



AVIATION IMPACT ASSESSMENT

**WATTA WELLA RENEWABLE ENERGY
PROJECT**

Prepared for Umwelt (Australia) Pty Limited on behalf of RES Australia Pty Ltd

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 **AVIATION PROJECTS**

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ACRONYMS

AAAA	Aerial Application Association of Australia
AC	Advisory Circular
AFAC	Australasian Fire and Emergency Services Council
AGL	above ground level
AHD	Australian Height Datum
AIA	aviation impact assessment
AIP	Aeronautical Information Package
AIS	aviation impact statement
ALA	aircraft landing area (uncertified aerodrome)
ALARP	as low as reasonably practicable
AMSL	above mean sea level
ARP	Aerodrome Reference Point
AsA	Airservices Australia
ATSB	Australian Transport Safety Bureau
BESS	battery energy storage system
BoM	Bureau of Meteorology
CAO	Civil Aviation Orders
CAP	Civil Aviation Publication (UK)
CAR	Civil Aviation Regulation (1988)
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulation (1998)
CFIT	controlled flight into terrain
CNS	communications, navigation and surveillance
DAH	Designated Airspace Handbook
DME	distance measuring equipment
DTP	Department of Transport and Planning
ERC-H	en-route chart high
ERC-L	en-route chart low

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ERSA	En Route Supplement Australia
GNSS	global navigation satellite system
ICAO	International Civil Aviation Organization
IFR	instrument flight rules
IMC	instrument meteorological conditions
LGA	local government area
LSALT	lowest safe altitude
MOC	minimum obstacle clearance
MOS	Manual of Standards
MSA	minimum sector altitude
NASAG	National Airports Safeguarding Advisory Group
NASF	National Airports Safeguarding Framework
NDB	non-directional radio beacon
OLS	obstacle limitation surface
PANS-OPS	Procedures for Air Navigation Services - Aircraft Operations
RAAF	Royal Australian Air Force
RFDS	Royal Flying Doctor Service
RNAV	area navigation
RSR	route surveillance radar
VFR	visual flight rules
VHF	very high frequency
VOR	VHF omni-directional radio range
VMC	visual meteorological conditions
WMTs	wind monitoring towers
WTGs	wind turbine generators

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UNITS OF MEASUREMENT

ft	feet	(1 ft = 0.3048 m)
km	kilometres	(1 km = 0.5399 nm)
m	metres	(1 m = 3.281 ft)
nm	nautical miles	(1 nm = 1.852 km)

DEFINITIONS

Definitions of key aviation terms are included in **Annexure 2**.

NOTES

A 5 m error budget for terrain derived from Google Earth has been applied for assessment of wind monitoring tower (WMT) maximum height.

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EXECUTIVE SUMMARY

Introduction

RES Australia Pty Limited (RES Australia) (the Proponent) is proposing to develop the Watta Wella Renewable Energy Project (the Project) wholly located in the Northern Grampians Shire Council local government area (LGA) in Victoria's central west, approximately 220 kilometres (km) north-west of Melbourne, 16 km north-east of Stawell and 30 km north of Ararat to the central location of the Project Area.

The Project is proposed to consist of up to 45 wind turbine generators (WTGs) with a maximum tip height of up to 255 m above ground level (AGL) and generation capacity of up to 360-megawatt (MW) with three wind monitoring towers (WMTs). One would have a nominal height of 100 metres (m) and the height of the remaining two being subject to further design and technical assessment, however, may have a minimum height of 80 m or a maximum height of 166 m AGL. A 400MW/1600MWh battery energy storage system (BESS) facility is also proposed.

Overhead transmission lines would connect the on-site substations to the existing AusNet-operated Bulgana Terminal Station. Electricity would then be exported to the transmission network via an existing 220 kV transmission line. The Project is reliant on the Western Renewables Link (WRL) project which would relieve congestion in the existing transmission line and unlock additional capacity for renewable energy projects in Western Victoria.

Aviation Projects Pty Ltd has been engaged by Umwelt (Australia) Pty Ltd to prepare an Aviation Impact Assessment (AIA) for the proposed Project.

This AIA has been prepared to support an application by the Proponent for a Planning Permit under the *Planning and Environment Act 1987*.

This AIA assesses the potential aviation impacts associated with the Project and provides aviation safety advice in respect of relevant requirements of air safety regulations and procedures and informs and documents consultation with relevant aviation agencies.

This AIA includes an Aviation Impact Statement (AIS) for assessment by Airservices Australia and a qualitative risk assessment to determine the need for obstacle lighting and marking for client review and acceptance before submission to external aviation regulators.

Project description

The Project will comprise the following:

- Up to 45 wind turbine generators (WTG) with a maximum overall height (tip height) of up to 255 m AGL and generation capacity of up to 360 MW. The highest wind turbine is WTG19 with a ground elevation of 265.3 m AHD (870.4 ft AMSL) and overall height of 520.3 m AHD (1707.0 ft AMSL).
- Turbine foundations and hardstands.
- A BESS facility.
- Overhead 220kV transmission lines connecting the Project to the existing transmission network at Bulgana Terminal Station.

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- Two onsite substations, one for the BESS and another for the Wind Farm including protection equipment, a control room, tanks for water and oil storage and main substation equipment.
- Approximately 48 km of Internal access tracks and access points (ten) from public roads for access to WTGs and for construction access.
- Approximately 370 km of 33kV underground reticulation connected WTGs to the main on-site substation.
- One temporary wind monitoring tower (WMT) with a maximum height of 100 m (328.1 ft) AG and two permanent WMTs with a maximum height of up to 166 m (544.6 ft).
- O&M facilities for both the Wind Farm and BESS.
- Temporary infrastructure including concrete batching plants, temporary construction compounds and laydown areas.

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Conclusions

Based on a comprehensive analysis and assessment detailed in this AIA, the following conclusions were made:

Planning considerations

1. The Project as proposed satisfies the Planning Policy Provisions of the Northern Grampians Planning Scheme regarding Stawell Airport and would not impact on the Airport Environs Overlay and Design and Development Overlay.

Certified airports

2. The Project Area is located within 30 nautical miles (nm) (55.6 km) of three Certified Airports – Stawell Airport (YSWL), Ararat Airport (YARA) and St Arnaud Airport (YSTA)
3. The Project Area is located laterally within the 10 nm minimum sector altitude (MSA) of Stawell Airport
4. Ararat Airport and Stawell Airport do not have published instrument approaches and are therefore unaffected
5. WTG19 is the highest wind turbine (overall height of 520.3 m AHD (1707.0 ft AMSL)) located within the horizontal extent of the 10 nm MSA buffer area of Stawell Airport but would be below the protection surface.
6. The Project Area is located beyond the horizontal extent of circling areas at Stawell Airport.

Uncertified aerodromes (Aircraft Landing Areas (ALAs))

7. All validated uncertified aerodromes are further than 3 nm (5.6 km) from the Project Area and would not be adversely affected by any wind turbines of the Project.
8. An uncertified aerodrome identified at Wyndarra is located approximately 2.5 nm (4.6 km) south-west of the nearest turbine (WTG19) and is beyond the limits of downwind referred to in NASF Guideline D in north easterly winds.

Obstacle Limitation Surfaces

9. The obstacle limitation surfaces (OLS) of Stawell Airport, Ararat Airport and St Arnaud Airport would not be impacted.

Air Routes and Lowest Safe Altitudes

10. The Project would not impact any air routes or grid lowest safe altitudes.

Airspace

11. The Project is located outside of controlled airspace (wholly within Class G airspace).

Aviation Navigation Facilities

12. The Project is located outside of all protection areas associated with aviation navigation facilities.

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Radar

13. The Project Area is located in Zone 4 (accepted zone) and outside the radar line of sight of Mt Macedon Route Surveillance Radar (RSR) and is not anticipated to interfere with the serviceability of this ATC surveillance system.

Aviation Impact Statement

14. Based on the Project site layout and overall turbine blade tip height limit of 255 m (836.6 ft) AGL, the blade tip elevation of the highest wind turbine, which is WTG19, would not exceed 520.3 m AHD (1707.0 ft AMSL).
15. This AIS concludes that the proposed Project:
 - a) would not infringe any obstacle limitation surface (OLS) surfaces
 - b) would not infringe Procedures for Air Navigation Services - Aircraft Operations PANS-OPS surfaces
 - c) would not impact any nearby designated air routes
 - d) would not have an impact on the grid lowest safe altitude (LSALT)
 - e) is wholly contained within Class G airspace
 - f) is unlikely to create downwind wake turbulence from the turbine blades in the circuit area of uncertified aerodromes
 - g) is outside the clearance zones associated with aviation navigation aids and communication facilities.

Obstacle lighting risk assessment

16. Aviation Projects has undertaken a safety risk assessment of the Project and concludes that WTGs and WMT would not require obstacle lighting to maintain an acceptable level of safety to aircraft.

Consultation

17. Refer to Section 5 for detailed responses from relevant aviation stakeholders.

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Summary of key recommendations

A summary of the key recommendations of this AIA is set out below.

The full list of recommendations and associated details is provided in **Section 12** 'Recommendations' at the end of this report.

1. Overhead transmission lines and/or supporting poles associated with the Project that are located near the ends of runways or where they could adversely affect aerial application operations should be identified in consultation with local aerial agriculture operators. They may need to be marked in accordance with Part 139 Manual of Standards (MOS) or with Australian Standard AS 3891.2:2018, Air Navigation – Cables and their supporting structures – Marking and safety requirements, Parts 1 and 2, where applicable. The proposed overhead transmission lines are intended to be installed near the existing transmission line in the Project Area. Any changes to the planned configuration of the transmission lines should be reviewed for potential risk to aerial application operations.
2. To facilitate the flight planning of aerial application operators, the location and height of the final layout of the WTGs and WMTs should be provided to landowners so that, when asked for hazard information on their property, the landowner may provide the aerial application pilot with all relevant information.
3. Final height and layout details of WGTs and WMTs with a height of 100 m or more AGL must be reported to CASA *as soon as practicable after forming the intention to construct or erect the proposed object or structure*, in accordance with CASR Part 139.165(1)(2).
4. Final layout details of the WTG and WMT coordinates and elevations must be provided to Airservices Australia using the following email address: vod@airservicesaustralia.com. It is best to provide at least 6 weeks prior notice to allow for the details to be included in aeronautical information systems that allow pilots to know of their pending existence.
5. The Proponent should consider engaging with local aerial agricultural operators, details of which can be obtained from the landholders, and aerial firefighting operators in developing procedures for such aircraft operations in the vicinity of the Project.
6. Details of the final wind farm layout should be provided to local and regional aircraft operators prior to construction in order for them to consider the wind farm for their operations.
7. The rotor blades, nacelles and towers of the wind turbines should be painted in a non-reflective off-white colour, providing sufficient contrast with the surrounding environment and to maintain an acceptable level of safety.

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1. INTRODUCTION

1.1. Situation

RES Australia is proposing to develop the Watta Wella Renewable Energy Project wholly located in the Northern Grampians Shire Council LGA in Victoria's central west, approximately 220 km north-west of Melbourne, 16 km north-east of Stawell and 30 km north of Ararat to the central location of the Project Area.

The Project is proposed to consist of up to 45 wind turbine generators (WTGs) with a maximum tip height of up to 255 m above ground level (AGL) and generation capacity of up to 360-megawatt (MW) with three wind monitoring towers (WMTs). One would have a nominal height of 100 metres (m) and the height of the remaining two being subject to further design and technical assessment, however, may have a minimum height of 80 m or a maximum height of 166 m AGL. A 400MW/1600MWh battery energy storage system (BESS) facility is also proposed.

Overhead transmission lines would connect the on-site substations to the existing AusNet-operated Bulgana Terminal Station. Electricity would then be exported to the transmission network via an existing 220 kV transmission line.

Aviation Projects Pty Ltd has been engaged by Umwelt (Australia) Pty Ltd to prepare an AIA Assessment for the proposed Project.

This AIA has been prepared to support an application by the Proponent for a Planning Permit under the Planning and Environment Act 1987.

This AIA assesses the potential aviation impacts associated with the Project and provides aviation safety advice in respect of relevant requirements of air safety regulations and procedures and informs and documents consultation with relevant aviation agencies.

This AIA includes an Aviation Impact Statement (AIS) for assessment by Airservices Australia and a qualitative risk assessment to determine the need for obstacle lighting and marking for client review and acceptance before submission to external aviation regulators.

1.2. Purpose and Scope

The purpose and scope of work is to prepare an AIA for consideration by Airservices Australia, CASA and Department of Defence and to support an application for a planning permit under *the Planning and Environment Act 1987*.

The assessment specifically responds to the:

- Victorian *Planning Guidelines for Development of Wind Energy Facilities*, dated September 2023 (DTP)
- Northern Grampians Planning Scheme
- NASF Guideline D: *Managing the Risk to aviation safety of wind turbine installations (wind farms)/Wind Monitoring Towers*
- An AIS required by Airservices Australia.

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1.3. Methodology

Aviation Projects conducted the task in accordance with the following methodology:

- Confirmed the scope and deliverables with the Proponent
- Reviewed client material
- Reviewed relevant regulatory requirements and information sources
- Prepared a draft AIA and supporting technical data that provides evidence and analysis for the planning application to demonstrate that appropriate risk mitigation strategies have been identified
- Prepared an AIS for Airservices Australia and a qualitative risk assessment to determine need for obstacle lighting and marking
- Identified risk mitigation strategies that provide an acceptable alternative to night lighting. The risk assessment was completed following the guidelines in *ISO 31000:2018 Risk Management – Guidelines*
- Consulted with relevant Councils, Part 173 procedure designers (Airservices Australia) and aerodrome operators of the nearest aerodrome/s to seek endorsement of the proposal to change instrument procedures (if applicable)
- Consulted/engaged with stakeholders to negotiate acceptable outcomes (if required)
- Finalised the AIA for client acceptance after responses received from stakeholders and assessed.

1.4. Aviation Impact Statement

The AIS includes the following specific requirements as advised by Airservices Australia:

Aerodromes:

- Specify all certified aerodromes that are located within 30 nm (55.6 km) of the Project Area
- Nominate all instrument approach and landing procedures at these aerodromes
- Review the potential effect of the Project operations on the operational airspace of the aerodrome(s).

Air Routes:

- Nominate air routes published in ERC-L & ERC-H which are located near/over the Project Area and review potential impacts of Project operations on aircraft using those air routes
- Specify two waypoint names located on the routes which are located before and after the obstacles.

Airspace:

- Nominate the airspace classification – A, C, D, E, G etc where the Project Area is located.

Navigation/Radar:

- Nominate radar navigation systems with coverage overlapping the site.

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1.5. Material reviewed

Material provided by the client for preparation of this assessment included:

- WTG and WMT data: PAUSplc098_unlocked.shp
- pAUSplc098_WW_WTG_WMT_Ground_Elev_20250130.xlsx
- Wind turbine downwind wake turbulence studies
- Watta Wella_Project Description_V9
- Project Commissioning Report, 100 m Temp Mast Install, Report No. 20454, Rev 01
- Permanent_Mast_Locations_20250204.

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2. BACKGROUND

2.1. Site overview

The closest townships to the Project Area include Stawell, 16 km south-west, Great Western 18 km south-west and Ararat 30 km south of the central part of the Project Area.

An overview of the Project Area relative to locality of Stawell is provided in Figure 1 (source: Umwelt, Google Earth).

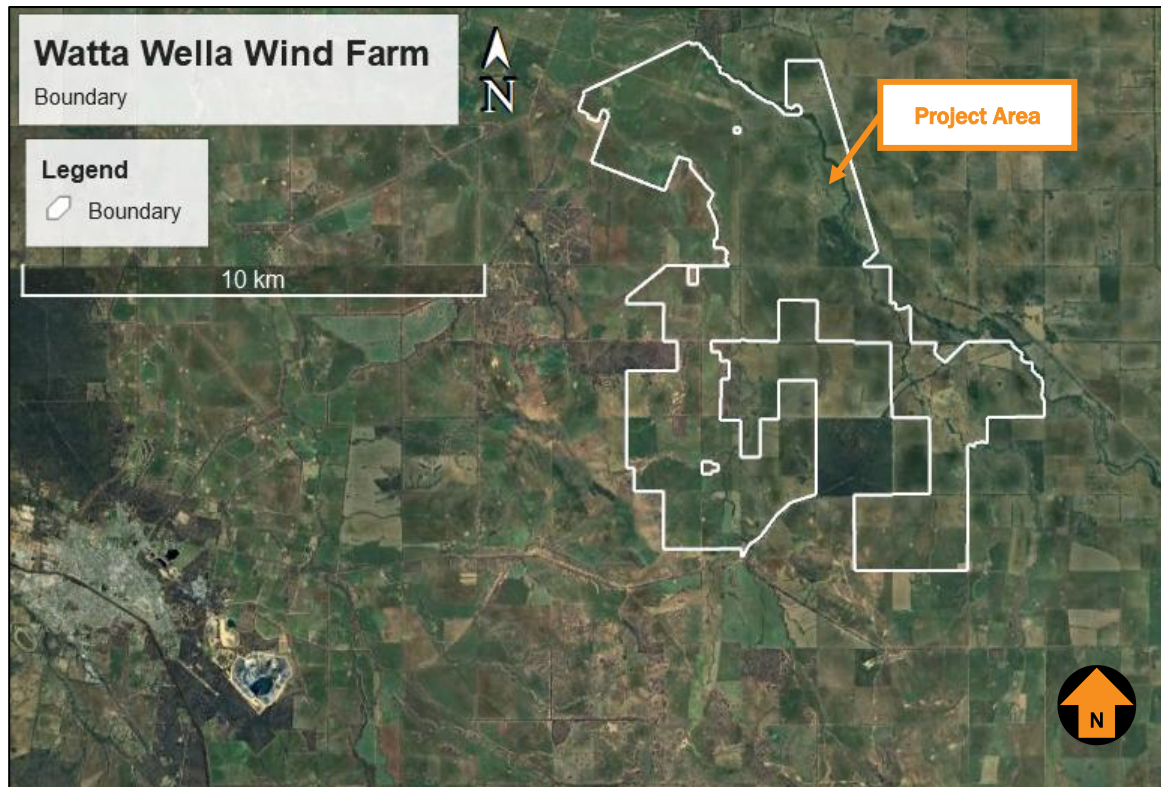


Figure 1 Project Area overview

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2.2. Project description

The Project would comprise the following:

- Up to 45 wind turbine generators (WTG) with a maximum overall height (tip height) of up to 255 m (836.6 ft) AGL and generation capacity of up to 360 MW. The highest wind turbine is WTG19 with a ground elevation of 265.3 m AHD (870.4 ft AMSL) and overall height of 520.3 m AHD (1707.0 ft AMSL).
- One temporary wind monitoring tower (WMT) with a maximum height of 100 m (328.1 ft) AGL and two permanent WMTs with a maximum height of up to 166 m (544.6 ft) AGL.
- Turbine foundations and hardstands.

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- A BESS facility.
- Overhead 220kV transmission lines connecting the Project to the existing transmission network at Bulgana Terminal Station.
- Two onsite substations, one for the BESS and another for the Wind Farm including protection equipment, a control room, tanks for water and oil storage and main substation equipment.
- Approximately 48 km of Internal access tracks and access points (ten) from public roads for access to WTGs and for construction access.
- Approximately 370 km of 33kV underground reticulation connected WTGs to the main on-site substation.
- O&M facilities for both the Wind Farm and BESS.
- Temporary infrastructure including concrete batching plants, temporary construction compounds and laydown areas.

An indicative layout of the proposed wind farm and BESS facility is provided in Figure 2 (source: Umwelt), including the 45 wind turbine locations and WMT locations.

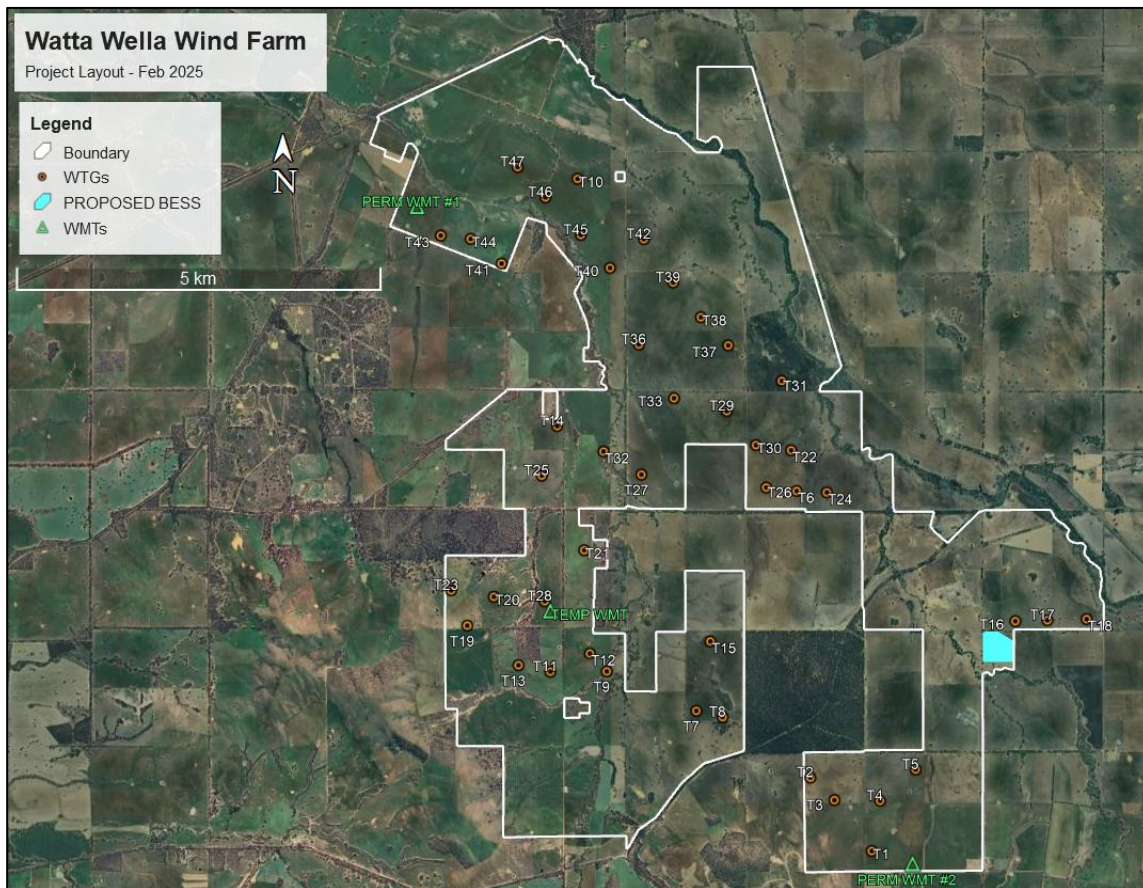


Figure 2 Project layout

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3. EXTERNAL CONTEXT

This chapter explores the federal, state, and local planning context that may impact the Project. Each section will explore and respond to the planning context to identify any conflict between the Project and applicable planning requirements.

3.1. Victorian planning context

The Department of Transport and Planning (DTP) (formerly Department on Environment, Land, Water and Planning (DELWP)) published the *Planning Guidelines for Development of Wind Energy Facilities* (revised September 2023) to provide advice to inform planning decisions about a wind energy facility proposal.

The purpose of these guidelines is to set out:

- a framework to provide a consistent and balanced approach to the assessment of wind energy projects across the state
- a set of consistent operational performance standards to inform the assessment and operation of a wind energy facility project
- guidance as to how planning permit application requirements might be met.

The guidelines provide advice regarding locations in the state that are not appropriate for wind energy facilities. They also give a framework to ensure proposals for wind energy facilities are thoroughly assessed, including other considerations and approvals required in the process.

Section 4.3.5 *Aircraft safety issues* and Section 5.1.5 *Aircraft safety* are relevant to this AIA and details are extracted below:

Section 4.3.5 Aircraft safety issues

The height of wind energy turbines can be substantial, resulting in potential impacts upon nearby airfields and air safety navigation. Applicants for a wind energy facility permit should address aircraft safety issues by considering the proximity of the site to airports, aerodromes, or landing strips.

