally be described as base to mobile station communications, including radio broadcasting, commercial and private telephony. The presence of wind turbines do not generally affect these types of licenses any more than effects such as alterations in terrain, vegetation and other forms of signal obstruction. Additionally, there are no base stations located within the wind farm development site so only minor local obstructions may occur. Should reception difficulty be encountered, the amelioration method consists of the user simply moving a short distance to receive a clearer signal.

3.5 Emergency and Local Shire Services

Radio communication assets operated by the local shires and emergency services in the vicinity of the proposed wind farm were identified via the ACMA database (1). FESA, Western Australian Police, St John Ambulance and the local bush fire radio (through the local shire and FESA) were found. All operators have been contacted requesting comment on the likely effect of the proposed wind farm development on current services, Appendix 1. The details of these services and their location are presented in Table 8.

3.6 Differential Geographical Positioning System (GPS)

GPS signal reception satellites are not detrimentally affected by wind farms (4). At any one time a standard GPS receiver will be communicating with many GPS satellites located in various positions in the sky. The receiver should therefore be able to communicate and operate with several of these satellites at any one time regardless of its position, or the position of the wind turbines. Therefore the likelihood of interference to GPS signals will be limited to users in the immediate vicinity of the wind farm, i.e. moving between the turbines.

MHE is aware that a number of farmers in the area within and surrounding the proposed wind farm may use GPS in their agricultural activities. Typically these services are utilised in the form of tractor auto-steer to accurately locate farm machinery on the ground, so that cropping activities such as seeding, fertiliser and chemical applications and harvesting can be completed with very high accuracy. There are two types of systems available, Differential GPS (DGPS), or a Real-Time Kinematic (RTK) GPS system, the later delivering greater accuracy. Both systems utilise ground based stations to improve the spatial accuracy above that achievable with conventional GPS systems.

In Australia transmissions between the base station and the GPS receiver for DGPS systems occur at frequencies of around 300 kHz or 100 MHz (5, 6) and are unlikely to be influenced by wind turbines. RTK systems communicate between the base station and a vehicle at frequencies between 400 and 900 MHz, and depending on the frequency of operation, maybe susceptible to interference. It should be noted these systems are designed to operate in the close proximately of other objects, such as trees and buildings and are expected to be robust to any potential interference from a wind turbine. As the vehicle fitted with the auto-steer system is continually moving, any potential interference is likely to be transient, and these systems are designed to quickly reacquire the base station signal when it becomes available again. If continual signal interference between the base station and vehicle occurs, it is possible to move

the base station to a new location, or use a mobile base station to provide coverage from a location where interference from the turbines is not likely to occur.

MHE will consult with surrounding landowners prior to final design layouts to ensure the location of services are known to further minimise the potential for disruption to these services.

3.7 Meteorological Radar

Wind turbines have the potential to interfere with meteorological and aviation radar. Reflection off turbine blades may give false readings or create a radar "shadow" behind turbines. Due to the distance from meteorological radar assets, it is unlikely that the proposed wind farm will cause any significant interference to meteorological radar. As per the draft national wind farm guidelines, MHE contacted the Bureau of Meteorology to provide feedback on the potential impacts of the Flat Rocks wind farm on meteorological radar operations. To date, this correspondence has been acknowledged but no comment on the effects of the proposed wind farm on operations has been received.

The Bureau of Meteorology (BOM) operates a network of weather stations across Australia, many of which use radar instruments for measuring wind speeds in the upper atmosphere (known as wind finding radar), and determining rain and storm activity (known as weather watch radar).

The "wind finding" radar uses radar echo from a target to determine wind speeds and direction. The target is attached to a balloon and tracked by ground radar. The "weather watch or surveillance" radar consists of a rotating antenna located on a building that is used to direct a thin beam of radio energy upward into the atmosphere which is then reflected back by a cloud mass. The location of the cloud is then determined by the direction and travel time of the reflected beam.

Wind profile measurements are used to ensure safe operation of aircraft and play a vital role in the Bureau's general weather forecasting system. "Weather watch" radars monitor weather situations and have the ability to predict potentially severe storms out to a distance of 250km or more. So whilst a meteorological radar may not be as critical as perhaps an aviation radar, they play a significant role when you consider public safety if severe weather is not predicted.

Wind farms located at distances greater than 5km from a BOM field station are unlikely to affect wind finding radar operations (3). However, wind farms can impact upon weather watch radar when located within several hundred kilometers of a radar station. The DNWFG recommend consultation with operators of weather stations if wind farms are proposed within 200nm of operating weather stations. Table 9 shows the location and distance of the operating BOM radar stations in the southern regions of Western Australia. Figure 4 displays this information graphically in Goggle Earth.

MHE has highlighted these operating stations and the location of the proposed wind farm with the BOM.

3.8 Citizens Band Radio

Citizen's Band Radio, or CB radio, is a class-licensed two-way, short distance, communication service that can be used in Australia by any person, for private use or work purposes. The class license means that all users of the CB radio operate within the same frequency on a shared basis and no individual license is required.

The CB radio service operates on two frequency bands, High Frequency (HF) band between 26.965 MHz and 27.405 MHz, and Ultra High Frequency (UHF) band between 476.425 MHz and 477.400 MHz. Over the last decade the use of 27 MHz or HF CB radio service has declined and has been replaced by UHF CB radio. CB radio services can be used for voice communication activities, telemetry and telecommand applications.

The UHF CB radio uses the FM transmission mode and is unique to Australia providing clear communication over 5-10km. In order to work well, UHF CB radio requires line of sight and is easily hindered by hilly terrain and forested areas. If on a hill top CB radio signals can be transmitted over at least 50km. Repeater stations are often set up on hilltops by community and commercial organisations to transmit signals from one channel to another. Whist no individual or organisation owns or has a right to use a channel exclusively of the 40 channels available, some are allocated to emergency, repeater and telemetry inputs.

As users of CB radio are not required to have a license, there are no records of users of the service and their locations and the channels are shared among the users and the repeater stations without a right of protection from interference. The impact of the proposed wind farm on local CB radio is expected to be minimal. In the event that interference from a wind turbine does occur, the simple mitigation steps are to move a short distance until the signal strength improves, a process currently used with existing forms of interference.

3.9 Mobile Telephones

The mobile telephone network operates at frequencies of between 800 and 900 MHZ, or between 1800 and 2100 MHz. At these frequencies, signals are likely to be affected by physical obstructions such as buildings and wind turbines. These networks are however designed to operate in such conditions and in most cases, if there is sufficient mobile network coverage and signal strength, the presence of wind turbines is unlikely to cause interference.

In rural areas, the mobile network coverage may be more susceptible to physical obstructions due to the large distance between the telephone towers and the mobile phone user. In that case, wind turbines could cause some interference to the signal.

MHE has obtained mobile telephone network coverage maps from Telstra and Optus (7, 8). The mobile network coverage of these providers in the Flat Rocks area is shown in Figures 5, 6 and 7, respectively. Overall the development area has variable mobile GSM coverage for Telstra and in some locations, only mobile satellite coverage is available. In terms of Telstra's Next G network again there is considerable variation coverage in and around the proposed site, however a higher level of access is present in comparison to the GSM network. The Optus mobile network coverage in the area is also varied with the majority illustrated as good service with areas requiring an external antenna. For these areas, the signal might be susceptible to interference if a wind turbine intercepts the signal between a mobile phone and the tower. In cases of marginal network coverage, simple mitigation procedures such as moving a short distance to a new location until the signal strength improves or installing an external antenna may improve signal quality. Again this is a practice currently used by individuals in areas of variable coverage.

3.10 Wireless Internet

A desktop review of wireless internet service providers operating in the Flat Rocks, Great Southern, Kojonup and Broomehill regions revealed that internet access in the area surrounding the proposed wind farm is likely to be provided via the 3G mobile network or satellite. Please refer to Section 3.9 of this report for additional comments on the likely impact of the Flat Rocks wind farm on the 3G network. Implications for interference of wind farms to satellite internet services are similar to those affecting satellite television services, refer to section 3.11.

3.11 Satellite Television and Internet

Some residents in the vicinity of the Flat Rocks wind farm may access television or the internet, or both via satellite. Satellite television is delivered from a communication satellite to a satellite dish connected to a set-top box. The satellite transmits television signals to the user's antenna at two frequency bands; the C band at between 4GHz and 8 GHz, and the K_u band at between 12 GHz and 18 GHz. Signals in the C band are susceptible to interference due to radio relay links, radar systems and other devices operating at a similar frequency. Meanwhile K_u band signals are most likely to be affected by rain which acts as an excellent absorber of microwave signals at this frequency.

In case of satellite internet, a user's computer is connected to a satellite modem which is in turn liked to a satellite dish mounted on the roof. According to the Australian ISP directory (9), there are at 13 satellite internet providers operating in the vicinity of the proposed Flat Rocks wind farm. The contact details of these providers are presented in Table 10 - Satellite internet providers operating in the vicinity of the proposed Flat Rocks wind farm. These providers have been contacted for comment on the likely impact of the proposed wind farm on their services. To date there have been no responses.

The main satellite for Pay TV and free-to-air TV in Australia is the Optus C1 satellite. From the proposed wind farm site, the Optus C1 satellite has an elevation of approximately 33.1^{o} and azimuth (true) 55.1 ^{o} and azimuth (magn.) 56.8 ^{o} (10). It is unlikely that the proposed wind farm will impact upon the line of sight from this satellite to any dwelling in and around the wind farm.

3.12 Radio Broadcasting

In Australia, AM radio operates in the Medium Wave (MW) band at frequencies of between 520 kHz and 1610 kHz, while FM radio operates in the very high frequency band (VHF) at between 87.5 MHz and 108 MHz. The locations of the AM and FM broadcast transmitters in the vicinity of the proposed wind farm are shown in Figure 8.

