
Appendix I

Electromagnetic Interference Assessment

High Road Wind Farm - Electromagnetic Interference Assessment

February 2010

Transfield Services Pty Ltd

DRAFT



*Parsons Brinckerhoff Australia Pty Limited
ABN 80 078 004 798*

*Level 15
28 Freshwater Place
SOUTHBANK VIC 3006
PO Box 19016
SOUTHBANK VIC 3006
Australia
Telephone +61 3 9861 1111
Facsimile +61 3 9861 1144
Email melbourne@pb.com.au*

Certified to ISO 9001, ISO 14001, AS/NZS 4801



Revision	Details	Date	Amended By
00	Original	1/02/2010	
		24/02/2010	Adam Trethowan

©Parsons Brinckerhoff Australia Pty Limited (PB) [2010].

Copyright in the drawings, information and data recorded in this document (the information) is the property of PB. This document and the information are solely for the use of the authorised recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that for which it was supplied by PB. PB makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.

Author: Adam Trethowan.....

Signed: .....

Reviewer: Ross Cooper.....

Signed: .....

Approved by: Andrew Kerley.....

Signed: .....

Date: 24/02/2010.....

Distribution: Transfield, PB Library.....

Please note that when viewed electronically this document may contain pages that have been intentionally left blank. These blank pages may occur because in consideration of the environment and for your convenience, this document has been set up so that it can be printed correctly in double-sided format.

Contents

	Page number
Glossary	iii
Executive summary	iv
1. Introduction	1
2. Wind farms and electromagnetic interference	3
2.1 Types of impacts	3
2.1.1 Characterising impact with exclusion zones	3
2.2 Relevant categories of radio communication services	4
2.3 Impacts and mitigation	5
3. Methodology	7
3.1 Reflection and scattering impacts	7
3.2 Australian Communications and Media Authority	7
3.3 Inputs to assessment	7
4. Assessment results	8
4.1 Assignment search	8
4.1.1 Site ID 21673 – Carr Site Longlands Gap	9
4.1.2 Site ID 21677 – Telstra Evelyn Central Exchange, Evelyn	10
4.1.3 Site ID 21679 – Ergon Energy Site, Longlands Gap	11
4.1.4 Site ID 21710 – Qld Police Site, Longlands Gap	12
4.1.5 Site ID 21713 – Telstra Radio Terminal, Longlands Gap	13
4.1.6 Site ID 9910607 – Mobile Spectrum Licensing Site, Kennedy Highway	15
4.1.7 Assignments without access ID pair	15
4.2 Near field exclusion	15
4.3 Point-to-point services	15
4.4 Point-to-multipoint	20
4.4.1 AM and FM radio broadcasting	20
4.4.2 Mobile radio	20
4.5 Digital and analogue television	20
5. Licensee consultation	22
6. References	23

Appendices

Appendix A

Proposed wind farm layout

Appendix B

ACMA RADCOM site search results (AMG66, Zone 55)

Appendix C

Registered assignments on sites within 5 km of HRWF

Glossary

ACMA	Australian Communications and Media Authority
AM	Amplitude Modulation
E70	Enercon E70 Wind Turbine Generator
FM	Frequency Modulation
HRWF	High Road Wind Farm
ND	Non-directional (in relation to an antenna radiation pattern)
RADCOM	ACMA Registry of Licensed Radio Communicators
RF	Radio Frequency
TV	Television
UHF	Ultra High Frequency
VHF	Very High Frequency

Executive summary

As part of Transfield's development of the High Road Wind Farm, Transfield engaged PB to investigate the potential impact of the wind farm to radio communication services in the area. The scope of the assessment was to consider potential impacts to registered point-to-point services, point-to-multipoint services and broadcast.

For this investigation, PB identified existing radio communication sites and services and their associated paths. This data was obtained from the Australian Communication and Media Authority's database of registered radio communication licenses (RADCOM).

Ninety-five radio communication sites were found within a 25 km distance of the wind farm boundary, with an associated 444 registered assignments. This data was mapped against the proposed wind farm layout, provided by Transfield. Communication towers and service paths that were within five kilometres of the wind farm were selected for further investigation. To this selected data, standard exclusion zones were calculated and the wind farm was assessed considering these zones.

No turbines were assessed to intrude on near field exclusion zones surrounding the identified radio towers. Three turbines were assessed to intrude upon calculated obstruction exclusion zones. The licence holders of the intruded services are Queensland Police Service, State Emergency Service, and Ergon Energy Corporation Limited.

PB has contacted all licensees that operate services within five kilometres of the wind farm boundary. These licensees were consulted to verify the correctness of the data in the RADCOM database and ascertain their position on the proposed wind farm development. The scope of this assessment was only for initial contact with these licensees.

PB recommends that, to avoid obstruction interference, no turbines intrude on the calculated 2nd Fresnel zone for point-to-point radio links. PB suggests if the consulted licensees verify the RADCOM data is correct and there is agreement over radio path and tower setback distances, Transfield investigates mitigation options to avoid any interference. PB has determined three turbines encroach upon 2nd Fresnel exclusion zones for radio paths in the area.

As per the assessment scope, reflection and scattering impacts were not calculated. It is recommended that these are calculated, if required, following receipt of any special requirements of the identified licensees.

PB believes point-to-multipoint and broadcast impacts should be minimal. However, PB recommends the position of registered point-to-multipoint license holders is sought with respect to the wind farm development. PB has initiated consultation with these license holders that are located within 5 km of the wind farm.

GIS data has been supplied to Transfield for their own use. This data includes the radio towers, paths and exclusion zones derived in this assessment.

1. Introduction

Transfield Services Pty Ltd (Transfield) are developing the High Road Wind Farm (HRWF) in far north Queensland, near to the town of Evelyn approximately 60 km directly west of the coastal town of Innisfail (see Figure 1). Transfield has advised that the wind farm consists of 37 Enercon E70 wind turbines – a 2.3 MW machine with a 71 m rotor diameter.

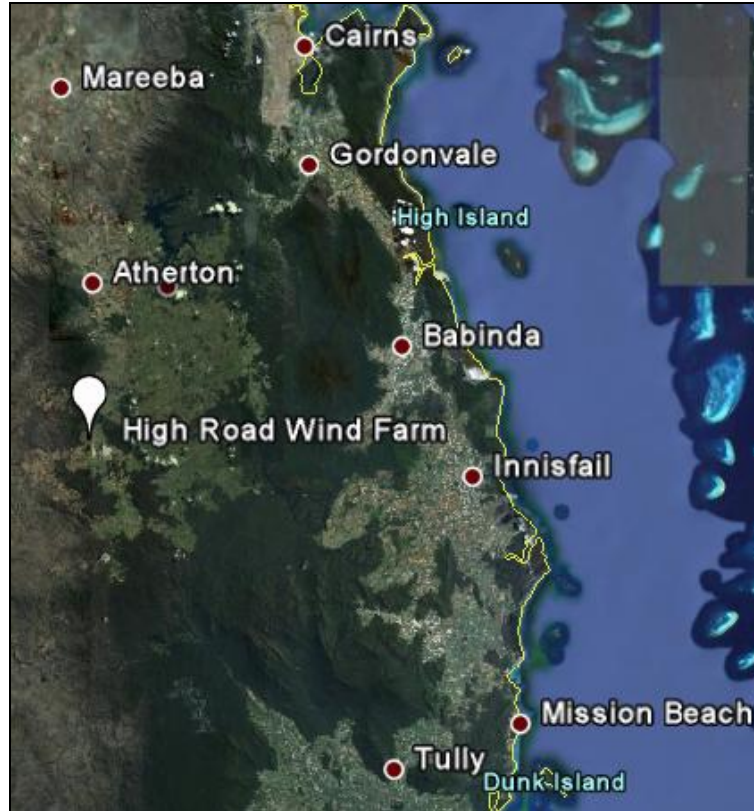


Figure 1: Location of High Road Wind Farm relative to local population centres (source: Google Earth)

As part of the site development, Transfield requested PB undertake an assessment of potential impacts to electromagnetic communication in the area. The scope of the investigation included the following (scope from the proposal italicized¹):

1. *Identify existing radio communication services and the related communication paths near to the wind farm site*
2. *Determine any high risk issues and constraints posed by the presence and operation of identified communications services with respect to the HRWF layout*
3. *Initial contact with potentially impacted communications licensees – we understand Transfield will be continuing consultation following the submission of this report*
4. *Provide recommendations on any further steps to be taken to mitigate radio communication impact risks*

¹ TRANSFIELD HIGH ROAD WIND FARM TELECOM ASSESSMENT R00, sent 03/02/2010.



This report documents the undertaking of this scope.

GIS data has been supplied to Transfield for their own use. This data includes the radio towers, paths and exclusion zones derived in this assessment.

2. Wind farms and electromagnetic interference

Communication systems using radio waves are heavily utilised in Australia. Mobile phones, television, commercial radio and emergency radio are common examples of systems that rely on radio communication. These systems generally use radio towers to help transmit and receive signals across a wide area. In the context of wind farm development, electromagnetic interference is the impact of a wind farm on radio communication services resulting in an unacceptable detrimental effect to the radio service. Radar services (civil and weather) can potentially be impacted by wind farms also.

The objective of considering electromagnetic interference during the wind farm development stage is to mitigate potential impacts caused by locating wind turbines in the vicinity of radio communication services.

2.1 Types of impacts

The different effects wind farms can have on communication services are discussed below.