Applicants should consult with the Civil Aviation Safety Authority (CASA) for wind energy facility proposals that:

- *are within 30 kilometres of a declared aerodrome or airfield*
- *infringe the obstacle limitation surface around a declared aerodrome*
- *include a building or structure the top of which will be 110 metres or more above natural ground level (height of a wind turbine is that reached by the tip of the turbine blade when vertical above ground level).*

Early engagement with aviation safety organisations like CASA is encouraged as aviation safety is a complex area of wind energy facility assessment.

In addition to CASA consultation, the following is relevant for anemometers and other pre-permit infrastructure.

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The Aeronautical Information Service of the Royal Australian Air Force (RAAF AIS) maintains a database of tall structures in the country. The RAAF AIS should be notified of all tall structures meeting the following criteria:

- 30 metres or more above ground level for structures within 30km of an aerodrome; or
- 45 metres or more above ground level for structures located elsewhere.

Operators of certified aerodromes are required to notify CASA if they become aware of any development or proposed construction near the aerodrome that is likely to create an obstacle to aviation, or if an object will infringe the Obstacle Limitation Surfaces (OLS) or Procedures for Air Navigation Services – Operations (PANS-OPS) surfaces of an aerodrome. Operators of registered aerodromes should advise CASA if the proposal will infringe the OLS; CASA will ask Airservices to determine if there is an impact on published flight procedures for the aerodrome

5.1.5 Aircraft safety

The height of wind energy turbines can be substantial, resulting in potential impacts upon nearby airfields and air safety navigation. A responsible authority should consider the proximity of the site to airports, aerodromes or landing strips, and ensure that any aircraft safety issues are identified and addressed appropriately.

Although the Civil Aviation Safety Authority (CASA) is not a formal referral authority for wind energy facility permit applications, a responsible authority should nevertheless consult with CASA in relation to aircraft safety impacts of a wind energy facility proposal, particularly proposals that:

- are within 30 kilometres of a declared aerodrome or airfield;
- infringe the obstacle limitation surface around a declared aerodrome;
- include a building or structure the top of which will be 110 metres or more above natural ground level (height of a wind turbine is that reached by the tip of the turbine blade when vertical above ground level).

Other private airstrips may not be identified by consultation with CASA. These may be identified using aerial photographs, discussions with the relevant council, or consultation with local communities. A responsible authority should ensure that the proponent has consulted appropriately with CASA in relation to aircraft safety and navigation issues. It is recommended that the proponent consults and receives approval from CASA prior to lodging their application for ease of process. Refer to Section 4.3.6 of these guidelines for more detail.

CASA may recommend appropriate safeguards to ensure aviation safety. These may include changes to turbine locations, turbine heights and/or the provision of aviation safety lighting. A responsible authority should ensure that any concerns raised by CASA are appropriately reflected in permit conditions. Aviation safety lighting can have an impact on the amenity of the surrounding area. Responsible authorities may consider the following impact reduction measures (subject to CASA requirements and advice):

- reducing the number of wind turbines with obstacle lights;
- specifying an obstacle light that minimises light intensity at ground level;
- specifying an obstacle light that matches light intensity to meteorological visibility;

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- mitigating light glare from obstacle lighting through measures such as baffling.

3.2. Northern Grampians Planning Scheme

The Project is located within the Northern Grampians Shire LGA and therefore, subject to the Northern Grampians Planning Scheme (the Planning Scheme).

Clause 02.03-8 (Transport) of the Planning Scheme identifies the Stawell Aerodrome as a valuable economic and strategic asset within the region, including serving as a major emergency response base. It states:

'the aerodrome caters for the general aviation needs of the region and is home to many aviation-related businesses, such as fire bombing, aircraft maintenance and restoration, crop-spraying, flying instruction, charter and recreational flight services. Planning must seek to protect the Stawell Aerodrome, as a key element in the local transport infrastructure of the region'.

The strategic directions of Clause 02.03-8 (Transport) of relevance to the Project and this assessment includes:

Support the ongoing operation of the Stawell Aerodrome, including any future expansions.

Clause 45.02 (Airport Environs Overlay (AEO)) of the Planning Scheme applies the Stawell Airport. The purpose of the AEO is to:

To implement the Municipal Planning Strategy and the Planning Policy Framework.

To identify areas which are or will be subject to significant noise, including areas where the use of land for uses sensitive to aircraft noise is not appropriate.

To ensure that land use and development are compatible with the operation of airports in accordance with the appropriate airport strategy or master plan and with safe air navigation for aircraft approaching and departing the airfield.

To assist in shielding people from the impact of aircraft noise by requiring appropriate noise attenuation measures in new dwellings and other noise sensitive buildings.

To limit the number of people residing in the area or likely to be subject to significant levels of aircraft noise.

Schedule 4 to Clause 43.02 (Design and Development Overlay (DDO4)) of the Planning Scheme relates to the Stawell Aerodrome Obstacle Limitation Surface Protection Area. The DDO4 includes the design objectives for the protection of the Stawell Airport's obstacle limitation surfaces (OLS) which are copied below:

To maintain the efficiency and safety of aircraft operations at the Stawell Aerodrome.

To ensure development and landscaping does not present a hazard to aircraft take offs and landings at the Stawell Aerodrome.

To ensure that development is appropriately sited and compatible with the operation of the Stawell Aerodrome.

To ensure that all buildings and works minimise impacts on the safe operation of the Stawell Aerodrome.

To recognise and implement any approved Obstacle Surface Limitation chart.

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Figure 3 below shows the extent of the DD04.

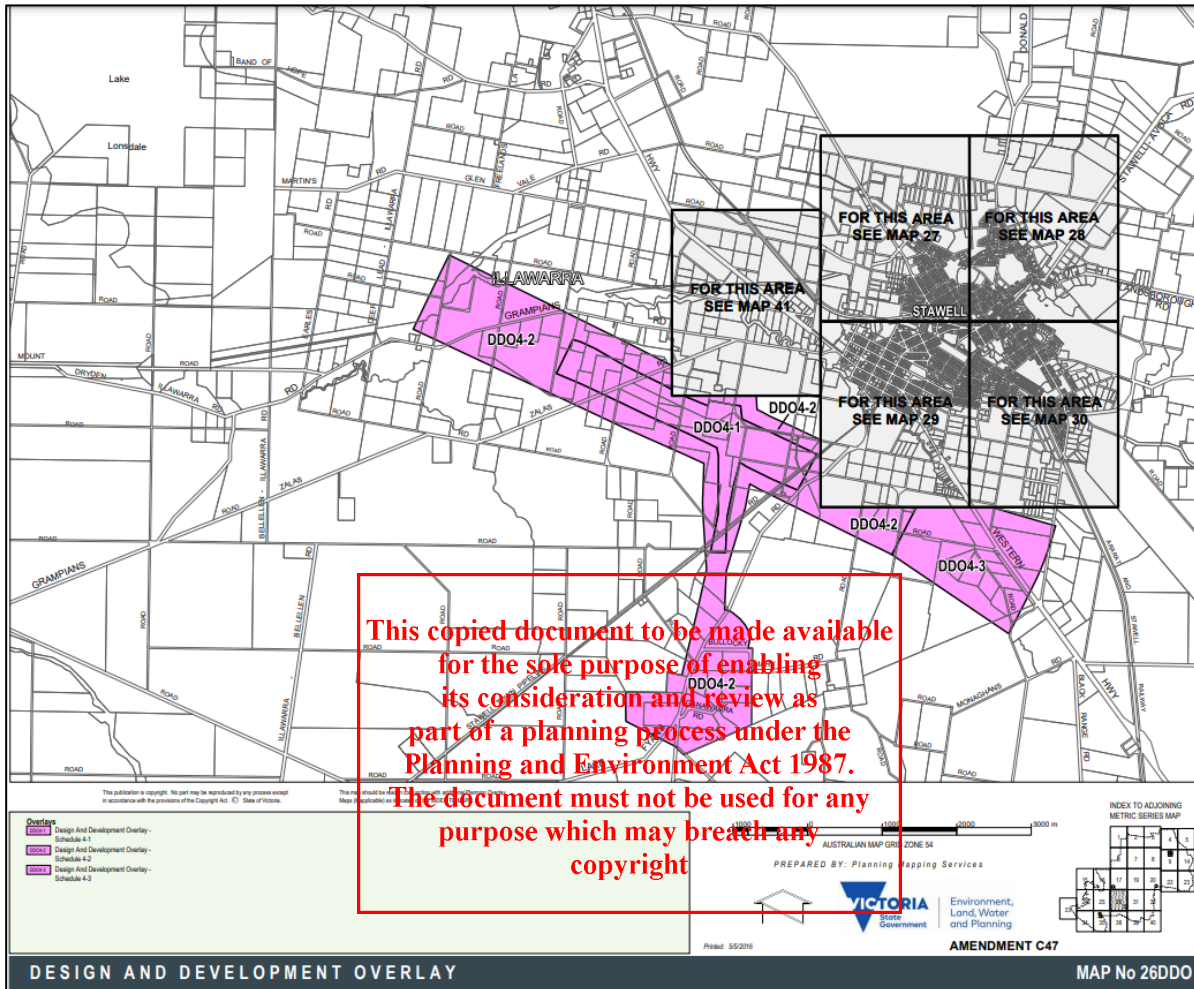


Figure 3 Northern Grampians Planning Scheme Design and Development Overlay – Schedule 4

The Project does not intersect with the AEO and DD04 under the Planning Scheme. The nearest WTG is located approximately 13 km northeast of the eastern edge of the land affected by DD04.

3.3. Stawell Aerodrome Master Plan

Airports Plus Pty Ltd undertook the Stawell Aerodrome Master Plan in 2008 which was adopted by the Northern Grampians Shire Council in January 2009. The review of the Master Plan was initiated to bring the master plan document up to date and consider any future development. The draft *Stawell Aerodrome Master Plan Review* was prepared by Airports Plus Pty Ltd in November 2014 and adopted by Northern Grampians Shire Council the review in 2015.

The master plan provides guidance and strategies for the current and future uses of Stawell Aerodrome. There is reference in the 2014 review about potentially lengthening the main runway 11/29 to accommodate large aircraft

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associated with aerial fire-fighting operations. The runway extension is constrained by land ownership issues. There is no reference in the master plan review of upgrading the runways to Code 4 and therefore expanding the applicable OLS dimensions.

The maximum distance an OLS extends from an aerodrome is 15,000 m. The Project is located more than 15,000 m from Stawell aerodrome and outside of the OLS associated with current and future aerodrome operations.

3.4. National Airports Safeguarding Framework

The National Airports Safeguarding Advisory Group (NASAG) was established by the Commonwealth Department of Infrastructure and Transport to develop a national land use planning framework called the National Airports Safeguarding Framework (NASF). The purpose of this framework is to enhance the current and future safety, viability, and growth of aviation operations at Australian airports through:

- the implementation of best practice in relation to land use assessment and decision making in the vicinity of airports
- assurance of community safety and amenity near airports
- better understanding and recognition of aviation safety requirements and aircraft noise impacts in land use and related planning decisions
- the provision of greater certainty and clarity for developers and landowners
- improvements to regulatory certainty and efficiency
- the publication and dissemination of information on best practice in land use and related planning that supports the safe and efficient operation of airports.

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NASF Guideline D: *Managing the Risk to Aviation Safety from Turbine Installations (Wind Farms)/Wind Monitoring Towers*, provides guidance to State/Territory and local government decision makers, airport operators and developers of wind farms to jointly address the risk to civil aviation arising from the development, presence and use of wind farms and wind monitoring towers.

The methodology for preparing the risk assessment is contained in the NASF Guideline D.

The risk assessment regards all potential aviation activities within the vicinity of the Project Area including recreation, commercial, civil (including for agricultural purposes) and military operations.

The AIS of this AIA identifies high level risks, risk mitigation measures and development constraints that are likely to be applicable to the aviation risk assessment.

3.5. Aircraft operations at non-controlled aerodromes

There are several uncontrolled aerodromes in the vicinity of the Project Area. Advisory Circulars (ACs) provide advice and guidance from CASA to illustrate a means, but not necessarily the only means, of complying with the Regulations, or to explain certain regulatory requirements. Advisory Circular AC 91-10 v1.4 *Operations in the vicinity of non-controlled aerodromes* provides guidance for pilots flying at or in the vicinity of non-controlled aerodromes, with respect to CASR 91.

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A conventional circuit pattern and heights are provided in the AC. The standard circuit consists of a series of flight paths known as *legs* when departing, arrival or when conducting circuit practice. Illustrations of the standard aerodrome traffic circuit procedures provided in the AC are shown in Figure 4 and Figure 5.

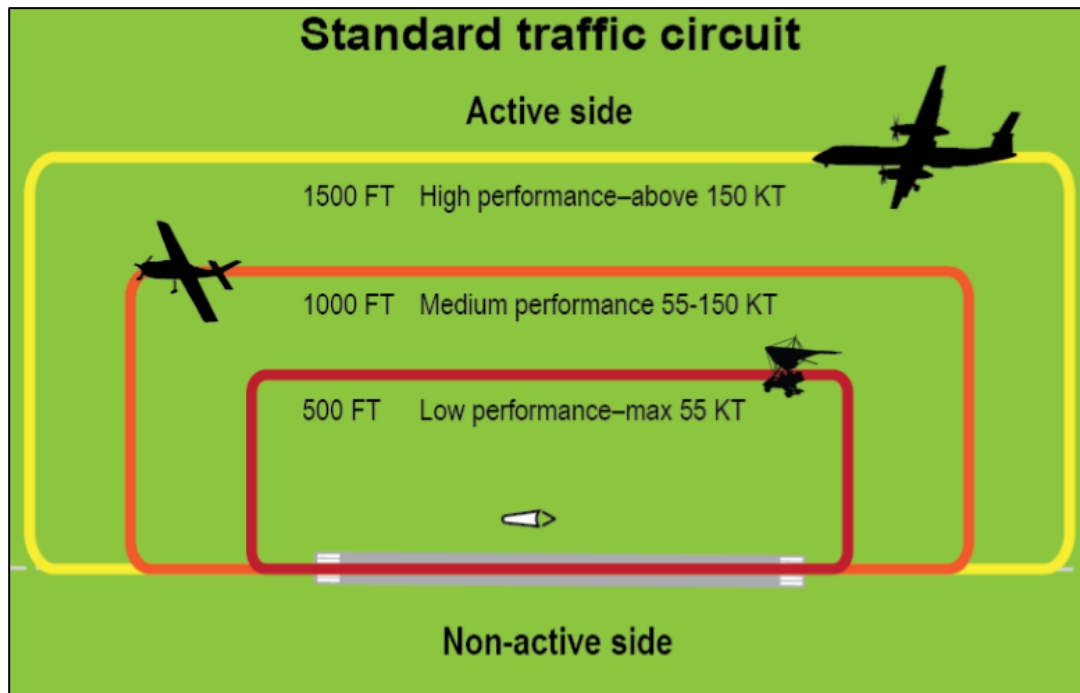


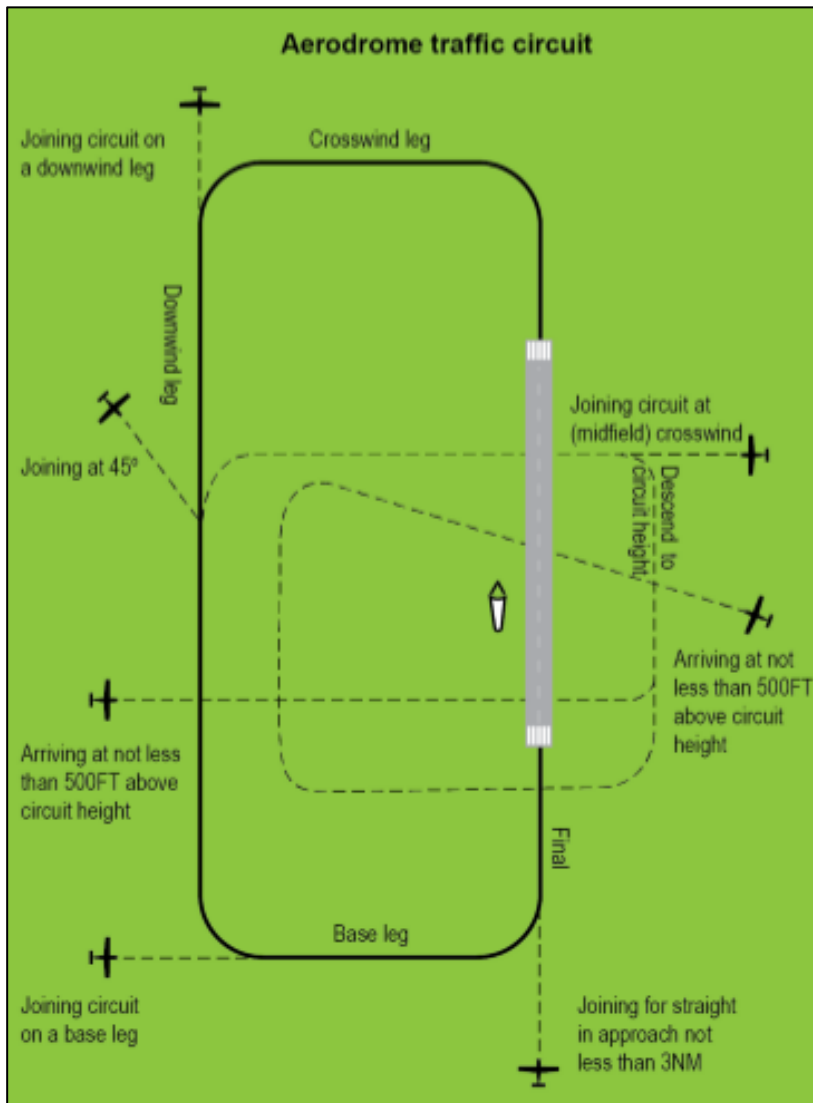
Figure 4 Lateral and vertical separation in the standard aerodrome traffic circuit

An aerodrome is defined by CASA as any place suitable for the landing and take-off of an aircraft.

They can range from an area recognised as an aerodrome by its infrastructure and layout, to a paddock that has been prepared by the landowner for the operation of aircraft for their own purposes, aerial application operations or authorised visitors with suitable aircraft.

The pilot is responsible for the safe operation of their aircraft at such aerodromes, and the landowner is responsible for providing pilots with information related to the condition of the aerodrome, to enable the pilot to make appropriate and safe decisions as to whether to use the aerodrome.

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Figure 5 Aerodrome standard traffic circuit, showing arrival and joining procedures

AC 91-10 v1.4. paragraph 7.11 makes reference to a distance that is “normally” well outside the circuit area and where no traffic conflict exists, which is at least 3 nm (5556 m). The paragraph is copied below:

7.11 Departing the circuit area

7.11.1 Aircraft should depart the aerodrome circuit area by extending one of the standard circuit legs or climbing to depart overhead. However, the aircraft should not execute a turn to fly against the circuit direction unless the aircraft is well outside the circuit area and no traffic conflict exists. This should be 500 ft or more above the circuit height and at least 3 NM from the departure end of the runway, but may be less for aircraft with high climb performance. In all cases, the distance should be based on the pilot’s awareness of traffic and the ability of the aircraft to climb above and clear of the circuit area.

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3.6. Rules of flight

3.6.1. Flight under Day Visual Flight Rules (VFR)

According to Aeronautical Information Publication (AIP) the meteorological conditions required for visual flight in the applicable (Class G) airspace at or below 3000 ft AMSL or 1000 ft AGL whichever is the higher are: 5000 m visibility, clear of clouds and in sight of ground or water.

Civil Aviation Safety Regulations (1998) 91.267 (Minimum height rules—other areas) prescribes the minimum height for flights in areas other than populous areas or public gatherings. Aircraft are required to maintain a minimum height of 500 ft AGL above the highest point of the terrain and any object on it within a radius of 300 m in visual flight during the day when not in the vicinity of built-up areas, and 1000 ft AGL over built up areas.

These rules do not apply during normal take-off and landing operations in accordance with procedures for operations at non-controlled aerodromes.

Flight below these height restrictions is also permitted in certain other circumstances.

3.6.2. Night VFR

With respect to flight under the VFR at night, Civil Aviation Safety Regulations (1998) 91.277 requires that the pilot in command of an aircraft flying VFR at night must not fly below the following heights (unless during take-off and landing operations, within 3 nm of an aerodrome, or with an air traffic control clearance):

- a) *the published lowest safe altitude for the route or route segment (if any);*
- b) *the minimum sector altitude published in the authorised aeronautical information for the flight (if any);*
- c) *the lowest safe altitude for the route or route segment;*
- d) *1,000 ft above the highest obstacle on the ground or water within 10 nautical miles ahead of, and to either side of, the aircraft at that point on the route or route segment;*
- e) *the lowest altitude for the route or route segment calculated in accordance with a method prescribed by the Part 91 Manual of Standards for the purposes of this paragraph.*

3.6.3. Instrument Flight Rules (Day or night) (IFR)

According to CASR 91, flight under the instrument flight rules (IFR) requires an aircraft to be operated at a height clear of obstacles that is calculated according to an approved method. Obstacle lights on structures not within the vicinity of an aerodrome are effectively redundant to an aircraft being operated under the IFR.

3.7. Aircraft operator characteristics

Flying training may be conducted under either the instrument flying rules (IFR) or visual flying rules (VFR). Other general aviation operations under either IFR or VFR are also likely to be conducted at various aerodromes in the area.

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Operations conducted under VFR are required to remain in visual meteorological conditions (VMC) (at least 5,000 m horizontal visibility at a similar height of the wind turbines) and clear of the highest point of the terrain by 500 ft vertical distance and 300 m horizontal distance in areas outside populous areas. In VMC, the wind turbines would likely be sufficiently conspicuous to allow adequate time for pilots to avoid the obstacles. VFR operators would most likely avoid the Project Area once wind turbines are erected.

Flight under day VFR is conducted above 500 ft (152.4 m) above the highest point of the terrain within a 300 m radius unless the operation is approved to operate below 500 ft above the highest point of the terrain.

IFR and Night VFR (which are required to conform to IFR applicable altitude requirements) aircraft operations are addressed in Section 6.

3.8. Passenger transport operations

Regular public transport (RPT) and passenger carrying charter operations are generally operated under the IFR.

3.9. Private operations

Private operations are generally conducted under day or night VFR, with some IFR. Flight under day VFR is conducted above 500 ft AGL and outside 300 m from known or observed obstacles and/or terrain. They are usually conducted at much higher altitudes for comfort and fuel efficiency.

3.10. Military operations

There may be occasional high-speed low-level military jet aircraft and helicopter operations conducted in the area. The Project is not located near to any defence aviation establishment that would regularly conduct such operations.

3.11. Aerial agricultural operations

Aerial agricultural operations including such activities as fertiliser, pest and crop spraying are generally conducted under day VFR below 500 ft AGL; between 6.5 ft (2.0 m) and 100 ft (30.5 m) AGL.

There is a medium rate of aerial application operations in the area.

Due to the nature of the operations conducted, aerial agriculture pilots are subject to rigorous training and assessment requirements in order to obtain and maintain their licence to operate under these conditions.

The Aerial Application Association of Australia (AAAA) has a formal risk management program which is recommended for use by its members.

The impact of the proposed turbines on the safe and efficient aerial application of agricultural fertilisers and pesticides in the vicinity of the Project was assessed.

Refer to **Section 5** for detailed responses from aerial agricultural operator stakeholders.

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3.12. Aerial Application Association of Australia

In previous consultation with the AAAA, Aviation Projects has been directed to the AAAA Windfarm Policy (dated March 2011), now superseded by the AAAA Tall Structures Policy dated March 2024, which states in part:

The development of tall structures in agricultural and bush fire prone areas can pose a direct threat to aviation safety, particularly where fixed and rotary aircraft may be requested to operate for agricultural or bush/grass fire control.

The absence of historical aircraft use in an area is considered an insufficient reason to discount the threat to Aviation Operations.

