Electromagnetic Interference Report

Wombelano Wind Farm

Prepared by Wind Projects Australia Pty Ltd

Document History

Version	Date	Changes	Author	Reviewer	Approver
0	6th August 2019		Jerome Rowcroft	Kingsley Slipper	Jerome Rowcroft

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Executive Summary

Wind Projects Australia Pty Ltd (WPA) are proposing a Wind Energy Facility (WEF) in the West Wimmera shire in Victoria, 20 km east of Edenhope and 65 km south-west of Horsham. The proposed facility will consist of up to seven Wind Energy Converters (WECs), exporting renewable energy for sale into the National Electricity Market (NEM), connecting into the Charam Zone Substation.

This Electromagnetic Interference (EMI) Report forms part of the Planning Permit Application. It is prepared in accordance with the Local and State Planning Provisions, specifically:

- Construction of a WEF on land zoned as Farming per VPP Clause 35.07 and the Schedule to that clause, LPP Clause 35.07;
- The development is a WEF, which, under VPP Clause 35.07, is designated as a Section 2 use, implying that a permit is required;
- Under VPP Clause 35.07, the WEF, including mast-based anemometry that is in place for greater than three years, must comply with VPP Clause 52.32.

The Determining Authority is the State of Victoria, as managed by the Department of Land, Water, and Planning (DELWP).

Telecommunication service providers Telstra and Optus were asked for an assessment for the impact on their services. Optus has not responded, while Telstra have confirmed that the proposal would not impact on their services.

This report identifies the communication links, broadcasting and receiving stations that exist near the site. The proposed wind farm, based on the layout that has been developed, will not impact on these communication facilities.

1. Introduction

Wind Projects Australia Pty Ltd (WPA) are proposing a Wind Energy Facility (WEF) in the West Wimmera shire in Victoria, 20 km east of Edenhope and 65 km south-west of Horsham, as shown in Figure 1. The proposed facility will consist of up to seven Wind Energy Converters (WECs), exporting renewable energy for sale into the National Electricity Market (NEM), connecting into the Charam Zone Substation (CHM) via a 66 kV sub-transmission line. This Electromagnetic Interference (EMI) report forms part of the Planning Permit Application for the Wombelano Wind Farm, which is made under Section 52.32 of the Victorian State Planning Provisions, where the Department of Land Water and Planning (DELWP) are the Determining Authority.

Specifically, the Wombelano Wind Farm is located on Crown Allotment 48A in the Parish of Wombelano, on Charam-Wombelano Road, and will consist of up to seven WECs, internal tracks and cabling, an on-site substation, lay-down and hard-stand areas, and maintenance facilities.

The site has been selected due to its proximity to existing electricity infrastructure, the simplicity of the topography, resulting in a simpler build process, the excellent site access available, and the separation between the wind turbines and neighbouring dwellings. A photograph of the site is shown in Figure 2.

The proposed wind turbines are proposed to have a height up to 250 m.

Assessment is made on the impact of these turbines on communications facilities, based on information obtained from the Australian Communication and Media Authority (ACMA) and the Bureau of Meteorology (BOM).