- *Near field impact*
A property of a transmitting and/or receiving antenna is a “near field” zone that is present around the antenna. Any object that can conduct or absorb radio waves, placed within the near field zone, can alter the behaviour of the antenna.
- *Obstruction impact*
If an absorbing object is placed within the advancing wavefront of a radio wave, wave obstruction can occur, detrimentally affecting the signal detected at the receiver.
- *Reflection and scattering impacts*
If an object that’s reflective to radio waves exists in the advancing wavefront, it may reflect energy away. The reflected signal may be reflected to the transmitting or receiving antenna which can interfere with the desired signal.
- *Electromagnetic fields / RF interference*
The operation of a wind turbine generator, and associated electrical transmission infrastructure, creates an electromagnetic field which can theoretically interact with radio communication.

2.1.1 Characterising impact with exclusion zones

In many cases, impacts can be sufficiently characterised and mitigated using calculated “exclusion zones” and ensuring these zones are free from wind turbines. In other cases, such as when exclusion zones are not feasible to calculate or not appropriate for the communication service, other options are available. Details of the calculated exclusion zones are given below.

- *Near field impact*
Recommendations for determining exclusion zones to mitigate near field impacts are given by Bacon (2002). Exclusion zones for the HRWF site have been calculated using this method and are discussed in Section 4.2. In many cases, these exclusion

zones are very small. However, PB recommends a minimum standard 500 m radio tower exclusion zone as a precautionary measure for any reflection and scattering impacts that may be produced. In general, this is easily achievable and has been achieved at HRWF.

- *Obstruction impact*
Recommendations for determining exclusion zones to mitigate obstruction are given by Bacon (2002). Exclusion zones have been calculated at HRWF using this method (2nd Fresnel zone method) and are discussed in Section 4.3.
- *Reflection and scattering impacts*
The accepted methods for calculating these impacts generally require information on signal performance requirements specific to each service and client. Additionally, impact calculations from this effect require complex modelling to determine. PB has consulted the licensees with services that would be susceptible to these impacts to determine their position regarding the development. The scope of this assessment does not include the calculation of reflection / scattering impacts. The recommendations for considering these impacts are given in Section 3.1.
- *Electromagnetic fields / RF interference*
These effects are not considered in this assessment. Providing appropriate standards and guidelines are observed in the wind turbine and balance of plant design, these electromagnetic fields are not expected to cause impacts that are relevant to this assessment. PB's scope does not include assessing this type of interference.

The possible wind farm electromagnetic impacts have only been briefly discussed. See the supplied references (Section 6) for further information.

2.2 Relevant categories of radio communication services

In assessing radio communication impact by wind farms, radio systems are commonly broken into a number of different categories based on type. For the purposes of electromagnetic impact investigation, the following categories of services are considered: point-to-point, point-to-multipoint, and radar.

- *Point-to-point*
Radio links that transmit and receive between two fixed points fall under this category. For example, network backhaul commonly utilises point-to-point communication.
- *Point-to-multipoint*
A central location transmits to, and receives from, a number independent of locations. Television and radio broadcasting and reception, mobile phones (to the mobile phone mast) and land mobile systems fall under this category.
- *Radar*
Radar transmits a signal which is reflected back to the transmitting station (some systems involve communication between a radar station and a transponder). Services that utilise radar technology include aircraft detection and weather services.

Point-to-point and point-to-multipoint impacts are considered separately in this assessment. Radar impacts are not part of the scope of this assessment; however PB suggests Transfield consults with the following radar operators (PB can provide further assistance with this consultation) to determine their position on the HRWF development:

- Department of Defence
- Air Services Australia
- Bureau of Meteorology

2.3 Impacts and mitigation

The objectives of investigating wind farm electromagnetic interference is to identify potential electromagnetic impacts based on the information available, and also to reach agreement with impacted radio licensees. This is so the design of the wind farm, including any impact mitigation strategies, will allow the wind farm to coexist with the present radio services.

This is achieved using a variety of methods, depending on the radio service category in question.

- *Point-to-point*
Abide by calculated and recommended minimum exclusion zones.

Consult with relevant licensees that may be affected by the wind farm development.
- *Point-to-multipoint*
Abide by calculated and recommended minimum near-field exclusion zones from the base station radio tower.

Consult with relevant, registered point-to-multipoint licensees that may be affected by the wind farm development. Users of radio equipment under a Class C license will not be present in the ACMA database and therefore cannot be assessed. It is believed the potential impact to these users will be low, however, PB recommends Transfield include EMI impacts to these users in their community consultation process.

Generally, mitigation of radio impacts involves manipulation of the turbine layout so that impacts are acceptably controlled. However, the wind farm proponent's considerations may make other options feasible (providing there is agreement amongst the relevant parties). The Draft National Wind Farm Development Guidelines (see Section 6 for reference) provides the following hierarchy of mitigation options (in order of most preferable to least preferable):

1. Re-location / removal of turbines
2. Replacement of existing radio communications service equipment with another less affected type (e.g., replace UHF link with microwave link; replace analogue TV with digital TV)
3. Re-location of radio communications services to another existing radio communications site
4. Re-location of radio communications services to a new telecommunications site.

5. Substitute radio communication for underground or overhead optical fibre
6. Enhance radar filters

3. Methodology

Based on a number of existing guidelines (see Section 6), and considering PB's knowledge of the HRWF status, PB has taken the course outlined below.

1. Identify any registered, licensed radio communication sites and services within a 25 km distance from the wind farm boundary
2. Determine near-field and obstruction exclusion zones using standard methods
3. Assess the wind farm layout against the exclusion zones calculated in step 2
4. Identify local commercial broadcasting stations and their location relative to the wind farm
5. Contact any registered and licensed radio communication site (and service) clients within a 5 km distance from the wind farm boundary notifying them of the proposed development and request their impact mitigation requests (if applicable)

3.1 Reflection and scattering impacts

These impacts were not determined as part of this assessment. PB generally suggests these impacts are calculated, if required, following the receipt of any specific requirements from the potentially impacted radio stakeholders.

3.2 Australian Communications and Media Authority

The Australian Communications and Media Authority (ACMA) is the Australian government body that regulates the use of Australia's radio spectrum. They maintain a register of radio licenses, radio communication towers and radio services (RADCOM).

PB utilised the ACMA issued RADCOM CD dated 1/01/2010 to conduct the assessment.

ACMA also maintains a register of licensed commercial broadcasters which was accessed via the ACMA webpage².

The ACMA RADCOM database has been known to contain inaccurate information. Additionally, the precision of some tower location measurements can be considered low for the purposes of this assessment. As part of the consultation process, PB has requested verification of the ACMA information relevant to each of the contacted stakeholders.

3.3 Inputs to assessment

PB received a turbine layout from Transfield for the HRWF. This layout is supplied in Appendix A. Transfield advised that the turbine expected to be used is the Enercon E70. This turbine is noted to have a 71 m rotor diameter, or alternatively, a 35.5 m rotor radius³.

² http://www.acma.gov.au/WEB/STANDARD/pc=PC_9150; accessed 25/01/2010

³ Turbine specifications from the Enercon website: <http://www.enercon.de/en/e70.htm>; accessed on 24/01/2010.

4. Assessment results

4.1 Assignment search

A search of the RADCOM database was conducted using a defined search area of 25 km from the wind farm boundary. Ninety-five sites were found within the defined search area. Details of these sites can be found in Appendix B.

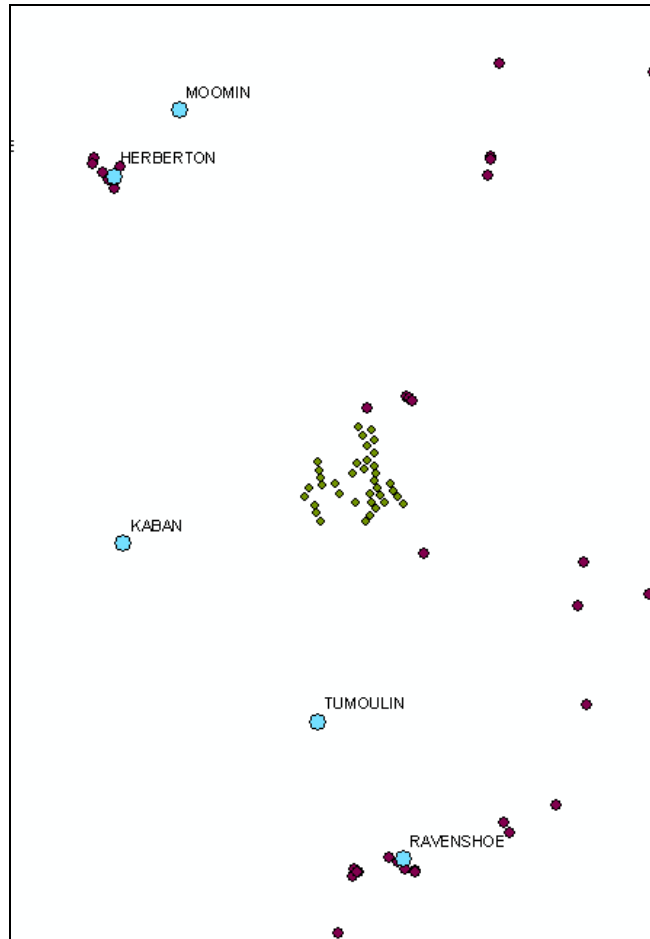


Figure 2: HRWF (green), surrounding radio sites (maroon), and nearby populated areas (blue)

Associated with these 95 sites were 444 registered assignments. These sites and assignments were mapped to determine those radio communication services that were proximal to the wind farm site. Within this mapped dataset, PB identified all sites and assignments within a 5 km radius of the wind farm boundary. An analysis of these sites and assignments is given below.

