

# Kyoto energypark

## Appendix F

Assessment of Environmental Issues  
Electromagnetic Interference (EMI)  
Garrad Hassan  
(19 May 2008)



**ASSESSMENT OF  
ENVIRONMENTAL ISSUES  
FOR THE PROPOSED  
KYOTO ENERGY PARK –  
ELECTROMAGNETIC INTERFERENCE**

Client	<b>Pamada Pty Ltd</b>
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## 1 EXECUTIVE SUMMARY

Pamada Pty Ltd. (Pamada) is developing the Kyoto Energy Park near Scone, New South Wales. Garrad Hassan Pacific (GH) has been requested by Pamada to carry out an environmental study relating to the installation of wind turbines across two sites within the Kyoto Energy Park project. The study is as follows:

### *Electromagnetic Interference (EMI) Analysis*

GH has assessed information relating to nearby radio communications licences obtained from the Australian Communications and Media Authority (ACMA).

In general VHF and UHF frequency band radio signals, and digital voice based technologies such as GSM and CDMA mobile, are essentially unaffected by a wind farm development. This includes land mobile repeaters, radio, the audio component of analogue television, and mobile phones.

If not properly designed for, wind farms can however interfere with both analogue television broadcast signals and microwave signals. Analogue broadcast signals (generally described as point to area) are still commonly used to transmit domestic television, while microwave links (generally described as point to point) are used for line of sight connections for data, voice and video. The interference mechanisms are different for each of these, and hence, there are different ways to avoid interference.

For analogue television broadcast signals (point to area) large scale interference can generally be avoided by placing the wind turbines distant from the broadcast tower. A clearance of at least 1 km is recommended. No analogue television broadcast or communications towers have been identified within 1 km of the proposed Kyoto Wind Park. The nearest analogue television broadcast tower is approximately 8.5 km to the south of the proposed site. It is still possible however for interference to television to occur at residences in and around a wind farm site, and this potential interference has been assessed here.

Wind turbines can cause interference, or diffraction, of point to point signals. However it is possible to design around this issue, as the path and interference zone of point to point signals is generally well known. The nearest transmission tower with Fixed licences of Point to Point type is at least 1.7 km from proposed turbine locations.

## **2 DESCRIPTION OF THE WIND FARM SITE**

There are two areas proposed for wind farms, Mountain Station and Middlebrook Station. The Mountain Station site is located approximately 10 kilometres west of Scone in New South Wales, as shown in Figure 1.

The Mountain Station site is an area of escarpments and ridges on the western side of the Hunter Valley. The proposed wind farm lies on a prominent escarpment called Mount Moobi and nearby ridgelines. Mount Moobi is of elevation between 600m and 640m which runs approximately north-south. Terrain slopes around the Main Ridge can be described as moderate to the west and complex in all other directions, as there are steep slopes present, particularly to the east.

It is assumed that the turbine dimensions are going to have a hub height of up to 105 m agl, with a blade radius of up to 45 m.

### 3 ELECTROMAGNETIC INTERFERENCE (EMI)

#### 3.1 Communication towers

An image of the ACMA database dated 1 May 2007 was used for this assessment. From the database there are 91 radiocommunication towers within a nominal 50 km of the Kyoto Wind Park. 50 km has been selected as a reasonable distance to ensure that all transmission vectors are captured in the licence survey. These telecommunication towers locations are shown in Figure 2 relative to the proposed Kyoto Wind Park.

Wind turbines, if not properly sited or designed, can interfere with both analogue television broadcast signals and microwave signals. The interference mechanisms are different for each of these, and hence, there are different ways to avoid interference. These are assessed in the sections below.

#### 3.2 Fixed licences of Point to Point type around the proposed wind farm site

Wind turbines can also cause interference, or diffraction, of point to point (microwave) signals. However it is possible to design around this issue as the path and interference zone of microwave signals are generally well known.

The criteria used for avoiding diffraction effects of point to point signals are normally based on an exclusion zone of circular cross-section around the direct path from the transmitter to the receiver (often called boresight). This exclusion zone is defined in terms of Fresnel zones. The  $n^{\text{th}}$  Fresnel zone is comprised of all points for which, if the radio signal travelled in a straight line from the transmitter to the point and then to the receiver, the additional path length compared to the straight transmitter-receiver path equals  $\frac{n \cdot \lambda}{2}$ , where  $\lambda$  = wavelength.

The usual requirement is that 60% of the 1<sup>st</sup> Fresnel zone should be unobstructed by large, static objects, such as buildings. However, for the varying geometry of a wind turbine, a more conservative approach is taken and the exclusion zone around a signal should at least include the entire 1<sup>st</sup> Fresnel zone. The radius of the 1<sup>st</sup> Fresnel zone varies along the length of the signal, and is given by:

$$R_{F2} = \sqrt{\frac{\lambda d_1 d_2}{D}}$$

Where  $d_1$  is the distance from the transmitter

$d_2$  is the distance from the receiver

$D$  is the distance from transmitter to receiver, i.e.  $d_1 + d_2 = D$

The registered communications licences for each tower according to the ACMA database were analysed to determine the transmission paths of licences that may potentially experience interference from wind turbines (i.e. for frequencies greater than UHF). The paths resulting from the towers analysed are shown graphically in Figure 2. It can be seen that not all of the identified transmission towers have a Fixed licence of Point to Point type transmission vector. Some towers have no active licences associated with them, and some towers are used solely for point to area style transmissions (e.g. some Rural Fire Service (RFS) towers).



A review of the ACMA database shows there are no links passing over either of the proposed wind farm sites.

### **3.3 Fixed licences of Point to Multipoint type around the wind farm site**

Fixed licences of the Point to Multipoint type are a variation of Point to Point type. The difference between them is administrative. A Point to Point type permits the communication between two static sites, where the locations of the sites are detailed in the licence register.

The Point to Multipoint type allows for communication between one or more static site(s) and multiple points or between the points. The Point to Multipoint type is usually licensed for a defined operational area.

Administratively, the ACMA database details the location of the static station for a Fixed licence of Point to Multipoint type. Hence, the location of the transmission vectors is not readily identifiable. A review of Fixed licences of Point to Multipoint type was undertaken and 28 Assignments were identified within 50 km of the proposed turbines. These licences are shown in Figure 3. The details of the licence holders as per the ACMA database are provided in Table 1.

4 assignments have been identified sited on Black Mountain and Scone Mountain which are to the east of the proposed development, and approximately 10 km from the sites. These assignments are shown as shaded cells within Table 1. It is recommended that the owners of these Assignments, Energy Australia and Telstra, be contacted as they may be servicing the area around the proposed wind farm.