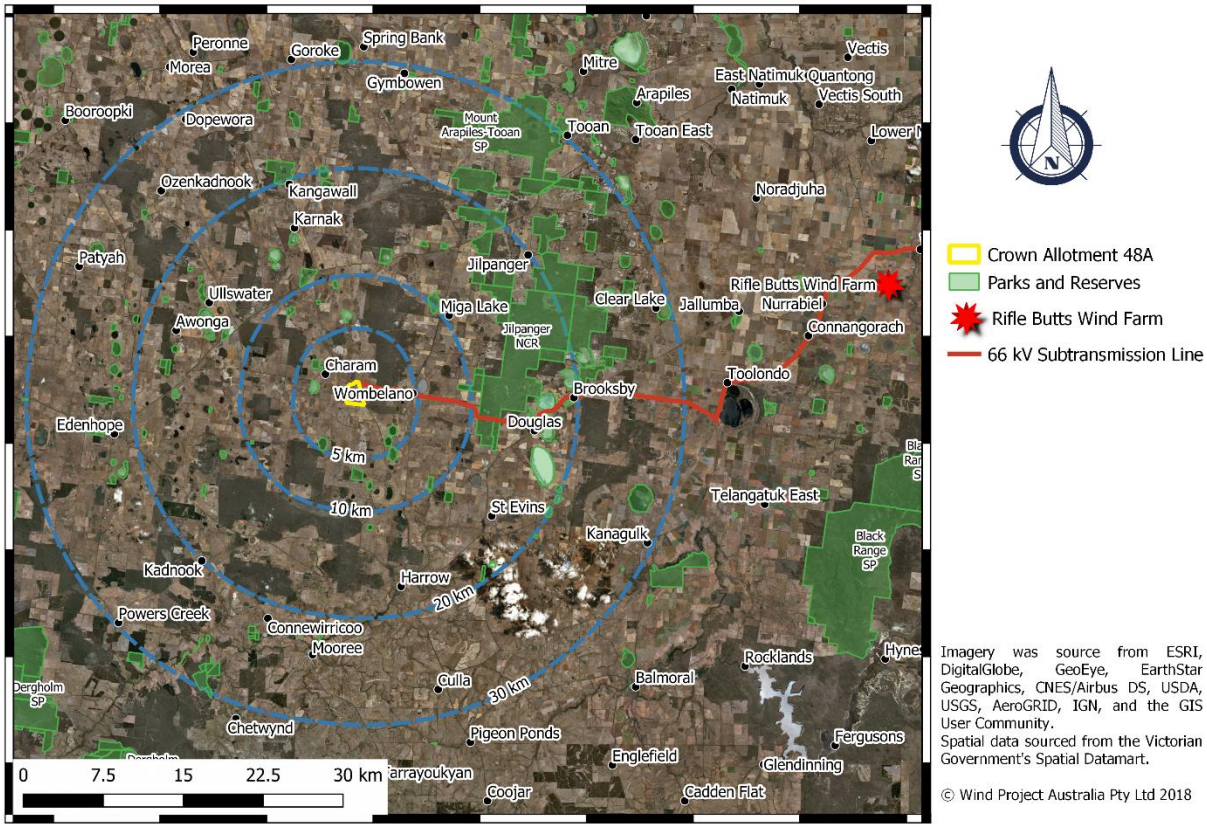


Figure 1: Wombelano Wind Farm regional context: proximity to nearby wind farms and National Parks.

Figure 2: View of the Wombelano Wind Farm site from the North-East corner of the site, looking South.