The AAAA will oppose any development application or similar process unless the proponent has:

- o *Identified the structure as posing a low-level flying risk that needs to be managed on an ongoing basis,*
- o *Consulted honestly and in detail with local aerial application operators or the AAAA where a local operator cannot be identified,*
- o *Consulted with adjoining landowners regarding the impact on adjacent properties,*
- o *Included appropriate lighting and marking in the development proposal, consistent with providing a warning to low level flying,*
- o *Identified the process for advising of the location height and presence of the structure to the relevant authorities, and*
- o *Ensure that the proposal is in keeping with CASA requirements for structures near aerodromes, including temporary landing areas.*

AAAA had developed National Windfarm Operating Protocols (adopted May 2014). These protocols note the following comments:

At the development stage, AAAA remains strongly opposed to all windfarms that are proposed to be built on agricultural land or land that is likely to be affected by bushfire. These areas are of critical safety importance to legitimate and legal low-level operations, such as those encountered during crop protection, pasture fertilisation or firebombing operations.

However, AAAA realises that some wind farm proposals may be approved in areas where aerial application takes place. In those circumstances, AAAA has developed the following national operational protocols to support a consistent approach to aerial application where windfarms are in the operational vicinity.

The protocols list considerations for developers during the design/build stage and the operational stage, for pilots/aircraft operators during aircraft operations and discusses economic compensation. NASF Guideline D is included in the Protocols document as Appendix 1, and AAAA Aerial Application Pilots Manual – excerpts on planning are provided as Appendix II.

This AIA has been prepared in consideration of the National Windfarm Operating Protocols.

3.13. Local aerial application operators

Local aerial application operators consulted in previous studies undertaken by Aviation Projects have stated that a wind farm would in all likelihood, prevent aerial agricultural operations in that particular area, but that properties adjacent to the wind farm would have to be assessed on an individual basis.

Aerial application operators generally align their positions with the AAAA policies.

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Based on previous studies undertaken by Aviation Projects, consultation between RES and local landholder already hosting wind turbines, and subject to the results of consultation with AAAA and any further consultation with local aerial application operators, it is reasonable to conclude that safe aerial application operations would still be possible on properties within and neighbouring the Project Area by implementing recommendations provided in this report.

The use of helicopters enables aerial application operations to be conducted in closer proximity to obstacles than would be possible with fixed wing aircraft due to their greater manoeuvrability.

To facilitate the flight planning of aerial application operators, details of the Project, including 'as constructed' location and height information of wind turbines, wind monitoring towers and overhead powerlines should be provided to landowners so that, when asked for hazard information on their property, the landowner may provide the aerial application pilot with all relevant information.

3.14. Aerial firefighting

Aerial firefighting operations (firebombing in particular) are conducted in Day VFR, sometimes below 500 ft AGL. Under certain conditions visibility may be reduced/limited by smoke/haze.

Most aerial firefighting organisations have formal risk management programs to assess the risks associated with their operations and implement applicable treatments to ensure an acceptable level of safety can be maintained. For example, pilots require specific training and additional equipment installed in the aircraft, and special procedures are developed.

The Australasian Fire and Emergency Services Council (AFAC) has developed a national position on wind farms, their development and operations in relation to bushfire prevention, preparedness, response and recovery, set out in the document titled *Wind Farms and Bushfire Operations*, version 3.0, dated 25 October 2018.

Of specific interest in this document is the 'operational fire response' heading, copied below:

Wind farm operators should be responsible for ensuring that the relevant emergency protocols and plans are properly executed in an emergency event. During an emergency, operators need to react quickly to ensure they can assist and intervene in accordance with their planned procedures.

The developer or operator should ensure that:

- o *liaison with the relevant fire and land management agencies is ongoing and effective*
- o *access is available to the wind farm site by emergency services response for on-ground firefighting operations*
- o *wind turbines are shut down immediately during emergency operations – where possible, blades should be stopped in the 'Y' or 'rabbit ear' position, as this positioning allows for the maximum airspace for aircraft to manoeuvre underneath the blades and removes one of the blades as a potential obstacle.*

Aerial personnel should assess risks posed by aerial obstacles, wake turbulence and moving blades in accordance with routine procedures.

Refer to **Section 5** for detailed responses from aerial firefighting stakeholders including CFA.

3.15. Emergency services - Royal Flying Doctor Service/Air Ambulance

Royal Flying Doctor Service (RFDS)/Air Ambulance and other emergency services operations are generally conducted under the IFR, except when arriving/departing a destination that is not serviced by instrument approach aids or procedures.

Most emergency aviation services organisations have formal risk management programs to assess the risks associated with their operations and implement applicable treatments to ensure an acceptable level of safety can be maintained.

For example, pilots and crew require specific training and approvals, additional equipment is installed in the aircraft, and special procedures are developed.

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4. INTERNAL CONTEXT

4.1. Wind farm location

The wind farm is situated in an area comprised mainly of farming properties on a landscape with rolling terrain.

4.2. Wind turbine description

The maximum blade tip height of the proposed wind turbines would be up to 255 m (836.6 ft) AGL.

The highest ground elevation of any of the proposed wind turbines (WTG19) is 265.3 m AHD (870.4 ft AMSL), results in a maximum overall height of 520.3 m AHD (1707.0 ft AMSL).

Figure 6 demonstrates the Project layout identifying the highest wind turbine WTG19 (source: RES, Google Earth).

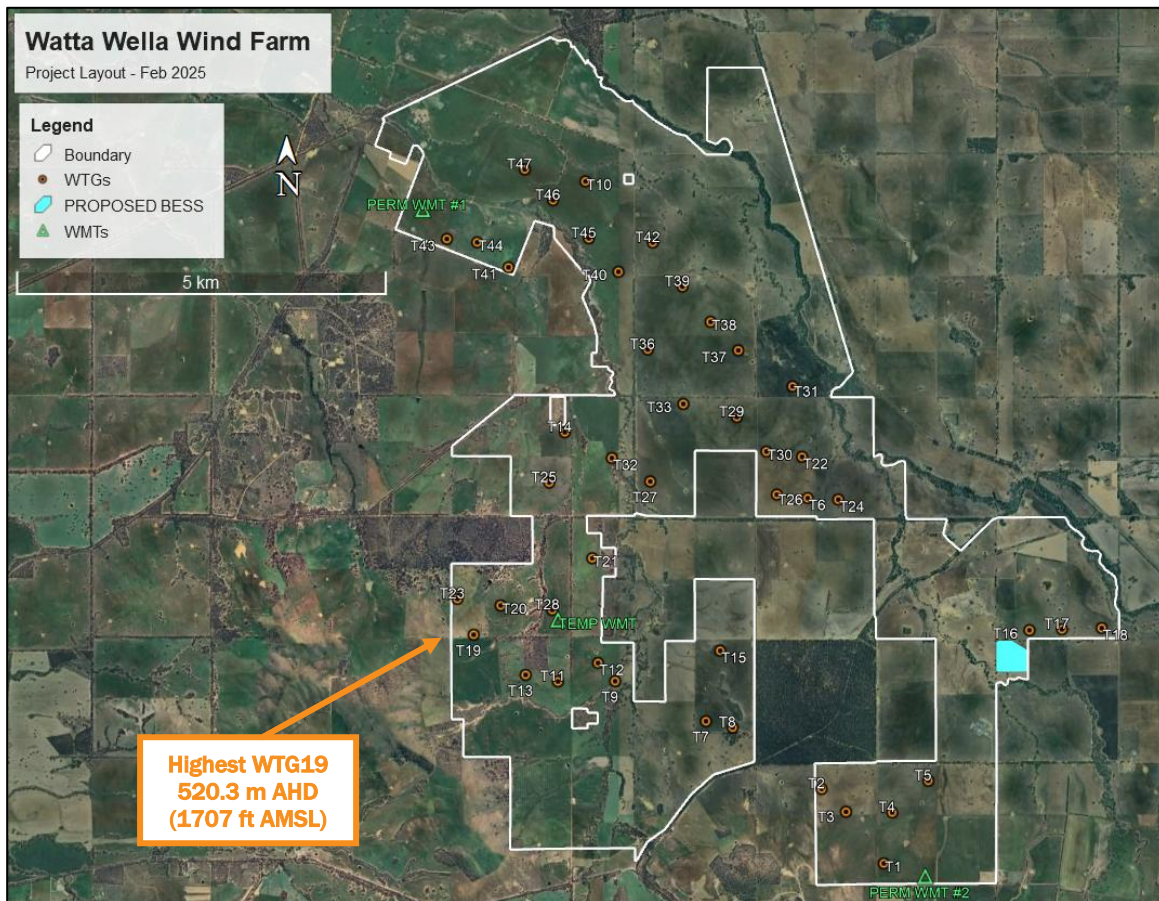


Figure 6 Project layout and highest wind turbine

The coordinates and ground elevations of the WTGs analysed are listed in **Annexure 3**.

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4.3. Wind monitoring tower description

A temporary WMT with a maximum height of 100 m (328.1 ft) AGL in height was installed in February 2022 and is proposed to be removed prior to the commencement of construction in 2027. The details of the WMT was reported to Airservices Australia. The WMT location is provided in Figure 7 (Source: RES, Google Earth)

A separate AIA was undertaken for the temporary WMT and is provided as an Annexure to this report. (Reference: 10220302_Watta_Wella_WF_WMT_AIA_v1.0_220624)

In addition to the temporary WMT, two permanent WMTs are proposed as part of the Project. The height of these met masts will be subject to later design and technical assessment. At a maximum, they will be the same height as the hub of the WTGs (up to 166 m) and at a minimum, could be 80 m in height. It is anticipated that the two permanent WMTs will be constructed during the broader construction of the Project, likely to be when the WTGs are being commissioned.

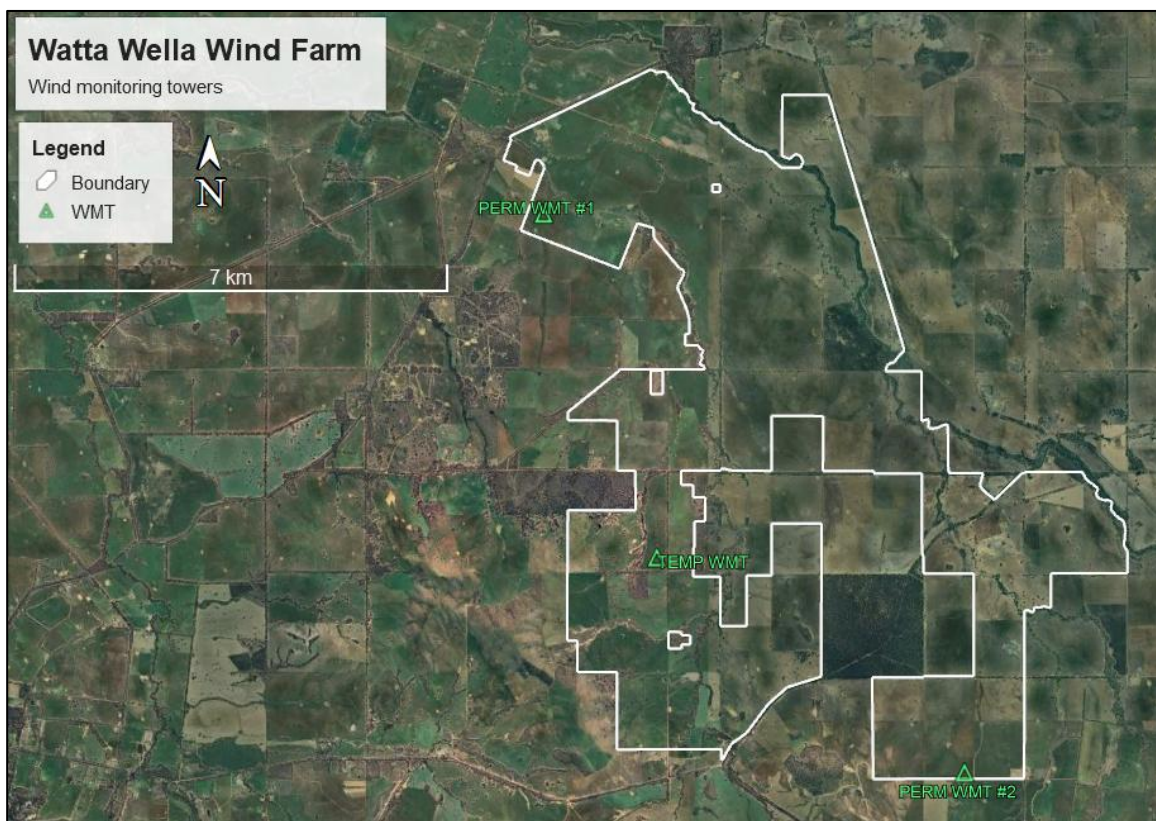


Figure 7 WMT locations within Project Area

Table 1 provides the details of the WMTs provided by RES.

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Table 1 WMT details

Parameter	Details		
WMT ID	Temp WMT	Perm WMT 1	Perm WMT 2
Location	37.023927° S 142.919895° E	36.975156° S 142.899593° E	37.055660° S 142.975674° E
Error budget (m)	5 m (16.4 ft)	TBC	TBC
Ground elevation at site (approximate)	239 m (784 ft AMSL)	TBC	TBC
Height of tower AGL	100 m (328.1 ft)	Up to 166 m AGL (TBC)	Up to 166 m AGL (TBC)
WMT Maximum height	344 m AHD (1,128.6 ft AMSL)	TBC	TBC
Lighting	Nil – assessed as not required	TBC	TBC
Marking	Marker balls at 2/3 of mast height, top 1/3 painted in red/white/red bands, Marking at guy bases	TBC	TBC
Design	Steel lattice	Steel lattice	Steel lattice
Commissioning date	6/02/2022	TBC	TBC
Reported to Airservices Australia	10/02/2022	TBC	TBC

Exact final locations and construction details are subject to further detailed design and assessment.

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5. CONSULTATION

The stakeholders consulted include:

- Airservices Australia
- Ararat Rural City Council
- Northern Grampians Shire Council
- Department of Defence
- Royal Flying Doctor Service
- Country Fire Authority VIC
- AgAir (VIC)
- Wyndarra Aerodrome Owner

Details and results of the consultation activities are provided in Table 2.

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Table 2 Stakeholder consultation details

<i>Agency/Contact</i>	<i>Activity/Date</i>	<i>Response/ Date</i>	<i>Issues Raised During Consultation</i>	<i>Action Proposed</i>
Airservices Australia	Consultation email sent 02 September 2021	Response received 14 October 2021 from William Zhao (Advisor Customer Engagement)	<p><i>...Summary</i></p> <p><i>Based on the above assessment, our view is that the proposed wind farm would not have an impact on any Airservices designed instrument procedures, CNS facilities or ATC operations at Melbourne Airport.</i></p> <p><i>Vertical Obstacle Notification</i></p> <p><i>We request that the proponent completes the Vertical Obstacle Notification Form for tall structures and submits it to VOD@airservicesaustralia.com as soon as the development reaches the maximum height.</i></p>	<p>Report tall structures when the layout is finalised by submitting the form at this webpage: https://www.airservicesaustralia.com/wp-content/uploads/ATS-FORM-0085_Vertical_Obstruction_Data_Form.pdf to the following email address: vod@airservicesaustralia.com</p>
Northern Grampians Shire Council	Consultation email sent 02 September 2021	Response received 01 October 2021 from Klaas Meekel (Statutory Planner)	<p><i>...All permits for wind farms in Victoria are now processed by DELWP (on behalf of the Minister).</i></p> <p><i>Council does not have the internal expertise to be able to give any meaningful comments / feedback on your attached report. Your report, together with all other required specialist reports for the planning permit, should therefore be sent to DELWP.</i></p>	No further action required.

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Agency/Contact	Activity/Date	Response/ Date	Issues Raised During Consultation	Action Proposed
Ararat Rural City Council	Consultation email sent 02 September 2021	Response received 22 October 2021 from Veronica Schilling (Manager Planning, Community and Compliance)	We have reviewed the materials and also liaised with the Ararat Airport Manager. We have no issue with the proposal at all.	No further action required.
CASA	CASA has advised that it will only review assessments referred to it by a planning authority or agency.			
CFA VIC	Consultation email sent 02 September 2021	Response received 03 September 2021. Email from Luke Patterson (Commander Aviation)	<p>This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright</p> <p>Luke Patterson replied...As you would be aware it's the pilot's responsibility to maintain separation alike any other vertical hazard eg communications tower, masts, terrain etc. A wind turbine tower is no different. Each aircraft and pilot have varying levels of experience, ability and other external factors ie weather to determine what separation they need to maintain - a wind turbine by itself or together as a facility isn't a major impediment to aerial firefighting operations as they're easily seen and reasonably known. However, the risk of metrological weather masts and associated guy wires under 150 feet in researching sites are a known</p>	It was recommended by CFA to consult with Agair (admin@agair.com.au). Agair added to consultation list. Action - consult with Agair.

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Agency/Contact	Activity/Date	Response/ Date	Issues Raised During Consultation	Action Proposed
			<p>hazard to fire aviation activities which are unmarked on navigational charts and unlit/unidentified.</p> <p>Copies of AFAC doctrine and Guidelines for Wind Energy Facilities were also attached to the response email and have been previously referenced in this AIA.</p>	
<p>Department of Defence</p>	<p>Consultation email sent 02 September 2021</p> <p>Reminder email sent 18 October 2021 and again 09 February 2021</p>	<p>Response received 03 March 2022 by Charles Mangion, Director of Land Planning and Regulation</p>	<p><i>Thank you for referring the abovementioned wind farm proposal to the Department of Defence (Defence) for comment. Defence understands that this is a proposal for the construction and operation of a wind farm 16km northeast of Stawell Township Victoria with 45 turbines and maximum height of 255 metres AGL (to blade tip). As tall structures, wind farms can have the potential to pose a number of concerns for Defence, particularly with regard to aircraft safety, military low flying and radar interference. Defence has conducted an assessment of the amended proposal for potential impacts on the safety of Defence flying operations.</i></p> <p><i>There is an ongoing need to obtain and maintain accurate information about tall structures so that this information can be marked on aeronautical charts. Marking tall structures on aeronautical charts assists pilot navigation and enhances flight safety. Airservices Australia (ASA) is responsible for recording the location and height of tall structures. The information is held in a</i></p>	<p>Report construction of structures as per recommendations in this assessment.</p>

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Agency/Contact	Activity/Date	Response/ Date	Issues Raised During Consultation	Action Proposed
			<p>central database managed by ASA and relates to the erection, extension, or dismantling of tall structures, the top of which is above:</p> <ul style="list-style-type: none"> a. 30 metres AGL, that are within 30 kilometres of an aerodrome; and b. 45 metres AGL elsewhere. <p>The proposed 250 metres AGL turbines meet the requirements for reporting of tall structures. Defence therefore requests that the applicant provide ASA with "as constructed" details. The details can be emailed to ASA at vod@airservicesaustralia.com.</p> <p>Defence notes that the National Airports Safeguarding Framework Guideline D – Managing the Risk to Aviation Safety of Wind Turbine Installations (Wind Farms)/Wind Monitoring Towers recommends that where a wind turbine 150 metres or taller in height is proposed away from aerodromes, the proponent should conduct an aeronautical risk assessment and submit that assessment to the Civil Aviation Safety Authority (CASA) to determine whether the proposal is a hazard to aircraft safety and requires approved lighting or marking.</p> <p>If CASA determines that obstacle lighting is to be provided, it should be compatible with persons using</p>	

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Agency/Contact	Activity/Date	Response/ Date	Issues Raised During Consultation	Action Proposed
			<p>night vision devices. If LED lighting is proposed, the frequency range of the</p> <p>2 LED light emitted should be within the range of wavelengths 665 to 930 nanometres. Defence also requests that the colour used for the wind turbines ensure that they are conspicuous to aircraft during daylight hours.</p> <p>Defence has no objection to the proposed wind farm provided that the project complies with the above conditions.</p> <p>Should you wish to discuss the content of this advice further, my point of contact is Tim Hogan at land.planning@defence.gov.au or telephone on (02) 5109 7933.</p>	
RFDS	<p>Consultation email sent 02 September 2021</p> <p>Reminder email sent 18 October 2021</p>	Nil response	<p>N/A</p>	No further action required
AgAir	Consultation email sent 06 September 2021	Response received 07 September 2021	<p>Response from Rob Boschen (CEO Agair)</p> <p>...Being the primary tenant at Stawell airport and a major contractor to the State Government of Victoria for firebombing aircraft, as well as providing an aerial application service to the agriculture sector in the</p>	Consider implementing marking in accordance with recommendations specified in NASF and per the specifications of Part 139 MOS 2019.

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Agency/Contact	Activity/Date	Response/ Date	Issues Raised During Consultation	Action Proposed
			<p>region, any constructions such as this do impact on our business. Any impact that adversely affects the safety of our aircraft operations is of great concern.</p> <p>We align ourselves with the AAAA Windfarm policy and communicate with our customers and suppliers the risks that windfarm developments create to our business. Apart from the obvious risk to safe flight that exists with wind towers, our clients are reminded that the quality of workmanship either in aerial application or in the construction of towers and obstacles such as the towers, the quality will come at a price. The towers are a hazard to our business with the windfarm. The towers seem to 'spring' up on any site, quickly and without notice. They are hard to see and are generally located in an area well away from any other vertical structures.</p> <p>Although your research shows no incidents of aircraft colliding with met towers it is not due to good management. Businesses operating aircraft at low level train their flight crew to look for, and be very vigilant when operating around these structures. Because they are so hard to see it is equally hard for a pilot to remember where they are at all times and determine</p>	<p>Refer WMT assessment 102203-02 (Annexure report)</p>

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Agency/Contact	Activity/Date	Response/ Date	Issues Raised During Consultation	Action Proposed
			<p>accurate distance reference from the tower or guy wires once in the pilots field of view.</p> <p>This is an area that wind farm proponents would do well to focus on so as to share the management of risk more equitably with flight crews of aircraft operating at low level.</p>	
Wyndarra Aerodrome Operator- initial consultation	Consultation email sent 06 September 2021	Response received 06 September 2021	<p>Response from Wyndarra aerodrome (ALA) owner -</p> <p>After looking closely at the proposed turbine site it is clear that the ALA will be affected by those turbines located to the west of the aerodrome. The positioning of some of the turbines, specifically the Westerly turbines, is a concern as it is likely to affect those aircraft that are operating in the area. The ALA owner is not a Part 137 operator and the aircraft are not certified for operations in the vicinity of the aerodrome. However they are much lighter weight aircraft and are susceptible to Wake turbulence emanating from these extra-large wind turbines..... That is fact!!!</p> <p>The 2 aircraft presently operating on a regular basis out of our ALA are Vans Aircraft RV9 & RV3B, they are not LSA aircraft. They need the same circuit area as your C210 or Bonanza.</p>	<p>Action taken – Aviation Projects were engaged specifically to liaise directly with the owner (engagement reference 102303-03) and attend the aerodrome site for further investigation.</p> <p>The engagement concluded that 'the wind farm is far enough away from the (sic) [aerodrome] that wind shear from the nearest WTGs is unlikely to have an adverse impact upon his take-off and landing activities, as opposed to the trees and nearby terrain which he recognises as a hazard that he addresses each time he goes flying.'</p>

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Agency/Contact	Activity/Date	Response/ Date	Issues Raised During Consultation	Action Proposed
			<p>I strongly recommend you play by the rules and remove the offending turbines from the proposed present wind farm plan.</p> <p>This paramount safety issue will be closely watched.</p>	
<p>Wyndarra Aerodrome Operator</p> <p>Onsite consultation with RES and Aviation Projects representatives 2022</p>	8 February 2022	17 February 2022, by Wyndarra aerodrome Owner	<p>There is no doubt Wind turbines do create significant Wake Turbulence. What is unclear is how potentially dangerous it can be. After carefully reading your Aviation Impact Assessment pages 32 to 35 I was impressed with your analysis and agree we do have a real problem of safety that needs to be addressed. From the practical standpoint, yes we do come well within the 2.8 Kms (16 x 178M) during a normal legally executed take off on our runway 07 with standard LH circuit. As you correctly point out on page 34, turbines WTG1, WTG14 & WTG35 and may I suggest from the plan WTG42 do pose an unacceptable risk to the safety of our operations during North Easterly wind conditions. As Dan made clear, they are able to move turbines around as necessary to mitigate risk to everyone's satisfaction.</p> <p>For us this is a very serious situation we find ourselves in.</p> <p>Sincerely,</p>	<p>The aerodrome owner's main concern is the additional turbulence that he believes will cause him a hazard when operating at his Wyndarra aerodrome (ALA)</p> <p>Further investigations into studies for the extent of wind farm generated turbulence have been obtained from RES Head Office in England.</p> <p>Assessment of the extent of this turbulence is referred to later in this report.</p> <p>Note: WTG numbers have changed since this response.</p>

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6. AVIATION IMPACT STATEMENT

NASF Guideline D provides information to proponents and planning authorities to help identify any potential safety risks posed by wind turbine and wind monitoring installations from an aviation perspective.

