

Tandegin Wind Farm

Electromagnetic Interference Assessment

Collgar Renewables Pty Ltd

Reference: P529171

Revision: 1

2026-08-25

Document control record

Document prepared by:

Aurecon Australasia Pty Ltd

ABN 54 005 139 873

Level 5, 863 Hay Street

Perth WA 6000

Australia

T +61 8 6145 9300

F +61 8 6145 5020

E perth@aurecongroup.com

W aurecongroup.com

A person using Aurecon documents or data accepts the risk of:

- a) Using the documents or data in electronic form without requesting and checking them for accuracy against the original hard copy version.
- b) Using the documents or data for any purpose not agreed to in writing by Aurecon.

Document control			aurecon			
Report title		Electromagnetic Interference Assessment				
Document code			Project number		P529171	
File path		https://aurecongroup.sharepoint.com/sites/529171/5_WorkingFiles/01. E&P Tandegin Wind Farm/01. E&P Deliverables/02. Tandegin Studies/04. Electro Magnetic Interference (EMI) Assessments/3. Report/529171_Tandegin Wind Farm_EMI Assessment_RevC.docx				
Client		Collgar Renewables Pty Ltd				
Client contact		Francois Giraud	Client reference			
Rev	Date	Revision details/status	Author	Reviewer	Verifier (if required)	Approver
A	2026-04-08	Initial draft	C Nicholson	C West	F Dahhan	R Duckworth
B	2026-08-17	Updated in response to Client comments and minor layout updates	C West	F Dahhan		R Duckworth
1	2026-08-25	Updates to executive summary	C West	F Dahhan		R Duckworth
Current revision		1				

Approval			
Author signature		Approver signature	
Name	Clare West	Name	Rupert Duckworth
Title	Senior Engineer, Power Generation	Title	Director, Environment and Planning

Executive Summary

Aurecon Australasia Pty Ltd (Aurecon) has been engaged by Collgar Renewables Pty Ltd (Collgar or the Client) to facilitate the environmental and planning assessments and approvals for the Tandegin Wind Farm Project (the Project). The Project is situated approximately 20 kilometres (km) southeast of the township of Merredin in the Wheatbelt region of Western Australia.

Aurecon has carried out a telecommunications (electromagnetic interference) assessment for the Project to support the development application. The assessment findings are summarised as follows:

- Fixed licence telecommunications towers: interference may occur for one identified tower, continuing consultation with the licence owner(s) is recommended
- Point-to-point links: no Project turbines encroach upon the second Fresnel zones for these links, however consultation with the licence owner(s) is recommended for two links due to potential reflection/scattering effects
- Point-to-multipoint: interference may occur for one identified tower, consultation with the licence owner is recommended
- Trigonometrical stations: interference may occur for two identified towers, consultation with GeoScience Australia is recommended
- Global navigation satellite system (GNSS) stations: impacts are considered unlikely
- Point-to-area:
 - Towers: interference may occur for three identified locations, consultation with the licence owners is recommended
 - Mobile networks: Several nearby dwellings may be affected, consultation with the network providers is recommended to confirm potential for any interference
 - Wireless internet: Several nearby dwellings may be affected, mitigation such as switching to satellite broadband is recommended if required
 - Digital television: Several nearby dwellings to the east and south of the Project may be affected, although some dwellings may not be currently receiving any television signal. Mitigation such as a signal booster or switching to satellite television is recommended if required
- Radar:
 - Meteorological: interference is likely for one radar (South Doodlakine) and possible for several more, consultation with the Bureau of Meteorology is recommended
 - Aeronautical: Interference is possible for at least one radar (Cunderdin Airport), consultation with Airservices Australia is recommended
 - Defence: interference is considered unlikely but still possible for several radars, consultation with the Department of Defence is recommended
- New communications tower: interference may occur for a new telecommunications tower proposed to be installed by Telstra in the northwest corner of the site. Consultation with Telstra is recommended.

Contents

1	Introduction.....	1
1.1	Purpose	1
2	Project Description.....	2
3	Electromagnetic interference	3
3.1	Introduction	3
3.2	Fresnel zone	3
4	Guidelines and limits	4
4.1	Australian Draft National Guidelines	4
4.2	State guidelines	4
5	Assessment of potential effects	6
5.1	Point-to-point and point-to-multipoint	6
5.1.1	Telecommunications towers	6
5.1.2	Point-to-point links	8
5.1.3	Point-to-multipoint licences	9
5.1.4	Trigonometrical and GNSS stations	10
5.2	Point-to-area	11
5.2.1	Signal coverage maps	11
5.2.2	Transmission locations	15
5.3	Radar.....	17
5.3.1	Meteorological	17
5.3.2	Aeronautical.....	18
5.3.3	Defence	20
5.4	Cumulative impacts	22
6	Consultation.....	23
7	Conclusions and recommendations	24

Appendices

Appendix A

Turbine coordinates

Figures

Figure 2-1	Site location and turbine layout
Figure 3-1	Telecommunication link Fresnel zone illustration
Figure 5-1	Closest fixed telecommunications sites to the Project
Figure 5-2	Fixed point-to-point licence links in the vicinity of the Project
Figure 5-3	Point-to-point links with second Fresnel zones
Figure 5-4	Trigonometrical and GNSS stations identified within/near the Project
Figure 5-5	Optus mobile network coverage
Figure 5-6	Telstra mobile network coverage
Figure 5-7	Vodafone mobile network coverage
Figure 5-8	NBN Fixed Wireless Coverage
Figure 5-9	Broadcast digital TV signal for Merredin
Figure 5-10	Broadcast digital TV signal for Central Agricultural

Figure 5-11	Point-to-area communication transmitters
Figure 5-12	Bureau of Meteorology radar locations
Figure 5-13	Aeronautical radar locations
Figure 5-14	Defence radar locations

Tables

Table 5-1	Closest fixed telecommunication site details
Table 5-2	Point-to-point links at risk of interference
Table 5-3	Point-to-multipoint telecommunication sites within 20 km of a turbine
Table 5-4	Trigonometrical stations within the Project boundaries
Table 5-5	GNSS base stations in the vicinity of the Project
Table 5-6	Digital television sites with coverage over the Project and surrounding dwellings
Table 5-7	Closest point-to-area communication transmitter site details
Table 5-8	Bureau of Meteorology radar sites within 250 nautical miles of the Project
Table 5-9	Airservices Australia radar sites within 250 nautical miles of the Project
Table 5-10	Department of Defence radar sites within 250 nautical miles of the Project
Table 5-11	Wind farms in the vicinity of the Project
Table 6-1	Stakeholders to be consulted

1 Introduction

Aurecon Australasia Pty Ltd (Aurecon) has been engaged by Collgar Renewables Pty Ltd (Collgar or the Client) to carry out an electromagnetic interference assessment for the proposed Tandegin Wind Farm (the Project).

1.1 Purpose

The purpose of this report is to provide an assessment of the potential electromagnetic interference effects anticipated once the wind farm is operational. Matters required to be considered under the Australian Draft National Guidelines¹ and the Western Australian Draft Renewable Energy Planning Code and Guidelines² are identified and addressed in this report.

In further detail, this report contains:

- A description of the Project location and environment
- A description of electromagnetic interference causes and potential effects
- A description of the relevant legislation, policies and guidelines that were taken into consideration during the assessment
- An overview of the methodology undertaken to inform the assessment
- An assessment of actual and potential effects
- Conclusion and recommendations.

¹ Commonwealth of Australia Environment Protection and Heritage Council (EPHC), "National Wind Farm Development Guidelines", DRAFT July 2010

² Western Australian Planning Commission, "Renewable Energy Planning Code and Guidelines", DRAFT December 2025

2 Project description

The Project is located approximately 20 km southeast of the town of Merredin, in the Wheatbelt Region of Western Australia.

The area is within a rural environment, consisting of areas of pasture, working farms and lifestyle blocks.

The Project will include approximately 310 MW of wind power and up to 300 MW of battery energy storage system (BESS) that will connect to the South West Interconnected System.

A wind turbine layout consisting of 50 turbines has been provided by the Client for this assessment³. The proposed turbine layout is shown in Figure 2-1 and the turbine coordinates are provided in Appendix A.

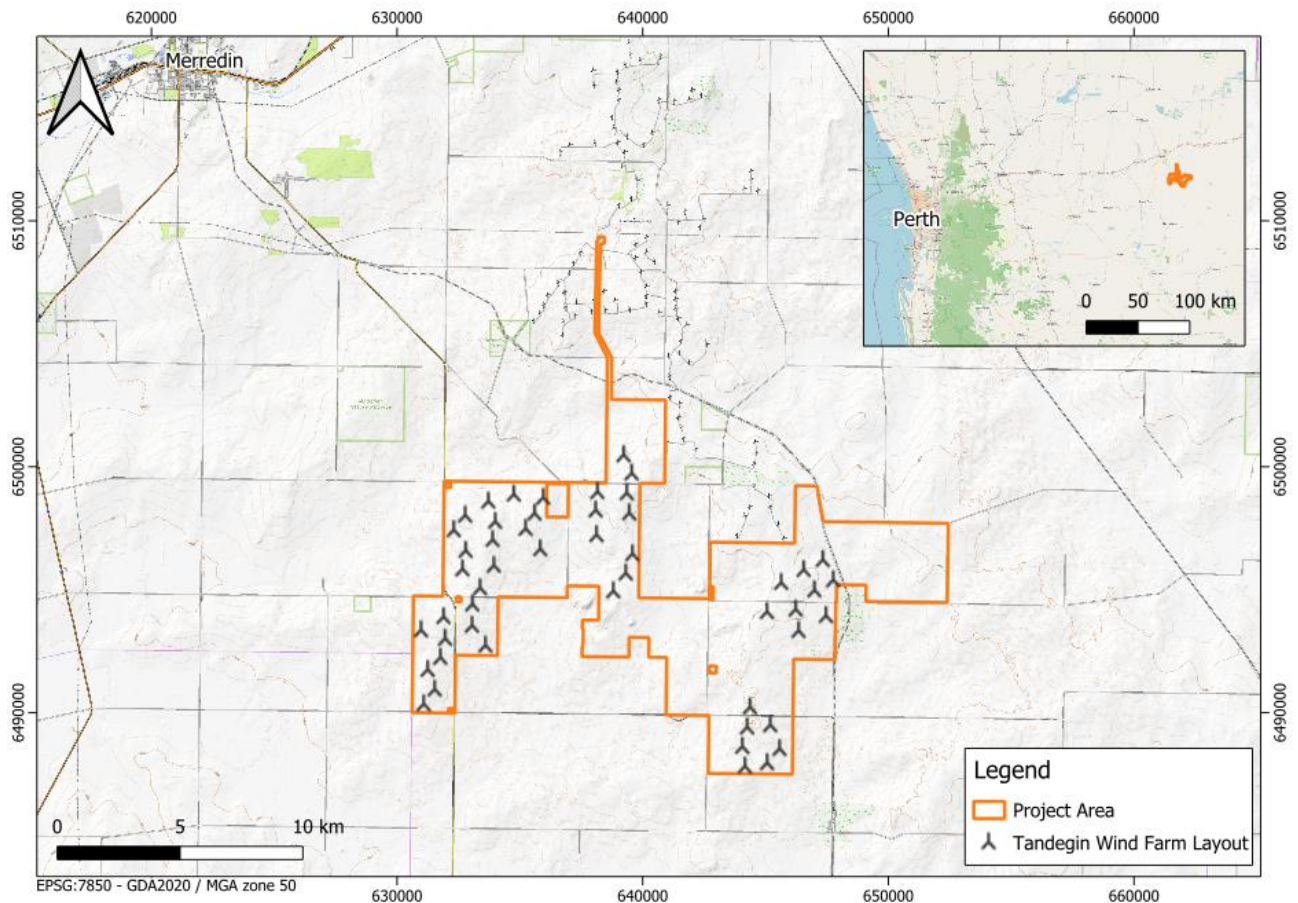


Figure 2-1 Site location and turbine layout

Background: OpenTopoMap and OpenStreetMap

This assessment is based on the following wind turbine dimensions provided by the Client:

- A maximum rotor diameter of 182 m
- A maximum upper blade tip height of 252 m.