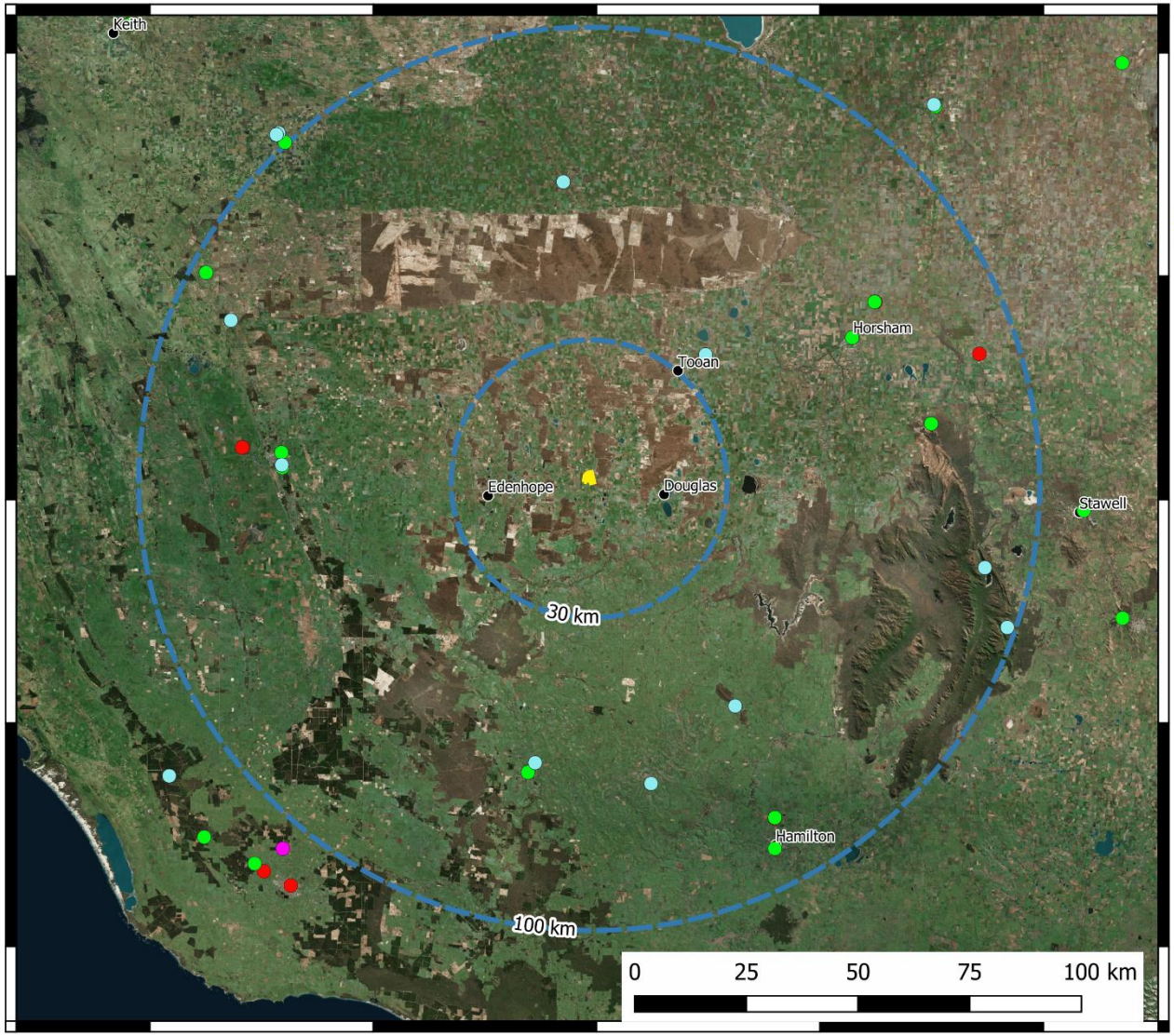
2. EMI and Wind Turbines

Wind turbines have the potential to cause Electro-Magnetic Interference (EMI). To a very limited extent, this can be due to the wind turbine's own Electro-Magnetic (EM) emissions, however, more significantly, and the subject of this report, as an obstacle for EM signals.

Wind turbine and wind farms more generally, do emit EM signals, however, their region of influence is confined to a small radius (in the tens of metres) around the turbines and infrastructure.