Table 1: Sites within a 5km radius of the HRWF boundary

SITE_ID	LATITUDE	LONGITUDE	SITE_NAME	PRECISION
21673	-17.457032	145.48524	Carr Site LONGLANDS GAP	Within 10 metres
21677	-17.508034	145.490054	Telstra Evelyn Central Exchange EVELYN	Within 100 metres
21679	-17.456386	145.484737	Ergon Energy Site LONGLANDS GAP	Within 100 metres
21710	-17.457043	145.485589	Old Police Site LONGLANDS GAP	Within 10 metres
21713	-17.457899	145.486354	Telstra Radio Terminal LONGLANDS GAP	Within 10 metres
9910607	-17.460294	145.471128	Mobile Spectrum Licensing Site KENNEDY HIGHWAY	Unknown

4.1.1 Site ID 21673 – Carr Site Longlands Gap

The site 21673 “Carr Site, Longlands Gap” is located approximately 1.7 km to the northeast of the wind farm and features six licences operated by Austek Communications Pty Ltd. All services are non-directional in the VHF to UHF bands.

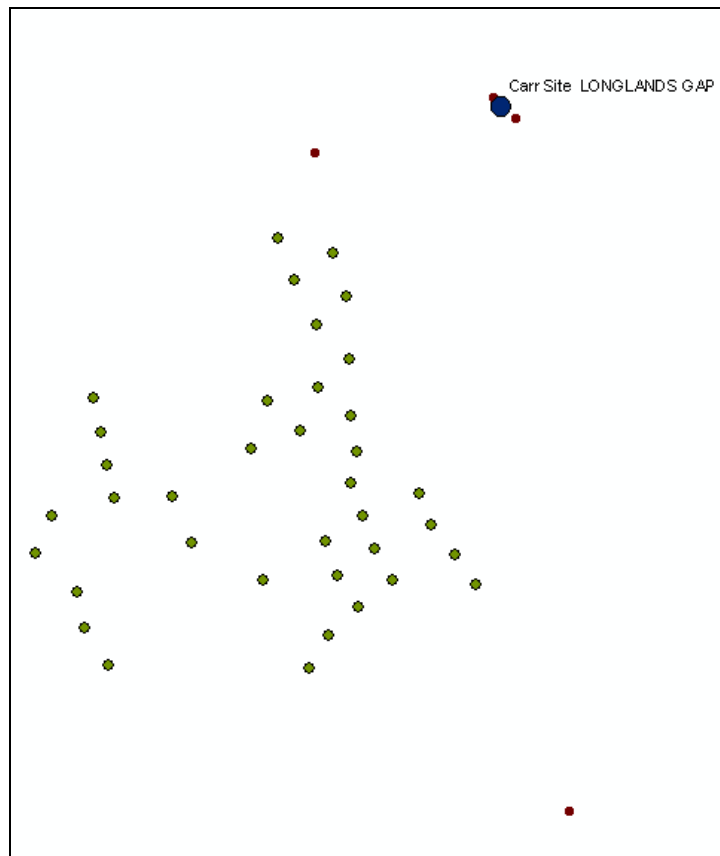


Figure 3: Site ID 21673 (blue)

4.1.2 Site ID 21677 – Telstra Evelyn Central Exchange, Evelyn

The site 21677 “Telstra Evelyn Central Exchange Evelyn” is located approximately 1.9 km southeast of the nearest wind turbine. The site features two registered assignments operated by Telstra Corporation Limited in the VHF to UHF bands, directed at an azimuth of 355°. These assignments are directed (one assignment is transmitted, the other received) to Site ID 21713 Telstra Radio Terminal, Longlands Gap (see Section 4.1.5). The radio path comes within 600 m of the nearest turbine tower.

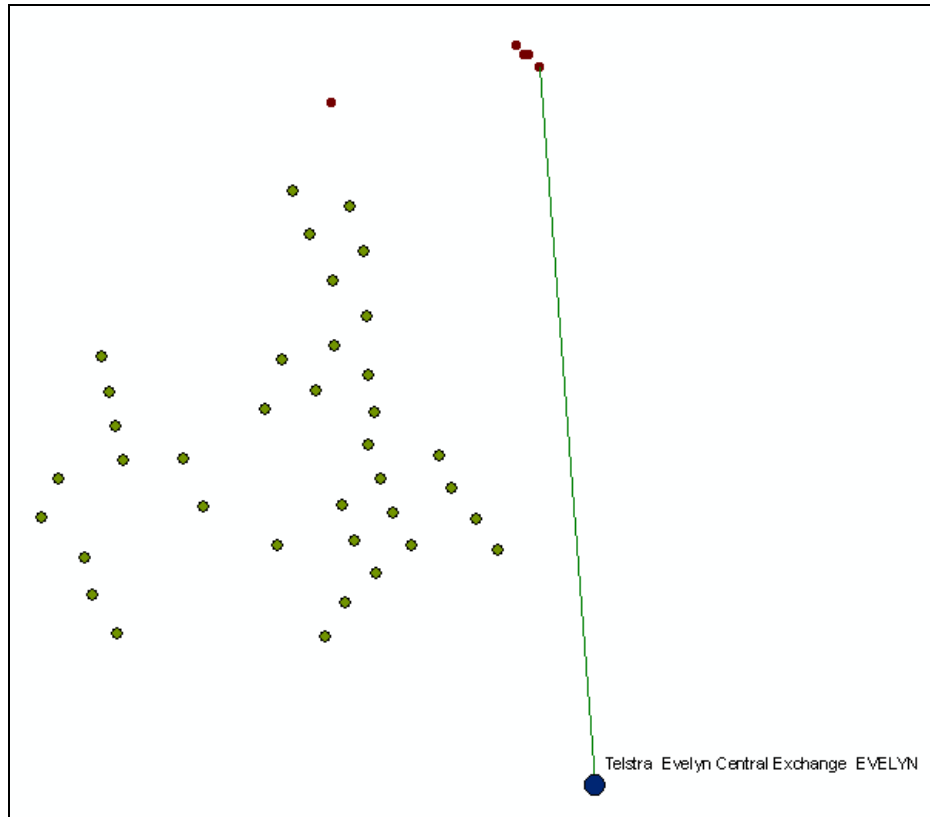


Figure 4: Site ID 21677 (blue) and associated assignments

4.1.3 Site ID 21679 – Ergon Energy Site, Longlands Gap

The site 21679 “Ergon Energy Site, Longlands Gap” is located approximately 1.7 km to the northeast of the closest wind turbine. The site features ten registered assignments with some directional and some non-directional assignments in the VHF to UHF bands. All assignments on this tower are operated by Ergon Energy Corporation Limited.

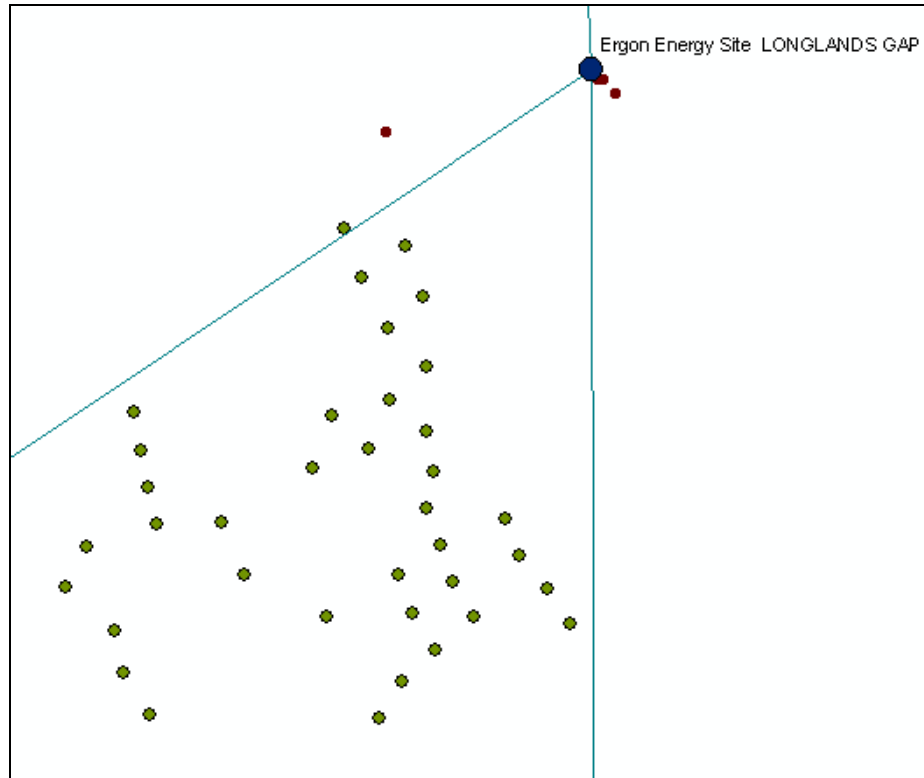


Figure 5: Site ID 21679 (blue) and associated assignments

The assignments are discussed below based on their azimuth entry:

- *236 degrees*
The tower corresponding to the access ID pair for both ID number 58291 and 351067 is the site “Ergon Site 139 km SW of Atherton, Round Mountain” (site ID 21229). Based on the RADCOM information, this site is calculated to be approximately 127 km away from site 21679. Due to the link distance and terrain, PB suggests confirmation of this service with Ergon Energy Corporation Limited.
- *Non-directional*
See Section 4.4.
- *357 degrees*
The tower corresponding to the services at a 357 degree azimuth is the site “Ergon Substation off Grant St, Atherton” (site ID 9001006). The services on this azimuth are directed away from the wind farm and are not expected to be obstructed by HRWF.
- *180 degrees*
The tower corresponding to the services directed on a 180 degree azimuth is the site “Powerlink Site, Gosham” (site ID 20639). This site is located approximately 77 km from this site. Due to the link distance and terrain, PB suggests confirmation of this

service with Ergon Energy Corporation Limited. This service passes within approximately 140 m from the nearest turbine tower.

