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## Appendix L

# Electromagnetic Interference Assessment

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# Normanville Energy Park

## Electromagnetic Interference Assessment

WestWind Energy Pty Ltd

15 November 2024

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<b>Project name</b>		EMI Assessment - Normanville Energy Park					
<b>Document title</b>		Normanville Energy Park   Electromagnetic Interference Assessment					
<b>Project number</b>		12601992					
<b>File name</b>		12601992-RPT-NormanvilleEnergyPark-EMI_Assessment_Rev3.docx					
<b>Status Code</b>	<b>Revision</b>	<b>Author</b>	<b>Reviewer</b>		<b>Approved for issue</b>		
			<b>Name</b>	<b>Signature</b>	<b>Name</b>	<b>Signature</b>	<b>Date</b>
S4	0	B. Siebert M. Eymael	B. Leedham	<i>BL*</i>	B. Leedham	<i>BL*</i>	23/06/2023
S4	1	A. Macdonald	B. Siebert	<i>BS*</i>	B. Leedham	<i>BL*</i>	19/09/2024
S4	2	A. Macdonald	B. Siebert	<i>BS*</i>	C. Startari	<i>CS*</i>	11/11/2024
S4	3	A. Macdonald	B. Siebert	<i>BS*</i>	C. Startari	<i>CS*</i>	15/11/2024

**GHD Pty Ltd | ABN 39 008 488 373**

211 Victoria Square, Level 4

Adelaide, South Australia 5000, Australia

**T** +61 8 8111 6600 | **F** +61 8 8111 6699 | **E** [adlmail@ghd.com](mailto:adlmail@ghd.com) | **ghd.com**

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# 1. Introduction

## 1.1 Purpose of this report

The purpose of this report is to assess the potential electromagnetic interference and subsequent impacts caused by the indicative wind turbine layout for the proposed Normanville Energy Park ('the Project'). This report is intended to support the application approval process and to present mitigation measures where required.

## 1.2 Project Description

The Project involves the establishment of a wind energy facility including 17 wind turbine generators (WTGs) and associated electrical infrastructure approximately 15km Southwest of Kerang township in the North of Victoria. The site is located wholly within the Gannawarra Shire. Additionally, the Project will involve minor augmentation works at the existing Koorangie Terminal Station (installation of transformer).

The total Project Area covers approximately 1932.83 ha. The Project site is located on private land that is primarily used for cropping and livestock grazing.

## 1.3 Scope and limitations

*This report: has been prepared by GHD for WestWind Energy Pty Ltd and may only be used and relied on by WestWind Energy Pty Ltd for the purpose agreed between GHD and WestWind Energy Pty Ltd as set out in section 1.1 of this report.*

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*The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.*

*The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.*

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### **Accessibility of documents**

*If this report is required to be accessible in any other format, this can be provided by GHD upon request and at an additional cost if necessary.*

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## 1.4 Abbreviations

The following abbreviations have been used in this report:

Table 1 Definitions

Abbreviation	Definition
ABC	Australian Broadcasting Corporation
ACMA	Australian Communications and Media Authority
AM	Amplitude Modulation
AMTA	Australian Mobile Telecommunications Association
BoM	Bureau of Meteorology
FM	Frequency Modulation
GHz	Gigahertz (10 <sup>9</sup> )
GNSS	Global Navigation Satellite System
kHz	Kilohertz (10 <sup>3</sup> )
LMR	Land Mobile Radio
MHz	Megahertz (10 <sup>6</sup> )
PTMP	Point to Multi-Point
PTP	Point to Point
RFNSA	Radio Frequency National Site Archive
UHF	Ultra-High Frequency
VAST	Viewer Access Satellite Television
VHF	Very-High Frequency

## 1.5 References

Table 2 References

Ref No	Reference
1	Visiwave™, <a href="http://www.vias.org/wirelessnetw/wndw_04_08b.html">http://www.vias.org/wirelessnetw/wndw_04_08b.html</a>
2	Javad Ahmadi, The effects of Fresnel Zone in communication theory based on radio waves, Bulletin de la Société Royale des Sciences de Liège, Vol. 85, 2016, p. 729 - 734
3	D. F. Bacon, A Proposed Method for Establishing an Exclusion Zone around a Terrestrial Fixed Link outside of which a Wind Turbine will cause Negligible Degradation of the Radio Link, Radiocommunications Agency UK Report Ver 1.1, 28 Oct 2002
4	Victoria State Government Department of Environment, Land, Water and Planning: Policy and Planning Guidelines of Wind Energy Facilities in Victoria, DELWP November 2021
5	Draft National Wind Farm Development Guidelines, Environment Protection and Heritage Council of Australia and New Zealand, EPHC July 2010

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## 2. Electromagnetic Interference Theory

Electromagnetic fields are a combination of electric fields associated with a voltage source and magnetic fields associated with current flowing through a conductor. These fields increase in strength with voltage and current.

Radio system interference may occur when a wind turbine is located in such a way as to induce an unwanted disturbance to radio waves propagated between a signal source and signal receiver. The interference may occur by way of radiation of electromagnetic energy by the turbine within the operating band of the radio system, diffraction, or partial reflection of the radio system signal by the turbine tower and rotor.

The following sections briefly describe the various types of interference that may impact existing operational telecommunications services in the vicinity of the wind farm development area to provide context to the specific findings identified in Section 4 of this report.

### 2.1 Radiation of Electromagnetic Energy

Electromagnetic interference potentially occurs when the wind turbine electrical infrastructure radiates energy with a frequency within the operating frequency of a radio communications system.

Turbines supplied within Australia are required to be compliant with electromagnetic compatibility as defined in relevant Australian Standards. As a result of complying with these standards, the electromagnetic interference due to radiation is negligible.

Battery storage inverters, synchronous condensers, and transformers may cause interference to radio signals due to the emission of electromagnetic fields. These electric fields typically propagate over very short distances (tens of metres) and are limited to “near-field” effects.

### 2.2 Diffraction

Diffraction occurs when the wind turbine infrastructure is positioned such that the signal of a radio communications system is partially or temporarily blocked causing a reduction in the signal power at the radio signal receiver.

For point-to-point radio systems it is understood that the radio signal travels on a path between the signal source and signal receiver defined by an ellipsoid area known as the Fresnel zone.

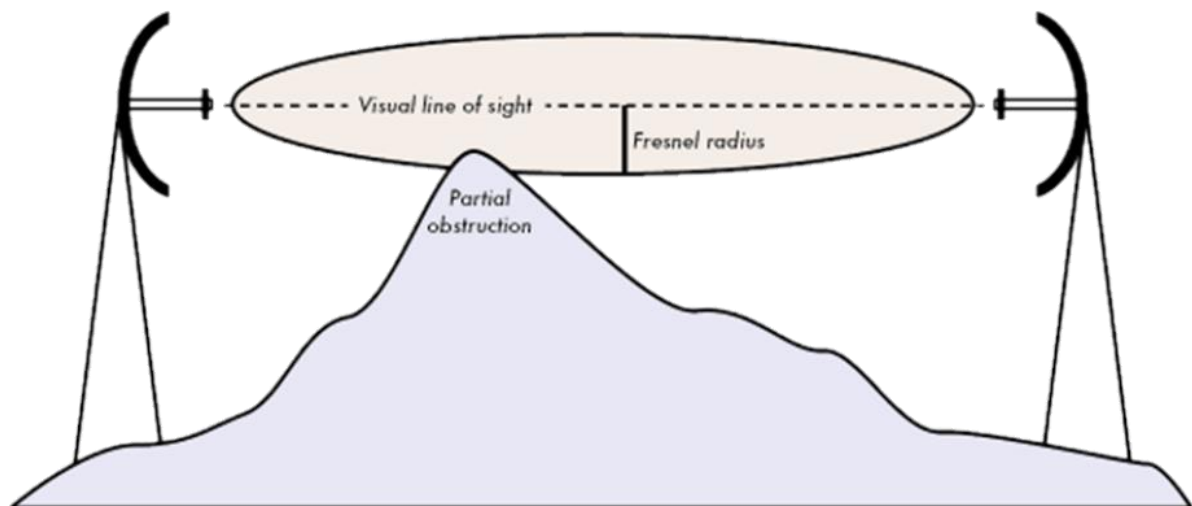


Figure 1 Fresnel Zone over the Radio Path<sup>1</sup>

The Fresnel zone is defined as the locus between two points, such as a radio transmitter and receiver, where the indirect ray path length from the point T to point R is multiple of the half-wavelength distance of the radio signal. Refer to Figure 2 and Figure 3 for further details.

<sup>1</sup> Source: Visiwave™, [http://www.vias.org/wirelessnetw/wndw\\_04\\_08b.html](http://www.vias.org/wirelessnetw/wndw_04_08b.html)

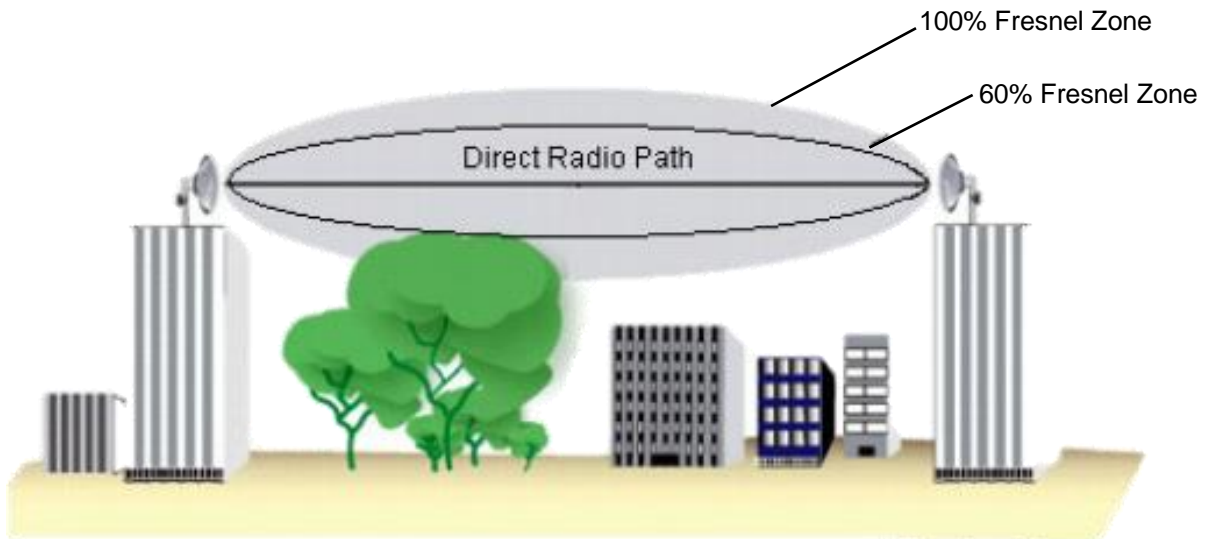


Figure 2 Fresnel Zone Clearance Criteria<sup>2</sup>

In the presence of an obstruction between the signal source and the signal receiver, it is generally accepted that an obstructed path provided with 60% clearance of the first Fresnel zone will operate without degradations to the communications system. By providing a further buffer of 100% clearance beyond the 100% Fresnel zone the risk of link degradation is negligible to nil.

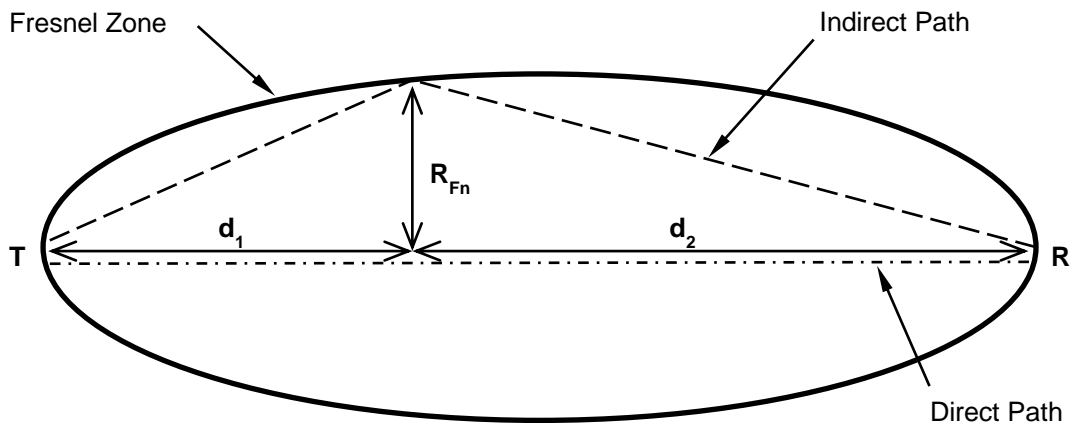


Figure 3 Fresnel Zone Calculation<sup>3</sup>

The Fresnel zone is defined by the formula:

$$R_{Fn} = \sqrt{\frac{n\lambda d_1 d_2}{d_1 + d_2}} \quad (1)$$

- RFn = the nth Fresnel Zone Radius in metres
- n = the nth Fresnel zone
- $\lambda$  = the wavelength of the transmitted signal in metres
- d1 = the distance from T in metres
- d2 = the distance from R in metres

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<sup>2</sup> Javad Ahmadi, The effects of Fresnel Zone in communication theory based on radio waves, Bulletin de la Société Royale des Sciences de Liège, Vol. 85, 2016, p. 729 - 734

<sup>3</sup> D. F. Bacon, A Proposed Method for Establishing an Exclusion Zone around a Terrestrial Fixed Link outside of which a Wind Turbine will cause Negligible Degradation of the Radio Link, Radiocommunications Agency UK Report Ver 1.1, 28 Oct 2002

F1 may be used to describe the first Fresnel zone between two points. F1 may also be described as the 100% Fresnel zone. In this case, F2 is the second Fresnel zone or the 200% Fresnel zone.

According to D F Bacon [Ref 3] it is recommended to design the geographic wind turbine layout such that all infrastructure including turbine blades are located outside the second Fresnel zone of all point-to-point radio systems.

The second Fresnel zone defines the region where an object such as a wind turbine may cause a reflected signal to be transmitted to the receiver at a half wavelength ( $180^\circ$ ) out of phase with the direct ray causing maximum interference potential.

The drawings included in Appendix B – Figure 1 shows the plot of ray-lines (direct line of sight) for point-to-point radio links and Appendix B – Figure 3 plots the second Fresnel zone (WTG exclusion zones) for point-to-point radio links.

## 2.3 Reflection

Reflection occurs when the wind turbine infrastructure is positioned such that the incident ray of a radio communication system is partially or temporarily reflected from its normal path of propagation. The complex geometrical design of the wind turbine causes the reflected signals to be dispersed or 'scattered' over a wide angle. These reflections have the potential to generate destructive interference to the radio signal resulting in signal power reduction or unwanted duplication of the radio signal as seen in Figure 4.

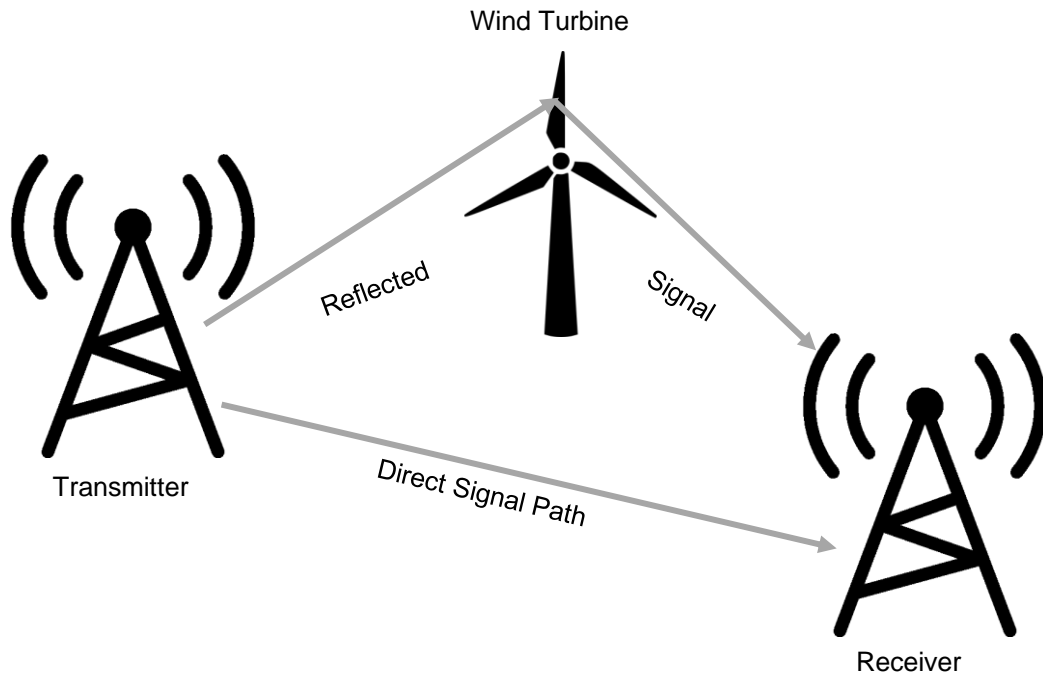


Figure 4 Reflection of Radio Signals by Wind Turbine Infrastructure

At the boundary of the second Fresnel zone, any reflected wave will be  $180^\circ$  out of phase with the direct signal, which can lead to cancellation effects at the receiver. As such, any turbine located along (and near) the F2 boundary has the potential to significantly degrade a radio link.

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## 2.4 Scattering

Wind turbines have been observed to cause interference by scattering the incident signal. Scattering is described as either 'forward' or 'back' and is depicted in Figure 5 below.

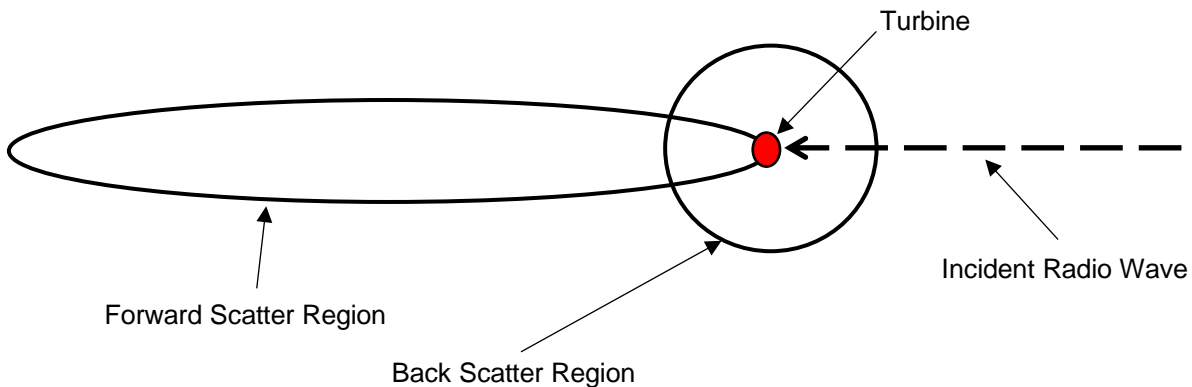


Figure 5 Scattering of Radio Signals by Wind Turbine Infrastructure

The forward scatter region is significant and can extend as far as 5 km forward of the wind turbine. Where the receiver is in direct line of sight of a turbine, but shielded from a direct signal from the transmission tower, the forward scatter region may extend beyond 5 km. The back scattering region created by the incident signal is generally less than 1 km from the turbine.

## 2.5 Near Field Effects

Wind turbine infrastructure located close to a radio communication system, such as within the near field of the radiating antenna, can detrimentally affect the normal radiation pattern of the antenna, causing unwanted signal power reductions to the radio system service area. The result is an alteration of the antenna's impedance.

Typical near-field exclusion zone radii are:

- 2 metres for low band VHF paging systems (i.e., under 50 MHz)
- 20 metres for UHF, LMR and cellular sites (i.e., up to 2.5 GHz)
- 720 metres for point-to-point microwave radio links (in the direction of the link)

Existing transmitters and microwave point to point links in the vicinity of the proposed wind farm have been analysed to aid in turbine micro-siting activities to mitigate the near field effects so that turbines should not be placed in paths of known microwave links. Future transmitter installations should be built outside the exclusion zones noted above. In the case of future PTP microwave links, antennas can be installed within 720 meters of a turbine, but the alignment of the link must be engineered to not point at a turbine.

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### 3. Guidelines and Codes

Wind farm developments in Victoria are informed by the *Policy and Planning guidelines for Development of Wind Energy Facilities in Victoria*<sup>4</sup> which aim to inform wind farm developers and local government area planners an acceptable level of documentation that wind farm developers must provide. The guidelines also suggest a higher standard of development detail that exceeds the minimum requirements and supports a best practice approach.

The Victorian Department of Environment, Land Water and Planning published guidelines state that the potential for electromagnetic interference from the generation of electricity from a wind energy facility should be minimised, if not eliminated, through appropriate turbine design and siting. The siting of wind turbines in the “line of sight” between transmitters and receivers should be avoided.

Additionally, a *Draft National Wind Farm Development Guidelines*<sup>5</sup> document was created in July 2010 by a working group coordinated by The Environment Protection and Heritage Council of Australia and New Zealand. *Section F – Electromagnetic Interference*, of this guideline details the issues addressed in this EMI assessment and references the relevant Australian Standards and publications surrounding EMI caused by wind farm developments in Australia.

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<sup>4</sup> Victoria State Government Department of Environment, Land, Water and Planning: Policy and Planning Guidelines of Wind Energy Facilities in Victoria, DELWP November 2021

<sup>5</sup> Draft National Wind Farm Development Guidelines, Environment Protection and Heritage Council of Australia and New Zealand, EPHC July 2010

## **4. Analysis of Development Impact**

### **4.1 Methodology**

GHD has undertaken this electromagnetic interference assessment to determine which areas of the Project site are unsuitable for the installation of turbines as well as to consider the impacts on wide-area services in the region. Information on radio sites and services in the proximity of the proposed Normanville Energy Park have been obtained from the ACMA Radio Communications Licence Database, covering an area of approximately 50 km radius from the centre of the provided Project boundary. This distance is sufficient to capture any potential point-to-point links traversing the development area.

Where point-to-point links have been identified, the Second (200%) Fresnel Zones have been modelled in purple in Appendix B - Figure 3 which denotes an area in which no part of the wind turbine should enter (including the blade extents).

Near-field exclusion zones, (areas in proximity to a radio transmitter which would cause excessive reflections back to the transmitter) have been calculated for radio sites that sit within 3 km of the current site. The current layout shows no wind turbines enter these exclusion zones.

This assessment also includes the impact of 50 Hz electromagnetic radiation which can be caused by high-voltage transmission lines.

### **4.2 Radio System Search**

In September 2024, a search was conducted on the Australian Communications and Media Authority (ACMA) radio communications database to identify all licensed radio systems, operating on the frequency above 30 MHz, within 50 km radius from the centre of the proposed wind farm development. Additional radio frequency information was accessed from The Australian Mobile Telecommunications Association's (AMTA) and the Radio Frequency National Site Archive (RFNSA). This search was conducted in accordance with the methodology stated in Section F of the Draft National Wind Farm Development Guidelines.

The results of the ACMA radio communications data extraction were reviewed and presented in graphical format depicting the radio site locations and ray-lines of the radio systems within the vicinity of the wind farm. The map was refined to only show those radio sites and services with the potential impact for radio-interference caused by the proposed wind farm development.

This method does not determine the impact on users of class licence services, as these services are operated on shared frequencies, can be used by member of public, and are not listed within the ACMA database.

The resulting maps for radio transmitters are presented in Appendix B.

### **4.3 Assumptions**

On 12<sup>th</sup> of September 2024, WestWind Energy Pty Ltd provided GHD the indicative location of 17 wind turbine generators, including the following turbine dimensions:

Maximum tip height: 280 m

Maximum hub height: 180 m

Maximum rotor diameter: 200 m

Minimum lower rotor sweep: 50 m

GHD has notified consulted organisations, and their individual feedback responses are shown in Appendix C.

### **4.4 Radio Technology Review**

The following radio systems are considered in this assessment:

- Fixed point-to-point radio systems (Appendix B - Figure 1),
- Fixed point-to-multipoint radio systems (Appendix B - Figure 2),
- Land Mobile Radio Systems (Appendix B - Figure 4),
- Digital Television Broadcast (Appendix B - Figure 5,6,7),
- AM/FM Radio Narrowcast and Broadcast (Appendix B - Figure 5),
- Mobile Telephone and Broadband Internet Broadcast (Appendix B - Figure 13,14,15,16,17,18)
- Aircraft Communications Systems (Appendix B - Figure 10),
- Meteorological Radar (Appendix B - Figure 11),
- Defence Radio Systems (Appendix B - Figure 9),
- Trigonometrical Systems (Appendix B - Figure 9), and
- Maritime Radio Systems (Appendix B - Figure 9).

Radio services below 30 MHz, including AM Radio Broadcast services, were excluded from this assessment as the propagation characteristics of the radio wave does not rely on direct-ray transmission characteristic between the transmitting and receiving antennas. e.g. AM radio broadcast services, operating within the Medium Frequency band of 300 kHz – 3 MHz, relies on ground wave (surface wave) propagation.

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# 5. Fixed Radio Systems

Wind turbines can heavily impact point-to-point radio systems, but the mitigation method is uncomplicated. To avoid the wind turbines downgrading or impacting the service, when determining final wind turbine locations, the turbines should not block the 200% Fresnel zone (second Fresnel Zone) exclusion zones of the radio links.

## 5.1 Fixed Point-to-Point Radio Links

The point-to-point radio systems within a 50 km radius of the centre of the proposed wind farm are shown in Figure 6 and are listed at Appendix D – Table 1. The exclusion zones of each point-to-point links are shown on Appendix B - Figure 2.

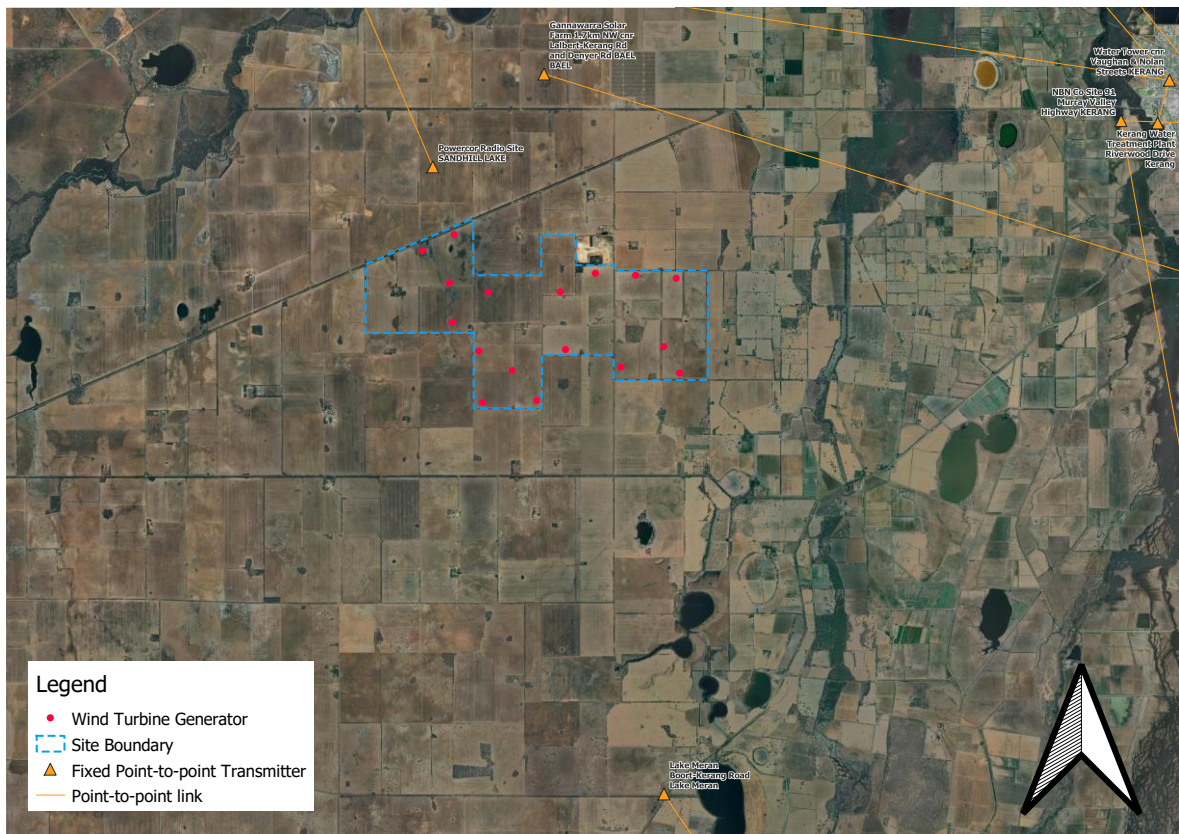


Figure 6 Fixed Point-to-Point Radio Links in Wind Farm Vicinity

The wind turbine generator layout shows that no turbines sit inside the exclusion zones of the fixed point-to-point radio links as shown in Figure 7. The closest distance between a turbine’s blade tip to the second Fresnel zone of a point-to-point link is approximately 1.5km.