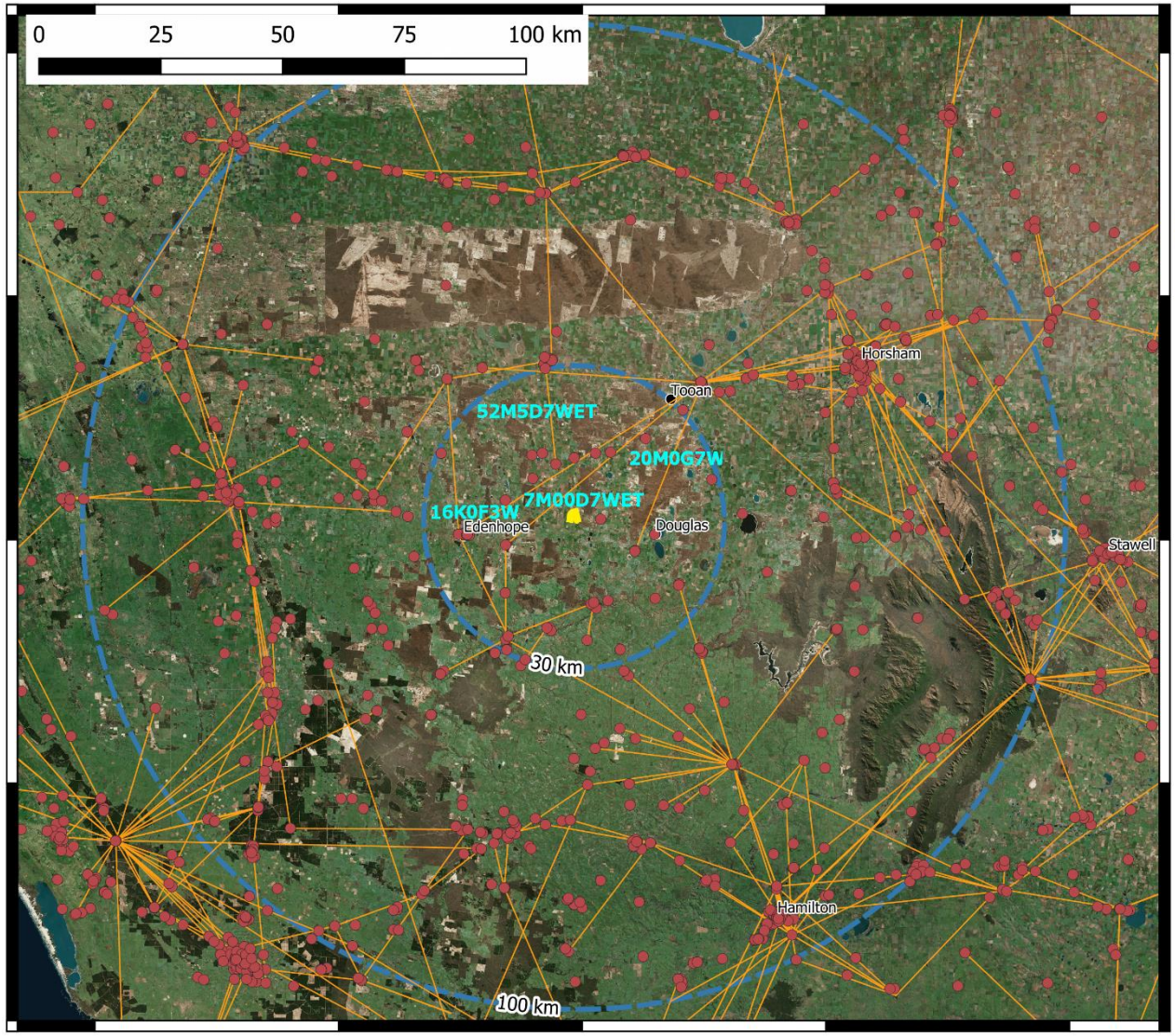
Of tangible concern is the wind turbine's potential to obstruct, diffract, reflect, or scatter EM signals. In this report, the following EM signals are considered in the context of the Wombelano Wind Farm:

- AM radio signals
- FM radio signals
- Digital television signals (noting that the analogue television signal was fully decommissioned in Australia by April 2014)
- Satellite television and internet
- Point to point communication (microwave)
- VHF and UHF signals
- Cellular telephony: 3G and 4G mobile phone networks
- Weather radar
- Aviation navigation facilities



Imagery was source from ESRI, DigitalGlobe, GeoEye, EarthStar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.
Spatial data sourced from the Victorian Government's Spatial Datamart.
Broadcast transmitter data from ACMA (2nd June 2019).

