Middleton Group Engineering Pty Ltd
ABN 67 607 858 551

www.middletongroup.com.au

Willogoleche Stage 2 Wind Farm

Electromagnetic Interference Assessment

Client: **ERM**
Revision: D
Project: **Willogoleche Stage 2 Wind Farm**
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DRAFT

Revision control

Revision	Date	Description	Prepared by	Reviewed by	Approved by
A	26.07.24	Initial Draft for Client Review	Harika Tatipakala Heshna Uppadoo	Craig Johnston	Craig Johnston
B	21.02.25	Initial Draft for Client Review	Heshna Uppadoo	Craig Johnston	Craig Johnston
C	15.09.25	Updated Layout	Harika Tatipakala	Heshna Uppadoo	Craig Johnston
D	15.12.25	Final Issue	Harika Tatipakala	Craig Johnston	Craig Johnston

Disclaimer

This document has been prepared for ERM for the purposes and objectives set out in this document. Use of this document by anyone else is at their own risk.

In arriving at the report conclusions, a number of assumptions have been made where input information is either not available, cannot be relied upon, or is subject to change. Should these assumptions provide to be incorrect based on new relevant information coming to light, it is likely the findings of this report may also need to change. The client should validate these assumptions prior to implementation of the conclusions or recommendations found in this report.

Executive Summary

Middleton Group Engineering has been engaged by Environmental Resources Management Australia Pty Ltd (ERM) on behalf of International Power (Australia) Pty Ltd (ENGIE)Pty Ltd to undertake an Electromagnetic Interference Assessment (EMI) by desktop study methodology, for the Willogoleche Stage 2 Wind Farm (the Project) located in the Mid North region of South Australia, 200 km north of Adelaide and 6 km from Hallet.

Methodology

This study assesses the impact of Willogoleche Stage 2 Wind Farm on the following telecommunication services:

- Point-to-point radiocommunications links;
- Meteorological radar;
- Mobile voice-based communications;
- Wireless and satellite internet services for dwellings;
- Broadcast and digital radio signals;
- Broadcast, digital and satellite television;
- Trigonometry stations; and
- Global Positioning System (GPS).

MGE conducted a review of the Australian Communications and Media Authority (ACMA) database for point-to-point links within a 150 kilometres radius of the site. Four links and three ACMA sites were identified within two kilometres of project boundary.

Assessment Overview

Based on our assessment, the WTGs are unlikely to affect the operation of the radio frequency communication links, and the other existing telecommunications services. As such, we believe that the project has been designed, located, and sited to avoid or minimise telecommunications impact to pre-existing television, radar and radio transmission.

Stakeholders have been contacted regarding impact on their services, and all correspondence are collated in Appendix B.

Recommendations

Due to the negligible impacts to EMI associated with the proposed development, no further specific actions are recommended. However, to safeguard against potential impacts, consultation with key stakeholders should continue and this study should be revised, to safeguard against potential impacts.

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Tables

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1 Abbreviations / Definitions

Table 1: Abbreviations

Abbreviation	Explanation
ACMA	Australian Communications and Media Authority
AM	Amplitude Modulation
BSL	Broadband Service Locator
BOM	Bureau of Meteorology
C/I	Carrier-to-interference ratio
D_a	Diameter of antenna physical aperture (m)
D_{nf}	Near-field clearance distance
DTV	Digital Television
EDM	Electronic Distance Measurement
EMI	Electro-Magnetic Interference
f	Frequency (GHz)
FM	Frequency Modulation
F_n	*n*th Fresnel Zone; also, F_1, F_2, etc.
G	Maximum (boresight) antenna gain (dBi)
GHz	Giga-Hertz – 10^9 Hertz
GIS	Geographic Information System
GNSS	Global Navigation Satellite System Networks
ICNIRP	International Commission on Non-Ionizing Radiation Protection
LoS	Line of Sight
MGE	Middleton Group Engineering
MHz	Mega-Hertz – 10^6 Hertz
PO3	Performance Outcome 3
RPM	Revolutions per minute
The Project	Willogoleche (Stage 2) Wind Farm
UHF	Ultra-High Frequency (300 MHz – 3 GHz)
WMO	World Meteorological Organization
η	Antenna efficiency

2 Background

Middleton Group (MG) has been engaged by Environmental Resources Management Australia Pty Ltd (ERM) on behalf of International Power (Australia) Pty Ltd (the Applicant) to undertake an Electromagnetic Field Interference (EMI) desktop study for Willogoleche Stage 2 Wind Farm project. The wind farm site is spread over 1,550 ha of land on Willogoleche hill, located in the Mid North region of South Australia, 200 km north of Adelaide and 6 km from Hallet.

The Project design consists of approximately 20 wind turbines with a net generation capacity of up to 110 MW, with the capability of powering 80,000 homes across the state. The wind farm will be connected via underground cabling and a new substation located adjacent to ElectraNet's Belalie-Mokota 275 kV transmission line.

3 Scope

This EMI is a desktop study mapping the WTG locations along with telecommunication services and evaluating the impact of the wind turbines on these services.

Wind turbine electromagnetic compatibility (EMC) has not been assessed in this report. All electrical equipment must comply with the Radiocommunications Act (1992) which includes EMC requirements. All installations on the wind farm must comply with these, including affixation of relevant compliance markers to the equipment. The original equipment manufacturers must ensure compliance which is regulated by the Australian Communications and Media Authority (ACMA).

The study is confined to the analysis of publicly available information and consultation with key stakeholders.

3.1 Other Requirements

3.1.1 Draft National Wind Farm Development Guidelines

The Draft National Wind Farm Development Guidelines [1] developed by Environmental Protection and Heritage Council offers guidance to the community, industry and regulators on the planning framework for the assessment of large-scale wind energy development proposals. The guideline provides a detailed overview in Appendix F of the issue and recommended methodology to conduct an electromagnetic interference assessment. This outline has been considered in the development MGE's methodology for the following report.

3.1.2 Clean Energy Council Best Practice Guidelines

The Clean Energy Council's Best Practice Guidelines [2] are designed to assist wind farm proponents, owners and operators in the planning, approval and operational phases of onshore wind farm projects. The Clean Energy Council provide an outline for the ideal scope, methodology and stakeholders for an EMI report.

"An assessment of the potential for communication and/or radar interference should be completed and should include discussion with communication system providers."

The Clean Energy Council defines the methodology of an EMI assessment as follows:

1. Identify all stakeholders potentially affected by the wind farm
2. Assess the potential EMI impacts
3. Consult with the relevant stakeholders
4. Mitigate against any potential EMI effects.

The scope of potential impacts of electromagnetic interference from a wind farm are summarised as:

- The wind turbine tower may obstruct, reflect or refract the electromagnetic waves used in a range of communications systems
- The rotating blades may have similar effects, on a time variable basis.
- In some cases, ghosting on TV receivers close to the wind farm may occur

As such the Clean Energy Council has established the following guidelines to determine whether a stakeholder is affected by the wind farm:

- A wind turbine is within 2 km of a radiocommunications transmission site; or within 2 km of a radiocommunications receiver and in line with the transmission site.
- A wind turbine is within the maximum second Fresnel zone of a point-to-point radio link.
- Aviation or meteorological radar operation can be affected by wind turbines. Even wind farms within 100 km of a radar installation may impact on its operation and this can depend on a number of factors including the type of radar used, distance from the radar installation, terrain, layout of the wind turbines and the size of the turbines. The owners of radar installations (e.g. the Bureau of Meteorology and Airservices) can generally assist in the assessment of the potential impact if required.

This report utilises these guidelines to analyse the impact of the Project on the stakeholders and through similar methodology, assesses the impacts (incorporating feedback from relevant stakeholders) and recommend mitigation where potential impacts to telecommunication services are identified.

4 Inputs

This assessment is based on ERM's provided information on behalf of ENGIE and key stakeholders' publicly available data specified in Table 2 and Table 3.

Table 2: Study Inputs – Project Infrastructure

Project Detail	Value
Wind turbine coordinates	Wind turbine layout received from ERM (via email on 26.08.2025)
Wind turbine dimensions	Tip Height: 300 m (Max height assumption) Turbine Blade Diameter: 200 m (Max diameter assumption)

Table 3: Study Inputs - Stakeholder Infrastructure

Input	Source	Date Provided/Accessed
Dwellings coordinates	The Applicant	30.05.24
Point-to -point microwave links, mobile voice-based communication, and internet services	ACMA Site Location Map RFNSA Website	01.09.25
AM, FM, Digital Radio, Digital TV broadcasters	List of transmitters with a licence to broadcast	01.09.25
Meteorological Radar	South Australia Radar Information	07.09.25
Survey Marks	South Australia Survey Marks information	07.09.25
Trigonometrical Station and GPS	GNSS Network Map	07.09.25

5 Analysis

5.1 Assumptions

This study has been developed on the following basis:

- The study is desktop only. No site visit or on-site ground-truthing has been conducted.
- Information, including the spatial location of items, antenna heights, emission frequencies and the like, as sourced from Australian Communications and Media Authority (ACMA) are correct.
- While MGE checked information against satellite imagery, MG has developed the report on the basis that information supplied by/through ACMA is correct, except where a stakeholder provides updated specifications.

5.2 Site Overview

An overview of the location of the Project and relevant telecommunication services is shown in Figure 1.

Figure 1: Site overview

5.3 Point-to-Point Links

Wind turbine generators (WTGs) have the potential to impact on point-to-point radio-frequency (RF) communication links through three mechanisms [1].

1. Near field effects.
2. Diffraction; and
3. Reflection or scattering effects.

As seen in, there are four communication links within a 2 km radius of the WTGs. Similarly, there are three ACMA sites within a 2 km radius of the WTGs. Detailed information for these links and sites is outlined in Table 4 and Table 5 respectively, with an in-depth analysis presented in the following subsections.