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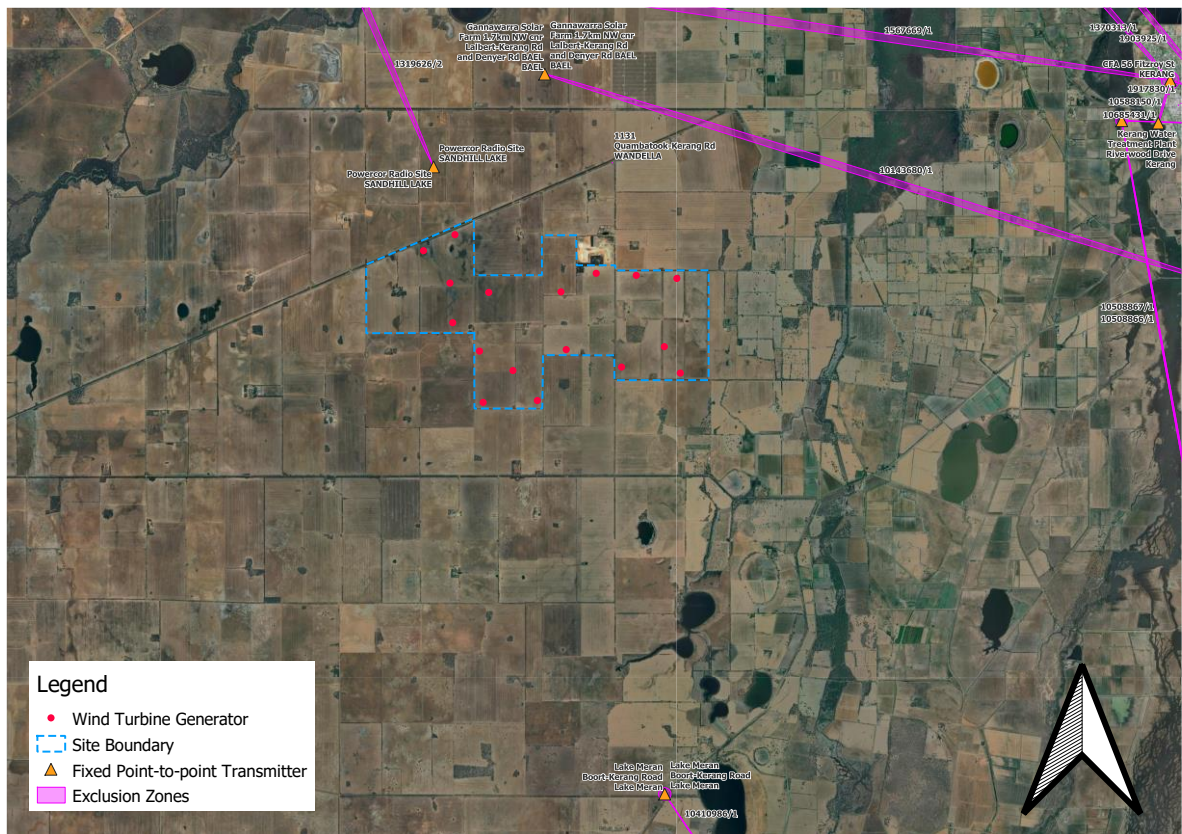


Figure 7 Fresnel Exclusion Zones of Fixed Point-to-Point Radio Links in Wind Farm Vicinity

GHD does not foresee any electromagnetic interference impact that would degrade known fixed point-to-point radio signals as a result of the proposed wind farm development.

## 5.2 Fixed Point-to-Multipoint Radio Links

The point-to-multipoint radio systems within a 50 km radius of the centre of the proposed wind farm are shown in Appendix B - Figure 2 and are listed at Appendix D – Table 2. The closest point-to-multipoint transmitter is located approximately 20km from the closest proposed turbine locations.

GHD does not foresee any electromagnetic interference impact that would degrade known point-to-multipoint radio systems as a result of the proposed wind farm development.

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## 6. Land Mobile Radio Systems

A land mobile radio system (LMRS) is a person-to-person voice communication system with the transmitter and receiver in one unit. It can be stationary (base station units), mobile (installed in vehicles), or portable (handheld two-way radios). In Australia, most land mobile radio systems operate in the VHF Mid Band (70-87.5 MHz), VHF High Band (148-174 MHz), and the UHF 400 MHz band<sup>6</sup>. As the wavelengths at these frequencies are large, the radio signals are generally unaffected by wind turbines.

Most land mobile radio systems are used exclusively for public safety organisations such as police, firefighters, and other emergency response organisations. The systems are quite resilient as they usually operate on specific reserved frequencies.

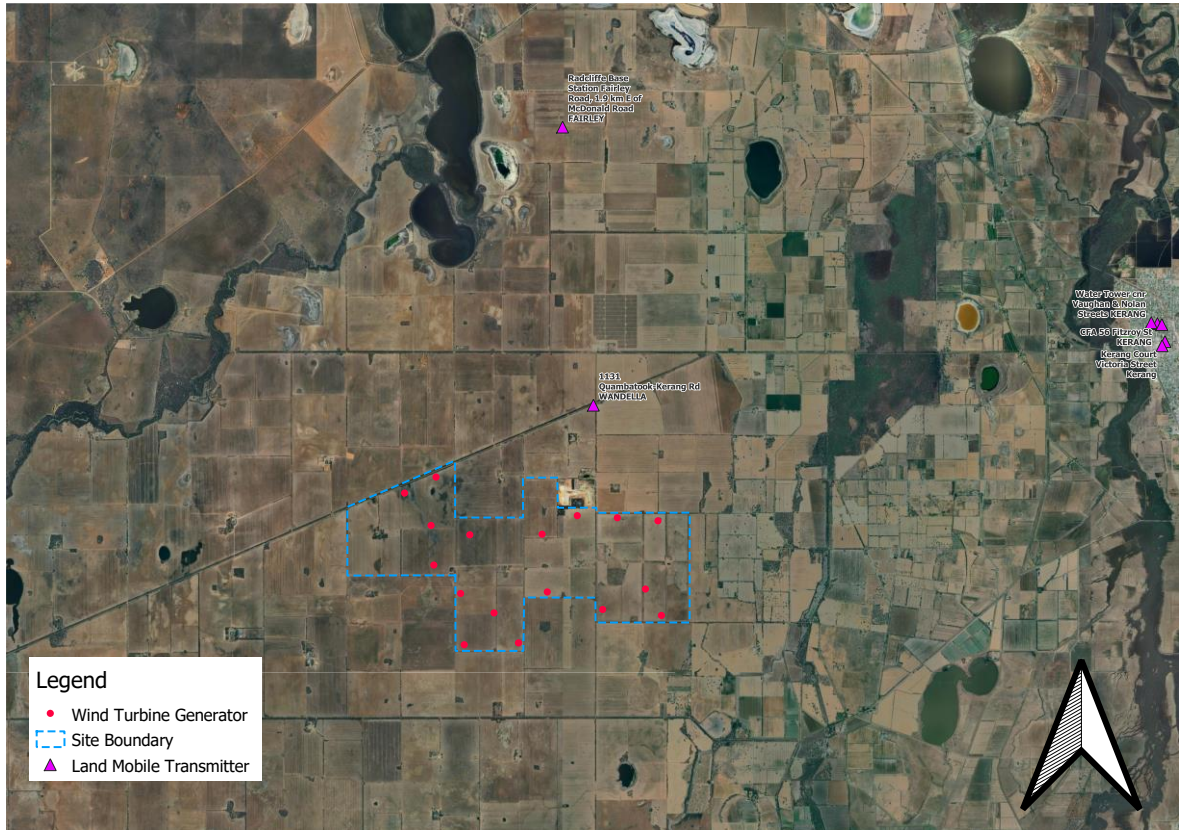


Figure 8 Land Mobile Radio Transmitters in Wind Farm Vicinity

The land mobile radio systems within a 50 km radius of the proposed wind farm are shown on Figure 8 and are listed on Appendix D – Table 3. There are no LMR transmitters located within 20 m of the current turbine layout.

GHD does not foresee any electromagnetic interference impact that would degrade LMRS signals as a result of the proposed wind farm development.

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<sup>6</sup> <https://www.acma.gov.au/technical-details-land-mobile-licences> Technical details for land mobile licences | Accredited persons | ACMA

## 7. Digital Television Broadcast

Wind farms have the potential to cause signal degradation to TV reception due to signal scattering, diffraction and near-field effects. In Australia, analogue television broadcasting ceased on 10 December 2013<sup>7</sup>, thus only digital television broadcasting systems are assessed in this report.

Digital television is not susceptible to visible “ghosting” degradation as was experienced from analogue broadcasts; any impact of reflections from the turbines would be a minor reduction of coverage at the limit of the service area. However, the signal can be degraded when the receivers are already at the border of the television reception zone or when the receiver is located within approximately 2 km of the wind farm, in the range affected by scattering of signals off the turbines. The most significant effect occurs when the receivers are near the wind farm and in the line of sight of the turbines but not in the line of sight of the television transmitter.

The zone of potential interference for a wind farm on digital television broadcast is the resultant total of the individual turbines’ effects. The International Telecommunications Union Recommendation ITU-R BT.1893<sup>8</sup> states that impacts beyond 10 km from a wind farm are unlikely.

There are no local digital television broadcast sites within 50 km radius of the proposed wind farm development, however television signal coverage is provided by transmitters at Murray Valley (Goshen) and Bendigo.

The signal scattering effect from the wind turbines to radio signals from the Murray Valley digital television transmitter is shown on Figure 9 and the scattering effect from the wind turbines to radio signals from the Bendigo digital television transmitter is shown on Figure 10.

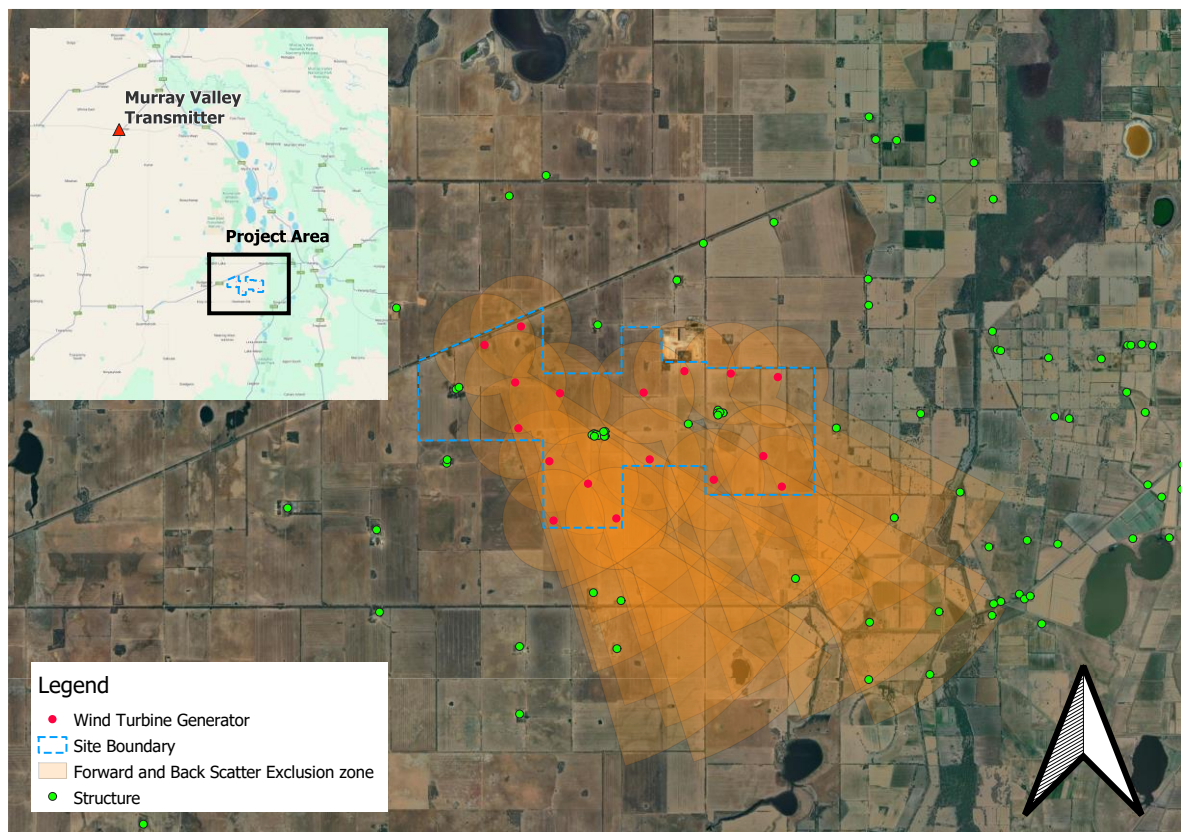


Figure 9 Murray Valley Television Transmitter Signal Scatter Zones

7 <https://www.acma.gov.au/sites/default/files/2019-08/Chapter-4.docx>

8 International Telecommunications Union Recommendation ITU-R BT.1893, Assessment of impairment caused to digital television reception by a wind turbine

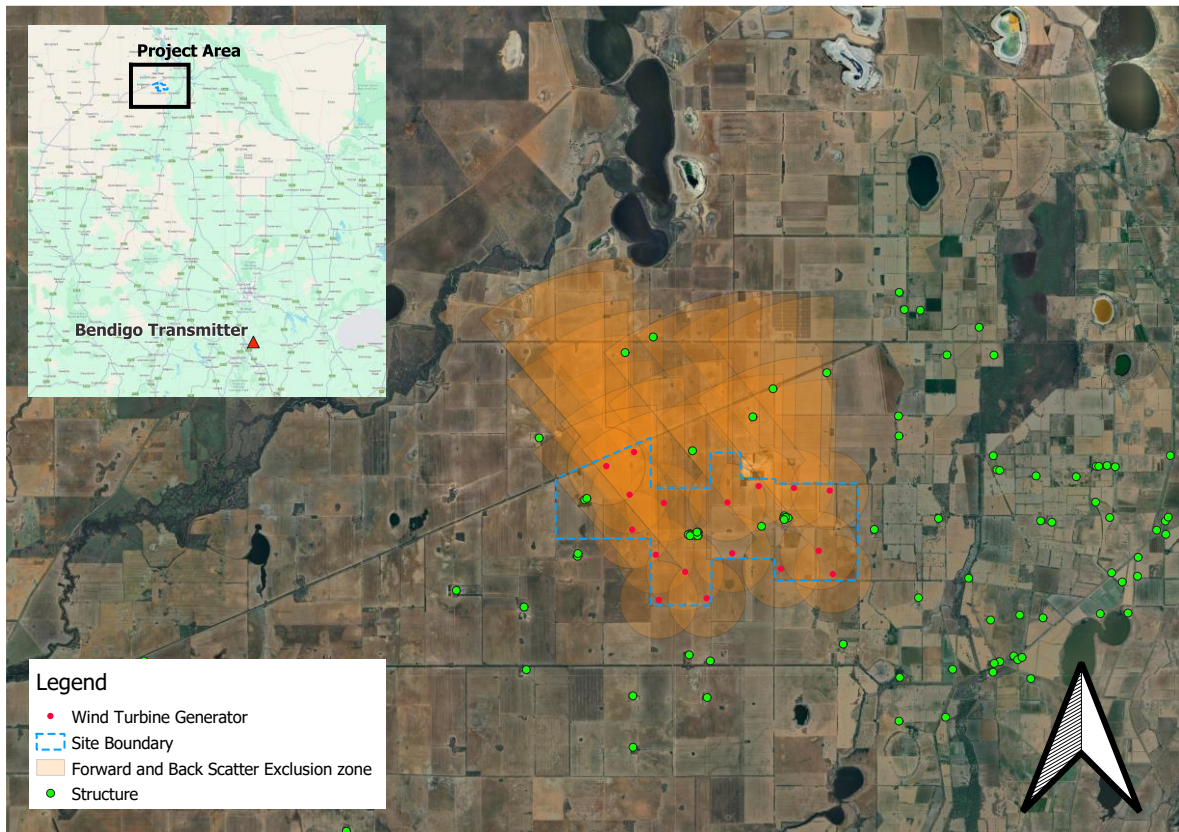


Figure 10 Bendigo Television Transmitter Signal Scatter Zones

Television reception at dwellings located in the scattering zones may be adversely affected by the proposed wind farm development. Figure 9 and Figure 10 give some indication on the possibility of the degraded signal to the dwellings either directly in the wind farm turbine area, or directly southeast and directly northwest of the wind farm.

The identified dwellings in the impact area will need service investigation to determine whether they are receiving digital television signal from the Terrestrial Digital Television System or Viewer Access Satellite Television System (VAST). If the dwellings are using VAST, there should be no impact to these dwellings.

For dwellings utilising terrestrial digital TV transmitters, the wind farm's impact on services can be quantified by recording and comparing pre-construction baseline signal measurements and post-construction signal level measurements at existing or approved dwellings in and within 5km of the wind farm areas as at the date of development by an independent radio monitoring specialist; however, the mitigation measures remain the same.

Mitigation strategies, should any signal degradation be observed, are to realign or reposition the receptor antenna more directly towards the existing transmitter, or replacing existing receptor antennas to higher gain alternatives. This will remediate most cases of forward scatter signal degradation effects. Alternatively, dwellings can change from terrestrial reception to satellite reception through VAST.

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## 8. AM / FM Narrowcast and Broadcast

Overseas and local experience indicates that radio reception is unlikely to be affected by operating wind farms. AM signals are not affected due to their low frequency resulting in a wavelength large enough relative to the turbine to not be affected by it. The majority of FM services transmitting in the vicinity of the wind farm are narrowcast services not focussed on servicing the wind turbine area.

Broadcast FM services are in a low frequency range and hence they are more resilient to disturbances. There is a minor chance of signal degradation for services broadcast for receivers in the immediate vicinity of the wind farm.

AM / FM narrowcast and broadcast sites within a 50 km radius of the proposed wind farm are shown on Figure 11 and are listed on Appendix D – Table 4.

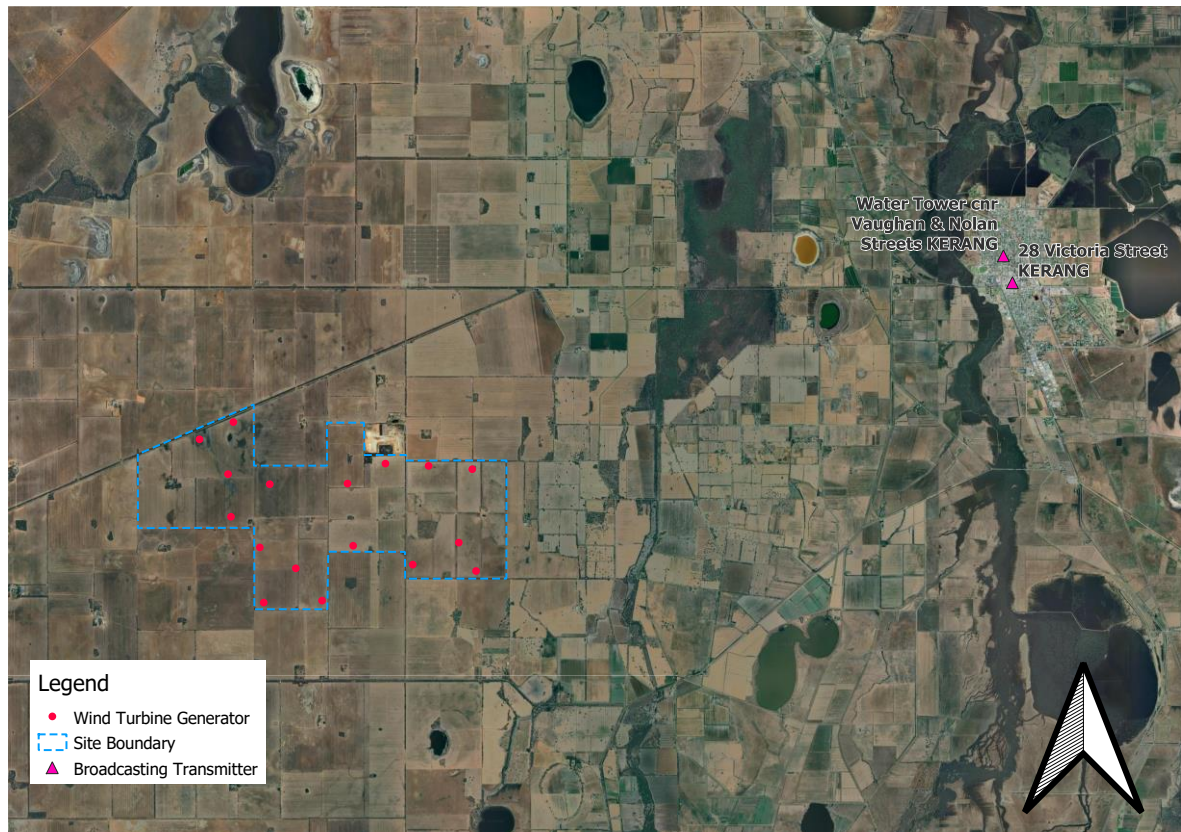


Figure 11 AM/FM Narrowcast and Broadcast Transmitters in Wind Farm Vicinity

GHD does not foresee any electromagnetic interference impact that would degrade AM/FM narrowcast or broadcast signals as a result of the proposed wind farm development.

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# 9. Mobile Telephone and Broadband Internet Broadcast

Cellular mobile phone technologies provide robust communications in areas of significant obstruction via multipath communications between customer equipment and the network base station sites. The four carrier networks (Telstra, Optus, Vodafone and NBN fixed wireless) have transmitter sites covering the main population areas around the greater wind farm area.

Interference to cellular phone coverage and NBN fixed wireless coverage is anticipated to be minimal except for those operating close to the proposed wind farm infrastructure (such as maintenance staff), or where existing coverage is already inadequate according to the carrier's publicly available coverage maps.

Mobile telephone and fixed wireless broadband sites within 50 km radius of the proposed wind farm are shown on Appendix B – Figure 8 and are listed on Appendix D – Table 5.

Telstra, Optus, Vodafone, and NBN Fixed Wireless mobile coverage is shown in the following figures:

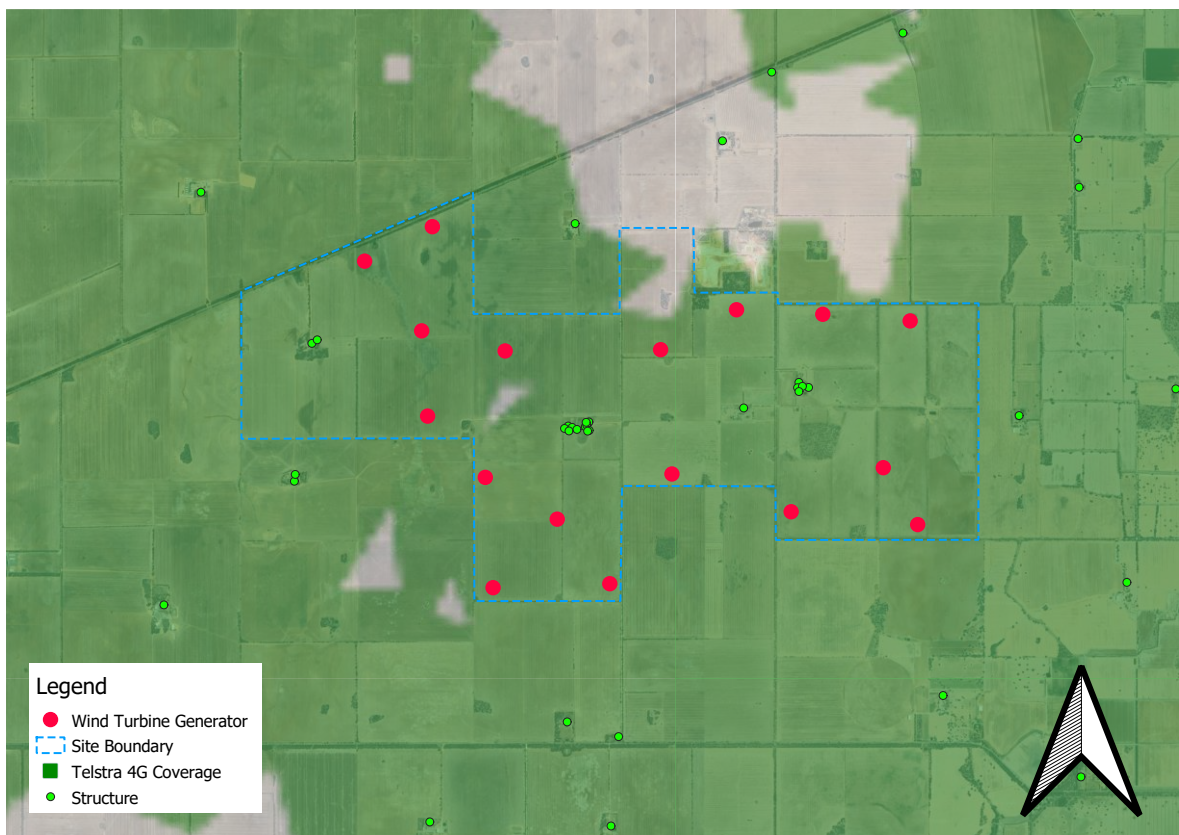
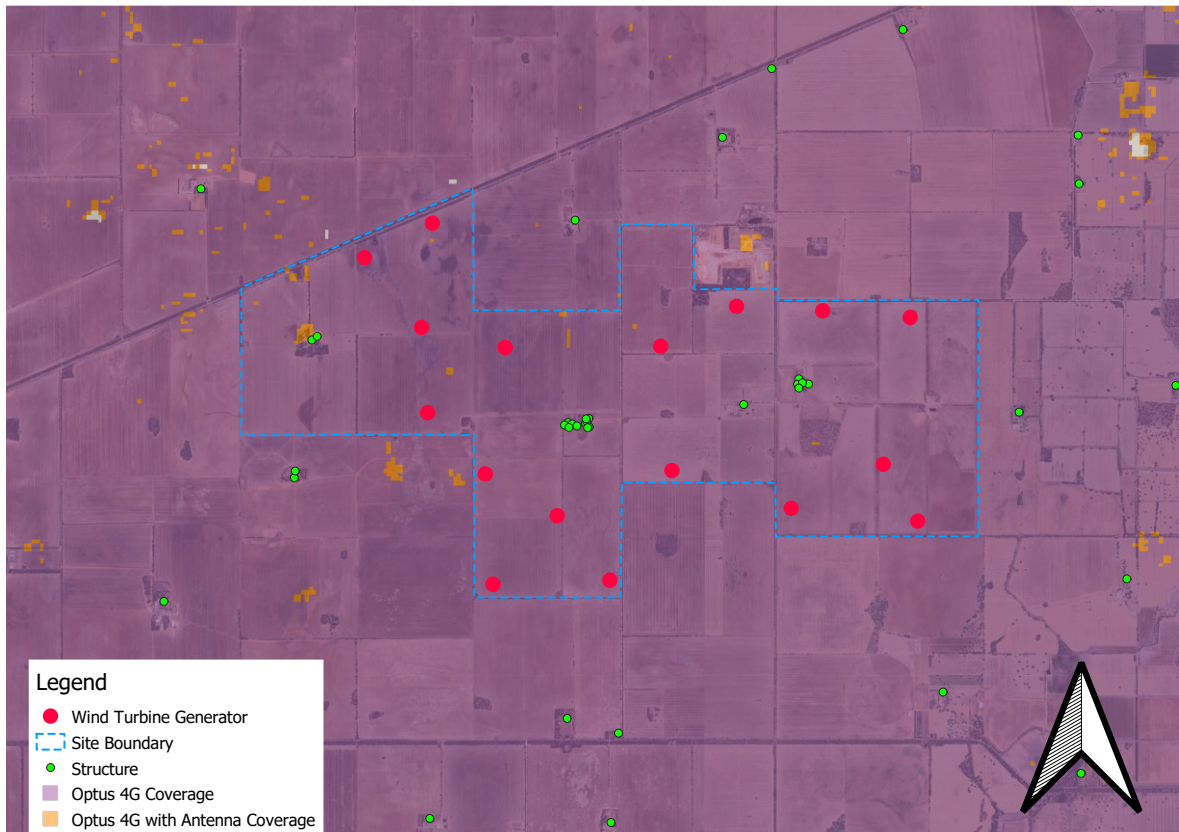