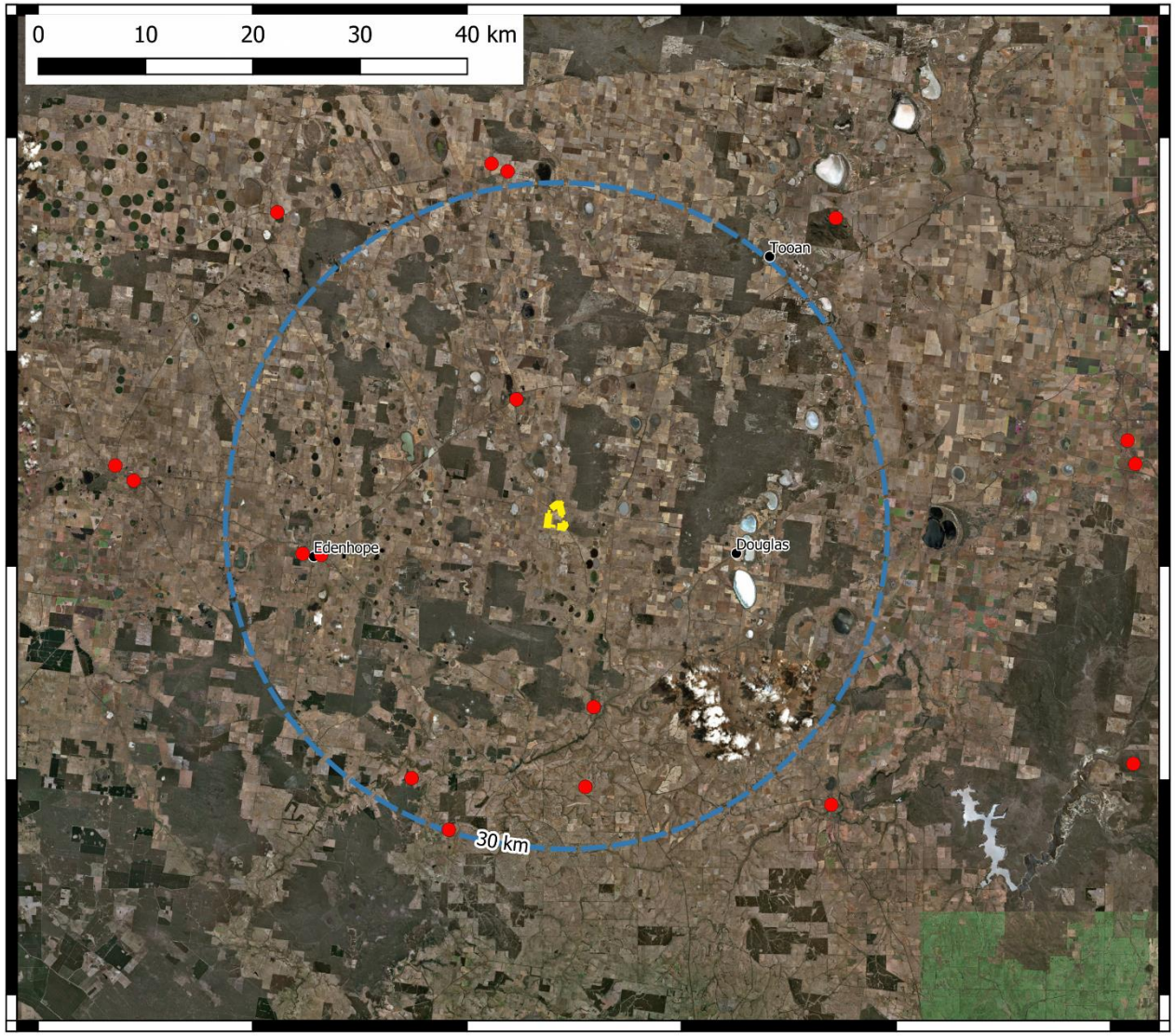
Figure 3: Licenced broadcasters and weather satellites in the vicinity of WWF.



Crown Allotment 48A
ACMA Sites
ACMA Site Links

Imagery was source from ESRI, DigitalGlobe, GeoEye, EarthStar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.
Spatial data sourced from the Victorian Government's Spatial Datamart.
Broadcast transmitter data from ACMA (Database accessed 25th June 2019).

Figure 4: ACMA Sites and links.



Crown Allotment 48A

Mobile Phone Tower

Imagery was source from ESRI, DigitalGlobe, GeoEye, EarthStar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.
Spatial data sourced from the Victorian Government's Spatial Datamart.
Mobile phone tower data from OzTowers (Database accessed 25th June 2019).