### **3.4 Other licence types around the wind farm site**

A review of the ACMA database for other licences with transmission frequencies of the UHF band or higher was conducted. The licences identified can broadly be described as base to mobile station style communication, and include radio broadcasting, commercial and private mobile telephony. These licences are shown in Figure 4, and a summary of the licence classes of those identified are provided in Table 2. These licence types are generally not affected by the presence of wind turbines any more than other effects such as terrain, vegetation and other forms of signal obstruction. Should reception difficulty be encountered, the amelioration method consists of the user simply moving to receive a clearer signal.

### **3.5 Analogue Broadcast Television licences around the proposed wind farm site**

For television broadcast signals, which are omni-directional or point to area signals, interference from wind turbines is dependent on many factors including:

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

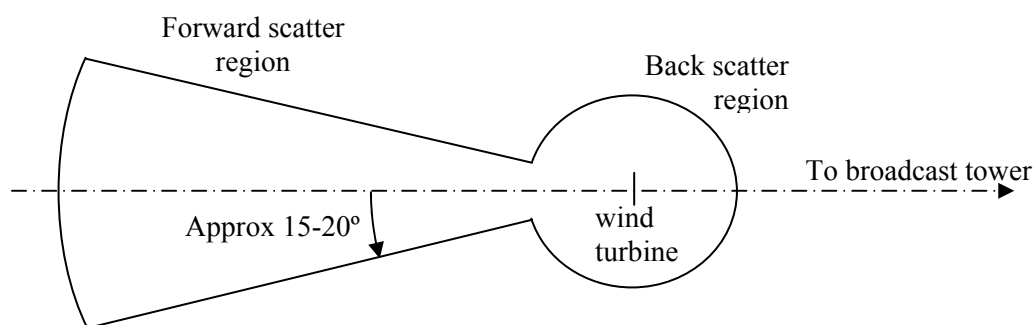
For broadcast signals large scale interference can generally be avoided by placing the wind turbines distant from the broadcast tower. A clearance of at least 1 km is recommended for relay TV transmitters [1]. Relay TV transmitter towers are more commonly found in rural

areas. A clearance of at least 6 km is recommended for primary TV transmitters [1]. Primary TV transmitter towers are higher power and are more commonly located near large urban areas.

The nearest television broadcast tower is approximately 8.5 km from the proposed Kyoto Wind Park site, therefore no large scale interference to television signals are expected.

The Broadcast Transmitter Data database [2] was interrogated to identify broadcasters nearby to the proposed Wind Farm, with those found shown in Figure 5.

Local interference to analogue television can occur to individual houses in and around the proposed wind farm. A wind turbine has the potential to scatter analogue television waves both forward and back. Forward scatter will only occur if a wind turbine is located approximately between the dwelling and the broadcast site. The forward scatter region is as shown in the figure below, and generally does not extend further than 5 km for the worst combination of factors [1, 3]. Interference may extend beyond 5 km if the dwellings are screened from the broadcast tower, but do have line-of-sight to the wind turbines. The effect of the forward scatter is to potentially cause the brightness of the television picture to vary with the rotation of each blade. Modern television sets usually incorporate Automatic Gain Compensators (AGC) which act to lessen or eliminate variations in picture gain or brightness.



**Potential analogue television interference zones around a wind turbine**

Back scattered signals arrive at the dwelling delayed relative to the source signal from the broadcast tower. The back scatter region is as shown in the figure above, and generally does not extend further than 500 m [1, 3]. If a dwelling is within 500 m of a wind turbine and its receiving antenna is not sufficiently directional to discriminate between the original and delayed signal, then pulsating ghost or secondary signal may appear on the television screen.

Television interference mechanisms rely on many factors (as previously mentioned) and are complex to calculate. Previous experience has shown that even after great effort has been put into performing such calculations, they tend to have limited accuracy, and would require field validation after the wind farm is operational.

As an alternative, it is best to identify those dwellings or areas that are most likely to experience potential analogue television interference based on the forward and back scatter regions. This usually results in only a few areas of potential impact. Those most likely to experience any interference may require an assessment of their TV reception prior to any wind farm operation. After the wind farm is operational any incidences of television interference would be monitored as part of normal consultations with the local community. As television interference from wind turbines is readily identifiable, appropriate mitigation measures (discussed below) can be readily taken if required.

To assist in identifying those houses that may have a potential for television interference due to the proposed Kyoto Wind Park, both back and forward scatter regions have been determined based on the points that make up the boundary of each wind farm. This has been calculated based on the location of each proposed turbine.

The nearby Rossgole Lookout broadcast tower was examined. It is clear that the preferred source of television signals for the area around the development is the Rossgole Lookout site to the south of the development. Rossgole Lookout is a retransmission source of both analogue and digital television signals that cover the Upper Hunter area [4, 5]. The regions where there may be the potential for television interference of the Rossgole Lookout transmission have been identified, and these are shown in Figure 5 and Figure 6.

As illustrated in Figure 6, there are several house locations that fall within the potential analogue TV EMI regions based the Rossgole Lookout broadcast site.

### **3.5.1 Mitigation**

As television interference from wind turbines is readily identifiable, appropriate mitigation measures can be readily taken if required.

In the event that TV interference is an issue after wind farm commissioning, there are several amelioration options available, in approximate order of cost;

1. Pointing the householder's TV antenna directly towards their existing transmitter;
2. The installation of more directional and/or higher gain antenna at the affected residence;
3. Relocating the antenna to a less affected position;
4. The installation of a digital set top box (and UHF antenna if required);
5. The installation of cable/satellite TV at the affected residences;
6. Installation of a TV relay station.

The introduction of digital television broadcast provides an attractive amelioration option for houses in and around wind farms as digital television signals are essentially unaffected by wind turbines. Anecdotal experience with television signals through wind farms indicate significant improvements are achieved by using digital receivers. A review of the aforementioned digital broadcast site indicates that 4 free to air digital TV channels are available.

In the case that digital TV could not provide an acceptable amelioration option, satellite television is another potential amelioration option. Satellite based television comprises both free to air and subscription based broadcasts. For the region around Kyoto Wind Park, the satellite dish inclination required for optimum reception is approximately 50° [6] to the horizontal. It appears possible that all residences around the Kyoto Energy Park would have a clear line of site for satellite TV reception.

## 4 CONCLUSIONS AND RECOMMENDATIONS

### *Electromagnetic Interference (EMI)*

Broadcast towers and transmission paths around the proposed Kyoto Wind Park sites were investigated to see if EMI would be an issue for the current proposal. No Point to Point style link vectors were identified to cross the site. Several Point to Multipoint type Fixed licences were identified proximate to the proposed site. The nearest licence is approximately 10 km to the east of the proposed development.