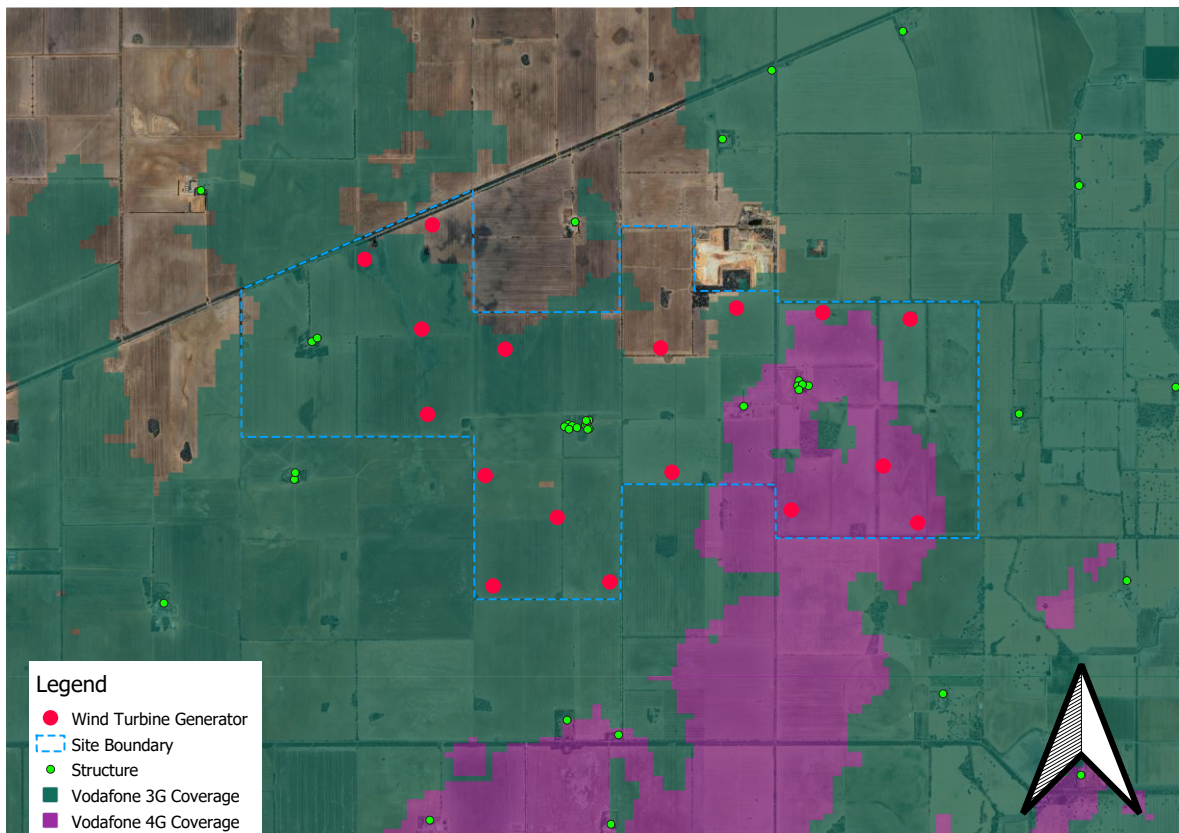
Figure 12 Telstra 4G Mobile Coverage in Wind Farm Vicinity

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**Figure 13** Optus Mobile Coverage in Wind Farm Vicinity



**Figure 14** Vodafone Mobile Coverage (3G Green, 4G Purple) in Wind Farm Vicinity

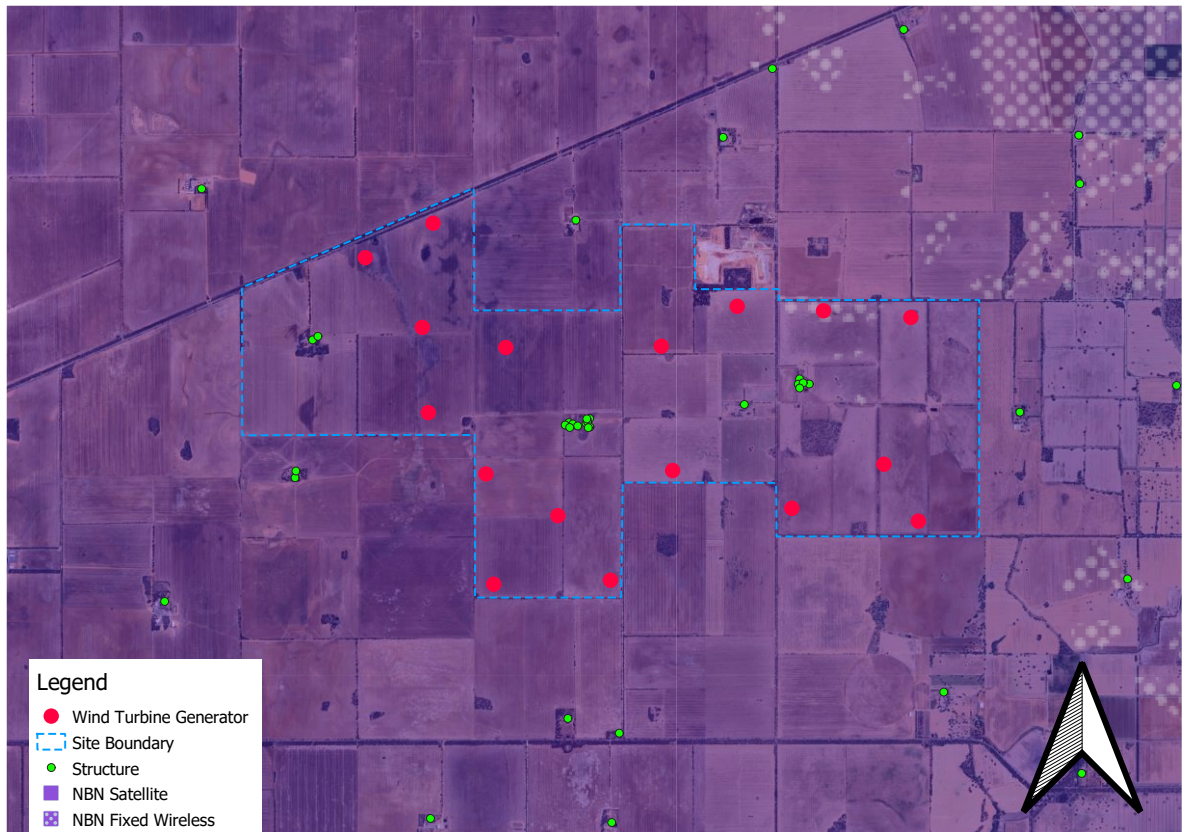


Figure 15 NBN Fixed Wireless and Satellite Coverage in Wind Farm Vicinity

GHD foresees nil to negligible electromagnetic interference impact on public telecommunications system signals as a result of the proposed wind farm development.

## 10. Aircraft Communications Systems

Wind farms have the potential to disturb navigational signals, which can distort the accuracy of the aircraft positioning systems and introduce 'false targets'.

The aircraft communications systems within 50 km radius of the proposed wind farm are shown in on Appendix B – Figure 8 and are listed on Appendix D – Table 6.

The nearest aircraft communication system to the proposed site is located at the Swan Hill Airport, which is approximately 45 kms from the closest wind turbine generator.

GHD foresees that the proposed wind farm development's effect on navigation signals will be nil to negligible.

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# 11. Meteorological Radar

The meteorological radar is a critical radio infrastructure operated by the Bureau of Meteorology (The Bureau). It provides data to be computationally analysed and give a precise prediction on the wind speeds and weather conditions in sight of the radar. The radar typically has capability to indicate the weather at 250 km or more. The meteorological radar is also called the weather watch radar.

There are no meteorological radars within 50 km radius of the proposed wind farm, however, the two closest radars, Rainbow (160km away) and Mildura (~255km away) are shown on Figure 16.



Figure 16 Bureau of Meteorology Weather Watch Radar Cross Sections (Rainbow and Mildura)

Due to the large distance between the transmitting radar and the proposed windfarm development the radar cross-sectional impact is very small and impact to the radar system will be minimal.

Consultations with the Bureau have confirmed minor impact to the weather radar will be manageable.

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## **12. Defence Radio Systems**

Defence radio systems are not required to be recorded in the ACMA radio communications database and therefore direct consultation with the Department of Defence is required to determine the impact of the wind farm on the Defence's operations around the wind farm area.

Typically, the Defence Spectrum Office (DSO), raises the following concerns to Defence HF transmissions and wind farm development projects:

Defence use HF in both a fixed and itinerant nature on their ranges and bases. They can use this equipment anywhere in country, but typical high tempo use of the itinerant variation could be at Defence range boundaries.

As the wind farm conforms to AS/NZS 61000.6.4:2012<sup>9</sup>, the wind farm will reduce, as much as is practicable, the emission of HF noise from the turbines, substation(s) and electronic control equipment.

Consultations with the Defence Security and Estate Group has not identified any impact to Defence by the proposed wind farm development.

## **13. Trigonometric Systems**

Trigonometrical systems operate across Australia are operated and maintained by Geoscience Australia. The GNSS networks of approximately 100 Continuously Operating Reference Stations (CORS) across the Australian region and the South Pacific, including: Australian Regional GNSS Network (ARGN), South Pacific Regional GNSS Network (SPRGN), and AuScope Network.

GHD foresees that the proposed wind farm development's effect on trigonometric systems will be nil as there are no assets in the vicinity.

## **14. Maritime Radio Systems**

The proposed wind farm development location is sited inland to the Marine Radio Victoria (MRV) VHF and HF maritime transmitter locations.

GHD does not foresee any electromagnetic interference impact that would degrade maritime radio systems.

## **15. Amateur Radio Systems**

Amateur radio can consist of transmitters ranging from HF to UHF spectrum in specific bands reserved for citizen use by licenced individuals. Fixed amateur stations are registered on the ACMA database however the specific frequencies of the transmissions can vary depending on the type of communications being used at the time.

The amateur radio systems within 50 km radius of the proposed wind farm are shown in on Appendix B – Figure 12 and are listed on Appendix D – Table 8.

The closest amateur radio system is approximately 50km from the proposed wind farm development and GHD foresees no impact to the known fixed amateur radio systems.

---

<sup>9</sup> AS/NZS 61000.6.4:2012, Electromagnetic compatibility (EMC) Generic standards - Emission standard for industrial environments, Standards Australia, 2012

## 16. Earth Stations

Earth stations are radio transmission systems which transmit and receive signals between the ground (Earth) and communication satellites in orbit. Earth station antennas face north in the southern hemisphere for communication with geostationary satellites and can face any direction for communication to low/medium earth orbit satellites.

Three earth stations are registered in the proposed wind farm vicinity, all of which are geostationary ViaSat services.

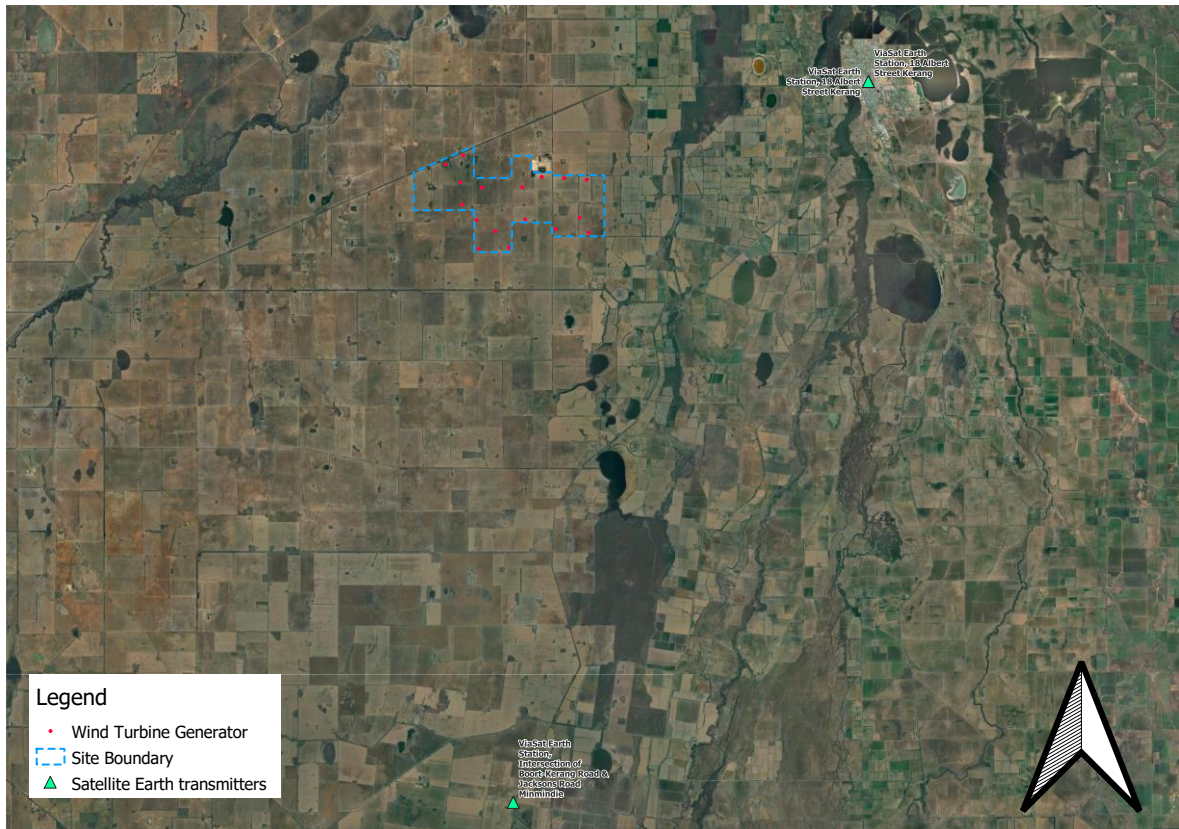


Figure 17 Satellite Earth Stations in Wind Farm Vicinity

The Earth stations within 50 km radius of the proposed wind farm are shown in Figure 17 and are listed on Appendix D– Table 9.

The closest Earth station is approximately 12 km directly east from the proposed wind farm development and GHD foresees no impact to known Earth station radio systems.

## 17. 50 Hz Radiation (Transmission Lines)

The primary sources of electromagnetic fields associated with wind farms are the substations and transmission lines. The proposed transmission line and substation will be equivalent to others in the electricity transmission network, with comparable electromagnetic field levels. The underground transmission line to Koorangie Terminal Station to connect the collector station to the Solar Farm BESS is shown in Figure 18.

Designing to the standards utilised by the local transmission and distribution authorities will ensure safe levels of electromagnetic radiation are achieved.

GHD does not foresee any electromagnetic interference impact that would degrade radio signals by the proposed transmission line and substation development.

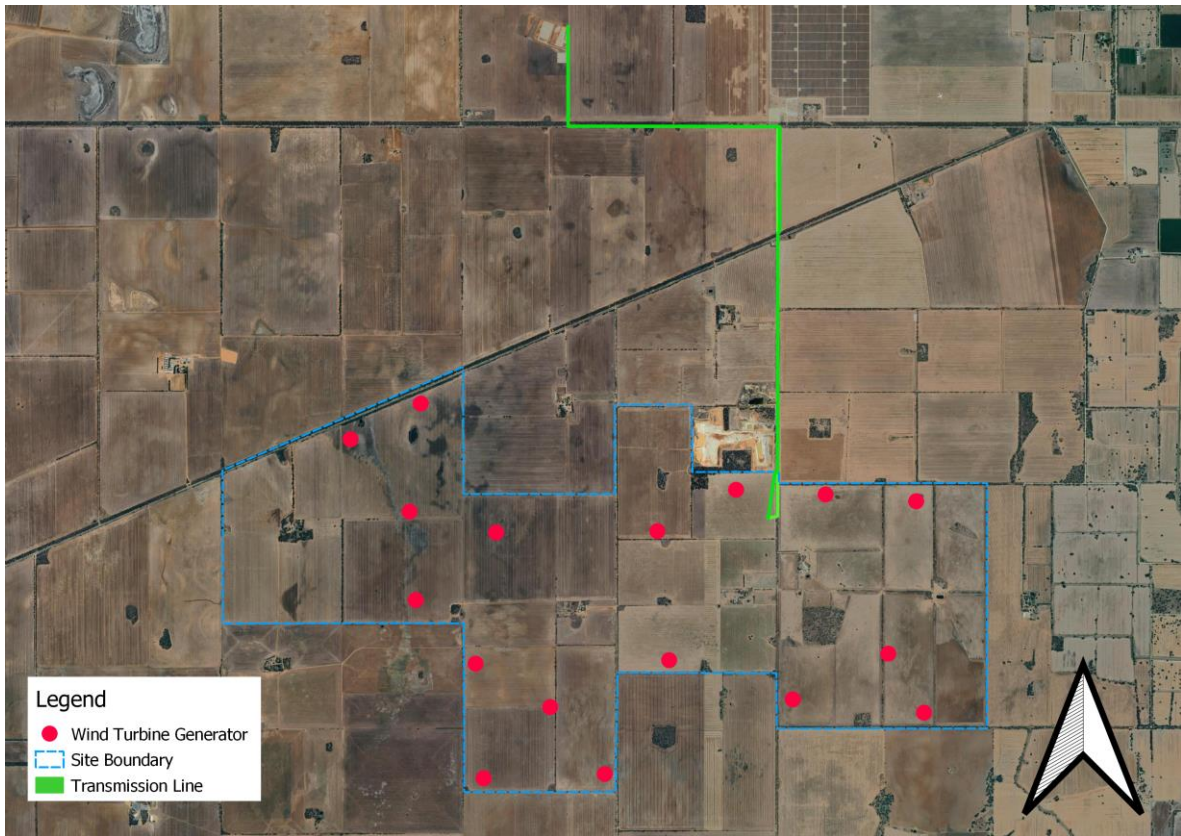


Figure 18 Transmission line

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## 18. General Mitigation Strategies

All types of radio communications can benefit from general mitigation through the design of the turbine and the choice of materials used in its construction.

The turbines have been spaced to mitigate the effect of creating a "virtual wall" of turbines. A virtual wall is an electromagnetic barrier between a TV transmitter and households serviced by that transmitter.

In addition, wind farm developers should utilise (wherever practical) equipment complying with the Electromagnetic Emission Standard, AS/NZS 61000.6.4:2012 to avoid the creation of excessive noise at frequencies that interfere with radio communication signals. Electrical insulation and shielding should be considered in the turbine design to reduce the RF noise emitted from the electronic control systems located in the nacelle.

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## 19. Summary of Mitigation Strategies and Recommendations

Table 3 Summary of Mitigation Strategies and Recommendations

Impact	Service Mitigation Strategy	Recommendation
Fixed Point-to-Point Radio Links		
Nil	Nil	Nil
Fixed Point-to-Multipoint Radio Links		
Nil	Nil	Nil
Land Mobile Radio Systems		
Nil	Nil	Nil
Digital Television Broadcast		
Minor to no impact anticipated to services.	<p>The wind farm's impact on digital TV services can be quantified by recording and comparing pre-construction baseline signal measurements and post-construction signal level measurements in and around the wind farm areas by an independent radio monitoring specialist; however, the mitigation measures remain the same.</p> <p>The first mitigation strategy can be performed from the user side by realigning the receptor antenna more directly towards the existing transmitter, repositioning or replacing existing antennas to higher gain alternatives can also remedy the majority of forward scatter signal degradation effects.</p>	<p>WestWind Energy Pty Ltd should undertake a pre- and post-construction assessment of the television reception strength at the location of any existing or approved dwellings as at the date of development approval that are within 5 kilometres of any turbine. The assessments should be undertaken by an independent television and radio monitoring specialist and include testing at locations to be determined by the television and radio monitoring specialist to enable the average television and radio reception strength to be determined.</p> <p>If the post-construction assessment establishes an unacceptable increase in interference to reception as a result of the wind farm, as determined by the independent television and radio monitoring specialist, measures to restore the affected reception to pre-construction quality should be undertaken.</p>
AM / FM Narrowcast and Broadcast		
Minor to no impact anticipated to services.	<p>Mitigation options may include installing high-quality antennas or amplifiers at affected dwellings, increasing broadcast signal strength from the transmission tower, moving the tower to a new location further away from the turbines, or installing a signal repeater or additional tower on the opposite side of the wind farm</p>	<p>WestWind Energy Pty Ltd should undertake a pre- and post-construction assessment of the radio reception strength at the location of any existing or approved dwellings as at the date of development approval that are within 5 kilometres of any turbine. The assessments should be undertaken by an independent television and radio monitoring specialist and include testing at locations to be determined by the television and radio monitoring specialist to enable the average television and radio reception strength to be determined.</p> <p>If the post-construction assessment establishes an unacceptable increase in interference to reception as a result</p>

Impact	Service Mitigation Strategy	Recommendation
		of the wind farm, as determined by the independent television and radio monitoring specialist, measures to restore the affected reception to pre-construction quality should be undertaken.
<b>Mobile Telephone and Broadband Internet Broadcast</b>		
Nil to negligible anticipated impact to services.	Nil.	Nil.
<b>Aircraft Communications Systems</b>		
Nil to negligible anticipated impact to services.	Nil.	Nil.
<b>Meteorological Radar</b>		
Minor manageable impact.	<p>Inform the Bureau of Meteorology of significant variation in turbine layout (i.e. by more than 100 m in any lateral direction, or alteration of tip height) between the initial plan and construction.</p> <p>Where possible, provide advance notice (one week preferably) to the Bureau of any planned wind farm shutdown events with durations greater than 12 hours, to allow the recalibration of radar systems.</p> <p>Collaborate with the Bureau in the event of severe weather conditions to assist in endeavour of community safety.</p>	WestWind Energy Pty Ltd should continue consulting with the Bureau on the exact terms of the manageable technical solutions for the Project to ensure that the radar can maintain operational efficiency.
<b>Defence Radio Systems</b>		
Possible impact on systems due to HF noise introduced by wind farm equipment.	Construction materials and conformance to AS/NZS IEC 61000.6.4:2012.	Ensure AS/NZS IEC 61000.6.4:2012 is followed.
<b>Trigonometric Systems</b>		
Nil.	Nil.	Nil.
<b>Maritime Radio Systems</b>		
Nil.	Nil.	Nil.
<b>Amateur Radio Systems</b>		
Nil.	Nil.	Nil.
<b>Earth Stations</b>		
Nil.	Nil.	Nil.
<b>Transmission Lines</b>		
Nil	Nil	Nil

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# Appendices

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# Appendix A

## Turbine Locations

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## Turbine Locations

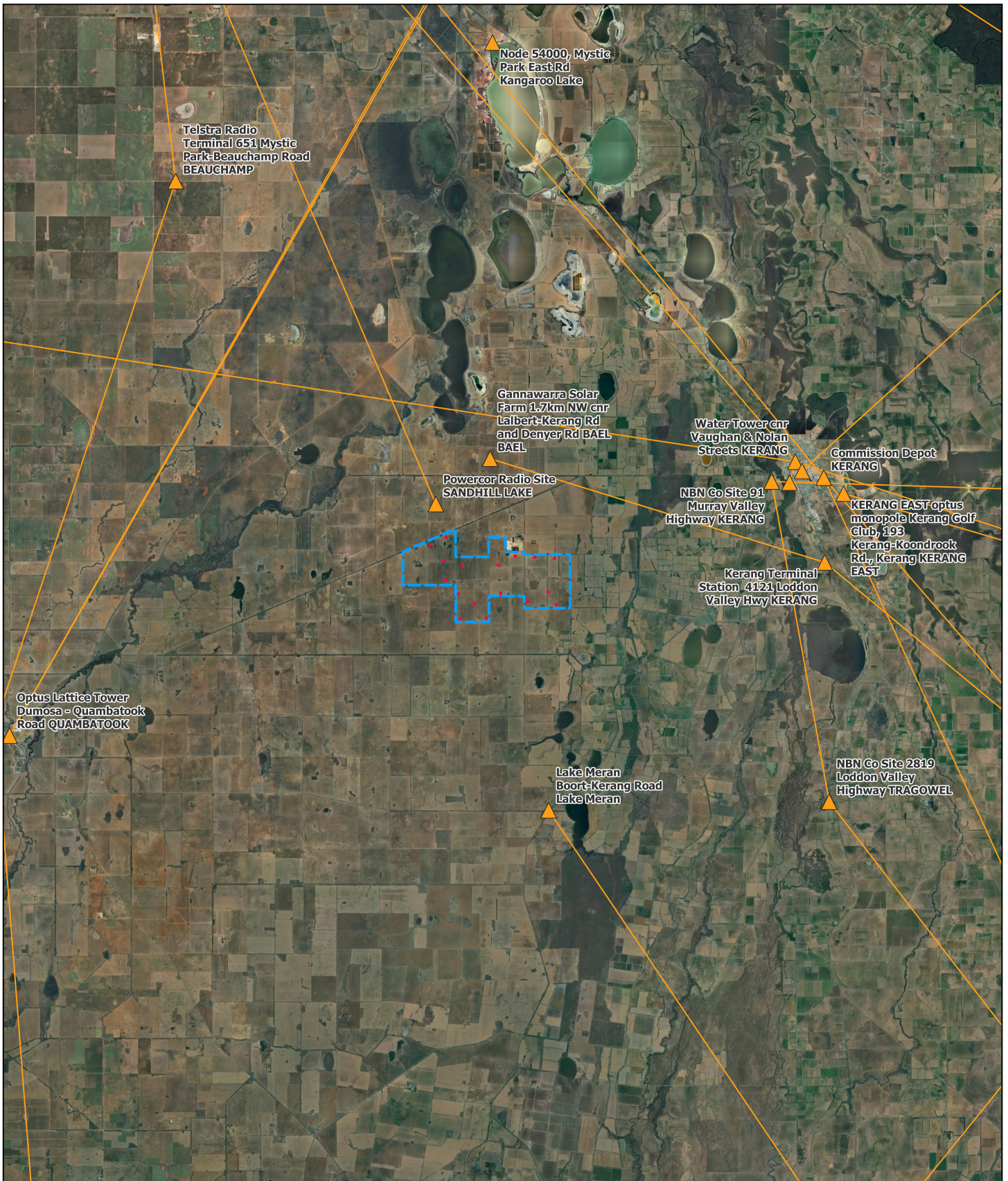
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T002	746839	6038787
T003	750749	6038165
T004	751658	6038092
T005	752578	6037996
T006	747421	6038037
T007	748295	6037801
T008	749937	6037769
T009	747458	6037139
T010	748049	6036478
T011	750019	6036458
T012	752251	6036461
T013	748795	6036017
T014	751265	6036026
T015	752597	6035853
T016	748098	6035316
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# Appendix B

Reference Figures

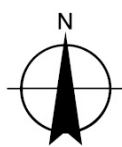
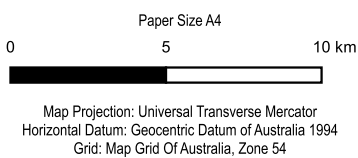
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**LEGEND**

- ▭ Proposed Site Boundary
- ▲ Fixed Point-to-Point Transmitter
- Turbine
- Radio Communications Link