Potential safety risks include (but are not limited to) impacts on flight procedures and aviation communications, navigation, and surveillance (CNS) facilities which require assessment by Airservices Australia.

To facilitate these assessments all wind farm proposals submitted to Airservices Australia must include an AIS.

This analysis considers the aeronautical impact of the WTGs on the following:

- The operation of nearby certified aerodromes
- The operation of nearby uncertified aerodromes
- Grid and air route LSALTS
- Airspace protection
- Aviation facilities
- Radar installations
- Local aircraft operations.

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6.1. Nearby certified aerodromes

The Project Area is located within 30 nm (55.6 km) of three certified airports – Stawell Airport (YSWL), Ararat Airport (YARA) and St Arnaud Airport. (YSTA)

Figure 8 shows the location of the Project Area relative to 30 nm radius from the aerodrome reference point of Stawell, Ararat and St Arnaud airports (source: Umwelt, Google Earth, Airservices).

The 30 nm radius represents the 25 nm minimum sector altitude (MSA) for aerodromes with terminal instrument flight procedures. The 25 nm MSA minimum altitude is determined by assessing obstacles within 30 nm (25 nm plus 5 nm buffer) of the aerodrome reference point or navigational aid on which the MSA is based on.

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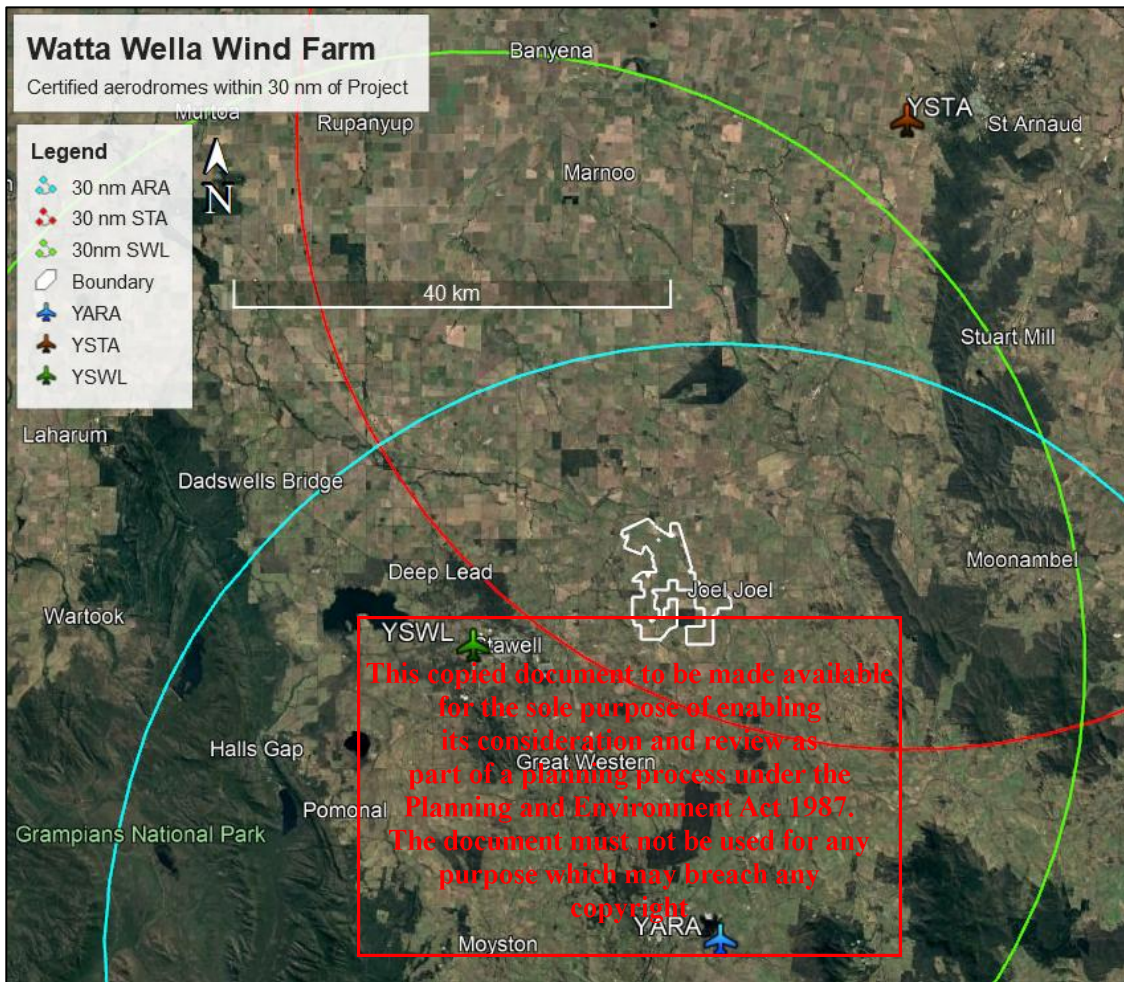


Figure 8 Location of Certified Airports within 30 nm of the Project

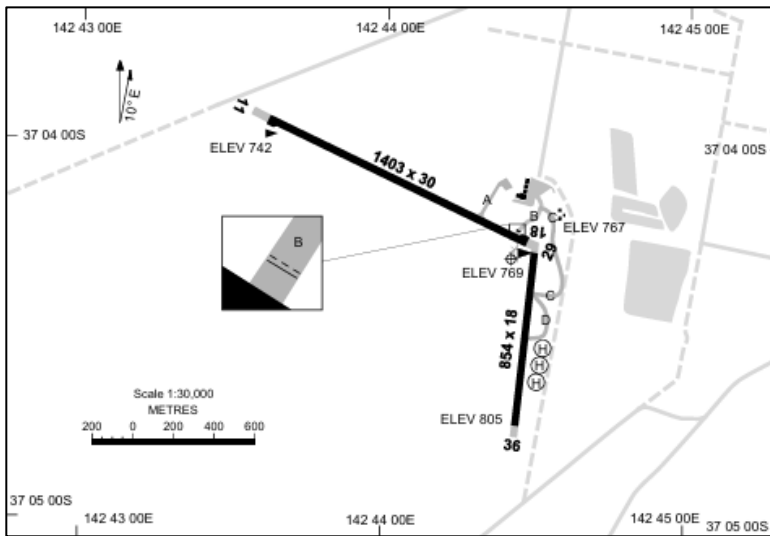
6.2. Stawell Airport

Stawell Airport (YSWL) is a certified aerodrome operated by Northern Grampians Shire Council, with a published aerodrome elevation of 246 m AHD (807.1 ft AMSL) (source: Airservices Australia).

YSWL has two runways:

- Runway 11/29 sealed runway with a length of 1403 m, width 30 m and runway strip 90 m
- Runway 18/36 sealed runway with a length of 854 m, width 18 m and runway strip 90 m.

Figure 9 shows the published runway layout for YSWL (source: Airservices Australia, Aerodrome Chart, dated 20 March 2025).



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Figure 9 Published YSWL runway layout

Stawell Airport’s Aerodrome Reference Point (ARP) coordinates published in Airservices Australia’s ERSA are Latitude 37° 04’18”S and Longitude 142° 44’25”E.

6.3. Instrument procedures – Stawell Airport

A non-precision instrument approach provides horizontal (lateral) guidance to an aircraft flying the published approach procedure and improves access to an aerodrome for aircraft in low cloud and/or poor visibility.

A check of Aeronautical Information Package (AIP) via the Airservices Australia website showed that YSWL is served by non-precision terminal instrument flight procedures, consisting of 2 separate RNP procedures aligned with runway 11/29.

Table 3 identifies the aerodrome and procedure charts for YSWL, designed by Airservices Australia.

Table 3 Stawell Airport (YSWL) aerodrome and procedure charts

<i>Chart name</i>	<i>Effective date</i>
AERODROME CHART	28 November 2024 (AM181)
RNP RWY 11	15 June 2023 (AM175)
RNP RWY 29	15 June 2023 (AM175)

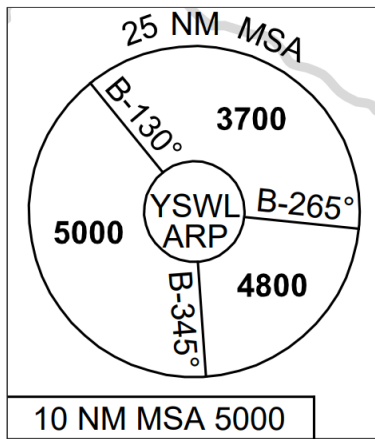
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6.4. YSWL – Minimum sector altitude (MSA)

Obstacles within the 10 nm MSA and within the 25 nm MSA of YSWL’s aerodrome reference point (ARP) define the minimum altitude at which an aircraft can fly when within 10 nm and 25 nm without the required visual reference to the ground or water until they commence the instrument approach procedure.

The CASR Manual of Standards 173 *Standards Applicable to Instrument Flight Procedure Design* (CASR Part 173 MOS), requires that a minimum obstacle clearance (MOC) of 984 ft below the published MSA is maintained.

An image of the MSA published for Stawell Airport is shown in Figure 10 (Source Airservices Australia March 2025).



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Figure 10 MSA established for YSWL

The Project is located within the 10 nm MSA area. The 25 nm MSA for YSWL is sectorised, with the 25 nm MSA sector B130° - B265° and sector B265° - B345° having a lower MSA than the 10 nm MSA. AIP ENR 1.5-18 specifies that when a sectorised 25nm MSA is provided with a lower MSA than the 10 nm MSA, the lower 25nm sector MSA may be used. Therefore, the 25 nm MSA sector B130° - B265° MSA of 3700 ft is the controlling surface.

Figure 11 shows the Project in relation to the YSWL MSA (Source: Umwelt, Google Earth).

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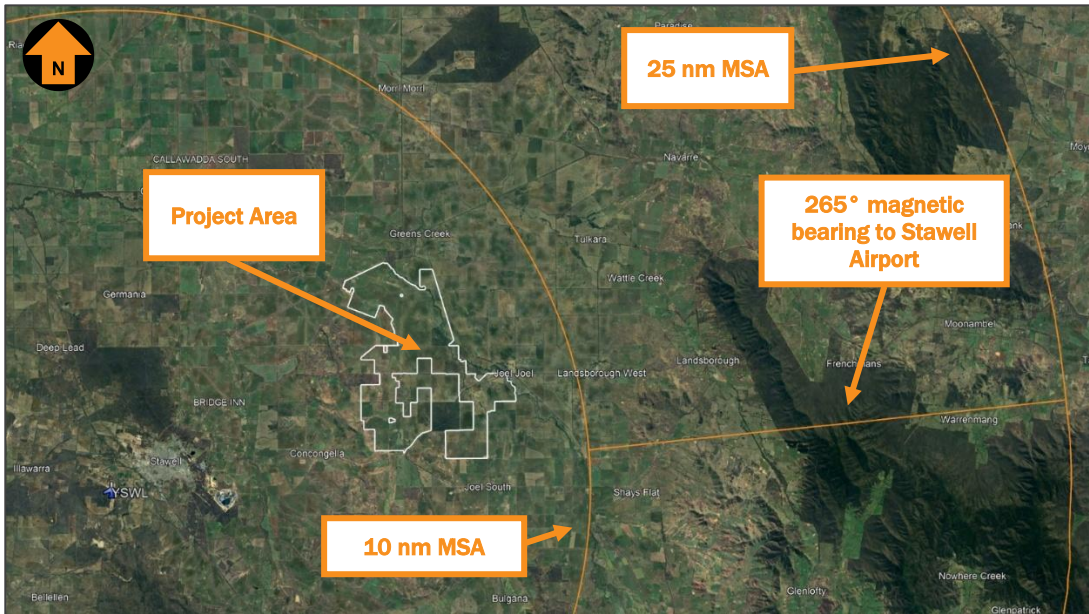


Figure 11 Project Area in relation to Stawell MSA. WTG19 is the highest wind turbine located inside of the horizontal extent of the 10 nm MSA. An impact analysis of Stawell Airport's MSA is provided in Table 4 based on the maximum Project height of 520.3 m AHD (1707.0 ft AMSL).

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Table 4 Stawell Airport MSA impact analysis

MSA	Minimum altitude (ft AMSL)	PANS OPS Surface (ft AMSL)	Impact on airspace design	Potential solution	Impact on aircraft ops
10 nm	5000	4016	Nil – below the controlling altitude by approximately 2293 ft	N/A	N/A
25 nm (sector B130° and B265°)	3700	2716	Nil – below controlling surface by approximately 993 ft	N/A	N/A
25 nm (sector B265° and B345°)	4800	3816	Nil – below controlling surface below controlling surface by approximately 2093 ft	N/A	N/A
25 nm (sector B345° and B130°)	5000	4016	Nil – below controlling surface below controlling surface by approximately 2293 ft	N/A	N/A

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The Project would not impact instrument flight procedures at Stawell Airport.

6.5. Circling areas – Stawell Airport

Qualified aircraft up to performance Category C may conduct instrument approaches at the aerodrome. The maximum horizontal distance that the Category C circling area may extend from an aerodrome in Australia is 4.2 nm (7.8 km) from the threshold of each usable runway.

The Project Area is located approximately 15.5 km (8.4 nm) northwest of the ARP and therefore beyond the horizontal extent of the Category C circling area at Stawell Airport.

6.6. Obstacle limitation surfaces – Stawell Airport

The maximum horizontal distance that an OLS may extend for an aerodrome in Australia is 15 km (8.1 nm) from the edge of a runway strip.

The Project Area is located approximately 15.5 km (8.4 nm) northwest of the ARP and therefore beyond the horizontal extent of the OLS of Stawell Airport.

6.7. Ararat Airport (YARA)

Ararat Airport is a certified aerodrome operated by Ararat Rural City Council, with a published aerodrome elevation of 307 m AHD (1007.2 ft AMSL) (source: Airservices Australia, 2025). The aerodrome is located approximately 28 km south of the nearest wind turbine, to the aerodrome reference point.

Ararat Airport has two runways:

- Runway 12/30 Code 1 sealed runway with a length of 1240 m, width 30 m and runway strip 90 m
- Runway 04/22 Code 1 grass runway with a length of 660 m, width 18 m and runway strip 90 m.

Figure 12 shows the published runway layout for YARA (source: Airservices, 20 March 2025)

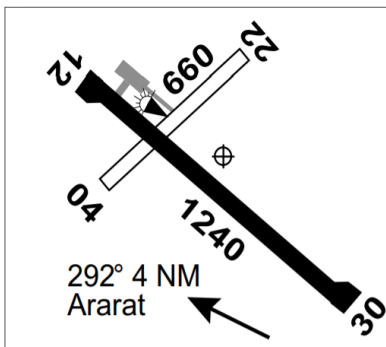


Figure 12 Published runway layout YARA

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There are no instrument approach procedures published for Ararat Airport. The Project is located beyond the horizontal distances specified for a Code 1 Non-instrument runway OLS in CASR Part 139 MOS and would not affect Ararat Airport's OLS.

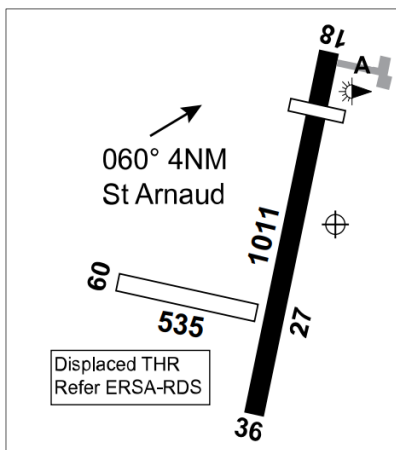
6.8. St Arnaud Airport (YSTA)

St Arnaud Airport is a certified aerodrome operated by Northern Grampians Shire Council, with a published aerodrome elevation of 195 m AHD (639.8 ft AMSL) (source: Airservices Australia, March 2025). The aerodrome is located approximately 44 km (23.8 nm) north-east of the nearest wind turbine, to the aerodrome reference point.

YSTA has two runways:

- Runway 18/36 Code 1 sealed runway with a length of 1011 m, width 18 m and runway strip 90 m
- Runway 09/27 Code 1 gravel runway with a length of 535 m, width 18 m and runway strip 90 m.

Figure 13 shows the YSTA published runway layout (source: Airservices Australia, ERSA-FAC, March 2025).



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Figure 13 Published runway layout YSTA

There are no instrument approach procedures published for St Arnaud Airport. The Project is located beyond the horizontal distances established for a Code 1 Non-instrument runway OLS in accordance with CASR Part 139 MOS Chapter 7 and would not affect YSTA's OLS.

6.9. Nearby uncertified aerodromes

As a guide, an area of interest within a 3 nm radius of an uncertified aerodrome is used to assess potential impacts of proposed developments on aircraft operations at or within the vicinity of the uncertified aerodrome.

A search on OzRunways, which sources its data from Airservices Australia (AIP), did not identify any recognised uncertified aerodromes within 3 nm (5.6 km) of the Project Area. The aeronautical data provided by OzRunways is approved under CASR Part 175.

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A review of NationalMap (an online map-based tool allowing access to spatial data from Australian government agencies) was also undertaken.

The two closest recognised uncertified aerodromes observed in relation to the Project Area (identified on OzRunways and NationalMaps) were Navarre and Moonambel. Figure 14 shows the location of these two uncertified aerodromes (and 3 nm radius) in relation to the Project Area. (Source Umwelt, Google Earth) All uncertified aerodromes identified via OzRunways are further than 3 nm from, and would not be adversely affected by, any wind turbines of the Project.

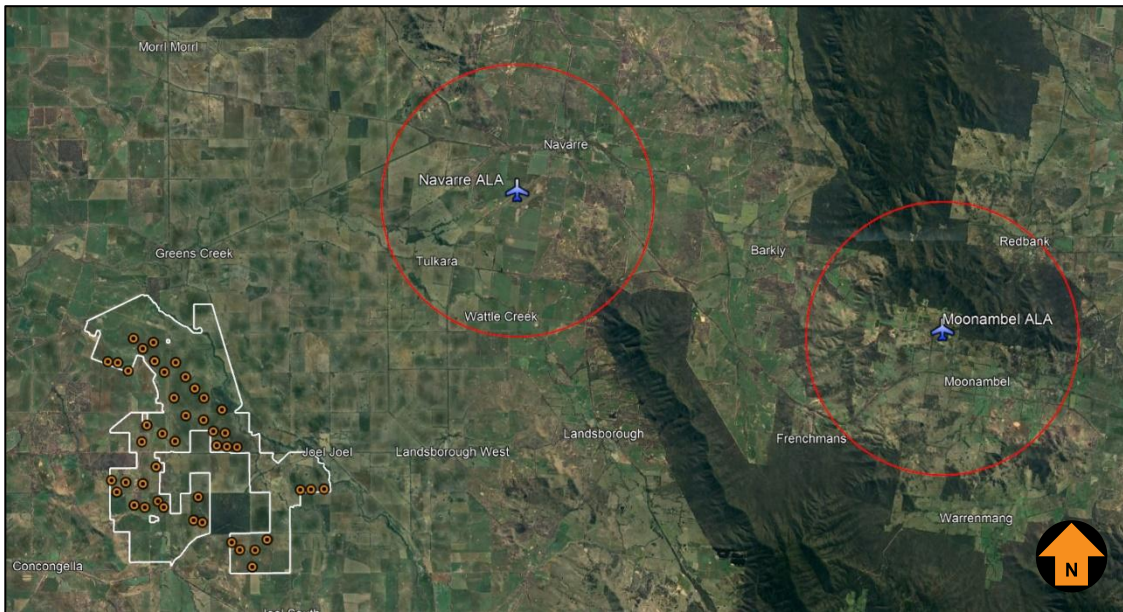


Figure 14 Project Area relative to closest aerodromes identified on OzRunways and NationalMaps

An additional uncertified aerodrome was identified near the Project Area during the site visit conducted by Aviation Projects on 17 March 2021. It is located on a property named Wyndarra. Figure 15 shows the aerodrome site (source Google Earth), and Figure 16 is a photo taken from Landsborough Road during the site visit, looking north towards the aerodrome. Figure 17 shows the aerodrome location (and 3 nm radius) in relation to the Project.

The Wyndarra aerodrome is located within 3 nm of wind turbines and may therefore be affected by the Project.

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Figure 15 Wyndarra aerodrome runway layout south-west of Project



Figure 16 photo of Wyndarra aerodrome from Landsborough Road

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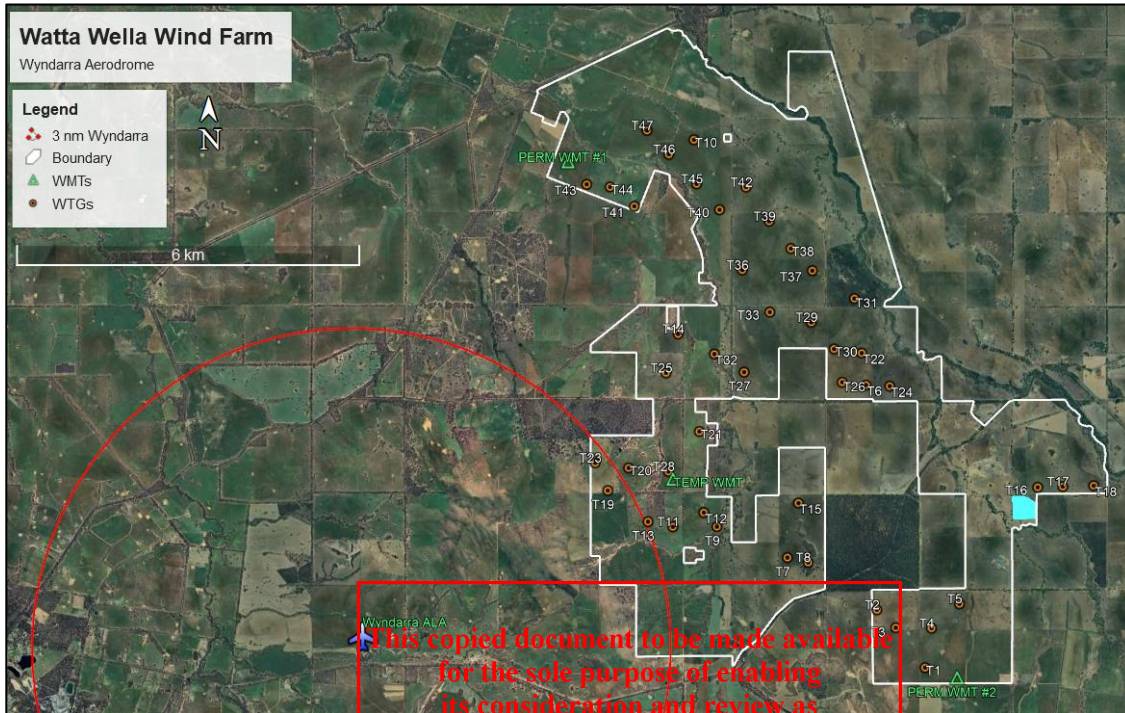


Figure 17 Location of Wyndarra aerodrome (and 3 nm AEA) in relation to Project

6.10. Impact on Wyndarra aerodrome South-west of Project

WTG19, located in the south-western quadrant of the Project area, is the closest turbine to the Wyndarra aerodrome displayed in Figure 15 and lies within a 3nm radius of the approximate centroid of the aerodrome. WTG 23 is also located within 3 nm of the nearest runway end of the aerodrome.