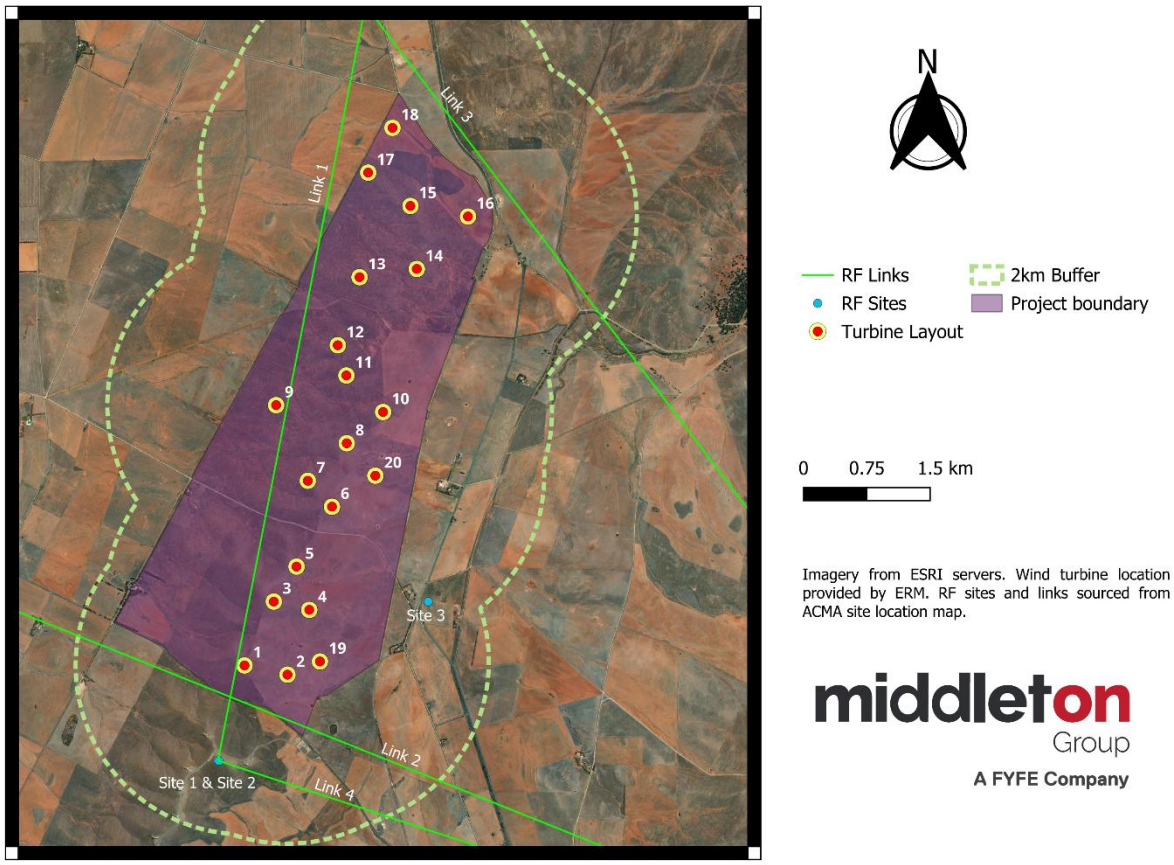


Figure 2: ACMA point-to-point links and sites within a 2 km radius

Table 4: Point-to-point link details.

Point-to-Point link number	BSL / Licence No	Site 1	Site 2	Length (km)	Frequency (MHz)	Owner
1	11912982/1	Optus Site Hallett Section 325 Jamestown Rd HALLETT ID: 134487	Telstra CMTS Terowie Barrier Highway, 8 km N of TEROWIE ID: 9004012	35.3	6019 6271	Optus Mobile Pty Limited
2	1568980/1	Canowie Substation 15 km NW of HALLETT ID: 9000139	Trig Point 7.7km ESE of Hallett MT BRYAN ID: 24322	22.5	7733 8044	ELECTRANET PTY LIMITED
3	10726084/1	Telstra Site Sec 325 Hundred of Anne HALLETT ID: 131772	Trig Point 7.7km ESE of Hallett MT BRYAN ID: 24322	12.0	10735 11225	TELSTRA LIMITED
4	1568981/1	Trig Point 7.7km ESE of Hallett MT BRYAN ID: 24322	Champion Hill 6.5 km ESE of TARCOWIE ID: 9004499	61.7	7851 8162	ELECTRANET PTY LIMITED

Multiple licences may be assigned to one link. This assessment highlights the licence with the lowest frequency when calculating Fresnel zones, as lower frequencies produce broader Fresnel zones.

Table 5: ACMA Site Information

ACMA Site ID	ACMA Site name	Distance to nearest WTG (km)	Number of assignments	Assessment required
134487	Optus Site Hallett Section 325 Jamestown Rd HALLETT	1.16	24	Yes
131772	Telstra Site Sec 325 Hundred of Anne	1.17	16	Yes

ACMA Site ID	ACMA Site name	Distance to nearest WTG (km)	Number of assignments	Assessment required
9912782	Mobile Spectrum Licensing Site	1.41	0	No

5.3.1 Near-field effects

Near-field effects occur in the vicinity of the transmitter and receiver, typically being impacted by objects with inductive fields up to several hundred metres from the transmitter/receiver – though the precise impact is difficult to calculate.

As per Bacon [1] the near-field clearance distance, D_{nf} (m) can be calculated as follows:

For a dish or horn type of antenna:

$$D_{nf} = 10 \times \eta \times D_a^2 \times f$$

For any other type of antenna:

$$D_{nf} = 0.1 \times 10^{0.1G} / f$$

Where:

η = antenna efficiency

D_a = diameter of antenna physical aperture (m)

f = frequency (GHz)

G = maximum (boresight) antenna gain (dBi)

5.3.1.1 Site 1

The site details are:

- ID: 134487
- Name: Optus Site Hallett Section 325 Jamestown Rd HALLETT
- Location: HALLETT SA 5419
- Assignments: 28

The near-field effects of the site are summarised in the table below:

Table 6: Site 1 Near Field Clearance Distance

Licence No	Antenna Type	Frequency (MHz)	Gain (dB)	Near-field Clearance (m)
9469858	Panel (1 sector)-R	708	16	5.7
10094267/146	Panel (1 sector)-R	1952.5	18	3.2
11912982/1	Parabolic	6019.3	39	132
12468165	Panel (1 sector)-R	902.5	16.5	5.0
10391286	Panel (1 sector)-R	740.5	16	5.4

Licence No	Antenna Type	Frequency (MHz)	Gain (dB)	Near-field Clearance (m)
10094267/190	Panel (1 sector)-R	1950	18	3.2

It is advised to place WTGs beyond the near-field clearance distance of any point-to-point transmission sites. For lower frequencies this distance can be more significant. The longest near-field clearance distance for transmitters at this site is 132 meters. As shown in Figure 3, the nearest WTG is considerably beyond this boundary. As such, no reflection/scattering effects are expected.

Consultation and engagement with Optus with respect to the impact on their mobile telemetry services has been conducted. Optus have concluded there will be no detrimental impact to their services, see Appendix B.5 for their full letter.

5.3.1.2 Site 2

Site 2 details are:

- ID: 131772
- Name: Telstra Site Sec 325 Hundred of Anne
- Location: HALLETT SA 5419
- Assignments: 16

The near-field effects of the site are summarised in the table below:

Table 7: Site 2 Near Field Clearance Distance

Licence	Antenna Type	Frequency (MHz)	Gain (dB)	Near-field Clearance (m)
9263433	Colinear Vertical	837.5	16.2	5.0
10726084/1	Parabolic	10735	34.8	28.1
9469862	Panel (1 sector) -R	723	16	5.1

It is advised to place WTGs beyond the near-field clearance distance of any point-to-point transmission sites. For lower frequencies this distance can be more significant. The highest near-field clearance distance for transmitters at this site is 28.1 meters. As shown in Figure 3, the nearest WTG is considerably beyond this boundary. As such, no reflection/scattering effects are expected.

Consultation and engagement with Telstra with respect to the impact on their mobile telemetry services has been conducted. Telstra have concluded there will be no detrimental impact to their mobile network and their existing point-to-point links. As part of Telstra's standard response to these enquiries, they request Low Frequency Induction and Earth Potential Rise assessments from the Proponent. These are technical studies related to high voltage infrastructure design, such studies will always be done as part of final design but are not relevant to a telecommunication related Electromagnetic Interference Assessment. The complete Telstra response is included in Appendix B.4

5.3.1.3 Site 3

The third site is inactive and has no current assignments.

The site details are:

- ID: 9912782
- Name: Mobile Spectrum Licensing Site
- Location: Barrier Highway SA 5419
- Assignments: 0

5.3.2 Reflection/scattering effects

Reflection and scattering relate to the interference by an object that reflects the signal from the transmitter to the receiver. This process creates a longer path between the transmitter and receiver, which can cause undesirable temporal modulation. However, where the carrier to interference ratio, that is the ratio of the strength of the intended signal to the interference signal is sufficiently high, the performance will be unaffected. This threshold varies from site to site. Generally, impacts on signal will be negligible beyond 2 km from a transmitter/receiver.

There are currently three transmitters/receivers within 2 km of Willogoleche Stage 2 Wind Farm.

Two active and one inactive ACMA sites were found within the project site boundary. These sites can be identified in Figure 3. A buffer around these sites is required to mitigate against near-field effects. The buffer size varies as a function of antenna radiation pattern and frequency.

The closest WTG is 1.13 km away from the closest ACMA site 1, no reflection/scattering effects are expected.

Figure 3: Site1 Near Field clearance and surrounding WTGs

5.3.3 Diffraction effects

Diffraction is where an object modifies a wave, by obstructing its path of travel. Fresnel zones define an envelope of influence along the length of the ray line, whereby a rotating wind turbine could adversely impact the signal.

The radius of the n[th] Fresnel Zone, F_n, of a point-to-point link of length D, at a distance d_1 from the transmitter (or receiver) is given by the following equation:

$$\mathrm{F}_n = \sqrt{\frac{n\lambda d_1(D-d_1)}{D}}$$

The wavelength of the transmittal signal, λ, is calculated as c/f, where c is the speed of light in air and f is the frequency of the transmittal signal.

Obstacles within the 1st Fresnel Zone will adversely impact the signal, whereas, beyond the 1st Fresnel Zone the impact is reduced. More specifically, for odd values of n the Fresnel Zone is a region of constructive interference, whereas for even values of n the Fresnel Zone is a region of destructive interference [2].

In calculating the paths of the links and the relative impact of obstacles, it is important to account for the curvature of the earth and the height of any antennae, as available.

Whilst a clearance threshold of 60% of the 1[st] Fresnel Zone Radius is often referred to in relation to geographical obstacles [1], this is not necessarily applicable to wind turbines. A more conservative approach for wind turbines is preferred – that is, maintaining a clearance of the full 1[st] Fresnel Zone, or even, as recommended by Bacon [1], clearance of the full 2[nd] Fresnel Zone. The latter is required for microwave (>1GHz) links and may also be required for UHF links.

For UHF (<1GHz) links, the impact of a wind turbine on the link will be a function of the carrier to interference ratio, C/I. In some instances, the presence of a wind turbine penetrating the 2[nd] Fresnel Zone will have no material impact on the performance of a non-microwave link; in other instances, there may be an impact.

The maximum radii of the 1st and 2nd Fresnel Zones for the communication links that traverse the project site is summarised in Table 8.

Table 8: Fresnel zone and exclusion zone for the point-to-point links.

Link number	BSL / Licence No	Length (km)	Frequency (MHz)	0.6 x F_{1Max} (m)	F_{1Max} (m)	F_{2Max} (m)
1	11912982/1	35.3	6019	12.6	20.9	29.7
2	1568980/1	22.5	7733	8.9	14.8	20.9
3	1568981/1	61.7	7851	14.6	24.3	34.3
4	10726084/1	12.0	10735	5.5	9.16	12.95

Link 1

Optus manages license 11912982/1 which connects Site 1 (Optus Site Hallett Section 325 Jamestown Rd HALLETT ID: 134487) to Site 2 (Telstra CMTS Terowie Barrier Highway, 8 km N of TEROWIE ID: 9004012). The lowest frequency signal, 6.019325 GHz, has been applied in this analysis.

Figure 4, below, shows Link 1 passing through the 2 km buffer. Turbine WTG01 is closer than the link's maximum second Fresnel zone.