Broadcast radio signals generally do not experience interference from wind turbines unless residences are within tens of meters from a wind turbine (4). AM radio signals are very unlikely to be affected by wind farms. FM radio signals are more susceptible to interference in the form of low level hiss or distortion, but generally only in close proximity to a wind turbine. Any reception difficulties experienced should be rectified by the installation of a high quality antenna.

3.12.1 AM Radio

AM radio waves are able to travel significant distances under the right conditions as they are diffracted by the ground as they propagate, such that they follow the curvature of the earth, and are refracted by the ionosphere at night. Their long wavelength means they can readily propagate around relatively small physical obstructions (such as a wind turbine). They do not however propagate easily through dense building materials like brick, concrete and aluminum.

The large distances that AM radio waves can travel means that by the time the signal reaches a receiver, it may be weak and therefore susceptible to interference. Some of the possible sources of interference include changes in atmospheric conditions, other distant signals from AM broadcasters operating on a similar frequency, electrical power lines and electrical equipment including electric motors.

As AM radio signals are able to propagate around obstructions such as wind turbines, it is expected that the proposed wind farm will not cause significant interference for a receiver. The long wavelength of the AM radio signal means interference is only likely in the immediate vicinity of a turbine (11). Any interference which may occur is likely to be resolved through the installation of a high quality antenna and or amplifier.

3.12.2 FM Radio

Unlike lower frequency signals, FM radio waves are more suited to short range broadcasting as they are not reflected or refracted off the ionosphere. The waves are slightly refracted by the atmosphere and curve back towards the earth, this means they can propagate slightly beyond the visual horizon. They may however be blocked by significant terrain features. Subsequently FM radio stations tend to have only local coverage which means that signals are less susceptible to interference from other distant FM broadcasters. They are also less susceptible to interference from changes in atmospheric conditions and electrical equipment than AM signals.

FM radio signals are susceptible to interference from buildings and other structures, although less vulnerable than higher frequency signals. Reflection or scattering of radio waves commonly associated with hissing or distortion can be caused by physical structures which reduce signal strength at the receiver. Physical structures can also cause multi-path errors through reception of a reflected signal in addition to the primary signal from the transmitter. Generally any interference to FM signals is only likely to occur in the immediate vicinity of the wind turbine (11), and can be easily rectified through the installation of a high quality antenna and or amplifier.

3.12.3 Digital Radio

Metropolitan license areas have had access to digital radio services since July 2009. The digital radio services offered use an updated version of the digital audio broadcasting (DAB) digital radio standard, DAB+, to broadcast digital radio to Adelaide, Brisbane, Perth, Melbourne and Sydney. Figure 9 - Perth digital radio coverage, shows the current digital radio footprint for Western Australia. This map illustrates that digital radio is not yet available in the Flat Rocks region (12). The digital radio channels ABC Dig, Music, ABC Jazz, SBS Radio 1 and SBS Radio 2 however are being broadcast as digital TV channels and are accessible with a high definition digital tuner.

3.13 Television Broadcasting

Large scale interference to analogue television broadcast signals (point-to-area) can generally be avoided by locating wind turbines at least 1km away from a broadcast tower. No analogue television broadcast towers are located within 1km of the proposed Flat Rocks wind farm development. There are two broadcast towers within the 50 km radius investigated; the closest is located 23.2km west of the proposed site, *1.6 km south of Kojonup*. The other broadcast tower is 24.3km north east of the proposed site at the *Wawa Site on Fairfield road in the Shire of Katanning*. Even with such large buffers from the broadcast towers interference to analogue television is still possible at residences in and around the wind farm site. It is important to note however that by the end of 2013 analogue television is scheduled to be replaced by digital television in the Flat Rocks area and digital television signals are less susceptible to interference from wind turbines. The introduction of digital television in the area coincides with the project's expected construction and connection dates of late 2013 early 2014.

Television broadcast signals are omni-directional or point-to-area signals, so interference from wind turbines is dependent on several factors, including:

- proximity of wind turbines to television broadcast towers;
- proximity of wind turbines to receivers (in most cases residential dwellings);
- location of wind turbines in relation to dwellings and television broadcast towers;
- the rotor blade material, rotor speed and rotor blade direction (always into the wind);
- type of receiving antenna (e.g. directional and height); and
- the frequency and power of the television broadcast signal.

Broadcast towers are either relay or primary transmitters. Relay TV transmitters tend to be located in rural areas whilst primary TV transmitter towers of higher power are more commonly located in larger urban areas. Typically a clearance of at least 6km is recommended for primary TV transmitters, while a clearance of at least 1km is recommended for relay TV transmitters (13).

For more information on the proximity of the proposed wind farm to television transmitters refer to section 3.13.2.

3.13.1 Digital Television

The switch to digital television for the Great Southern region in Western Australia is scheduled for the second half of 2013 between July and December (14). From this point onwards, analogue television signals will cease transmission. It is therefore highly likely that analogue television signals will be unavailable by the time the proposed wind farm has commenced constructed. Digital television will therefore be the main form of free to air television when the Flat Rocks wind farm is operational. It is important to note that digital television signals are less susceptible to interference from wind turbines than traditional analog television signals.

A recent report published by the UK telecommunications regulator Ofcom (15), made the following conclusions regarding interference to digital television reception.

"Digital television signals are much better at coping with signal reflections, and digital television pictures do not suffer from ghosting. However a digital receiver that has to deal with reflections needs a somewhat higher signal level than one that has to deal with the direct path only. This can mean that viewers in areas where digital signals are fairly weak can experience interruptions to their reception should new reflections appear… reflections may still affect digital television reception in some areas, although the extent of the problem should be far less than for analogue television".

Two conclusions can be drawn from this report:

- Firstly that digital television signals are very robust and do not suffer from ghosting. In most cases digital television reception should be satisfactory in and around wind farm developments.
- Secondly, that areas of weak signal can experience interruptions to their reception should new reflections appear, such as those from nearby wind turbines.

The ABC Reception Advice website (16), illustrates that the area around the wind farm is able to receive an adequate digital television signal mainly from the Southern Agricultural WA, Mt Barker transmitter, Figure 10 - ABC Digital TV - Southern Agricultural WA, and to a lesser extent the Wagin transmitter, and Figure 11 - ABC Digital TV - Wagin, WA .

3.13.2 Analogue Television

The Broadcast Transmitter Database (17) was reviewed to identify the location of broadcaster transmitters close to the proposed wind farm, Figure 12 - Analogue broadcast transmitters proximate to the Flat Rocks wind farm.

Local interference to analogue television can occur at individual houses in and around the proposed wind farm. A wind turbine has the potential to scatter analogue television waves forwards and backwards. Forward scatter only occurs if the wind turbine is located between the dwelling and the broadcast site. The forward scatter region is shown in Figure 13 - Potential analogue television interference zones around a wind turbine, and generally does not extend further than 5km (14, 18). Interference may extend beyond the 5km zone if the dwellings are screened from the broadcast tower, whilst having line of sight to wind turbines. Forward scatter effects can cause the brightness of the television picture to vary with the rotation of each blade. Modern television sets tend to contain Automatic Gain Compensators (AGC) which lessen or eliminate these variations in picture gain or brightness.

Back scattered signals arrive at the dwelling delayed relative to the source signal from the broadcast tower. The back scatter region shown in the Figure 13, generally does not extend further than 500m (14). Therefore if a dwelling is within 500m of a wind turbine and its receiving antenna is not sufficiently directional to discriminate between the original and delayed signal, then a pulsating ghost or secondary signal may appear on the television screen. No residential dwellings are located closer than 1km from a wind turbine in the proposed wind farm, thereby making back scattering unlikely to occur. The potential for interference will be reduced in houses already using set top boxes to receive digital television, as a digital TV signal are less susceptible to interference from a wind farm.

Potential interference to analogue television signals in and around the proposed site have not been directly identified in this report, as analogue TV signals are due to be switched off in the Flat Rocks area and replaced with digital TV between July and December 2013 (14). As the current digital TV coverage in the vicinity of the proposed wind farm is adequate, refer to Figure 10, and that the wind farm is not

expected to be operational until late 2013 early 2014, this simplified analysis of analogue TV interference is appropriate as the potential for interference to signals are minimal. Should interference occur, MHE has a range of mitigation options discussed in the following section. MHE is aware through the local council public submissions process, that many residents in the vicinity of the wind farm are already experiencing poor analogue television reception. In view of this fact and the recommendations made in the DNWFG, all houses within a 5-10km of the wind farm should undergo baseline testing of TV signals prior to construction for picture quality and sound level.

During construction and operations, MHE will monitor any television reception interference as part of local community consultation with consideration of baseline, construction and operational status.

3.14 Mitigation Options

In the event that TV interference is encountered and attributable to the wind farm, the following mitigation options are available to rectify the situation:

1. Realigning the resident's TV antenna more directly towards their existing transmitter;
2. Tuning the resident's antenna into alternative sources of the same or suitable TV signal;
3. Installation of more directional and/or higher gain antenna at the affected residence;
4. Relocating the antenna to a less affected position;
5. Installation of satellite TV at the affected residence; and
6. Installation of a TV relay station.

The introduction of digital television broadcasts provide an attractive mitigation option for residences in and around wind farms as digital television signals are essentially unaffected by wind turbines. Analogue television is currently scheduled to be phased out in regional Western Australia in mid to late 2013 (14).

In the unlikely event that digital television can not provide an acceptable outcome, satellite television represents another mitigation option. Satellite based television services comprise of both free to air and subscription based broadcasts.

4. CONCLUSIONS

MHE has investigated the potential of electromagnetic interference from the Flat Rocks wind farm and identified all broadcast towers and transmission vectors in the vicinity of the proposed development. MHE has contacted all relevant stakeholders requesting comment on the potential for interference to services as a direct result of the proposed wind farm. At the time of writing this report, no operator had identified any problems or potential for interference.