NASF Guideline D details that “wind turbines may create turbulence which is noticeable up to 16 rotor diameters from the turbine”.

A typical circuit pattern (comprised of 1 nm upwind and crosswind legs) is displayed Figure 18 to the closest runway and both circuit directions in relation to a 16 x rotor diameter (178 m) radius of 2848 m, an area described in NASF Guideline D.

The NASF Guideline D turbulence figure is based on United Kingdom (UK) Civil Aviation Authority (CAA) Civil Aviation Publication (CAP) 764 – CAA Policy and Guidelines on Wind Turbines, which in turn is based on “research activity or modelling and studying the wake characteristics.....using computational fluid dynamics techniques, wind tunnel tests and on site LIDAR measurements.”

This CAP recognises that the extent of the turbulence diminishes to less than 10% of what exists immediately behind the turbine within 5 rotor diameters (RD). This study was based on a 30 m diameter turbine.

Section 4.2 of the CAP specifies anticipated distances from a wind turbine development which might have an impact on ‘civil aerodromes,’ depending on the nature of the aerodrome and length of runway(s). Relevant to

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the Wyndarra aerodrome, with a runway distance less than 800 m, the following distance is identified for potential impacts by wind turbine development:

6. *Within 3 km of a non-radar equipped unlicensed aerodrome with a runway of less than 800 m.*

A study by the European Academy of Wind Energy, - *Do Wind Turbines Pose Roll Hazards to Light Aircraft*, 2018, used a large-eddy simulations (LES) to assess wind-generated roll hazards to small aircraft from the wake of a utility-scale wind turbine – a GE 1.5 MW turbine with three bladed rotor of 77 m in diameter and a hub height of 80 m. A typical aircraft was used in the study, a Cessna 172.

This study is considered a simple method for quantifying turbine-wake-induced roll hazards on general aviation aircraft.

The "assessment criteria are based on the maximum rolling moment that the aileron on a typical aircraft can generate to counteract a moment induced by the wake field."

This study determined:

- Turbine wakes tend to diffuse more rapidly in convective conditions as the mechanical mixing of the air erodes the wake (Baker and Walker 1984, Magnusson and Smedman 1994, Mirocha et al., 2015)
- The worst case for longer persisting wakes exist in stable atmospheric conditions (Bodini et al., 2018)
- 99.99% of all calculations exist in low hazard conditions
- No moments reached the high hazard threshold
- In stable conditions the largest roll hazards occur most frequently about 3 D downwind of the turbine
- All of the peak hazards are located in the high shear zone at the edge of the wake between 3 and 7 D downwind from the turbine
- Normal control inputs by pilots when first noticing the roll movement would alleviate the wake impact.

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The advice provided by the NASF Guideline D and the data and conclusions contained in the above study is clear that any turbulence downwind of a turbine is significantly decreased beyond approximately 7 rotor diameters. After consideration of available reports provided by both independent research and by RES UK Head Office, Aviation Projects and RES Australia Pty Ltd have agreed that a conservative distance of 10 rotor diameters is an appropriate distance to consider that the turbulence is dissipated to an extent less than the effect of the turbulence generated by the wind flow over hills, trees and other natural objects.

The aerodrome consists of two runways, one with a length of approximately 740 m and the other approximately 770 m. This indicates that the aerodrome is used by light aircraft only and potentially including aerial agriculture operators. Aircraft typically associated with operations at an aerodrome with this length of runway are unlikely to require a circuit pattern as large as the indicative one used for this analysis. Wake turbulence would only affect the aerodrome with a wind from the north-east in which case aircraft would generally be taking off toward the north-east and could make a turn at 500 ft AGL and avoid the potential extent of wake turbulence impact.

Stands of trees immediately adjacent to the aerodrome plus hills to the north and east of the aerodrome also generate wind shear type turbulence to aircraft operating at Wyndarra, as recognised by the aerodrome operator during on site discussions with him on 8 February 2022. His main concern was that there would be increased turbulence from the wind farm, within his nominal circuit area.

Using the results of the study above that show that the turbine turbulence is dissipated within approximately 7 rotor diameters, it is apparent that there would be no additional turbulence occurring within the nominal circuit area or beyond 10 rotor diameters.

The aerodrome operator indicated that he flies a CASA compliant circuit in his aircraft and therefore in doing so, would be outside of the area of likely wind turbine generated turbulence. There is also sufficient distance from/to the runway to enable normal manoeuvring outside the area where turbine created turbulence is likely to exist in the north easterly winds.

The standard circuit area at Wyndarra aerodrome is outside the 16 RD area referenced by NASF Guideline D. Turbulence from trees and nearby hills is likely to be felt by aircraft operating in the standard circuit area at Wyndarra aerodrome.

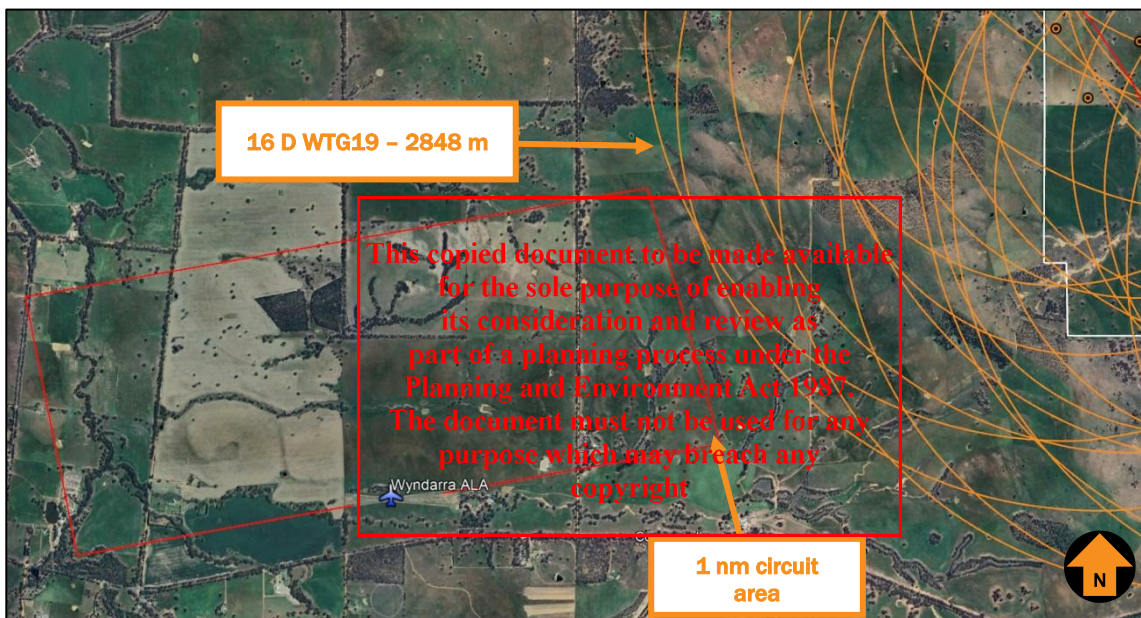


Figure 18 Potential turbulence 16 in relation to 1 nm circuit area for the closest runway

The Bulgana Green Energy Hub (wind farm) is located approximately 11 km east of Stawell and south of the Project Area. It consists of 114 m AGL wind turbines. The cumulative effect of the Project and the existing wind farm in proximity to the aerodrome could limit accessibility further for aircraft arriving from and departing to an easterly direction to avoid overfly turbines on approach and departure.

Figure 19 demonstrates the representative project boundary for the Bulgana Green Energy Hub in relation to the Project Area and the Wyndarra aerodrome in proximity to the Project Area (source: RES, Bulgana Green Power Hub, Google Earth).

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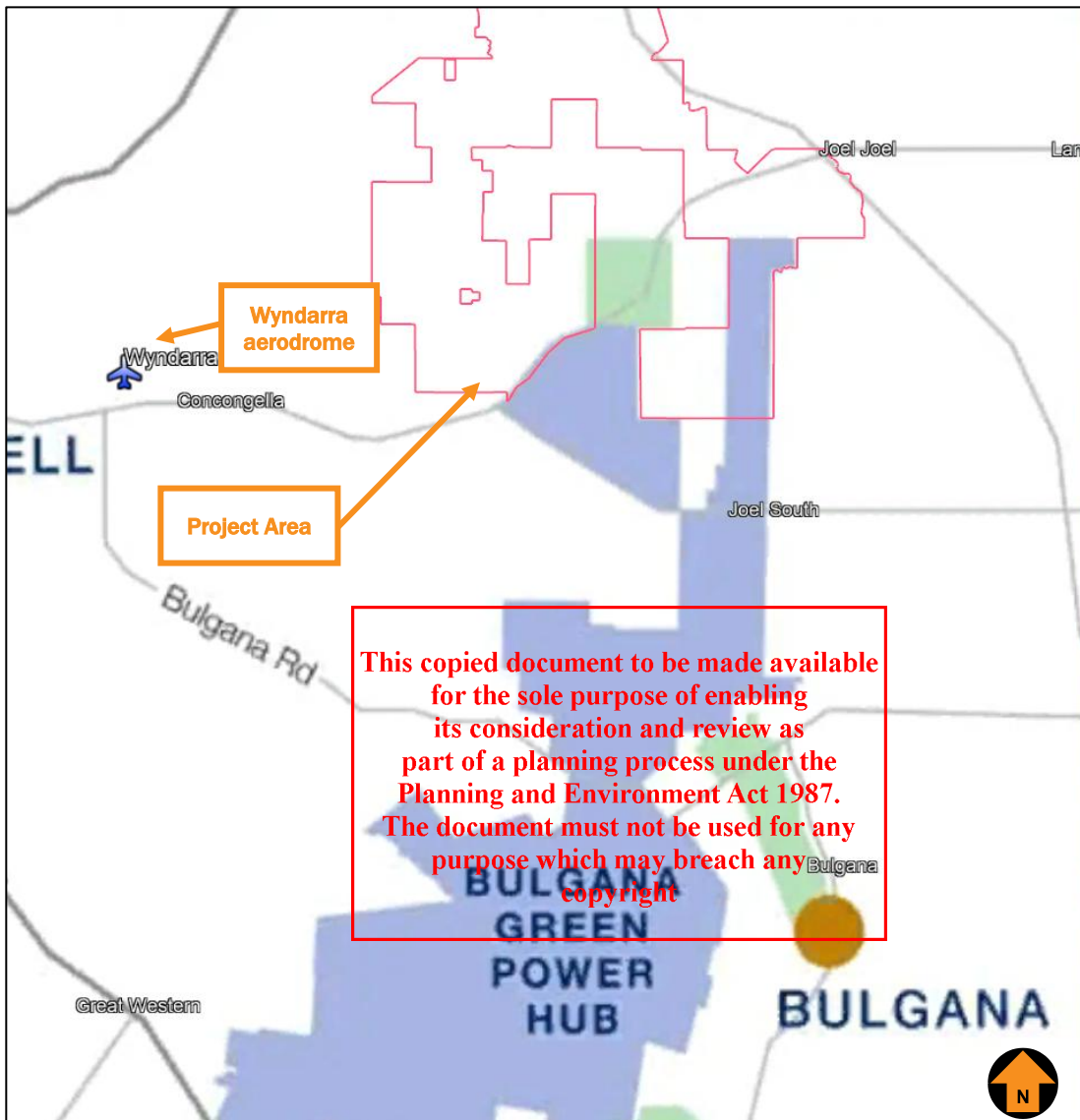


Figure 19 Wyndarra aerodrome in relation to the Project Area and representative location of Bulgana Green Energy Hub

Summary

The standard circuit area at Wyndarra aerodrome is beyond the maximum extent of the area that NASF Guideline D considers where downwind turbulence could be felt by pilots.

Aviation Projects considers that there would be no adverse impact to flight operations at Wyndarra aerodrome caused by the proposed wind farm.

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6.11. Air routes and LSALT

CASR Part 173 MOS requires that a minimum obstacle clearance of 1000 ft below the published LSALT is maintained along each air route.

The Project is located in the vicinity of 3 air routes. It is also located in 4 separate LSALT grids identified in the EnRoute Chart – Low (ERCL 2). The most limiting Grid LSALT applicable to the wind farm location is 3400 ft AMSL in the north-eastern quadrant of the wind farm.

The highest wind turbine is WTG19, with a maximum overall height of 520.3 m AHD (1707.0 ft AMSL) is below the lowest applicable grid LSALT protection surface of 2400 ft AMSL by 693 ft. Therefore, the proposed Project would not affect the Grid LSALT.

An impact analysis of the surrounding air routes is provided in Table 5 based on the maximum Project height of 520.3 m AHD (1707.0 ft AMSL).

Table 5 Air route impact analysis

<i>Air route</i>	<i>Waypoint pair</i>	<i>Route LSALT (ft AMSL)</i>	<i>Obstacle Height Limit (ft AMSL)</i>	<i>Impact on airspace design</i>	<i>Potential solution</i>	<i>Impact on aircraft ops</i>
H345 (ERC-L & ERC-H)	Nevis – Borto	5200	4200	Nil – below surface	N/A	N/A
W291 (ERC-L)	Ubgut – Esdig	4800	3800	Nil – below surface	N/A	N/A
V223 (ERC-L)	Burra – Ubgut	4700	3700	Nil – below surface	N/A	N/A

The Project would not an impact on any route or grid LSALT.

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6.12. Airspace

The Project Area is located outside of controlled airspace (wholly within Class G airspace) and is not located in any Prohibited, Restricted or Danger areas (Special Use Airspace).

Therefore, the Project would not impact controlled or special use airspace.

6.13. Aviation navigation and communication facilities

NASG Guideline G *Protecting Aviation Facilities – Communication, Navigation and Surveillance (CNS)* provides guidance regarding the assessment and potential impact on aviation facilities. CASR Part 139 MOS prescribes the requirements for impact assessment for development within a certified aerodrome boundary or near an existing CNS facility.

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The following aviation facilities were identified in proximity to the Project Area:

- Mt William Repeater Station located approximately 21 nm (39 km) southwest of the Project
- BEN NEVIS Airservices Tower approximately 15 nm (28 km) southeast of the Project.

The Project would not infringe any protection areas associated with aviation facilities specified in NASF Guideline G and CASR Part 139 MOS.

6.14. ATC Surveillance Radar installations

Airservices Australia requires an assessment of the potential for the WTGs to affect radar line of sight. With respect to aviation radar facilities, the closest radar is the Mt Macedon Route Surveillance Radar (RSR) which is located approximately 78 nm (145 km) east southeast of the Project Area. The Gellibrand Hill Primary Surveillance Radar is located approximately 98 nm (181 km) to the southeast of the Project Area boundary.

EUROCONTROL guidelines for assessing the potential impact on wind turbines and WMTs on radar surveillance sensors stipulate the following assessment requirements:

Primary Surveillance Radar (PSR)

- Zone 1 0-500 m: Not permitted
- Zone 2 500 m – 15 km: Detailed assessment
- Zone 3: Further than 15 km but within maximum instrumented range and in radar line of sight: Simple assessment
- Zone 4: Anywhere within maximum instrumented range but not in radar line of sight or outside the maximum instrumented range: No assessment

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Secondary Surveillance Radar (SSR)

- Zone 1: 0-500 m: Not permitted
- Zone 2 500 m – 16 km but within maximum instrumented range and in radar line of sight: Detailed assessment
- Zone 4: Further than 16 km or not in radar line of sight: No assessment
- (Zone 3 is not established for secondary surveillance radar)

Due to the distance and intervening terrain between the Project Area and the facilities, the Project would not impact the Mt Macedon route surveillance radar or Gellibrand Hill Primary Surveillance Radar.

Airservices Australia confirmed the Project would not impact radar facilities in correspondence received during October 2021, as documented in section 5 of this AIA.

6.15. Consultation

An appropriate and justified level of consultation was undertaken with relevant parties.

Refer to **Section 5** for details of the stakeholders and a summary of the consultation.

6.16. AIS summary

Based on the Project layout and overall turbine blade tip height limit of 255 m (836.6 ft) AGL, the blade tip elevation of the highest wind turbine, which is WTG19, would not exceed 520.3 m AHD (1707.0 ft AMSL) and:

- would not infringe any OLS surfaces
- would not infringe any PANS-OPS surfaces
- would not impact any nearby designated air routes
- would not have an impact on the grid LSALT
- would be wholly contained within Class G airspace
- would be unlikely to produce any hazardous turbulence to aircraft operating at Wyndarra aerodrome
- would be outside the clearance zones associated with aviation navigation aids, ATC radar systems and communication facilities.

6.17. Uncertified aerodrome analysis summary

All validated uncertified aerodromes, other than Wyndarra aerodrome are further than 3 nm from, and would not be adversely affected by, any wind turbines of the Project.

The standard circuit area at Wyndarra aerodrome would not be impacted by the Project.

The list of wind turbines (obstacles), showing coordinates and elevation data that are applicable to this AIS, is provided in **Annexure 3**.

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7. HAZARD LIGHTING AND MARKING

Based on the risk assessment set out in Section 9 it has been concluded that there would be an acceptable level of aviation safety risk associated with the potential for an aircraft collision with the WTGs or WMTs, without obstacle lighting on the Project's WTGs and WMTs.

For completeness, lighting standards and guidelines are summarized in **Annexure 5**.

7.1. Wind monitoring towers

In terms of obstacle marking and lighting requirements, relevant requirements set out in CASR Part 139 MOS and NASF are provided below.

Consideration could be given to marking any WMTs according to the requirements set out in CASR Part 139 MOS 2019 Chapter 8 Division 10 Obstacle Markings; specifically:

8.109 Obstacles and hazardous obstacles

(1) The following objects or structures at an aerodrome are obstacles and must be marked in accordance with this Division unless CASA determines otherwise under subsections (3) and (5):

any fixed object or structure, whether temporary or permanent in nature, extending above the obstacle limitation surfaces. Note an ILS building is an example of a fixed object;

any object or structure on a controlled movement area that is removable and is not immediately removed.

8.110 Marking of hazardous obstacles

(5) long, narrow structures like masts, poles and towers which are hazardous obstacles must be marked in contrasting colour bands so that:

(a) the darker colour is at the top; and

(b) the bands:

i. are, as far as physically possible, marked at right angles along the length of the long, narrow structure; and

ii. have a length ("z" in Figure 8.110 (5)) that is, approximately, the lesser of:

(A) 1/7 of the height of the structure; or

(B) 30 m.

(7) Hazardous obstacles in the form of wires or cables must be marked using 3-dimensional coloured objects attached to the wire or cables. Note: Spheres and pyramids are examples of 3-dimensional objects.

(8) The objects mentioned in subsection (7) must:

(a) be approximately equivalent in size to a cube with 600 mm sides; and

(b) be spaced 30 m apart along the length of the wire or cable.

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NASF Guideline D suggests consideration of the following measures specific to the marking and lighting of WMTs:

- *the top 1/3 of wind monitoring towers to be painted in alternating contrasting bands of colour. Examples of effective measures can be found in the Manual of Standards for Part 139 of the Civil Aviation Safety Regulations 1998. In areas where aerial agriculture operations take place, marker balls or high visibility flags can be used to increase the visibility of the towers;*
- *marker balls or high visibility flags or high visibility sleeves placed on the outside guy wires;*
- *ensuring the guy wire ground attachment points have contrasting colours to the surrounding ground/vegetation; or*
- *a flashing strobe light during daylight hours.*

Refer to Section 4.3 for additional information regarding the temporary and permanent WMTs. An AIA has also been conducted on the WMTs and is referenced as an annexure in this report.

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8. ACCIDENT STATISTICS

This section establishes the external context to ensure that stakeholders and their objectives are considered when developing risk management criteria, and that externally generated threats and opportunities are properly taken into account.

8.1. General aviation operations

The general aviation (GA) activity group is considered by the Australian Transport Safety Bureau (ATSB) to be all flying activities that do not involve commercial air transport (activity group), which includes scheduled (RPT) and non-scheduled (charter) passenger and freight type. It may involve Australian civil (VH-) registered aircraft, or aircraft registered outside of Australia. General aviation/recreational encompasses:

- Aerial work (activity type). Includes activity subtypes: agricultural mustering, agricultural spreading/spraying, other agricultural flying, photography, policing, firefighting, construction – sling loads, other construction, search and rescue, observation and patrol, power/pipeline surveying, other surveying, advertising, and other aerial work.
- Own business travel (activity type).
- Instructional flying (activity type). Includes activity subtypes: solo and dual flying training, and other instructional flying.
- Sport and pleasure flying (activity type). Includes activity subtypes: pleasure and personal transport, glider towing, aerobatics, community service flights, parachute dropping, and other sport and pleasure flying.
- Other general aviation flying (activity type). Includes activity subtypes: test flights, ferry flights and other flying.

8.2. ATSB occurrence taxonomy

The ATSB uses a taxonomy of occurrence sub-type. Of specific relevance to the subject assessment are terms associated with **terrain collision**. Definitions sourced from the ATSB website are provided below:

- **Collision with terrain:** Occurrences involving a collision between an airborne aircraft and the ground or water, where the flight crew were aware of the terrain prior to the collision.
- **Controlled flight into terrain (CFIT):** Occurrences where a serviceable aircraft, under flight crew control, is inadvertently flown into terrain, obstacles, or water without either sufficient or timely awareness by the flight crew to prevent the event.
- **Ground strike:** Occurrences where a part of the aircraft drags on, or strikes, the ground or water while the aircraft is in flight, or during take-off or landing.
- **Wirestrike:** Occurrences where an aircraft strikes a wire, such as a powerline, telephone wire, or guy wire, during normal operations.

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8.3. National aviation occurrence statistics 2010-2019

The ATSB recently published a summary of aviation occurrence statistics for the period 2010-2019 (AR-2020-014, Final - 29 April 2020). More recent reports have not been issued by ATSB.

According to the report, there were no fatalities in high or low capacity RPT operations during the period 2010-2019. In 2019, 220 aircraft were involved in accidents in Australia, with a further 154 aircraft involved in serious incidents (an incident with a high probability of becoming an accident). In 2019, there were 35 fatalities from 22 fatal accidents. There have been no fatalities in scheduled commercial air transport in Australia since 2005.

Of the 326 fatalities recorded in the 10-year period, over 50% (175 or 53.68%) occurred in the general aviation segment. On average, there were 1.51 fatalities per aircraft associated with a fatality in this segment. The fatalities to aircraft ratio ranges from 1.09:1 to 1.77:1. Whilst it can be inferred from the data that the majority of fatal accidents are single person fatalities, it is reasonable to assert that the worst credible effect of an aircraft accident in the general aviation category would be multiple fatalities.

A breakdown of aircraft and fatalities by general aviation sub-categories is provided in Table 6 (source: ATSB).

Table 6 Number of fatalities by GA sub-category – 2010 to 2019

<i>Sub-category</i>	<i>Aircraft assoc. with fatality</i>	<i>Fatalities</i>	<i>Fatalities to aircraft ratio</i>
Aerial work	37	44	1.18:1
Instructional flying	11	19	1.72:1
Own business travel	3	5	1.6:1
Sport and pleasure flying	53	94	1.77:1
Other general aviation flying	11	12	1.09:1
Totals	115	174	1.51:1

Figure 20 refers to Fatal Accident Rate by operation type per million departures over the 6-year period 2014-2019 (source: ATSB).

Note the rates presented are not the full year range of the study (2010–2019). This was due to the availability of exposure data (departures and hours flown) which was only available between 2014-2019. According to the ATSB report, the number of fatal accidents per million departures for GA aircraft over the 6-year reporting period 2014-2019 ranged between 6.6 in 2014 and 4.9 in 2019.