This is a conservative analysis, using the maximum 2nd Fresnel Zones of the link. The radius of the link's Fresnel zone changes in size across the course of the link, reaching a maximum size at the mid-point of the link. The actual Fresnel zone size of Link 1 in vicinity of WTG 01 may be smaller than what is represented in Figure 4. As WTG encroaches the link's Fresnel zones, further 3D analysis must be conducted to determine if the WTG locations are likely to cause telecommunication interference with Link 1. This is investigated in the sections below.

In addition, Figure 4 shows that WTG 09 is located near the link, but it does not encroach upon the second Fresnel zone. Therefore, WTG 09 is unlikely to cause telecommunication interference with Link 1.

Consultation and engagement with Optus with respect to the impact on their services has been conducted. Optus have concluded there will be no detrimental impact to their services, see Appendix B.5 for their full letter.

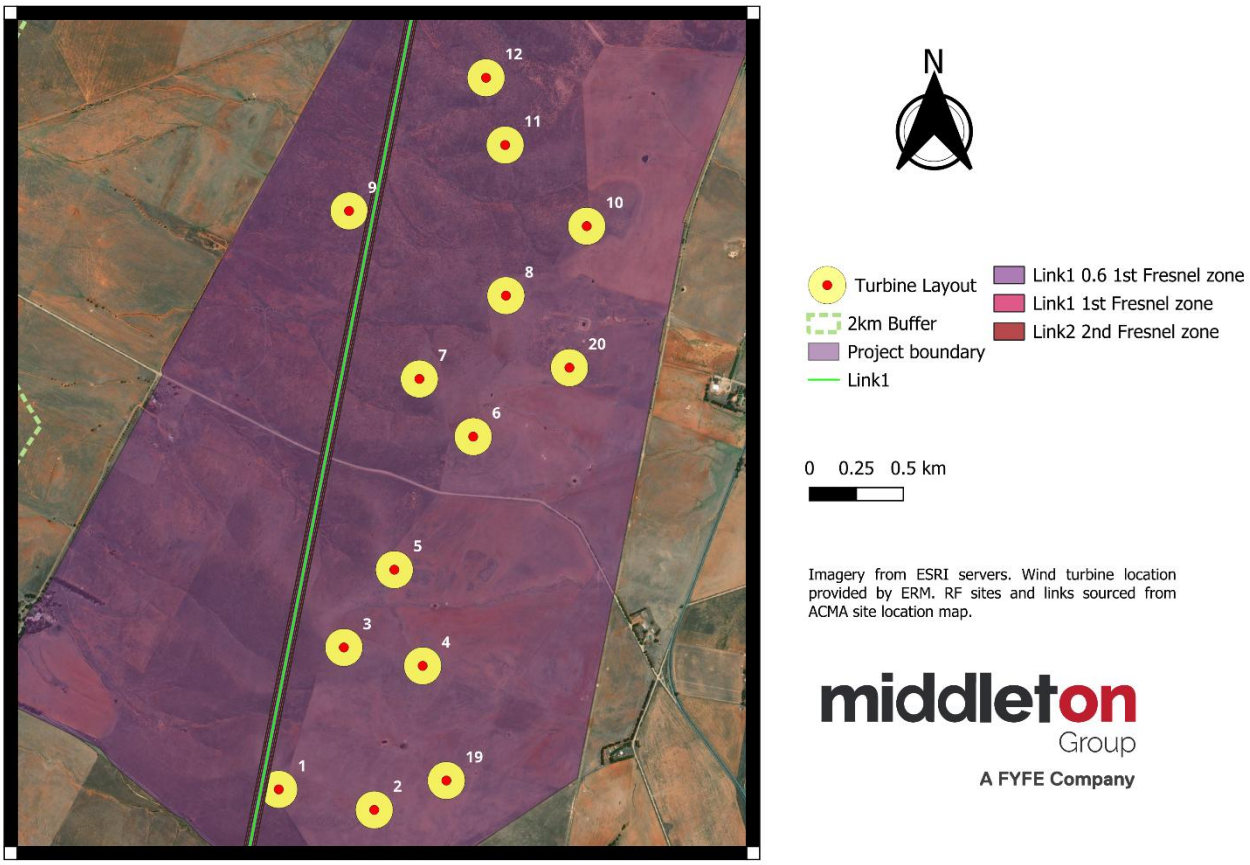


Figure 4: Link 1 passing through the Project Site

Figure 5 and Figure 6 below, show a snapshot of the 3D analysis results for link 1 and WTG 01. In 3D analysis, MGE models the width of the Fresnel zone at the specific location of the WTG, to increase accuracy. Obstructions in the middle of the link are more likely to cause signal disruption, as the Fresnel zone is widest there.

As seen in , when viewed in elevation, Link 1's line-of-sight path profile intersects with the bottom of the WTG. However, Figure 6 shows a cross-sectional view of the rotor of WTG 01 with respect to the link's Fresnel zones. The rotor of the WTG does not cross the 2nd Fresnel zone of link 1 at that point. As such, this assessment finds that WTG 01 is unlikely to cause interference to link 1.

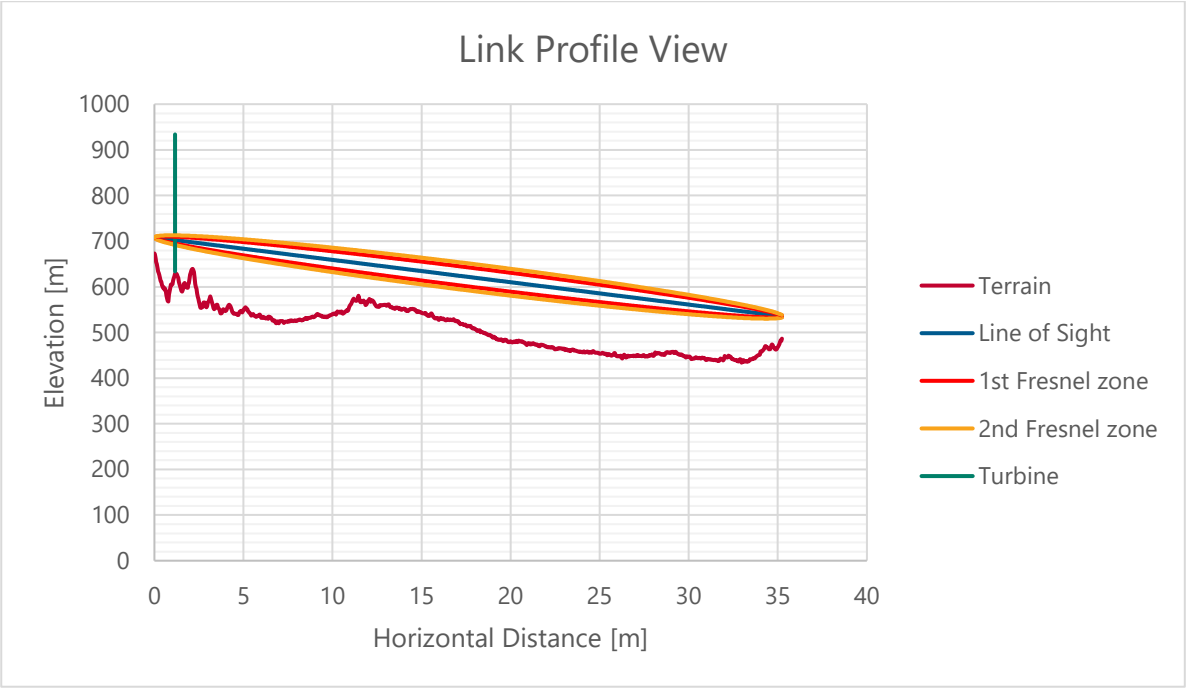


Figure 5: Link Profile view of Link1 and WTG 01

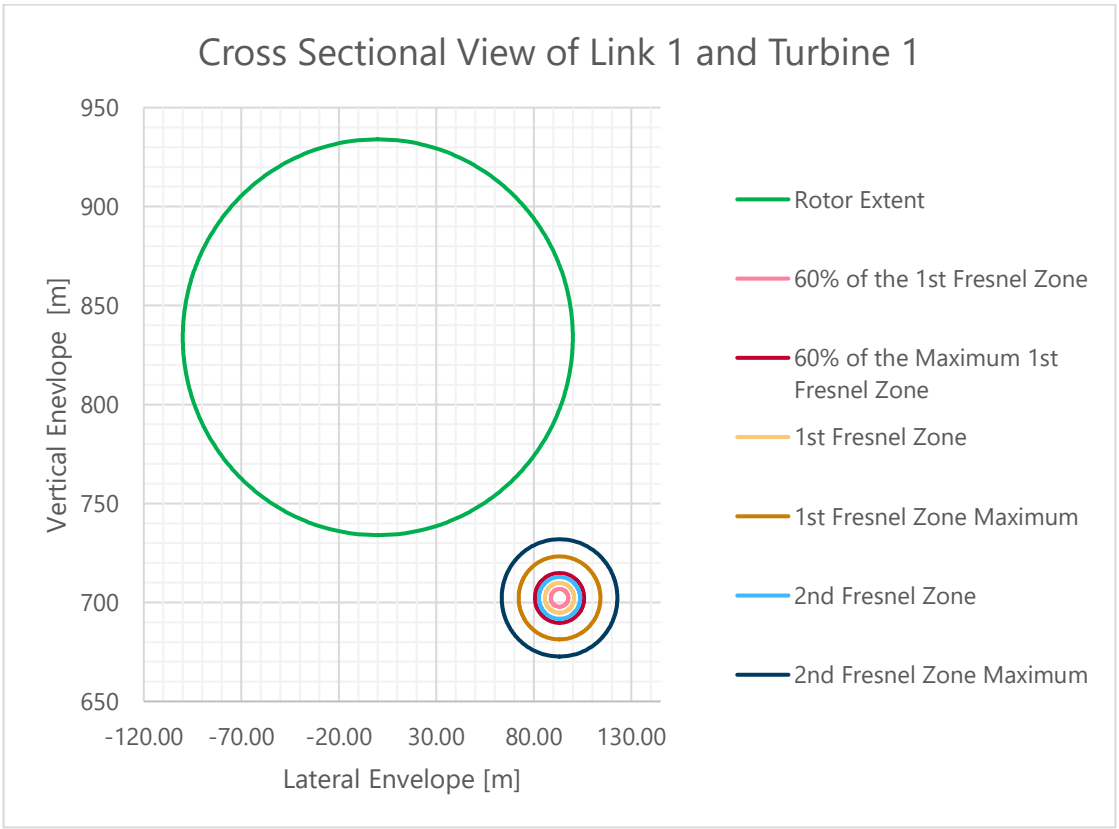


Figure 6: Cross sectional View of Link1 and WTG01

Link 2

Electranet Pty Limited manages license 1568980/1 which connects Site 1 (Canowie Substation 15 km NW of Hallett ID: 9000139) to Site 2 (Trig Point 7.7 km ESE of Hallett Mt Bryan ID: 24322). The lowest frequency signal, 7.733 GHz, has been applied in this analysis.

Figure 7, below shows the link 2 passing through the 2km buffer. None of the turbines contacts the links maximum Fresnel zones with closest turbine, WTG01 being 400 meters from the 60% first Fresnel zone.

Consequently, the proposed WTGs are unlikely to cause telecommunication interference with Link 2.