The details of the licensees of radio communication licences in the region have been provided. It is recommended that these licensees be contacted as part of the wider community consultation process. Additionally, it is recommended that essential and emergency service organisations be contacted to minimise risks of conflict with radio communications.

Broadcast towers around the proposed Kyoto Wind Park were investigated to see if television interference would be an issue for the current proposal.

Television interference mechanisms are complex to calculate and can have limited predictive accuracy. Television interference around wind turbines is generally limited to less than 1 km and potentially up to 5 km from the wind turbines, and is a function of the visibility of the wind turbines and the transmitter from the receptor.

Work presented here highlights the areas around the proposed turbine locations where television interference could potentially occur. Wind farm interference to analogue television is readily identifiable. Those most likely to experience any interference may require an assessment of their analogue TV reception prior to any wind farm operation. Should TV interference be observed after wind farm commissioning, options for reinstatement of TV signals include;

- Pointing the householders TV antenna directly towards their existing transmitter;
- The installation of more directional and/or higher gain antenna at the affected residences;
- Relocating the antenna to a less affected position;
- The installation of a digital set top box (and UHF antenna if required);
- The installation of cable/satellite TV at the affected residences;
- Installation of a TV relay station.

A review of the most appropriate broadcast site (Rossgole Lookout) indicates that 4 free to air digital TV channels are available.

## 5 REFERENCES

- 1 Hall, S. H., 'The assessment and Avoidance of Electromagnetic Interference Due to Windfarms', *Wind Engineering*, Vol. 16 No. 6, 1992, pp326-338.
- 2 [http://www.acma.gov.au/WEB/STANDARD/pc=PC\\_9150](http://www.acma.gov.au/WEB/STANDARD/pc=PC_9150)
- 3 Recommendation ITU-R BT.805, 'Assessment of the impairment caused to television reception by a wind turbine', 1992.
- 4 <http://www.abc.net.au/reception/freq/>
- 5 <http://www.dba.org.au/index.asp?sectionID=22>
6. <http://www.users.bigpond.net.au/sattv4caravans/oz.html>

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ACMA Assignment No.	ACMA Licence No.	Site ID	AMG Location	Contact Details
10233-23037	39825	35562	56 382080 6357200	Mobil Oil Australia Ltd Attn Ms Marie L Rowley Telecoms Support Analyst PO Box 4507 MELBOURNE VIC 3001
1105687-1105348	1106897	101233	56 306623 6408859	Coal and Allied Operations Pty Ltd C/- Rio Tinto Coal Australia Pty Ltd GPO Box 391 BRISBANE QLD 4000
1105688-1105348	1106897	101233	56 306623 6408859	Coal and Allied Operations Pty Ltd C/- Rio Tinto Coal Australia Pty Ltd GPO Box 391 BRISBANE QLD 4000
1138938-2209647	1136430	6475	56 305170 6560050	Telstra Corporation Ltd Atten R Curtis Wireless Technologies 15/242-282 Exhibition St MELBOURNE VIC 3000
1138939-2209647	1136430	6475	56 305170 6560050	Telstra Corporation Ltd Atten R Curtis Wireless Technologies 15/242-282 Exhibition St MELBOURNE VIC 3000
1138940-2209648	1136430	6475	56 305170 6560050	Telstra Corporation Ltd Atten R Curtis Wireless Technologies 15/242-282 Exhibition St MELBOURNE VIC 3000
1138941-2209648	1136430	6475	56 305170 6560050	Telstra Corporation Ltd Atten R Curtis Wireless Technologies 15/242-282 Exhibition St MELBOURNE VIC 3000
1138942-2209649	1136430	6475	56 305170 6560050	Telstra Corporation Ltd Atten R Curtis Wireless Technologies 15/242-282 Exhibition St MELBOURNE VIC 3000
1138943-2209649	1136430	6475	56 305170 6560050	Telstra Corporation Ltd Atten R Curtis Wireless Technologies 15/242-282 Exhibition St MELBOURNE VIC 3000
1139003-2209679	1136421	6333	56 304499 6428292	Telstra Corporation Ltd Atten R Curtis Wireless Technologies 15/242-282 Exhibition St MELBOURNE VIC 3000
1139004-2209679	1136421	6333	56 304499 6428292	Telstra Corporation Ltd Atten R Curtis Wireless Technologies 15/242-282 Exhibition St MELBOURNE VIC 3000
1140347-2212514	1136611	6277	56 326896 6401607	Telstra Corporation Ltd Atten R Curtis Wireless Technologies 15/242-282 Exhibition St MELBOURNE VIC 3000

**Table 1      Details of Point to Multipoint licences within 50 km of the proposed Kyoto Wind Park. (Cont.)**

ACMA Assignment No.	ACMA Licence No.	Site ID	AMG Location	Contact Details
1140348-2212514	1136611	6277	56 326896 6401607	Telstra Corporation Ltd Atten R Curtis Wireless Technologies 15/242-282 Exhibition St MELBOURNE VIC 3000
1140349-2212515	1136612	6401	56 295626 6487557	Telstra Corporation Ltd Atten R Curtis Wireless Technologies 15/242-282 Exhibition St MELBOURNE VIC 3000
1140350-2212515	1136612	6401	56 295626 6487557	Telstra Corporation Ltd Atten R Curtis Wireless Technologies 15/242-282 Exhibition St MELBOURNE VIC 3000
1140635-2213866	1211274	250116	56 302479 6452489	Telstra Corporation Ltd Atten R Curtis Wireless Technologies 15/242-282 Exhibition St MELBOURNE VIC 3000
1140636-2213866	1211274	250116	56 302479 6452489	Telstra Corporation Ltd Atten R Curtis Wireless Technologies 15/242-282 Exhibition St MELBOURNE VIC 3000
1146823-2220179	1140460	203318	56 302547 6558080	Regional Internet Australia Pty Ltd PO Box 1982 TOWNSVILLE QLD 4810
1215592-1211531	1211653	6399	56 294800 6483300	Bureau of Meteorology Communications Section GPO Box 1289K MELBOURNE VIC 3001
1215593-1211531	1211653	6399	56 294800 6483300	Bureau of Meteorology Communications Section GPO Box 1289K MELBOURNE VIC 3001
1228345-1221886	1224970	6246	56 313147 6393338	Wambo Coal Pty Limited Private Bag 1 SINGLETON DC NSW 2330
1228346-1221886	1224970	6246	56 313147 6393338	Wambo Coal Pty Limited Private Bag 1 SINGLETON DC NSW 2330
1230957-1224461	1227475	5838	56 363230 6359750	NBN Ltd PO Box 750L NEWCASTLE NSW 2300
1230958-1224461	1227475	5838	56 363230 6359750	NBN Ltd PO Box 750L NEWCASTLE NSW 2300