Figure 5: Mobile Phone towers in the Wombelano and Edenhope environs.

3. Wombelano Wind Farm and Signal Transmitters

Figure 3 shows all AM, FM, Digital Television, Digital Radio and Temporary Broadcast Licence locations in the vicinity of WWF, as well as weather radars.

Location of broadcasters was sourced from the ACMA database of licenced broadcasters available on their website, while the location of weather radars was sourced from the BOM website.

The map illustrates that there are no weather radars, digital radio broadcasters or temporary broadcast licences within 100 km of the site.

3.1 AM Radio

Amplitude Modulation signals are long wave signals. Operating wind turbines can influence the radiating patterns, with the potential to result in reduced signal quality and strength, as well as causing interference at neighbouring frequencies. A 2 km radius consultation zone exists around AM transmitters. The field of influence from the receiver's perspective is in the order of tens of metres.

As can be seen in Figure 3, the nearest AM transmitter is located over 75 km to the west of the site in South Australia, while the nearest Victorian AM transmitter is east of Horsham, over 90 km from the site. With the exception of the immediate vicinity of a wind turbine, WWF will have no effect on AM radio.

3.2 FM Radio

Frequency modulated signals tend to be more robust around obstructions such as buildings and wind farms. At the edge of their transmission range, where the signal to noise ratio is already quite low, wind turbines can have an adverse influence on the signal. A 1 km radius consultation zone exists around FM radio transmitters. WWF site falls well beyond this zone – as can be seen in Figure 3, the nearest FM transmitter is 65 km from the site, in Horsham.

3.3 Digital Television and Radio

With analogue television transmission decommissioned throughout Australia in April 2014, only digital television (DTV) transmission needs to be considered. There are also a number of digital radio transmitters across Victoria, which have similar requirements to the DTV transmission.

Wind turbines can cause shielding and disruption of the transmitted signal. A 2 km radius exclusion/consultation zone is in place around transmitters, but, as can be seen in Figure 3, the nearest DTV transmitter is over 30 km from the site, near Tooan, while there are no digital radio transmitters in the area.

DTV signals are resilient to multipath propagation, which, with an analogue signal, results in ghosting. DTV signals are, however, susceptible to frequency variation from passing rotor blades, with impacts varying as a function of turbine orientation and rotational speed, or wind direction and wind speed. The rotor pass causes a signal frequency variation, resulting in an increase in the bit error rate.

As a starting point, DTV signal degradation issues are often resolved by refocussing the receiver on the existing transmitter or realigning the receiver towards an alternative transmitter. In the case of WWF, there are a number of DTV transmitters that surround the site – to the south, near Casterton, Coleraine and Gatum, all approximately 60 km to the South of the site, while there is a DTV transmitter 65 km to the North of the site, near Lawloit. There are further transmitters to the West, in South Australia.

3.4 Point to Point Communications

To avoid impacting on point to point communications/microwave links, the wind turbine hub must not cut the first Fresnel Zone of a point to point link. In this case, the maximum extent of the second Fresnel Zone is used as a conservative exclusion zone.

Point to point links are licenced by ACMA, and links within 100 km of the site have been mapped in Figure 4. The communication nodes typically represent telecommunication customers. This map demonstrates that no link passes within 3.5 km of wind turbine. The maximum radius of the second Fresnel Zone of the nearest link is 32.4 m. Assuming a maximum blade length of 100 m, an offset of 133 m should be in place between the nearest turbine and the link; thus, the WWF will have no impact on this, the closest of the microwave links or any of the other links in the region.

Details of the nearest four links are tabulated in Table 1.

Table 1: Details of nearest Point-to-Point links to WWF.