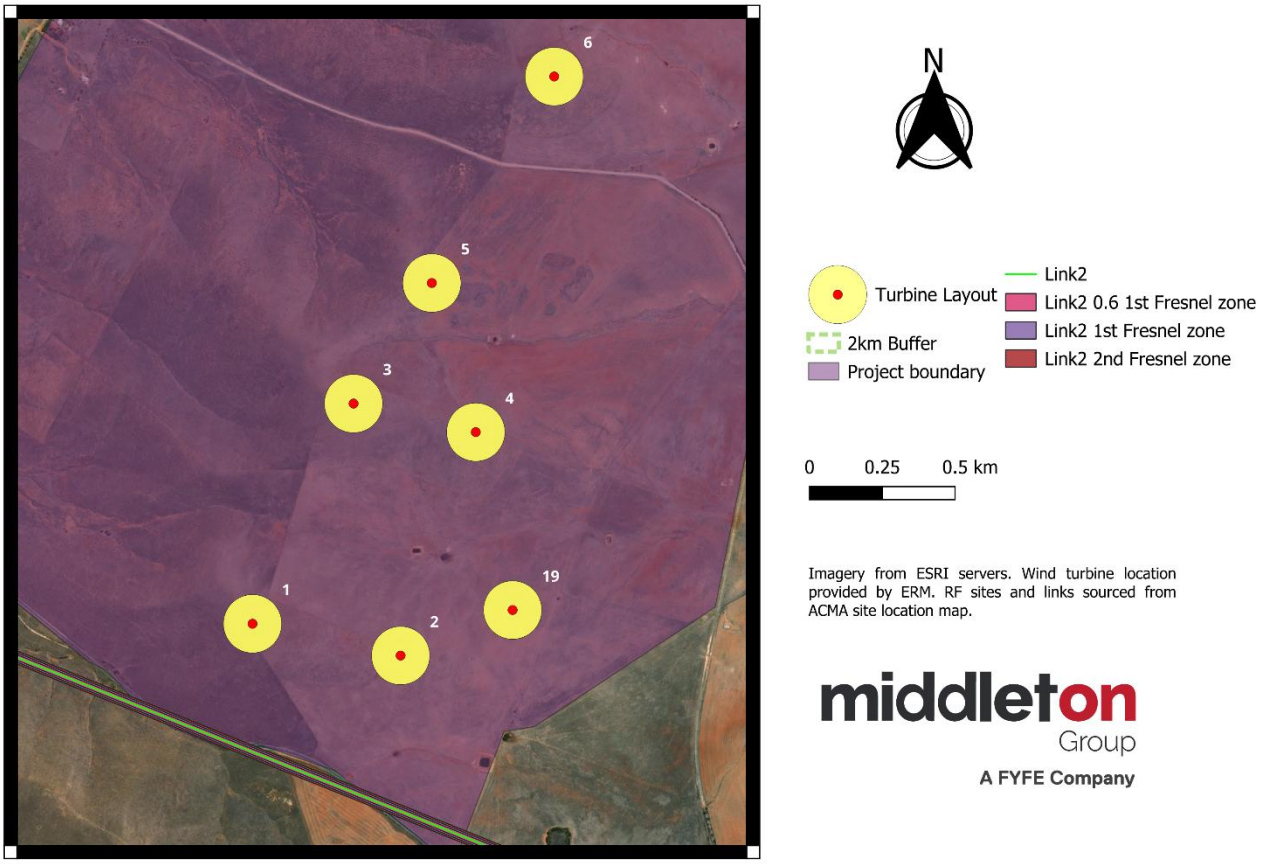


Figure 7: Link 2 passing through the Project Site

Link 3

Electranet Pty Limited manages license 1568981/1 which connects Site 1 (Champion Hill 6.5 km ESE of TARCOWIE of ID: 9004499) to Site 2 (Trig Point 7.7 km ESE of Hallett Mt Bryan ID: 24322). The lowest frequency signal, 7.85 GHz, has been applied in this analysis.

Figure 8, below shows the link 3 passing through the 2km buffer. None of the turbines contacts the links maximum Fresnel zones with closest turbine, WTG16, is 532 meters from the 60% first Fresnel zone.

Consequently, the proposed WTGs are unlikely to cause telecommunication interference with Link 3.

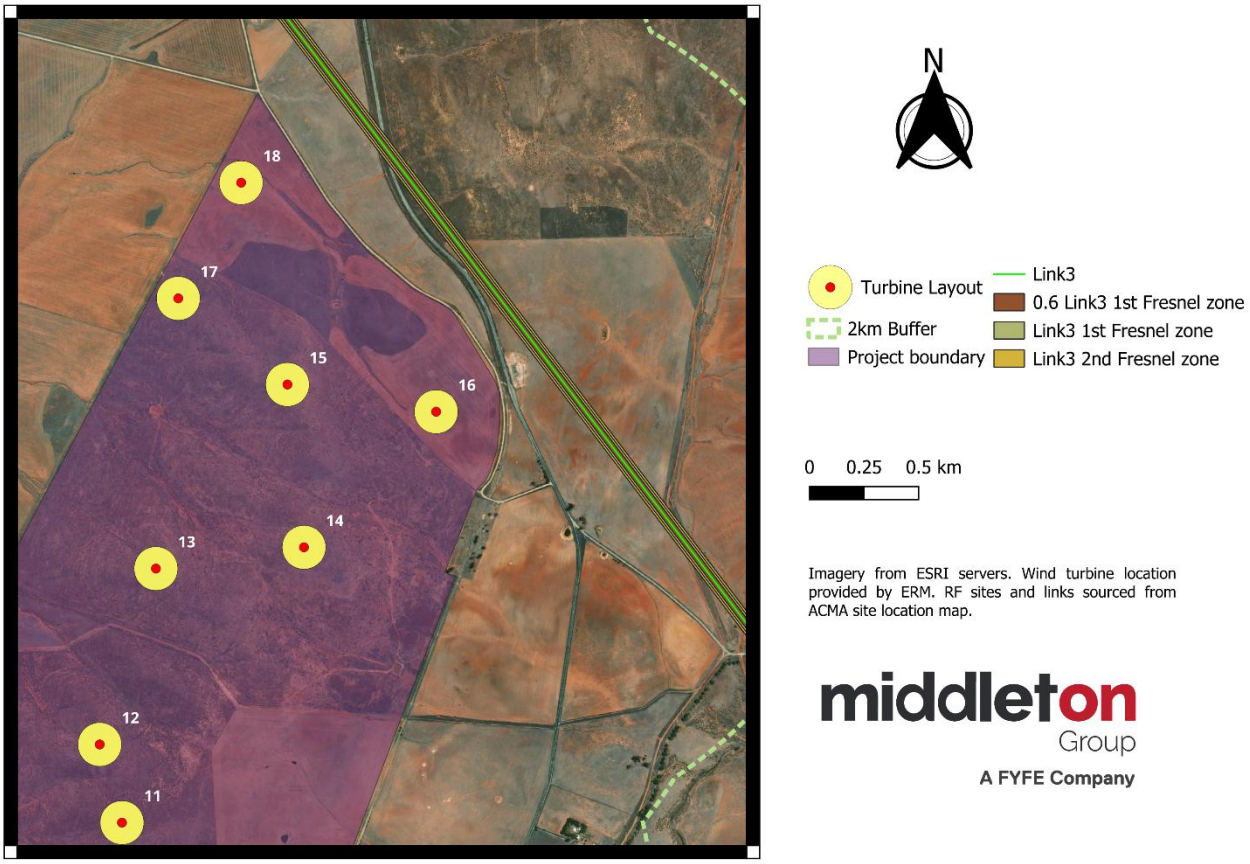


Figure 8: Link 3 passing through the Project Site within 2km

Link 4

Telstra Pty Limited manages license 10726084/1 which connects Site 1 (Trig Point 7.7 km ESE of Hallett MT BRYAN of ID: 24322) to Site 2 (Telstra Site Sec 325 Hundred of Anne HALLETT of ID: 131772). The lowest frequency signal, 10.73 GHz, has been applied in this analysis.

Figure 9 , below shows the link 3 passing through the 2km buffer. None of the turbines contacts the links maximum Fresnel zones with closest turbine, WTG01, is 1165 meters from the 60% first Fresnel zone.

Consequently, the proposed WTGs are unlikely to cause telecommunication interference with Link 4.

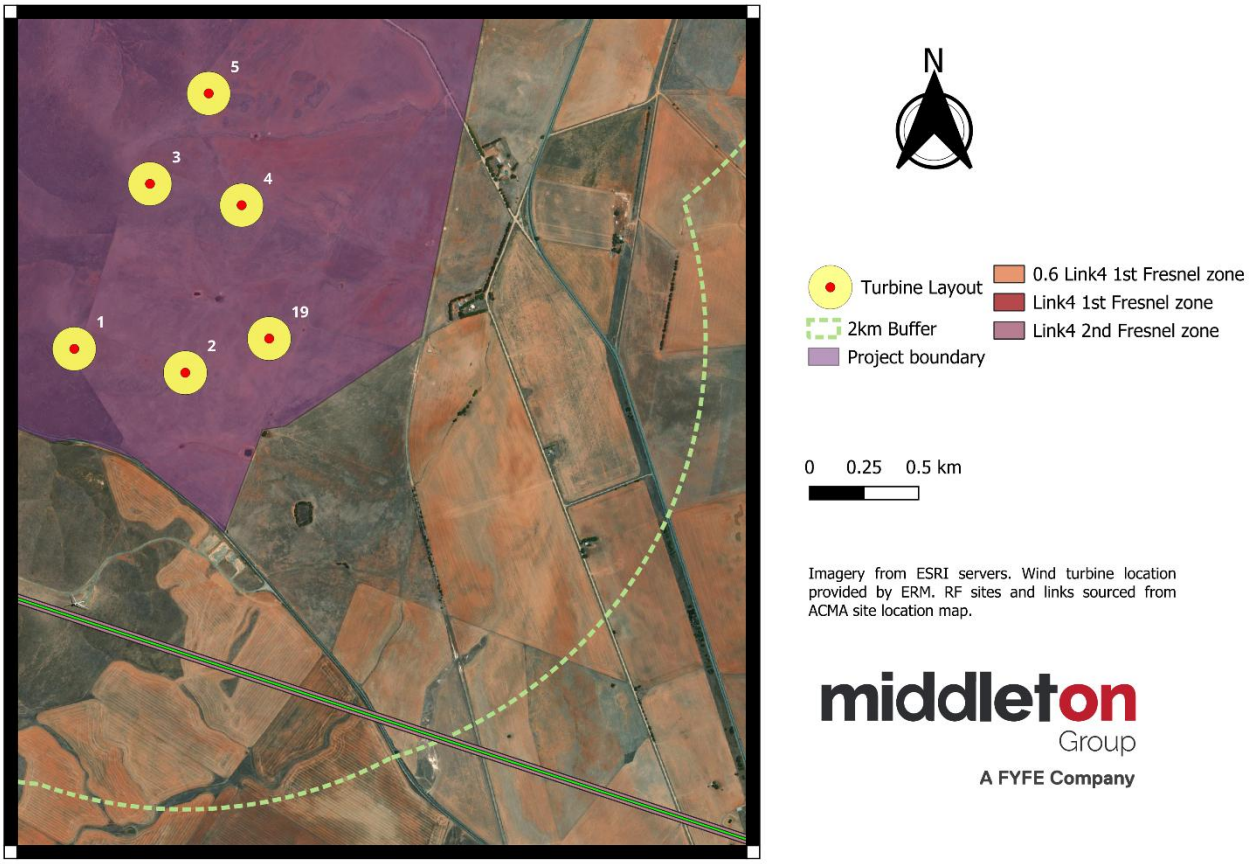


Figure 9: Link 4 passing through the Project Site within 2km

5.4 Meteorological Radar

Meteorological radars detect rain and thunderstorm events, as well as other phenomena such as flocks of birds, smoke, or ash, which cause echoes to be visible. The Bureau of Meteorology's (BoM's) radars typically detect rain between 2.5 km to 3.5 km above the ground within a radius of 250 km, and in some instances, beyond. Some wind farms are visible to meteorological radars, registering as static echoes.