**Table 1 Details of Point to Multipoint licences within 50 km of the proposed Kyoto Wind Park (Cont.)**



<b>ACMA Assignment No.</b>	<b>ACMA Licence No.</b>	<b>Site ID</b>	<b>AMG Location</b>	<b>Contact Details</b>
1236570-1229462	1232425	130157	56 305080 6560029	Country Broadband & Telecoms Pty Ltd Country Broadband 48 Seaview St BALGOWLAH NSW 2093
1236571-1229462	1232425	130157	56 305080 6560029	Country Broadband & Telecoms Pty Ltd Country Broadband 48 Seaview St BALGOWLAH NSW 2093
1250893-1250813	1250869	250132	56 297382 6436379	Dartbrook Coal Pty Ltd PO Box 517 MUSWELLBROOK NSW 2333
1250894-1250813	1250869	250132	56 297382 6436379	Dartbrook Coal Pty Ltd PO Box 517 MUSWELLBROOK NSW 2333
1250897-1250816	1250864	250081	56 320296 6413616	Thiess Contractors Thiess Mt Owen Mine PO Box 175 SINGLETON DC NSW 2330
1250898-1250816	1250864	250081	56 320296 6413616	Thiess Contractors Thiess Mt Owen Mine PO Box 175 SINGLETON DC NSW 2330
1251130-1250998	1251103	250202	56 384100 6358973	Port Waratah Coal Services Ltd PO Box 57 CARRINGTON NSW 2294
1251131-1250998	1251103	250202	56 384100 6358973	Port Waratah Coal Services Ltd PO Box 57 CARRINGTON NSW 2294
1251249-1251121	1224915	250276	56 380340 6366904	Tomago Aluminium Company Pty Ltd Plant Services (Attn Malcolm Muddle) PO Box 405 RAYMOND TERRACE NSW 2324
1251250-1251121	1224915	250276	56 380340 6366904	Tomago Aluminium Company Pty Ltd Plant Services (Attn Malcolm Muddle) PO Box 405 RAYMOND TERRACE NSW 2324
1251694-1251446	1251483	250363	56 319019 6391851	Warkworth Mining Ltd PO Box 267 SINGLETON DC NSW 2330
1251695-1251446	1251483	250363	56 319019 6391851	Warkworth Mining Ltd PO Box 267 SINGLETON DC NSW 2330
1252112-1251752	1251765	5974	56 383770 6358800	Port Waratah Coal Services Ltd PO Box 57 CARRINGTON NSW 2294

**Table 1 Details of Point to Multipoint licences within 50 km of the proposed Kyoto Wind Park (Cont.)**

ACMA Assignment No.	ACMA Licence No.	Site ID	AMG Location	Contact Details
1252113-1251752	1251765	5974	56 383770 6358800	Port Waratah Coal Services Ltd PO Box 57 CARRINGTON NSW 2294
1252186-1251809	1251809	5974	56 383770 6358800	Port Waratah Coal Services Ltd PO Box 57 CARRINGTON NSW 2294
1252187-1251809	1251809	5974	56 383770 6358800	Port Waratah Coal Services Ltd PO Box 57 CARRINGTON NSW 2294
164554-23036	515424	53863	56 367330 6370350	Bloomfield Collieries Pty Ltd PO Box 4 EAST MAITLAND NSW 2323
17325-27423	56023	6084	56 333438 6373340	Energy Australia c/o MGR Technical Services East GPO Box 4009 SYDNEY NSW 2001
17326-27424	56024	6116	56 356290 6351188	Energy Australia c/o MGR Technical Services East GPO Box 4009 SYDNEY NSW 2001
17327-27425	56025	6337	56 298310 6417030	Energy Australia c/o MGR Technical Services East GPO Box 4009 SYDNEY NSW 2001
17328-27426	56026	5852	56 377400 6355300	Energy Australia c/o MGR Technical Services East GPO Box 4009 SYDNEY NSW 2001
17329-27427	56027	6210	56 246309 6442747	Energy Australia c/o MGR Technical Services East GPO Box 4009 SYDNEY NSW 2001
17330-27368	56028	6337	56 298310 6417030	Energy Australia c/o MGR Technical Services East GPO Box 4009 SYDNEY NSW 2001
17331-25583	56029	6337	56 298310 6417030	Energy Australia c/o MGR Technical Services East GPO Box 4009 SYDNEY NSW 2001
17332-27369	56030	6337	56 298310 6417030	Energy Australia c/o MGR Technical Services East GPO Box 4009 SYDNEY NSW 2001

**Table 1 Details of Point to Multipoint licences within 50 km of the proposed Kyoto Wind Park (Cont.)**

ACMA Assignment No.	ACMA Licence No.	Site ID	AMG Location	Contact Details
17333-27373	56031	6370	56 304204 6463009	Energy Australia c/o MGR Technical Services East GPO Box 4009 SYDNEY NSW 2001
313446-1563	15560	6112	56 361160 6353680	Australian Petroleum Pty Ltd PO Box 441 MATRAVILLE NSW 2036
314642-1328	23860	5838	56 363230 6359750	Hunter Water Corporation PO Box 5171 Attention Leanne Mullins HRMC NSW 2310
315969-23037	39825	35562	56 382080 6357200	Mobil Oil Australia Ltd Attn Ms Marie L Rowley Telecoms Support Analyst PO Box 4507 MELBOURNE VIC 3001
319573-27423	56023	6084	56 333438 6373340	Energy Australia c/o MGR Technical Services East GPO Box 4009 SYDNEY NSW 2001
319574-27424	56024	6116	56 356290 6351188	Energy Australia c/o MGR Technical Services East GPO Box 4009 SYDNEY NSW 2001
319575-27425	56025	6337	56 298310 6417030	Energy Australia c/o MGR Technical Services East GPO Box 4009 SYDNEY NSW 2001
319576-27426	56026	5852	56 377400 6355300	Energy Australia c/o MGR Technical Services East GPO Box 4009 SYDNEY NSW 2001
319577-27427	56027	6210	56 246309 6442747	Energy Australia c/o MGR Technical Services East GPO Box 4009 SYDNEY NSW 2001
319578-27368	56028	6337	56 298310 6417030	Energy Australia c/o MGR Technical Services East GPO Box 4009 SYDNEY NSW 2001
319579-25583	56029	6337	56 298310 6417030	Energy Australia c/o MGR Technical Services East GPO Box 4009 SYDNEY NSW 2001
319580-27369	56030	6337	56 298310 6417030	Energy Australia c/o MGR Technical Services East GPO Box 4009 SYDNEY NSW 2001