Radio signals, GPS and digital technologies will be unaffected by the wind farm development and includes land mobile repeaters, radio, the audio component of analogue television and mobile phones. Currently analogue broadcast signals, which may be susceptible to interference from wind turbines, are used to transmit domestic television in Western Australia. In mid 2013 and coinciding with commencement of construction, digital television will be the main form of TV broadcast signal in the Flat Rocks region. As digital signals are less likely to be affected by interference from wind turbines, interference to TV signals is not expected.

Two point to point type microwave link vectors pass through the proposed wind farm in close proximity to proposed wind turbines, WTG 40 and WTG 67. Appropriate exclusion zones for these links have been calculated and compared to the current buffer zones for the proposed wind turbine layout. MHE has contacted the operator of the links for feedback on service effects and to date has had no reply. It is recommended that prior to finalisation of the turbine layout MHE liaise with the license operator or consider relocating WTG 67 and WTG 40 by 50m and 60m respectively. It is also advised that the accuracy if the radiocommunications sites co-ordinates obtained from the ACMA database be verified as the accuracy of these coordinates is variable (3).

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Figure 1: Locality Map - Proposed Flat Rocks Wind Farm.

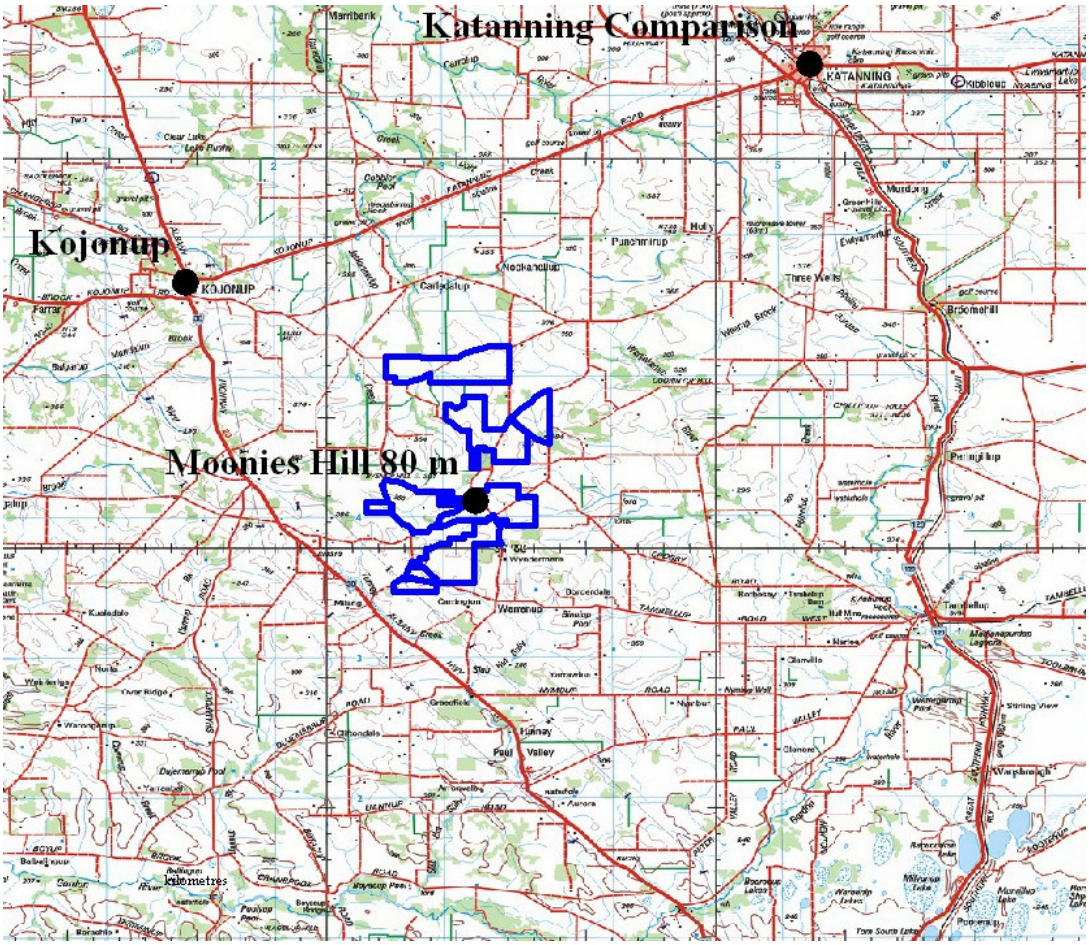


Figure 2: Transmission vectors for Fixed Point to Point Licenses within 50km of the Flat Rocks wind farm.

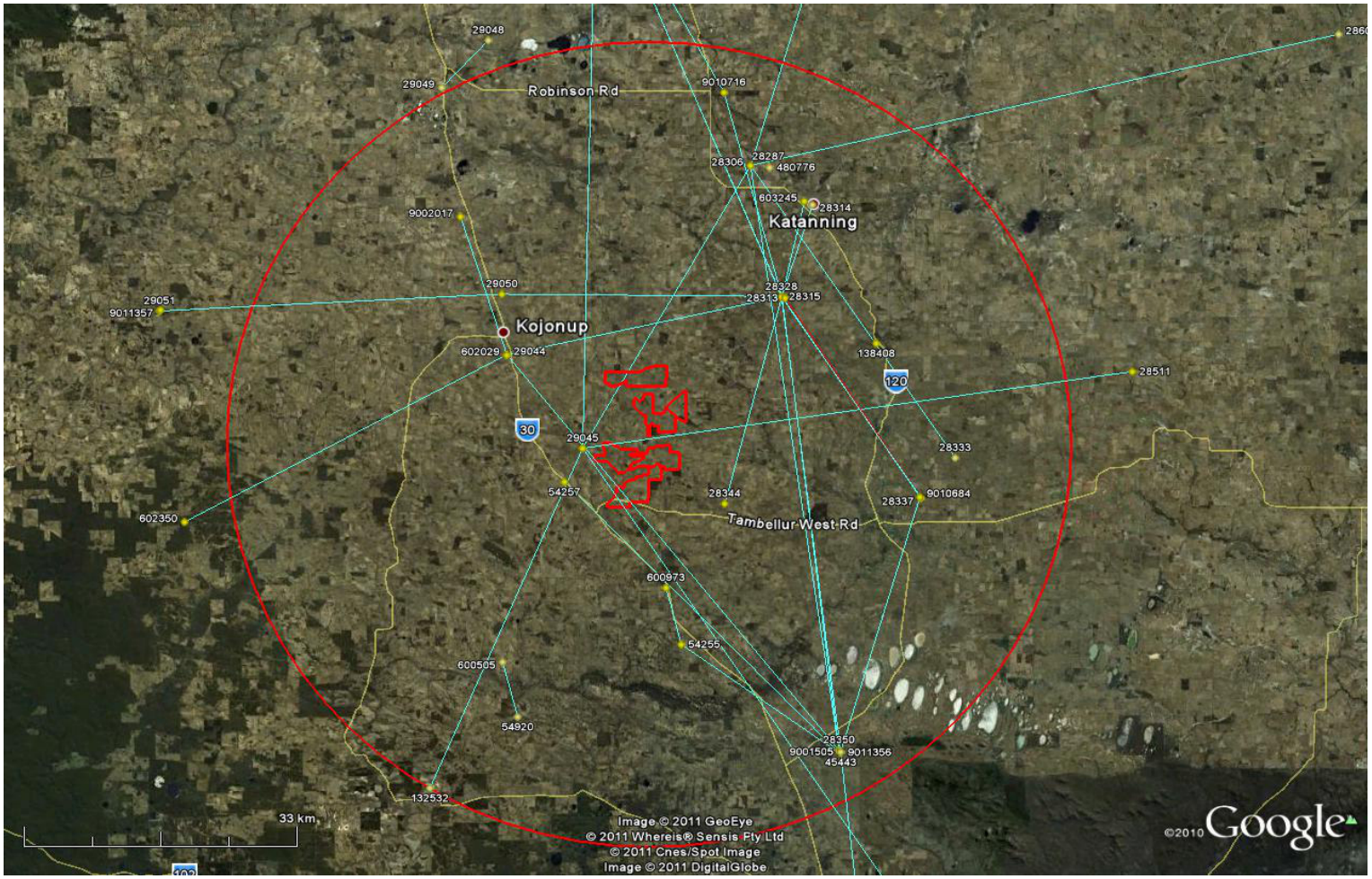


Figure 3: Location of Point-to-Multipoint licenses.