4.1.4 Site ID 21710 – Qld Police Site, Longlands Gap

The site 21710 “Queensland Police Site, Longlands Gap” is located approximately 1.7 km to the northeast of the wind farm and the closest wind turbine. The site features 37 registered assignments with some directional and some non-directional assignments in the VHF to UHF bands. The assignments on the tower are operated by a variety of licensees.

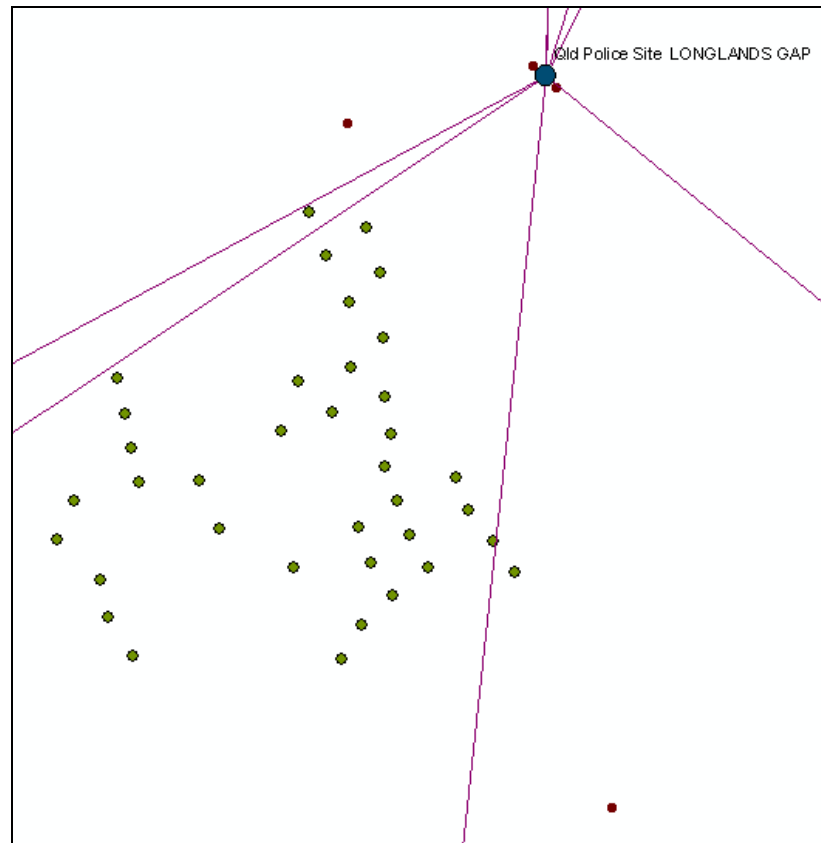


Figure 6: Site ID 21710 (blue) and associated assignments

The assignments are discussed below based on their azimuth entry:

- **001**
Four assignments are listed as having azimuths of 001 degrees. Two of these assignments (ACCESS IDs 1481784, 1481785) link with “QAS Site Hallorans Hill, Atherton” (site ID 22009) The remaining two assignments link with the site “Telstra Radio Terminal Hallorans Hill Atherton”, site ID 22011. The sites on the bearing 001 degrees are directed to the north, away from HRWF and are not expected to be obstructed by HRWF.
- **17 & 18**
The assignments with bearing 17 and 18 degrees all are listed with the same linked tower: Miles Site, Lambs Head (site ID 20804). These services are directed away from HRWF and are not expected to be obstructed by HRWF.
- **027**
The two assignments bearing 027 degrees link to the tower “SES HQ State

Government Building, Shield St, Cairns” (site ID 440351). These services are directed away from HRWF and are not expected to be obstructed by HRWF.

- **111**
This site has an azimuth entry of 111 degrees, but the other tower in the point-to-point link is the tower “QAS Site Bald Rock, Ravenshoe” (site ID 39742). If these two points define the point-to-point link, the azimuth is required to be 186 degrees which would mean this path would be within 18 m of a turbine tower in the wind farm. PB has contacted the licensees to verify the ACMA information .
- **129**
The two services bearing 129 degrees, licensed to the State Emergency Service, link to the tower “Lookout Carpark, McHugh Rd, Millaa Millaa” (site ID 440405). These services are directed away from the wind farm and are not expected to be obstructed by HRWF.
- **186**
The four services on bearing 186 degrees link to the tower “QAS Site Bald Rock, Ravenshoe” (site ID 39742). The radio path from these services passes within 18 m of a turbine tower in the wind farm.
- **236**
The two services bearing 236 degrees link to the tower “Telstra Radio Terminal, Mount Garnet” (site ID 21714). These services pass within 136 m of a turbine in the wind farm (distance from radio path to tower).
- **242**
The services directed on a bearing of 242 degrees link to the tower “SES Site, Newcastle Range” (site ID 441142). These services pass within 65 m of a turbine within the wind farm (distance from radio path to tower).
- **ND**
See Section 4.4.

4.1.5 Site ID 21713 – Telstra Radio Terminal, Longlands Gap

The site 21710 “Telstra Radio Terminal, Longlands Gap” is located approximately 1.7 km from the closest wind turbine in HRWF. The site features 40 registered assignments with some non-directional and some directional assignments in the VHF to microwave frequency bands. The assignments on the tower are operated by a variety of licensees.

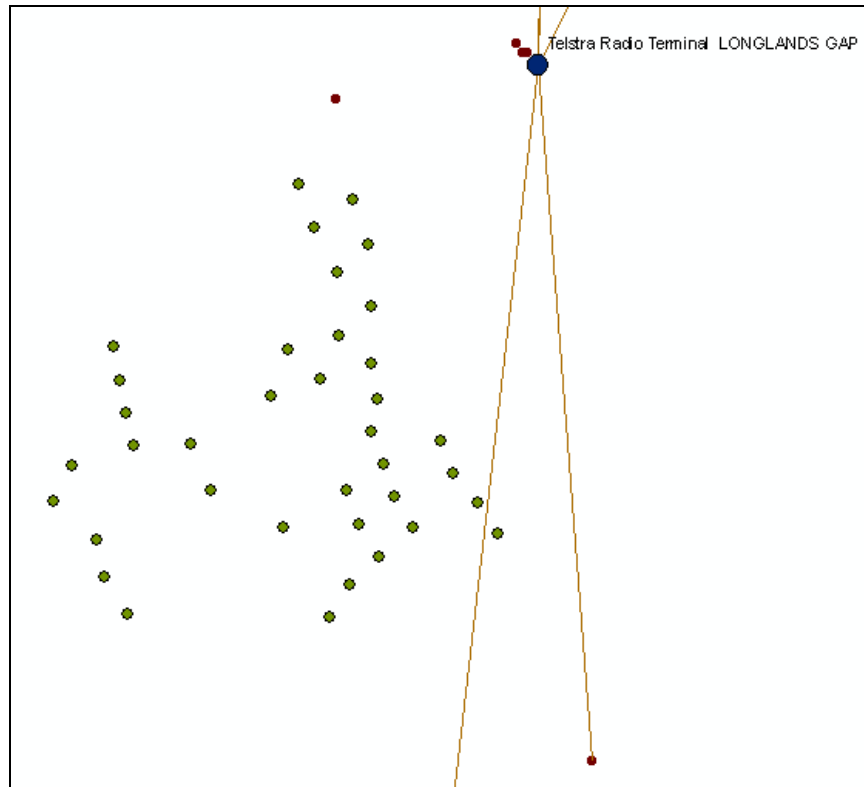


Figure 7: Site ID 21713 (blue) and associated assignments

The assignments are discussed below based on their azimuth entry:

- *No entry*
See Section 4.1.7.
- *001*
The two sites on bearing 001 degrees link to the tower “Optus Site, Dalziel Avenue, Atherton” (site ID 130247). These services are directed away from the wind farm and are not expected to be obstructed by HRWF.
- *002*
The two sites on bearing 002 degrees link to tower “Telstra Radio Terminal, Hallorans Hill, Atherton” (site ID 22011). These services are directed away from the wind farm and are not expected to be obstructed by HRWF.
- *160*
See Section 4.1.7.
- *175*
The four services on bearing 175 degrees link to the tower “Telstra Evelyn Central Exchange, Evelyn” (site ID 21677). These assignments pass within 600 m of the nearest turbine (from radio path to tower).
- *187*
The two services on bearing 187 degrees link to the tower “Ravenshoe B.A. Co-location N/A Bald Rock Road, Ravenshoe” (site ID 9010957). These services pass within approximately 70 m from the nearest turbine in the HRWF wind farm.

- 280
See Section 4.1.7.
- ND
See Section 4.4.

4.1.6 Site ID 9910607 – Mobile Spectrum Licensing Site, Kennedy Highway

The mobile spectrum licensing site is not a tower but is used by ACMA to designate different spectrum licensing areas. Therefore, this site does not need to be considered.