Emission Designator	Length [m]	Frequency	Fresnel Zone 1 [m]	Fresnel Zone 2 [m]	Distance to WWF [km]
52M5D7WET	22,100	7.87 GHz	14.51	20.52	10.5
16K0F3W	58,200	451 MHz	98.32	139.04	8.2
7M00D7WET	52,200	7.46 GHz	22.90	32.39	3.6
20M0G7W	37,300	5.75 GHz	22.06	31.19	13.0

3.5 VHF and UHF Signals

VHF and UHF signals are used for regional communications between fixed and mobile stations, offering robust, low bandwidth links. They typically operate at low power and have broad beamwidth, rarely less than 40°. As such, line of sight is not required between stations, and signal attenuation is much lower than high energy, microwave links. For example, through a forest section, attenuation of 0.4 dB/m is expected with a microwave link, whereas, with a VHF signal, the attenuation is 0.05 dB/m.[1]

As such, wind farms are not anticipated to have an impact on VHF and UHF signals.

3.6 Mobile Phone Networks

There are no mobile phone towers within 10 km of the site, as can be seen in Figure 5. Previous experience suggests that the signal will not be impacted where the towers are located more than 1 km from wind turbines. The mobile phone reception in the vicinity of the wind farm is relatively weak, and the increased traffic through the area may result in increased investment in mobile phone tower roll-out in the region.

3.7 Weather Radars

As can be seen in Figure 3, the nearest weather radar to the site is located in Mount Gambier, 105 km from the site. The nearest Victorian radar is in Melbourne, 300 km from the site.

At an elevation angle of 1°, the Mount Gambier radar echoes propagate through to WWF at a height of approximately 1.75 km above the radar's location datum (84 m AMSL). The WWF is at an elevation of approximately 180 m AMSL, implying that the wind farm will have no impact on weather radars.

[1] Electromagnetic Interference Analysis for Mortlake South Wind Farm.

3.8 Aviation Radars

Impact on aviation, including primary and secondary surveillance radars will be addressed under the project's Aviation Impact Assessment, with validation provided by Airservices Australia.

4. Conclusions

Based on the assessment provided in this report, the Wombelano Wind Farm will have a minimal impact on communication links – whether corporate broadcasting services or mobile phone services, UHF and VHF communications.

Correspondence with telecommunications provider Telstra has confirmed that their services will not be impacted, based on the site location and preliminary layouts provided, as shown in the appendix; however, Optus have not responded.

While some influence on radio signal reception is expected, this is anticipated to extend only to the order of tens of metres from turbines. FM signals will be largely unaffected, unless signal to noise ratios are already very low. Digital television signals may be affected; however, this is mitigated by directing the receiver at an alternative signal source – which has been demonstrated to exist in the area. The wind farm will have no significant impact on weather radars. Any impact on aviation communications will be assessed in the Aviation Impact Assessment, which is reviewed by Airservices Australia.

APPENDIX: Consultation with Telecommunication Providers

Telstra Response

RE: Wombelano Wind Farm - Impact on Telecommunications

SK Sullivan, Karyn [redacted]
To jerome
Cc Fuge, Michele

Reply | Reply All | Forward | ...

Tue 9/07/2019 11:22 AM

You replied to this message on 9/07/2019 11:34 AM.

Hi Jerome,

I confirm that our RF team have report no known issues with the proposal.

Kind Regards,

Karyn Sullivan Business Senior Specialist
Governance and Compliance | Wireless Access | Network Engineering | Networks & IT

P [redacted]
M
E
W www.telstra.com

Optus Request

Wombelano Wind Farm - Impact on Telecommunications

J jerome@windprojectsaustralia.com.au
To [redacted]@optus.com.au'

Reply | Reply All | Forward | ...

Wed 26/06/2019 10:07 AM

You forwarded this message on 27/06/2019 3:54 PM.

WWF_Layout_20190626.csv
6 KB

WWF_Mobile Phone Towers - For Service Providers_20190626.png
10 MB

Hi Jayanthe

WPA are proposing the Wombelano Wind Farm near Edenhope.

Would you be able to review the location to ensure no impact on Optus operations.

Co-ordinates are attached, as well as a map of the region.

Regards,
Jerome

Jerome Rowcroft Ph.D. B.E. (Mech)(Hons)
Director
Wind Projects Australia
0419 133 538

The contents of this email are confidential.