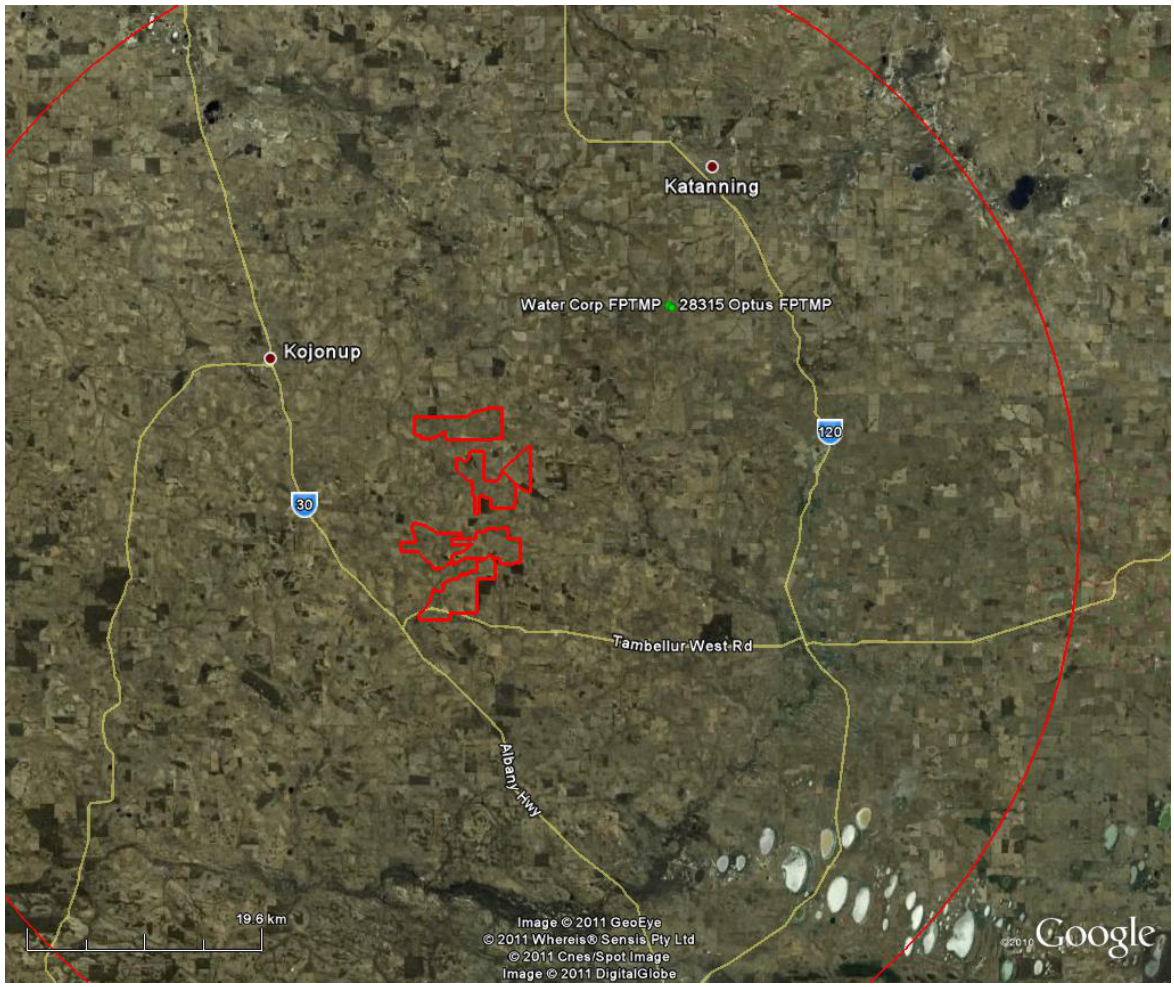


Figure 4: BOM radar sites relative to the Flat Rocks wind farm.

Figure 5: Telstra 3G and GSM Coverage Map proximate to the Flat Rocks wind farm.

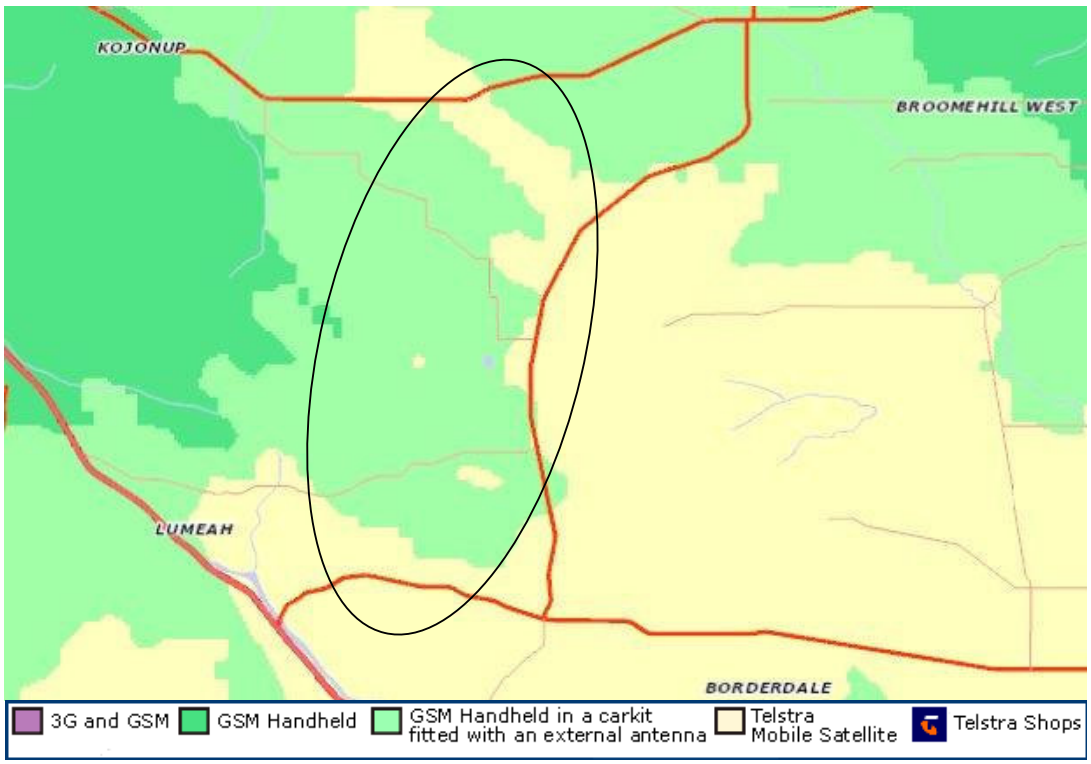


Figure 6: Telstra Next G Coverage Map proximate to the Flat Rocks wind farm.

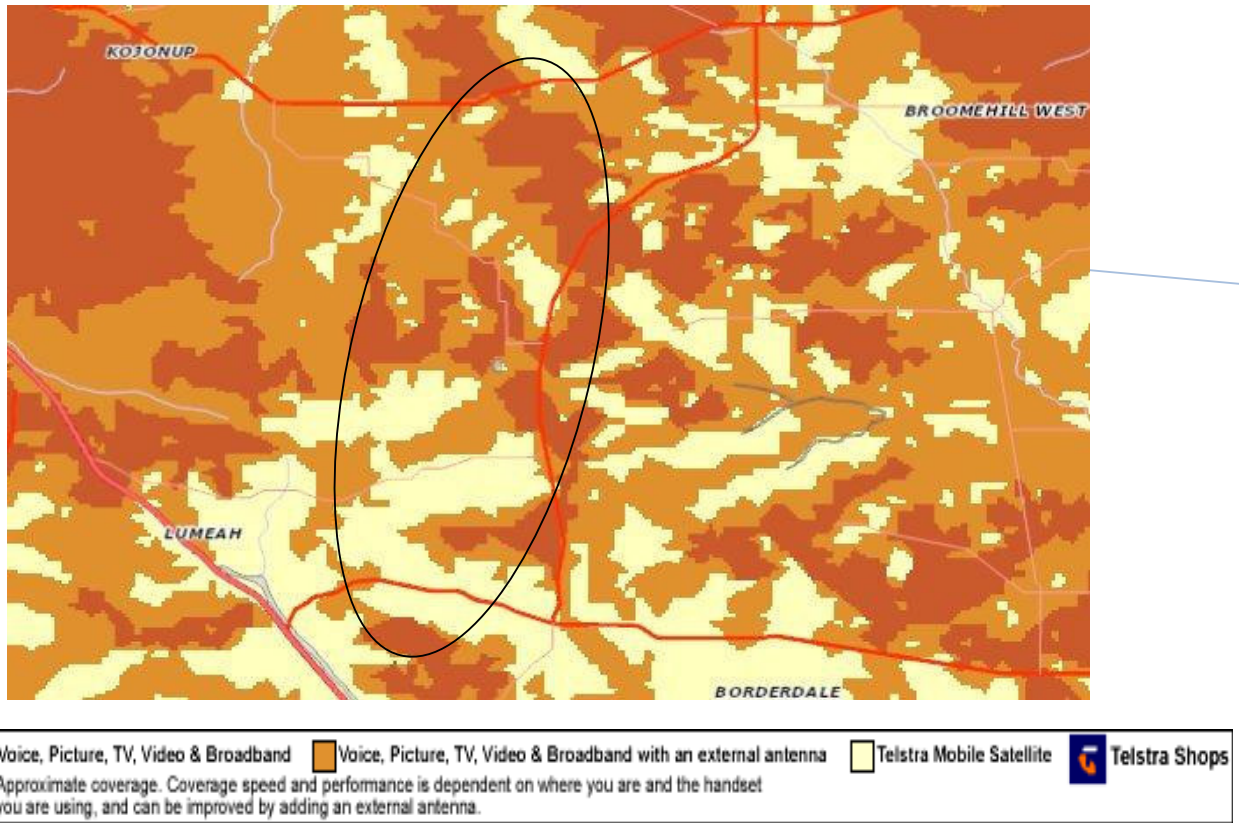
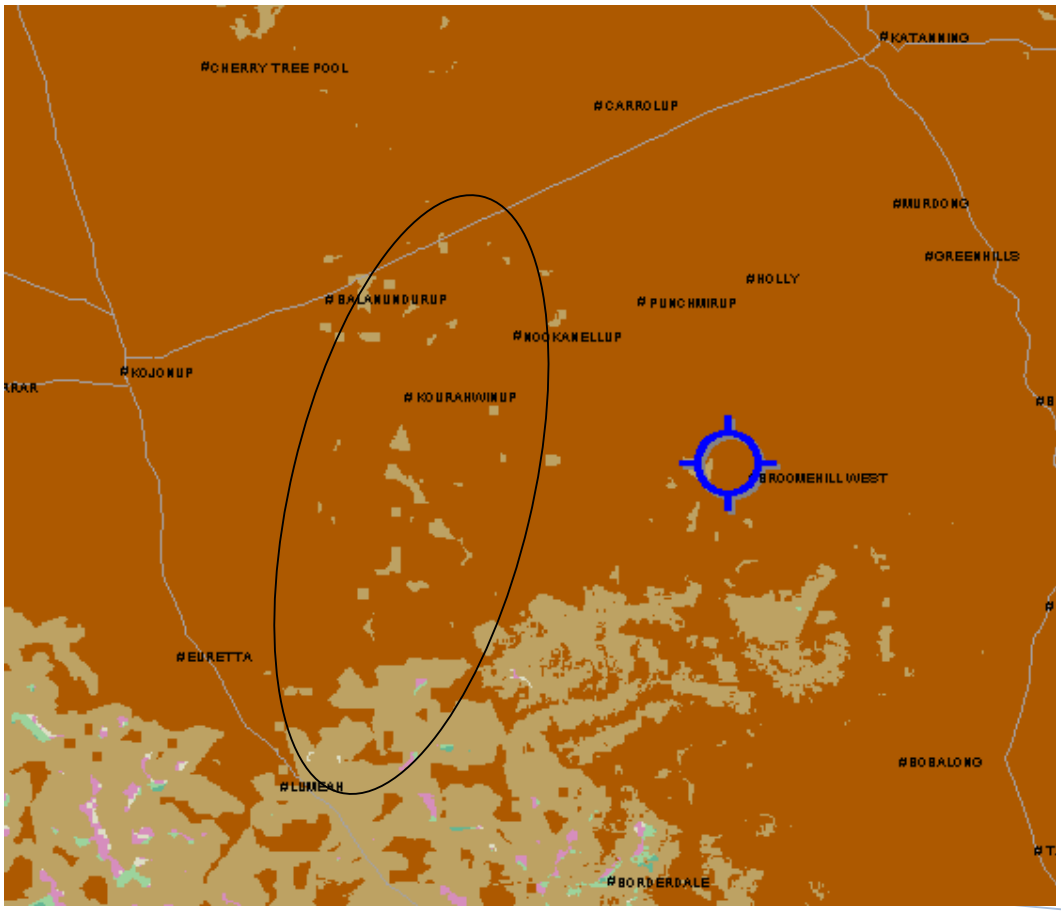