# ADVERTISED PLAN



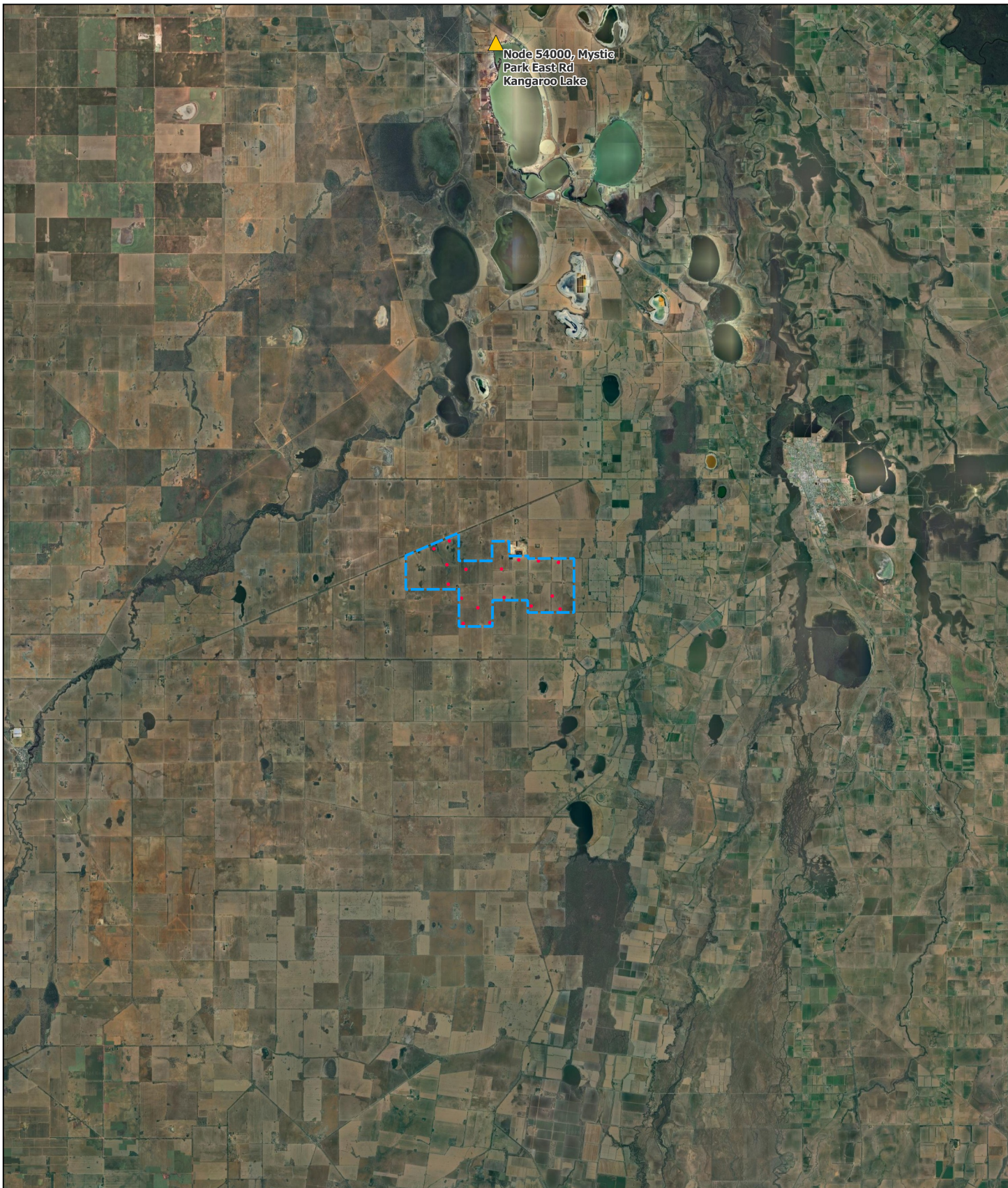
Normanville Energy Park  
Electromagnetic Interference  
Assessment

**Fixed Point-to-Point Radio  
Systems**




Project No. **12651568**  
Revision No. **1**  
Date. **19/09/2024**

**FIGURE 1**

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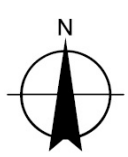
# ADVERTISED PLAN

- LEGEND**
-  Proposed Site Boundary
  -  Turbine
  -  Point-to-Multipoint Transmitter

Paper Size A4

0 5 10 km

Map Projection: Universal Transverse Mercator  
Horizontal Datum: Geocentric Datum of Australia 1994  
Grid: Map Grid Of Australia, Zone 54



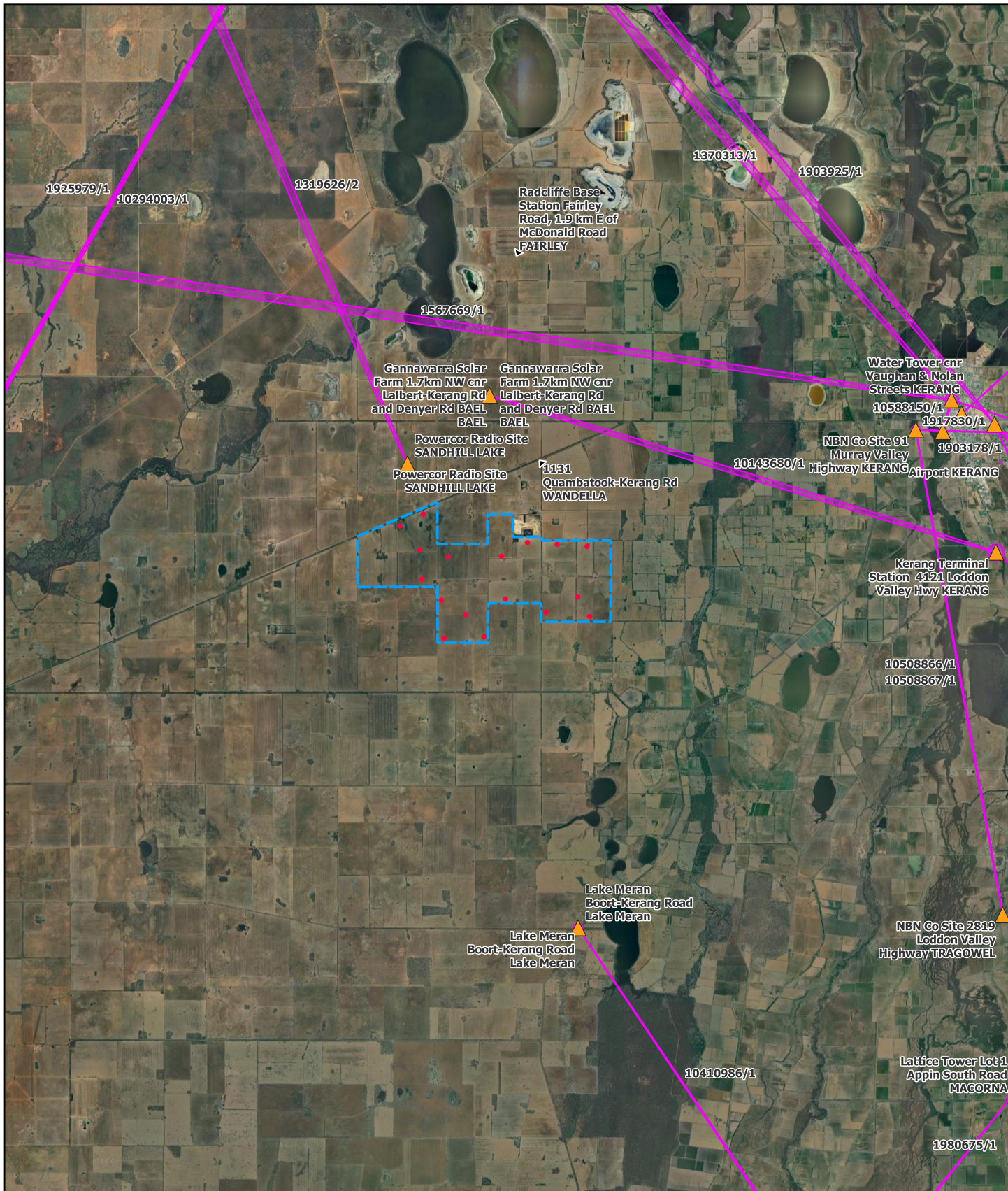
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Assessment

**Point-to-Multipoint Radio  
Systems**

Project No. 12651568  
Revision No. 1  
Date. 19/09/2024

**FIGURE 2**

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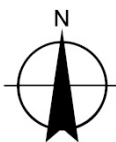


**LEGEND**

- Proposed Site Boundary
- Turbine
- ▲ Fixed Point-to-Point Transmitter
- Exclusion Zone

# ADVERTISED PLAN

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 Grid: Map Grid Of Australia, Zone 54



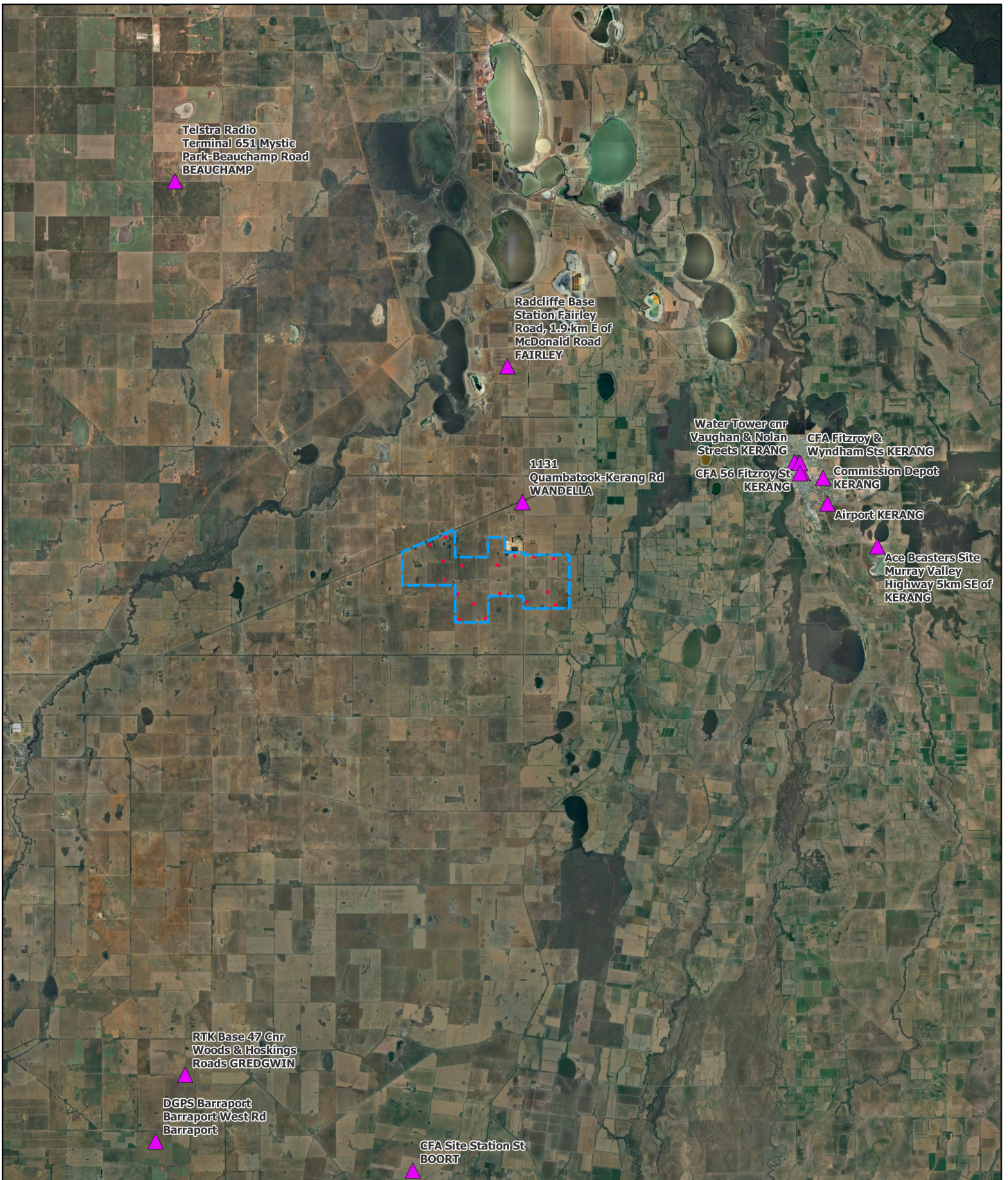
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 Electromagnetic Interference  
 Assessment

Project No. 12651568  
 Revision No. 1  
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**Point-to-Point Exclusion Zones**

**FIGURE 3**

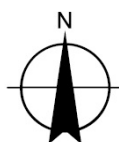
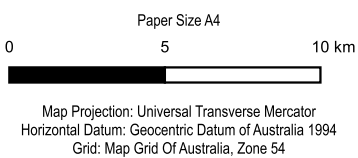
G:\33\12651568\GIS\Maps\Deliverables\_PDF\Figure 3 - Point-to-Point Exclusion Zones.pdf  
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**LEGEND**

- Proposed Site Boundary
- Turbine
- ▲ Land Mobile Transmitter

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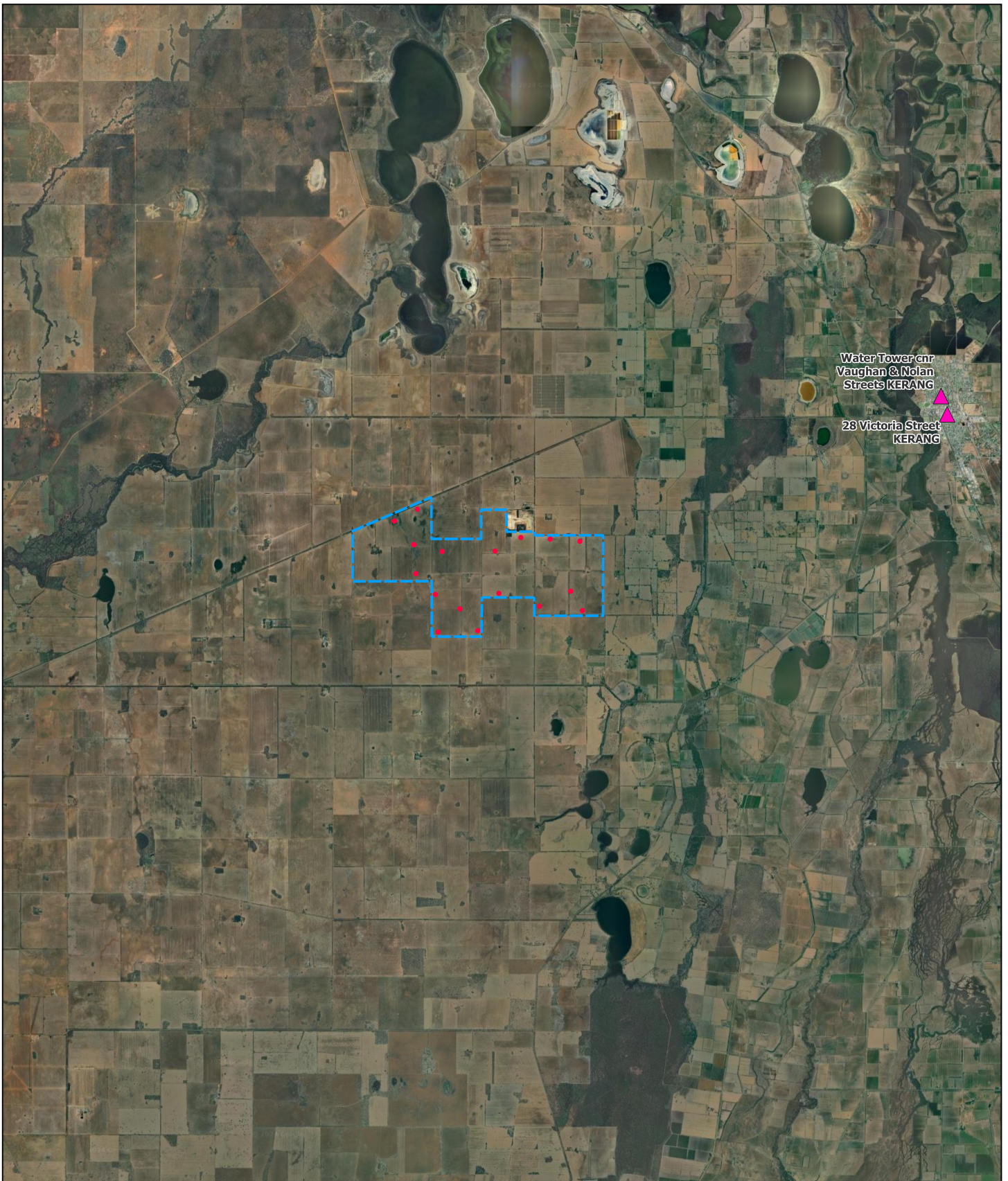
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 Electromagnetic Interference  
 Assessment

**Land Mobile Transmitters**

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 Revision No. 1  
 Date. 19/09/2024

**FIGURE 4**

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Water Tower cnr  
Vaughan & Nolan  
Streets KERANG

28 Victoria Street  
KERANG

**LEGEND**

- Proposed Site Boundary
- Turbine
- ▲ Broadcasting Transmitter

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Horizontal Datum: Geocentric Datum of Australia 1994  
Grid: Map Grid Of Australia, Zone 54



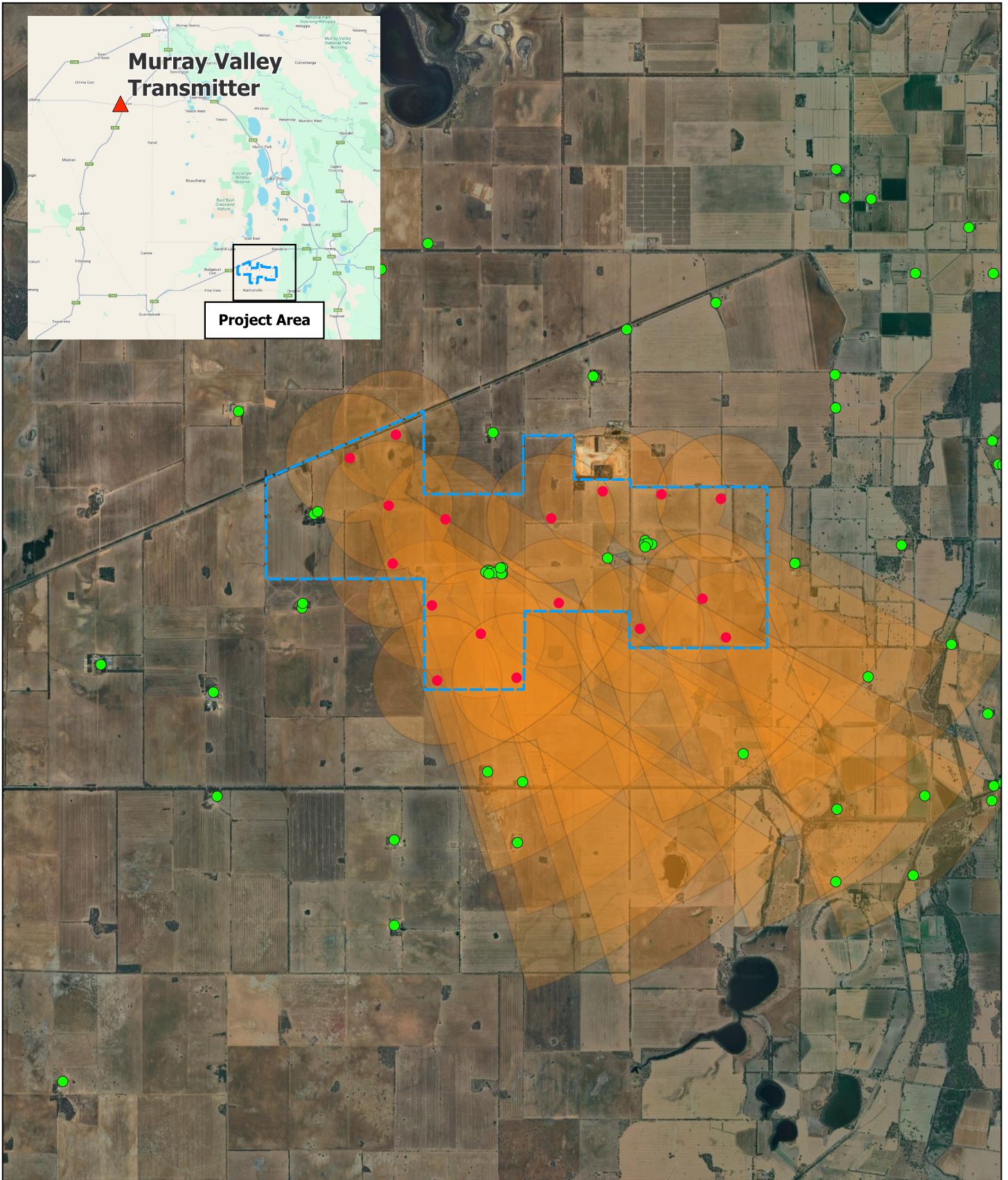
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Electromagnetic Interference  
Assessment

**Broadcasting Transmitters**

Project No. 12651568  
Revision No. 1  
Date. 19/09/2024

**FIGURE 5**

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**LEGEND**

- ▭ Proposed Site Boundary
- Turbine
- ▭ Scatter Zone
- Structure
- ▲ Murray Valley TV Transmitter

# ADVERTISED PLAN

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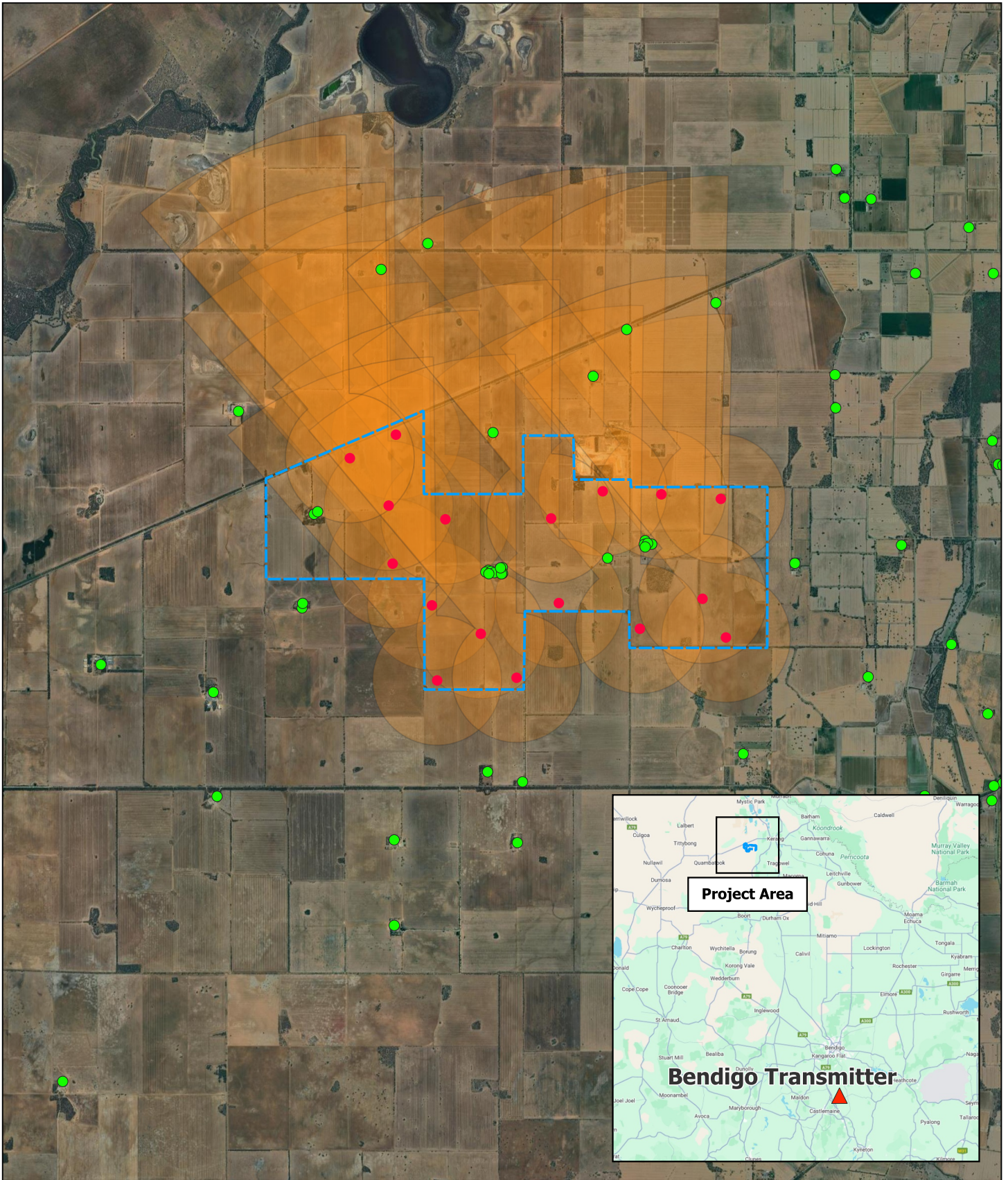


Normanville Energy Park  
 Electromagnetic Interference  
 Assessment  
**Murray Valley TV Transmitter  
 Scatter Zones**

Project No. **12651568**  
 Revision No. **1**  
 Date. **19/09/2024**

**FIGURE 6**

G:\33\12651568\GIS\Maps\Deliverables\_PDF\Figure 6 - Murray Valley Transmitter Scatter Zones.pdf  
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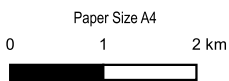


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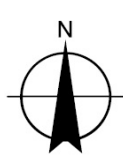
- ▭ Proposed Site Boundary
- Turbine
- ▲ Bendigo TV Transmitter

- Scatter Zone
- Structure

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PLAN



Map Projection: Universal Transverse Mercator  
Horizontal Datum: Geocentric Datum of Australia 1994  
Grid: Map Grid Of Australia, Zone 54



Normanville Energy Park  
Electromagnetic Interference  
Assessment

Bendigo TV Transmitter Scatter  
Zones

Project No. 12651568  
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FIGURE 7

G:\13312651568\GIS\Maps\Deliverables\\_PDF\Figure 7 - Bendigo Transmitter Scatter Zones.pdf  
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- LEGEND**
- ▭ Proposed Site Boundary
  - Turbine
  - ▲ PTS Transmitter

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Paper Size A4

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Horizontal Datum: Geocentric Datum of Australia 1994  
Grid: Map Grid Of Australia, Zone 54



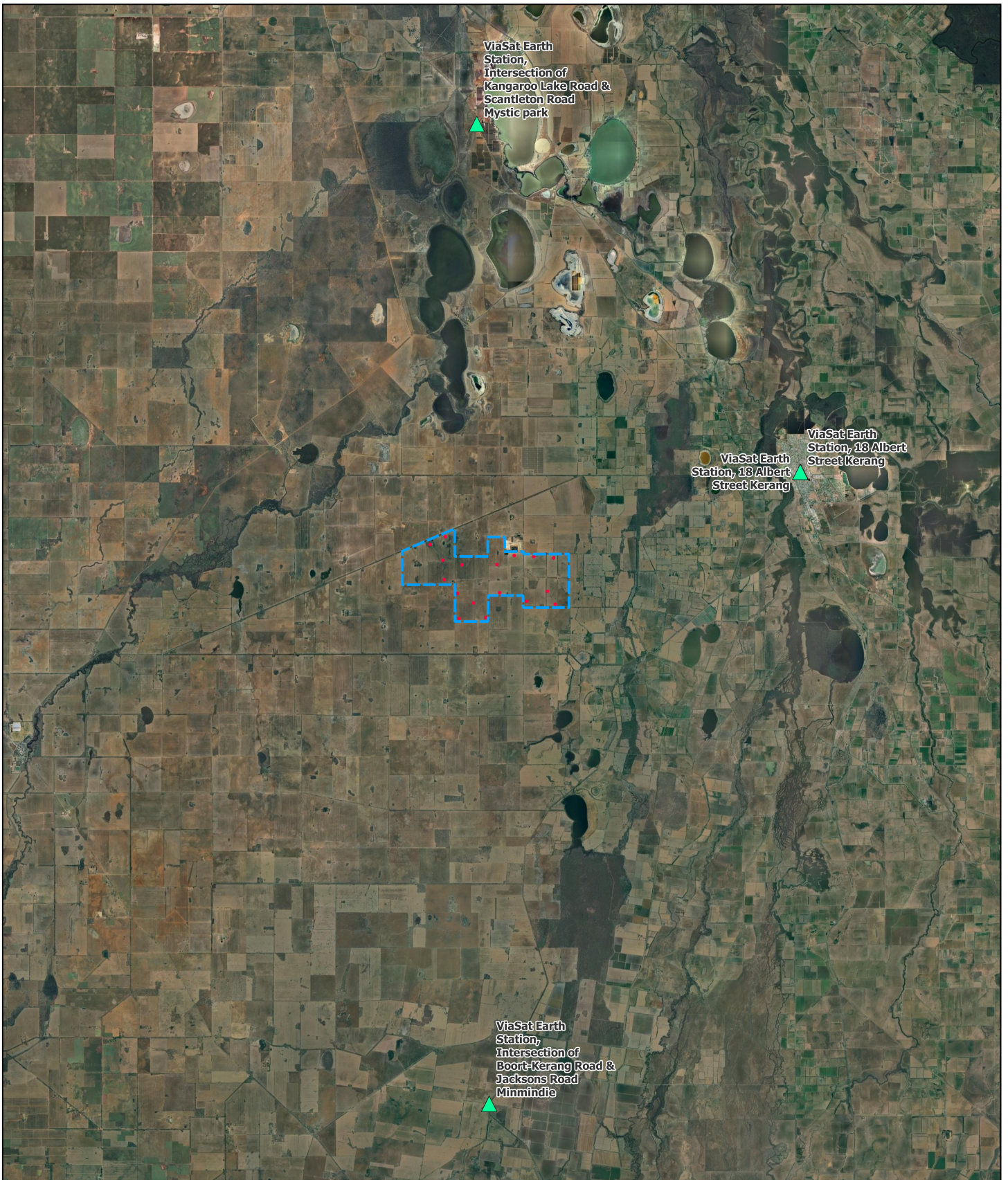
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Electromagnetic Interference  
Assessment