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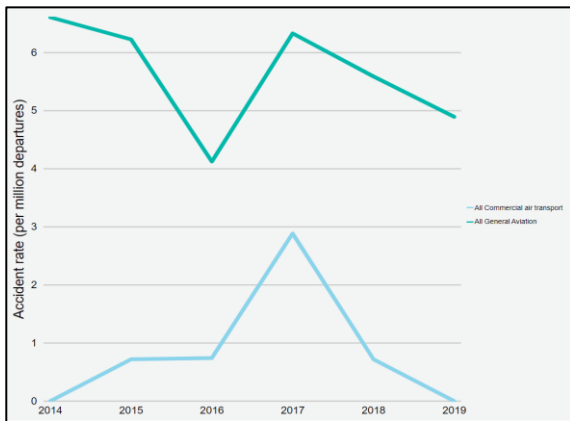


Figure 20 Fatal Accident Rate (per million departures) by Operation Type

In 2018, there were 9 fatal accidents and 9 fatalities involving GA aircraft, resulting in a rate of 5.6 fatal accidents per million departures and 7.7 fatal accidents per million hours flown.

In 2019, there were 1,760,000 landings, and 1,320,000 hours flown by VH-registered general aviation aircraft in Australia, with 8 fatal accidents and 17 fatalities. Based on these results, in 2019 there were 4.9 fatal accidents per million departures and 6.4 fatal accidents per million hours flown. A summary of fatal accidents from 2010-2019 by GA sub-category is provided in Table 7 (source: ATSB).

Table 7 Fatal accidents by GA sub-category – 2010-2019

<i>Sub-category</i>	<i>Fatal accidents</i>	<i>Fatalities</i>
Agricultural spreading/spraying	13	13
Agricultural mustering	11	12
Other agricultural	1	1
Survey and photographic	5	10
Search and rescue	2	2
Firefighting	2	2
Other aerial work	3	4
Instructional flying	11	19
Own business travel	3	5
Sport and pleasure flying	53	94
Other general aviation flying	11	12
Total	115	174

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Over the 10-year period and subsequently, no aircraft has collided with a wind turbine or a wind monitoring tower.

Of the 20,529 incidents, serious incidents, and accidents in GA operations in the 10-year period, 1404 (6.83%) were terrain collisions.

The underlying fatality rate for GA operations discussed above is considered tolerable within Australia's regulatory and social context.

8.4. Worldwide accidents involving wind farms

To provide some perspective on the likelihood of a VFR aircraft colliding with a wind turbine, a summary of the five accidents that involved an aircraft colliding with a wind turbine, and the relevant factors applicable to this assessment, is incorporated in this section.

Based on the statistic of the Global Wind Energy Council (GWEC) report 2019, there were 341,320 wind turbines operating around the world at the end of 2016. In 2019, approximately 60.4 GW of wind power had been installed worldwide.

Based on the Australia's Clean Energy Council statistics there were 110 wind farms in Australia as of 2023. Aviation Projects has researched public sources of information, accessible via the world wide web, regarding aviation safety occurrences associated with wind farms. Occurrence information published by Australia, Canada, Europe (Belgium, Denmark, France, Germany, Norway, Sweden and The Netherlands), New Zealand, the United Kingdom and the United States of America was reviewed.

The 5 recorded aviation accidents involving a wind farm are summarised as follows:

- One accident occurred in Texas, United States in October 2019 resulting in minor aircraft damage no injury to the pilot and significant injury to a person on the ground. The aircraft, an Air Tractor AT502, was returning from a local aerial application flight and was flown deliberately at low-level in close vicinity to a wind turbine generator (WTG) because the pilot believed his friend was working on the turbine. The aircraft collided with a tagline rope that was attached to a blade of the WTG and which was being held by a person working on the ground. The worker was thrown about 20 ft in the air and experienced significant non-life-threatening injuries. The aircraft sustained minor damage however the pilot landed the aircraft without further incident.
- One accident, which resulted in 2 fatalities, occurred in Palm Springs in 2001. This accident involved a wind farm but was not caused by the wind farm. The cause of the accident was the inflight separation of the majority of the right canard and all of the right elevator resulting from a failure of the builder to balance the elevators per the kit manufacturer's instructions. The accident occurred above a wind farm, and the aircraft struck a WTG on its descent and therefore the cause of the accident was not attributable to the wind farm and not applicable to this AIA.
- Two accidents involving collision with a WTG were during the day, as follows:
 - One accident occurred in Melle, Germany in 2017 as the result of a collision with a WTG mounted on a steel lattice tower at a very low altitude during the day with good visibility and no cloud. The accident resulted in one fatality. If the tower was solid and painted white, as is standard on contemporary wind farms, then it more than likely would have been more visible than if it were to be equipped with an obstacle light which in all likelihood would not have been operating during daylight with good visibility conditions.

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- One accident occurred in Plouguin, France in 2008 when the pilot decided to descend below cloud in an attempt to find the destination aerodrome. The aircraft was flying in conditions of significantly reduced horizontal visibility in fog where the top of the WTGs were obscured by cloud. The WTGs became visible too late for avoidance manoeuvring and the aircraft made contact with two WTGs. The aircraft was damaged but landed safely. No fatalities were recorded.
- In both of the above cases, it is difficult to conclude that obstacle lighting would have prevented the accidents.
- One fatal accident, near Highmore, South Dakota in 2014 occurred at night in Instrument Meteorological Conditions (IMC). Limited information is available regarding this accident.

There is one other accident mentioned in a database compiled by an anti-wind farm lobby group (wind-watch.org), which suggests a Cessna 182 collided with a WTG near Baraboo, Wisconsin, on 29 July 2000. The NTSB database records details of an accident involving a Cessna 182 that occurred on 28 July 2000 in the same area. For this particular accident, NTSB found that the probable cause of the accident was VFR flight into IMC encountered by the pilot and exceeding the design limits of the aircraft. A factor was that the flight continued on to the original destination rather than to a suitable alternate aerodrome. No mention in the NTSB database is made of WTGs or a wind farm.

Based on current worldwide accident reports, available to Aviation Projects, the small number of aircraft accidents involving wind farms remains tolerable within Australia given the large number of wind turbines present.

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9. RISK ASSESSMENT FRAMEWORK

A risk management framework is comprised of likelihood and consequence descriptors, a matrix used to derive a level of risk, and actions required of management according to the level of risk.

The risk assessment framework used by Aviation Projects has been developed in consideration of ISO 31000:2018 *Risk management—Guidelines* and the guidance provided by CASA in its Safety Management System (SMS) for Aviation guidance material, which is aligned with the guidance provided by the International Civil Aviation Organization (ICAO) in Doc 9589 *Safety Management Manual*, Third Edition, 2013. Doc 9589 is intended to provide States (including Australia) with guidance on the development and implementation of a State Safety Programme (SSP), in accordance with the International SARPs, and is therefore adopted as the primary reference for aviation safety risk management in the context of the subject assessment.

Section 2.1 of the ICAO Doc 9589 *The concept of safety* defines safety as follows [author’s underlining]:

2.1.1 Within the context of aviation, safety is “the state in which the possibility of harm to persons or of property damage is reduced to, and maintained at or below, an acceptable level through a continuing process of hazard identification and safety risk management.”

Likelihood

Likelihood is defined in ISO 31000:2018 as the chance of something happening. Likelihood descriptors used in this report are as indicated in Table 8.

Table 8 Likelihood Descriptors

No	Descriptor	Description
1	Rare	It is almost inconceivable that this event will occur
2	Unlikely	The event is very unlikely to occur (not known to have occurred)
3	Possible	The event is unlikely to occur, but possible (has occurred rarely)
4	Likely	The event is likely to occur sometimes (has occurred infrequently)
5	Almost certain	The event is likely to occur many times (has occurred frequently)

Consequence

Consequence is defined as the outcome of an event affecting objectives, which in this case is the safe and efficient operation of aircraft, and the visual amenity and enjoyment of local residents.

Consequence descriptors used in this report are as indicated in Table 9.

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Table 9 Consequence Descriptors

No	Descriptor	People Safety	Property/Equipment	Effect on Crew	Environment
1	Insignificant	Minor injury – first aid treatment	Superficial damage	Nuisance	No effects or effects below level of perception
2	Minor	Significant injury – outpatient treatment	Moderate repairable damage – property still performs intended functions	Operations limitation imposed. Emergency procedures used.	Minimal site impact – easily controlled. Effects raised as local issues, unlikely to influence decision making. May enhance design and mitigation measures.
3	Moderate	Serious injury – hospitalisation	Major repairable damage – property performs intended functions with some short-term rectifications	Significant reduction in safety margins. Reduced capability of aircraft/crew to cope with conditions. High workload/stress on crew. Critical incident stress on crew.	Moderate site impact, minimal local impact, and important consideration at local or regional level, possible long-term cumulative effect. Not likely to be decision making issues. Design and mitigation measures may ameliorate some consequences.
4	Major	Permanent injury	Major damage rendering property ineffective in achieving design functions without major repairs	Large reduction in safety margins. Crew workload increased to point of performance decrement. Serious injury to small number of occupants. Intense critical incident stress.	High site impact, moderate local impact, important consideration at state level. Minor long-term cumulative effect. Design and mitigation measures unlikely to remove all effects.
5	Catastrophic	Multiple Fatalities	Damaged beyond repair	Conditions preventing continued safe flight and landing. Multiple deaths with loss of aircraft	Catastrophic site impact, high local impact, national importance. Serious long-term cumulative effect. Mitigation measures unlikely to remove effects.

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Risk matrix

The risk matrix, which correlates likelihood and consequence to determine a level of risk, used in this report is shown in Table 3.

Table 3 Risk Matrix

		CONSEQUENCE				
		INSIGNIFICANT 1	MINOR 2	MODERATE 3	MAJOR 4	CATASTROPHIC
LIKELIHOOD	ALMOST CERTAIN 5	6	7	8	9	10
	LIKELY 4	5	6	7	8	9
	POSSIBLE 3	4	5	6	7	8
	UNLIKELY 2	3	4	5	6	7
	RARE 1	2	3	4	5	6

Actions required

Actions required according to the derived level of risk are shown in Table 4.

Table 4 Actions Required

8-10	Unacceptable Risk	Immediate action required by either treating or avoiding risk. Refer to executive management.
5-7	Tolerable Risk	Treatment action possibly required to achieve As Low As Reasonably Practicable (ALARP) - conduct cost/benefit analysis. Relevant manager to consider for appropriate action.
0-4/5	Broadly Acceptable Risk	Managed by routine procedures, and can be accepted with no action.

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10. RISK ASSESSMENT

10.1. Risk Identification

The primary risk being assessed is that of aviation safety associated with WTGs and WMTs of the Project.

Based on an extensive review of accident statistics data (see summary in Section 8) and input from stakeholders, five (5) identified risk events associated with wind turbines and WMTs relate to aviation safety, and are listed as follows:

1. potential for an aircraft to collide with a wind turbine, controlled flight into terrain (CFIT);
2. potential for an aircraft to collide with a wind monitoring tower (CFIT);
3. potential for a pilot to initiate manoeuvring to avoid colliding with a wind turbine or monitoring tower resulting in collision with terrain;
4. potential for the hazards associated with the Project to invoke operational limitations or procedures on operating crew; and
5. effect of obstacle lighting on neighbours.

It should be noted that according to guidance provided by the Commonwealth Department of Infrastructure and Regional Development, and in line with generally accepted practice, the risk to be assessed should primarily be associated with passenger transport services. The risk being assessed herein is primarily associated with smaller aircraft likely to be flying under the VFR, and so the maximum number of passengers exposed to the nominated consequences is likely to be limited.

A fifth identified risk event associated with WTGs and WMTs is the potential visual impact associated with obstacle lighting (if fitted) on surrounding residents.

The five risk events identified here are assessed in detail in the following section.

10.2. Risk Analysis, Evaluation and Treatment

For the purpose of considering applicable consequences, the concept of worst credible effect has been used. Untreated risk is first evaluated, then, if the resulting level of risk is unacceptable, further treatments are identified to reduce the level of risk to an acceptable level.

A summary of the level of risk associated with the proposed Project, under the proposed treatment regime, with specific consideration of the effect of obstacle lighting, is provided in Table 10 to Table 14 below.

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Table 10 Aircraft Collision with a wind turbine

Risk ID:	1. Aircraft collision with wind turbine (CFIT)	
Discussion		
<p>An aircraft collision with a wind turbine would result in harm to people and damage to property. Property could include the aircraft itself, as well as the wind turbine.</p> <p>There have been four reported occurrences worldwide of aircraft collisions with a component of a wind turbine structure since the year 2000 as discussed in Section 8. These reports show a range of situations where pilots were conducting various flying operations at low level and in the vicinity of wind farms in both IMC and VMC. No reports of aircraft collisions with wind farms in Australia have been found.</p> <p>In consideration of the circumstances that would lead to a collision with a wind turbine:</p> <ul style="list-style-type: none"> GA VFR aircraft operators generally do not individually fly a significant number of hours in total, let alone in the area in question; There is a very small chance that a pilot, suffering the stress of weather, will continue into poor weather conditions (contrary to the rules of flight) rather than divert away from it, is not aware of the wind farm, will not consider it or will not be able to accurately navigate around it; and If the aircraft was flown through the wind farm, there is still a very small chance that it would hit a wind turbine. <p>Refer to the discussion of worldwide accidents at Section 8.4.</p> <p>There are no known aerial agriculture operations conducted at night in the vicinity of the Project.</p> <p>If a proposed object or structure is identified as likely to be an obstacle, details of the relevant proposal must be referred to CASA for CASA to determine, in writing:</p> <ol style="list-style-type: none"> whether the object or structure will be a hazard to aircraft operations whether it requires an obstacle light that is essential for the safety of aircraft operations. <p>The Project is clear of the OLS of any aerodrome.</p>		
Consequence		
<p>If an aircraft collided with a wind turbine, the worst credible effect would be multiple fatalities and damage beyond repair. This would be a Catastrophic consequence.</p>		
		Consequence Catastrophic
Untreated Likelihood		
<p>There have been five reports of aircraft collisions with wind turbines worldwide which have resulted in a range of consequences, where aircraft occupants sustained minor injury in some cases and fatal injuries in others. Similarly, aircraft damage sustained ranged from minor to catastrophic. One of these accidents resulted from structural failure of the aircraft before the collision. Only two relevant accidents occurred during the day, and only one resulted in a single fatality. It is assessed that collision with a wind turbine resulting in multiple fatalities and damage beyond repair is unlikely to occur, but possible (has occurred rarely), which is classified as Possible.</p>		
		Untreated Likelihood Possible

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<p>Current Treatments (without lighting)</p> <ul style="list-style-type: none"> • The Project is clear of the OLS of any aerodrome. • Aircraft are restricted to a minimum height of 500 ft (152.4 m) AGL above the highest point of the terrain and any object on it within a radius of 300 m in visual flight during the day when not in the vicinity of built-up areas. The proposed turbines will be a maximum of 255 m (836 ft) at the top of the blade tip. The rotor blade at its maximum height will be approximately 103 m (337 ft) above aircraft flying at the minimum altitude of 152.4 m AGL (500 ft). • If cloud descends below the turbine hub, obstacle lighting would be obscured and therefore ineffective. • Aircraft are restricted to a minimum height of 304.8 m (1000 ft) above obstacles within 10 nm of the aircraft in visual flight at night and potentially even higher during instrument flight (day or night). • Aircraft authorised to intentionally fly below 152.4 m AGL (500 ft) AGL (day) or below safety height (night) are operated in accordance with procedures developed as an outcome of thorough risk management activities. • The wind turbines are typically coloured white so they should be visible during the day. • The 'as constructed' details of wind turbines are required to be notified to Airservices Australia so that the location and height of wind turbines can be noted on aeronautical maps and charts. • Because the turbines are above 100 m AGL, there is a statutory requirement to report the towers to CASA. 	
<p>Level of Risk</p> <p>The level of risk associated with a Possible impact on the local and regional aviation is 8.</p>	<p style="text-align: center;">Current Level of Risk</p> <p style="text-align: center;">8 - Unacceptable</p>
<p>Risk Decision</p> <p>A risk level of 8 is classified as Unacceptable: Immediate action required by either treating or avoiding risk. Refer to executive management.</p>	
<p style="text-align: right;">Risk Decision</p> <p style="text-align: right;">Unacceptable</p>	
<p>Recommended Treatments</p> <p>The following treatments which can be implemented at little cost will provide an acceptable level of safety:</p> <ul style="list-style-type: none"> • Details of the Project should be communicated to local and regional aircraft operators prior to, during and following construction to heighten their awareness of its location and so that they can plan their operations accordingly. Specifically: <ul style="list-style-type: none"> ○ Engage with local aerial agricultural and aerial firefighting operators to develop procedures, which may include, for example, stopping the rotation of the wind turbine rotor blades prior to the commencement of the subject aircraft operations within the Project Area. 	

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- Arrangements should encourage applicable aerodrome operators to publish details of the wind farm in ERSA for surrounding aerodromes.

Residual Risk

With the additional recommended treatments, the likelihood of an aircraft collision with a wind turbine resulting in multiple fatalities and damage beyond repair will be **Unlikely**, and the consequence remains **Catastrophic**, resulting in an overall risk level of **7 - Tolerable**.

It is considered that the significant cost of obstacle lighting (which is not a preventative control), may only slightly reduce the likelihood of a collision given that the pilot is already in a highly undesirable situation (and not in all situations – such as where the obstacle light may be obscured by cloud) and hence is not justified.

In the circumstances, the level of risk under the proposed treatment plan is considered **as low as reasonably practicable (ALARP)**.

It is our assessment that there will be an acceptable level of aviation safety risk associated with the potential for an aircraft collision with a wind turbine, without obstacle lighting on the turbines of the Project.

Residual Risk | **7 - Tolerable**

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Table 11 Aircraft collision with wind monitoring tower

Risk ID:	2. Aircraft collision with a wind monitoring tower (CFIT)	
Discussion	<p>An aircraft collision with a WMT would result in harm to people and damage to property.</p> <p>One temporary WMT with a maximum height of 100 m (328.1 ft) AGL in height has been installed in the Project Area. The final location of the WMT was reported to Airservices Australia.</p> <p>Two permanent WMT's will be installed close the commissioning of The Project. These WMTs will be used to validate and compare the actual performance of the WTGs with expected performance. The final locations of these WMTs will be reported to Airservices Australia</p> <p>There are only a few instances of aircraft colliding with a WMT, but they were all during the day with good visibility, and no instance was in Australia.</p> <p>There is a relatively low rate of aircraft activity in the vicinity of the wind farm.</p> <p>There are no known aerial agriculture operations conducted at night in the vicinity of the wind farm.</p> <p>If a proposed object or structure is identified as likely to be an obstacle, details of the relevant proposal must be referred to CASA for CASA to determine, in writing:</p> <p>(a) whether the object or structure will be a hazard to aircraft operations</p> <p>(b) whether it requires an obstacle light that is essential for the safety of aircraft operations.</p>	
Consequence	<p>If an aircraft collided with a WMT, the worst credible effect would be multiple fatalities and damage beyond repair. This would be a Catastrophic consequence.</p>	
	<i>Consequence</i>	Catastrophic
Untreated Likelihood	<p>There are a few occurrences of an aircraft colliding with a WMT, but all were during the day with good visibility when obstacle lighting would arguably be of no effect, and none were in Australia. It is assessed that collision with a wind monitoring tower without obstacle lighting that would be effective in alerting the pilot to its presence is unlikely to occur, but possible (has occurred rarely), which is classified as Possible.</p>	
	<i>Untreated Likelihood</i>	Possible
Current Treatments	<ul style="list-style-type: none"> The location of the temporary WMT was reported to Airservices Australia. The two permanent WMTs will be notified when details are confirmed closer to construction. Aircraft are restricted to a minimum height of 152.4 m (500 ft) AGL above the highest point of the terrain and any object on it within a radius of 300 m in visual flight during the day when not in the vicinity of built-up areas. The temporary WMT has a maximum height of 100 m (328.1 ft) AGL, which 	

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<p>will be approximately 52.4 m (171.9 ft) below the minimum height of 500 ft AGL for an aircraft flying at this height.</p> <ul style="list-style-type: none"> • Aircraft are restricted to a minimum height of 304.8 m (1000 ft) above obstacles within 10 nm of the aircraft in visual flight at night and potentially even higher during instrument flight (day or night). • Aircraft authorised to intentionally fly below 152.4 m (500 ft) (day) or below safety height (night) are operated in accordance with procedures developed as an outcome of thorough risk management activities. • The WMTs will be constructed from grey steel and marked appropriately. • Future permanent WMTs will be marked appropriately and will be lower than the WTGs and will therefore not present an increased risk of collision. 	
<p>Level of Risk</p> <p>The level of risk associated with a Possible likelihood of a Catastrophic consequence is 8.</p>	
<p>Current Level of Risk</p>	<p>8 - Unacceptable</p>
<p>Risk Decision</p> <p>A risk level of 8 is classified as Unacceptable: Immediate action required by either treating or avoiding risk. Refer to executive management.</p>	
<p>Risk Decision</p>	<p>Unacceptable</p>
<p>Recommended Treatments</p> <p>The following treatments which can be implemented at little cost will provide an acceptable level of safety:</p> <ul style="list-style-type: none"> • The WMT is marked with aviation marker balls and consideration was made to Part 139 MOS Chapter 8 Division 10 Obstacle Markings (as modified by the guidance in NASF Guideline D); specifically: <ul style="list-style-type: none"> 8.110 (5) As illustrated in Figure 8.110 (5), long, narrow structures like masts, poles and towers which are hazardous obstacles must be marked in contrasting colour bands so that the darker colour is at the top; and the bands are, as far as physically possible, marked at right angles along the length of the long, narrow structure; and have a length ("z" in Figure 8.110 (5)) that is, approximately, the lesser of: 1/7 of the height of the structure; or 30 m. 8.110 (7) Hazardous obstacles in the form of wires or cables must be marked using 3-dimensional coloured objects attached to the wire or cables. Note: Spheres and pyramids are examples of 3-dimensional objects. (8) The objects mentioned in subsection (7) must: be approximately equivalent in size to a cube with 600 mm sides; and be spaced 30 m apart along the length of the wire or cable. • Future WMTs should be subject to their own risk assessment. The location of these masts will also be reported to Airservices Australia. 	

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Residual Risk

With the additional recommended treatments, the likelihood of an aircraft colliding with a WMT resulting in multiple fatalities and damage beyond repair will be **Unlikely**. The consequence remains **Catastrophic**, resulting in an overall risk level of **7 – Tolerable**.

It is considered that the significant cost of obstacle lighting (which is not a preventative control), may only slightly reduce the likelihood of a collision, given that the pilot is already in a highly undesirable situation (and not in all situations – such as where the obstacle light may be obscured by cloud) and hence is not justified. Only if a WMT exceeds 150 m AGL in height and is not in relatively close proximity to a wind turbine.

In the circumstances, the level of risk under the proposed treatment plan is considered **as low as reasonably practicable ALARP**.

It is our assessment that there will be an acceptable level of aviation safety risk associated with the potential for an aircraft collision with the WMTs, without obstacle lighting on the WMT of the Project.