Figure 7: Optus Open Network Coverage Map proximate to the Flat Rocks wind farm.

Optus Open Network Coverage Locator

Address : BROOMEHILL WEST 6318 WA Date/time : 23/04/2011 7:24:48 PM



LEGEND

The Open Network includes:

3G dual band: on street voice, data & video *

3G dual band: on street voice, data & video with external antenna *

3G single band: on street voice, data & video ^

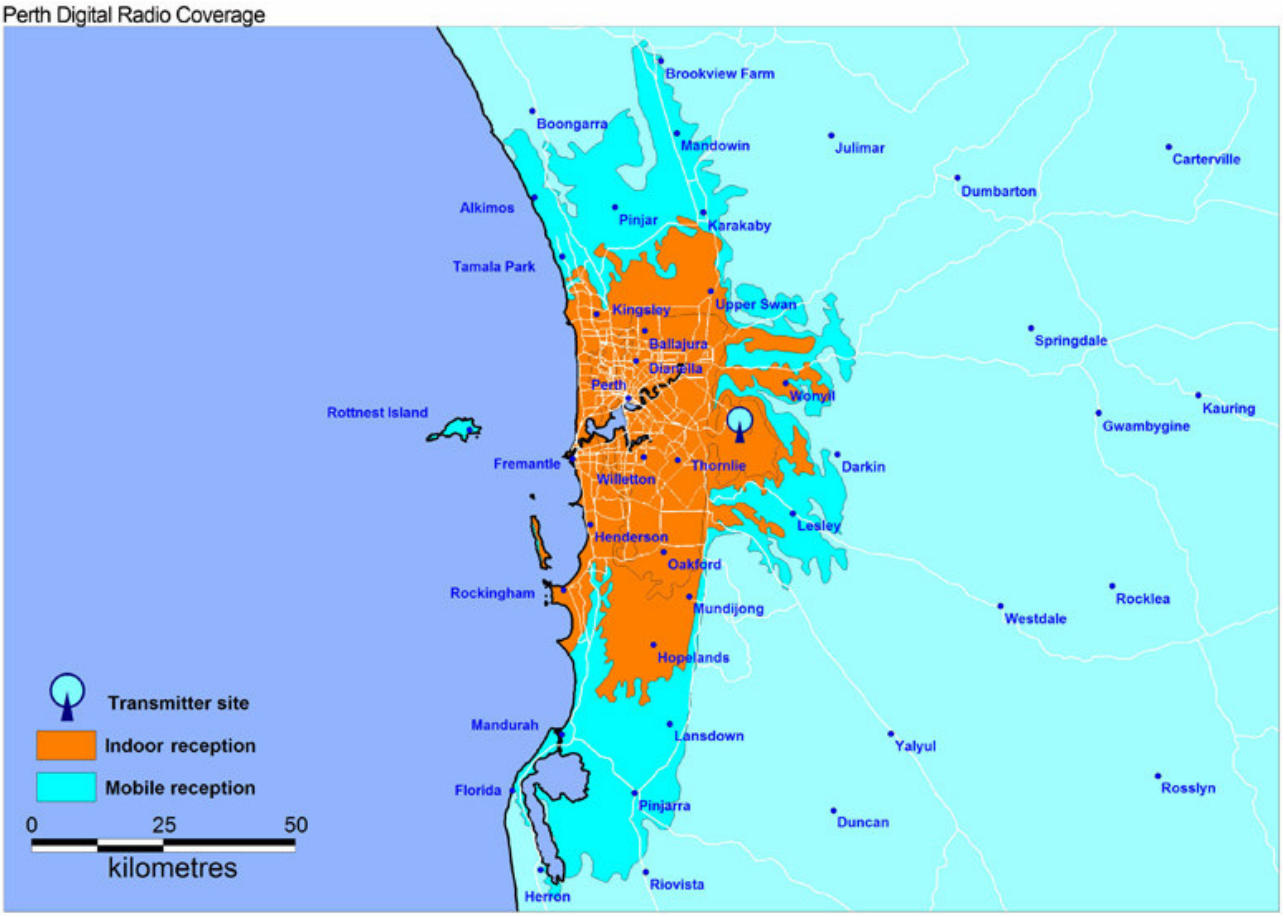
Future 3G dual band: on street voice, data & video*

2G on street voice & GPRS #

2G car kit with external antenna voice & GPRS #

Figure 8: AM and FM Broadcast transmitters proximate to the Flat Rocks wind farm.

Figure 9: Perth digital radio coverage (12)



The best way to contact the ABC Reception Advice team is by calling 1300 13 9994.
This number is staffed between 8am and 7pm weekdays (Sydney time). Voicemail is available outside these hours.
There may be more information at
http://abc.net.au/reception/radio/digitalradio.htm
http://abc.net.au/reception/contact/