Details of specific radars and corresponding coverage maps are available online from: http://www.bom.gov.au/australia/radar/index.shtml.

The World Meteorological Organisation (WMO) recommends that wind turbines are sited, at a minimum, beyond 5 km from meteorological radars, and preferably beyond 20 km [3]. Furthermore, The Operational Programme for the Exchange of Weather Radar Information (OPERA), and the radar programme of European Meteorological Services Network (EUMETNET), state that no wind turbine should be deployed within 5 km radius of C-band radars and 10 km radius of S-band radars. An impact study should be submitted if the wind turbines are sited within 20 km radius of C-band radars and 30 km radius of S-band radars [4].

Figure 10 demonstrates the location of the Meteorological radars in relation to the Project Site. The details of the closest two weather radars that are within 250 km are also outlined in Table 9.

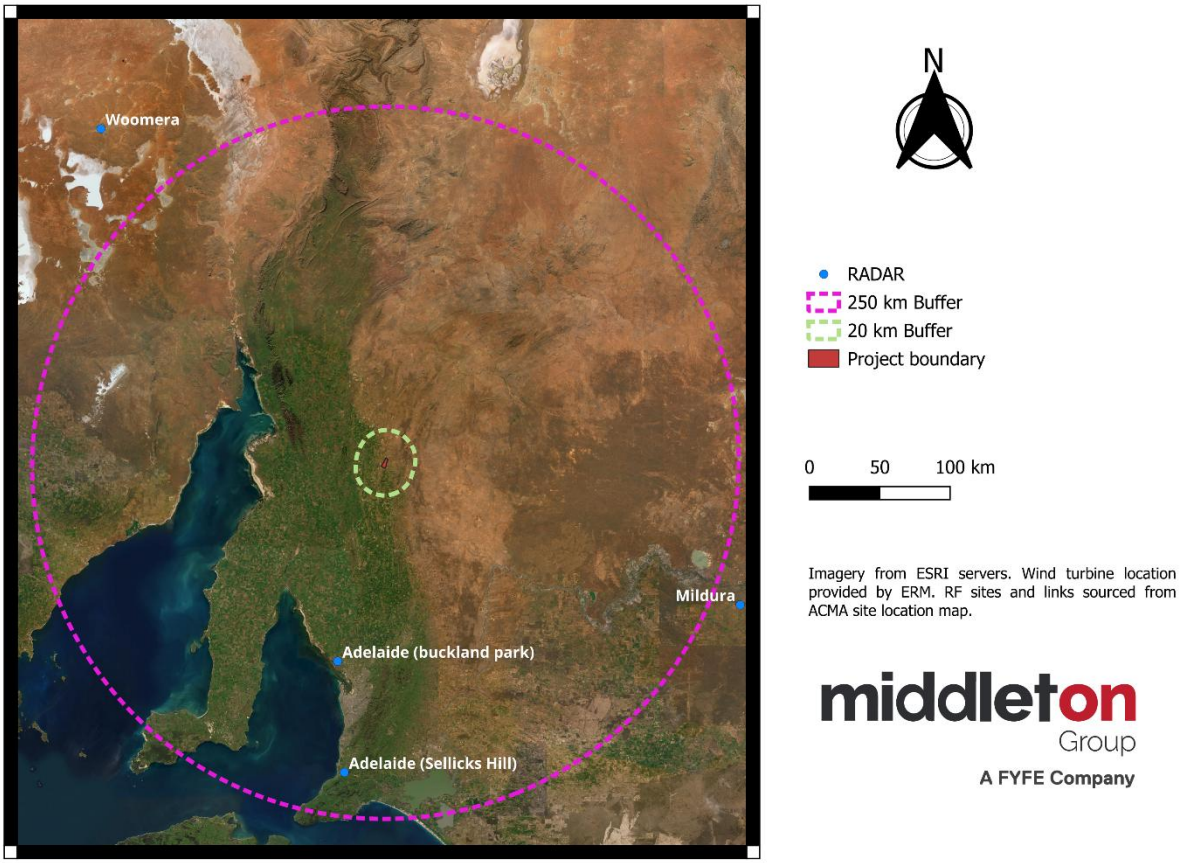


Figure 10: Meteorological Radar

Table 9: Meteorological Radar Information

Weather Radar Name	Coordinate	Radar type	Distance to Willogoleche Wind Farm Project Site
Adelaide (Buckland Park)	-34.6147° N,138.4654° E	Meteor 1500 SDP	140.52 km
Adelaide (Sellicks Hill)	-35.32961° N,138.49892° E	WF 100, C-band	218.16 km

The Project complies with WMO standards based on distance setbacks from the various meteorological radars in the region. Further, there is excellent coverage from the two radars within 250 km of the wind farm, giving good visibility of weather events in that region. As such, the presence of the Project is unlikely to cause adverse performance of the radars during extreme weather events.

Stakeholder engagement has been completed by the ERM, and the response has been collated in Appendix BB.2. BoM have indicated that under normal atmospheric conditions, the project poses manageable risk on their radars and radiocommunications assets and have no objection to the proposed project.

5.5 Mobile Voice-Based Communications

5.5.1 Mobile Coverage – Nearby Towers

There is one mobile phone base station located within the 2 km buffer of the Project's wind turbines as shown in Figure 11. The closest mobile phone base station is 1.16 km away from the nearest WTG. Typically, the signal will not be significantly impacted where the towers are located more than 1 km from wind turbines. Therefore, it is unlikely that the Project will cause any significant impact on the operation of mobile phone base stations.

Consultation and engagement with Telstra and Optus with respect to the impact on their mobile telemetry services has been conducted. Optus have concluded there will be no detrimental impact to their services, and Telstra have requested some further assurances from the Proponent regarding operation of the wind farm, see Appendix B.4 & B.5 for their full letters.

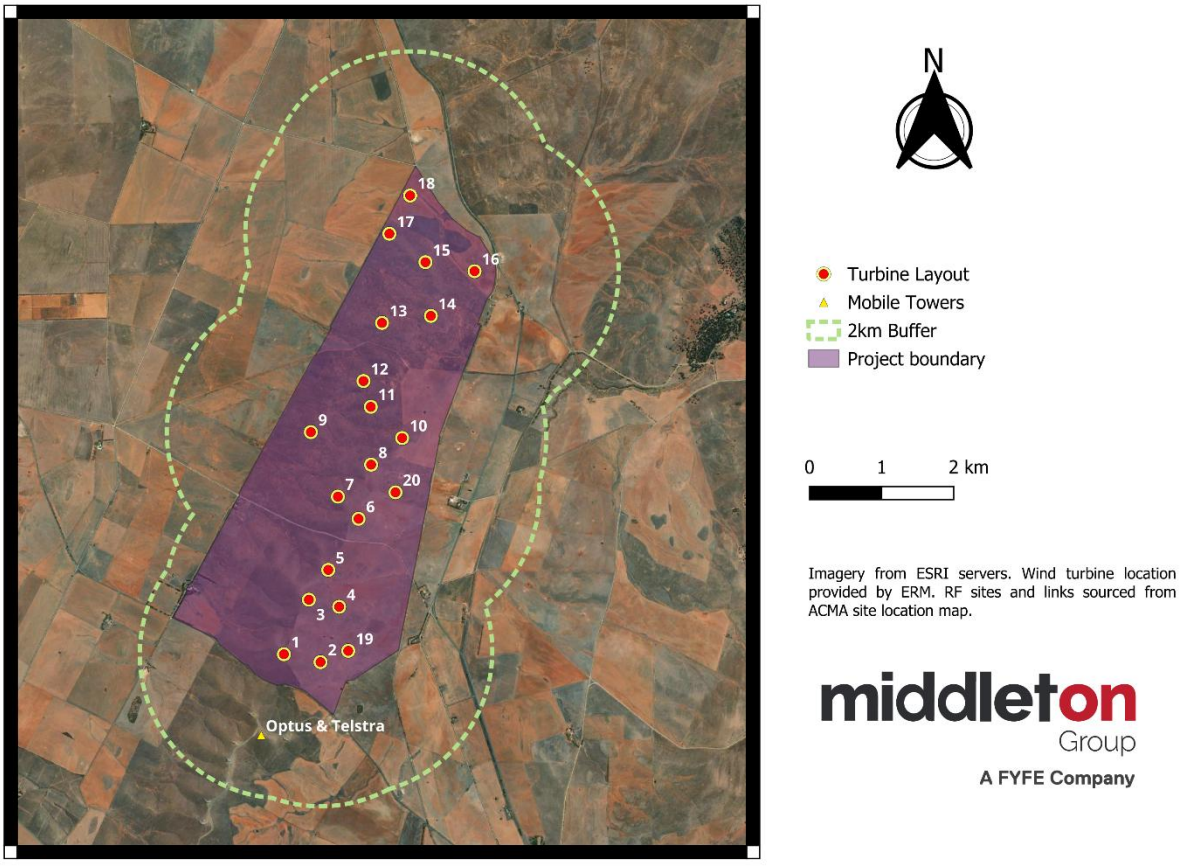


Figure 11: Proximity of Project to mobile phone base stations

5.5.2 Mobile Coverage – General

The mobile network coverage maps of Telstra and Optus within the region are shown in Figure 12 and Figure 13 respectively.

In the immediate vicinity of the wind turbines, some reduction in signal may occur. However, this can be mitigated by relocating the mobile phone receiver in the order of tens of metres. Beyond the Project Site, there will not be any significant impact on the signal.