	Residual Risk 7 - Tolerable
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Table 12 Harsh manoeuvring leading to controlled flight into terrain

Risk ID:	3. Harsh manoeuvring leads to controlled flight into terrain (CFIT)	
Discussion	<p>An aircraft colliding with terrain as a result of manoeuvring to avoid colliding with a wind turbine would result in harm to people and damage to property.</p> <p>There are a few ground collision accidents resulting from manoeuvring to avoid wind farms, but none in Australia, and all were during the day.</p> <p>The Project is clear of the OLS of any aerodrome.</p> <p>Aircraft are restricted to a minimum height of 152.4 m (500 ft) above the highest point of the terrain and any object on it within a radius of 300 m in visual flight during the day when not in the vicinity of built-up areas.</p> <p>The proposed turbines will be a maximum of 255 m (837 ft) at the top of the blade tip. The rotor blade at its maximum height will be approximately 103 m (337 ft) above aircraft flying at the minimum altitude of 152.4 m (500 ft) AGL.</p> <p>Nevertheless, the minimum visibility of 5000 m required for visual flight during the day should provide adequate time for pilots to observe and manoeuvre their aircraft clear of wind turbines.</p> <p>If cloud descends below the turbine hub, obstacle lighting would be obscured and therefore ineffective.</p> <p>Aircraft are restricted to a minimum height of 304.8 m (1000 ft) above obstacles within 10 nm of the aircraft in visual flight at night and potentially even higher during instrument flight (day or night).</p> <p>Aircraft authorised to intentionally fly below 152.4 m (500 ft) AGL (day) or below safety height (night) are operated in accordance with procedures developed as an outcome of the risk management activities.</p> <p>Assumed risk treatments</p> <ul style="list-style-type: none"> The wind turbines are typically coloured white and should be visible during the day The 'as constructed' details of wind turbines are required to be notified to Airservices Australia so that the location and height of wind farms can be noted on aeronautical maps and charts Since the turbines will be higher than 100 m AGL, there is a statutory requirement to report the turbines to CASA. 	
Consequence	Consequence	Catastrophic
Untreated Likelihood	<p>There are a few ground collision accidents resulting from manoeuvring to avoid wind farms, but none in Australia, and all were during the day. It is assessed that a ground collision accident following manoeuvring to avoid a wind turbine is unlikely to occur, but possible (has occurred rarely), which is classified as Possible.</p>	
	Untreated Likelihood	Possible

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Current Treatments (without lighting)

- The Project is clear of the OLS of any aerodrome.
- Aircraft are restricted to a minimum height of 152.4 m (500 ft) above the highest point of the terrain and any object on it within a radius of 300 m in visual flight during the day when not in the vicinity of built-up areas.
- Wind turbines will be a maximum of 255 m (837 ft at the top of the blade tip, so the rotor blade at its maximum height will be approximately 103 m (337 ft) above aircraft flying at the minimum altitude of 152.4 m AGL (500 ft).
- Nevertheless, the minimum visibility of 5000 m required for visual flight during the day should provide adequate time for pilots to observe and manoeuvre their aircraft clear of wind turbines.
- Aircraft are restricted to a minimum height of 304.8 m (1000 ft) above obstacles within 10 nm of the aircraft in visual flight at night and potentially even higher during instrument flight (day or night).
- Aircraft authorised to intentionally fly below 152.4 m AGL (500 ft) (day) or below safety height (night) are operated in accordance with procedures developed as an outcome of thorough risk management activities.
- The wind turbines are typically compared with typical of those which are operational in Australia, so they should be visible during the day.
- The final layout and 'as constructed' details of wind turbines are required to be notified to Airservices Australia so that the location and height of wind farms can be noted on aeronautical maps and charts.
- Since the turbines will be higher than 100 m AGL, there is a statutory requirement to report the turbines to CASA.

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Level of Risk

The level of risk associated with a Possible likelihood of a Catastrophic consequence is 8.

Current Level of Risk	8 – Unacceptable
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Risk Decision

A risk level of 8 is classified as Unacceptable: Immediate action required by either treating or avoiding risk. Refer to executive management.

Risk Decision	Unacceptable
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Recommended Treatments

The following treatments which can be implemented at little cost will provide an acceptable level of safety:

- Ensure details of the Project have been communicated to Airservices Australia, and local and regional aerodrome and aircraft operators before, during and following construction.

<ul style="list-style-type: none"> Although there is no requirement to do so, The Proponent may consider engaging with local aerial agricultural and aerial firefighting operators to develop procedures for their safe operation within the Project Area. 	
<p>Residual Risk</p> <p>With the additional recommended treatments, the likelihood of ground collision resulting from manoeuvring to avoid a wind turbine resulting in multiple fatalities and damage beyond repair will be Unlikely, and the consequence remains Catastrophic, resulting in an overall risk level of 7 – Tolerable.</p> <p>It is considered that the significant cost of obstacle lighting (which is not a preventative control), may only slightly reduce the likelihood of a collision given that the pilot is already in a highly undesirable situation (and not in all situations – such as where the obstacle light may be obscured by cloud) and hence is not justified.</p> <p>In the circumstances, the level of risk under the proposed treatment plan is considered ALARP.</p> <p>It is our assessment that there is an acceptable level of aviation safety risk associated with the potential for ground collision resulting from manoeuvring to avoid a wind turbine, without obstacle lighting on the turbines of the Project.</p>	
	<p><i>Residual Risk</i> 7 - Tolerable</p>

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Table 13 Effect of Project on operating crew

Risk ID:	4. Effect of the Project on aircraft operating crew	
Discussion		
Introduction or imposition of additional operating procedures or limitations can affect an aircraft's operating crew.		
There are no known aerial agriculture operations conducted at night in the vicinity of the Project.		
Consequence		
The worst credible effect a wind farm could have on flight crew would be the imposition of operational limitations, and in some cases, the potential for use of emergency procedures. This would be a Minor consequence.		
Consequence		Minor
Untreated Likelihood		
The imposition of operational limitations is unlikely to occur, but possible (has occurred rarely), which is classified as Possible.		
Untreated Likelihood		Possible
Current Treatments (without lighting)		
<ul style="list-style-type: none"> • The Project is clear of the OLS of any aerodrome. • Aircraft are restricted to a minimum height of 152.4 m (500 ft) above the highest point of the terrain and any object on it within a radius of 300 m in visual flight during the day when not in the vicinity of built-up areas. • Wind turbines will be a maximum of 255 m (837 ft) at the top of the blade tip, so the rotor blade at its maximum height will be approximately 103 m (337 ft) above aircraft flying at the minimum altitude of 152.4 m AGL (500 ft). • Nevertheless, the minimum visibility of 5000 m required for visual flight during the day should provide adequate time for pilots to observe and manoeuvre their aircraft clear of wind turbines. • Aircraft are restricted to a minimum height of 304.8 m (1000 ft) above obstacles within 10 nm of the aircraft in visual flight at night and potentially even higher during instrument flight (day or night). • Aircraft authorised to intentionally fly below 152.4 m AGL (500 ft) (day) or below safety height (night) are operated in accordance with procedures developed as an outcome of thorough risk management activities. • The wind turbines are coloured white so they should be visible during the day. • The 'as constructed' details of wind turbines are required to be notified to Airservices Australia so that the location and height of wind farms can be noted on aeronautical maps and charts. 		

<ul style="list-style-type: none"> Since the turbines will be higher than 110 m AGL, there is a statutory requirement to report the turbines to CASA. 	
<p>Level of Risk</p> <p>The level of risk associated with a Possible likelihood of a Minor consequence is 5.</p>	
<i>Current Level of Risk</i>	5 - Tolerable
<p>Risk Decision</p> <p>A risk level of 5 is classified as Tolerable: Treatment action possibly required to achieve ALARP - conduct cost/benefit analysis. Relevant manager to consider for appropriate action.</p>	
<i>Risk Decision</i>	Accept, conduct cost benefit analysis
<p>Proposed Treatments</p> <p>Given the current treatments and the limited scale and scope of flying operations conducted within the vicinity of the Project, there is likely to be little additional safety benefit to be gained by installing obstacle lighting, other than if a WMT exceeds 150 m AGL in height and is not in relatively close proximity to a wind turbine. However, the following treatments, which can be implemented at little cost, will provide an additional margin of safety:</p> <ul style="list-style-type: none"> Ensure details of the Project have been submitted to CASA, Australia, and local and regional aerodrome and aircraft operators before drilling and following Act 1987. Although there is no requirement to do so, the Proponent may consider engaging with local aerial agricultural and aerial firefighting operators to develop procedures for such aircraft operations in the vicinity of the Project. 	
<p>Residual Risk</p> <p>Notwithstanding the current level of risk is considered Tolerable, the additional recommended treatments will enhance aviation safety. The likelihood remains Possible, and consequence remains Minor. In the circumstances, the risk level of 5 is considered as low as reasonably practicable ALARP.</p> <p>It is our assessment that there is an acceptable level of aviation safety risk associated with the potential for operational limitations to affect aircraft operating crew, without obstacle lighting on the WTGs and WMTs of the Project.</p>	
<i>Residual Risk</i>	5 - Tolerable

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Table 14 Effect of obstacle lighting on neighbours

Risk ID:	5. Effect of obstacle lighting on neighbours
Discussion	
<p>This scenario discusses the consequential impact of a decision to install obstacle lighting on the wind farm.</p> <p>Installation and operation of obstacle lighting on wind turbines or WMT can have an effect on neighbours' visual amenity and enjoyment, specifically at night and in good visibility conditions. This may create objections to the wind farm.</p> <p>If a proposed object or structure is identified as likely to be an obstacle, details of the relevant proposal must be referred to CASA for CASA to determine, in writing:</p> <ul style="list-style-type: none"> (a) whether the object or structure will be a hazard to aircraft operations (b) whether it requires an obstacle light that is essential for the safety of aircraft operations. <p>In general, objects outside an OLS and above 100 m would require obstacle lighting unless CASA, in an aeronautical study, assesses it is shielded by another lit object or it is of no operational significance.</p> <p>This is considered as an Environment risk as detailed in Table 9.</p>	
Consequence	
<p>The worst credible effect of obstacle lighting specifically at night in good visibility conditions would be:</p> <ul style="list-style-type: none"> • Moderate site impact, minimal local impact, important consideration at local or regional level, possible long-term cumulative effect. Not likely to be decision making issues. Design and mitigation measures may ameliorate some consequences. <p>This would be a Moderate consequence.</p>	
Consequence	Moderate
Untreated Likelihood	
<p>The likelihood of moderate site impact, minimal local impact is Almost certain - the event is likely to occur many times (has occurred frequently).</p>	
Untreated Likelihood	Almost certain
Current Treatments	
<p>If the wind turbines or WMTs are higher than 150 m (492 ft) AGL, they must be regarded as obstacles unless CASA assess otherwise. For objects outside an OLS and above 110 m obstacle lighting is required, unless CASA, in an aeronautical study, assesses it is shielded by another lit object or it is of no operational significance.</p>	
Level of Risk	
<p>The level of risk associated with an Almost certain likelihood of a Moderate consequence is 8.</p>	

<i>Current Level of Risk</i>	8 - Unacceptable
Risk Decision	
A risk level of 8 is classified as Unacceptable: Immediate action required by either treating or avoiding risk. Refer to executive management.	
<i>Risk Decision</i>	Unacceptable
Recommended Treatments	
<p>Not installing obstacle lighting would completely remove the source of the impact.</p> <p>If lighting is required, there are impact reduction measures that can be implemented to reduce the impact of lighting on surrounding neighbours, including:</p> <ul style="list-style-type: none"> reducing the number of wind turbines with obstacle lights specifying an obstacle light that minimises light intensity at ground level specifying an obstacle light that matches light intensity to meteorological visibility mitigating light glare from obstacle lighting through measures such as baffling or shielding. <p>There are impact reduction measures that can be implemented to reduce the impact of lighting on surrounding neighbours. These measures are designed to reduce the impact of lighting on surrounding neighbours while minimising the visual impact to those on the ground.</p> <p>Consideration may be given to activating the obstacle lighting via a pilot activated lighting system.</p> <p>An option is to consider using Aircraft Detection Lighting Systems (referred to in the United States Federal Aviation Administration Advisory Circular AC70/7460-1L CHG1 - <i>Obstruction Marking and Lighting</i>). Such a system would only activate the lights when an aircraft is detected in the near vicinity and deactivate the lighting once the aircraft has passed. This technology reduces the impact of night lighting on nearby communities and migratory birds and extends the life expectancy of obstruction lights.</p>	
Residual Risk	
<p>Not installing obstacle lights would clearly be an acceptable outcome to those potentially affected by visual impact.</p> <p>If lighting is required, consideration of visual impact in the lighting design should enable installation of lighting that reduces the impact to neighbours.</p> <p>The likelihood of a Moderate consequence remains Likely, with a resulting risk level of 7 – Tolerable.</p> <p>It is our assessment that visual impact from obstacle lights can be negated if they are not installed. If obstacle lights are to be installed, they can be designed so that there is an acceptable risk of visual impact to neighbours.</p>	
<i>Residual Risk</i>	7 - Tolerable

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11. CONCLUSIONS

The results of this study are summarised as follows:

11.1. Project description

The Project will comprise the following:

- Up to 45 wind turbine generators (WTG) with a maximum overall height (tip height) of up to 255 m (836.6 ft) AGL and generation capacity of up to 360 MW. The highest wind turbine is WTG19 with a ground elevation of 265.3 m AHD (870.4 ft AMSL) and overall height of 520.3 m AHD (1707.0 ft AMSL).
- Turbine foundations and hardstands.
- A BESS facility.
- Overhead 220kV transmission lines connecting the Project to the existing transmission network at Bulgana Terminal Station.
- Two onsite substations, one for the BESS and another for the Wind Farm including protection equipment, a control room, tanks for water and oil storage and main substation equipment.
- Approximately 48 km of Internal access tracks and access points (ten) from public roads for access to WTGs and for construction access.
- Approximately 370 km of 33kV underground reticulation connected WTGs to the main on-site substation.
- One temporary wind monitoring tower (WMT) with a maximum height of 100 m (328.1 ft) AG and two permanent WMTs with a maximum height of up to 166 m (544.6 ft) AGL.
- O&M facilities for both the Wind Farm and BESS.
- Temporary infrastructure including concrete batching plants, temporary construction compounds and laydown areas.

11.2. Regulatory requirements

The following regulatory requirements apply:

- Objects of 100 m or greater AGL must be reported to CASA as soon as practicable after forming the intention to construct or erect the proposed object or structure, in accordance with CASR 139.165(1)(2)
- Wind turbines and wind monitoring towers must be marked in accordance with respect to CASR Part 139 MOS 2019 Chapter 8 Division 10 8.110
- Wind turbines must be lit in accordance with CASR Part 139 MOS 2019 Chapter 9 Division 4 9.30 and 9.31, unless an aeronautical study assesses they are of no operational significance.

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11.3. Planning considerations

The Project as proposed satisfies the provisions of the Planning Scheme regarding Stawell Airport and will not impact on the Airport Environs Overlay and the Design and Development Overlay – Schedule 4.

11.4. Consultation

An appropriate and justified level of consultation was undertaken with relevant parties, refer to **Section 5** for a detailed summary of the consultation.

11.5. Aviation Impact Statement

- Based on the Project site layout and overall turbine blade tip height limit of 255 m (836.6 ft) AGL, the blade tip elevation of the highest wind turbine, which is WTG19, will not exceed 520.3 m AHD (1707.0 ft AMSL).
- This AIS concludes that the proposed Project:
 - will not infringe any OLS surfaces
 - would not infringe PANS-OPS surfaces
 - would not impact any nearby designated air routes
 - would not have an impact on the grid lowest safe altitude (LSALT)
 - would be wholly contained within Class G airspace
 - would be unlikely to create downwind wake turbulence from the turbine blades in the circuit area of uncertified aerodromes
 - would be outside the clearance zones associated with aviation navigation aids and communication facilities.

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Airservices Australia has advised that the proposed wind farm would not have an impact on any Airservices designed instrument procedures, CNS facilities or ATC operations at Melbourne Airport. **Refer to Section 5**

11.6. Uncertified aerodrome analysis summary

Uncertified aerodromes further than 3 nm from the Project would not be adversely affected by any wind turbines of the Project.

Wyndarra aerodrome would be unlikely to be affected by downwind wake turbulence from the nearest turbines.

11.7. Aircraft operator characteristics

Aircraft would be required to navigate around the Project Area in low cloud conditions where aircraft need to fly at 500 ft AGL or at a higher altitude below the top of the WTGs.

The Proponent may consider engaging with local aerial agricultural and aerial firefighting operators to develop procedures, which may include, for example, stopping the rotation of the wind turbine rotor blades prior to the commencement of the subject aircraft operations within the Project Area.

Wind turbines are generally not a safety concern to aerial agricultural operators. WMTs remain the primary safety concern to aerial agricultural operators, who have expressed a general desire for these towers to be more visible.

11.8. Hazard lighting and marking

The following conclusions apply to hazard marking and lighting:

- Wind turbines and wind monitoring towers must be marked in accordance with CASR Part 139 MOS.
- Wind turbines must be lit in accordance with CASR Part 139 MOS Chapter 9 Division 4 9.30 and 9.31, unless an aeronautical study assesses they are of no operational significance, which this AIA concludes.
- Aviation Projects has assessed that the Project would not require obstacle lighting to maintain an acceptable level of safety to aircraft.
- CASA has advised that it will only review assessments referred to it by a planning authority or agency.

With respect to marking of turbines, a non-reflective white or off-white colour would provide sufficient contrast with the surrounding environment to maintain an acceptable level of safety while lowering visual impact to the neighbouring residents.

11.9. Summary of risks

A summary of the level of residual risk associated with the proposed Project with the recommended treatments implemented, is provided in Table 15.

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Table 15 Summary of Risks

<i>Risk Element</i>	<i>Consequence</i>	<i>Likelihood</i>	<i>Risk</i>	<i>Actions Required</i>
Aircraft collision with wind turbine	Catastrophic	Unlikely	7	Acceptable without obstacle lighting (ALARP). Communicate details of the Project to local and regional operators and encourage applicable aerodrome operators to publish details in ERSA for surrounding aerodromes before, during and following construction.
Aircraft collision with wind monitoring tower	Catastrophic	Unlikely	7	Acceptable without obstacle lighting (ALARP). Although there is no obligation to do so, consideration should be made for marking the wind monitoring tower according to the requirements set out in Part 139 MOS 2019 Chapter 8 Division 10 Obstacle Markings, specifically 8.110 (5), (7) and (8). Details of wind monitoring towers should be communicated to local and regional operators and to CASA and Airservices Australia following construction.
Avoidance manoeuvring leads to ground collision	Catastrophic	Unlikely	7	Acceptable without obstacle lighting (ALARP). Communicate details of the Project to local and regional operators and encourage applicable aerodrome operators to publish details in ERSA for surrounding aerodromes before, during and following construction.
Effect on crew	Minor	Possible	5	Acceptable without obstacle lighting (ALARP). Communicate details of the Project to local and regional operators and encourage applicable aerodrome operators to publish details in ERSA for surrounding aerodromes before, during and following construction.
Visual impact from obstacle lights	Moderate	Likely	7	Acceptable without obstacle lighting (zero risk of visual impact from obstacle lighting). If lights are installed, design to minimise impact.

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12. RECOMMENDATIONS

Recommended actions resulting from the conduct of this assessment are provided below.

Notification and reporting

1. Final location and height details of WGTs and WMTs of 100 m or greater AGL must be reported to CASA as soon as practicable after forming the intention to construct or erect the proposed object or structure, in accordance with CASR Part 139.165(1)(2).
2. Final height and location details of wind turbine and WMT coordinates and elevation should be provided to Airservices Australia, using the following email address: vod@airservicesaustralia.com.
3. Any obstacles 100 m AGL or above (including temporary construction equipment) should be reported to Airservices Australia NOTAM office until they are incorporated in published operational documents. With respect to crane operations during the construction of the Project, a notification to the NOTAM office may include, for example, the following details:
 - a. The planned operational timeframe and maximum height of the crane; and
 - b. Either the general area within which the crane would operate and/or the planned route with timelines that crane operations would follow.
4. Details of the wind farm should be provided to local and regional aircraft operators prior to construction in order for them to consider the potential impact of the wind farm on their operations.
5. To facilitate the flight planning of aerial application operators, details of the Project, including the 'as constructed' location and height information of wind turbines, wind monitoring tower and overhead transmission lines should be provided to landowners so that, when asked for hazard information on their property, the landowner may provide the aerial application pilot with all relevant information.

Operation

6. Whilst not a statutory requirement, the Proponent should consider engaging with local aerial agricultural operators and aerial firefighting operators in developing procedures for such aircraft operations in the vicinity of the Project.

Marking of turbines

7. The rotor blades, nacelle and the supporting mast of the wind turbines should be painted in a non-reflective off-white colour, typical of most wind turbines operational in Australia. No additional marking measures are required for WGTs.

Lighting of turbines

8. Aviation Projects has assessed that the Project would not require obstacle lighting to maintain an acceptable level of safety to aircraft.

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Marking of wind monitoring towers

9. Aviation Projects undertook a separate AIA for the temporary wind monitoring tower.

Micrositing

10. The potential micrositing of the turbines and wind monitoring tower have been considered in the assessment with the estimate of the overall maximum height being based on the highest ground level is within 100 m of the nominal turbine and wind monitoring tower positions. Providing the micrositing is within 100 m of the turbines and wind monitoring towers is likely to not result in a change in the maximum overall blade tip height of the Project. No further assessment is likely to be required from micrositing and the conclusions of this aviation impact assessment would remain the same.

Overhead transmission line

11. Overhead transmission lines and/or supporting poles associated with the Project that are located near the ends of runways or where they could adversely affect aerial application operations should be identified in consultation with local aerial agriculture operators. They may need to be marked in accordance with Part 139 Manual of Standards (MOS) or with Australian Standard AS 3891.2:2018, Air Navigation – Cables and their supporting structures – Marking and safety requirements, Parts 1 and 2, where applicable. The proposed overhead transmission lines are intended to be installed near the existing transmission line in the Project Area. Any changes to the planned configuration of the transmission lines should be reviewed for potential risk to aerial application operations.

Triggers for review

12. Triggers for review of this risk assessment are provided for consideration:
 - a. prior to construction to ensure the regulatory framework has not changed
 - b. following any significant changes to the context in which the assessment was prepared, including the regulatory framework
 - c. following any near miss, incident or accident associated with operations considered in this risk assessment.

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ANNEXURES

1. References
2. Definitions
3. Turbine coordinates and heights
4. CASA Regulatory Requirements – Lighting and Marking

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ANNEXURE 1 – REFERENCES

References used or consulted in the preparation of this report include:

- Airports Plus Pty Ltd, *Stawell Aerodrome Master Plan Review 2014*
- Airservices Australia, Aeronautical Information Package dated 20 March 2025
- Civil Aviation Safety Authority, Civil Aviation Regulations 1998 (CAR)
- Civil Aviation Safety Authority, Civil Aviation Safety Regulations 1998 (CASR)
- Civil Aviation Safety Authority, Advisory Circular (AC) 91-10 v1.3: *Operations in the vicinity of non-controlled aerodromes*, dated January 2025
- Civil Aviation Safety Authority, Manual of Standards Part 173 – Standards Applicable to Instrument Flight Procedure Design, version 1.8, dated August 2022
- Civil Aviation Safety Authority, *Part 139 (Aerodromes) Manual of Standards 2019*, Compilation 4, dated 14 December 2024
- Civil Aviation Safety Authority, Advisory Circular 139.E-01 v1.1—Reporting of Tall Structures, dated October 2022
- Civil Aviation Safety Authority, Advisory Circular (AC) 139.E-05 v1.1 Obstacles (including wind farms) outside the vicinity of a CASA certified aerodrome, dated October 2022
- Department of Infrastructure and Regional Development, Australian Government, National Airport Safeguarding Framework, Guideline D *Managing the Risk to Aviation Safety of Wind Turbine Installations(Wind Farms)/Wind Monitoring Towers*, dated July 2012
- European Academy of Wind Energy, Do wind turbines pose roll hazards to light aircraft - 2018
- International Civil Aviation Organization (ICAO) Doc 8168 Procedures for Air Navigation Services—Aircraft Operations (PANS-OPS)
- ICAO Standards and Recommended Practices, Annex 14—Aerodromes
- OzRunways, aeronautical navigation charts extracts, dated 2 April 2025
- Standards Australia, ISO 31000:2018 *Risk management – Guidelines*
- Victorian Government, Department of Environment, Land, Water & Planning, *Development of Wind Energy Facilities in Victoria Policy and Planning Guidelines*, (revised November 2021).
- Victoria State Government, the Department on Environment, Land, Water and Planning (DELWP), VicPlan – Interactive Planning Information.