Figure 10: ABC Digital TV - Southern Agricultural, WA

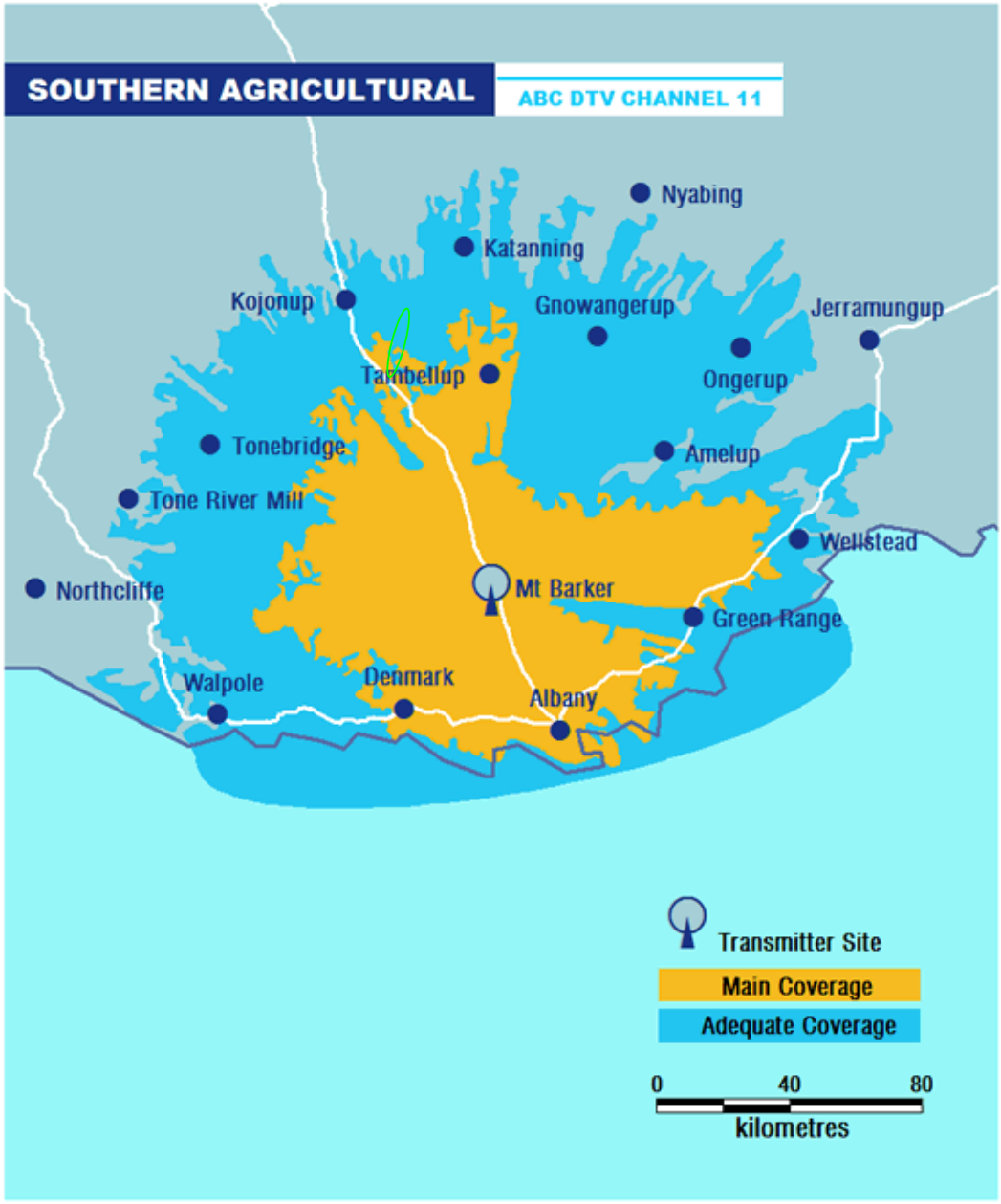


Figure 11: ABC Digital TV - Wagin, WA

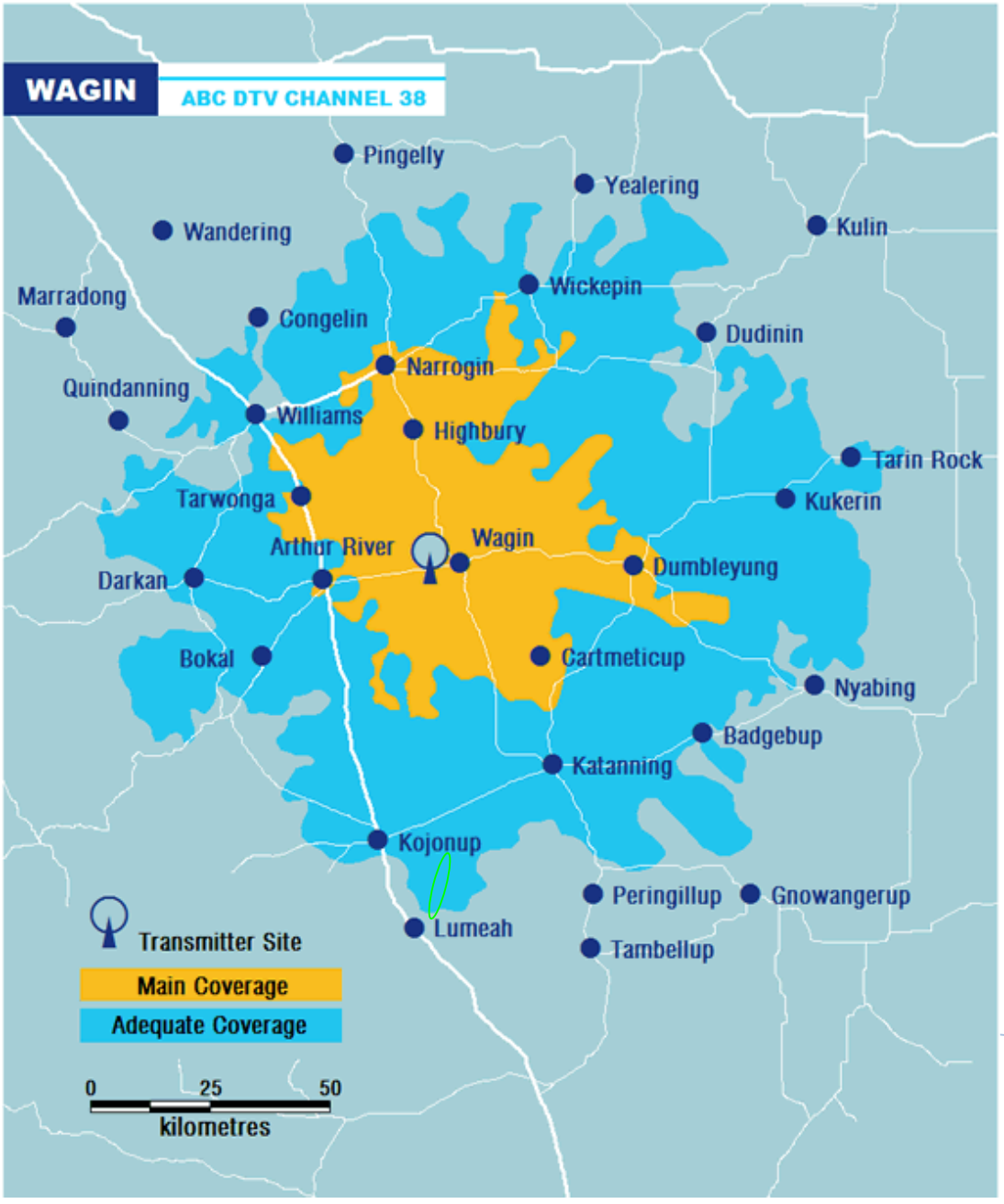


Figure 12: Analogue broadcast transmitters proximate to the Flat Rocks wind farm.

Figure 13: Potential analogue television interference zones around a wind turbine

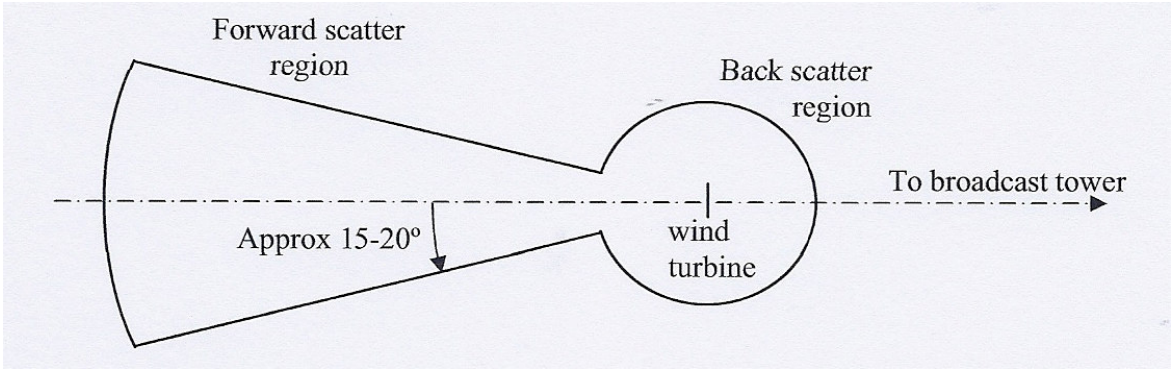


Table 1 – Proposed layout for 74 turbines for the Flat Rocks wind farm

Turbine ID	Easting	Northing	Turbine ID	Easting	Northing
1	533353	6251758	38	526877	6242486
2	533872	6251546	39	527681	6242229
3	532675	6251443	40	526488	6242210
4	533626	6251119	41	527310	6241900
5	532328	6250880	42	528113	6241847
6	533248	6250736	43	531840	6241787
7	533756	6250500	44	532391	6241738
8	531575	6250252	45	527860	6241246
9	532922	6250191	46	532100	6241227
10	532333	6250139	47	531471	6241171
11	533464	6250113	48	530014	6241007
12	533791	6249619	49	530604	6240976
13	533260	6249574	50	532458	6240750
14	536267	6247980	51	530327	6240492
15	536201	6247429	52	532848	6240303
16	534497	6246947	53	530035	6240010
17	530818	6247319	54	533060	6239760
18	536269	6246950	55	529575	6239800
19	534021	6246789	56	533224	6239233
20	535002	6246668	57	533285	6238735
21	531467	6246454	58	533253	6238266
22	530744	6246520	59	531682	6237572
23	535002	6245864	60	530107	6237475
24	535977	6246267	61	531221	6237400
25	531130	6246118	62	530660	6237354
26	534675	6246351	63	530360	6236850
27	535305	6246210	64	531585	6236810
28	531636	6245855	65	530044	6236516

29	534457	6245858	66	531584	6236243
30	531663	6245378	67	528030	6236155
31	531924	6244916	68	530335	6236001
32	534160	6246308	69	527800	6235752
33	534374	6244473	70	531374	6235569
34	531927	6244440	71	527479	6235400
35	533574	6244165	72	527103	6235127
36	534120	6244096	73	527537	6234777
37	531648	6246882	74	528087	6234661

Coordinate system UTM zone 50H, WGS84 datum

Table2 – Location of Residences

House ID	Easting (m)	Northing (m)	Distance to closest turbine (km)	Occupied?
NSH01	529798	6252398	2.8	Y
NSH02	534034	6254130	2.5	N
NSH03	534715	6252104	1.0	Y
NSH04	533706	6248509	1.1	N
NSH05	538397	6245086	2.7	Y
NSH06	536092	6244487	1.7	Y
NSH07	536187	6243019	2.3	Y
NSH08	533602	6237033	1.3	Y
NSH09	533299	6237262	1.0	Y
NSH10	527067	6249862	4.5	Y
NSH11	527858	6248864	3.3	Y
NSH12	529822	6247171	1.0	Y
NSH13	530084	6245361	1.3	Y
NSH14	531650	6243477	1.0	Y
NSH15	532980	62442569	1.0	Y
NSH16	527583	6245239	2.8	Y
NSH17	525526	6244591	2.5	Y
NSH18	525548	6238704	3.4	Y
NSH19	528558	6237293	1.3	Y
NSH20	531581	6233170	2.4	Y
NSH21	526817	6247723	4.0	Y
NSH22	529707	6247138	1.1	Y
NSH23	527880	6245017	2.7	Y
NSH24	529664	6247150	1.2	N
NSH25	539639	6249790	3.8	Y
SH26	537647	6239337	4.4	Y
SH27	534084	6239794	1.0	Y
SH28	531662	6251703	1.0	Y
SH29	533630	6245183	1.0	Y
SH30	528913	6240557	1.0	Y
SH31	529077	6237156	1.1	Y
SH32	528718	6236883	1.0	Y
SH33	537743	6239372	4.5	N
Proposed NSH34	531507	6239494	1.5	N