**PTS Transmitters**

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**FIGURE 8**

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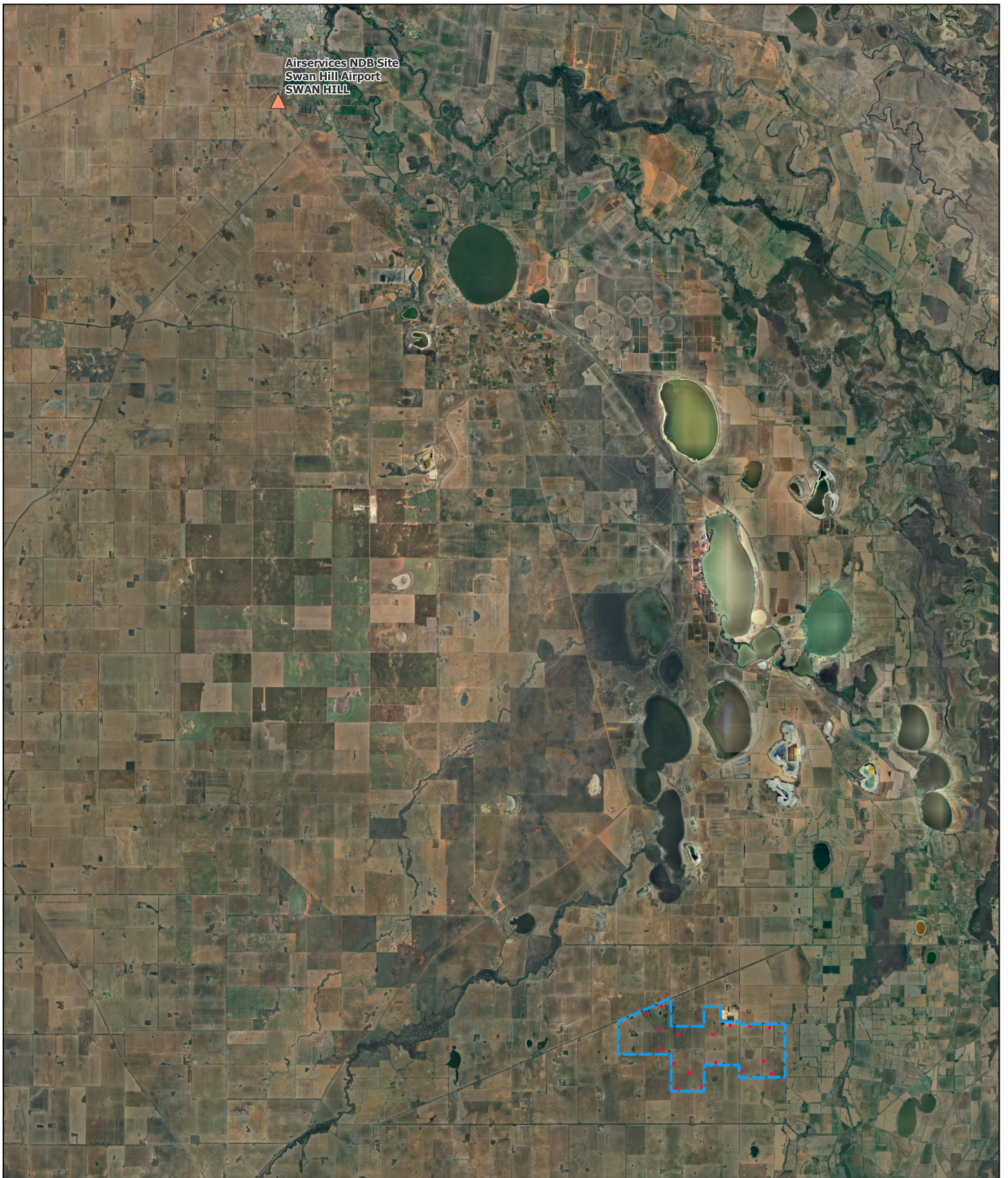
- LEGEND**
- ▭ Proposed Site Boundary
  - Turbine
  - ▲ Miscellaneous Transmitter

# ADVERTISED PLAN

<p>Paper Size A4</p> <p>0 5 10 km</p> <p>Map Projection: Universal Transverse Mercator Horizontal Datum: Geocentric Datum of Australia 1994 Grid: Map Grid Of Australia, Zone 54</p>		 	<p>Normanville Energy Park Electromagnetic Interference Assessment</p> <p><b>Miscellaneous Transmitters</b></p>	<p>Project No. <b>12651568</b> Revision No. <b>1</b> Date. <b>19/09/2024</b></p>
--	--	------	---	--

**FIGURE 9**

G:\13312651568\GIS\Maps\Deliverables\\_PDF\Figure 9 - Miscellaneous Transmitters.pdf  
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 Data source: DELWP, Google Earth Imagery 2024. Created by: AM



**LEGEND**

- ▭ Proposed Site Boundary
- Turbine
- ▲ Aeronautical Transmitter

# ADVERTISED PLAN

Paper Size A4

0 5 10 km

Map Projection: Universal Transverse Mercator  
Horizontal Datum: Geocentric Datum of Australia 1994  
Grid: Map Grid Of Australia, Zone 54



Normanville Energy Park  
Electromagnetic Interference  
Assessment




Project No. 12651568  
Revision No. 1  
Date. 19/09/2024

**Aeronautical Transmitters**

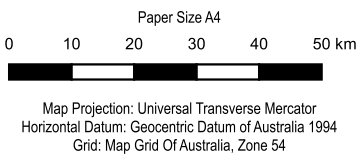
**FIGURE 10**

G:\33\12651568\GIS\Maps\Deliverables\_PDF\Figure 10 - Aeronautical Transmitters.pdf  
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 Data source: DELWP, Google Earth Imagery 2024 Created by: AM



- LEGEND**
-  Proposed Site Boundary
  -  Meteorological Radar
  -  Radar Cross-Sectional Impact

# ADVERTISED PLAN



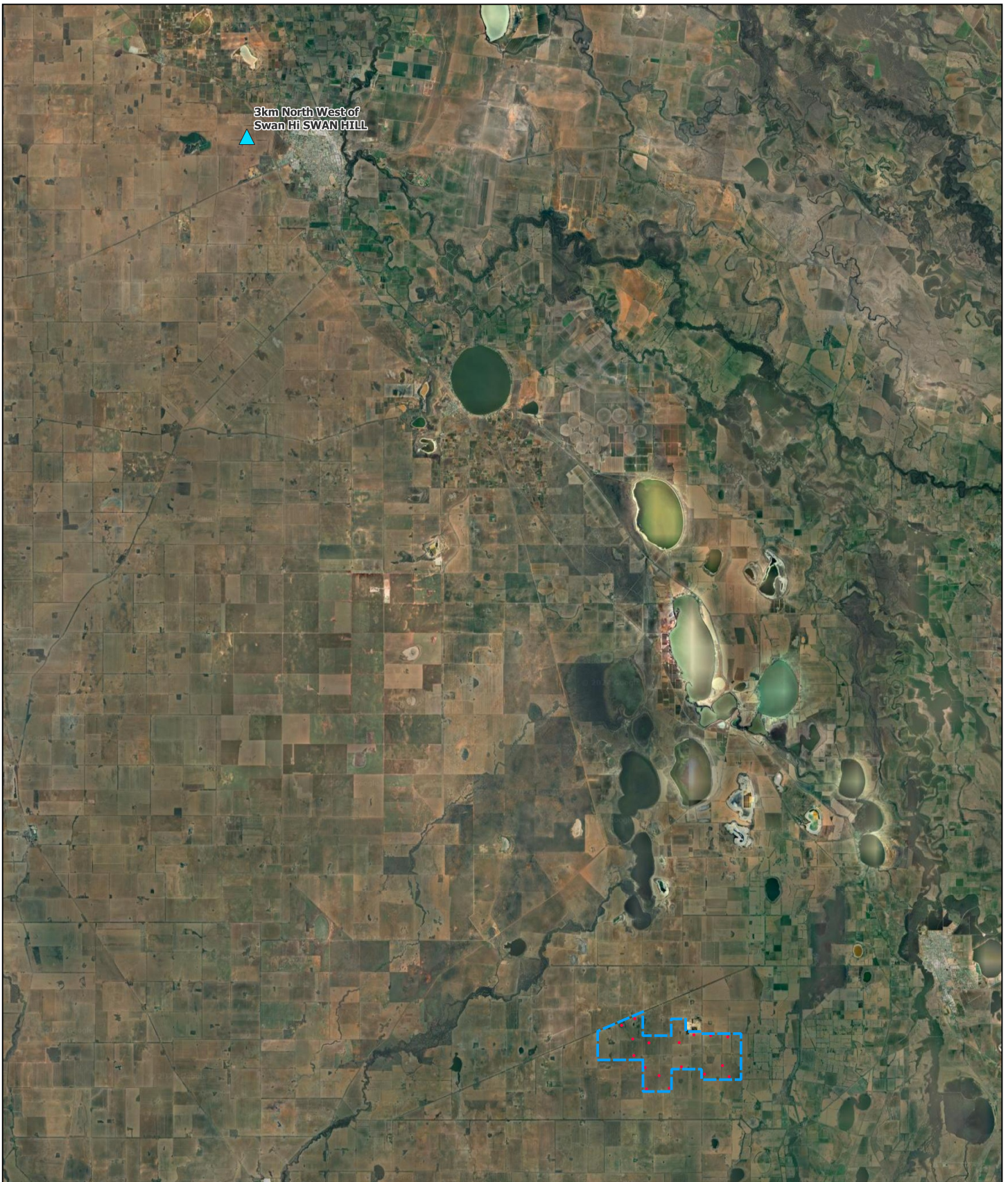
Normanville Energy Park  
Electromagnetic Interference  
Assessment

**Meteorological Radar**

Project No. **12651568**  
Revision No. **1**  
Date. **19/09/2024**

**FIGURE 11**

G:\133\12651568\GIS\Maps\Deliverables\_PDF\Figure 11 - Meteorological Transmitters.pdf  
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Data source: DELWP, Google Earth Imagery 2024. Created by: AM



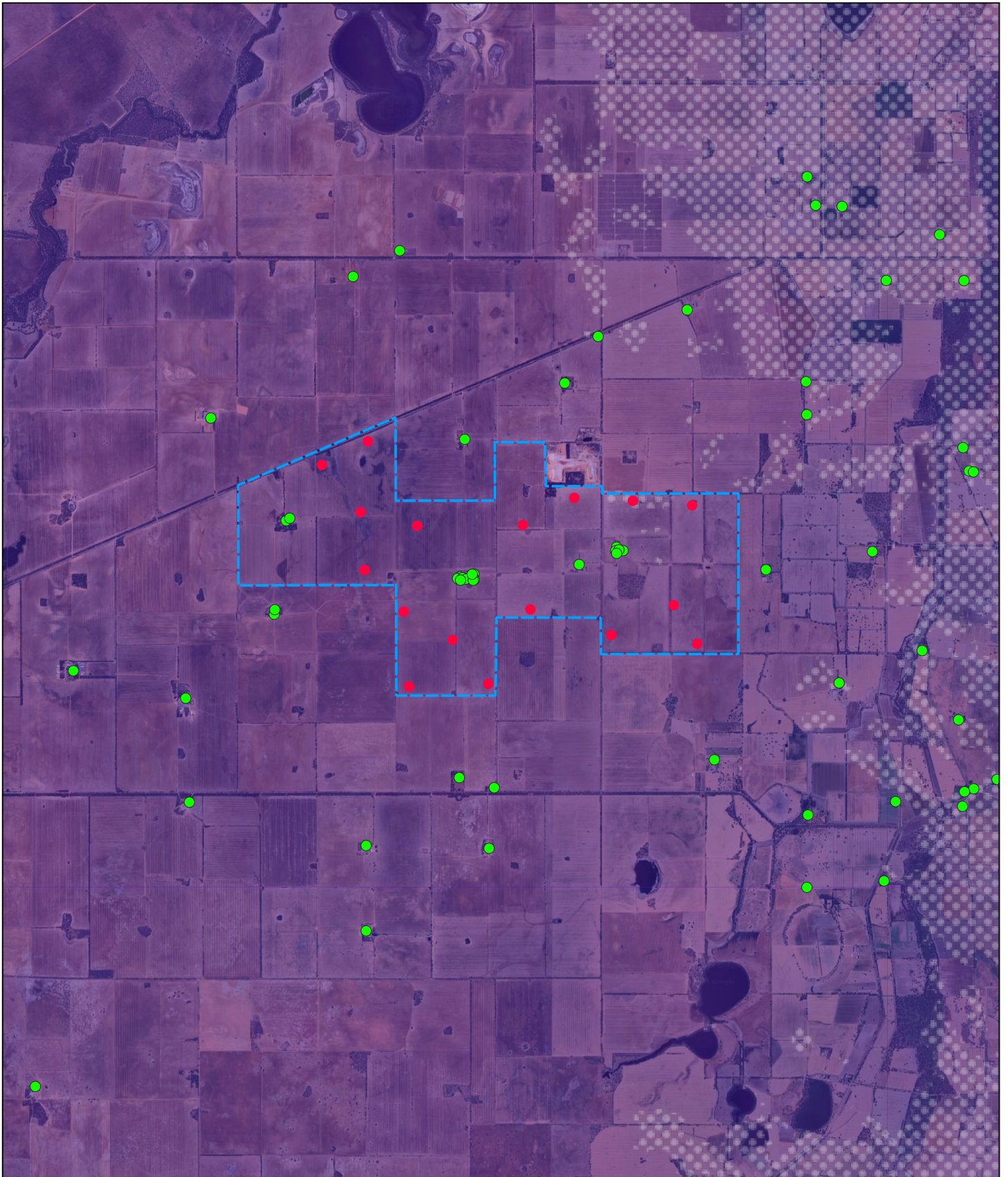
- LEGEND**
- ▭ Proposed Site Boundary
  - Turbine
  - ▲ Amateur Transmitter

# ADVERTISED PLAN

<p>Paper Size A4</p> <p>0      5      10 km</p> <p>Map Projection: Universal Transverse Mercator Horizontal Datum: Geocentric Datum of Australia 1994 Grid: Map Grid Of Australia, Zone 54</p>		 	<p>Normanville Energy Park Electromagnetic Interference Assessment</p> <p><b>Amateur Transmitters</b></p>	<p>Project No. <b>12651568</b> Revision No. <b>1</b> Date. <b>19/09/2024</b></p>
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**FIGURE 12**

G:\13312651568\GIS\Maps\Deliverables\_PDF\Figure 12 - Amateur Transmitters.pdf  
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 Data source: DELWP, Google Earth Imagery 2024. Created by: AM



**LEGEND**

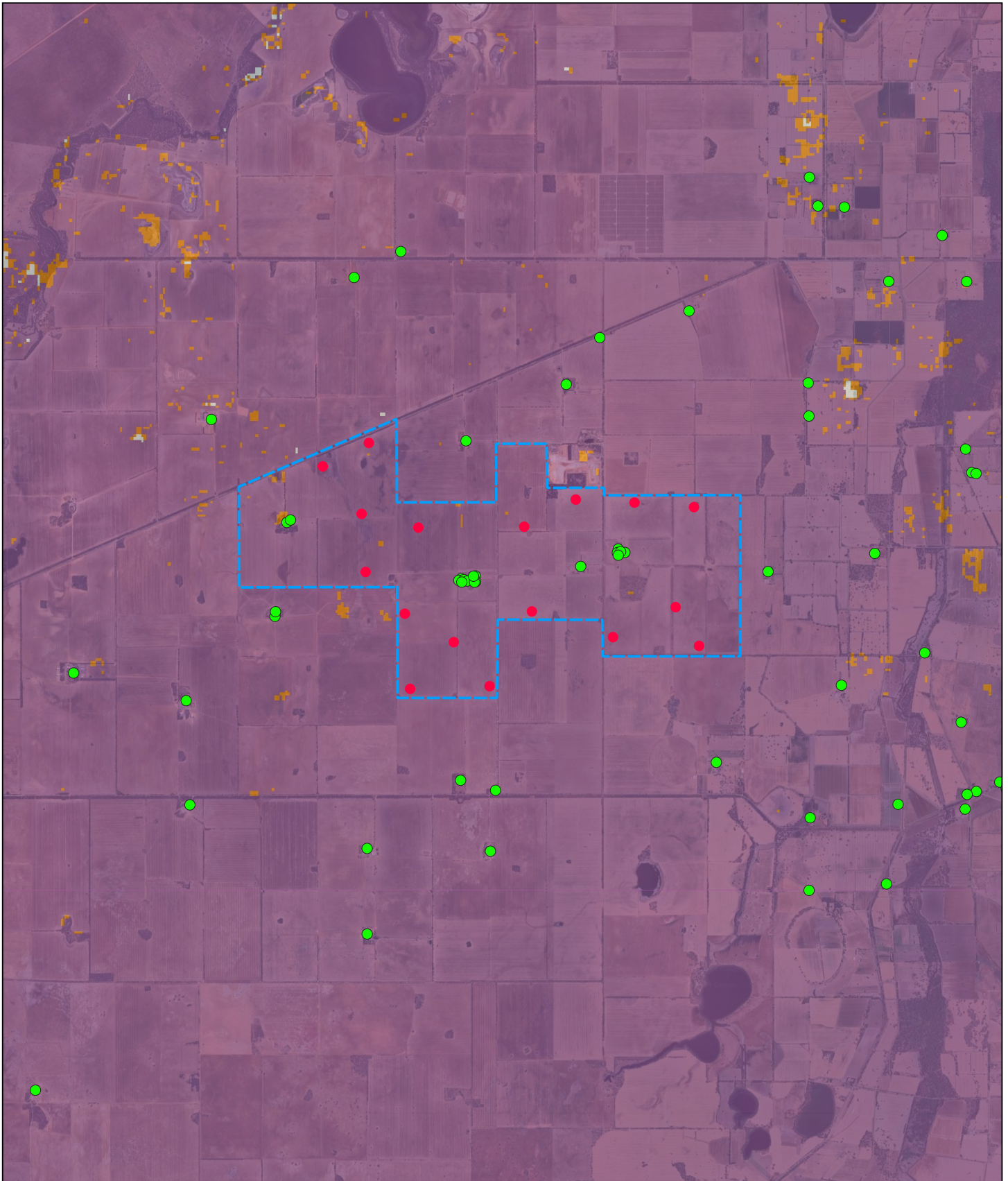
- Proposed Site Boundary
- Turbine
- Structure
- NBN Fixed Wireless
- NBN Satellite

# ADVERTISED PLAN

<p>Paper Size A4</p> <p>0 1 2 km</p> <p>Map Projection: Universal Transverse Mercator Horizontal Datum: Geocentric Datum of Australia 1994 Grid: Map Grid Of Australia, Zone 54</p>			<p>Normanville Energy Park Electromagnetic Interference Assessment</p> <p><b>NBN Spectrum Coverage</b></p>	<p>Project No. <b>12651568</b> Revision No. <b>1</b> Date. <b>19/09/2024</b></p>
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**FIGURE 13**

G:\13312651568\GIS\Maps\Deliverables\_PDF\Figure 13 - NBN Spectrum Coverage.pdf  
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 Data source: DELWP, Google Earth Imagery 2024. Created by: AM



**LEGEND**

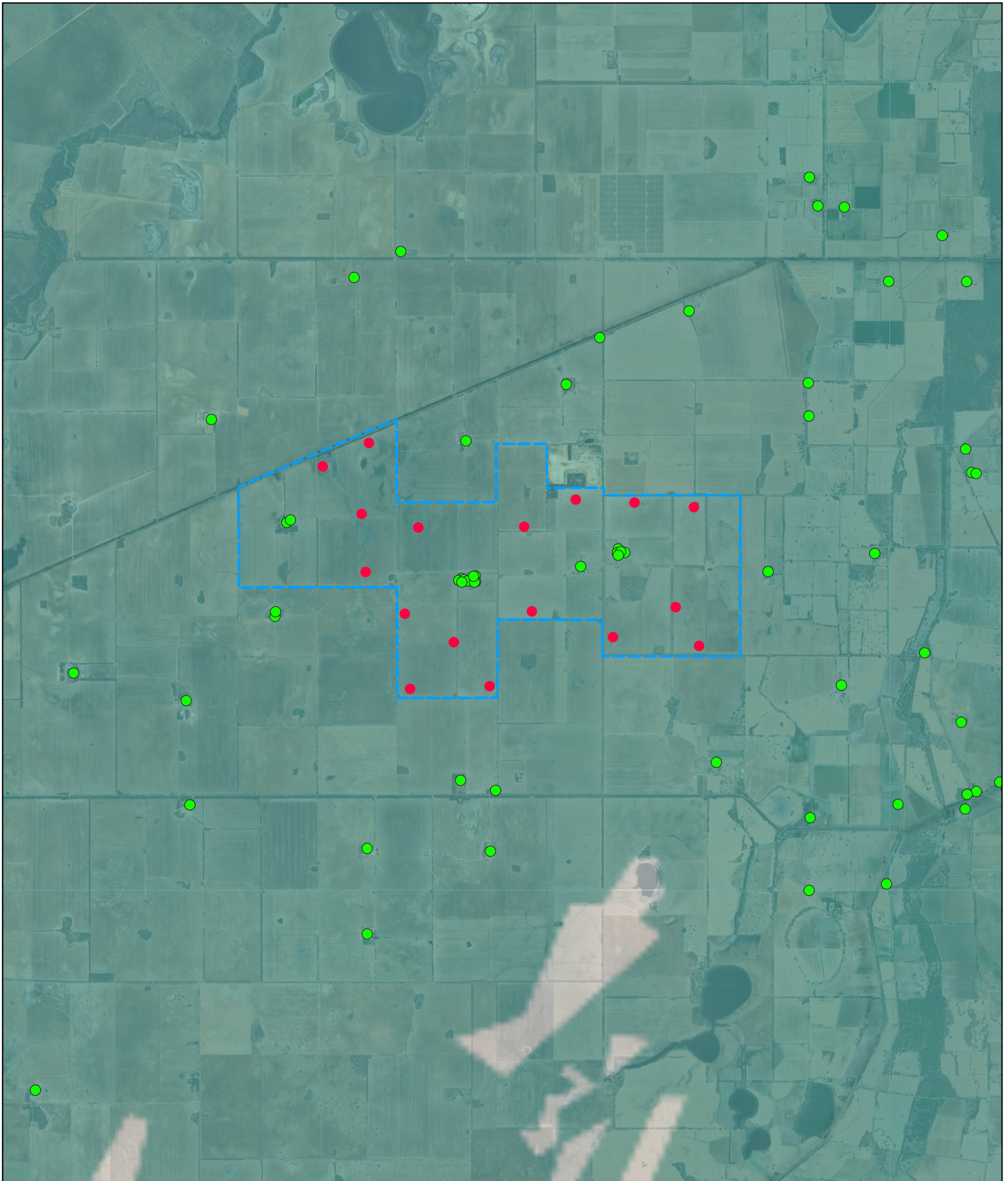
- Proposed Site Boundary
- Turbine
- Structure
- Optus 4G Coverage
- Optus 4G with Antenna Coverage

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<p>Paper Size A4</p> <p>0 1 2 km</p> <p>Map Projection: Universal Transverse Mercator Horizontal Datum: Geocentric Datum of Australia 1994 Grid: Map Grid Of Australia, Zone 54</p>		 	<p>Normanville Energy Park Electromagnetic Interference Assessment</p> <p><b>Optus Spectrum Coverage</b></p>	<p>Project No. <b>12651568</b> Revision No. <b>1</b> Date. <b>19/09/2024</b></p>
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**FIGURE 14**

G:\13312651568\GIS\Maps\Deliverables\_PDF\Figure 14 - Optus Spectrum Coverage.pdf  
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 Data source: DELWP, Google Earth Imagery 2024. Created by: AM



**LEGEND**

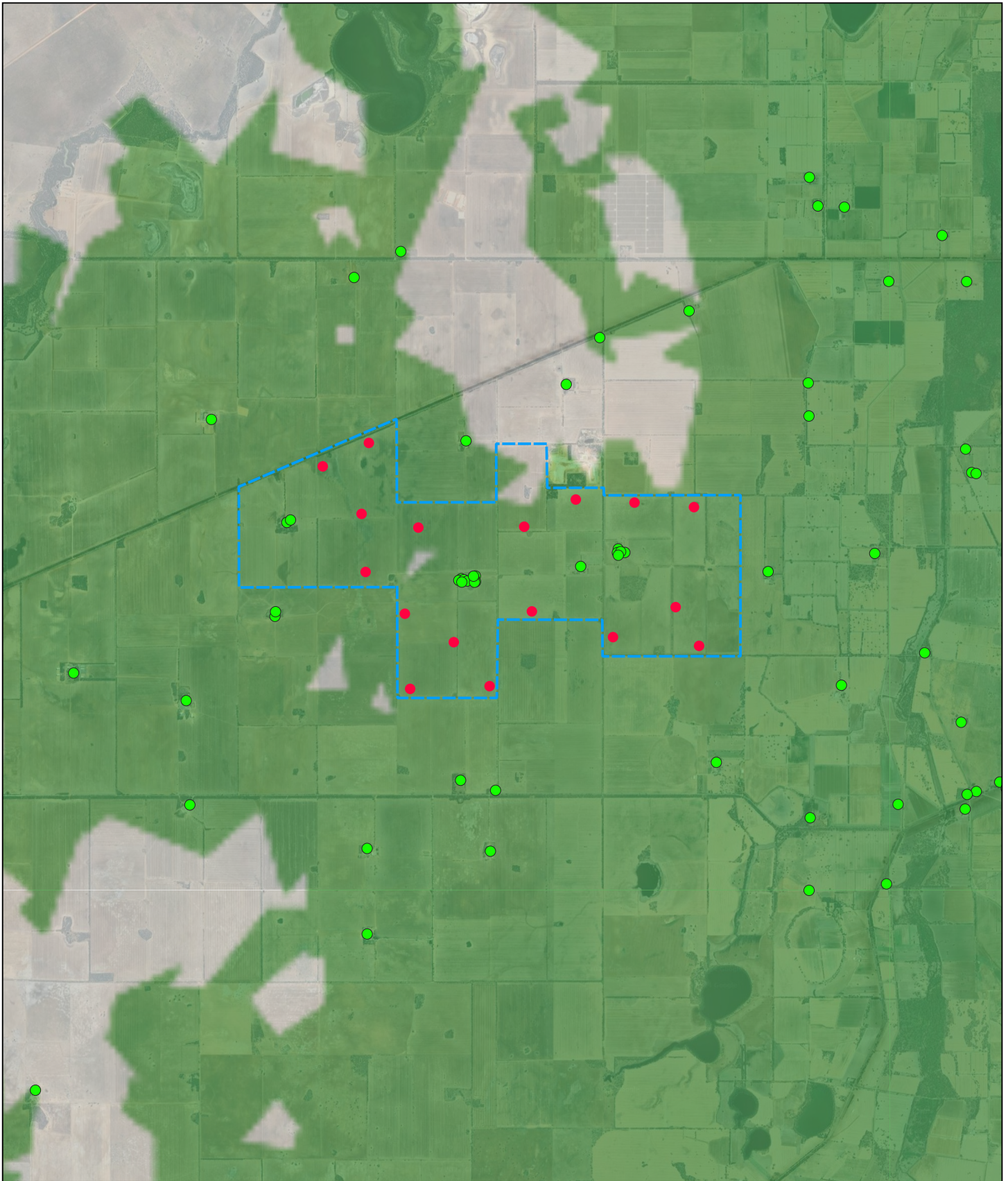
- ▭ Proposed Site Boundary
- Turbine
- Structure
- Telstra 3G Coverage

# ADVERTISED PLAN

<p>Paper Size A4</p> <p>0 1 2 km</p> <p>Map Projection: Universal Transverse Mercator Horizontal Datum: Geocentric Datum of Australia 1994 Grid: Map Grid Of Australia, Zone 54</p>		 	<p>Normanville Energy Park Electromagnetic Interference Assessment</p> <p><b>Telstra 3G Spectrum Coverage</b></p>	<p>Project No. <b>12651568</b> Revision No. <b>1</b> Date. <b>19/09/2024</b></p>
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FIGURE 15