4.1.7 Assignments without access ID pair

The 5 km “further investigation radius” that PB used to determine which assignments to examine more carefully is used to search for assignments in the RADCOM database. A point-to-point link will have, for instance, a transmit assignment and a receive assignment (two points are required to define the link). Sometimes, a point-to-point link cannot be constructed because a directional antenna cannot be matched with the antenna on another tower. In these cases, the lone antenna has been assessed to be part of a point-to-point network and not a point-to-multipoint site (which may have unregistered receivers).

Several assignments were returned in the 5km investigation radius that did not have matching pairs. In several cases, these returned assignments had azimuths that were directed near to, or into, the HRWF. PB has contacted the licensees in each of these cases to request more information.

4.2 Near field exclusion

For the services attached to towers discussed in Section 4.1, the near field exclusion zones were calculated. The exclusion zones were mapped with respect to the HRWF layout. As discussed in Section 2.1.1, PB recommends an exclusion zone equal to the maximum of the calculated near field exclusion zone and 500 m (whichever is the greater). No turbines are located within these defined exclusion zones.

4.3 Point-to-point services

For the point-to-point services in the search results in Section 4.1, PB calculated the recommended obstruction exclusion zones (2nd Fresnel exclusion zone). Based on this methodology, the following turbines were found to intrude on obstruction exclusion zones:

Table 2: Turbines intruding on calculated obstruction exclusion zones

Turbine #	
2	
Intruded Access ID	Intruded Service Client
57058	Queensland Police Service
Turbine #	
26	
Intruded Access ID	Intruded Service Client
1445160	State Emergency Service
58291	Ergon Energy Corporation Limited
Turbine #	
32	
Intruded Access ID	Intruded Service Client
57148	Queensland Police Service
58291	Ergon Energy Corporation Limited

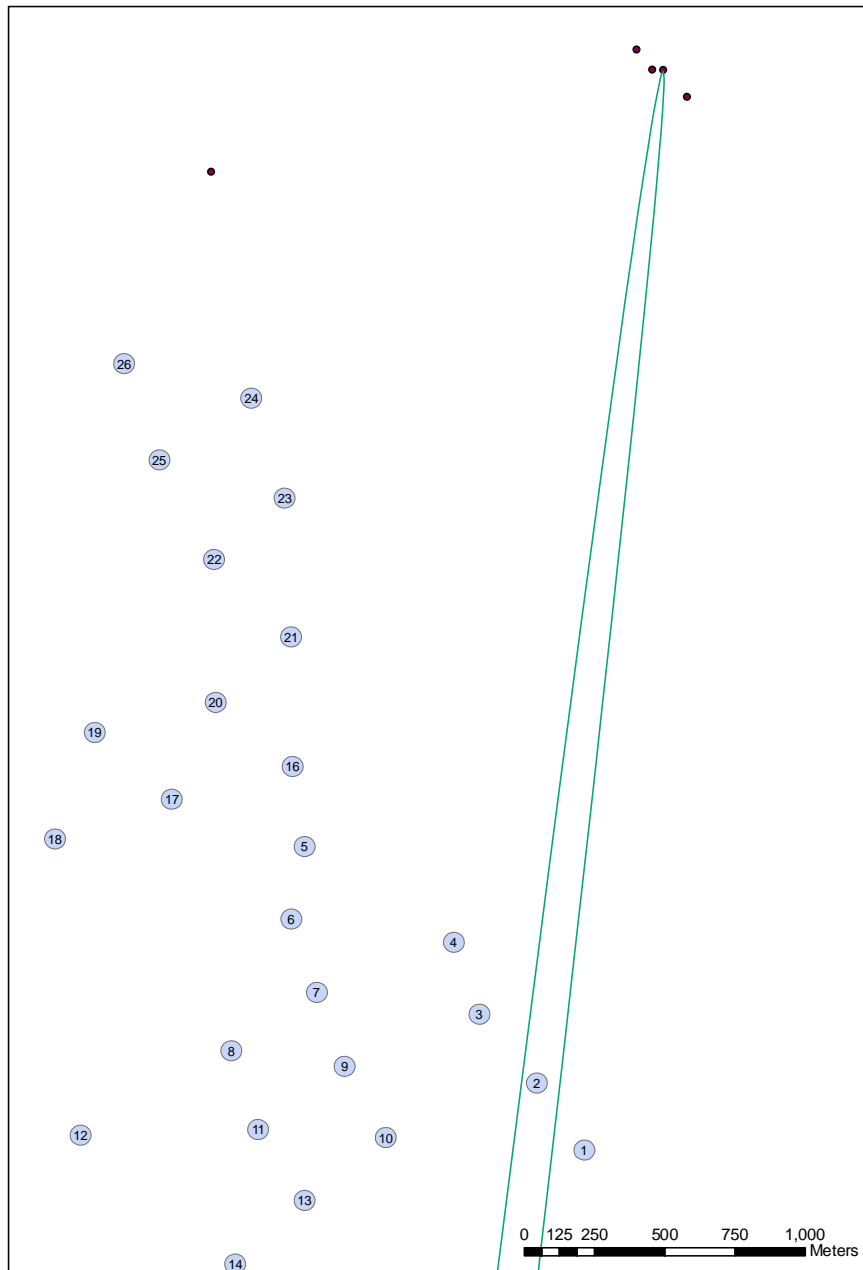


Figure 8: Wind turbine #2 encroaching on the QLD Police Service Fresnel zone

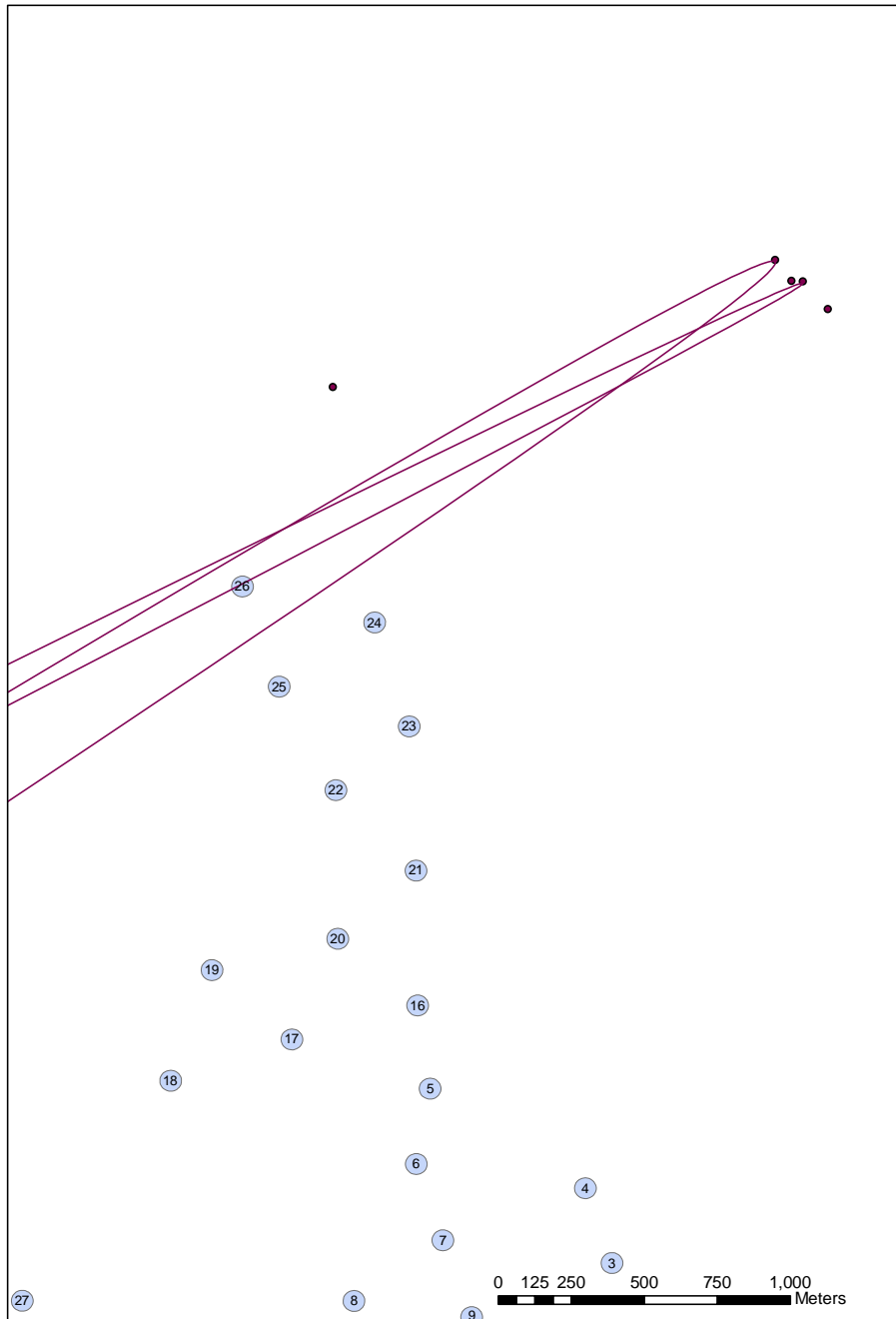


Figure 9: Wind turbine #26 encroaching on the QLD Police Service and Ergon Energy Fresnel zones