NHS – Non Stakeholder, SH – Stakeholder, Coordinate system is UTM zone 50H, WGS84 datum

Table 3 – Radiocommunications sites within 25km radius of the Flat Rocks wind farm from ACMA Database (1)

ACMA Site ID	Site Name	Location	
Referenced from Monitoring Mast Location -33.970511 117.345604			
29026	4 Km East of JINGALUP	-33.933945	117.349492
29045	SEC Site Potts Rd Enter Gate Opposite Bilney Rd KOJONUP	-33.963025	117.260639
9009820	Wellard Site 2.4 km West of Bilney and Potts Road KOJONUP	-33.962638	117.260421
9913254	Mobile Spectrum Licensing Site ALBANY HIGHWAY	-34.050808	117.287745
28344	Telstra West Site TAMBELLUP	-34.024725	117.443048
54257	Telstra Exchange Lumeah via CRANBROOK	-34.000528	117.237429
9913195	Mobile Spectrum Licensing Site ALBANY HIGHWAY	-33.961395	117.201753
600973	Telstra Tunney Exchange 25 km SW of TAMBELLUP	-33.118731	117.367784
9913275	Mobile Spectrum Licensing Site ALBANY HIGHWAY	-34.121826	117.370433
29028	Korong Vale Trust 8 km East of KOJONUP	-33.859819	117.22973
50138	Etna Rd BROOMEHILL	-33.89732	117.507248
461483	Kings Cross Rd TAMBELLUP	-34.113611	117.450556
601719	Sunny Valley Merino Stud 8 km S of KOJONUP	-33.9049	117.172729
9913125	Mobile Spectrum Licensing Site ALBANY HIGHWAY	-33.886578	117.175395
29037	Danetree KOJONUP	-33.801614	117.24632
602029	CMTS Site Farm Property 2431 Albany Hwy Kojonup	-33.859005	117.16348
29044	Police Site South of Kojonup	-33.858573	117.163241
54255	Telstra Sturry Road Repeater 20 km NW of CRANBROOK	-34.182063	117.387397
601275	St Clair Farm Carlecatup Nth Rd	-33.769502	117.265494
41222	Broadcast Site 1.6km S of Kojonup	-33.847754	117.159978
29018	12 Delaney Street Kojonup	-33.848211	117.155547
200727	Cnr Spencer and Honner St Kojonup	-33.837743	117.159635
28320	Cheviot Hills Rd KATANNING	-33.863851	117.551268
29040	Kojonup VFB Lot 101 Albany Hwy Kojonup	-33.833507	117.157465
29038	Hospital Spring St Kojonup	-33.830178	117.151191
28328	WAGR Site Fairfield Rd Katanning	-33.793758	117.515214
28315	Telstra Microwave Site Fairfield Rd	-33.79354	117.515752
151105	Broadcast Site Fairfield	-33.792703	117.515294
28330	WAWA Site Fairfield Rd	-33.793427	117.516918
28313	Shire Site Fairfield Rd	-33.795181	117.520105
29050	Telstra Radio Terminal Bell Rd	-33.790865	117.157214

Table 4: Assignments to Site ID 29045 – Closest radiocommunications tower.

Assignment ID	Frequency	Client	Licence No
116831-58475	163.8500000 MHz	Forts Valley Pastoral Co (229765)	327853
369920-30162	460.0000000 MHz	Electricity Networks Corporation (1139619)	331012
370026-30163	450.6000000 MHz	Electricity Networks Corporation (1139619)	331238
370037-3803	81.3500000 MHz	Electricity Networks Corporation (1139619)	331253
370096-30164	460.9250000 MHz	Electricity Networks Corporation (1139619)	331348
1607840-58475	159.2500000 MHz	Forts Valley Pastoral Co (229765)	327853
8160682-8153488	460.5250000 MHz	Electricity Networks Corporation (1139619)	1624134
8160684-8153492	451.0250000 MHz	Electricity Networks Corporation (1139619)	1624134
8160685-8153493	460.8000000 MHz	Electricity Networks Corporation (1139619)	1624133
8160686-8153497	451.3000000 MHz	Electricity Networks Corporation (1139619)	1624133
8168150-8163722	150.2500000 MHz	Electricity Networks Corporation (1139619)	1149371
117085-2795	78.9375000 MHz	Electricity Networks Corporation (1139619)	328957
8168151-8163723	154.8500000 MHz	Electricity Networks Corporation (1139619)	1149371
8173741-8172080	460.6500000 MHz	Electricity Networks Corporation (1139619)	1182656
8173742-8172083	451.1500000 MHz	Electricity Networks Corporation (1139619)	1182656
117430-30161	460.2750000 MHz	Electricity Networks Corporation (1139619)	330686
117733-30162	450.5000000 MHz	Electricity Networks Corporation (1139619)	331012
117955-30163	460.1000000 MHz	Electricity Networks Corporation (1139619)	331238
117970-3803	78.8500000 MHz	Electricity Networks Corporation (1139619)	331253
118061-30164	451.4250000 MHz	Electricity Networks Corporation (1139619)	331348
369528-2795	81.4375000 MHz	Electricity Networks Corporation (1139619)	328957
369827-30161	450.7750000 MHz	Electricity Networks Corporation (1139619)	330686

Table 5: Point to point links passing the FRWF site from Site 29045.

Licence Operator	License No	Link Site ID	Assignment ID	Lowest frequency (GHz)	Link length (km)	2nd Fresnel Zone (m)	Exclusion Zone (m)
Western Power Corporation GPO Box L921, Perth, WA, 6842	331238	28372	370026-30200	0.4506	95	92.92	148.9
	1624134	28511	8160684-8153491	0.451025	65.9	55.98	111.98
	331348	28306	370096-30179	0.451425	40.2	115.5	171.50

Table 6: Point to point links passing the FRWF site from Site 29044

Licence Operator	Licence No	Link Site ID	Assignment ID	Lowest frequency (GHz)	Link length (km)	2nd Fresnel Zone (m)	Exclusion Zone (m)
Western Australia Police Service, 2 Swanbank rd MAYLANDS WA 6501	281061	28350	366460-1601202	0.4043	62.8	152.55	208.55

Table 7: Closest Fixed Point-to-Multipoint Licenses to the Flat Rocks Wind Farm

Assignment ID	ACMA License	Site ID	Site ID Location		Contact Details
8185856-8189500	1562872	28315	-33.7935	117.515752	Optus Networks Pty Limited PO Box 888 NORTH RYDE BC NSW 1670
8185865-8189503	1562872	28315	-33.7935	117.515752	
1604211-1604346	1607438	28330	-33.7934	117.516918	Water Corp (MESB - Henery Oosterbann) PO Box 100 LEEDERVILLE WA 6902
1604210-1604346	1607438	28330	-33.7934	117.516918	

Table 8: Registered Emergency and Local Shire Services within 25km of the Flat Rocks wind farm – ACAM database July 2011

Site ID	ACMA Licence	Type of Service	Service Operator
28313	254569	Land Mobile System->30MHz	Shire of Broomehill Tambellup
28328	1906785 1906784 514002 1906785	Point to Point Point to Point Land Mobile System->30MHz Point to Point	FESA
28313	514002	Land Mobile System->30MHz	
29040	270667	Land Mobile System->30MHz	
29044	1906785 1906786	Point to Point Point to Point	
29046	513825	Land Mobile System->30MHz	
28337	514003 1610331 1906784	Land Mobile System->30MHz Point to Point Point to Point	
29046	270597 270655 1601939	Land Mobile System->30MHz Land Mobile System->30MHz CBRS Repeater	Shire of Kojonup
29044	278433 281061	Land Mobile System->30MHz Point to Point	WA Police Service
28306	278385 281165 281292	Land Mobile System->30MHz Point to Point Point to Point	
28313	1905520 1905521 1905522 284856 1905523 1905694 1905695	Land Mobile System->30MHz Land Mobile System->30MHz Land Mobile System->30MHz Land Mobile System->30MHz Land Mobile System->30MHz Land Mobile System->30MHz Land Mobile System->30MHz	St John Ambulance Australia
29038	284780	Land Mobile System->30MHz	
29044	284910	Land Mobile System->30MHz	

Table 9: Name, location and distance of BOM relative to the proposed Flat Rocks wind farm site

BOM Radar Sites			
Site	**Lat**	**Long**	**Distance from FRWF in km**
Albany	34.95 S	117.80 E	110.0
Esperance	33.83 S	121.89 E	415.8
Kalgoorlie-Boulder	30.79 S	121.45 E	513.6
Perth (Serpentine)	32.39 S	115.87 E	211.5

Note: 1. Coordinate system used is Lat/Long GDA94 datum.