³ Tandegin_Turbine_Location_20260721.shp, provided 07/08/2026.

3 Electromagnetic interference

3.1 Introduction

Electromagnetic interference (EMI) is a reduction in telecommunications signal quality, clarity or magnitude. The presence of turbines has the potential to cause EMI on telecommunication services including:

- Point-to-point and point-to-multipoint between fixed transmitter and receiver tower locations
- Point-to-area such as radio and digital television broadcasts, and mobile phone and internet services
- Radar such as meteorological (weather) and aeronautical.

EMI can occur through mechanisms such as the turbine structure or blades causing obstruction, reflection or refraction of the electromagnetic waves used in various telecommunications services⁴. In some cases, potential interference can be mitigated or avoided by appropriate siting of turbines.

3.2 Fresnel zone

Fixed point-to-point (as well as point-to-multipoint) radio communication signals follow the line of sight between transmitter and receiver locations. The established method to mitigate interference is to keep structures out of the Fresnel zone of the signal. This Fresnel zone is represented as an ellipsoid around the line of sight between the two ends of the link (telecommunication towers). The ellipsoid radius (r) is defined by the distance along the link (d_1 , d_2), length of link (D), the telecommunications signal wavelength (λ), and the zone number (n), as shown in Figure 3-1 and the equation below:

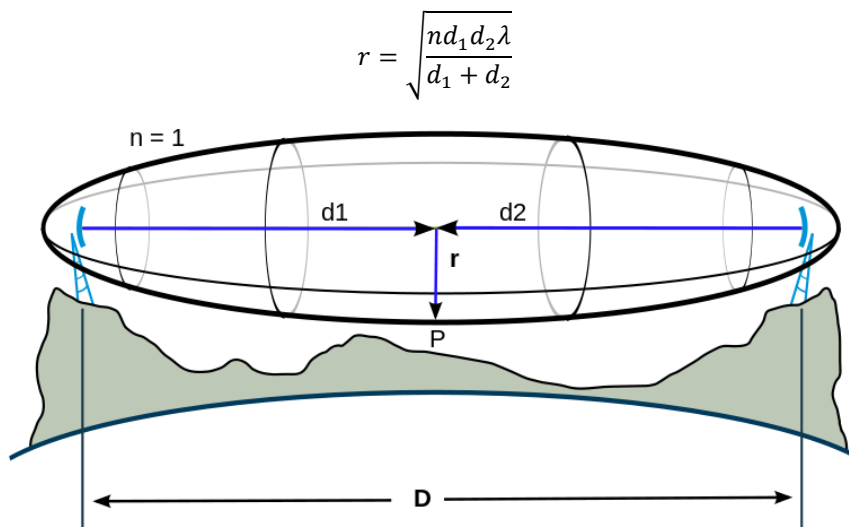


Figure 3-1 Telecommunication link Fresnel zone illustration⁴

The zone number can be any value greater than zero, and the radius of the Fresnel zone increases with the zone number. The zone number is an indication of how conservative the distance being allowed around the link is – a zone number of one is relatively close to the link, while a zone number of two has a larger radius around the link.

There are various recommendations to avoid adverse effects of structures on the point-to-point telecommunication signal, such as no more than 20% or 40% blockage of the first Fresnel zone ($n = 1$), and the 0.6 Fresnel zone ($n = 0.6$) is often applied when designing point-to-point telecommunications links over terrain and vegetation. The second Fresnel zone ($n = 2$) is often used as a conservative safeguarding of the telecommunications links from potential interference from turbines⁵.

⁴ Podhorský, Dušan & Fabo, Peter. (2016). *Localization of rainfall and determination its intensity in the lower layers of the troposphere from the measurements of local RF transmitter characteristics*. Journal: Contributions to Geophysics and Geodesy Vol 46(4). DOI:10.1515/congeo-2016-0018

⁵ D. Bacon, "Fixed-link wind turbine exclusion zone method - Version 1.1," 28 October 2009.

4 Guidelines and limits

EMI can be considered in terms of two key limits:

1. Separation distances required to avoid obstruction or degradation of electromagnetic signals
2. The need for consultation where infrastructure lies within defined influence zones.

These limits apply to all third-party telecommunications or radar assets potentially affected by wind turbine structures.

4.1 Australian Draft National Guidelines

The most recent and relevant Australian guidelines for EMI assessment are the Australian Draft National Guidelines⁶ (2010). Aurecon considers the Draft National Guidelines to be appropriate, detailed and in accordance with other international guidelines and they have been used for reference in this assessment.

Although this legislation never progressed past “draft” stage, as individual states began to develop their own planning guidelines⁷, they remain the most detailed and thorough set of recommendations in Australia and are still generally held in industry as the basis for assessment.

The Draft National Guidelines recommend the following criteria in relation to potential interference:

- Point-to-point and point-to-multipoint links: No encroachment of any part of the turbine, including the maximum rotor sweep envelope, into the second Fresnel zone of the link
- Telecommunication towers/sites: within 2 km from turbines
- Radar systems: within 250 nautical miles (463 km) from turbines.

If any turbines are located within the above distances, the Draft National Guidelines recommend consultation with the relevant licence holder(s) to assess potential impacts and determine whether further investigation or mitigation is required.

4.2 State guidelines

The Western Australian Planning Commission (WAPC) draft of the Renewable Energy Planning Code and Guidelines (dated December 2025) is currently within a public consultation phase⁸. The document aims to provide a framework for assessing renewable energy development projects with an initial focus on wind farms, creating a statewide standard for projects.

The Draft WAPC Code and Guidelines require proponents to demonstrate that wind farms are sited, designed and operated to avoid adverse impacts on telecommunications infrastructure, and for EMI to be minimised through mitigation where it cannot be avoided.

Unlike the Australian Draft National Guidelines, the Draft WAPC Guidelines do not provide technical criteria for interference or propose methodologies for assessment of interference. Instead, the framework adopts a performance-based approach that requires proponents to demonstrate that EMI impacts are understood, assessed, and appropriately managed. Aurecon considers this is best achieved by following the recommendations of the Draft National Guidelines and other sources as outlined in this report.

⁶ Commonwealth of Australia Environment Protection and Heritage Council (EPHC), “National Wind Farm Development Guidelines”, DRAFT July 2010

⁷ <https://www.nepc.gov.au/publications/archive/ephc-archive/ephc-archive-future-national-wind-farm-development-guidelines>

⁸ Western Australia Planning Commission, “Renewable Energy Planning Code and Guidelines”, Draft Code and Guidelines – Public Consultation December 2025

Aurecon notes that the Draft WAPC Guidelines require the assessment of potential impacts regarding the following:

- Observatories and radio astronomy
- Radio Quiet Zones.

Due to the location of the Project, assessment of potential impacts in relation to these services is not applicable.

Aurecon also notes that the Draft WAPC Guidelines include a requirement to consider the National Airports Safeguarding Framework Guideline G (Protecting Aviation Facilities – Communication, Navigation and Surveillance)⁹ where applicable. Guideline G defines a building restricted area of up to 15 km radius around communication navigation and surveillance (CNS) facilities. The nearest facilities are beyond the minimum setback distances (see above) to avoid potential interference from the Project. Aurecon therefore considers this requirement to not be applicable for the Project. Aurecon has assessed potential impacts to aeronautical radar as per the Draft National Guidelines, as presented in Section 5.3.2.

⁹ Australian Government Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts, 'National Airports Safeguarding Framework, Guideline G: Protecting aviation facilities – communication, navigation and surveillance', Version 1.0, November 2016.

5 Assessment of potential effects

Aurecon has accessed the Australian Communications and Media Authority (ACMA) telecommunication licences database¹⁰ through the MAPRAD.IO website¹¹ to obtain the broadcasting locations and other details for point-to-point, point-to-area and radar telecommunications in the vicinity of the Project. Sites within 50 km of the Project have been included for all licence types except for radar, for which a distance of 250 nautical miles (463 km) has been applied in accordance with the Draft National Guidelines.

Impacts on mobile phone, wireless internet and digital television point-to-area telecommunications to nearby buildings were investigated using coverage maps from the various service providers.

Aurecon understands that a new telecommunications tower is proposed to be installed by Telstra in the northwest corner of the Project^{12,13}. Aurecon is not aware of what kinds of telecommunications licences will be registered at this location, so it has not been included in this assessment. However, Aurecon recommends consultation with Telstra to confirm what kind of communication licences will be installed and whether any effects are expected as a result of the Project.

5.1 Point-to-point and point-to-multipoint

5.1.1 Telecommunications towers

The locations of the closest identified fixed (point-to-point and point-to-multipoint) telecommunications towers within 50 km of the Project are shown in Figure 5-1. The closest site is within the Project boundary, and this tower may experience interference due to its proximity to turbines. The next closest sites are within 2 km of the Project boundary, and are over 5 km from any turbines which means there is low potential for interference to occur. The details of the identified towers are shown in

Table 5-1.

¹⁰ Australian Communications and Media Authority, Register of Radiocommunications Licences, https://web.acma.gov.au/pls/radcom/site_proximity.main_page/

¹¹ MAPRAD.IO website, <https://maprad.io/au>, data downloaded 25/02/2026

¹² Email from Francois Giraud <francois.giraud@collgar.com.au>, "RE: Tandegin Wind Farm Environmental & Planning Workshop 03/12/2025 - Meeting Minutes & Slides," Sent: Tuesday, 9 December 2025 12:34 PM

¹³ Notice of Public Advertisement of Planning Proposal, published 31 Oct 2025, *Public-Advertisement-of-Planning-Proposal-Proposed-Telecommunications-Infrastructure-1062-Briant-Road-Tandegin-WA.pdf*