G:\13312651568\GIS\Maps\Deliverables\_PDF\Figure 15 - Telstra 3G Spectrum Coverage.pdf  
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 Data source: DELWP, Google Earth Imagery 2024. Created by: AM



**LEGEND**

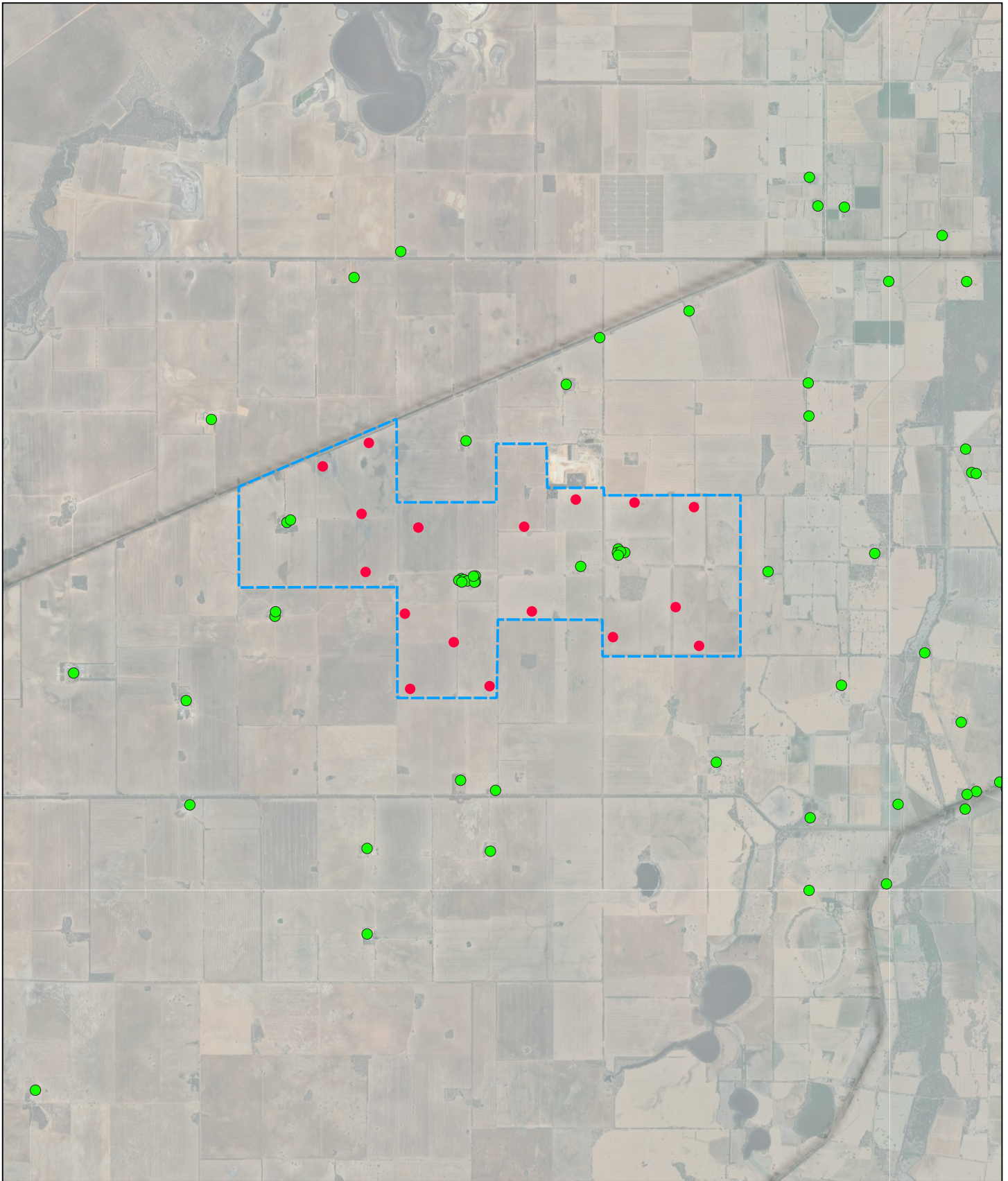
- Proposed Site Boundary
- Turbine
- Structure
- Telstra 4G Coverage

# ADVERTISED PLAN

<p>Paper Size A4</p> <p>0 1 2 km</p> <p>Map Projection: Universal Transverse Mercator Horizontal Datum: Geocentric Datum of Australia 1994 Grid: Map Grid Of Australia, Zone 54</p>		 	<p>Normanville Energy Park Electromagnetic Interference Assessment</p> <p><b>Telstra 4G Spectrum Coverage</b></p>	<p>Project No. <b>12651568</b> Revision No. <b>1</b> Date. <b>19/09/2024</b></p>
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**FIGURE 16**

G:\13312651568\GIS\Maps\Deliverables\_PDF\Figure 16 - Telstra 4G Spectrum Coverage.pdf  
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 Data source: DELWP, Google Earth Imagery 2024. Created by: AM



**LEGEND**

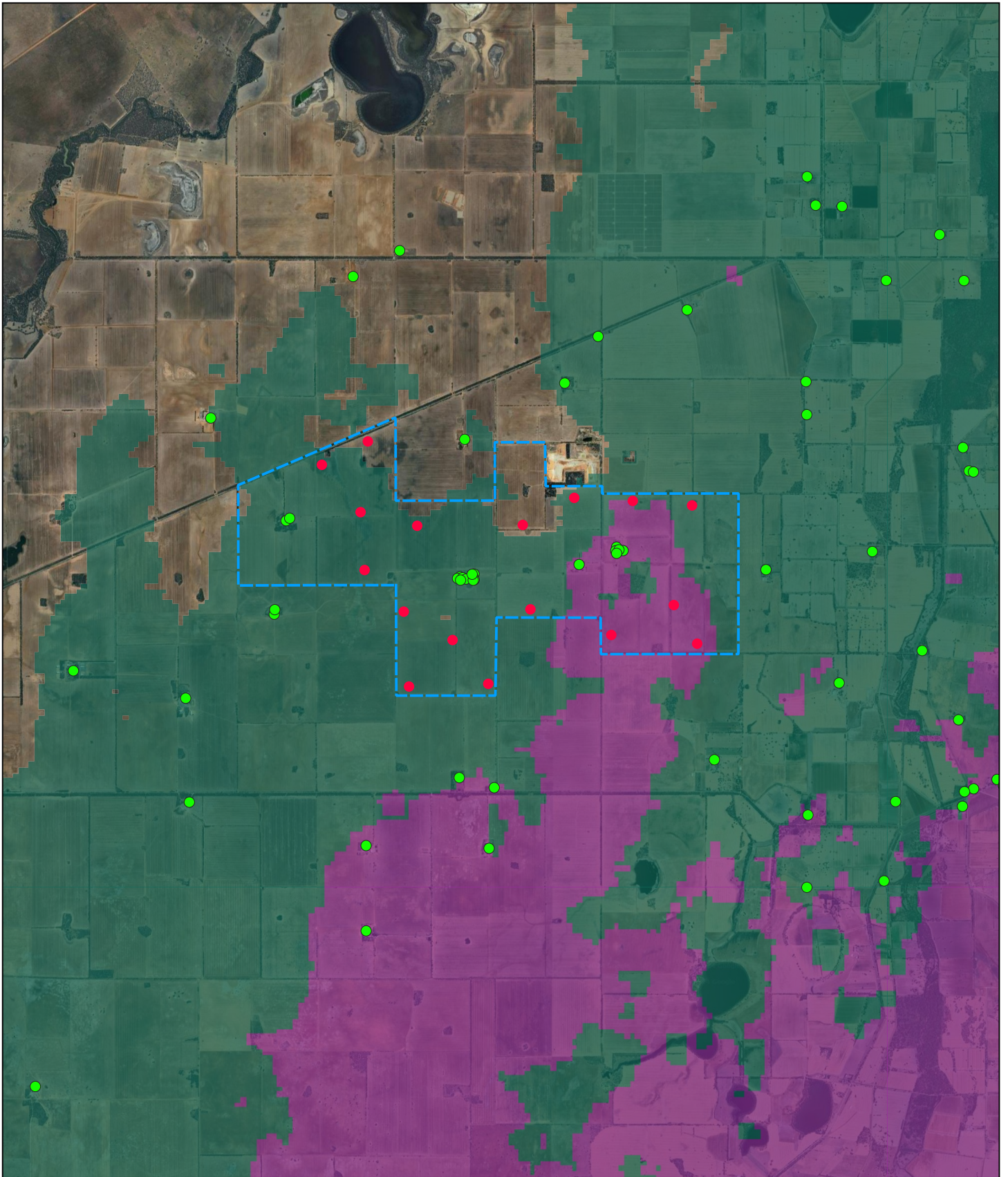
- ▭ Proposed Site Boundary
- Turbine
- Structure
- Telstra 5G Coverage

# ADVERTISED PLAN

<p>Paper Size A4</p> <p>0 1 2 km</p> <p>Map Projection: Universal Transverse Mercator Horizontal Datum: Geocentric Datum of Australia 1994 Grid: Map Grid Of Australia, Zone 54</p>			<p>Normanville Energy Park Electromagnetic Interference Assessment</p> <p><b>Telstra 5G Spectrum Coverage</b></p>	<p>Project No. <b>12651568</b> Revision No. <b>1</b> Date. <b>19/09/2024</b></p>
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**FIGURE 17**

G:\13312651568\GIS\Maps\Deliverables\PDF\Figure 17 - Telstra 5G Spectrum Coverage.pdf  
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 Data source: DELWP, Google Earth Imagery 2024. Created by: AM



**LEGEND**

- Proposed Site Boundary
- Turbine
- Structure
- Vodafone 3G Coverage
- Vodafone 4G Coverage

# ADVERTISED PLAN

<p>Paper Size A4</p> <p>0 1 2 km</p> <p>Map Projection: Universal Transverse Mercator Horizontal Datum: Geocentric Datum of Australia 1994 Grid: Map Grid Of Australia, Zone 54</p>		 	<p>Normanville Energy Park Electromagnetic Interference Assessment</p> <p><b>Vodafone Spectrum Coverage</b></p>	<p>Project No. <b>12651568</b> Revision No. <b>1</b> Date. <b>19/09/2024</b></p>
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**FIGURE 18**

G:\13312651568\GIS\Maps\Deliverables\_PDF\Figure 18 - Vodafone Spectrum Coverage.pdf  
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 Data source: DELWP, Google Earth Imagery 2024. Created by: AM

# Appendix C

## Consultation Reference Letters

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## Ashton Wahlstrom

---

**From:** Mohammad Zomorodi <Mohammad.Zomorodi@bom.gov.au>  
**Sent:** Thursday, 23 February 2023 1:34 PM  
**To:** Ashton Wahlstrom  
**Cc:** Marc Keppler (He/His); Brendan Siebert; windfarmenquiries  
**Subject:** Re: Wind Farm EMI Assessment - Normanville Victoria [SEC=OFFICIAL]

Hi Ashton,

We have finalized our assessment through desktop analysis for the proposed Normanville windfarm.

The assessment shows manageable impact on the Bureau of Meteorology's assets, specifically on its weather radar network, in normal atmospheric/propagation conditions. As such, the Bureau could conditionally agree to this project.

The Bureau requires a letter from the farm developer/owner to acknowledge that the operation of the proposed wind farm will include the following commitments:

1. Informing the Bureau of significant variation in turbine layout (i.e. by more than 100 m in any lateral direction, or alteration of tip height) between the initial plan and construction.
2. Providing advance notice (one week preferably) to the Bureau of any planned wind farm shutdown events for more than 12 hours, to allow the recalibration of radar systems.
3. Collaborate with the Bureau in the event of severe weather conditions to assist in endeavour of community safety.

Please don't hesitate to contact me should you require any further details.

Regards  
Mohammad

**Dr. Mohammad Zomorodi**

Radio Frequency Spectrum Manager

Data & Digital, Operational Technology & Engineering

M: 0415 524 457 | T: 03 9669 4413

Level 7, 700 Collins St, Docklands, VIC 3008

[Mohammad.Zomorodi@bom.gov.au](mailto:Mohammad.Zomorodi@bom.gov.au) | [www.bom.gov.au](http://www.bom.gov.au)

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---

**From:** Ashton Wahlstrom <[Ashton.Wahlstrom@ghd.com](mailto:Ashton.Wahlstrom@ghd.com)>  
**Sent:** Tuesday, 21 February 2023 11:42 AM  
**To:** Mohammad Zomorodi <[Mohammad.Zomorodi@bom.gov.au](mailto:Mohammad.Zomorodi@bom.gov.au)>  
**Cc:** Marc Keppler (He/His) <[Marc.Keppler@bom.gov.au](mailto:Marc.Keppler@bom.gov.au)>; Brendan Siebert <[Brendan.Siebert@ghd.com](mailto:Brendan.Siebert@ghd.com)>;  
windfarmenquiries <[windfarmenquiries@bom.gov.au](mailto:windfarmenquiries@bom.gov.au)>  
**Subject:** RE: Wind Farm EMI Assessment - Normanville Victoria [SEC=OFFICIAL]

Hi Mohammad,

Apologies for the delay - I've attached the completed form and additional requested information.

Kind regards,

**Ashton Wahlstrom**  
Graduate Engineer

**GHD**  
Proudly employee-owned | [ghd.com](http://ghd.com)  
Level 3, 211 Victoria Square Adelaide SA 5000 Australia  
D +61 8 8111 6866 E [ashton.wahlstrom@ghd.com](mailto:ashton.wahlstrom@ghd.com)

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---

**From:** Mohammad Zomorodi <[Mohammad.Zomorodi@bom.gov.au](mailto:Mohammad.Zomorodi@bom.gov.au)>  
**Sent:** Friday, 10 February 2023 2:31 PM  
**To:** Ashton Wahlstrom <[Ashton.Wahlstrom@ghd.com](mailto:Ashton.Wahlstrom@ghd.com)>  
**Cc:** Marc Keppler (He/His) <[Marc.Keppler@bom.gov.au](mailto:Marc.Keppler@bom.gov.au)>; Brendan Siebert <[Brendan.Siebert@ghd.com](mailto:Brendan.Siebert@ghd.com)>;  
windfarmenquiries <[windfarmenquiries@bom.gov.au](mailto:windfarmenquiries@bom.gov.au)>  
**Subject:** RE: Wind Farm EMI Assessment - Normanville Victoria [SEC=OFFICIAL]

Hi Ashton,

Thanks for contacting the Bureau on the proposed Normanville WF.

Would you please fill the attached form and send it back?

Regards  
Mohammad

**Dr. Mohammad Zomorodi**  
Radio Frequency Spectrum Manager

Data & Digital, Operational Technology & Engineering

M: 0415 524 457 | T: 03 9669 4413

Level 7, 700 Collins St, Docklands, VIC 3008

[Muhammad.Zomorodi@bom.gov.au](mailto:Muhammad.Zomorodi@bom.gov.au) | [www.bom.gov.au](http://www.bom.gov.au)



---

**From:** Ashton Wahlstrom <[Ashton.Wahlstrom@ghd.com](mailto:Ashton.Wahlstrom@ghd.com)>  
**Sent:** Wednesday, 8 February 2023 11:16 AM  
**To:** Muhammad Zomorodi <[Muhammad.Zomorodi@bom.gov.au](mailto:Muhammad.Zomorodi@bom.gov.au)>  
**Cc:** Marc Keppler (He/His) <[Marc.Keppler@bom.gov.au](mailto:Marc.Keppler@bom.gov.au)>; Brendan Siebert <[Brendan.Siebert@ghd.com](mailto:Brendan.Siebert@ghd.com)>  
**Subject:** Wind Farm EMI Assessment - Normanville Victoria

Hi Muhammad,

GHD is conducting an Electromagnetic Interference Assessment for a proposed wind farm in Normanville, Victoria. Are you able to help investigate any potential impacts that might affect the nearby weather watch radars?

I have attached the proposed wind farm boundary and turbine locations. The wind turbine generators have a maximum blade tip height of 300m and a maximum blade length of 100m (200m diameter).

Please let me know if you require any additional information.

Kind regards,

**Ashton Wahlstrom**

Graduate Engineer

**GHD**

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Level 3, 211 Victoria Square Adelaide SA 5000 Australia

D +61 8 8111 6866 E [ashton.wahlstrom@ghd.com](mailto:ashton.wahlstrom@ghd.com)

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## Ashton Wahlstrom

---

**From:** Murray, Adam MR 3 <adam.murray3@defence.gov.au> on behalf of SEG-EstatePlanningBranchExternalLandPlanning&Regulation <land.planning@defence.gov.au>  
**Sent:** Monday, 27 February 2023 1:58 PM  
**To:** Ashton Wahlstrom  
**Cc:** Brendan Siebert  
**Subject:** RE: Wind Farm EMI Assessment - Normanville Victoria [SEC=OFFICIAL]

### OFFICIAL

Good afternoon Ashton,

Apologies for the delay.

There is no impact to Defence identified from this proposal.

Kind regards,  
Adam

**Adam Murray**

Estate Strategic Planner - Land Planning and Regulation Directorate  
Estate Planning Branch | Infrastructure Division | Security and Estate Group

Department of Defence | BP26-1-A004 | Brindabella Business Park | Canberra Airport | ACT 2609  
P: (02) 5109 5509 | E: [adam.murray3@defence.gov.au](mailto:adam.murray3@defence.gov.au)

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---

**From:** Ashton Wahlstrom <[Ashton.Wahlstrom@ghd.com](mailto:Ashton.Wahlstrom@ghd.com)>  
**Sent:** Wednesday, 8 February 2023 2:05 PM  
**To:** Murray, Adam MR 3 <[adam.murray3@defence.gov.au](mailto:adam.murray3@defence.gov.au)>  
**Cc:** Brendan Siebert <[Brendan.Siebert@ghd.com](mailto:Brendan.Siebert@ghd.com)>  
**Subject:** Wind Farm EMI Assessment - Normanville Victoria

 **EXTERNAL EMAIL:** Do not click any links or open any attachments unless you trust the sender and know the content is safe. 

Hi Adam,

GHD is conducting an Electromagnetic Interference Assessment for a proposed wind farm in Normanville, Victoria.

Is it possible that you could pass this information to the correct person or team within the Department who can confirm whether there will be an impact on Defence services?

I have attached the proposed wind farm boundary and turbine locations. The wind turbine generators have a maximum blade tip height of 300m and a maximum blade length of 100m (200m diameter).

Please let me know if you require any additional information.

Kind regards,

**Ashton Wahlstrom**

Graduate Engineer

**GHD**

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Level 3, 211 Victoria Square Adelaide SA 5000 Australia

D +61 8 8111 6866 E [ashton.wahlstrom@ghd.com](mailto:ashton.wahlstrom@ghd.com)

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## Ashton Wahlstrom

---

**From:** Network\_Capacity\_Enquiries <Network\_Capacity\_Enquiries@nbnco.com.au>  
**Sent:** Wednesday, 8 February 2023 11:56 AM  
**To:** Ashton Wahlstrom  
**Cc:** Brendan Siebert; Network\_Capacity\_Enquiries  
**Subject:** Wind Farm EMI Assessment - Normanville Victoria - nbn Engineering Assessment  
**Attachments:** Normanville Turbines and Boundary (Shape Files).zip;  
Normanville\_Turbines\_and\_Boundary.zip; Normanville Turbine Lat-Long.csv

**CompleteRepository:** 12601992  
**Description:** EMI Assessment - Normanville Energy Park  
**JobNo:** 12601992  
**OperatingCentre:** 33  
**RepoEmail:** 12601992@ghd.com  
**RepoType:** Project

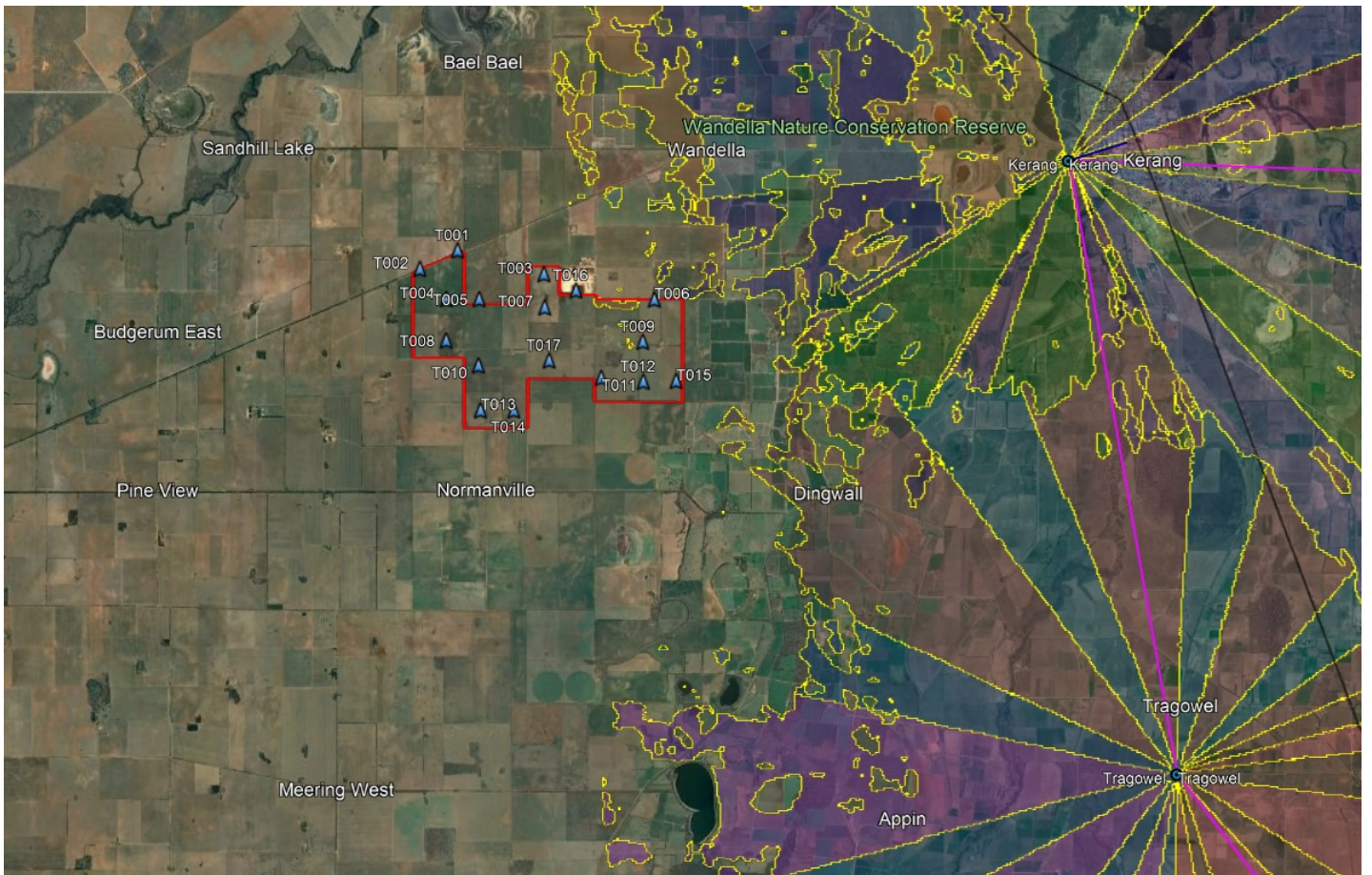
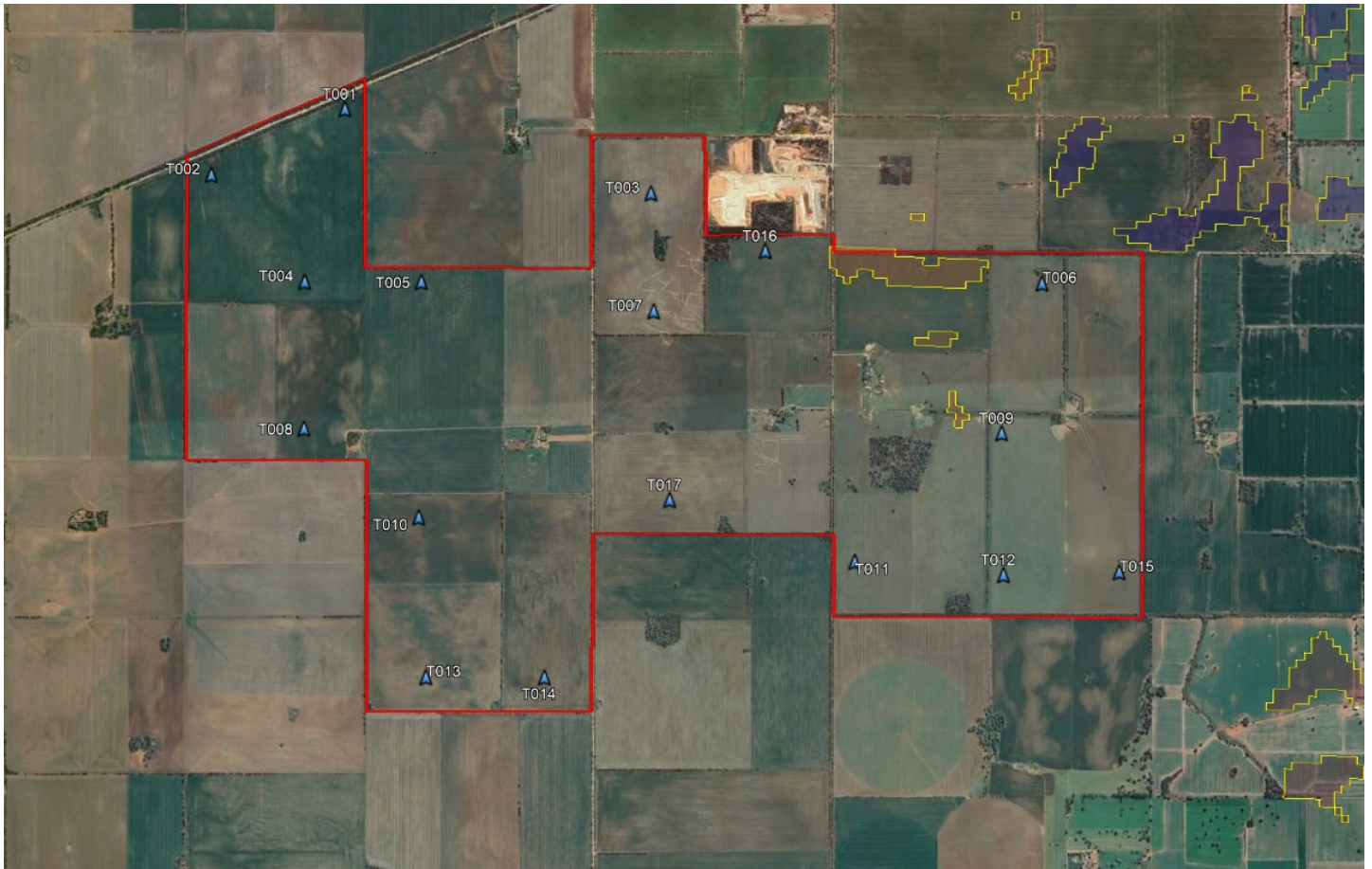
Good Morning Ashton,

Please see below Frank's review:

### Desktop Analysis

I have reviewed the data provided based on the proposed wind farm location ; The wind farm boundaries are partially inside the existing nbn wireless coverage boundaries, however none of the proposed wind tower locations pose any risk of introducing a physical obstruction to existing wireless customer RF Path Profiles or any boresight paths of existing nbn microwave links.

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Images show current operational nbn wireless coverage areas relative to wind farm location and turbines. Eastern end of the wind farm is partially inside current nbn Wireless Coverage Boundaries.

Legend: blue triangle = wind turbine, yellow line = nbn Wireless Coverage Boundary, purple line = nbn microwave link

Please provide information on any planned RF transmission equipment planned to be installed so a potential interference impact can be assessed. This information should include as a minimum, the operating transmission frequencies and transmit power, channel bandwidths, antenna types and radiation patterns as well as the exact location with antenna height, boresight azimuth and tilt [mechanical and electrical tilt.

A standard nbn response for wind farm applications regarding potential interference impact on the nbn Fixed Wireless network is as follows;

## Potential Impacts of the Proposed Hills of Normanville Wind Farm on NBN Co Spectrum Communication Assets

Referring to the email dated 7<sup>th</sup> February 2023 regarding the application for the Normanville Wind Farm .