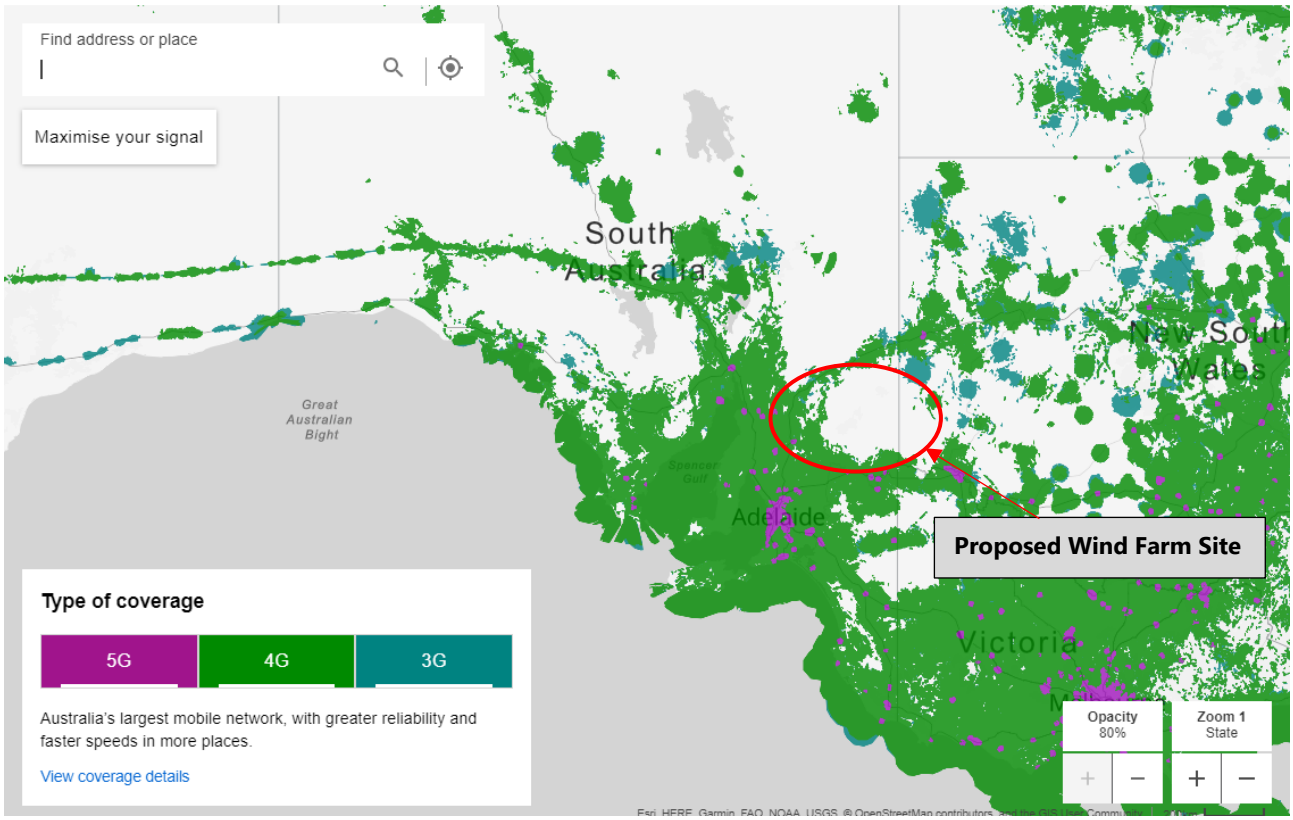


Figure 12: Telstra Network Coverage Map of Willogoleche Stage 2 Wind Farm

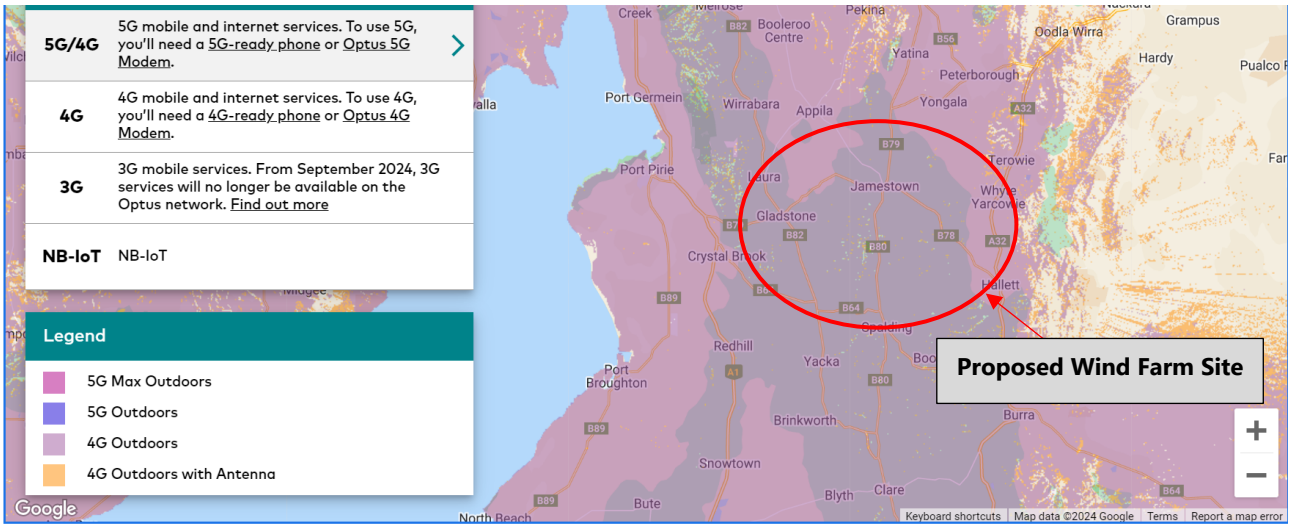


Figure 13: Optus Network Coverage Map of Willogoleche Stage 2 Wind Farm

5.6 Wireless and Satellite Services

Satellite services will only be impacted where receivers are sited very close proximity to turbines, obstructing their line of sight to the sky. A conservative distance of 2 km is used as a screening criteria. These satellites typically provide pay-tv, wireless internet, and satellite phone coverage, as well as TV coverage where there is no terrestrial service available.

As shown in Figure 14, there are nine associated and three non-associated dwellings within 2 km of the WTGs. The closest associated dwelling (AD2) is 0.8 km from the WTG20. The Project may cause degradation to signal quality from satellite services to these associated dwellings.

Non-associated dwellings will not be impacted by the project.

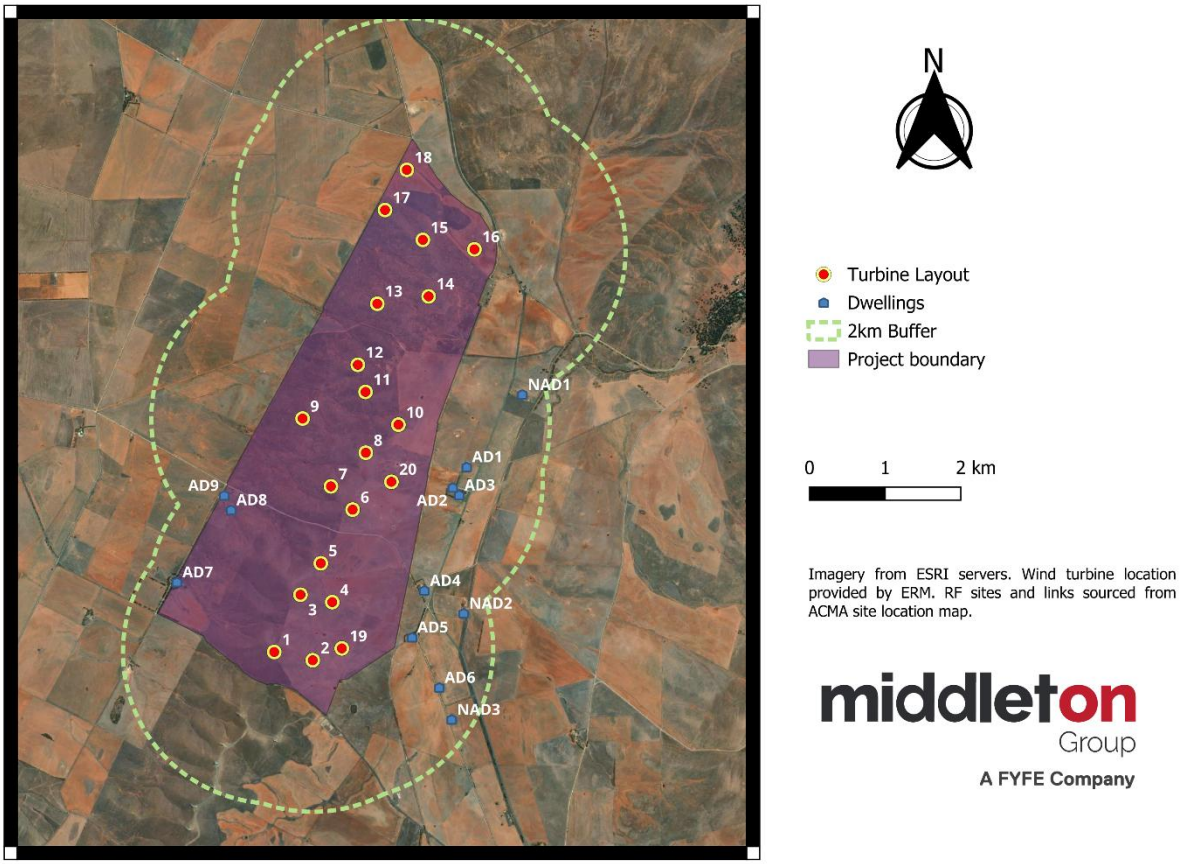


Figure 14: Dwellings located nearby the project

Table 10: Dwellings Summary

Dwelling ID	WTG ID	Distance (km)
AD2	WTG 20	0.81
AD3	WTG 20	0.91
AD5	WTG 19	0.94
AD1	WTG 20	1.01
AD4	WTG 4	1.25
AD8	WTG 7	1.35
AD6	WTG 19	1.38
AD9	WTG 7	1.41
AD7	WTG 1	1.58
NAD2	WTG 19	1.67
NAD1	WTG 10	1.68
NAD3	WTG 19	1.72

5.7 Trigonometrical Stations and GPS

5.7.1 Survey Marks

Trigonometrical stations and survey marks are physical observation marks used for surveying or distance measuring purposes, administered by state-based authorities.