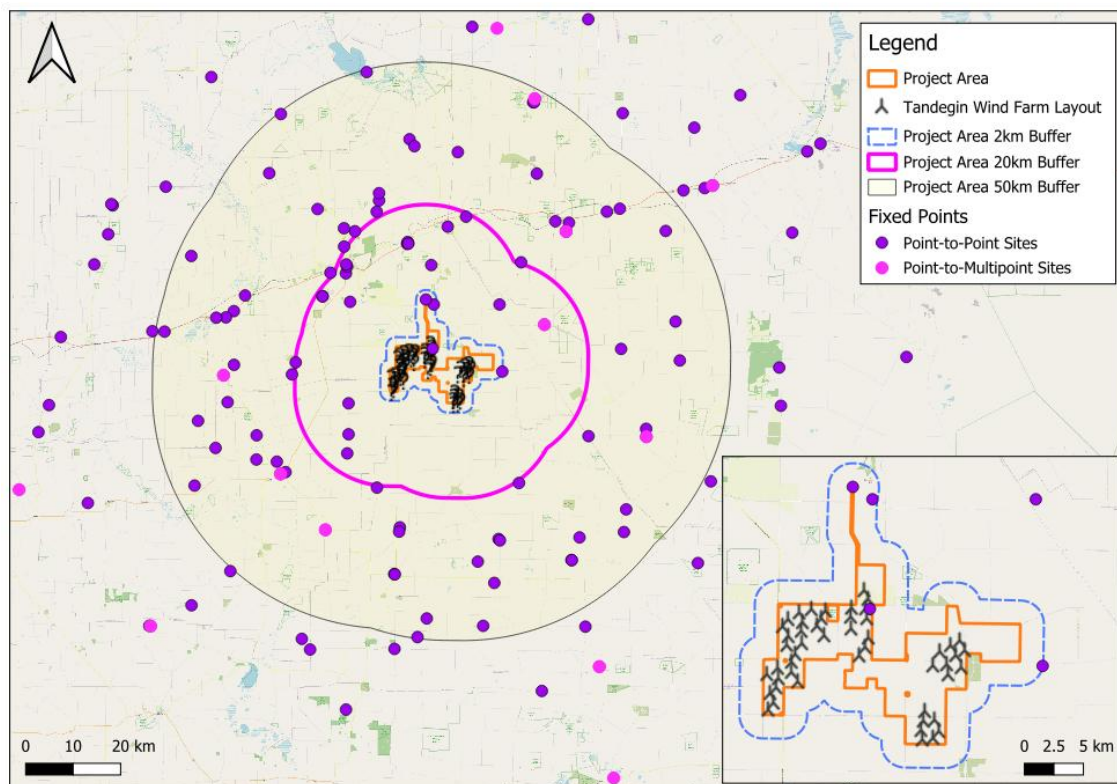


Figure 5-1 Closest fixed telecommunications sites to the Project

Table 5-1 Closest fixed telecommunication site details

Site name	Site ID	Lat/Long	Licence number	Licence frequencies (GHz)	Licensee	Distance to nearest turbine (km)
Wards, Briant Road Norpa	10022803	-31.635670°, 118.472650°	11166412/1	11.155, 11.645	Crisp Wireless Pty Ltd	0.4 (T28)
			11974563/1	10.915, 11.405		
			11166413/1	10.995, 11.485		
			11346574/1	11.075, 11.565		
25400 Tandegin East Road Tandegin	10027200	-31.677390°, 118.627800°	11346574/1	11.075, 11.565	Crisp Wireless Pty Ltd	6.7 (T38)
Telstra Site Dulebanyundy Hill MERREDIN *	600326	-31.551824°, 118.473622°	84775/1	1.7205, 1.8395	Telstra Limited	7.9 (T47)
Collgar Terminal Substation off Bulls Head Rd NORPA	9014928	-31.542536°, 118.455960°	1944599/1	5.9452, 6.19724	Electricity Networks Corporation	8.9 (T25)

Table note:

* Registered coordinates do not align with any visible infrastructure. Correct coordinates are expected to be -31.554070°, 118.474927° (~280 m south), according to satellite imagery.

Near-field effects

One tower is within 2 km of the nearest turbine (Site ID 10022803), as shown in

Table 5-1. To assess the likelihood of potential interference, Aurecon has calculated the near-field interference zone from the available information about each licence.

Aurecon has assessed the near-field interference zone for the registered antenna and licence frequencies for this site using the method outlined by D Bacon⁵. The calculated maximum near-field zone for Site ID 10022803 is approximately 94 m. The proposed layout ensures the turbines are located far enough from the tower that no interference is expected for the near-field interference zones of any licence at this tower. Nevertheless, Aurecon recommends consulting with the licence operator (Crisp Wireless Pty Ltd) in line with the Draft National Guidelines recommendations. Aurecon understands this has already been initiated by the Client.

5.1.2 Point-to-point links

The locations of fixed point-to-point links identified within 50 km of the Project centre are shown in Figure 5-2.

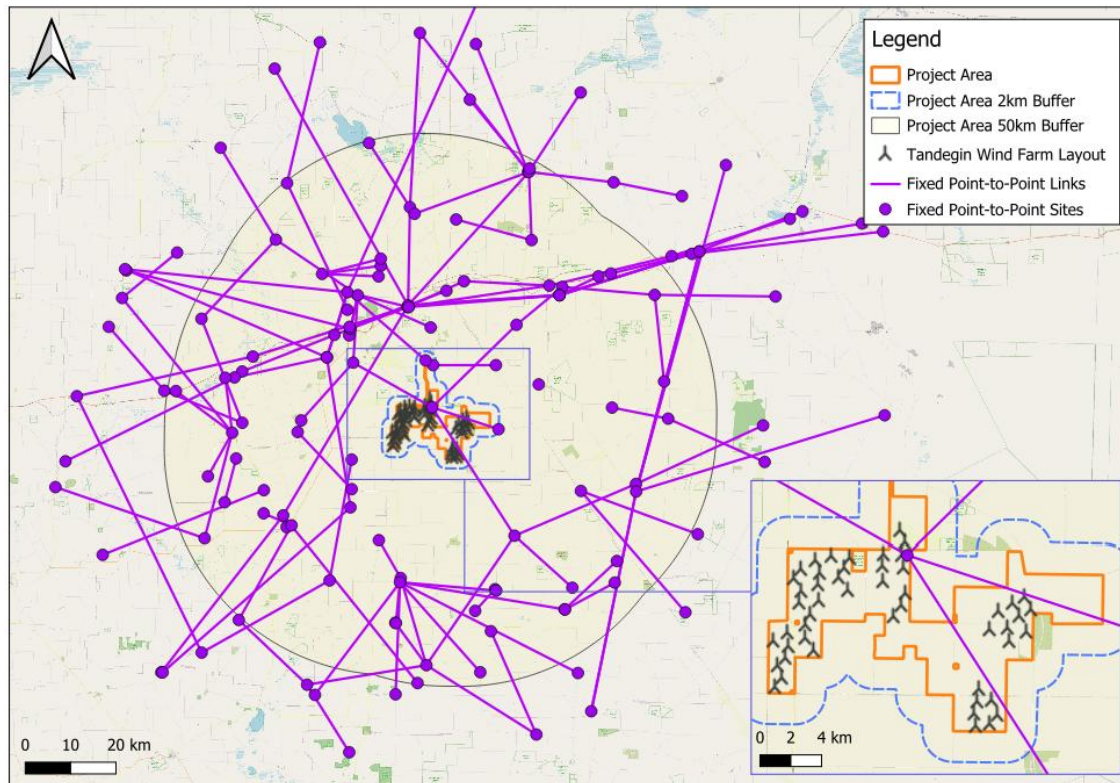


Figure 5-2 Fixed point-to-point licence links in the vicinity of the Project

Four point-to-point links have been identified that cross the Project boundary. The four links are all associated with the same telecommunication tower within the Project boundary identified in

Table 5-1. The link details are outlined in Table 5-2. Only the minimum frequency is shown as this results in the highest Fresnel radius as outlined in Section 3.2.

Table 5-2 Point-to-point links at risk of interference

Site ID 1	Site ID 2	Licence number(s)	Licensee	Minimum frequency	2 nd Fresnel Zone radius
10022803	10022802	11166412/1	Crisp Wireless Pty Ltd	11.155 GHz	16.4 m
10022803	10033508	11974563/1	Crisp Wireless Pty Ltd	10.915 GHz	18.9 m
10022803	10027200	11346574/1	Crisp Wireless Pty Ltd	11.075 GHz	14.4 m
10022803	10022804	11166413/1	Crisp Wireless Pty Ltd	10.995 GHz	21.4 m

Aurecon notes that sometimes the ACMA coordinates for the start and end locations of links are incorrect and do not line up accurately with the actual tower location that can be seen in satellite imagery. Aurecon has therefore verified the position of the towers associated with the four links that cross the Project boundary using satellite imagery. All other links are far enough from the Project that any minor adjustment to the coordinates will not impact the results.

The second Fresnel zone was calculated for each of the four links that cross the Project boundary. These are shown in Table 5-2 and Figure 5-3. The second Fresnel zones are shown with a buffer of 91 m width (maximum turbine blade length). All four links' licences are Super High Frequency (SHF)/microwave frequency above 3 GHz which means the Fresnel zones are relatively narrow. No turbines are encroaching upon the second Fresnel zones as shown in Figure 5-3. However, interference is still possible for two of the links with turbines fairly close by due to reflection and scattering effects which can affect a wider area. Therefore consultation is still recommended with the licences' owner as a result of these links.

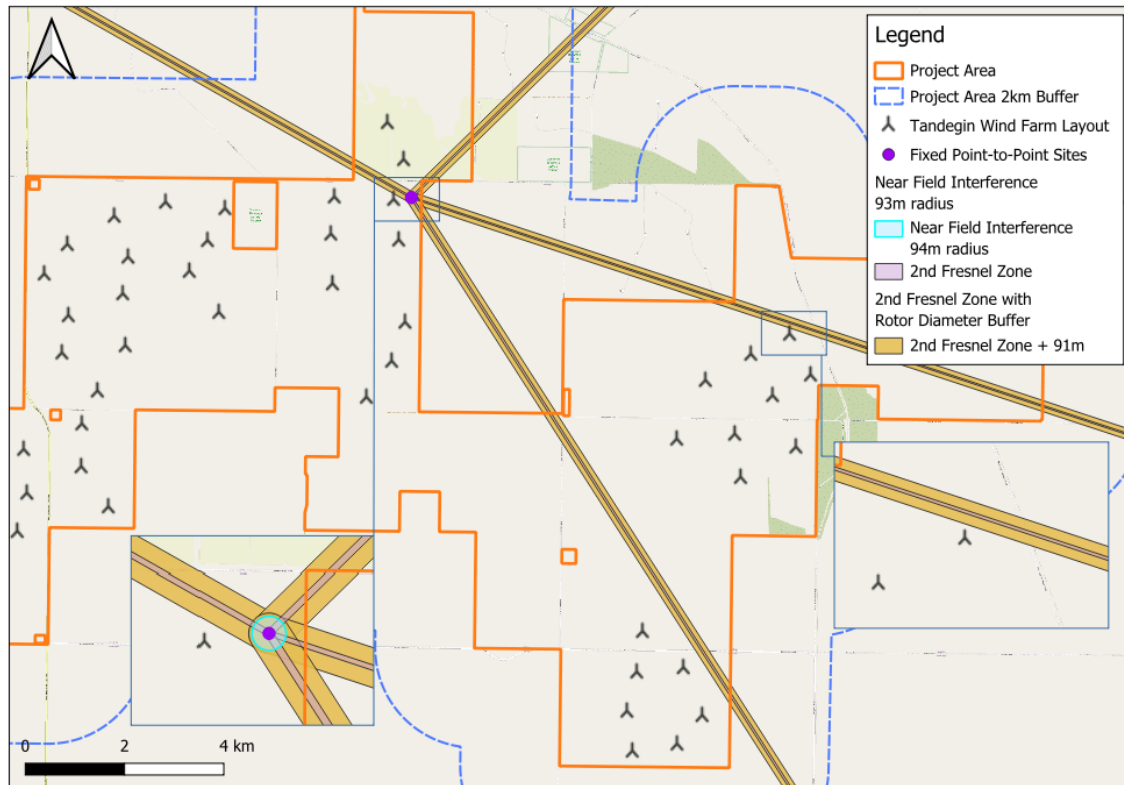


Figure 5-3 Point-to-point links with second Fresnel zones

5.1.3 Point-to-multipoint licences

Fixed point-to-multipoint licences operate on a similar basis to point-to-point licences, with the main difference being the use of a central tower communicating with a number of corresponding remote stations. Only the central tower location is registered in the ACMA database, so the signal link paths cannot be determined without consultation with the operator. However, as these licences are designed to service nearby locations, impacts are generally considered unlikely if turbines are over ~20 km from the nearest central tower.

Details of the nearest licensed tower are shown in Table 5-3. There is only one tower with multipoint licences within 20 km of the Project. The licences associated with this tower may experience interference if the associated communications link paths cross the Project.