We confirm that NBN Co Spectrum Pty Ltd (**nbn Spectrum**) has a number of spectrum licenses within 75 km of the proposed Hills of Normanville Wind Farm.

nbn have strict obligations to provide internet services to the community, and this area has been determined as a FW service area where the footprint of this service is now in place.

nbn will be forced to consider its position as part of the planning should there an interference issue.

If the Application is amended before it is lodged, we request that we are sent any amended Application so we can determine whether we have any objections to the amended Application.

We note that, as you would be aware, under section 197 of the *Radiocommunications Act 1992* (Cth) it is an offence to knowingly or recklessly do anything likely to interfere substantially with radiocommunications or otherwise substantially disrupt or disturb radiocommunications.

*regards,*  
*Frank*

Thank you

**Whitney Tucker**  
Escalations and Complaints Business Partner  
Regional Development & Engagement

*Please note workdays: Monday to Thursday*

**M** +61 429 682 709 | **E** [whitneytucker@nbnco.com.au](mailto:whitneytucker@nbnco.com.au)

Level 4, 202 Pier Street Perth, WA 6000

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**From:** Ashton Wahlstrom <[Ashton.Wahlstrom@ghd.com](mailto:Ashton.Wahlstrom@ghd.com)>  
**Sent:** Tuesday, 7 February 2023 4:33 PM  
**To:** Frank Van Rooden <[FrankVanRooden@nbnco.com.au](mailto:FrankVanRooden@nbnco.com.au)>  
**Cc:** Network\_Capacity\_Enquiries <[Network\\_Capacity\\_Enquiries@nbnco.com.au](mailto:Network_Capacity_Enquiries@nbnco.com.au)>; Shante Craven <[shantecraven@nbnco.com.au](mailto:shantecraven@nbnco.com.au)>; Brendan Siebert <[Brendan.Siebert@ghd.com](mailto:Brendan.Siebert@ghd.com)>  
**Subject:** [External] Wind Farm EMI Assessment - Normanville Victoria

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Hi Frank,

GHD is conducting an Electromagnetic Interference Assessment for a proposed wind farm in Normanville, Victoria.

According to the public ACMA database, NBNC Co has been identified to have assets in the vicinity of the proposed wind farm development area and have been analysed based on the information in the database.

The licensed point to point links details listed on the database online have been analysed and we predict there to be no impact to NBNC Co, however, point to multi-point services are not detailed in the ACMA database.

Can you confirm that there will be no impact on NBNC Co, or otherwise identify potential impacts that this wind farm development may have on NBNC Co?

I have attached the proposed wind farm boundary and turbine locations. The wind turbine generators have a maximum blade tip height of 300m with a maximum blade length of 100m (200m diameter).

Please let me know if you require any additional information.

Kind regards,

**Ashton Wahlstrom**

Graduate Engineer

GHD

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## Ashton Wahlstrom

---

**From:** Ashton Wahlstrom  
**Sent:** Tuesday, 7 February 2023 4:58 PM  
**To:** 'Ron Vesely'; Greg Dunn; Michael Odogwu  
**Cc:** Brendan Siebert  
**Subject:** RE: Wind Farm EMI Assessment - Normanville Victoria  
**Attachments:** Normanville Turbine Lat-Long.csv

Thanks Ron,

I've attached a csv with the Lat/Long of each wind turbine.

Kind regards,

**Ashton Wahlstrom**

Graduate Engineer

GHD

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**From:** Ron Vesely <[Ron.Vesely@optus.com.au](mailto:Ron.Vesely@optus.com.au)>

**Sent:** Tuesday, 7 February 2023 2:13 PM

**To:** Greg Dunn <[Greg.Dunn@optus.com.au](mailto:Greg.Dunn@optus.com.au)>; Ashton Wahlstrom <[Ashton.Wahlstrom@ghd.com](mailto:Ashton.Wahlstrom@ghd.com)>; Michael Odogwu <[Michael.Odogwu@optus.com.au](mailto:Michael.Odogwu@optus.com.au)>

**Cc:** Brendan Siebert <[Brendan.Siebert@ghd.com](mailto:Brendan.Siebert@ghd.com)>

**Subject:** RE: Wind Farm EMI Assessment - Normanville Victoria

You don't often get email from [ron.vesely@optus.com.au](mailto:ron.vesely@optus.com.au). [Learn why this is important](#)

Thanks Greg,

Hi Ashton, are you able to send us the Lat/Long of each Wind tower?

Hi Michael, from a Tx perspective there a number of Radio Tx units in the area. Are you able to review if there is any potential LOS issues once the Wind towers are constructed at Normanville VIC. Exact Lat/Long to be provided. Closest site is 7.4km from Normanville township with 3 additional sites within 17-20km.

WA ID	Optus Site No	Optus Site Name	AOP Program	AOP Subprogram	Tech Type	Work Type	Proposed TU Config	RFNSA Number	Optus Site Code
357219	M2404	LAKE MERAN	Greenfield (OO)	Regional Blackspot	BUILD	Greenfield	-	3579012	RMCK

Show fields last updated popup log

Details | Milestones | **Transmission** | Tags | IBC | Diary | E/N | NTQ | Site/TU Details | Work Request Summary | PO Summary | PORF Summary | HOP Summary | Project Bookier | Impacted Tail

Back Save

Tx EO

NTU EO

Tx Order Date

Tx Program

Tx Supplier

Tx Medium

Regards,  
**Ron Vesely**  
 Manager State Radio Planning and Quality VIC/TAS | Access Network Strategy Planning and Quality | Networks  
 03 9033 8326  
 0403 500 650  
 Level 3, 271 Collins Street, Melbourne VIC 3000  
[ron.vesely@optus.com.au](mailto:ron.vesely@optus.com.au)



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**From:** Greg Dunn  
**Sent:** Tuesday, 7 February 2023 1:53 PM  
**To:** Ashton Wahlstrom <[Ashton.Wahlstrom@ghd.com](mailto:Ashton.Wahlstrom@ghd.com)>; Ron Vesely <[Ron.Vesely@optus.com.au](mailto:Ron.Vesely@optus.com.au)>  
**Cc:** Brendan Siebert <[Brendan.Siebert@ghd.com](mailto:Brendan.Siebert@ghd.com)>  
**Subject:** RE: Wind Farm EMI Assessment - Normanville Victoria

Hi Ashton,

I will refer this enquiry to my Victorian counterpart Ron Vesely – for response

Regards

**Greg Dunn**

Manager State Radio Planning and Quality QLD | Mobile Radio Planning & Quality | Networks  
 Consumer | Optus  
 OCB Level 6

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**From:** Ashton Wahlstrom <[Ashton.Wahlstrom@ghd.com](mailto:Ashton.Wahlstrom@ghd.com)>  
**Sent:** Tuesday, 7 February 2023 12:15 PM  
**To:** Greg Dunn <[Greg.Dunn@optus.com.au](mailto:Greg.Dunn@optus.com.au)>  
**Cc:** [James.Baker@optus.com.au](mailto:James.Baker@optus.com.au); Brendan Siebert <[Brendan.Siebert@ghd.com](mailto:Brendan.Siebert@ghd.com)>  
**Subject:** Wind Farm EMI Assessment - Normanville Victoria

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---

Hello Greg,

GHD is conducting an Electromagnetic Interference Assessment for a proposed wind farm in Normanville, Victoria.

According to the public ACMA database, Optus has been identified to have assets in the vicinity of the proposed wind farm development area and have been analysed based on the information in the database.

The licensed point to point links details listed on the database online have been analysed and we predict there to be no impact to Optus, however, point to multi-point services are not detailed in the ACMA database.

Is it possible that you could pass this information to the correct person in Optus, who can confirm that there will be no impact on Optus, or otherwise can identify potential impacts that this wind farm development may have on Optus?

I have attached the proposed wind farm boundary and turbine locations. The wind turbine generators have a maximum blade tip height of 300m with a maximum blade length of 100m (200m diameter).

Please let me know if you require any additional information.

Kind regards,

**Ashton Wahlstrom**

Graduate Engineer

**GHD**

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## Ashton Wahlstrom

---

**From:** Ashton Wahlstrom  
**Sent:** Tuesday, 7 February 2023 11:54 AM  
**To:** Colin.Partridge1@team.telstra.com  
**Cc:** WindfarmAssesmentRequests@team.telstra.com; Brad.Richards@team.telstra.com; Brendan Siebert  
**Subject:** Wind Farm EMI Assessment - Normanville Victoria  
**Attachments:** Normanville\_Turbines\_and\_Boundary.zip; Normanville Turbines and Boundary (Shape Files).zip

Hello Colin,

GHD is conducting an Electromagnetic Interference Assessment for a proposed wind farm in Normanville, Victoria.

According to the public ACMA database, Telstra has been identified to have assets in the vicinity (the nearest Telstra transmitter is at 5 Brady Lane Sandhill Lake (Site ID 10018181)) of the proposed wind farm development area and have been analysed based on the information in the database.

The licensed point to point links details listed on the database online have been analysed and we predict there to be no impact to Telstra, however, point to multi-point services are not detailed in the ACMA database.

Is it possible that you could pass this information to the correct person in Telstra, who can confirm that there will be no impact on Telstra, or otherwise can identify potential impacts that this wind farm development may have on Telstra?

I have attached the proposed wind farm boundary and turbine locations. The wind turbine generators have a maximum blade tip height of 300m with a maximum blade length of 100m (200m diameter).

Please let me know if you require any additional information.

Kind regards,

**Ashton Wahlstrom**

Graduate Engineer

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## Ashton Wahlstrom

---

**From:** Ashton Wahlstrom  
**Sent:** Tuesday, 7 February 2023 2:13 PM  
**To:** 'Colin.Lee@Nokia.com'; 'Syed.Mohyuddin@tpgtelecom.com.au'  
**Cc:** Brendan Siebert  
**Subject:** Wind Farm EMI Assessment - Normanville Victoria  
**Attachments:** Normanville Turbines and Boundary (Shape Files).zip;  
Normanville\_Turbines\_and\_Boundary.zip

**CompleteRepository:** 12601992  
**Description:** EMI Assessment - Normanville Energy Park  
**JobNo:** 12601992  
**OperatingCentre:** 33  
**RepoEmail:** 12601992@ghd.com  
**RepoType:** Proposal

Hi Colin and Syed,

I was provided your contact details by an engineer at Vodafone who believed you could assist me.

GHD is conducting an Electromagnetic Interference Assessment for a proposed wind farm in Normanville, Victoria.

According to the public ACMA database, Vodafone has been identified to have assets in the vicinity of the proposed wind farm development area and have been analysed based on the information in the database.

The licensed point to point links details listed on the database online have been analysed and we predict there to be no impact to Vodafone, however, point to multi-point services are not detailed in the ACMA database.

Is it possible for you to confirm that there will be no impact on Vodafone's services, or otherwise identify potential impacts that this wind farm development may have on Vodafone?

I have attached the proposed wind farm boundary and turbine locations. The wind turbine generators have a maximum blade tip height of 300m with a maximum blade length of 100m (200m diameter).

Please let me know if you require any additional information.

Kind regards,

**Ashton Wahlstrom**

Graduate Engineer

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## Ashton Wahlstrom

---

**From:** Mohammad Zomorodi <Mohammad.Zomorodi@bom.gov.au>  
**Sent:** Thursday, 23 February 2023 1:34 PM  
**To:** Ashton Wahlstrom  
**Cc:** Marc Keppler (He/His); Brendan Siebert; windfarmenquiries  
**Subject:** Re: Wind Farm EMI Assessment - Normanville Victoria [SEC=OFFICIAL]

Hi Ashton,

We have finalized our assessment through desktop analysis for the proposed Normanville windfarm.

The assessment shows manageable impact on the Bureau of Meteorology's assets, specifically on its weather radar network, in normal atmospheric/propagation conditions. As such, the Bureau could conditionally agree to this project.

The Bureau requires a letter from the farm developer/owner to acknowledge that the operation of the proposed wind farm will include the following commitments:

1. Informing the Bureau of significant variation in turbine layout (i.e. by more than 100 m in any lateral direction, or alteration of tip height) between the initial plan and construction.
2. Providing advance notice (one week preferably) to the Bureau of any planned wind farm shutdown events for more than 12 hours, to allow the recalibration of radar systems.
3. Collaborate with the Bureau in the event of severe weather conditions to assist in endeavour of community safety.

Please don't hesitate to contact me should you require any further details.

Regards  
Mohammad

**Dr. Mohammad Zomorodi**

Radio Frequency Spectrum Manager

Data & Digital, Operational Technology & Engineering

M: 0415 524 457 | T: 03 9669 4413

Level 7, 700 Collins St, Docklands, VIC 3008

[Mohammad.Zomorodi@bom.gov.au](mailto:Mohammad.Zomorodi@bom.gov.au) | [www.bom.gov.au](http://www.bom.gov.au)

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**From:** Ashton Wahlstrom <[Ashton.Wahlstrom@ghd.com](mailto:Ashton.Wahlstrom@ghd.com)>  
**Sent:** Tuesday, 21 February 2023 11:42 AM  
**To:** Mohammad Zomorodi <[Mohammad.Zomorodi@bom.gov.au](mailto:Mohammad.Zomorodi@bom.gov.au)>  
**Cc:** Marc Keppler (He/His) <[Marc.Keppler@bom.gov.au](mailto:Marc.Keppler@bom.gov.au)>; Brendan Siebert <[Brendan.Siebert@ghd.com](mailto:Brendan.Siebert@ghd.com)>;  
windfarmenquiries <[windfarmenquiries@bom.gov.au](mailto:windfarmenquiries@bom.gov.au)>  
**Subject:** RE: Wind Farm EMI Assessment - Normanville Victoria [SEC=OFFICIAL]

Hi Mohammad,

Apologies for the delay - I've attached the completed form and additional requested information.

Kind regards,

**Ashton Wahlstrom**  
Graduate Engineer

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**From:** Mohammad Zomorodi <[Mohammad.Zomorodi@bom.gov.au](mailto:Mohammad.Zomorodi@bom.gov.au)>  
**Sent:** Friday, 10 February 2023 2:31 PM  
**To:** Ashton Wahlstrom <[Ashton.Wahlstrom@ghd.com](mailto:Ashton.Wahlstrom@ghd.com)>  
**Cc:** Marc Keppler (He/His) <[Marc.Keppler@bom.gov.au](mailto:Marc.Keppler@bom.gov.au)>; Brendan Siebert <[Brendan.Siebert@ghd.com](mailto:Brendan.Siebert@ghd.com)>;  
windfarmenquiries <[windfarmenquiries@bom.gov.au](mailto:windfarmenquiries@bom.gov.au)>  
**Subject:** RE: Wind Farm EMI Assessment - Normanville Victoria [SEC=OFFICIAL]

Hi Ashton,

Thanks for contacting the Bureau on the proposed Normanville WF.

Would you please fill the attached form and send it back?

Regards  
Mohammad

**Dr. Mohammad Zomorodi**  
Radio Frequency Spectrum Manager

Data & Digital, Operational Technology & Engineering

M: 0415 524 457 | T: 03 9669 4413

Level 7, 700 Collins St, Docklands, VIC 3008

[Muhammad.Zomorodi@bom.gov.au](mailto:Muhammad.Zomorodi@bom.gov.au) | [www.bom.gov.au](http://www.bom.gov.au)



---

**From:** Ashton Wahlstrom <[Ashton.Wahlstrom@ghd.com](mailto:Ashton.Wahlstrom@ghd.com)>  
**Sent:** Wednesday, 8 February 2023 11:16 AM  
**To:** Muhammad Zomorodi <[Muhammad.Zomorodi@bom.gov.au](mailto:Muhammad.Zomorodi@bom.gov.au)>  
**Cc:** Marc Keppler (He/His) <[Marc.Keppler@bom.gov.au](mailto:Marc.Keppler@bom.gov.au)>; Brendan Siebert <[Brendan.Siebert@ghd.com](mailto:Brendan.Siebert@ghd.com)>  
**Subject:** Wind Farm EMI Assessment - Normanville Victoria

Hi Muhammad,

GHD is conducting an Electromagnetic Interference Assessment for a proposed wind farm in Normanville, Victoria. Are you able to help investigate any potential impacts that might affect the nearby weather watch radars?

I have attached the proposed wind farm boundary and turbine locations. The wind turbine generators have a maximum blade tip height of 300m and a maximum blade length of 100m (200m diameter).

Please let me know if you require any additional information.

Kind regards,

**Ashton Wahlstrom**

Graduate Engineer

**GHD**

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## Ashton Wahlstrom

---

**From:** Murray, Adam MR 3 <adam.murray3@defence.gov.au> on behalf of SEG-EstatePlanningBranchExternalLandPlanning&Regulation <land.planning@defence.gov.au>  
**Sent:** Monday, 27 February 2023 1:58 PM  
**To:** Ashton Wahlstrom  
**Cc:** Brendan Siebert  
**Subject:** RE: Wind Farm EMI Assessment - Normanville Victoria [SEC=OFFICIAL]

### OFFICIAL

Good afternoon Ashton,

Apologies for the delay.

There is no impact to Defence identified from this proposal.

Kind regards,  
Adam

**Adam Murray**

Estate Strategic Planner - Land Planning and Regulation Directorate  
Estate Planning Branch | Infrastructure Division | Security and Estate Group

Department of Defence | BP26-1-A004 | Brindabella Business Park | Canberra Airport | ACT 2609  
P: (02) 5109 5509 | E: [adam.murray3@defence.gov.au](mailto:adam.murray3@defence.gov.au)

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**From:** Ashton Wahlstrom <[Ashton.Wahlstrom@ghd.com](mailto:Ashton.Wahlstrom@ghd.com)>  
**Sent:** Wednesday, 8 February 2023 2:05 PM  
**To:** Murray, Adam MR 3 <[adam.murray3@defence.gov.au](mailto:adam.murray3@defence.gov.au)>  
**Cc:** Brendan Siebert <[Brendan.Siebert@ghd.com](mailto:Brendan.Siebert@ghd.com)>  
**Subject:** Wind Farm EMI Assessment - Normanville Victoria

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Hi Adam,

GHD is conducting an Electromagnetic Interference Assessment for a proposed wind farm in Normanville, Victoria.

Is it possible that you could pass this information to the correct person or team within the Department who can confirm whether there will be an impact on Defence services?

I have attached the proposed wind farm boundary and turbine locations. The wind turbine generators have a maximum blade tip height of 300m and a maximum blade length of 100m (200m diameter).

Please let me know if you require any additional information.

Kind regards,

**Ashton Wahlstrom**

Graduate Engineer

**GHD**

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## Ashton Wahlstrom

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**From:** Network\_Capacity\_Enquiries <Network\_Capacity\_Enquiries@nbnco.com.au>  
**Sent:** Wednesday, 8 February 2023 11:56 AM  
**To:** Ashton Wahlstrom  
**Cc:** Brendan Siebert; Network\_Capacity\_Enquiries  
**Subject:** Wind Farm EMI Assessment - Normanville Victoria - nbn Engineering Assessment  
**Attachments:** Normanville Turbines and Boundary (Shape Files).zip;  
Normanville\_Turbines\_and\_Boundary.zip; Normanville Turbine Lat-Long.csv

**CompleteRepository:** 12601992  
**Description:** EMI Assessment - Normanville Energy Park  
**JobNo:** 12601992  
**OperatingCentre:** 33  
**RepoEmail:** 12601992@ghd.com  
**RepoType:** Project

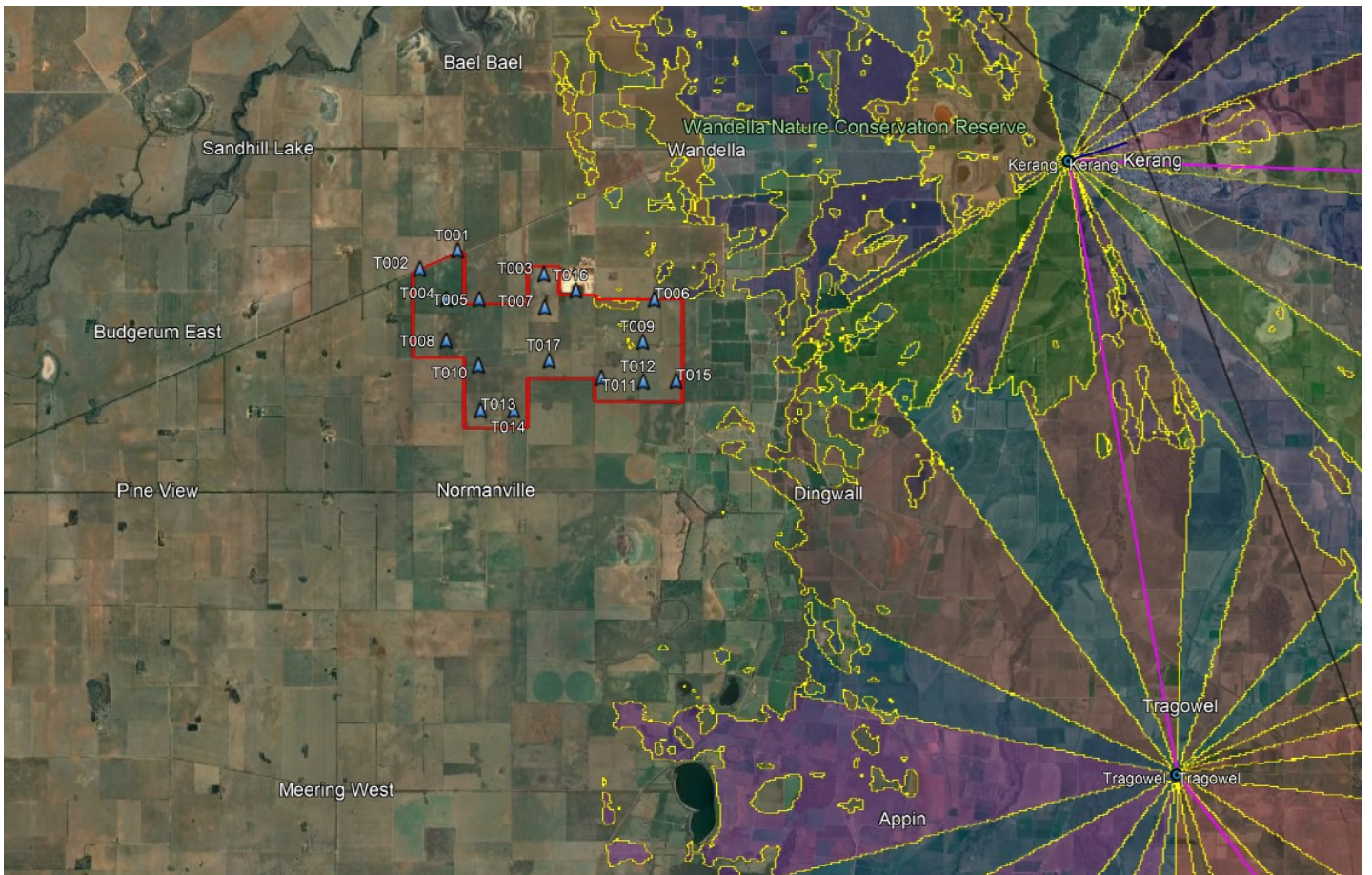
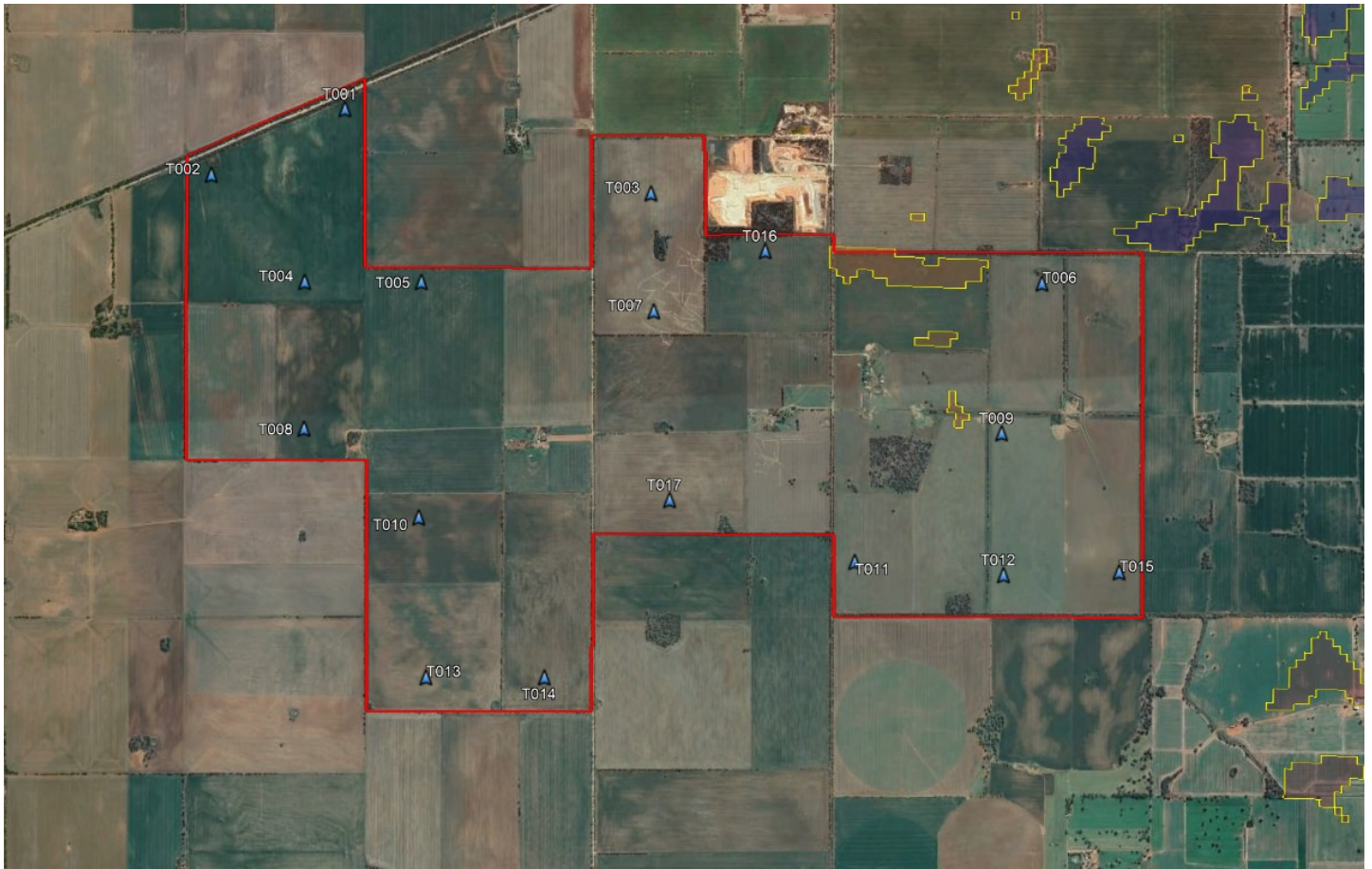
Good Morning Ashton,

Please see below Frank's review:

### Desktop Analysis

I have reviewed the data provided based on the proposed wind farm location ; The wind farm boundaries are partially inside the existing nbn wireless coverage boundaries, however none of the proposed wind tower locations pose any risk of introducing a physical obstruction to existing wireless customer RF Path Profiles or any boresight paths of existing nbn microwave links.

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Images show current operational nbn wireless coverage areas relative to wind farm location and turbines. Eastern end of the wind farm is partially inside current nbn Wireless Coverage Boundaries.

Legend: blue triangle = wind turbine, yellow line = nbn Wireless Coverage Boundary, purple line = nbn microwave link

Please provide information on any planned RF transmission equipment planned to be installed so a potential interference impact can be assessed. This information should include as a minimum, the operating transmission frequencies and transmit power, channel bandwidths, antenna types and radiation patterns as well as the exact location with antenna height, boresight azimuth and tilt [mechanical and electrical tilt.

A standard nbn response for wind farm applications regarding potential interference impact on the nbn Fixed Wireless network is as follows;

## Potential Impacts of the Proposed Hills of Normanville Wind Farm on NBN Co Spectrum Communication Assets

Referring to the email dated 7<sup>th</sup> February 2023 regarding the application for the Normanville Wind Farm .

We confirm that NBN Co Spectrum Pty Ltd (**nbn Spectrum**) has a number of spectrum licenses within 75 km of the proposed Hills of Normanville Wind Farm.

nbn have strict obligations to provide internet services to the community, and this area has been determined as a FW service area where the footprint of this service is now in place.

nbn will be forced to consider its position as part of the planning should there an interference issue.

If the Application is amended before it is lodged, we request that we are sent any amended Application so we can determine whether we have any objections to the amended Application.

We note that, as you would be aware, under section 197 of the *Radiocommunications Act 1992* (Cth) it is an offence to knowingly or recklessly do anything likely to interfere substantially with radiocommunications or otherwise substantially disrupt or disturb radiocommunications.