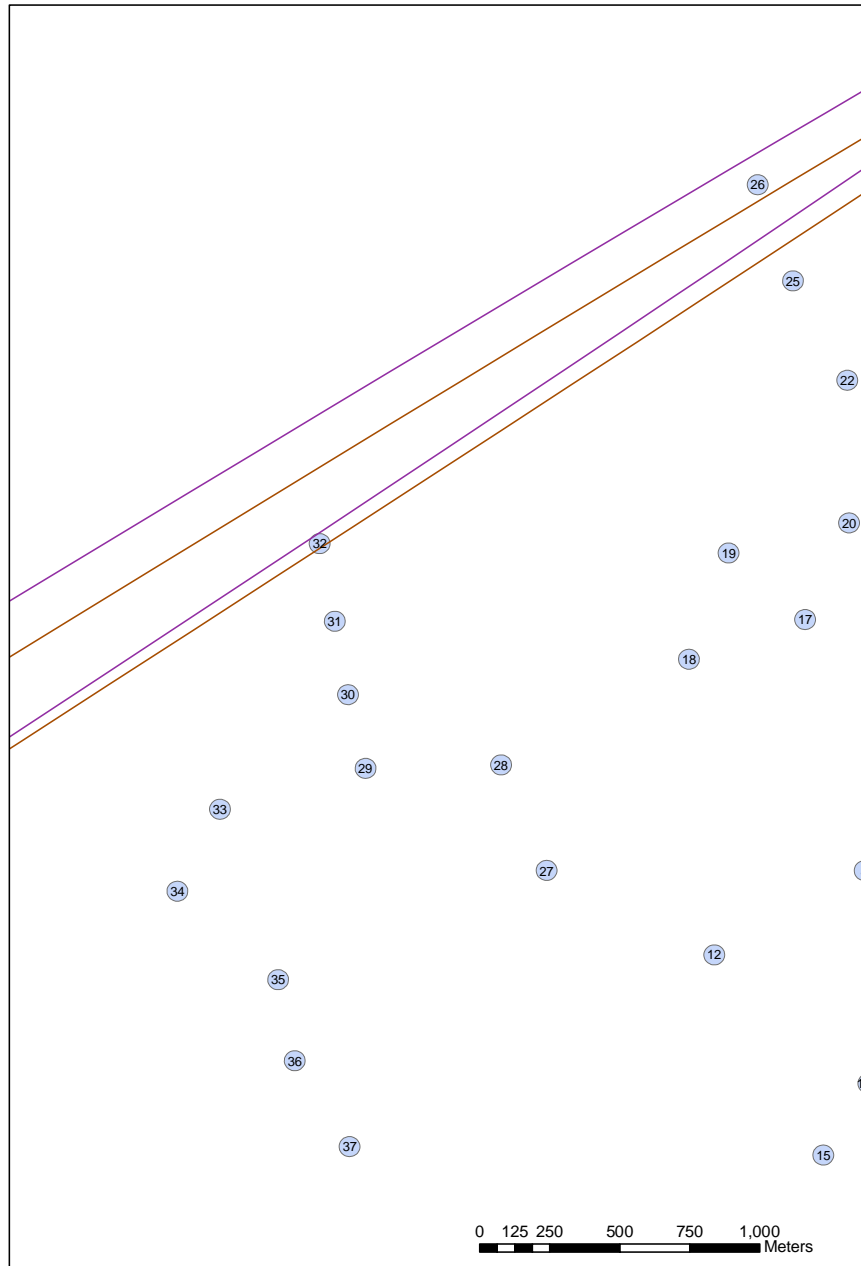


Figure 10: Wind turbine #32 encroaching on the SES and Ergon Energy Fresnel zones

PB recommends that turbines do not intrude on the 2nd Fresnel exclusion zone. However, before any layout adjustment occurs, PB recommends the coordinates of the transmitting and receiving towers, the status of the services and requirements of the licensees are verified during the consultation phase. The tower coordinates may not be accurate, the services may not be active or the requirements of the licence holders may change the requirements for layout adjustment. PB has initiated contact with the licensees (see Section 5).

4.4 Point-to-multipoint

Point-to-multipoint links are similarly susceptible to the types of impacts discussed in Section 2.1. However, because of the nature of many uses of point-to-multipoint radio communication, the likelihood of a wind farm causing unacceptable impacts is generally low. For example, for land mobile systems a mobile receiver can generally get an adequate signal by moving a short distance to an unobstructed area. However, there may be point-to-multipoint services with fixed receivers that can be impacted. Any registered services will be present and accounted for in the ACMA database used in this assessment. However, unregistered operators (such as Class licensees⁴) may not be detected. PB has consulted point-to-multipoint and broadcast licensees on towers within a 5 km distance from the wind farm boundary to determine their position on the development. PB recommends Transfield gathers information on fixed Class license receivers during their community consultation phase to determine if there are any users in the area.

PB has considered the impact to the following point-to-multipoint radio communication services.

4.4.1 AM and FM radio broadcasting

The impact to FM radio broadcasting reception is considered to be negligible. The impact to AM radio broadcasting is considered to be negligible beyond the boundary of the wind farm.

4.4.2 Mobile radio

Mobile radio may be affected by interference from the HRWF. However, if this is the case, any problems can usually be rectified through a minor adjustment in the position of the receiver. However, there are several mobile radio towers in the close area whose users may be impacted by the HRWF (for example, Site ID 21673 – Carr Site Longlands Gap). These licensees have been contacted requesting their position on the development.

4.5 Digital and analogue television

Reflection of an analogue video signal can result in impact to analogue television services. Analogue television broadcast stations are present near to the towns of Ravenshoe, Herberton and Cairns that appear to service the area. Based on the coverage patterns given by the Australian Broadcast Corporation⁵, further information would be required to determine which site(s) is being used by local receivers. A broadcast tower is near Atherton; however the coverage pattern is directed northward.

⁴ http://www.acma.gov.au/WEB/STANDARD/pc=PC_481 accessed on 20/02/2010

⁵ <http://www.abc.net.au/reception/freq/>

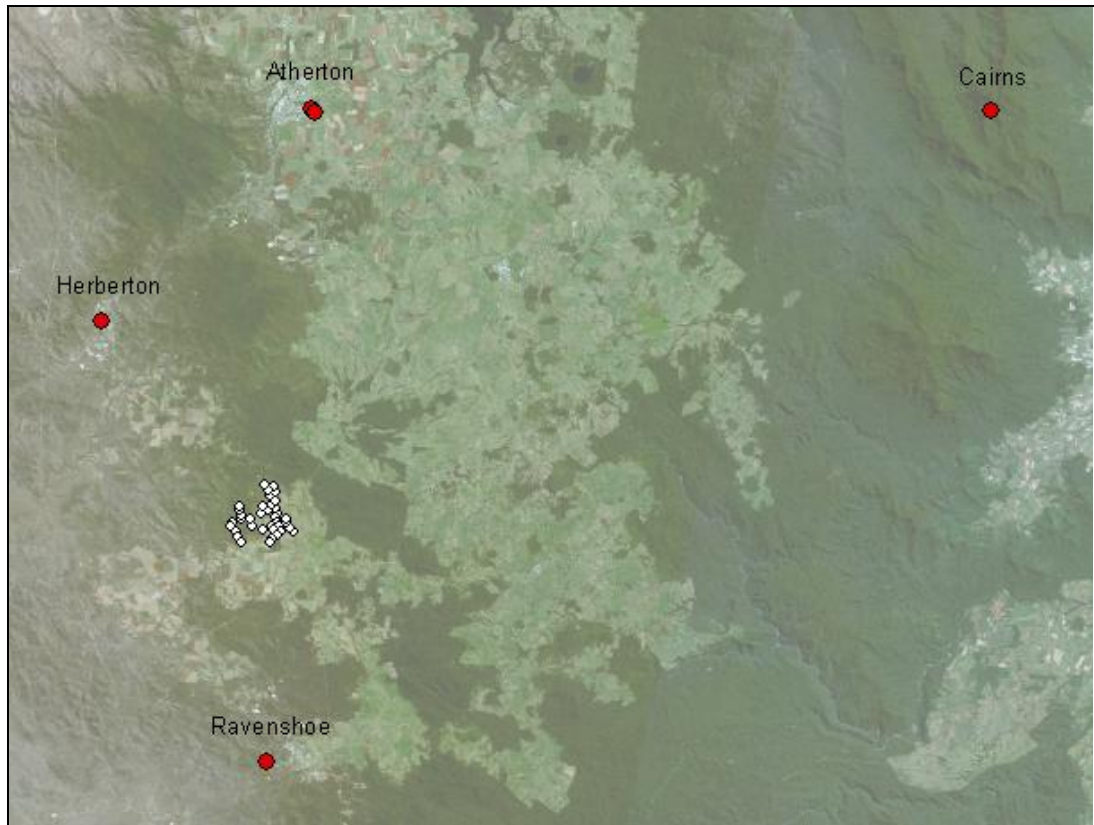


Figure 11: HRWF (white) and the surrounding broadcast stations

No population centre lies such that the HRWF is obstructing either of these broadcast stations lines of sight. However, residences may be located near the wind farm such that there is line of sight obstruction between the residence and the broadcast site. More information would be required to determine if this is the case.

Digital television signals are generally not degraded due to interference from wind turbines.

Residences close to HRWF may experience interference to their analogue television signals. Further modelling would need to be undertaken to determine the extent of that impact, if required. However, a potential mitigation option for analogue television impact is converting an analogue television receiver to digital. The Australian government has declared analogue television will be phased completely out of service by the end of 2013 with service in many areas ceasing operation before that time. Given a reasonable construction schedule for HRWF, many television users will likely have converted to digital television when construction has commenced.