Table 5-3 Point-to-multipoint telecommunication sites within 20 km of a turbine

Site name	Site ID	Lat/long	Licence number(s)	Frequencies (MHz)	Licensee	Distance to nearest turbine (km)
Hackling Rd MUNTAGIN	602683	-31.586989°, 118.719653°	1619939/1	452.4875, 461.9875	Water Corporation	17.7 (T37)
			10657682/1	452.2875, 461.7875		

Aurecon recommends consulting with the licence owner (Water Corporation) to understand if any impacts to their services are expected as a result of the Project.

5.1.4 Trigonometrical and GNSS stations

Aurecon has reviewed the site area for trigonometrical and global navigation satellite system (GNSS) base stations. Trigonometrical stations are used for surveying purposes, while GNSS base stations are used for precision positioning. Wind farms operating within close proximity of these facilities may have the potential to impact their operation, as specified by the Draft National Guidelines.

The following trigonometrical stations have been identified within the Project boundaries, as shown in Figure 5-4 and detailed in Table 5-4 Trigonometrical stations within the Project boundaries.

Table 5-4 Trigonometrical stations within the Project boundaries

Coordinate ID	Datum	Latitude	Longitude	Distance to nearest turbine (km)
4838	AGD66	-31.636935°	118.470838°	0.18 (T28)
4840	GDA94	-31.635709°	118.472368°	0.32 (T28)

Due to the proximity to the nearest turbine, Aurecon recommends consultation with GeoScience Australia to confirm the potential for any impacts to these stations that may be caused by the Project.

The following GNSS base stations have been identified in the vicinity of the Project, as shown in Table 5-5.

Table 5-5 GNSS base stations in the vicinity of the Project

Station name / ID	Latitude	Longitude	Distance to nearest turbine (km)
Merredin / 8MRR	-31.480023°	118.284465°	21.3 (T02)
Merredin2 / 8MR2	-31.483021°	118.299000°	20.3 (T01)

Due to the distance from these base stations to the Project, Aurecon considers impacts from the Project to be unlikely.

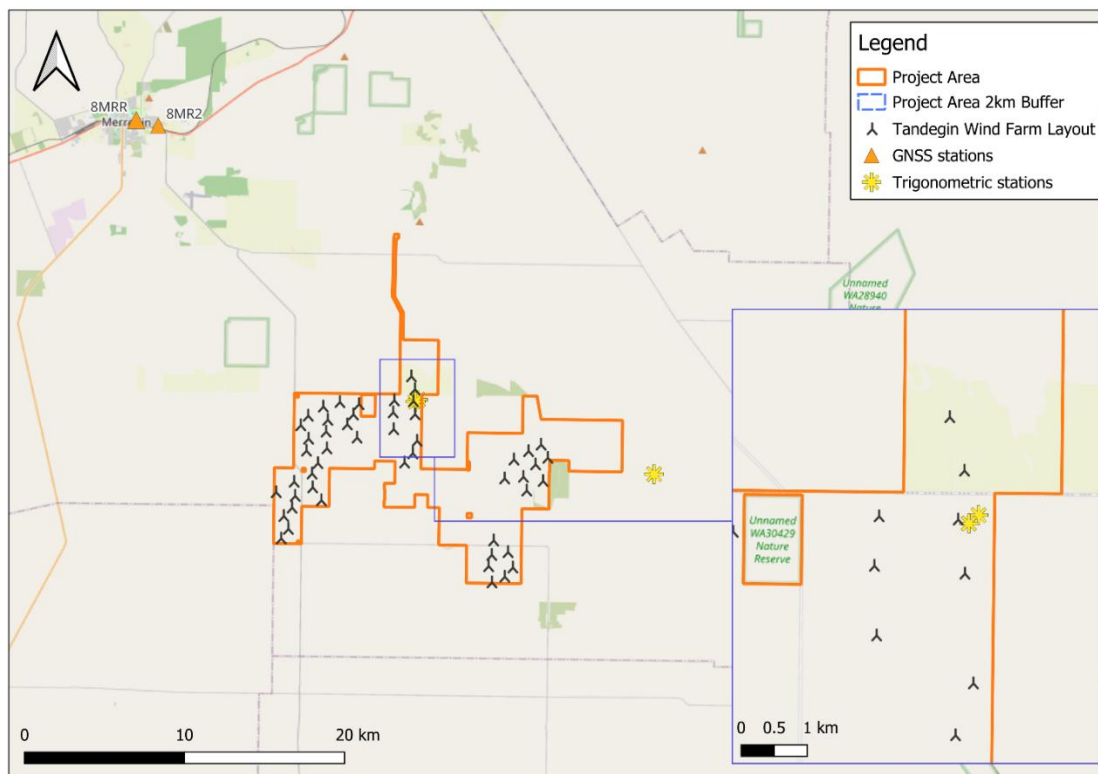


Figure 5-4 Trigonometrical and GNSS stations identified within/near the Project

5.2 Point-to-area

5.2.1 Signal coverage maps

Aurecon has reviewed publicly available mobile phone (Optus¹⁴, Telstra¹⁵, and Vodafone¹⁶), wireless internet (National Broadband Network)¹⁷ and digital television coverage¹⁸ maps with regards to identified dwellings within close vicinity of the proposed wind farm. Dwellings are categorised as “participant” (landowners hosting the wind farm) or “non-participant” and have been provided by the Client. Participant landowner dwellings are of lesser concern given the expectations of some impacts and compensation for hosting wind farm infrastructure. Locations that are in presently low or no coverage areas and in proximity to turbines may experience interference to available service due to signal scattering off the turbine.

Mobile phone

The available signal coverage maps are shown below in Figure 5-5, Figure 5-6 and Figure 5-7.