*regards,*  
*Frank*

Thank you

**Whitney Tucker**  
Escalations and Complaints Business Partner  
Regional Development & Engagement

*Please note workdays: Monday to Thursday*

**M** +61 429 682 709 | **E** [whitneytucker@nbnco.com.au](mailto:whitneytucker@nbnco.com.au)

Level 4, 202 Pier Street Perth, WA 6000

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**From:** Ashton Wahlstrom <[Ashton.Wahlstrom@ghd.com](mailto:Ashton.Wahlstrom@ghd.com)>  
**Sent:** Tuesday, 7 February 2023 4:33 PM  
**To:** Frank Van Rooden <[FrankVanRooden@nbnco.com.au](mailto:FrankVanRooden@nbnco.com.au)>  
**Cc:** Network\_Capacity\_Enquiries <[Network\\_Capacity\\_Enquiries@nbnco.com.au](mailto:Network_Capacity_Enquiries@nbnco.com.au)>; Shante Craven <[shantecraven@nbnco.com.au](mailto:shantecraven@nbnco.com.au)>; Brendan Siebert <[Brendan.Siebert@ghd.com](mailto:Brendan.Siebert@ghd.com)>  
**Subject:** [External] Wind Farm EMI Assessment - Normanville Victoria

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Hi Frank,

GHD is conducting an Electromagnetic Interference Assessment for a proposed wind farm in Normanville, Victoria.

According to the public ACMA database, NBNC Co has been identified to have assets in the vicinity of the proposed wind farm development area and have been analysed based on the information in the database.

The licensed point to point links details listed on the database online have been analysed and we predict there to be no impact to NBNC Co, however, point to multi-point services are not detailed in the ACMA database.

Can you confirm that there will be no impact on NBNC Co, or otherwise identify potential impacts that this wind farm development may have on NBNC Co?

I have attached the proposed wind farm boundary and turbine locations. The wind turbine generators have a maximum blade tip height of 300m with a maximum blade length of 100m (200m diameter).

Please let me know if you require any additional information.

Kind regards,

**Ashton Wahlstrom**

Graduate Engineer

GHD

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Level 3, 211 Victoria Square Adelaide SA 5000 Australia

D +61 8 8111 6866 E [ashton.wahlstrom@ghd.com](mailto:ashton.wahlstrom@ghd.com)

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## Ashton Wahlstrom

---

**From:** Ashton Wahlstrom  
**Sent:** Tuesday, 7 February 2023 4:58 PM  
**To:** 'Ron Vesely'; Greg Dunn; Michael Odogwu  
**Cc:** Brendan Siebert  
**Subject:** RE: Wind Farm EMI Assessment - Normanville Victoria  
**Attachments:** Normanville Turbine Lat-Long.csv

Thanks Ron,

I've attached a csv with the Lat/Long of each wind turbine.

Kind regards,

**Ashton Wahlstrom**

Graduate Engineer

GHD

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Level 3, 211 Victoria Square Adelaide SA 5000 Australia

D +61 8 8111 6866 E [ashton.wahlstrom@ghd.com](mailto:ashton.wahlstrom@ghd.com)

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**From:** Ron Vesely <[Ron.Vesely@optus.com.au](mailto:Ron.Vesely@optus.com.au)>

**Sent:** Tuesday, 7 February 2023 2:13 PM

**To:** Greg Dunn <[Greg.Dunn@optus.com.au](mailto:Greg.Dunn@optus.com.au)>; Ashton Wahlstrom <[Ashton.Wahlstrom@ghd.com](mailto:Ashton.Wahlstrom@ghd.com)>; Michael Odogwu <[Michael.Odogwu@optus.com.au](mailto:Michael.Odogwu@optus.com.au)>

**Cc:** Brendan Siebert <[Brendan.Siebert@ghd.com](mailto:Brendan.Siebert@ghd.com)>

**Subject:** RE: Wind Farm EMI Assessment - Normanville Victoria

You don't often get email from [ron.vesely@optus.com.au](mailto:ron.vesely@optus.com.au). [Learn why this is important](#)

Thanks Greg,

Hi Ashton, are you able to send us the Lat/Long of each Wind tower?

Hi Michael, from a Tx perspective there a number of Radio Tx units in the area. Are you able to review if there is any potential LOS issues once the Wind towers are constructed at Normanville VIC. Exact Lat/Long to be provided. Closest site is 7.4km from Normanville township with 3 additional sites within 17-20km.

WA ID	Optus Site No	Optus Site Name	AOP Program	AOP Subprogram	Tech Type	Work Type	Proposed TU Config	RFNSA Number	Optus Site Code
357219	M2404	LAKE MERAN	Greenfield (OO)	Regional Blackspot	BUILD	Greenfield	-	3579012	RMCK

Show fields last updated popup log

Details | Milestones | **Transmission** | Tags | IBC | Diary | E/N | NTQ | Site/TU Details | Work Request Summary | PO Summary | PORF Summary | HOP Summary | Project Bookier | Impacted Tail

Back Save

Tx EO

NTU EO

Tx Order Date

Tx Program

Tx Supplier

Tx Medium

Regards,  
**Ron Vesely**  
 Manager State Radio Planning and Quality VIC/TAS | Access Network Strategy Planning and Quality | Networks  
 03 9033 8326  
 0403 500 650  
 Level 3, 271 Collins Street, Melbourne VIC 3000  
[ron.vesely@optus.com.au](mailto:ron.vesely@optus.com.au)



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**From:** Greg Dunn  
**Sent:** Tuesday, 7 February 2023 1:53 PM  
**To:** Ashton Wahlstrom <[Ashton.Wahlstrom@ghd.com](mailto:Ashton.Wahlstrom@ghd.com)>; Ron Vesely <[Ron.Vesely@optus.com.au](mailto:Ron.Vesely@optus.com.au)>  
**Cc:** Brendan Siebert <[Brendan.Siebert@ghd.com](mailto:Brendan.Siebert@ghd.com)>  
**Subject:** RE: Wind Farm EMI Assessment - Normanville Victoria

Hi Ashton,

I will refer this enquiry to my Victorian counterpart Ron Vesely – for response

Regards

**Greg Dunn**

Manager State Radio Planning and Quality QLD | Mobile Radio Planning & Quality | Networks  
 Consumer | Optus  
 OCB Level 6

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**From:** Ashton Wahlstrom <[Ashton.Wahlstrom@ghd.com](mailto:Ashton.Wahlstrom@ghd.com)>  
**Sent:** Tuesday, 7 February 2023 12:15 PM  
**To:** Greg Dunn <[Greg.Dunn@optus.com.au](mailto:Greg.Dunn@optus.com.au)>  
**Cc:** [James.Baker@optus.com.au](mailto:James.Baker@optus.com.au); Brendan Siebert <[Brendan.Siebert@ghd.com](mailto:Brendan.Siebert@ghd.com)>  
**Subject:** Wind Farm EMI Assessment - Normanville Victoria

[External email] Please be cautious when clicking on any links or attachments.

---

Hello Greg,

GHD is conducting an Electromagnetic Interference Assessment for a proposed wind farm in Normanville, Victoria.

According to the public ACMA database, Optus has been identified to have assets in the vicinity of the proposed wind farm development area and have been analysed based on the information in the database.

The licensed point to point links details listed on the database online have been analysed and we predict there to be no impact to Optus, however, point to multi-point services are not detailed in the ACMA database.

Is it possible that you could pass this information to the correct person in Optus, who can confirm that there will be no impact on Optus, or otherwise can identify potential impacts that this wind farm development may have on Optus?

I have attached the proposed wind farm boundary and turbine locations. The wind turbine generators have a maximum blade tip height of 300m with a maximum blade length of 100m (200m diameter).

Please let me know if you require any additional information.

Kind regards,

**Ashton Wahlstrom**

Graduate Engineer

**GHD**

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**D** +61 8 8111 6866 **E** [ashton.wahlstrom@ghd.com](mailto:ashton.wahlstrom@ghd.com)

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## Ashton Wahlstrom

---

**From:** Ashton Wahlstrom  
**Sent:** Tuesday, 7 February 2023 11:54 AM  
**To:** Colin.Partridge1@team.telstra.com  
**Cc:** WindfarmAssesmentRequests@team.telstra.com; Brad.Richards@team.telstra.com; Brendan Siebert  
**Subject:** Wind Farm EMI Assessment - Normanville Victoria  
**Attachments:** Normanville\_Turbines\_and\_Boundary.zip; Normanville Turbines and Boundary (Shape Files).zip

Hello Colin,

GHD is conducting an Electromagnetic Interference Assessment for a proposed wind farm in Normanville, Victoria.

According to the public ACMA database, Telstra has been identified to have assets in the vicinity (the nearest Telstra transmitter is at 5 Brady Lane Sandhill Lake (Site ID 10018181)) of the proposed wind farm development area and have been analysed based on the information in the database.

The licensed point to point links details listed on the database online have been analysed and we predict there to be no impact to Telstra, however, point to multi-point services are not detailed in the ACMA database.

Is it possible that you could pass this information to the correct person in Telstra, who can confirm that there will be no impact on Telstra, or otherwise can identify potential impacts that this wind farm development may have on Telstra?

I have attached the proposed wind farm boundary and turbine locations. The wind turbine generators have a maximum blade tip height of 300m with a maximum blade length of 100m (200m diameter).

Please let me know if you require any additional information.

Kind regards,

**Ashton Wahlstrom**

Graduate Engineer

**GHD**

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## Ashton Wahlstrom

---

**From:** Ashton Wahlstrom  
**Sent:** Tuesday, 7 February 2023 2:13 PM  
**To:** 'Colin.Lee@Nokia.com'; 'Syed.Mohyuddin@tpgtelecom.com.au'  
**Cc:** Brendan Siebert  
**Subject:** Wind Farm EMI Assessment - Normanville Victoria  
**Attachments:** Normanville Turbines and Boundary (Shape Files).zip;  
Normanville\_Turbines\_and\_Boundary.zip

**CompleteRepository:** 12601992  
**Description:** EMI Assessment - Normanville Energy Park  
**JobNo:** 12601992  
**OperatingCentre:** 33  
**RepoEmail:** 12601992@ghd.com  
**RepoType:** Proposal

Hi Colin and Syed,

I was provided your contact details by an engineer at Vodafone who believed you could assist me.

GHD is conducting an Electromagnetic Interference Assessment for a proposed wind farm in Normanville, Victoria.

According to the public ACMA database, Vodafone has been identified to have assets in the vicinity of the proposed wind farm development area and have been analysed based on the information in the database.

The licensed point to point links details listed on the database online have been analysed and we predict there to be no impact to Vodafone, however, point to multi-point services are not detailed in the ACMA database.

Is it possible for you to confirm that there will be no impact on Vodafone's services, or otherwise identify potential impacts that this wind farm development may have on Vodafone?

I have attached the proposed wind farm boundary and turbine locations. The wind turbine generators have a maximum blade tip height of 300m with a maximum blade length of 100m (200m diameter).

Please let me know if you require any additional information.

Kind regards,

**Ashton Wahlstrom**

Graduate Engineer

**GHD**

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# Appendix D

Radio sites in vicinity of wind farm ACMA  
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**Table 1** Fixed Point-to-Point Radio Links

Radio Site A   Radio Site B	Site ID A   Site ID B	Licence No.	Licensee	Site A Location   Site B Location	Operating Frequency A   Operating Frequency B
Cnr Sea Lake & Swan Hill Rd & Dead Horse Lane SWAN HILL  Powercor Radio Site SANDHILL LAKE	300875	1319626/2	Powercor Australia Ltd	-35.345428, 143.522897	414.20 MHz
	303438			-35.746911, 143.732865	404.75 MHz
Kerang Terminal Station 4121 Loddon Valley Hwy KERANG  Gannawarra Solar Farm 1.7km NW cnr Lalbert-Kerang Rd and Denyer Rd BAEL BAEL	10002229	10143680/1	Powercor Australia Ltd	-35.771297, 143.933107	410.05 MHz
	10002185			-35.727961, 143.760797	419.50 MHz

**Table 2** Point-to-Multipoint Radio Links

Site Name	Site ID	Licence No.	Licensee	Location	Operating Frequency
Node 54000, Mystic Park East Rd Kangaroo Lake	10016654	10670588/1	Goulburn-Murray Rural Water Corporation	-35.553824, 143.762008	461.10 MHz

**Table 3** Land Mobile Radio Systems

Site Name	Site ID	Licence No.	Licensee	Location	Operating Frequency
1131 Quambatook-Kerang Rd WANDELLA	140470	1947796/1 1947797/1 1947798/1	Country Fire Authority	-35.746071, 143.777768	161.025 MHz 161.05 MHz 161.125 MHz

**Table 4** Digital Television Broadcast and AM/FM Narrowcast and Broadcast

Site Name	Site ID	Licence No.	Licensee	Location	Operating Frequency
Water Tower cnr Vaughan & Nolan Streets KERANG	42703	483607/1	United Christian Broadcasters Australia Limited	-35.729223, 143.917957	88 MHz
21 Armstrong Street BOORT	10003959	9862288/2		-36.112231, 143.730838	87.6 MHz
50 Mellool Street BARHAM	10027512	511799/3		-35.62678, 144.126605	88 MHz
77 McCallum Street SWAN HILL	301399	484578/1	Ace Radio Broadcasters Pty Limited	-35.339294, 143.557359	88 MHz
Cnr Channel Cohuna and Lietch COHUNA	52188	483556/1	Seventh-day Adventist Church (Australian Union Conf.) Ltd	-35.812656, 144.212699	88 MHz

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Site Name	Site ID	Licence No.	Licensee	Location	Operating Frequency
77 McCallum Street SWAN HILL	301399	1319464/4	NICHE RADIO NETWORK PTY LTD	-35.339294, 143.557359	87.6 MHz
93 Godfrey Street BOORT	138711	1920616/2	Ian Munro	-36.116258, 143.723421	88 MHz
Site 6-8 Niemur St BARHAM	10007867	10333685/1	Raymond Oaff	-35.630914, 144.129065	87.6 MHz
Lot 1 Bryans Road PENTAL ISLAND	303078	1137145/1	W & L Phillips Pty Limited	-35.363042, 143.585068	1.629 MHz
18 Victoria Street PYRAMID HILL	137165	1569541/1	Gregory Symes	-36.055589, 144.113889	88 MHz
28 Victoria Street KERANG	137703	1904884/1		-35.734319, 143.920067	87.6 MHz
13-15 Market Street COHUNA	137514	1902459/1		-35.81051, 144.22239	87.6 MHz
72 Leitchville Road LEITCHVILLE	136819	1562101/1		-35.908338, 144.301938	88 MHz
Lot 6 Blackwire Road SWAN HILL	302811	1136957/1	Gumnut Nominees Pty Ltd	-35.334571, 143.481309	1.611 MHz

Table 5 Mobile Telephone and Internet Broadcast Sites

Site Name	Site ID	Licence No.	Licensee	Location	Operating Frequency
BARHAM Telstra monopole 12 View St., Koondrook BARHAM	10003005	10094269/94 1136358/1 10941473/1	Optus Mobile Pty Limited	-35.634346, 144.122942	2.1475 GHz 2.1425 GHz 947.6 MHz 11.645 GHz
Boort Mcmillans Rd BOORT VIC 3537	9011676			-36.108882, 143.734915	2.1475 GHz 2.1425 GHz 947.6 MHz 8.059 GHz
KERANG EAST optus monopole Kerang Golf Club, 193 Kerang-Koondrook Rd., Kerang KERANG EAST	10003105	10094269/94 1136358/1 11376812/1		-35.742554, 143.9428	2.1475 GHz 2.1425 GHz 947.6 MHz 6.019 GHz
Lake Boga 107 Cemetery Road LAKE BOGA VIC 3584	9008743	10094269/94 1136358/1 11345039/1 11345040/1 1803032/1		-35.468801, 143.621912	2.1475 GHz 2.1425 GHz 947.6 MHz 11.075 GHz 10.735 GHz
Lake Meran Boort-Kerang Road Lake Meran	10009437	1136358/1 10410986/1		-35.874805, 143.790948	947.6 MHz 8.177 GHz
Optus Lattice Tower Dumosa - Quambatook Road QUAMBATOOK	9011970	10094269/94 1136358/1 10294003/1 11143818/1 11143817/1 1930242/1		-35.843634, 143.513363	2.1475 GHz 2.1425 GHz 947.6 MHz 6.2268 GHz 6.2713 GHz 6.2120 GHz

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Site Name	Site ID	Licence No.	Licensee	Location	Operating Frequency
		1925979/1			6.3454 GHz 6.1972 GHz
Optus Lattice Tower Football Ground Gladfield Road PYRAMID HILL	9010834	10094269/94 1136358/1 1920011/1 10002071/2		-36.053377, 144.109072	2.1475 GHz 2.1425 GHz 947.6 MHz 10.735 GHz 10.775 GHz
Optus Lattice Tower Football Oval Glossop St MITIAMO	9010838	10094269/94 1136358/1 11001414/1 11001413/1 10999311/1 10999310/1 1922344/1 1922343/1		-36.212655, 144.237577	2.1475 GHz 2.1425 GHz 947.6 MHz 8.1183 GHz 8.0590 GHz 8.2369 GHz 8.1331 GHz 8.0441 GHz
Optus Mast off Bryan La PENTAL ISLAND	9000985	10094269/94 1136358/1 11270262/1		-35.353844, 143.590341	2.1475 GHz 2.1425 GHz 947.6 MHz 22.036 GHz
Optus Site Ellis Property Murray Valley Hwy MYSTIC PARK	305386	11345039/1 11345040/1 11697106/1 11697107/1 11697105/1 10294003/1 1803032/1 1803040/1 1942545/1 1942329/1		-35.527513, 143.735602	11.565 GHz 8.1183 GHz 8.2369 GHz 8.1183 GHz 5.9748 GHz 11.225 GHz 8.2517 GHz 8.1924 GHz 8.1034 GHz
Optus Site Farmland Birchip-Wycheproof Rd WYCHEPROOF	305488	11143818/1 11143817/1 1991474/1 1940923/1 1920864/1 1930242/1		-36.066459, 143.213341	6.0193 GHz 5.9600 GHz 7.9256 GHz 7.9107 GHz 7.8218 GHz 6.0934 GHz
Optus Site Loddon Valley Hwy DURHAM OX	305693	10094269/94 1136358/1 1920011/1 11001326/1 10999311/1 10999310/1 10410986/1 11809719/1 11809717/1 11884310/1 11884309/1 10002071/2 1925038/1 1803643/1		-36.064664, 143.949327	2.1475 GHz 2.1425 GHz 947.6 MHz 11.225 GHz 11.225 GHz 7.7477 GHz 7.9256 GHz 7.8663 GHz 6.1379 GHz 6.0786 GHz 11.265 GHz 7.7625 GHz 7.9107 GHz

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Site Name	Site ID	Licence No.	Licensee	Location	Operating Frequency
Optus Site Mystic Park Murray Valley Highway MYSTIC PARK	135540	10094269/94 1136358/1 1925979/1		-35.526609, 143.734887	2.1475 GHz 2.1425 GHz 947.6 MHz 5.9452 GHz
Optus Site Roney Property Weinberg St COHUNA	305692	10094269/94 1136358/1 10999289/1 10999290/1 11376812/1 11809719/1 11809717/1 11884310/1 11884309/1 1925038/1 1803643/1		-35.805896, 144.208034	2.1475 GHz 2.1425 GHz 947.6 MHz 8.0590 GHz 6.2713 GHz 6.3899 GHz 6.3306 GHz 8.0738 GHz 8.2220 GHz
Optus Site Sunnyside Property 62 Loop Rd KOONDROOK	305694	10094269/94 1136358/1 10941473/1 10631611/1 10999289/1 10999290/1 11886361/1 11886138/1 10258339/1 1806675/1		-35.625346, 144.067683	2.1475 GHz 2.1425 GHz 947.6 MHz 11.155 GHz 10.755 GHz 7.7477 GHz 6.98 GHz 7.06 GHz 7.807 GHz 7.8663 GHz
Optus Site Wycheproof Wycheproof - Birchip Road WYCHEPROOF	134246	10094269/94 1136358/1		-36.066207, 143.213322	2.1475 GHz 2.1425 GHz 947.6 MHz
Optus Tower Football Ground 3535 Culgoa-Ultima Road ULTIMA	9011049	10094269/94 1136358/1 1921188/1		-35.473917, 143.261292	2.1475 GHz 2.1425 GHz 947.6 MHz 8.1331 GHz
Telstra Exchange 18 Albert Street KERANG	11881	10631611/1		-35.733105, 143.921415	11.245 GHz
Telstra Site Swan Hill 77-89 Campbell Street SWAN HILL	11889	10094269/94 11870552/2 1136358/1		-35.33682, 143.55932	2.1475 GHz 2.1425 GHz 947.6 MHz 939.2 MHz
Telstra Tower Albert St KERANG	36239	10094269/94 1136358/1		-35.732105, 143.917687	2.1475 GHz 2.1425 GHz 947.6 MHz
NBN Co Site 205 Kerang-Leitchville Road LEITCHVILLE	9023031	11895300/1 11895299/1 11370148/2 11370149/2 11370147/2 11370146/2 10459092/1	NBN CO LIMITED	-35.903833, 144.295577	6.98 GHz 7.06 GHz 10.995 GHz 10.995 GHz 10.915 GHz 10.915 GHz 11.175 GHz

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Site Name	Site ID	Licence No.	Licensee	Location	Operating Frequency
		11876983/1 11876985/1 10459091/1 11876986/1 1984999/2 11876987/1 10459090/1 10459006/1 1984997/2 1984998/2 10459007/1			11.155 GHz 11.075 GHz 11.135 GHz 10.995 GHz 11.095 GHz 10.915 GHz 11.055 GHz 10.895 GHz 10.975 GHz 10.935 GHz 11.015 GHz
NBN Co Site 2819 Loddon Valley Highway TRAGOWEL	9023021	10508867/1 10508869/1 10508868/1 10508866/1 11427896/1 11427894/1 11568710/1 11568708/1 11568709/1 11427895/1 11568711/1 11427897/1		-35.871224, 143.935393	11.265 GHz 11.345 GHz 11.305 GHz 11.225 GHz 6.64 GHz 6.72 GHz 6.7 GHz 6.58 GHz 6.62 GHz 6.72 GHz 6.74 GHz 6.64 GHz
NBN Co Site 3220 Birchip-Wycheproof Rd Wycheproof	10012808	11480277/1 11478015/1		-36.06736, 143.2132	5.9600 GHz 6.0193 GHz
NBN Co Site 827 Koroop Road KOROOB	9023024	10698839/1 10685431/1		-35.741556, 144.065521	11.565 GHz 11.485 GHz
NBN Co Site 91 Murray Valley Highway KERANG	9023022	10685431/1 10508867/1 10508869/1 10508868/1 10508866/1		-35.737485, 143.905791	10.995 GHz 10.775 GHz 10.855 GHz 10.815 GHz 10.735 GHz
Optus Lattice Tower Football Ground Gladfield Road PYRAMID HILL	9010834	11427896/1 11427894/1 11568710/1 11568708/1 11568709/1 11427895/1 11568711/1 11427897/1		-36.053377, 144.109072	6.98 GHz 7.06 GHz 7.04 GHz 6.92 GHz 6.96 GHz 7.08 GHz
Optus Site Farmland Birchip-Wycheproof Rd WYCHEPROOF	305488	11566878/1		-36.066459, 143.213341	6.98 GHz
Optus Site Roney Property Weinberg St COHUNA	305692	11895300/1 11895299/1 11370148/2 11370149/2 11370147/2 11370146/2 10459006/1		-35.805896, 144.208034	6.64 GHz 6.72 GHz 11.485 GHz 11.485 GHz 11.405 GHz 11.405 GHz 11.385 GHz

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Site Name	Site ID	Licence No.	Licensee	Location	Operating Frequency
		1984997/2 1984998/2 10459007/1			11.465 GHz 11.425 GHz 11.505 GHz
Optus Site Sunnyside Property 62 Loop Rd KOONDROOK	305694	10698839/1		-35.625346, 144.067683	11.075 GHz
Telstra Site next to Coliban water tank off Coutts St BOORT	131923	10535139/1 10535140/1 10535138/1 1967508/2		-36.112317, 143.725917	11.225 GHz 11.265 GHz 11.345 GHz 11.305 GHz
Broadcast Australia Site Ultima-Lake Boga Rd GOSCHEN	11885	11332890/1	TELSTRA LIMITED	-35.472881, 143.455867	11.075 GHz
SEC Site MANGATE HILL	51172	520407/1 463690/1 463692/1 520406/1 463691/1 463693/1 1966082/1 1326851/1 1181731/1 1317758/1		-35.996692, 144.158873	164.45 MHz 165.1375 MHz 164.225 MHz 164.8875 MHz 164.6625 MHz 163.95 MHz 167.05 MHz 163.9375 MHz 165.4375 MHz 163.7125 MHz
Telstra Exchange 18 Albert Street KERANG	11881	464225/1		-35.733105, 143.921415	163.825 MHz
Telstra Exchange ULTIMA	11890	11332890/1 1142777/1 1946058/1		-35.470998, 143.264086	11.565 GHz 14.5045 GHz 7.435 GHz
Telstra Radio Terminal 651 Mystic Park-Beauchamp Road BEAUCHAMP	11884	1142771/1 1142770/1 463734/1 1146684/1 1146685/1 1966080/1 1146686/1 1146683/1		-35.611874, 143.598908	7.442 GHz 15.1485 GHz 163.675 MHz 164.7125 MHz 164.5 MHz 166.7375 MHz 164.2875 MHz 164.9375 MHz
Telstra Radio Terminal QUAMBATOOK	36792	1142775/1 1142770/1		-35.83877, 143.506028	7.456 GHz 14.5045 GHz
Telstra Site 12a View Street KOONDROOK	131851	1966078/1 1184124/1 1184123/1 1184125/1		-35.634355, 144.122981	164.075 MHz 165.55 MHz 165.25 MHz 164.95 MHz
Telstra Site Swan Hill 77-89 Campbell Street SWAN HILL	11889	1942464/1 1142771/1 1142776/1 1142777/1 463733/1 464245/1 520015/1 463732/1		-35.33682, 143.55932	451.225 MHz 7.603 GHz 7.603 GHz 15.1485 GHz 164.525 MHz 164.75 MHz 164.3125 MHz 164.9625 MHz

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Site Name	Site ID	Licence No.	Licensee	Location	Operating Frequency
		464028/1 1184133/1 520016/1			164 MHz 165.8625 MHz 164.0875 MHz

**Table 6** *Aeronautical Transmitter*

Site Name	Site ID	Licence No.	Licensee	Location	Operating Frequency
Airservices NDB Site Swan Hill Airport SWAN HILL	9010672	419548/1	Airservices Australia	-35.380494, 143.54031	407 KHz

**Table 7** *Meteorological Radar*

Site Name	Site ID	Licence No.	Licensee	Location	Operating Frequency
Rainbow Meteorological Radar	10012512	10547311/1 10771653/1	Bureau of Meteorology	-35.99, 142.01	5.625 GHz 11.225 GHz 10.735 GHz
Mildura Meteorological Radar	10019217	10923284/1		-34.284082, 141.58588	5.625 GHz

**Table 8** *Amateur*

Site Name	Site ID	Licence No.	Licensee	Location	Operating Frequency
3km North West of Swan Hi SWAN HILL	2729552	10262510/1	Swan Hill District Radio Club	-35.330018, 143.505368	146.9 MHz

**Table 9** *Miscellaneous / Earth Stations*

Site Name	Site ID	Licence No.	Licensee	Location	Operating Frequency
ViaSat Earth Station, Intersection of Kangaroo Lake Road & Scantleton Road Mystic park	10024440	11204122	Viasat Australia Pty Ltd	-35.5879, 143.7544	27.75 GHz 29.25 GHz 28.75 GHz 28.25 GHz 29.75 GHz
ViaSat Earth Station, 18 Albert Street Kerang	10024520			-35.7337, 143.9212	29.75 GHz 29.25 GHz 28.75 GHz 28.25 GHz 27.75 GHz
ViaSat Earth Station, 18 Albert Street Kerang	10026192			-35.7336, 143.9210	28.25 GHz 27.75 GHz 29.75 GHz 29.25 GHz 28.75 GHz
ViaSat Earth Station, Intersection of Boort- Kerang Road & Jacksons Road Minmindie	10024462			-35.9975, 143.7608	28.75 GHz 28.25 GHz 27.75 GHz 29.75 GHz

Site Name	Site ID	Licence No.	Licensee	Location	Operating Frequency
					29.25 GHz

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