**Table 1 Details of Point to Multipoint licences within 50 km of the proposed Kyoto Wind Park (Cont.)**

ACMA Assignment No.	ACMA Licence No.	Site ID	AMG Location	Contact Details
319581-27373	56031	6370	56 304204 6463009	Energy Australia c/o MGR Technical Services East GPO Box 4009 SYDNEY NSW 2001
385225-23036	515424	53863	56 367330 6370350	Bloomfield Collieries Pty Ltd PO Box 4 EAST MAITLAND NSW 2323
4951-1563	15560	6112	56 361160 6353680	Australian Petroleum Pty Ltd PO Box 441 MATRAVILLE NSW 2036
7356-1328	23860	5838	56 363230 6359750	Hunter Water Corporation PO Box 5171 Attention Leanne Mullins HRMC NSW 2310
8164231-8158301	1143729	250198	56 308285 6410332	Coal and Allied Operations Pty Ltd C/- Rio Tinto Coal Australia Pty Ltd GPO Box 391 BRISBANE QLD 4000
8164232-8158302	1143729	250198	56 308285 6410332	Coal and Allied Operations Pty Ltd C/- Rio Tinto Coal Australia Pty Ltd GPO Box 391 BRISBANE QLD 4000

**Table 1      Details of Point to Multipoint licences within 50 km of the proposed Kyoto Wind Park (Concl.)**

Licence Type	Licence Category	Number of Instances
Amateur	Amateur Repeater	6
Broadcasting	Broadcast Service	134
Fixed	Point to Multipoint	67
Land Mobile	Land Mobile System - > 30MHz	153
Land Mobile	Ambulatory System	1
Land Mobile	PABX Cordless Telephone Service	2
PTS	PMTS Class B	308
Radiodetermination	Radiodetermination	34
Spectrum	800 MHz Lower Band	217
Spectrum	800 MHz Upper Band	337
Spectrum	1.8 GHz Upper Band	48
Spectrum	1.8 GHz 2000 Upper Band	15
Spectrum	1.8 GHz Lower Band	2
Spectrum	3.4 GHz Upper Band B	12
Spectrum	3.4 GHz Lower Band	17
Spectrum	500 MHz Upper Band	3
Spectrum	500 MHz Lower Band	3
Spectrum	2.3 GHz MDS B Band	57
Spectrum	3.4 GHz Upper Band A	7

**Table 2 Details of other licences identified within 50 km of the proposed Kyoto Wind Park for frequencies greater than 500 MHz.**