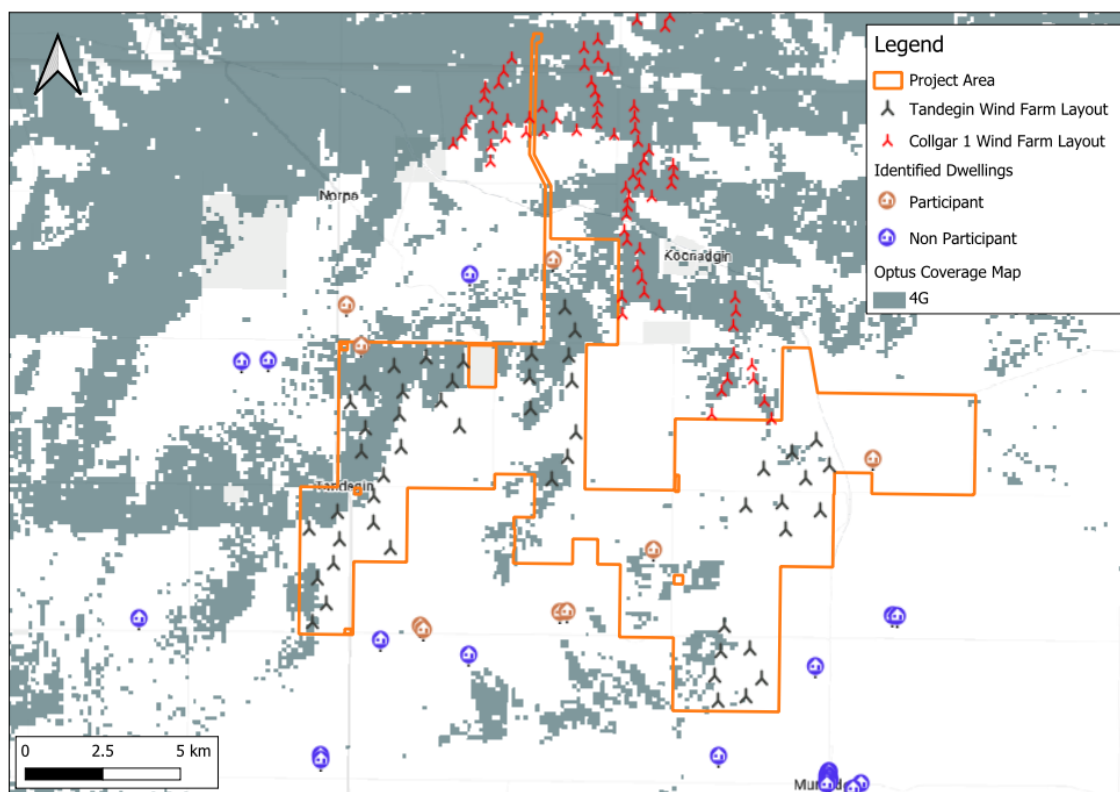


Figure 5-5 Optus mobile network coverage

¹⁴ <https://www.optus.com.au/living-network/coverage>

¹⁵ <https://www.telstra.com.au/coverage-networks/our-coverage>

¹⁶ <https://www.vodafone.com.au/network/coverage-checker>

¹⁷ <https://www.nbnco.com.au/learn/rollout-map>

¹⁸ <https://myswitch.digitalready.gov.au/>

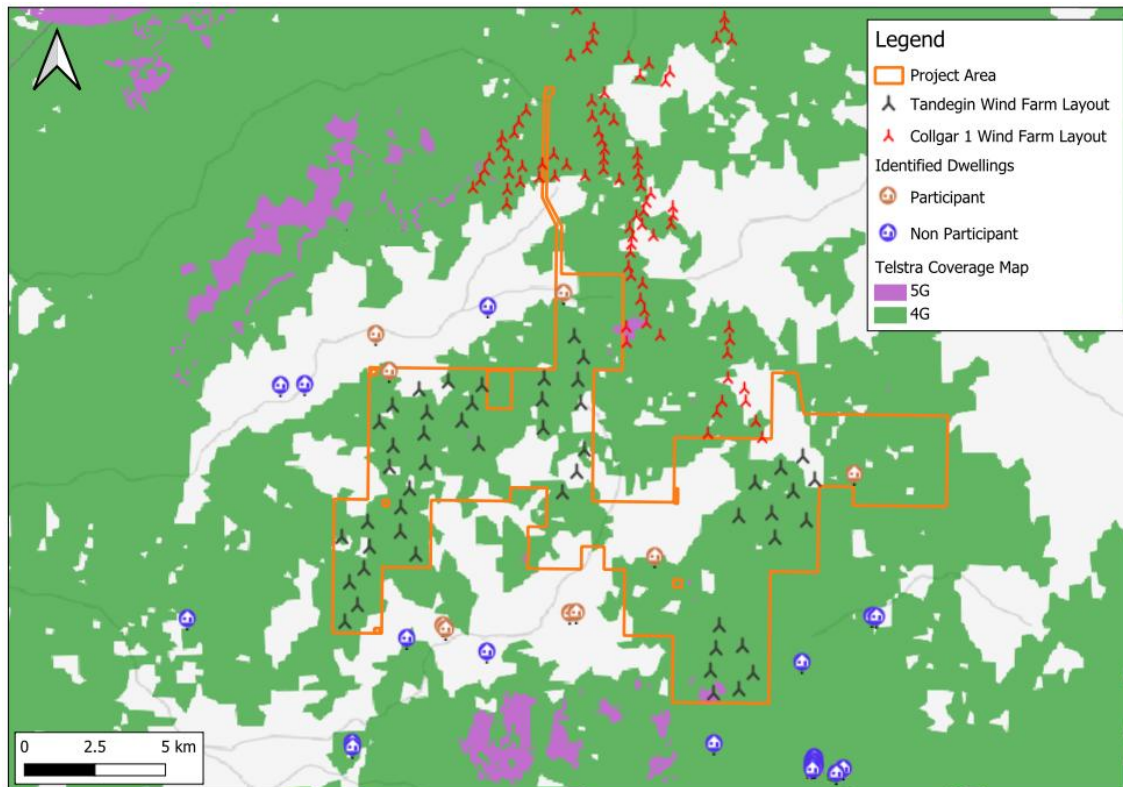


Figure 5-6 Telstra mobile network coverage

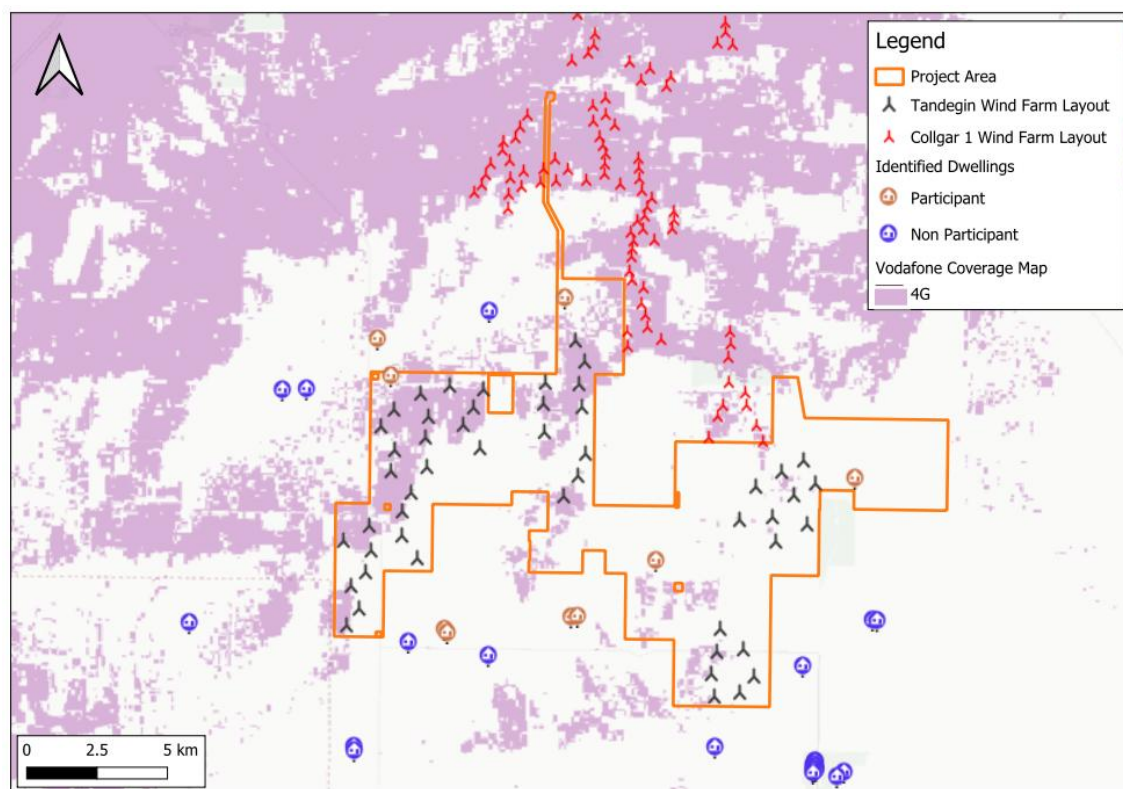


Figure 5-7 Vodafone mobile network coverage

Several dwellings are near or within no or low coverage areas for all three mobile networks that are available and may experience reduced signal as a result of the Project. In the case of interference to signals, mitigation options for users may include the use of an external antenna. Aurecon recommends consultation with Optus, Telstra, and Vodafone to confirm whether their services will be impacted.

Internet

National Broadband Network (NBN) indicates that wireless and satellite broadband is available within various parts to the northwest of the Project area. The wireless signal available at some dwelling locations and is transmitted from a station in Merredin to the northwest of the Project (refer Figure 5-8). Based on this, most dwellings behind the wind farm (in the southeast) are generally not expected to have any interference due to already not having coverage, although any existing coverage not predicted by the NBN map will likely be negatively impacted by the Project. Any dwellings with wireless signal from the northwest of the Project are not obstructed by the proposed turbines and are therefore not expected to be affected.

For any users that may experience reduced signal, mitigation options include installing a signal booster, an external antenna or switching to satellite broadband. Satellite broadband is the option available for areas without wireless coverage and is typically unaffected by wind turbines. As such, no mitigation for satellite internet service is required.

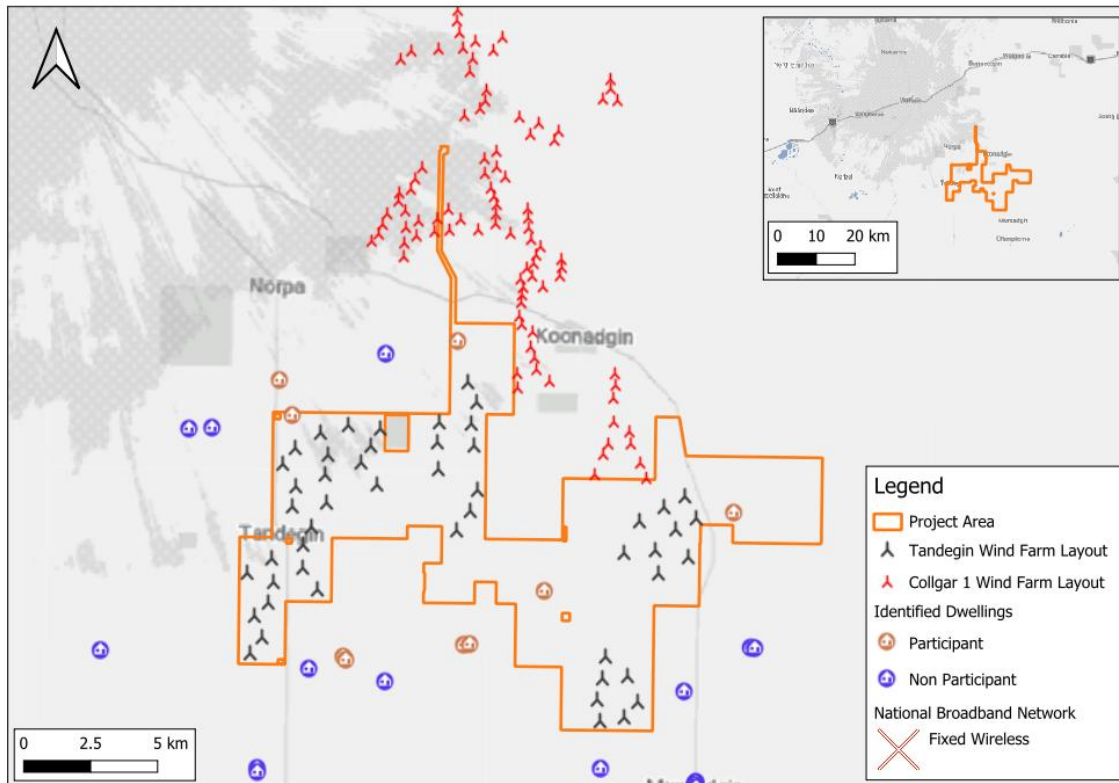


Figure 5-8 NBN Fixed Wireless Coverage



Digital television

The Australian Government 'MySwitch' map indicates that there are two television broadcast stations that have signal coverage within the Project area, and the surrounding area on the west and north sides of the Project. The closest digital television station is Merredin located ~19 km northwest of the Project, which provides no coverage to any identified dwelling. The second station is Central Agricultural located ~116 km northeast of the Project, which provides "variable" to no coverage across parts of the Project. The coverage maps are shown in Figure 5-9 and Figure 5-10 with details for each site listed in Table 5-6.

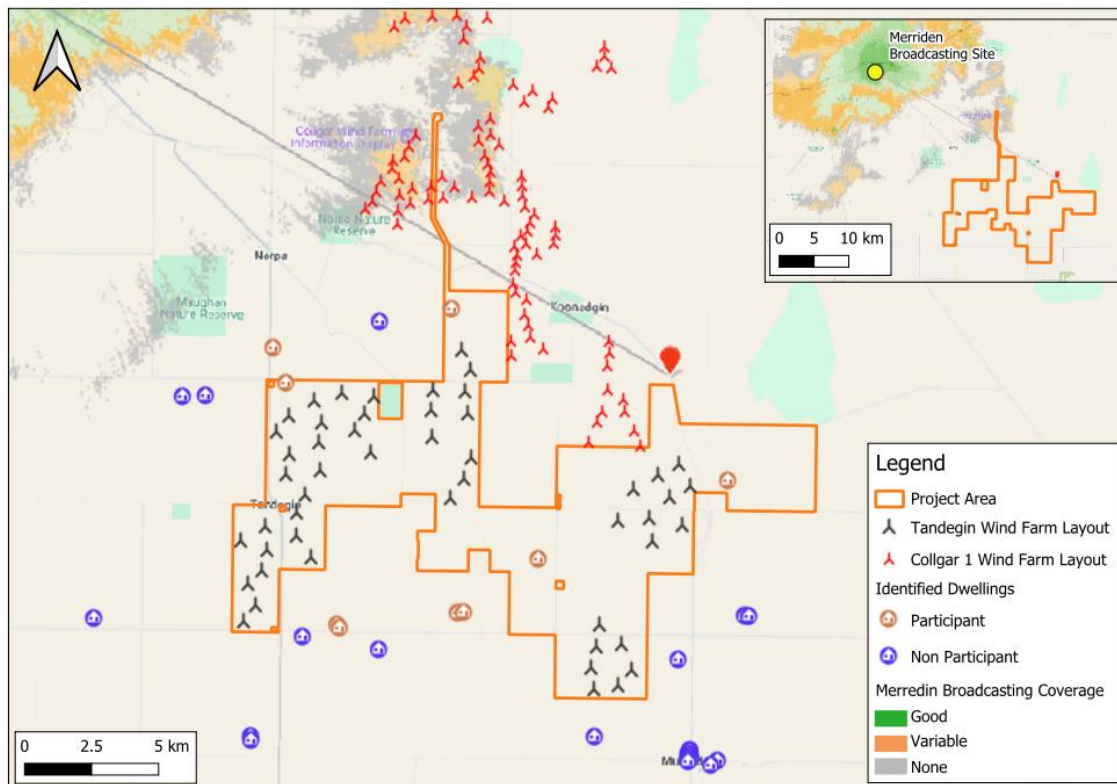


Figure 5-9 Broadcast digital TV signal for Merredin

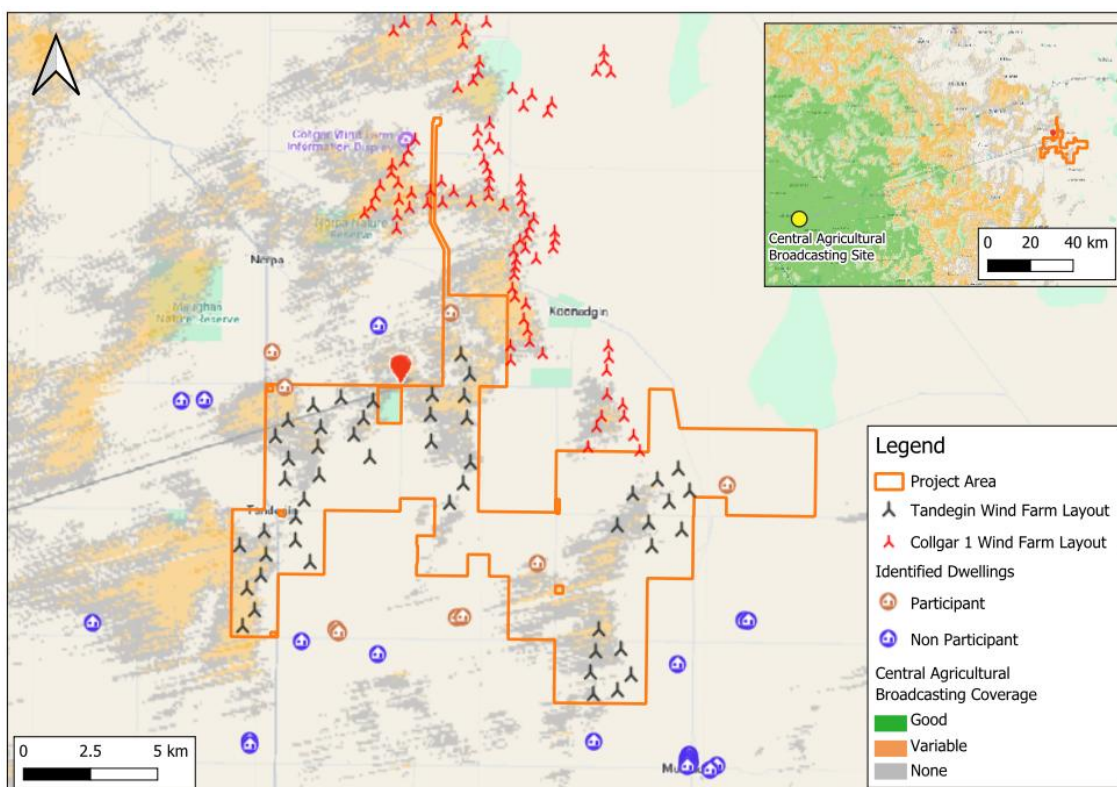


Figure 5-10 Broadcast digital TV signal for Central Agricultural

Table 5-6 Digital television sites with coverage over the Project and surrounding dwellings