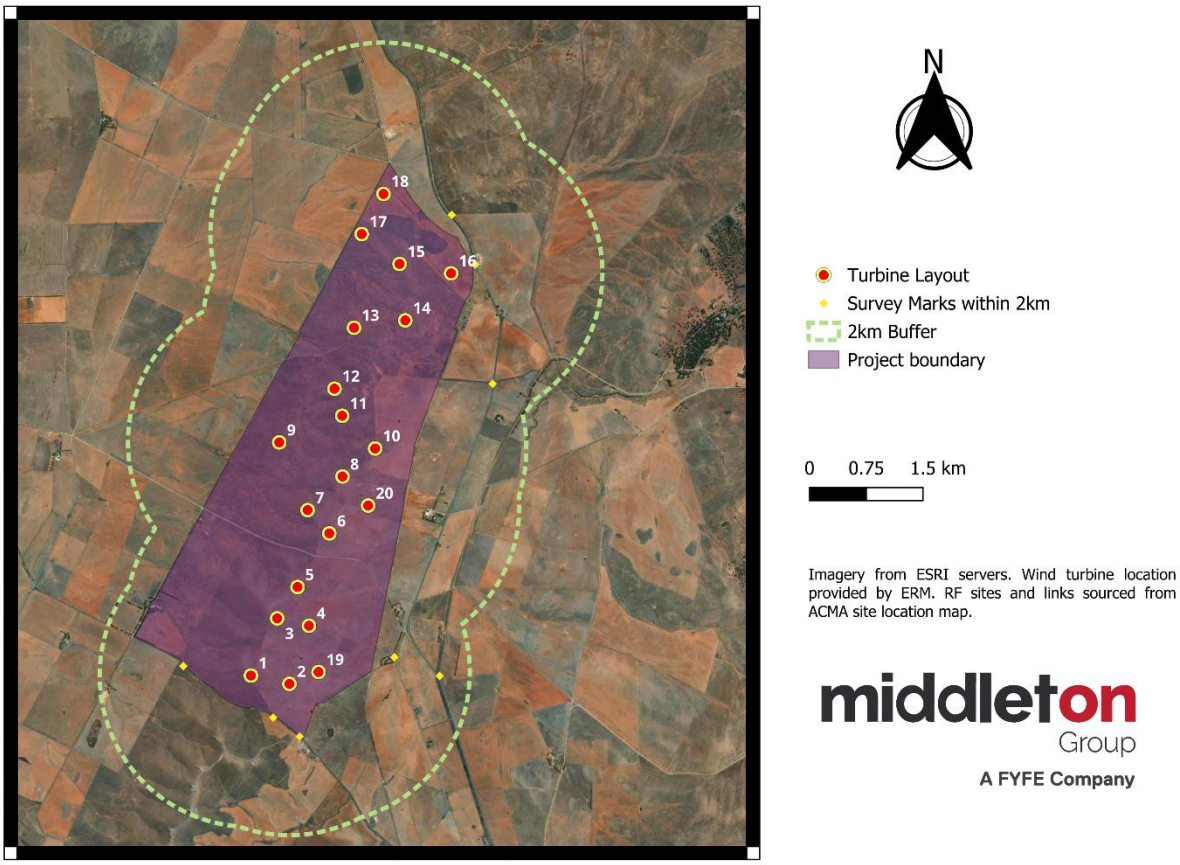


Figure 15: Survey Marks within the Project Site

A review on the location of all active survey marks has been completed, and the findings are summarised as the below:

- There is no proposed wind turbine location that shares the same location as a survey mark.
- There are 8 survey marks within a 2 km buffer of proposed wind turbine location.
- The closest distance between a survey mark and the wind turbine (WTG 16) is approximately 0.34 km, as shown in Figure 15. Site works will need to be designed to avoid the survey mark, or, alternatively, seek assistance from a registered surveyor to move or remove the survey marks.

Construction works can physically impact survey marks if in very close proximity. If this is likely to occur, ENGIE should consult with the South Australia Government via the following website: SA Survey Marks. As stated above, assistance from a registered surveyor may be required.

No stakeholder consultation is required at this stage for survey marks.

The summary of survey marks is listed in Table 11.

Table 11: Proximity of Nearby Survey Marks and the Project Site

Survey Mark ID	WTG ID	Distance (km)
66311396	WTG 16	0.34
66311388	WTG 02	0.49
66311389	WTG 02	0.70
66311378	WTG 16	0.77
66311435	WTG 01	0.90
66311737	WTG 19	1.02
66311402	WTG 14	1.42
66311400	WTG 19	1.60

5.7.2 Global Navigation Satellite System (GNSS) Station

Global Navigation Satellite System (GNSS) networks are operated and maintained across the Australian region and the South Pacific. This includes the Australian Regional GNSS Network (ARGN), the South Pacific Regional GNSS Network (SPRGN) and the AuScope Network. GNSS networks provide the geodetic framework for the spatial data infrastructure in Australia and its territories. Data from the GNSS Network also contributes to the International GNSS Service (IGS).

Based on the GNSS network map provided by Geoscience Australia [6], the EMI impact of the project to the GNSS stations has been analysed shown in Figure 16, demonstrates that there is one GNSS station Booborowie within the Willogoleche Stage 2 Wind Farm's 20 km boundary, 19.6 km away from the closest WTG (WTG01). The other nearest GNSS station, Clare is 55 km away from the nearest wind turbine.

It is highly unlikely that the Willogoleche Stage 2 Wind Farm will impact the GNSS services.

Consultation and engagement with Geo Science Australia with respect to the impact on their services has been conducted. Geo Science Australia have concluded there will be no detrimental impact to their services, see Appendix B.3 for their full letter.

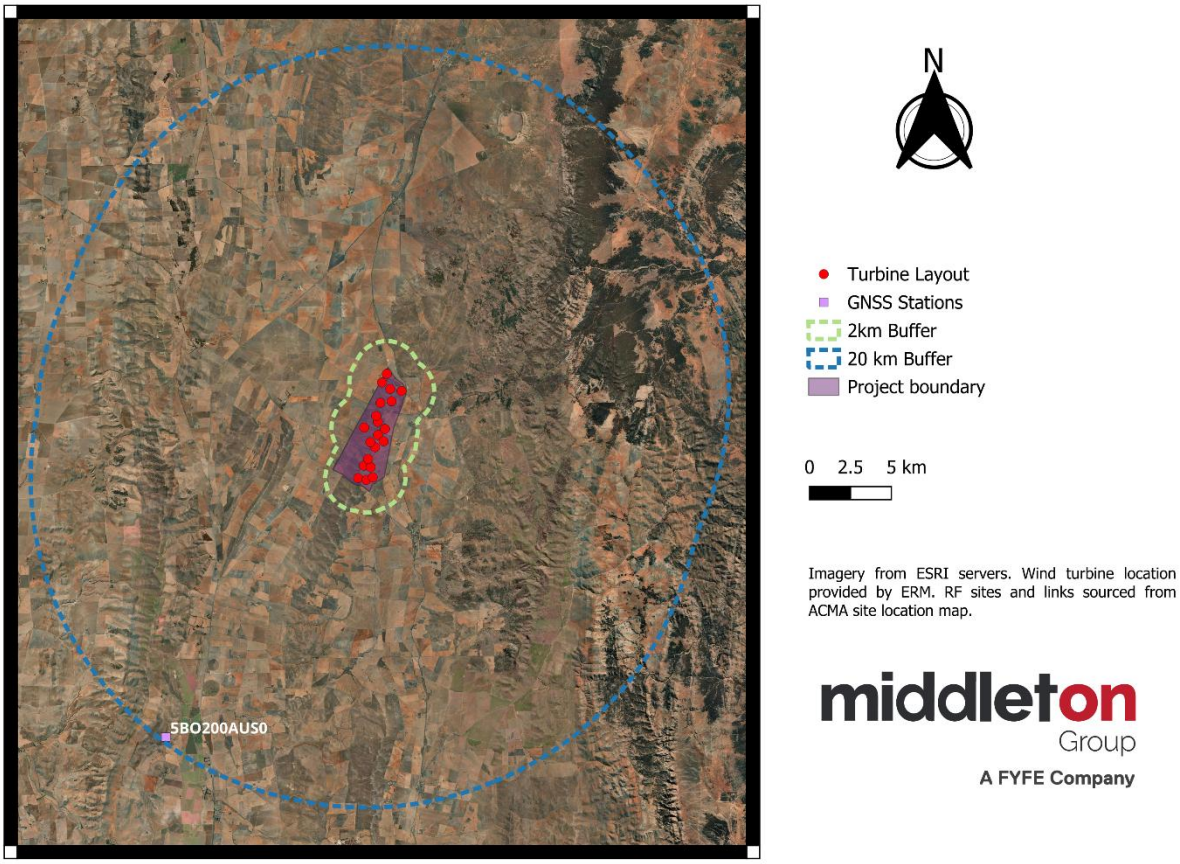


Figure 16: GNSS Station locations relative to WTG layout

5.8 Broadcast, Digital Radio and Television

Amplitude Modulation (AM) broadcast-band signals are medium 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.

Frequency modulated (FM) broadcast-band 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.

Digital signals tend to be more robust than analogue signals. A 2 km radius is generally desirable around transmitters – for both digital radio and Digital Television (DTV). Digital signals are more robust against ghosting, though wind turbine rotor pass can cause signal frequency variation.

As can be seen in Figure 17, no broadcast, radio, and television services transmitters are located within 5 km of a wind turbine. The closest is the MT BRYAN which is 11.3 km away from the nearest turbine.

It is highly unlikely that the Project will impact any broadcast, radio, and television services transmitters.

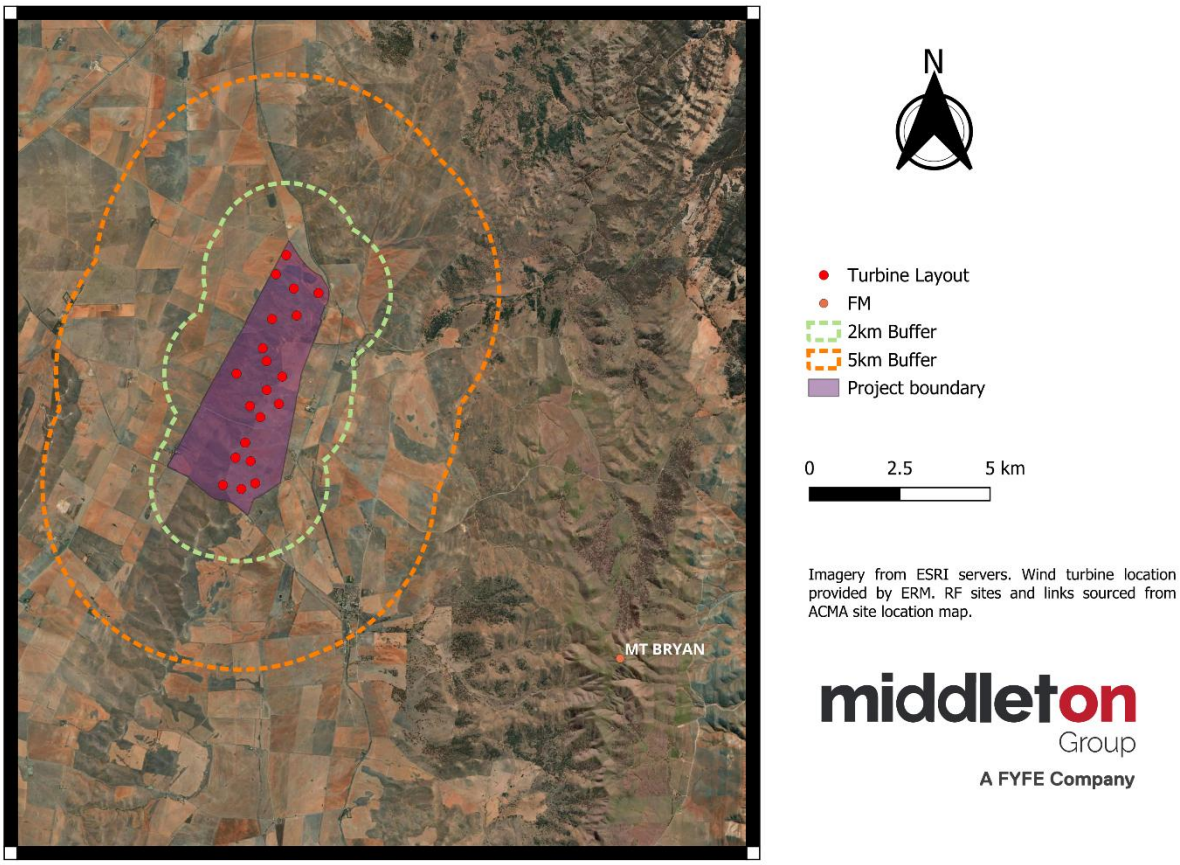


Figure 17: Location of broadcast transmitters relative to WTG layout

6 Stakeholder Engagement

Consultation and engagement with stakeholders were initiated by MG. A list of key stakeholders is presented in Table 12. Responses from these stakeholders are provided in Appendix B.