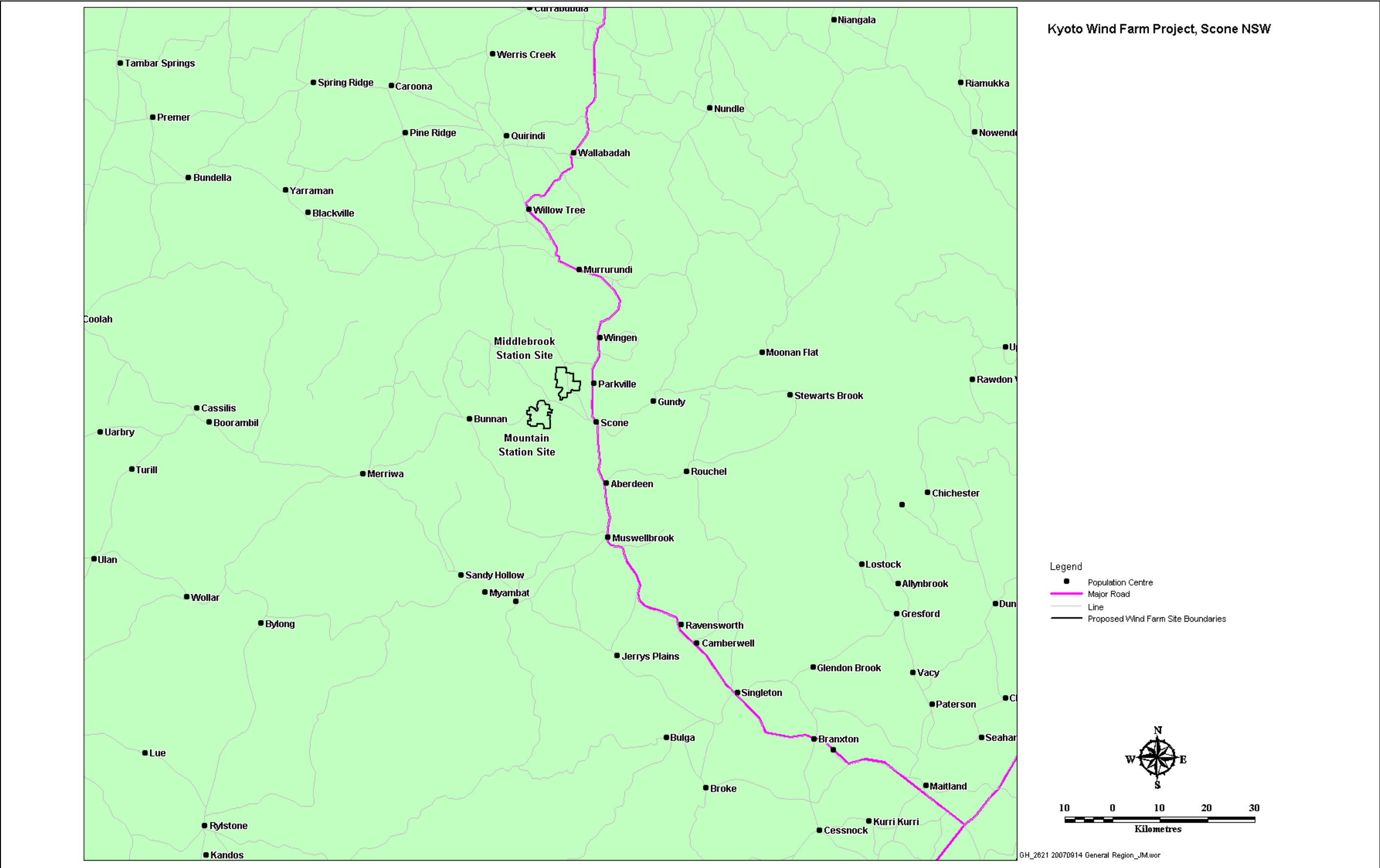


Figure 1    Location of proposed Kyoto Wind Park

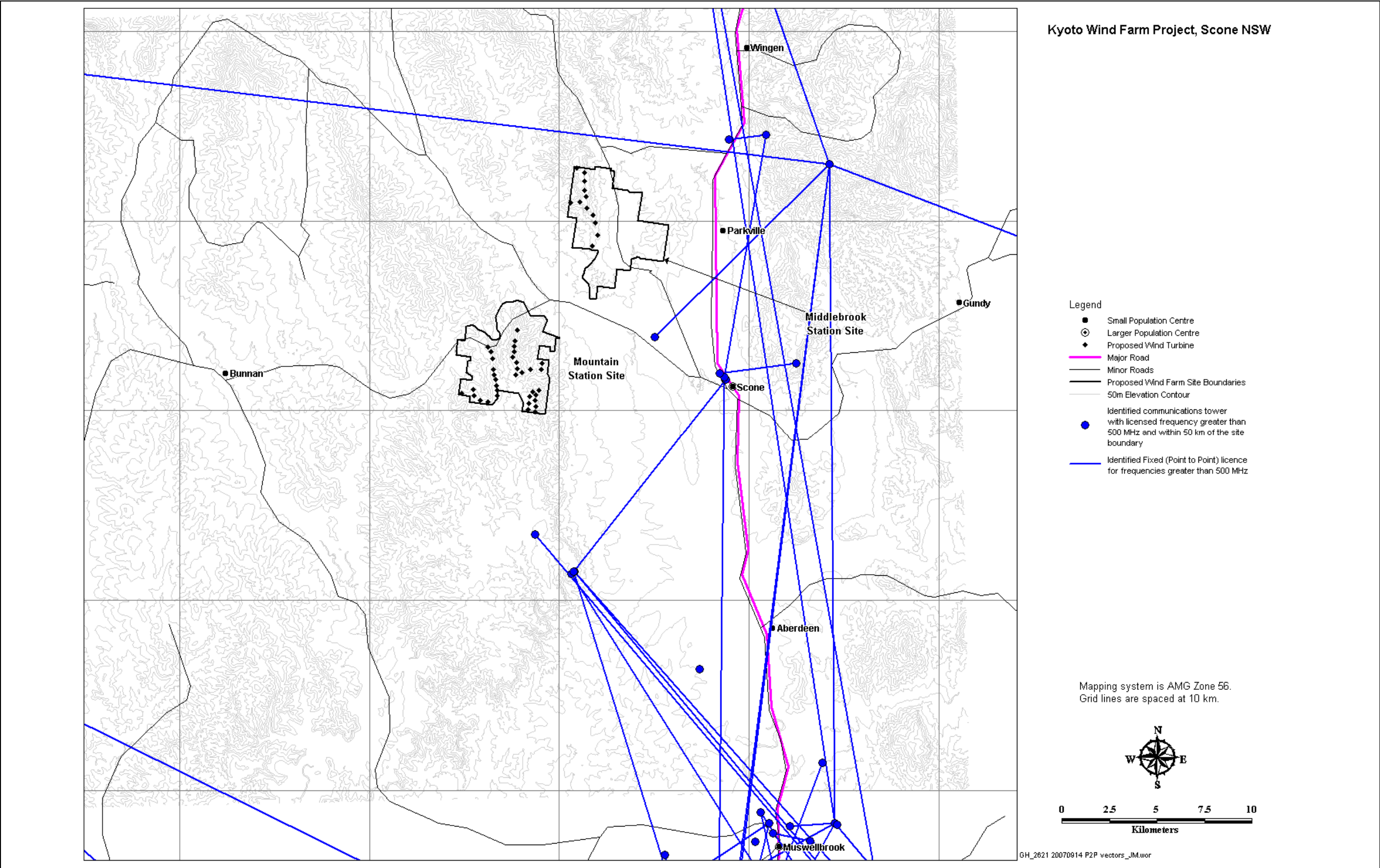


Figure 2    Identified transmission vectors for Fixed licences of Point to Point type proximate to the Kyoto Wind Park.