Name	Lat/Long	Site ID	Site name	Licence number/s	Networks
Merredin	-31.4939984°, 118.273297°	153347	Broadcast Site SE corner of reserve 23793 MERREDIN	1962697, 1962593, 1947998, 1947987, 1948018, 1503754	ABC, SBS, GWN (WAW), West Digital Television, WIN Television, United Christian Broadcasters Australia Limited
Central Agricultural	-31.984229°, 117.190032°	28153	Broadcast Australia Site Doodenanning Road 3km NE of MAWSON WA	1158945, 1153435, 1198499, 1192580, 1159330, 1947958, 1947972, 1914477	ABC, SBS, WIN Television, GWN (WAW), West Digital Television (WDW)

There is potential for television signal interference for dwellings identified around the Project, due to all broadcasting signals already being relatively weak (“variable” to “none”). However, the impact may be reduced to the north and west of the Project due to:

- The presence of multiple broadcast stations available to provide signals, and
- The absence of turbines located between broadcast stations and dwellings in these areas.

The region affected by scattering that may receive reduced signal generally extends up to 5 km behind the turbine and 500 m in all other directions around the turbine^{19,20}. The dwellings to the east and south of the Project are likely to be the most affected. However, Aurecon notes that some of these dwellings may not currently be receiving any television signal based on a desktop analysis of the coverage maps above.

Mitigation options at impacted dwellings could include installation of an upgraded antenna, a signal booster to improve the signal, or installation of satellite television.

5.2.2 Transmission locations

Point-to-area telecommunication locations are shown in Figure 5-11 for locations that are within 50 km of the Project boundary. Aurecon notes that some sites may have more than one licence type associated with them, but only one licence type is shown in Figure 5-11.

¹⁹ S. H. Hall, “The assessment and avoidance of electromagnetic interference due to wind farms,” Wind Engineering, vol. 16, no. 6 (1992), pp. 326-338

²⁰ Ofcom, “Tall structures and their impact on broadcast and other wireless services,” dated 26 Aug 2009

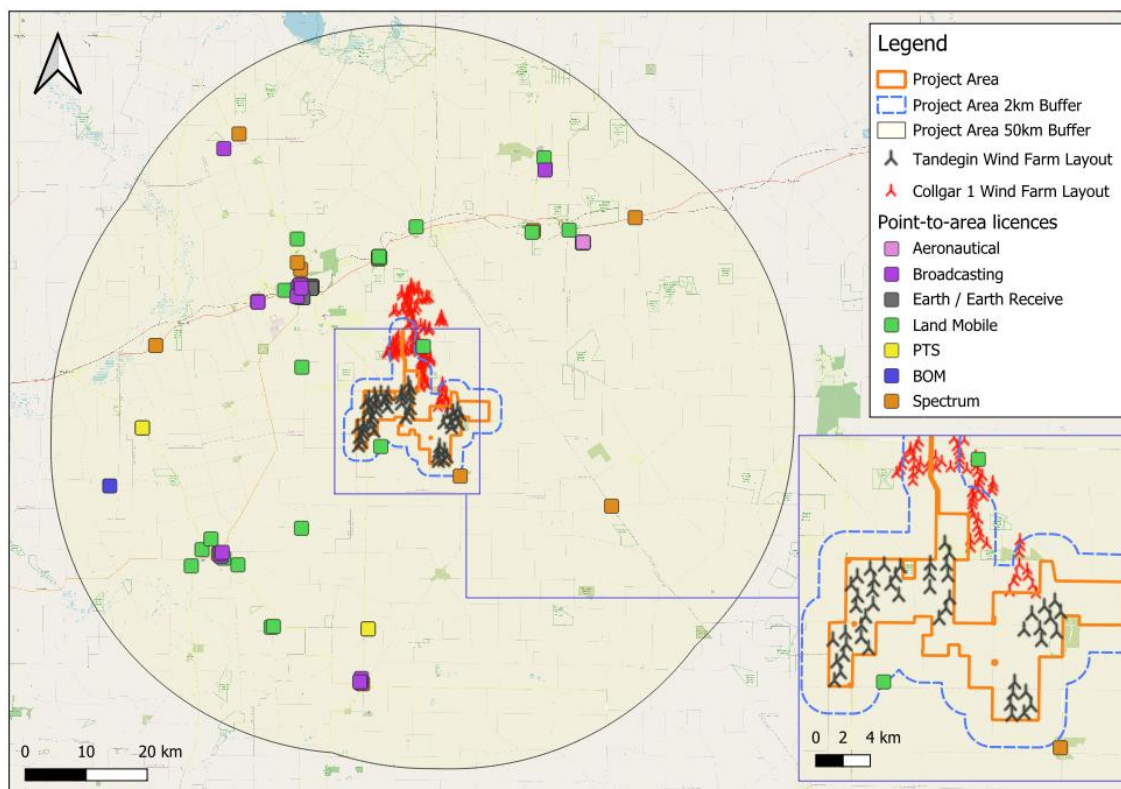


Figure 5-11 Point-to-area communication transmitters

There are three point-to-area telecommunication sites just over 2 km from the Project area boundary (two land mobile licences, one spectrum licence). The details of these point-to-area telecommunication sites are listed in Table 5-7.

Table 5-7 Closest point-to-area communication transmitter site details

Site name	Site ID	Lat/Long	Licence type	Licensee	Licence number(s)	Distance to nearest turbine (km)
Brissenden Rd MUNTADGIN	29239	-31.714352°, 118.420996°	Land Mobile	G.N Auld & M.C Auld & M.E Auld	488082/1	2.7 (T15)
Muntadgin Exchange Off Camm Street MUNTADGIN	9026340	-31.756509°, 118.559026°	Spectrum (700 MHz)	Telstra Limited	9469862, 9263433, 9263433, 9469862, 9469862	3.6 (T50)
Paddock (500m from) cnr Scott & Bulls Head Roads 22km ESE of MERREDIN	9012219	-31.565591°, 118.492226°	Land Mobile	Atkinson Group	10117147/1	6.7 (T25)

Most types of point-to-area licences are generally not expected to be impacted by the presence of turbines, and all of these sites are over 2 km from the nearest turbine so interference is considered unlikely. No consultation is required as per the Draft National Guidelines, however Aurecon recommends informing the licence owners about the proposed Project, particularly given the proximity of Collgar Wind Farm which may cause cumulative effects as presented in Section 5.4.

5.3 Radar

According to the Draft National Guidelines, radar services may be impacted by the presence of turbines hundreds of kilometres away if they are located within the radar operating range and line of sight. However, due to the curvature of the earth the interference from near-ground level objects reduces over large distances. Aurecon has assessed the location of meteorological, aeronautical and Defence radar stations in line with the Draft National Guidelines.

5.3.1 Meteorological

Meteorological radar stations licensed to the Bureau of Meteorology are shown in Figure 5-12. There were nine Bureau of Meteorology radar sites identified within 250 nautical miles (463 km) radius of the site. Details of these sites are shown in Table 5-8.

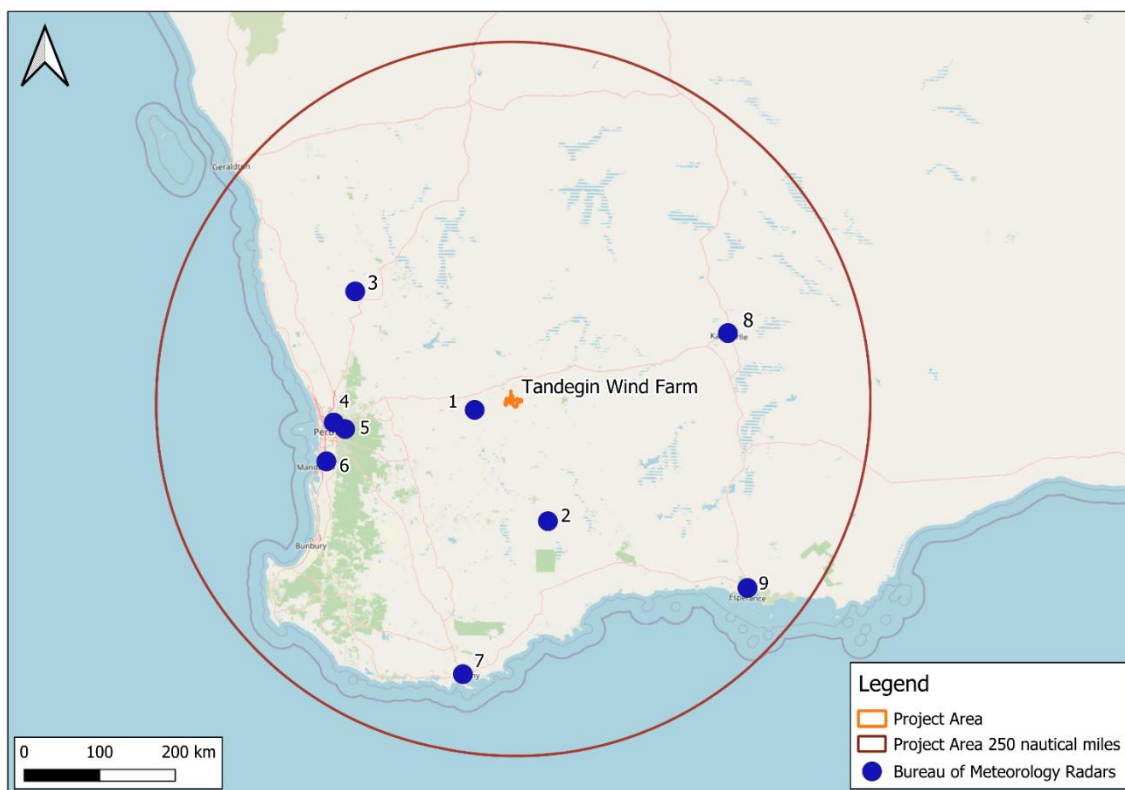


Figure 5-12 Bureau of Meteorology radar locations

Table 5-8 Bureau of Meteorology radar sites within 250 nautical miles of the Project