5. Licensee consultation

All the licensees within Appendix C have been contacted to give them opportunity to comment on the development. The contact details for each of the licensees are given below.

LICENSEE	Contact details
Austek Communications Pty Ltd	Austek Communications Pty Ltd, Queensland
Telstra Corporation Limited	Russell Curtis, Telstra
Ergon Energy Corporation Limited	Peter Griggs, Ergon Energy ⁶
State Emergency Service	Geoff Meehan, Technical Planning and Support officer, Department of Community Safety, Queensland
Queensland Police Service	Stuart McMurtrie, Queensland Police
Commissioner Queensland Ambulance Service	Geoff Meehan, Technical Planning and Support officer, Department of Community Safety, Queensland
Queensland Fire and Rescue Service	Geoff Meehan, Technical Planning and Support officer, Department of Community Safety, Queensland
St John Ambulance Australia	Stephen Carter, St John Ambulance Australia
Optus Mobile Pty Limited	Jayantha Wickramasinghe, Radio Transmission Planning, Optus
Tableland Radio & Electronics Club Inc	Dale McCarthy, Tablelands Radio & Electronics Club, Queensland
Telstra Corporation Ltd attn R Preston	Russell Curtis, Telstra

Correspondence received by PB from the licensees at the time of writing has been forwarded to Transfield.

⁶ PB was advised by Ergon Energy call centre that our information was passed to Peter Griggs who is the relevant contact. PB could not obtain his contact details.

6. References

1. Bacon, D. F. (2002) – Fixed link wind turbine exclusion zone method. Ofcom.
2. National Wind Farm Development Guideline, Public Consultation Draft (2009) – Environment Protection and Heritage Council
3. ERA Technology (2009) - RF Measurement Assessment of Potential Wind Farm Interferences to Fixed Links and Scanning Telemetry Devices. ERA Technology Ltd.

Appendix A

Proposed wind farm layout

Table 3: Wind farm layout coordinates (AMG66, Zone 55)

Turbine No.	East	North
1	338944	8065420
2	338781	8065656
3	338584	8065898
4	338495	8066152
5	337985	8066487
6	337942	8066230
7	338031	8065971
8	337742	8065762
9	338127	8065710
10	338269	8065459
11	337835	8065484
12	337232	8065459
13	337995	8065234
14	337761	8065007
15	337609	8064752
16	337942	8066770
17	337532	8066651
18	337137	8066507
19	337269	8066885
20	337679	8066995
21	337933	8067229
22	337669	8067501
23	337907	8067720
24	337791	8068073
25	337481	8067852
26	337358	8068192
27	336658	8065754
28	336500	8066127
29	336038	8066111
30	335976	8066372
31	335929	8066632
32	335875	8066907
33	335543	8065962
34	335400	8065670
35	335746	8065359
36	335805	8065072
37	335994	8064769



Appendix B

ACMA RADCOM site search results
(AMG66, Zone 55)

SITE_ID	SITE_NAME	EAST	NORTH	PRECISION
14513	Rural Fires Site Nellas Farm EAST BARRON	342450	8081300	Within 100 metres
14514	Telstra Radio Terminal UPPER BARRON	342138	8077952	Within 10 metres
14515	Rural Fires Site Schoorls Farm EAST BARRON	343650	8083850	Within 100 metres
20639	Powerlink Site GOSHAM	339300	7992600	Within 100 metres
21673	Carr Site LONGLANDS GAP	339144	8069240	Within 10 metres
21675	Council Depot Curmbu Street RAVENSHOE	338418	8052642	Within 100 metres
21677	Telstra Evelyn Central Exchange EVELYN	339700	8063600	Within 100 metres
21679	Ergon Energy Site LONGLANDS GAP	339090	8069311	Within 100 metres
21681	Forestry Site 8.7 km W of Atherton MT WALLUM	329000	8090300	Within 100 metres
21686	B&W Site 51.7 km W of Innisfail MT FISHER	345600	8058125	Within 100 metres
21696	Millstream Estates 8.5km ESE of RAVENSHOE	331000	8049300	Within 100 metres
21700	NPWS Site LAKE EACHAM	354500	8088550	Within 100 metres
21707	Pump Site Millstream RAVENSHOE	334000	8047900	Within 100 metres
21709	Powerlink Site 67 km WSW of Innisfail MT RONALD	333200	8040900	Within 100 metres
21710	Qld Police Site LONGLANDS GAP	339181	8069239	Within 10 metres
21713	Telstra Radio Terminal LONGLANDS GAP	339263	8069145	Within 10 metres
21714	Telstra Radio Terminal MOUNT GARNET	300510	8043470	Within 100 metres
21722	SES Building 52 Grigg Street RAVENSHOE	338778	8052470	Within 100 metres
21728	Telstra Site Homestead TOP NETTLE	315400	8056200	Within 100 metres
21229	Ergon Site 139 km SW of Atherton ROUND MOUNTAIN	233200	7998500	Within 100 metres
22000	45 Mabel Street ATHERTON	337850	8090055	Within 100 metres
22001	53 Mabel Street ATHERTON	337800	8090000	Within 100 metres
22006	DPI Office Main Street ATHERTON	337700	8090150	Within 100 metres
22008	Jack Street ATHERTON	338590	8090100	Within 100 metres
22009	QAS Site Hallorans Hill ATHERTON	339575	8090130	Within 10 metres
22010	Powerlink Site 8.7 km W of Atherton MT WALLUM	328960	8090735	Within 100 metres
22011	Telstra Radio Terminal Hallorans Hill ATHERTON	339804	8089984	Within 10 metres
22016	Rural Fires Site Beatties Farm EAST BARRON	346450	8085800	Within 100 metres
22020	Lot 1 Carson Road MALANDA	348000	8081000	Within 100 metres
22025	Met Bureau Flood Warning Repeater Site MILLAA MILLAA	352239	8062464	Unknown
22031	Telstra Exchange MILLAA MILLAA	352483	8063149	Within 100 metres
39423	QAS Site Hallorans Hill ATHERTON	339625	8090010	Unknown
39548	Anglican Church Maple St MILLAA MILLAA	352524	8063184	Within 100 metres
39741	Theta Street RAVENSHOE	339375	8052150	Unknown
39742	QAS Site Bald Rock RAVENSHOE	337332	8052128	Within 10 metres
40369	Broadcast Site Jane St HERBERTON	327800	8077900	Unknown
40447	Broadcast Site 3.8 km SW of Yungaburra ATHERTON	346400	8085400	Unknown
130247	Optus Site Dalziel Avenue ATHERTON	339613	8090103	Unknown
135394	Optus Site Atherton Dalziel Avenue ATHERTON	339849	8089911	Within 10 metres
136288	BOM site Maalan Road access from Sutties Road TULLY	351030	8050605	Within 10 metres
136706	Cnr Grace and William Streets HERBERTON	328303	8077132	Within 10 metres
136890	Fuller Road LAKE EACHAM	359255	8085835	Within 10 metres
136891	7 Park Avenue YUNGABURRA	350050	8090165	Within 10 metres
137423	Atherton Showground Mazlin Street ATHERTON	338663	8089920	Within 10 metres
138530	Cnr Memorial Ave & Milla Milla Malanda Rd Malanda	350619	8079912	Within 10 metres
138542	2 Heale St MALANDA	350784	8079978	Within 10 metres
138678	Atherton Showgrounds Corner Robert St and Mazlin St ATHERTON	338648	8089920	Unknown
150419	Malanda Show Ground MALANDA	350300	8080900	Within 100 metres