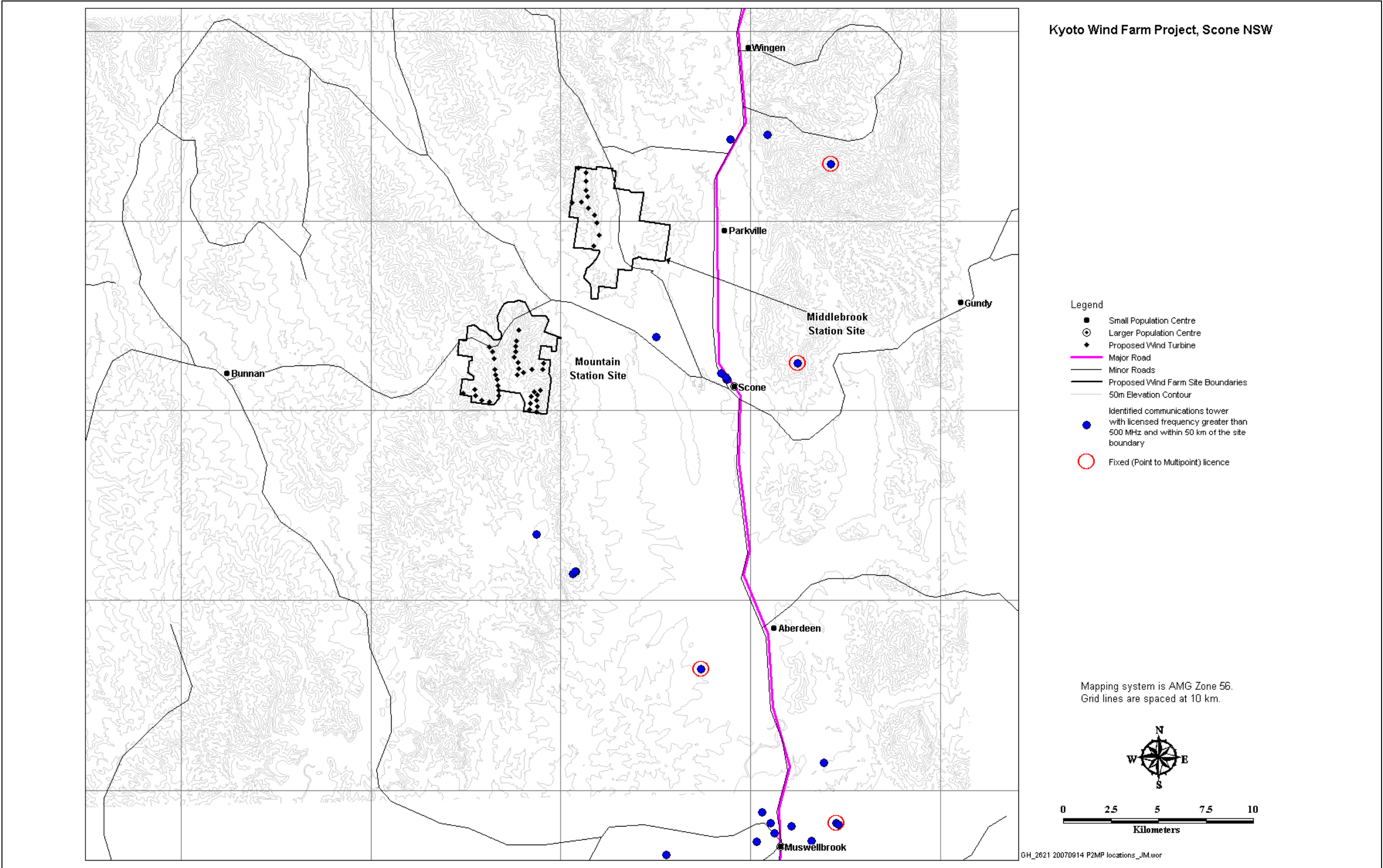


Figure 3    Identified base stations for Fixed licences of Point to Multipoint type proximate to the Kyoto Wind Park.



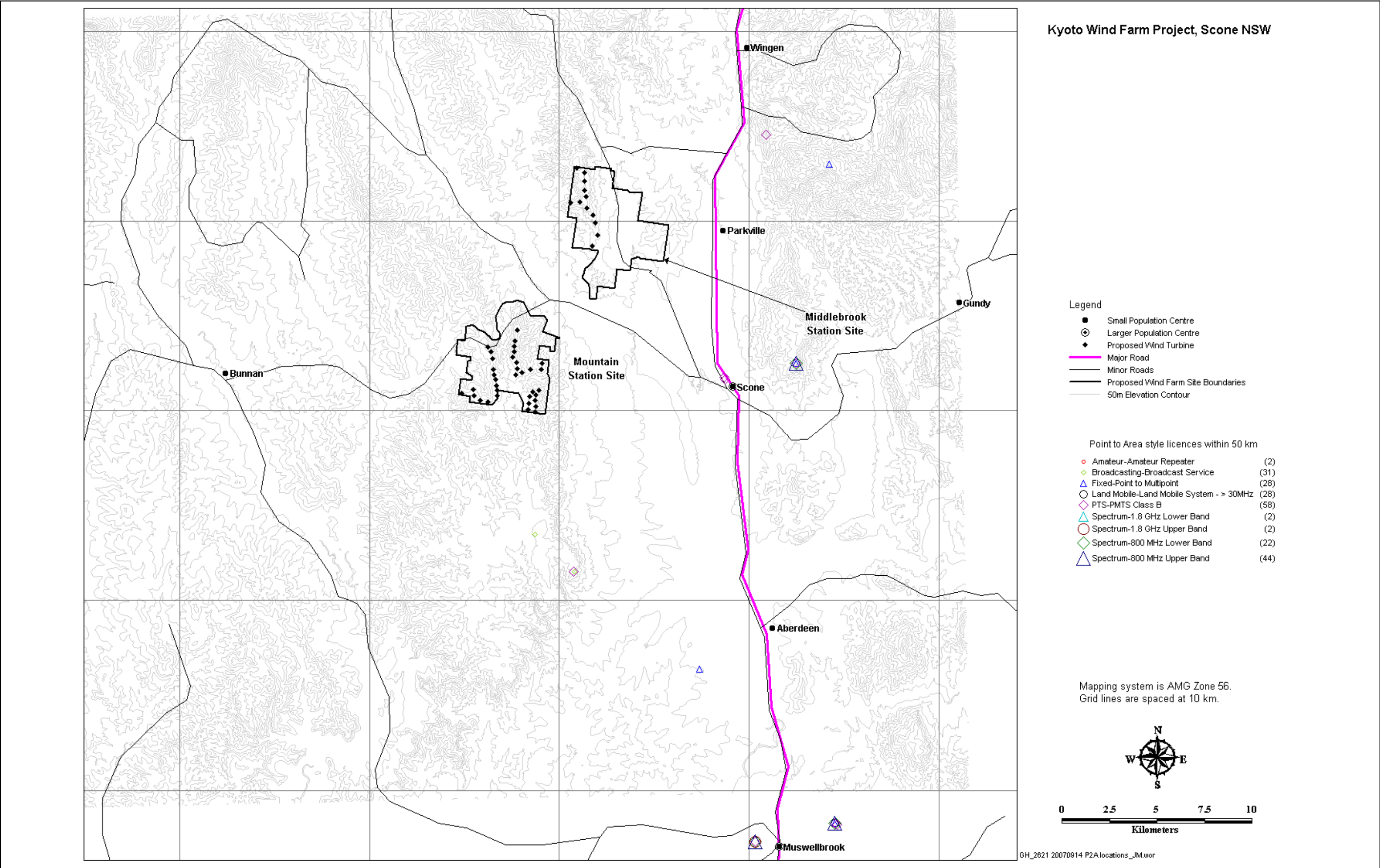


Figure 4      Location of general point to area style licences for frequencies greater than 500 MHz within 50 km of the Kyoto Wind Park.