Label on Map	Site name	Site ID	Lat/Long	Licence number	Frequency (GHz)	Distance from Project (km)
1	Bureau of Meteorology Station Approximately 1.2km South of Fire Road, SOUTH DOODLAKINE	10000627	-31.777°, 117.9529°	10073024/1	5.625	41
2	Off Lake Grace-Newdegate Road, NEWDEGATE	10000625	-33.097°, 119.0087°	10072898/1	5.625	157
3	Off Edawa Road WATHEROO	10000636	-30.36°, 116.2896°	10073103/1	5.625	245
4	Bureau of Meteorology Office Northern Perimeter Road, PERTH AIRPORT	601351	-31.927387°, 115.976477°	1909700/1	5.625	229
5	Walnut Rd, BICKLEY	44829	-32.007684°, 116.134871°	1215014/3	11.3	215

Label on Map	Site name	Site ID	Lat/Long	Licence number	Frequency (GHz)	Distance from Project (km)
6	Bureau of Meteorology across the road from runway Lot 164 (286) Yangedi Rd, HOPELAND	138152	-32.391691°, 115.866971°	11309328/1	2.817	250
7	Bureau of Meteorology Met Office Albany Airport, ALBANY	140115	-34.941829°, 117.816357°	433542/3 10529903/1	5.625 5.625	361
8	Met Bureau Office off Hart Kerspien Drive Airport, KALGOORLIE	29482	-30.783957°, 121.453674°	433982/1	5.625	288
9	Bureau of Met Radar Fairfields Street, ESPERANCE	30184	-33.816292°, 121.884215°	10529902/1 433537/3	5.625 5.625	388

The South Doodlakine radar (#1) is closest at a distance of 41 km from the Project, and interference is considered likely. Additionally, Aurecon notes the nearest two radars listed above are both high-resolution Doppler radars²¹ which are of high importance. The Bureau of Meteorology may require an assessment of potential effects for these radars. Aurecon considers that the furthest radar sites from the Project, such as those in Albany and Esperance, are unlikely to be affected. However, Aurecon recommends that the Client consult with the Bureau of Meteorology so that any potential effects from the Project on the radars listed above can be assessed.

5.3.2 Aeronautical

Aeronautical radar stations licensed to Airservices Australia are shown in Figure 5-13. There were 44 aeronautical radar licences identified within a 463 km radius from the site. Details of these sites are shown in Table 5-9.

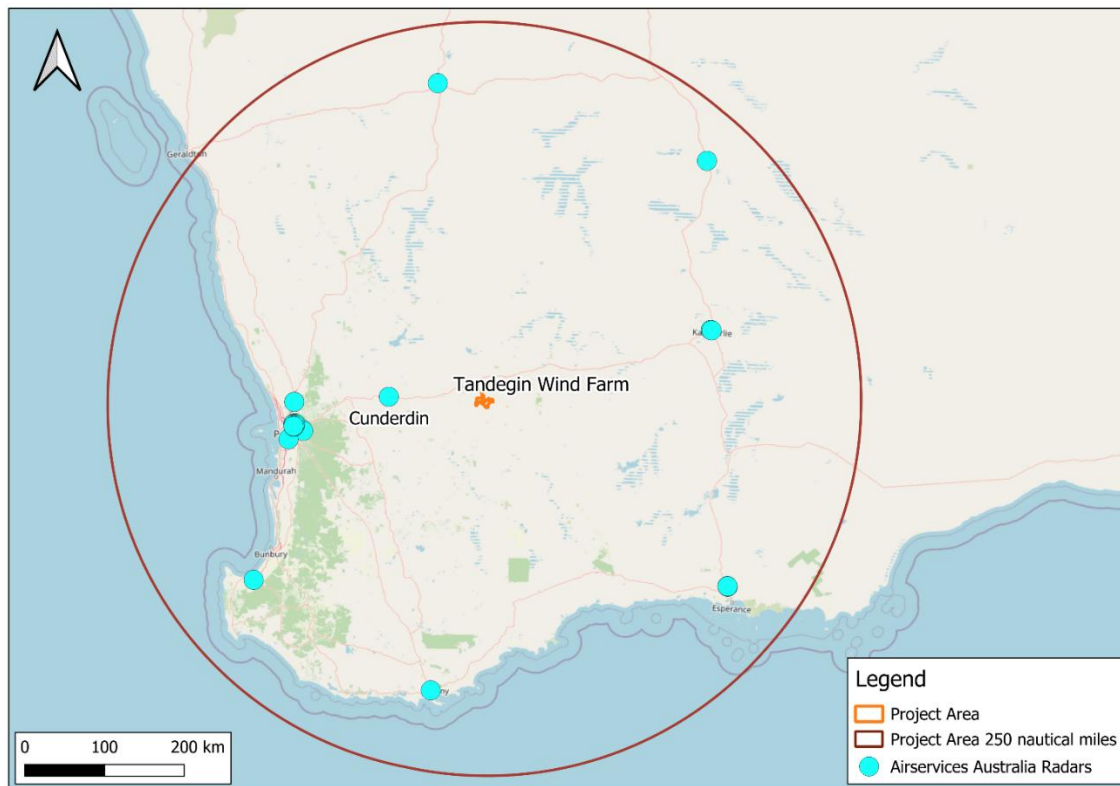


Figure 5-13 Aeronautical radar locations

²¹ https://www.bom.gov.au/australia/radar/wa_radar_sites_table.shtml

Table 5-9 Airservices Australia radar sites within 250 nautical miles of the Project

Site name	Site ID	Lat/Long	Licence number	Frequency (GHz)	Distance from Project (km)
Airservices NDB Site Aerodrome Rd CUNDERDIN AIRPORT, CUNDERDIN WA	9008587	-31.625163°, 117.223977°	422824/1	0.000293	120
Tower TXA Bickley Site Television Road, BICKLEY	26647	-32.008347°, 116.084151°	423065/3	1.03, 1.09	232
Radar Tower Airservices Site Lesmurdie Rd, East KALAMUNDA	26639	-31.99097°, 116.071494°	422928/1	1.03, 1.09	233
Airservices Radar Site Monitor Eclipse Hill, BULLSBROOK WA	9003784	-31.679815°, 115.96898°	1193370/1 1193328/1	1.03, 1.09 1.03, 1.09	239
Airservices HF Rx Site Communications Tower, BULLSBROOK	9021382	-31.680017°, 115.968965°	1978060/1	1.03, 1.09	239
Tar Instrument Building Access off Kalamunda Rd, PERTH AIRPORT	26467	-31.9227°, 115.981479°	1189114/1 423063/1 1189510/1	2.75 1.03, 1.09 2.85	240
Airservices Site North Perimeter Rd near 24 Threshold Perth, Airport PERTH	141812	-31.931779°, 115.981527°	10051847/1	1.03, 1.09	240
Runway 24 ILS DME Antenna Perth Airport, GUILDFORD 6105	10021325	-31.933637°, 115.97691°	10998900/1	1.06, 0.997	240
Area Runway 24 Glide Path Perth Airport, GUILDFORD	141715	-31.933554°, 115.976874°	10051847/1	1.03, 1.09	240
Runway 24 Glide Path Perth Airport, GUILDFORD	49443	-31.933524°, 115.976831°	10998900/1	0.3338	240
Airservices SMR Tower North Perimeter Rd, Perth Airport PERTH	141954	-31.927076°, 115.973529°	1977259/1 10051847/1	9.1 1.03, 1.09	241
International Tower International Airport, PERTH	26846	-31.943372°, 115.975061°	10051847/1	1.03, 1.09	241
Perth Airport 03 Runway Localiser, PERTH	204335	-31.92598°, 115.969228°	10998899/1	0.1101	241
Runway 21 Perth Airport, REDCLIFFE	26853	-31.93139°, 115.969313°	10998901/1 10998901/1	0.3326 1.056, 0.993	241
Lightpole Sthn International Apron Perth Airport, PERTH	9023335	-31.947217°, 115.968651°	10051847/1	1.03, 1.09	241
Lightpole Gate 14 Perth Airport, PERTH	141855	-31.933539°, 115.961704°	10051847/1	1.03, 1.09	242
Light pole 501 Perth Airport, PERTH	141850	-31.927148°, 115.957989°	10051847/1	1.03, 1.09	242
Airservices DME RWY03, PERTH AIRPORT	9013614	-31.956129°, 115.961855°	10998899/1	1.062, 0.999	242
Airservices GP Rwy 03, Perth Airport PERTH	9023331	-31.956095°, 115.961726°	10998899/1 10051847/1	0.3344 1.03, 1.09	242
Airservices DME Site Perth Airport REDCLIFFE	26778	-31.945044°, 115.959543°	422880/1	1.108, 1.171	242
Airservices VOR Site Perth Airport, REDCLIFFE 6105	10007438	-31.94504°, 115.959226°	422843/2	0.1137	242
Lightpole Domestic Apron Perth Airport, PERTH	9023332	-31.93946°, 115.95657°	10051847/1	1.03, 1.09	242
Runway 24 Localiser Perth Airport, REDCLIFFE	9002652	-31.942204°, 115.956846°	10998900/1	0.1099	242

Site name	Site ID	Lat/Long	Licence number	Frequency (GHz)	Distance from Project (km)
Runway 21 Localiser Perth Airport, REDCLIFFE	9002687	-31.961976°, 115.95875°	10998901/1	0.1095	243
Microwave Tower Airservices Perth Airport, PERTH	26803	-31.929566°, 115.953635°	1182255/1	1.03, 1.09	243
Airservices Runway 21 LLZ Building, PERTH AIRPORT	9012168	-31.961623°, 115.957857°	10051847/1	1.03, 1.09	243
Southern Substation Dunreath Drive, PERTH AIRPORT	9023386	-31.955293°, 115.95639°	10051847/1	1.03, 1.09	243
Airservices Site, JANDAKOT	27101	-32.102698°, 115.886764°	1602519/1	0.000281	252
Airservices VOR Site, KALGOORLIE	9007857	-30.789825°, 121.452789°	422849/1	0.1141	297
DME/VOR Site, KALGOORLIE	600530	-30.789828°, 121.452947°	1602310/1	1.112, 1.175	297
Airservices NDB Site Kalgoorlie Airport, KALGOORLIE	9011762	-30.795287°, 121.463382°	422848/1	0.000287	298
Airservices NDB Site, Busselton Airport, BUSSELTON	10032029	-33.692428°, 115.395163°	11843160/1	0.000386	369
Airservices NDB Site Albany Airport Albany Highway, ALBANY	28428	-34.952138°, 117.810391°	422807/1	0.000240	373
Airservices Radar Site Airport, ESPERANCE	30146	-33.67857°, 121.821707°	422942/1	1.113, 1.176	385
Airservices Site, ESPERANCE	30149	-33.680592°, 121.823786°	422831/1	0.1142	386
Airservices NDB Site Esperance Airport 20 km N of ESPERANCE	30147	-33.686972°, 121.827114°	422830/1	0.000326	386
Airservices NDB Site Cnr Richardson & Criddle Sts, MOUNT MAGNET	9013727	-28.064116°, 117.843711°	422868/1	0.000395	401
Airservices NDB Site Leonora Airport, LEONORA	9010667	-28.878832°, 121.3203°	422863/1	0.000377	410

The Project may potentially cause interference for the Cunderdin Airport radar due to its proximity to the Project. While interference to the other radar licences is expected to be unlikely due to the distances from the Project, Aurecon recommends consultation with Airservices Australia to understand any potential effects for the identified radar stations. Mitigation options may include the use of enhanced radar filters by the operator that can remove reflections caused by turbines.