150496	St Barnabus Church Moore St RAVENSHOE	339414	8052097	Within 100 metres
150528	UCB LPON 12 Mulgrave Road YUNGABURRA	348980	8090124	Within 100 metres
151753	Broadcast Site INNOT HOT SPRINGS	313490	8045813	Unknown
151754	Broadcast Site 1km E of BALD ROCK	337205	8052196	Unknown
152255	8 Herbert Street RAVENSHOE	339000	8052220	Unknown
403972	Hallorans Hill Reservoir ATHERTON	339623	8090135	Unknown
404594	17 Vernon St ATHERTON	337780	8090100	Within 10 metres
440227	Pioneer Ave MALANDA	351150	8080650	Within 100 metres
440366	Fire Station 43 Grace Street HERBERTON	328100	8077400	Unknown
440405	Lookout Carpark McHugh Rd MILLAA MILLAA	347861	8062156	Unknown
440470	Telstra Millaa Millaa Exchange Active Repeater MILLAA MILLAA	345500	8063300	Unknown
440482	Mandalee Station INNOT HOT SPRINGS	315318	8039009	Unknown
440639	Water Reservoir Ash St YUNGABURRA	349886	8089453	Within 100 metres
440958	Lot 42 Maunds Road ATHERTON	339850	8090950	Unknown
441009	Amateur Radio Site Land Rd BUTCHERS CREEK	361672	8084754	Unknown
441100	Telstra GSM Site RAVENSHOE	337300	8052100	Unknown
441101	Telstra GSM Site Gle Allyn Rd MALANDA	350933	8079807	Unknown
441102	Telstra GSM Site Eacham Rd YUNGABURRA	349974	8089633	Unknown
441122	NAS site Windy Hill via RAVENSHOE	344500	8054500	Unknown
441142	SES Site NEWCASTLE RANGE (coordinates in Zone 54)	793759	7973596	Within 10 metres
441198	QLink Depot ATHERTON	337854	8090459	Within 10 metres
441223	Cedarview Farm Windy Hill via RAVENSHOE	342594	8053893	Within 10 metres
441307	Woodleigh College Broadway HERBERTON	328710	8077580	Unknown
441382	Upper Barron State School Kennedy Highway UPPER BARRON	342040	8077290	Unknown
500716	Palmerston Highway MILLAA MILLAA	352620	8062950	Unknown
9000136	Fire Station Maple St MILLAA MILLAA	352825	8063425	Within 100 metres
9000164	Fire Station 32 Eacham St YUNGABURRA	349490	8089710	Within 10 metres
9000166	Fire Station 23 James St MALANDA	350650	8080620	Within 10 metres
9001006	Ergon Substation off Grant St ATHERTON	337985	8091485	Within 10 metres
9002630	DGPS Operations within 80 km radius of ATHERTON	337843	8090160	Within 10 metres
9003264	QPWS Site 63 km WSW of Innisfail MT PANDANUS	337820	8042007	Within 10 metres
9006997	331 James Street MALANDA	350548	8080712	Within 10 metres
9009001	TRC Site BALD ROCK	337113	8051973	Within 10 metres
9009002	Reservoir Jane St HERBERTON	327697	8077711	Within 10 metres
9009128	Police Station Lillian St HERBERTON	328499	8076800	Within 10 metres
9010370	High Level Reservoir Hillcrest Road MALANDA	350805	8079395	Within 10 metres
9010904	Optus Monopole off Malinda Atherton Road UPPER BARRON	349102	8080449	Within 10 metres
9010905	Optus Monopole Turner Property Off Hunt Road PEERAMON	348165	8086804	Within 10 metres
9010957	Ravenshoe B.A. Co-location N/A Bald Rock Road RAVENSHOE QLD 4872	337300	8052129	Within 10 metres
9010980	Milla Milla Palmerstone Highway MILLAA MILLAA QLD 4886	352202	8062469	Within 10 metres
9900006	Mobile Spectrum Licensing Site ATHERTON	338302	8090155	Unknown
9910599	Mobile Spectrum Licensing Site KENNEDY HIGHWAY	342117	8077867	Unknown
9910607	Mobile Spectrum Licensing Site KENNEDY HIGHWAY	337648	8068867	Unknown
9910610	Mobile Spectrum Licensing Site PALMERSTON HIGHWAY	354531	8063803	Unknown
9910614	Mobile Spectrum Licensing Site PALMERSTON HWY	345275	8061733	Unknown
9910617	Mobile Spectrum Licensing Site PALMERSTON HIGHWAY	360367	8057712	Unknown
9910620	Mobile Spectrum Licensing Site KENNEDY HIGHWAY	342803	8053519	Unknown
9910624	Mobile Spectrum Licensing Site KENNEDY HIGHWAY	336627	8049912	Unknown
9910626	Mobile Spectrum Licensing Site KENNEDY HIGHWAY	318523	8048070	Unknown

9910628	Mobile Spectrum Licensing Site KENNEDY HIGHWAY	327245	8048784	Unknown
9910630	Mobile Spectrum Licensing Site KENNEDY HIGHWAY	310288	8042173	Unknown
21229	Ergon Site 139 km SW of Atherton ROUND MOUNTAIN	233200	7998500	Within 100 metres
20639	Powerlink Site GOSHAM	339300	7992600	Within 100 metres
21714	Telstra Radio Terminal MOUNT GARNET	300510	8043470	Within 100 metres
441142	SES Site NEWCASTLE RANGE (coordinates in zone 54)	793759	7973596	Within 10 metres

Appendix C

Registered assignments on sites
within 5 km of HRWF

Site ID 21673 – Carr Site Longlands Gap

ACCESS_ID	FREQ_ASS (HZ)	ANT_AZ	LICENSEE
127558	476475000	ND	Austek Communications Pty Ltd
372715	477225000	ND	Austek Communications Pty Ltd
127559	70325000	ND	Austek Communications Pty Ltd
372716	72825000	ND	Austek Communications Pty Ltd
166045	162887500	ND	Austek Communications Pty Ltd
385436	158287500	ND	Austek Communications Pty Ltd

Site ID 21677 – Telstra Evelyn Central Exchange, Evelyn

ACCESS_ID	FREQ_ASS (HZ)	ANT_AZ	LICENSEE
1443151	1909500000	355	Telstra Corporation Limited
1443152	1790500000	355	Telstra Corporation Limited

Site ID 21679 – Ergon Energy Site, Longlands Gap

ACCESS_ID	FREQ_ASS (HZ)	ANT_AZ	LICENSEE
58291	72740000	236	Ergon Energy Corporation Limited
351067	75800000	236	Ergon Energy Corporation Limited
58315	78787500	ND	Ergon Energy Corporation Limited
351087	81287500	ND	Ergon Energy Corporation Limited
8169104	450925000	357	Ergon Energy Corporation Limited
8169112	460425000	357	Ergon Energy Corporation Limited
8169125	451075000	357	Ergon Energy Corporation Limited
8169127	460575000	357	Ergon Energy Corporation Limited
8174475	450925000	180	Ergon Energy Corporation Limited
8174481	460425000	180	Ergon Energy Corporation Limited

Site ID 21710 – Qld Police Site, Longlands Gap

ACCESS_ID	FREQ_ASS (HZ)	ANT_AZ	LICENSEE
1481784	460150000	1	State Emergency Service
1481785	450650000	1	State Emergency Service
1481794	414150000	27	State Emergency Service
1481795	404700000	27	State Emergency Service
56163	150500000	1	Queensland Police Service
350315	155100000	1	Queensland Police Service
57058	460900000	111	Queensland Police Service
350616	451400000	111	Queensland Police Service
1807615	154662500	129	State Emergency Service
1807616	150062500	129	State Emergency Service
171149	414225000	17	Commissioner Queensland Ambulance Service
171152	404775000	17	Commissioner Queensland Ambulance Service
8153065	404400000	18	Queensland Fire and Rescue Service
8153066	413850000	18	Queensland Fire and Rescue Service
61574	404200000	186	Commissioner Queensland Ambulance Service
352140	413650000	186	Commissioner Queensland Ambulance Service
1440525	404600000	186	Queensland Fire and Rescue Service
1440526	414050000	186	Queensland Fire and Rescue Service
1481786	460225000	186	State Emergency Service
1481787	450725000	186	State Emergency Service
57148	150500000	236	Queensland Police Service
350665	155100000	236	Queensland Police Service
1445160	451225000	242	State Emergency Service
1445161	460725000	242	State Emergency Service
56204	467900000	ND	Queensland Police Service
350354	458400000	ND	Queensland Police Service
61563	79787500	ND	Commissioner Queensland Ambulance Service
352131	82287500	ND	Commissioner Queensland Ambulance Service
1440729	468625000	ND	State Emergency Service
1440730	459125000	ND	State Emergency Service
1442981	465950000	ND	Queensland Fire and Rescue Service
1442982	456450000	ND	Queensland Fire and Rescue Service
1422410	71300000	ND	Commissioner Queensland Fire Service
1422411	73800000	ND	Commissioner Queensland Fire Service

Site ID 21713 – Telstra Radio Terminal, Longlands Gap

ACCESS_ID	FREQ_ASS (HZ)	ANT_AZ	LICENSEE
1820041	162362500		St John Ambulance Australia
1820042	157762500		St John Ambulance Australia
1820043	162212500		St John Ambulance Australia
1820044	157612500		St John Ambulance Australia
1820045	162737500		St John Ambulance Australia
1820046	158137500		St John Ambulance Australia
1820047	162612500		St John Ambulance Australia
1820048	158012500		St John Ambulance Australia
1443141	1853500000	2	Telstra Corporation Limited
1443142	1734500000	2	Telstra Corporation Limited
8224175	7762525000	1	Optus Mobile Pty Limited
8224181	8073845000	1	Optus Mobile Pty Limited
8244395	877500000	160	Telstra Corporation Limited
8244399	832500000	160	Telstra Corporation Limited
8244400	840000000	160	Telstra Corporation Limited
8244406	885000000	160	Telstra Corporation Limited
1443151	1909500000	175	Telstra Corporation Limited
1443152	1790500000	175	Telstra Corporation Limited
8253275	7762525000	187	Optus Mobile Pty Limited
8253278	8073845000	187	Optus Mobile Pty Limited
8253130	10735000000	27	Optus Mobile Pty Limited
8253131	11225000000	27	Optus Mobile Pty Limited
8244396	840000000	280	Telstra Corporation Limited
8244402	885000000	280	Telstra Corporation Limited
8244404	877500000	280	Telstra Corporation Limited
8244405	832500000	280	Telstra Corporation Limited
8244397	832500000	40	Telstra Corporation Limited
8244398	877500000	40	Telstra Corporation Limited
8244401	840000000	40	Telstra Corporation Limited
8244403	885000000	40	Telstra Corporation Limited
131143	146675000	ND	Tableland Radio & Electronics Club Inc
373649	146075000	ND	Tableland Radio & Electronics Club Inc
131144	144900000	ND	Tableland Radio & Electronics Club Inc
1440427	144900000	ND	Tableland Radio & Electronics Club Inc
1440425	146675000	ND	Tableland Radio & Electronics Club Inc
1440426	146075000	ND	Tableland Radio & Electronics Club Inc
1375656	939200000	ND	Telstra Corporation Ltd attn R Preston
1375657	894200000	ND	Telstra Corporation Ltd attn R Preston

9323724	839800000	ND	Telstra Corporation Limited
9328764	884800000	ND	Telstra Corporation Limited