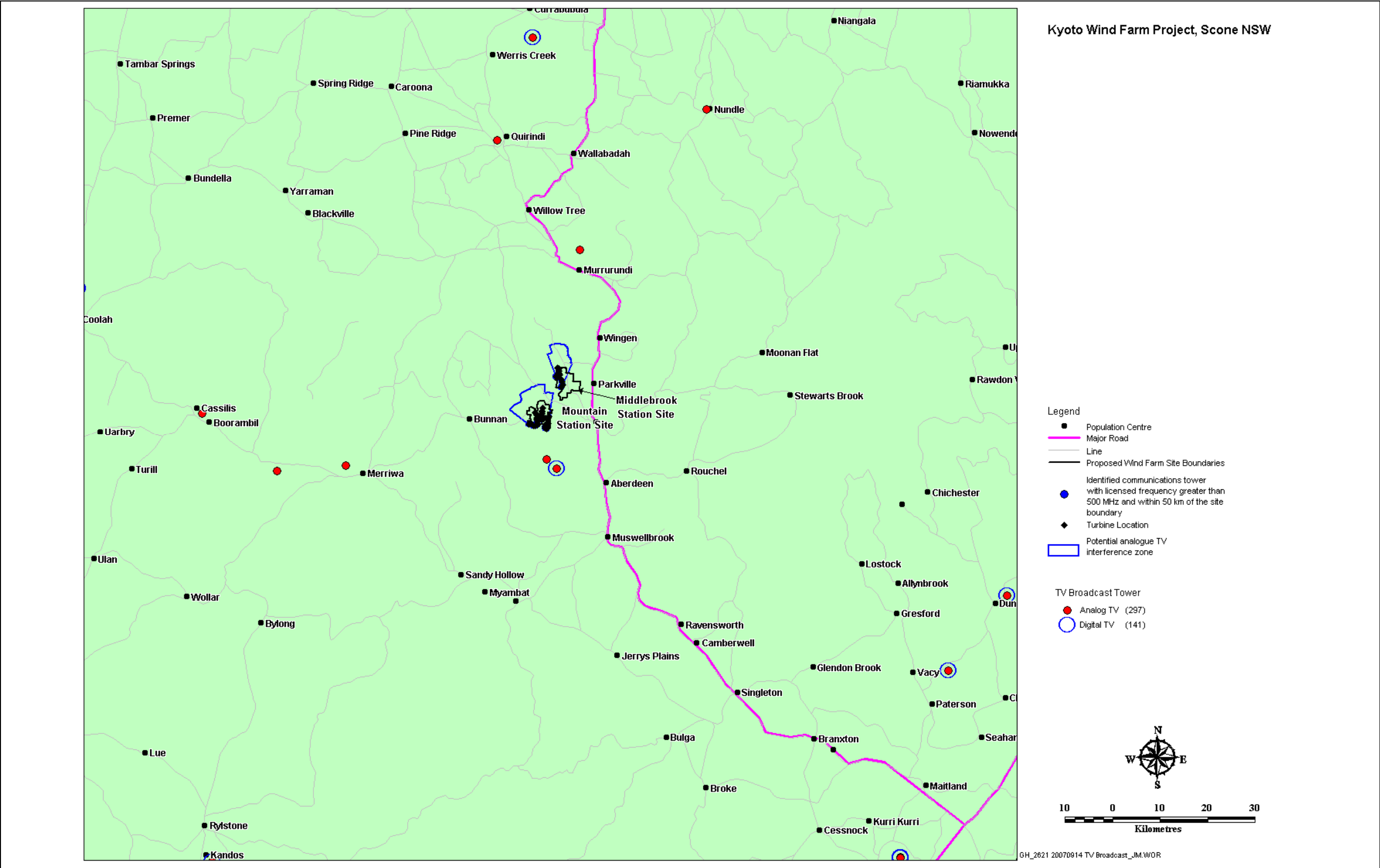


Figure 5 Regions that may have the potential to experience TV based EMI from the Rossgole Lookout broadcast site

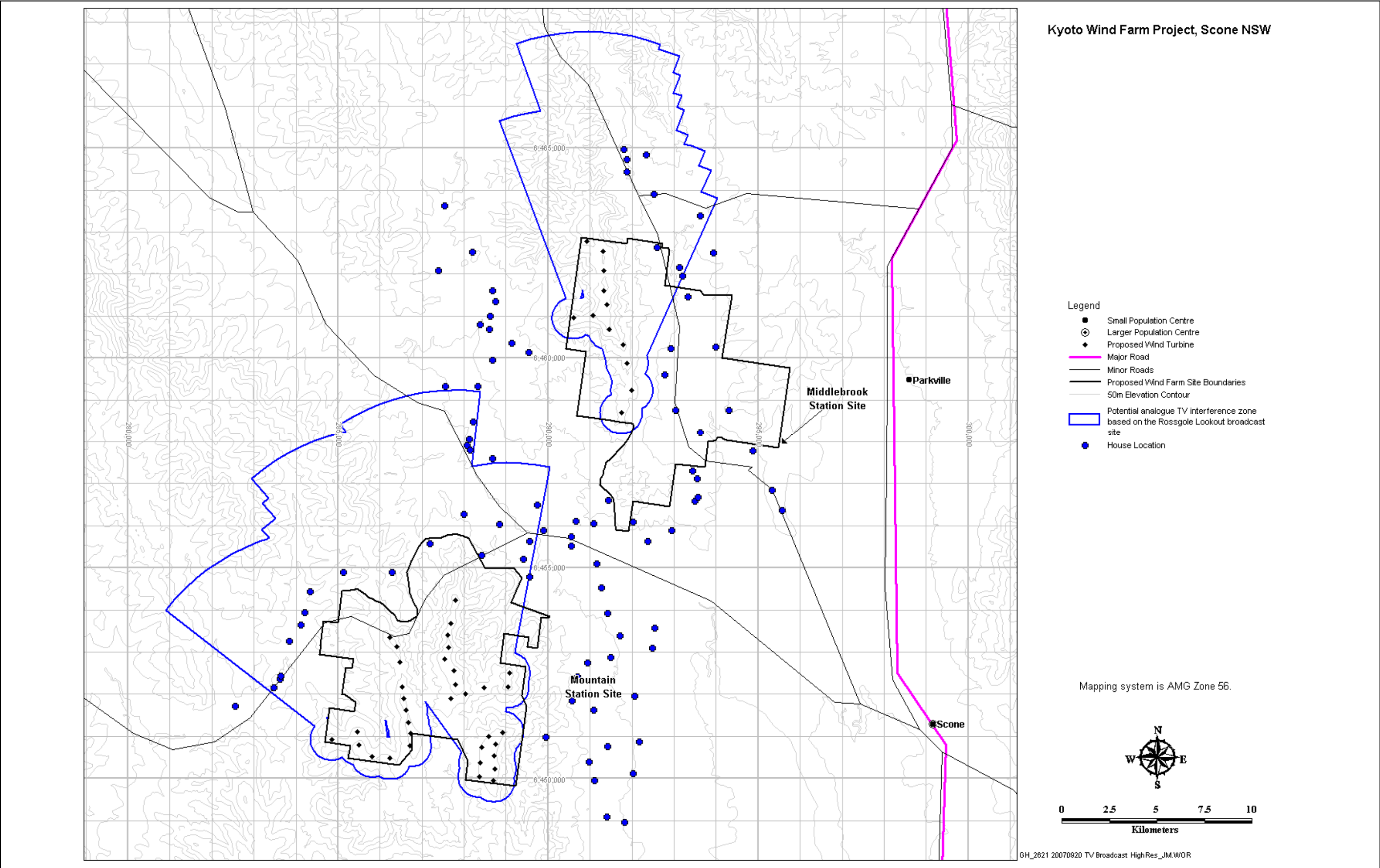


Figure 6 Potential TV interference regions identified nearby to the proposed Kyoto Wind Park based on Rossgole Lookout broadcasts.