Table 10: Satellite internet providers operating in the vicinity of the proposed Flat Rocks wind farm

Provider	Contact Details	Telephone	Fax	Response
Skymesh	37 Baxter St, PO Box 255 Fortitude Valley, QLD 4006	08 6365 4000	1300 859 637	No response to date
Activ8me	Level 2, Building 2, 13A Albert Street, PRESTON VIC 3072	1800 80 44 10	03 8080 1617	No response to date
Clear Networks	PO Box 333, BLACKBURN VIC 3130	1300 855 215	1300 139 774	No response to date
DragNet	1105 Mate Street Albury, NSW 2640	02 6049 0700	02 6049 0710	No response to date
Genius8 Telecom	PO Box 240, Montville, QLD 4560	1300 654 302		No response to date
Optus	1 Lyonpark Rd, Macquarie Park, NSW	02 8082 7800	02 8082 7100	No response to date
Telstra BigPond	242 Exhibition Street Melbourne VIC	133 933	08 8211 9297	Response Nov 2010, No issues
Westnet	Locked Bag 16, Cloisters Square WA	1300 786 068	1300 554 160	No response to date
Ocean Broadband	Ocean Broadband Ltd, Suite 7, 295 Rokeby Road, SUBIACO WA 6008	08 9380 0222	08 9467 6217	No response to date
IPSTAR	Artarmon Central, Unit 13, 12-18 Clarendon St, Artarmon, NSW	02 9966 4793	02 9966 4794	No response to date
Harbour IT	PO Box 572, Mudgee NSW 2850	1300 366 169	1300 766 909	No response to date
Iinet	Locked Bag 16, Cloisters Square, WA	08 9214 2207	1300 785 632	No response to date
BorderNET	702/434 St Kilda Road, Melbourne VIC	1300 730 302	03 8080 0712	No response to date

Appendix 1 - Summary of Stakeholder Comments

Licensee	Address	Date of Enquiry	Date of Response	Comment
Fire and Emergency Services	PO Box P1174, Perth, WA, 6844	28-Oct-10		No response
Western Australian Police Service	2 Swanbank Rd, Maylands, WA, 6051	28-Oct-10	16-Nov-10	Raised no concerns over the proposed development
St John Ambulance Australia WA	PO Box 183, Belmont, WA, 6984	28-Oct-10		No response
Air Services Australia	GPO Box 367, Canberra, ACT, 2601	28-Oct-10		Raised no concerns, see response and FRWF Airspace Study
Telstra Corporation Limited	email to Bruno Remigio	7-Oct-10	1-Nov-10	Raised no concerns over the proposed development
Singtel Optus Pty Ltd	PO Box 888, Macquarie Park, NSW, 2113	28-Oct-10		No response
ABC	GPO Box 9994, Sydney, NSW, 2001	28-Oct-10		No response
SBS	Locked Bag 028, Crows Nest, NSW, 1585	28-Oct-10		No response
WIN	Locked Bag 8800, Wollongong, NSW, 2500	28-Oct-10		No response
GWN	PO Box 878, Dickson, ACT, 2602	28-Oct-10		No response
Southern Cross Media (HOTFM & RadioWest)	PO Box 5910, Gold Coast Mail Ctr, Bundall, Qld, 9726	28-Oct-10		No response
Western Power Corporation	GPO Box L921, Perth, WA, 6842	28-Oct-10		No response
Vodafone Australia Ltd	Locked Bag 1581, Chatswood, NSW, 2057	28-Oct-10		No response
Intelligent IP Communications	PO Box 589, Belmont LPO, WA, 6984	28-Oct-10		No response
Broadcast Australia	PO Box 1212, Crows Nest, NSW, 1585		8-Dec-10	Raised no concerns over the proposed development
Aerial Ag Assoc of Australia	PO Box 353, Mitchell, ACT, 2911	26-Jan-11		No response
Goodwin McCarthy Helicopters	Manna Park, Nyabing, WA, 6341	Various		Discussion regarding Aerial Spraying
Dunn Aviation	Wongan-Ballidu Airport, Ballidu, WA, 6606	22-Feb-11		Discussion regarding Aerial Spraying
Tauras Aviation	Aerodrome Road, Cunderdin, WA 6407	22-Feb-11		Discussion regarding Aerial Spraying
Shire of Kojonup	PO Box 163, Kojonup, WA, 6395	Ongoing		Involved in Local Emergency Services discussions
Shire of Katanning	PO Box 130, Katanning, WA, 6317	Ongoing		No concerns, mainly involved in Airspace considerations
Shire of Broomehill Tambellup	46 - 48 Norrish St, Tambellup 6320	Ongoing		

Appendix 2 – Written Responses from Interested Parties

-----Original Message-----
From: GRIFFITHS Martin [PD85886] [mailto:Martin.GRIFFITHS@police.wa.gov.au]
Sent: Tuesday, 16 November 2010 9:24 AM
To: 'info@MHEnergy.com.au'
Cc: MANNA Phillip [PD83020]; STARLING Tina [PD86271]
Subject: Moonies Energy farm Kojonup (EMI - Michael Baulch)

Dear Michael

Thank you for your letter (28 October 2010) in reference to your EMI study; WA Police have reviewed the coordinates of your wind farm proposal near Kojonup. To make an engineered assessment of your proposal we would have to know more about the amount of EMI the farm is likely to emit.

I can inform you that WA Police operate 4 x 450-460MHz analogue repeaters and 400-420MHz point to point links at 4 sites within 50km of the proposed location. The nearest site is at a distance of 18 km and we do have 400MHz point to point links with directional yagi antennas that will look past your farms location. It is my technical understanding that the distances involved and the frequency band we operate in should not be affected by EMI emissions from your wind farm proposal.

If you are aware of any likelihood of interference to the WA Police services it would be necessary for you to contact me as soon as possible for us to make arrangements to mitigate the effect on our services.

Regards

Martin Griffiths

Business Integration Supervisor

WA Police Service

Radio and Electronic Services Unit

Ph: 08 9370 7196

Fax: 08 9370 7194

Mob: 0488 908 025

-----Original Message-----
From: Peter Rowswell [mailto:P.Rowswell@bom.gov.au]
Sent: Thursday, 16 June 2011 9:21 AM
To: 'sarah@mhenergy.com.au'
Subject: Wind farm in Kojonup/Broomehill Shire [SEC=UNCLASSIFIED]

Sarah,

We do appreciate you advice about the wind farm and my apologies for not getting back to you sooner. I forwarded your email to our Head Office in Melbourne and unfortunately they have been slow to respond however I expect that you will have a response by early next week.

If you do not get a response by Thursday next week please email me and I'll take it up again.

Regards,

Peter Rowswell
Engineering Services Manager WA
Bureau Of Meteorology

08 9263 2203
P.Rowswell@bom.gov.au

Michael Baulch

From: Tattam, Steve [steve.tattam@AirservicesAustralia.com]
Sent: Thursday, 3 March 2011 8:36 AM
To: Michael Baulch
Cc: council@kojonup.wa.gov.au; mail@shirebt.wa.gov.au
Subject: Airservices Australia Assessment - Flat Rocks Wind Farm South East of Kojonup, WA (Airservices Assessment Reference: WA-WF-005)

Importance: High

(Airservices Assessment Reference: WA-WF-005)

Dear Michael,

I refer to your request for Airservices Australia (Airservices) to conduct an assessment on potential impact Aviation Air Traffic Management services in relation to the proposed Flat Rocks Wind Farm project located South East of Kojonup, Western Australia.

At a maximum height of 526.00m (1726ft) AHD, some of the proposed wind turbines will affect the Katanning Aerodrome 25 Minimum Sector Altitude (MSA) proceadure. No other sector or circling altitude, nor any approach or departure procedure at Katanning airport is affected. Please Note: The maximum allowable height for any of the wind turbines associated with this wind farm proposal is **522.70m (1715ft) AHD** before the 25 MSA procedure is affected.

This proposed wind farm will not impact the technical performance of Precision/Non-Precision Nav Aids, HF/VHF Comms, A-SMGCS, Radar, or Satellite/Links.

If applicable to the airport, no assessment was conducted in relation to Naverus designed Required Navigation Performance - Authorisation Required (RNP-AR) type procedures or any other procedures designed by external Part 173 providers.

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These comments are also provided for information and advice to the following Shire Offices to fulfil their DA consultation requirements:

Shire of Broomehill – Tambellup (Reference: ADM0283) – Attn Joanne Trezona *CEO*

Shire of Kojonup (Reference: DB.BDA.8) – Attn Stephen Gash *CEO* & Phil Shephard *Town Planner*

Regards,

Steve Tattam

Airport Relations & Development Manager
Airservices Australia
E-mail: steve.tattam@airservicesaustralia.com

Secretariat to ASTRA - www.astra.aero

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Ph 02 6268 4891
Mobile 0402 776 524
www.airservicesaustralia.com
~~~~~~

1 November 2010

Network and Technology
Forecasting and Area Planning

Greg Parker

Telephone (08) 9491 6490
Facsimile (08) 9221 3633

Greg.B.Parker@team.telstra.com

Michael Baulch
PO Box 108
Kojonup WA 6395

Re: [Flat Rocks Wind Farm]

Dear Michael,

In response to your query about the effect of the Flat Rocks Wind Farm on the Telstra network, a desk top study was undertaken of the area and nearby telecommunications infrastructure.

Based on the provided information relating to the proposed wind farm, results of the investigation reveals that there is no potential for undue interference.

Telstra has no objection to development application in relation to the proposed wind farm.

Yours faithfully,

Greg Parker
Area Planner

BROADCASTAUSTRALIA

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Direct Phone: (02) 8113 4718
Fax: (02) 8113 4646
E-mail: carina.cowham@broadcastaustralia.com.au

8 December, 2010

Mr Michael Baulch
Moonies Hill Energy
78 Pensioner Road
Konjonup WA 6395

Dear Michael,

RE: FLAT ROCKS WIND FARM (FRWF) PROJECT

We refer to the above mentioned project and advise that in principal, Broadcast Australia (BA) is not opposed to the installation of windfarms by Moonies Hill Energy in the Konjonup area, WA.

BA recognises the importance and benefits of windfarms being "alternative green energy sources" however wind farms have been known to cause interference known as 'ghosting', particularly to analogue television reception.

Ghosting occurs caused by the turbine blades reflecting the television signal in the reception area and causes an annoying flickering or ghosting effect. In the case of the proposed windfarms in the Konjonup area, there are 2 transmission sites which are approximately 15 and 20 km respectively from the top of the proposed windfarms.

Whilst we can conclude that interference is unlikely to occur where the major populations in the region are situated, the same cannot be said for the few remote residences which are situated in the vicinity of the proposed windfarm.

Overall BA does not envisage any significant issues with the proposed wind farm but would suggest that Moonies Hill Energy engage an appropriate engineering consultant to undertake a detailed study as a part of any environmental impact investigations.

Yours sincerely,

Carina Cowham
Property Manager

Broadcast Australia Pty Ltd
ABN 99 086 048 562
Trading as Broadcast Australia