A summary of the engagement is listed below:

Table 12: List of stakeholder engagement

Stakeholder	Impact	Responses
ElectraNet	ACMA Link	**No Impact**
Bureau of Meteorology	Meteorological radar operations	**Manageable Impact**
Geoscience Australia	GNSS Towers and Trigonometrical infrastructure	**No Impact**
Telstra	Mobile service operation ACMA Link and Site	**No Impact**
Optus	Mobile service operation ACMA Link and Site	**No Impact**

7 Recommendations

Due to the negligible impacts to EMI associated with the proposed development, no further specific actions are recommended. However, to safeguard against potential impacts, consultation with key stakeholders should continue, and this study should be revised, if any design changes occur that have the potential to generate electromagnetic interference issues or telecommunications impacts

8 Conclusion

The potential electromagnetic interference impact of the Willogoleche Stage 2 Wind Farm has been assessed in this report.

Based on analysis, the Project will have no material impact on:

- Point-to-point radiocommunications links;
- Meteorological radar;
- Mobile voice-based communications;
- Wireless and satellite internet services for dwellings;
- Broadcast and digital radio signals;
- Broadcast, digital and satellite television;
- Trigonometry stations; and
- Global Positioning System (GPS).

The Bureau of Meteorology have indicated that the project will pose manageable risk on their radars and communications assets under normal atmospheric conditions and have no objection to the proposed project.

Appendix A References

[1] D. Bacon, "Fixed-link wind-turbine exclusion zone method," Radiocommunications Agency UK, 2002.

[2] G. Durgin, "The Practical Behavior of Various Edge-Diffraction Formulas," *IEEE Antennas and Propagation Magazine,* vol. 51, no. 3, pp. 24-35, 2009.

[3] Commission for Instruments and Methods of Observation, "WMO Guidance Paper on Weather Radar/Wind Turbine Siting," World Meteorological Organisation, Helsinki, 2010.

[4] O. Il, "Impact of Wind Turbines on Weather Radars," 2006.

[5] Satheesh Gopi, R. Sathikumar, N. Madhu, "8.3 EDM Instrument Characteristics," in *Advanced Surveying: Total Station, Gis and Remote Sensing*, Pearson, 2006.

[6] G. Australia, "GNSS Network Map," Geoscience Australia, [Online]. Available: https://gnss.ga.gov.au/network. [Accessed 25 05 2021].

Appendix B Stakeholder Correspondence

B.1 ElectraNet

Hello and good afternoon Heshna,

Based on the co-ordinates you've provided, there appears to be suitable clearance to existing ElectraNet microwave links.

Location 1 is the closest to an existing link at 173m, 2 and 16 are further distant at 276m and 491m respectively.

The Freznel zone closest to location 1 has a radius from direct LOS of 14.5m, leaving a clearance of approx. 158m.

These selected turbine sites would not be expected to impact ElectraNet's existing links.

If you have further questions, please let me know.

Best regards
Stephen

B.2 Bureau of Meterology (BoM)

In reply please quote: CAS-114230-C0P4X1

Date: 26/08/2025

Dear Andressa,

Thank you for your continued patience.

Our assessment of the current Willogoleche stage 2 wind farm proposal has determined that, under normal atmospheric conditions, it poses a manageable risk to Bureau radar and radiocommunication assets.

As a result, the Bureau has no objections to the proposed development proceeding, as detailed in the documentation provided for assessment.

Modifications to the wind farms parameters, including layout designs, turbine locations, or heights, will require a new assessment.

Please contact us if you have any further enquiries.

Kind regards,

Stephanie Osborne (she/her)
Customer Specialist - Energy & Resources
Working days: Tuesday, Wednesday, Thursday, Friday (half-day)

energy@bom.gov.au | www.bom.gov.au

B.3 Geoscience Australia

Good afternoon,

Thank you for your update of the layout change.
We don't foresee any impact to our infrastructure due to the new layout of the Willogoleche wind farm.

Kind regards,
Tayla Hume (she/they) | Operations Officer
GNSS Infrastructure and Informatics
Positioning Australia Branch
Space Division
Contactable between 8am and 4pm | Monday, Tuesday, and Friday

Hi,

There has been a change in the layout of the Willogoleche Wind Farm. Could you please review the layout for any impact on your assets and operations?
Note that we are still considering a maximum rotor diameter of the turbines of 200 metres, with a tip height of 300 metres.

Attached are the .kml and .csv files of the new layout.

If you have any concerns relating to the development and any potential impacts on your communication links, let me know as early as possible.

B.4 Telstra

Heshna Uppadoo
Middleton Group
RE: Proposed Willogoleche Wind Farm

Dear Heshna,

To provide a better understanding of potential impacts to Telstra infrastructure a desktop assessment was undertaken, based on information received via email on 16/09/2025. The results were as follows:

1. There are no expected impacts to Telstra's Mobile network due to this wind farm based on the turbine locations provided.

2. Based on the turbine locations provided and information regarding Telstra's existing point to point radio links obtained from Waypoint and maprad.io, the proposed wind farm should not impact on any of Telstra's existing point to point radio links.

3. A detailed analysis of the full power coordination impact (Low Frequency Induction (LFI) and/or Earth Potential Rise (EPR)) of the wind farm development is required. This includes location of the wind farm switch yard, the route and potential of any associated HV transmissions lines and the LFI and EPR impact on any Telstra plant they may affect.

4. It is recommended that you contact Before You Dig Australia, so you are aware of the underground assets in the area. They will provide you with the location of Telstra's as well as any other utilities' underground assets.

Based on this assessment, to minimise potential interference to Telstra's telecommunications network, Telstra requires the developer to confirm its agreement to the conditions and matters set out in the above points.
The developer also confirms its role as the proponent and ultimate owner of the proposed wind farm and that it has the authority to ensure that the conditions set out above are implemented and complied with. If the agreement of any other person or entity is required to ensure the conditions set out in this letter are complied with, the developer undertakes to obtain that agreement in writing and to provide it to Telstra prior to lodging a development application for the wind farm.

If the proposed plans and specifications of the development are altered or amended, Telstra reserves the right to request further conditions and amendments to the development.

Should you wish to discuss any aspect of this letter please do not hesitate to contact the undersigned. Otherwise, I would appreciate you responding to me confirming the developer's

agreement to the conditions and matters set out above.

Regards,
Andrew Panagopoulos
Fixed Access Network Reliability
Network and Infrastructure Engineering, Global Networks & Technology

B.5 Optus

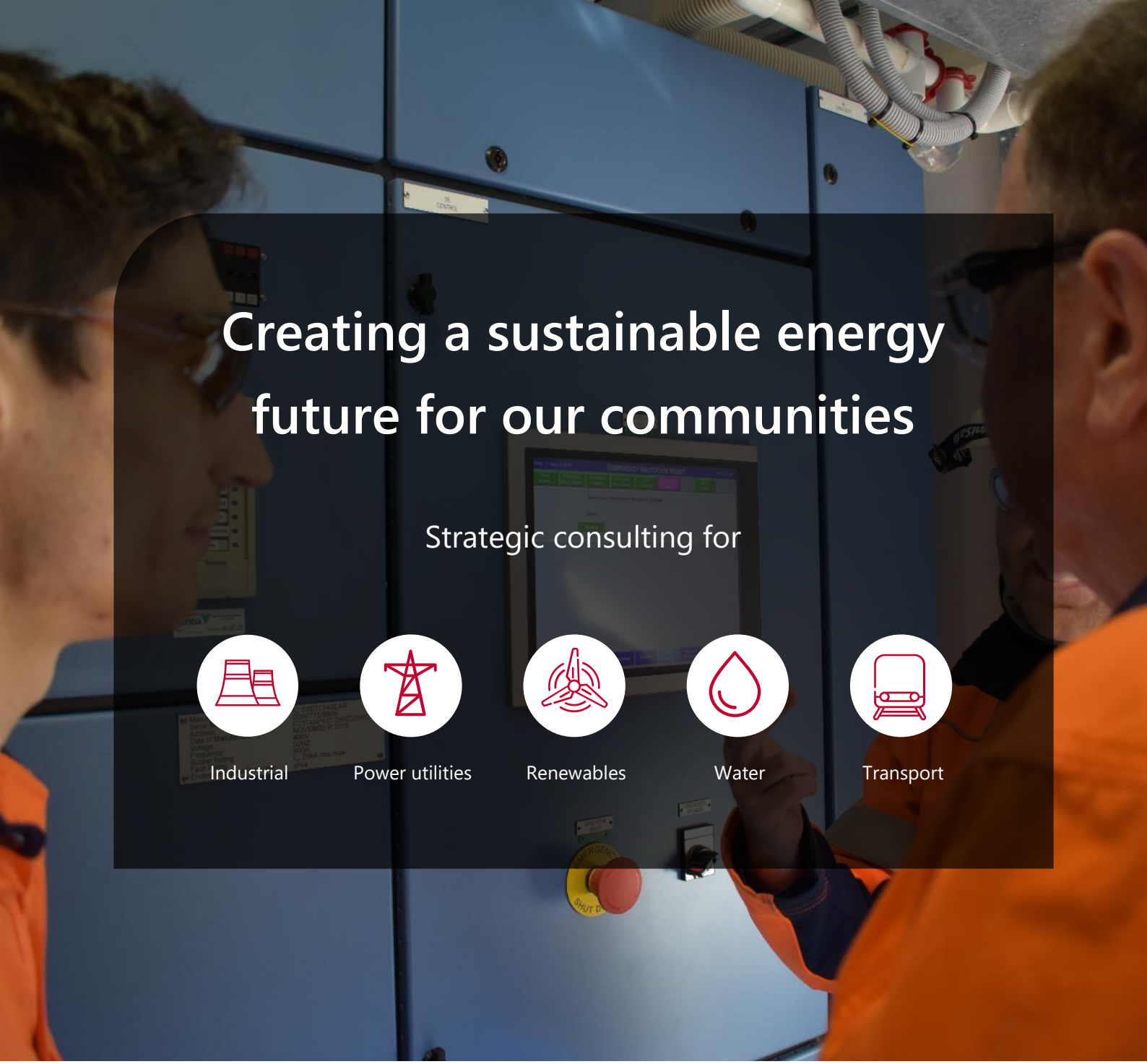
Hi Heshna,

Our technical team has reviewed the updated proposal for Willogoleche Wind Farm and advised no interference issues with Optus equipment.

Kind regards,

Andjela

EME Enquiries | Mobile Deployment | Optus



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Melbourne
L13, 500 Collins Street
Melbourne VIC 3000

Sydney
Tower 2 Darling Park L20
201 Sussex Street, Sydney NSW 2000

www.middletongroup.com.au