Aurecon notes that Merredin Aerodrome is located approximately 15 km northwest of the Project. However no communications licences are located at this site. Aurecon notes that any potential impacts to operation of the Merredin Aerodrome are outside the scope of this assessment and are recommended to be covered by an independent aviation impact study.

5.3.3 Defence

Radar stations licensed to the Department of Defence are shown in Figure 5-14. There were 16 Department of Defence radars identified within 463 km radius of the site, all along the highway to the west coast near Perth. All 16 radar details are shown in Table 5-10.



Figure 5-14 Defence radar locations

Table 5-10 Department of Defence radar sites within 250 nautical miles of the Project

Site name	Site ID	Lat/Long	Licence number(s)	Frequencies	Distance from Project (km)
Defence Site, PEARCE	26684	-31.673944°, 116.017389°	495248/2	1.099 GHz, 1.162 GHz	224
ATC Tower RAAF Base Pearce, PEARCE	39352	-31.668723°, 116.020031°	10294402/1	1.03 GHz, 1.09 GHz	224
Runway 18 Localiser, PEARCE	39353	-31.686778°, 116.01694°	12336160/1	110.7 MHz	224
Runway 36 Glide Path, PEARCE	600781	-31.681017°, 116.017456°	11971093/1	331.1 MHz	224
			11971093/1	1.017 GHz, 1.08 GHz	
NDB Site RAAF Base Pearce, PEARCE 6084	10007015	-31.654403°, 116.018911°	495286/2	340.0 KHz	225
Runway 18 Glide Path, PEARCE	39354	-31.664957°, 116.012771°	12336160/1	330.2 MHz	226
			12336160/1	1.005 GHz, 1.068 GHz	
Runway 36 Localiser, PEARCE	600782	-31.655°, 116.012778°	11971093/1	111.9 MHz	226
Eclipse Hill SSR Site Creighton Rd, GINGIN	9021519	-31.393792°, 115.931731°	10293698/1	2.785 GHz	240
			10293698/1	2.887 GHz	
			10293698/1	2.779 GHz	
			10293698/1	2.893 GHz	
			10294402/1	1.03 GHz, 1.09 GHz	
SSR Site RAAF Base PEARCE	205162	-31.392722°, 115.933056°	1228621/1	1.03 GHz	240
Airservices NDB Site GINGIN	30501	-31.459717°, 115.865558°	495287/1	372.0 KHz	246
	600785		12213023/1	332 MHz	252

Site name	Site ID	Lat/Long	Licence number(s)	Frequencies	Distance from Project (km)
Glide Path RAAF Training Area, BEERMULLAH		-31.268161°, 115.824066°	1137360/1	332 MHz	
			12213023/1	1.054 GHz, 991 MHz	
Localiser RAAF Training Area, BEERMULLAH	600786	-31.278094°, 115.827947°	1137359/1	109.3 MHz	252
			12213023/1	109.3 MHz	
RAAF Training Area, BEERMULLAH	130776	-31.273538°, 115.829126°	10528266/1	1.042 GHz, 979 MHz	252
Middle Marker RAAF Training Area, BEERMULLAH	600787	-31.257561°, 115.821864°	1137358/1	75 MHz	253
Outer Marker RAAF Training Area, BEERMULLAH	600784	-31.189388°, 115.805129°	1137357/1	75 MHz	255
HMAS Stirling, GARDEN ISLAND	27375	-32.223816°, 115.69315°	99347/1	1.03 GHz, 1.09 GHz	260

Although interference to the radars listed above is generally considered unlikely due to the distances from the Project, Aurecon recommends consulting with the Department of Defence to confirm whether there are any potential effects on these radar stations.

5.4 Cumulative impacts

Cumulative impacts on point-to-area and radar services can occur due to neighbouring wind farms where none or minimal impacts were predicted for each individual wind farm. This can contribute to impacts such as TV and mobile service, e.g. where service may still be viable with a single wind farm, but too much interference is caused by two wind farms. Aurecon has identified one existing wind farm and one proposed wind farm in the vicinity of the Project, as summarised in Table 5-11. The existing Collgar Wind Farm can be seen to the north of the Project in Figure 5-1 above.

Table 5-11 Wind farms in the vicinity of the Project

Wind farm	Status	Number of turbines	Distance between nearest turbines
Collgar Wind Farm	Operational	111	1.3 km north
Kondinin Wind Farm	Proposed	46	~75 km south

A detailed cumulative impact analysis has not been considered as part of this assessment. Kondinin Wind Farm is at sufficient distance from the Project that no cumulative effects are expected. However, due to the size and proximity of Collgar Wind Farm, there is the potential for cumulative effects to occur, in particular to the following services:

- Point to area including mobile phone, internet and digital television
- Radar including meteorological, aeronautical and defence.

This will need to be accounted for by the communications licence owners when determining any potential effects of the Project on their services, through the stakeholder consultation process.

6 Consultation

Aurecon recommends that the following stakeholders will need to be consulted with as a result of this EMI assessment:

Table 6-1 Stakeholders to be consulted

Licensee(s)	Telecommunication type affected	Comment
Telstra	Unknown – new tower to be installed in Project site	Consultation with Telstra is required to confirm which type(s) of licences will be installed and whether any impacts are expected as a result of the Project
Crisp Wireless Pty Ltd	Fixed licence tower	Tower within 2 km of turbine(s) – may be affected, although no near-field impacts are predicted based on calculation
	Point-to-point links	No encroachment upon second Fresnel zones but communications may still be impacted by reflection/scattering effects
Water Corporation	Point-to-multipoint	Tower within 20 km of turbine(s) – may be affected
Geoscience Australia	Trigonometrical station	Stations within 1 km of turbine – may be affected
G.N Auld & M.C Auld & M.E Auld	Point-to-area	Tower over 2 km from turbine(s) so interference is unlikely, but consultation still recommended
Telstra Limited	Point-to-area	Tower over 2 km from turbine(s) so interference is unlikely, but consultation still recommended
Atkinson Group	Point-to-area	Tower over 2 km from turbine(s) so interference is unlikely, but consultation still recommended
Telstra, Optus, Vodafone	Mobile network signal	Signal in Project area is already poor
Bureau of Meteorology (BOM)	Radar	South Doodlakine radar around 40 km from turbine(s) and is likely to be affected
Airservices Australia	Radar	Potential for interference to Cunderdin airport radar 120 km from turbine(s)
Department of Defence	Radar	Interference considered unlikely but consultation still recommended to confirm

7 Conclusions and recommendations

Turbines have the potential to cause some EMI with telecommunications including point-to-point, point-to-multipoint, point-to-area, and radar services. Aurecon has obtained the licence details of all licensed telecommunication equipment in the vicinity of the Project to assess if any impact is expected. Aurecon notes that any changes to the turbine positions as the project progresses may impact the below conclusions.

7.1 Fixed licences

One fixed-licence telecommunication tower was identified within 2 km of a Project turbine. Aurecon has calculated that near field interference is not expected, but still recommends consulting with the licences' owner to confirm whether any impacts are expected. Aurecon understands that this consultation has already been initiated by the Client.

7.2 Point-to-point

There are four point-to-point links crossing the Project boundary. No Project turbines encroach upon the second Fresnel zones for these links, but interference may still occur due to reflection/scattering effects for two of the links and therefore consultation with the licences' owner is recommended.

7.3 Point-to-multipoint

One licensed tower is located within 20 km of the Project, and interference may occur if communications from the associated licences cross the Project. Aurecon recommends consultation with the licence operator to confirm whether their communications may be impacted.

7.4 Trigonometrical and GNSS stations

Two trigonometrical stations are located within the Project boundary, within 1 km of the nearest turbine. There may be potential for interference to these stations, and consultation with GeoScience Australia is recommended.

The nearest identified GNSS station is located approximately 20 km from the Project, and impacts from the Project are considered unlikely.

7.5 Point-to-area

Three point-to-area broadcasting locations were identified within 10 km of a Project turbine. All are above 2 km from the nearest turbine but interference may still occur for the point-to-area licences from these sites due to their proximity. Consultation with these licence owners is recommended.

Several dwellings are near or within no or low coverage areas for all mobile networks investigated (Optus, Telstra, and Vodafone) that are available in the area around the Project and may experience reduced signal as a result of the Project. Aurecon recommends consultation with Optus, Telstra, and Vodafone to confirm whether their services may be impacted and what effects this will have on the surrounding dwellings.

Wireless internet for several dwellings surrounding the Project may be affected, and mitigation such as switching to satellite broadband is recommended for any impacted residents.

Digital television signals are expected to be impacted by the Project, with potential for reduced and/or interrupted signal at dwellings identified in the vicinity of the Project, particularly to the east and south of the Project. However, Aurecon notes that some of these dwellings may not currently be receiving any television signal based on a desktop analysis of the signal coverage maps. Mitigation options to improve signal could include installation of an upgraded antenna, signal booster, or satellite television.

7.6 Radar

There are nine Bureau of Meteorology radar sites within 250 nautical miles of the Project. The closest two are approximately 40 km and 160 km away, and the closest one in particular is likely to experience interference. The Bureau of Meteorology should be contacted so that any potential effects of the Project on all identified weather radars can be assessed.

There are 44 aeronautical radar sites within 250 nautical miles of the Project. The nearest site is located 120 km from the Project and may potentially experience interference due to the Project. While interference to the other radars is expected to be unlikely due to the distances from the Project, Aurecon recommends that Airservices Australia should be contacted to determine whether any impact on their radars is expected.

There are 16 Department of Defence radar sites within 250 nautical miles of the Project. The nearest site is located 224 km from the Project. Although interference to the radars is considered unlikely due to the distances from the Project, Aurecon recommends consulting with the Department of Defence to confirm whether there are any potential effects caused by the Project.

7.7 Telstra new telecommunications tower

A new telecommunications tower is proposed to be installed by Telstra in the northwest corner of the site. Consultation with Telstra is recommended to confirm what kind of licence(s) will be installed and whether any impacts as a result of the Project are expected.

Appendix A

Turbine coordinates

Turbine name	UTM(South) – GDA2020		Turbine name	UTM(South) – GDA2020	
	Easting	Southing		Easting	Southing
T01	633667	6498620	T26	639499	6499759
T02	632723	6498051	T27	638103	6499007
T03	633946	6497795	T28	639298	6498957
T04	632258	6497455	T29	639400	6498140
T05	633840	6497058	T30	638032	6498259
T06	632744	6496616	T31	638066	6497258
T07	632614	6495866	T32	639528	6496483
T08	633891	6496011	T33	639258	6495699
T09	633329	6495100	T34	638750	6494974
T10	633015	6494436	T35	645580	6495312
T11	631843	6493924	T36	646495	6495840
T12	630927	6493388	T37	647276	6496244
T13	631907	6493043	T38	647698	6495422
T14	633002	6493575	T39	646932	6495009
T15	633549	6492767	T40	647403	6493971
T16	631714	6492273	T41	646171	6494231
T17	631197	6491782	T42	646288	6493361
T18	631482	6490979	T43	645002	6494131
T19	631035	6490382	T44	644312	6490258
T20	634703	6498901	T45	644197	6489441
T21	635899	6498772	T46	645135	6489529
T22	635547	6498129	T47	645514	6488567
T23	635182	6497510	T48	643999	6488652
T24	635776	6496682	T49	644107	6487849
T25	639171	6500504	T50	645008	6487991

Document prepared by

Aurecon Australasia Pty Ltd

ABN 54 005 139 873

Level 5, 863 Hay Street

Perth WA 6000

Australia

T +61 8 6145 9300

F +61 8 6145 5020

E perth@aurecongroup.com

W aurecongroup.com