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ANNEXURE 2 – DEFINITIONS

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<i>Term</i>	<i>Definition</i>
Aerial Agricultural Operator	Specialist pilot and/or company who are required to have a commercial pilot's licence, an agricultural rating and a chemical distributor's licence
Aerodrome	A defined area on land or water (including any buildings, installations, and equipment) intended to be used either wholly or in part for the arrival, departure, and surface movement of aircraft.
Aerodrome facilities	Physical things at an aerodrome which could include: <ol style="list-style-type: none"> a. the physical characteristics of any movement area including runways, taxiways, taxilanes, shoulders, aprons, primary and secondary parking positions, runway strips and taxiway strips; b. infrastructure, structures, equipment, earthing points, cables, lighting, signage, markings, visual approach slope indicators.
Aerodrome reference point (ARP)	The designated geographical location of an aerodrome.
Aeronautical Information Publication (AIP)	Details of regulations, procedures, and other information pertinent to the operation of aircraft
Aeronautical Information Publication En-route Supplement Australia (AIP ERSA)	Contains information vital for planning a flight and for the pilot in flight as well as pictorial presentations of all licensed aerodromes
Civil Aviation Safety Regulations 1998 (CASR)	Contain the mandatory requirements in relation to airworthiness, operational, licensing, enforcement.
Instrument meteorological conditions (IMC)	Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling, less than the minimum specified for visual meteorological conditions.
Manual of Standards (MOS)	The means CASA uses in meeting its responsibilities under the Act for promulgating aviation safety standards
National Airports Safeguarding Framework (NASF)	Framework has the objective of developing a consistent and effective national framework to safeguard both airports and communities from inappropriate on and off airport developments.

<i>Term</i>	<i>Definition</i>
Obstacles	All fixed (whether temporary or permanent) and mobile objects, or parts thereof, that are located on an area intended for the surface movement of aircraft or that extend above a defined surface intended to protect aircraft in flight.
Runway	A defined rectangular area on a land aerodrome prepared for the landing and take-off of aircraft.
Runway strip	A defined area including the runway and stopway, if provided, intended: <ul style="list-style-type: none"> a. to reduce the risk of damage to aircraft running off a runway; and b. to protect aircraft flying over it during take-off or landing operations.
Safety Management System	A systematic approach to managing safety, including organisational structures, accountabilities, policies and procedures.

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ANNEXURE 3 – TURBINE COORDINATES AND HEIGHTS

Source: Umwelt, pAUSplc098_WW_WTG_WMT_Ground_Elev_20250130.xlsx

(Sorted tallest to smallest AMSL)

WTG ID	Easting	Northing	Base Elevation (m AHD)	WTG Maximum tip height (m AGL)	Overall height (m AHD)	Overall height (ft AMSL)
T19	669671.8	5900497	265.3	255	520.3	1707.0
T13	670358.2	5899946	257.68	255	512.68	1682.0
T2	674305.7	5898339	256.85	255	511.85	1679.3
T20	670040.7	5900881	256.27	255	511.27	1677.4
T23	669461.9	5900981	253.85	255	508.85	1669.5
T11	670789	5899847	248.35	255	503.35	1651.4
T1	675122.6	5897322	246.66	255	501.66	1645.9
T8	673126.7	5899182	245.24	255	500.24	1641.2
T4	675250	5898000	244.61	255	499.61	1639.1
T3	674628	5898023	244.28	255	499.28	1638.1
T7	672768.6	5899274	244.11	255	499.11	1637.6
T15	672979.9	5900212	241.2	255	496.2	1628.0
T28	670731	5900805	237.35	255	492.35	1615.3
T21	671283	5901486	237.32	255	492.32	1615.2
T12	671330.8	5900082	231.28	255	486.28	1595.4
T17	677587.6	5900404	229.09	255	484.09	1588.2
T33	672550.5	5903527	227.72	255	482.72	1583.7
T26	673784	5902287	227.24	255	482.24	1582.2
T36	672086.4	5904266	226.79	255	481.79	1580.7
T29	673268	5903336	225.76	255	480.76	1577.3
T25	670723	5902511	225.56	255	480.56	1576.6
T5	675746	5898411	224.59	255	479.59	1573.5
T30	673656.2	5902867	222.89	255	477.89	1567.9
T9	671554.7	5899832	221.91	255	476.91	1564.7
T24	674611.2	5902204	220.96	255	475.96	1561.5
T22	674135.2	5902786	219.72	255	474.72	1557.5
T16	677150.3	5900400	219.27	255	474.27	1556.0

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<i>WTG ID</i>	<i>Easting</i>	<i>Northing</i>	<i>Base Elevation (m AHD)</i>	<i>WTG Maximum tip height (m AGL)</i>	<i>Overall height (m AHD)</i>	<i>Overall height (ft AMSL)</i>
T6	674199.1	5902231	218.55	255	473.55	1553.6
T18	678124.8	5900408	218.5	255	473.5	1553.5
T37	673305	5904230	217.68	255	472.68	1550.8
T14	670945.6	5903181	216.41	255	471.41	1546.6
T38	672940	5904620	216.05	255	471.05	1545.4
T39	672571	5905101	213.06	255	468.06	1535.6
T27	672082.4	5902498	212.8	255	467.8	1534.8
T46	670848	5906297	212.2	255	467.2	1532.8
T42	672181	5905700	211.19	255	466.19	1529.5
T45	671321	5905775	211.16	255	466.16	1529.4
T32	671571	5902822	211.04	255	466.04	1529.0
T40	671710.6	5905318	210.24	255	465.24	1526.4
T31	674027.1	5903733	209.35	255	464.35	1523.5
T43	669407	5905806	208.64	255	463.64	1521.1
T47	670475.2	5906718	205.21	255	460.21	1509.9
T10	671291	5906540	203.69	255	458.69	1504.9
T41	670229	5905409	203.18	255	458.18	1503.2
T44	669813.5	5905753	201.82	255	456.82	1498.8

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ANNEXURE 4 – CASA REGULATORY REQUIREMENTS – LIGHTING AND MARKING

In considering the need for aviation hazard lighting and marking, the applicable regulatory context was determined.

The Civil Aviation Safety Authority (CASA) regulates aviation activities in Australia. Applicable requirements include the Civil Aviation Regulations 1988 (CAR), Civil Aviation Safety Regulations 1998 (CASR) and associated Manual of Standards (MOS) and other guidance material. Relevant provisions are outlined in further detail in the following section.

Civil Aviation Safety Regulations 1998, Part 139—Aerodromes

CASR 139.165 requires the owner of a structure (or proponents of a structure) that would be 100 m or more above ground level to inform CASA. This must be given in written notice and contain information on the proposal, the height and location(s) of the object(s) and the proposed time-frame for construction. This is to allow CASA to assess the effect of the structure on aircraft operations and determine whether or not the structure would be hazardous to aircraft operations.

Manual of Standards Part 139—Aerodromes

Chapter 9 sets out the standards applicable to Visual Aids Provided by Aerodrome Lighting.

Section 9.30 provides guidance on Types of Obstacle Lighting and Their Use:

1. *The following types of obstacle lights must be used, in accordance with this MOS, to light hazardous obstacles:*
 - a. *low-intensity;*
 - b. *medium-intensity;*
 - c. *high-intensity;*
 - d. *a combination of low, medium or high-intensity.*
2. *Low-intensity obstacle lights:*
 - a. *are steady red lights; and*
 - b. *must be used on non-extensive objects or structures whose height above the surrounding ground is less than 45 m.*
3. *Medium-intensity obstacle lights must be:*
 - a. *flashing white lights; or*
 - b. *flashing red lights; or*
 - c. *steady red lights.*

Note CASA recommends the use of flashing red medium-intensity obstacle lights.

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4. *Medium-intensity obstacle lights must be used if:*
 - a. *the object or structure is an extensive one; or*
 - b. *the top of the object or structure is at least 45 m but not more than 150 m above the surrounding ground; or*
 - c. *CASA determines in writing that early warning to pilots of the presence of the object or structure is desirable in the interests of aviation safety.*

Note For example, a group of trees or buildings is regarded as an extensive object.

5. *For subsection (4), low-intensity and medium-intensity obstacle lights may be used in combination.*
6. *High-intensity obstacle lights:*
 - a. *must be used on objects or structures whose height exceeds 150 m; and*
 - b. *must be flashing white lights.*
7. *Despite paragraph (6) (b), a medium-intensity flashing red light may be used if necessary, to avoid an adverse environmental impact on the local community.*

Sections 9.31 (8) and (9) provide guidance on obstacle lighting specific to wind farms:

8. *Subject to subsection (9), for wind turbines in a wind farm, medium-intensity obstacle lights must:*
 - a. *mark the highest point reached by the rotating blades; and*
 - b. *be provided on a sufficient number of individual wind turbines to indicate the general definition and extent of the wind farm, but such that intervals between lit turbines do not exceed 900 m; and*
 - c. *all be synchronised to flash simultaneously; and*
 - d. *be seen from every angle in azimuth.*

Note: This is to prevent obstacle light shielding by the rotating blades of a wind turbine and may require more than 1 obstacle light to be fitted.

9. *If it is physically impossible to light the rotating blades of a wind turbine:*
 - a. *the obstacle lights must be placed on top of the generator housing; and*
 - b. *a note must be published in the AIP-ERSA indicating that the obstacle lights are not at the highest position on the wind turbines.*
10. *If the top of an object or structure is more than 45 m above:*
 - a. *the surrounding ground (ground level); or*
 - b. *the top of the tallest nearby building (building level); then the top lights must be medium-intensity lights, and additional low-intensity lights must be:*
 - c. *provided at lower levels to indicate the full height of the structure; and*

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- d. spaced as equally as possible between the top lights and the ground level or building level, but not so as to exceed 45 m between lights.

Advisory Circular 139.E-01 v1.0—Reporting of Tall Structures

In Advisory Circular (AC) 139.E-01 v1.0—*Reporting of Tall Structures*, CASA provides guidance to those authorities and persons involved in the planning, approval, erection, extension or dismantling of tall structures so that they may understand the vital nature of the information they provide.

Airservices Australia has been assigned the task of maintaining a database of tall structures, the top measurement of which is:

- a) 30 metres or more above ground level—within 30 kilometres of an aerodrome; or
- b) 45 metres or more above ground level elsewhere.

The purpose of notifying Airservices Australia of these structures is to enable their details to be provided in aeronautical information databases and maps/charts etc used by pilots, so that the obstacles can be avoided.

The proposed wind turbines must be reported to Airservices Australia. This action should occur once the final layout after micrositing is confirmed and prior to construction.

International Civil Aviation Organisation

Australia, as a contracting State to the International Civil Aviation Organisation (ICAO) and signatory to the Chicago Convention on International Civil Aviation (the Convention), has an obligation to implement ICAO's standards and recommended practices (SARPs) as published in the various annexes to the Convention.

Annex 14 to the Convention — *Aerodromes, Volume 1*, Section 6.2.4 provides SARPs for the obstacle lighting and marking of wind turbines, which is copied below:

6.2.4 Wind turbines

6.2.4.1 A wind turbine shall be marked and/or lighted if it is determined to be an obstacle.

Note 1. — Additional lighting or markings may be provided where in the opinion of the State such lighting or markings are deemed necessary.

Note 2. — See 4.3.1 and 4.3.2

Markings

6.2.4.2 Recommendation. — The rotor blades, nacelle and upper 2/3 of the supporting mast of wind turbines should be painted white, unless otherwise indicated by an aeronautical study.

Lighting

6.2.4.3 Recommendation. — When lighting is deemed necessary, in the case of a wind farm, i.e. a group of two or more wind turbines, the wind farm should be regarded as an extensive object and the lights should be installed:

- a) to identify the perimeter of the wind farm;

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- b) respecting the maximum spacing, in accordance with 6.2.3.15, between the lights along the perimeter, unless a dedicated assessment shows that a greater spacing can be used;
- c) so that, where flashing lights are used, they flash simultaneously throughout the wind farm;
- d) so that, within a wind farm, any wind turbines of significantly higher elevation are also identified wherever they are located; and
- e) at locations prescribed in a), b) and d), respecting the following criteria:

- i) for wind turbines of less than 150 m in overall height (hub height plus vertical blade height), medium-intensity lighting on the nacelle should be provided;

- ii) for wind turbines from 150 m to 315 m in overall height, in addition to the medium-intensity light installed on the nacelle, a second light serving as an alternate should be provided in case of failure of the operating light. The lights should be installed to assure that the output of either light is not blocked by the other; and

- iii) in addition, for wind turbines from 150 m to 315 m in overall height, an intermediate level of high-intensity lighting should be provided. If an aeronautical study shows that low-intensity Type E lights are not suitable, low-intensity Type A or B lights may be used.

Note. — The above 6.2.4.3 e) does not address wind turbines of more than 315 m of overall height. For such wind turbines, additional marking and lighting may be required as determined by an aeronautical study.

6.2.4.4 Recommendation. — The obstacle lights should be installed on the nacelle in such a manner as to provide an unobstructed view for aircraft approaching from any direction.

6.2.4.5 Recommendation. — Where lighting is deemed necessary for a single wind turbine or short line of wind turbines, the installation should be in accordance with 6.2.4.3 e) or as determined by an aeronautical study.

As referenced in Section 6.2.4.3(e)(iii), Section 6.2.1.3 is copied below:

6.2.1.3 The number and arrangement of low-, medium- or high-intensity obstacle lights at each level to be marked shall be such that the object is indicated from every angle in azimuth. Where a light is shielded in any direction by another part of the object, or by an adjacent object, additional lights shall be provided on that adjacent object or the part of the object that is shielding the light, in such a way as to retain the general definition of the object to be lighted. If the shielded light does not contribute to the definition of the object to be lighted, it may be omitted.

As referenced in Section 6.2.4.3(b), Section 6.2.3.15 is copied below:

6.2.3.15 Where lights are applied to display the general definition of an extensive object or a group of closely spaced objects, and

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a) low-intensity lights are used, they shall be spaced at longitudinal intervals not exceeding 45 m; and

b) medium-intensity lights are used, they shall be spaced at longitudinal intervals not exceeding 900 m.

Section 4.3 Objects outside the OLS states the following:

4.3.1 Recommendation.— Arrangements should be made to enable the appropriate authority to be consulted concerning proposed construction beyond the limits of the obstacle limitation surfaces that extend above a height established by that authority, in order to permit an aeronautical study of the effect of such construction on the operation of aeroplanes.

4.3.2 Recommendation. — In areas beyond the limits of the obstacle limitation surfaces, at least those objects which extend to a height of 150 m or more above ground elevation should be regarded as obstacles, unless a special aeronautical study indicates that they do not constitute a hazard to aeroplanes.

Note. — This study may have regard to the nature of operations concerned and may distinguish between day and night operations.

ICAO Doc 9774 Manual on Certification of Airports defines an aeronautical study as:

An aeronautical study is a study of an aeronautical problem to identify potential solutions and select a solution that is acceptable without degrading safety.

Light characteristics

If obstacle lighting is required, installed lights should be designed according to the criteria set out in the applicable regulatory material and taking CASA's recommendations into consideration in the case that CASA has reviewed this risk assessment and provided recommendations.

The characteristics of the obstacle lights should be in accordance with the applicable standards in Part 139 MOS 2019.

The characteristics of low and medium intensity obstacle lights specified in Part 139 MOS 2019, Chapter 9, are provided below.

Part 139 MOS 2019 Chapter 9 Division 4 – Obstacle Lighting section 9.32 outlines Characteristics of Low Intensity Obstacle Lights.

1. Low-intensity obstacle lights must have the following:
 - a. fixed lights showing red;
 - b. a horizontal beam spread that results in 360-degree coverage around the obstacle;
 - c. a minimum intensity of 100 candela (cd);
 - d. a vertical beam spread (to 50% of peak intensity) of 10 degrees;
 - e. a vertical distribution with 50 cd minimum at +6 degrees and +10 degrees above the horizontal;

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- f. not less than 10 cd at all elevation angles between -3 degrees and +90 degrees above the horizontal.

Note: The intensity requirement in paragraph (c) may be met using a double-bodied light fitting. CASA recommends that double-bodied light fittings, if used, should be orientated so that they show the maximum illuminated surface towards the predominant, or more critical, direction of aircraft approach.

- 2. To indicate the following:
 - a. taxiway obstacles;
 - b. unserviceable areas of the movement area; low-intensity obstacle lights must have a peak intensity of at least 10 cd.

Part 139 MOS 2019 Chapter 9 Division 4 – Obstacle Lighting section 9.33 outlines Characteristics of Medium Intensity Obstacle Lights.

- 1. Medium-intensity obstacle lights must:
 - a. be visible in all directions in azimuth; and
 - b. if flashing – have a flash frequency of between 20 and 60 flashes per minute.
- 2. The peak effective intensity of medium intensity obstacle lights must be 2 000 \pm 25% cd with a vertical distribution as follows:
 - a. for vertical beam spread – a minimum of 3 degrees;
 - b. at -1-degree elevation – a minimum of 50% of the tolerance value of the peak intensity;
 - c. at 0 degrees elevation – a minimum of 100% of the lower tolerance value of the peak intensity.
- 3. For subsection (2), vertical beam spread means the angle between 2 directions in a plane for which the intensity is equal to 50% of the lower tolerance value of the peak intensity.
- 4. If, instead of obstacle marking, a flashing white light is used during the day to indicate temporary obstacles in the vicinity of an aerodrome, the peak effective intensity of the light must be increased to 20 000 \pm 25% cd when the background luminance is 50 cd/m² or greater.

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Visual impact of night lighting

Annex 14 Section 6.2.4 and Part 139 MOS 2019 Chapter 9 are specifically intended for wind turbines and recommends that medium intensity lighting is installed.

Generally accepted considerations regarding minimisation of visual impact are provided below for consideration in this aeronautical study:

- To minimise the visual impact on the environment, some shielding of the obstacle lights is permitted, provided it does not compromise their operational effectiveness;

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- Shielding may be provided to restrict the downward component of light to either, or both, of the following:
 - such that no more than 5% of the nominal intensity is emitted at or below 5 degrees below horizontal; and
 - such that no light is emitted at or below 10 degrees below horizontal;
- If a light would be shielded in any direction by an adjacent object or structure, the light so shielded may be omitted, provided that such additional lights are used as are necessary to retain the general definition of the object or structure.
- If flashing obstacle lighting is required, all obstacle lights on a wind farm should be synchronised so that they flash simultaneously; and
- A relatively small area on the back of each blade near the rotor hub may be treated with a different colour or surface treatment, to reduce reflection from the rotor blades of light from the obstacle lights, without compromising the daytime visibility of the overall turbine.

Marking of turbines

ICAO Annex 14 Vol 1 Section 6.2.4.2 recommends that the rotor blades, nacelle and upper 2/3 of the supporting mast of the wind turbines should be painted a shade of white, unless otherwise indicated by an aeronautical study.

It is generally accepted that a shade of white reflective painting should provide sufficient contrast with the surrounding environment to maintain an acceptable level of visibility, lowering visual impact to the neighbouring residents.

Wind monitoring towers

Consideration could be given to marking any WMTs according to the requirements set out in CASR Part 139 MOS Chapter 8 Division 10 Obstacle Markings; specifically:

8.110 Marking of Hazardous Obstacles

(5) As illustrated in Figure 8.110 (5), long, narrow structures like masts, poles and towers which are hazardous obstacles must be marked in contrasting colour bands so that the darker colour is at the top; and the bands are, as far as physically possible, marked at right angles along the length of the long, narrow structure; and have a length ("z" in Figure 8.110 (5)) that is, approximately, the lesser of: 1/7 of the height of the structure; or 30 m.

(7) Hazardous obstacles in the form of wires or cables must be marked using 3-dimensional coloured objects attached to the wire or cables. Note: Spheres and pyramids are examples of 3-dimensional objects.

(8) The objects mentioned in subsection (7) must:

- (a) be approximately equivalent in size to a cube with 600 mm sides; and
- (b) be spaced 30 m apart along the length of the wire or cable.

NASF Guideline D suggests consideration of the following measures specific to the marking and lighting of WMTs:

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- the top 1/3 of wind monitoring towers to painted in alternating contrasting bands of colour. Examples of effective measures can be found in the Manual of Standards for Part 139 of the Civil Aviation Safety Regulations 1998. In areas where aerial agriculture operations take place, marker balls or high visibility flags can be used to increase the visibility of the towers
- marker balls or high visibility flags or high visibility sleeves placed on the outside guy wires
- ensuring the guy wire ground attachment points have contrasting colours to the surrounding ground/vegetation or
- a flashing strobe light during daylight hours.

Overhead transmission lines

Overhead transmission lines and/or supporting poles that are located where they could adversely affect aerial application operations should be identified in consultation with local aerial agriculture operators and marked in accordance with CASR Part 139 MOS 2019 Chapter 8 Division 10 section 8.110 (7) and section 8.110 (8):

8.110 Marking of hazardous obstacles

(7) Hazardous obstacles in the form of wires or cables must be marked using 3-dimensional coloured objects attached to the wire or cables. Note: Spheres and pyramids are examples of 3-dimensional objects.

(8) The objects mentioned in subsection (7) must:
(a) be approximately 100 mm in diameter with 100 mm sides; and
(b) be spaced 30 m apart along the length of the cable.

As the transmission line structures are likely to be lower than 100 metres AGL and do not infringe on any certified aerodrome OLS surface, there are no legislative requirements or guidelines for specific aviation related marking outside of Australian Standard AS 3891.1:2018 and AS 3891.2:2018.

Australian Standard AS3891.2:2018, *Air Navigation – Cables and their supporting structures – Marking and safety requirements, Part 2, Low level aviation operations* “specifies requirements for marking of overhead cables and their supporting structures for visual warnings to pilots of aircraft involved in planned legal low-level aviation operations.”

Aircraft warning markers specified in the standard are designed as a visual reminder of the location of cables and their supporting structures.

They are applicable to transmission lines located near to the ends of runways where the transmission line is considered to be a hazard to aircraft operations at that aerodrome, where making the transmission line more conspicuous will improve the ability of pilots to identify and avoid the transmission line.

Transmission lines are not generally marked in Australia. Pre-flight planning in cooperation with landholders to identify all hazards to low-level flight operations on or near the landholder’s property reduces the need for such markings.

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ANNEXURES

1. Wind Monitoring tower aviation impact assessment - 102203-02_Watta_Wella_WF_WMT_AIA_v1.0_210628

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Renee Brozovich
Senior Environmental Planner
Umwelt (Australia) Pty Limited

By email: rbrozovich@umwelt.com.au

Our ref: 102203-02

Dear Renee

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Re: Watta Wella Wind Farm wind monitoring tower – Aviation Impact Assessment

Please find in this correspondence a summary overview of the aviation impact assessment on possible constraints to the development of the Wind Monitoring Tower (WMT) at Watta Wella in Western Victoria.

1.1. Project background

RES Australia Pty Limited (RES Australia) proposes to install a temporary weather monitoring station to monitor wind/temperature/pressure at Watta Wella in western Victoria (the Project). The station will include a mast of lattice construction and have a total height of 97 m above ground level (AGL). The Project is located along Landsborough Road between Landsborough and Stawell.

RES Australia wishes to understand the need for aviation hazard marking and lighting of the WMT.

1.2. References

References used or consulted in the preparation of this report included:

- Airservices Australia, *Aeronautical Information Package; including AIP Book, Departure and Approach Procedures and En Route Supplement Australia*, dated 25 March 2021
- Airservices Australia, *Designated Airspace Handbook*, effective 05 November 2020
- Bureau of Meteorology, Victoria Radar Sites Table and Information, http://www.bom.gov.au/australia/radar/vic_radar_sites_table.shtml
- Civil Aviation Safety Authority, *Civil Aviation Regulations 1998 (CAR)*
- Civil Aviation Safety Authority, *Civil Aviation Safety Regulations 1998 (CASR)*
- Civil Aviation Safety Authority, *Civil Aviation Advisory Publication (CAAP) 92-1(1): Guidelines for aeroplane landing areas*, dated July 1992
- Civil Aviation Safety Authority, *Civil Aviation Advisory Publication (CAAP) 166-1(4.1): Operations in the vicinity of non-controlled aerodromes*, dated April 2017
- Civil Aviation Safety Authority, *Part 139 (Aerodromes) Manual of Standards 2019*, dated 13 August 2020 Version F2020C00797

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PO Box 116, Toowong DC, Toowong Qld 4066

19/200 Moggill Road, Taringa Qld 4068

aviationprojects.com.au

- Civil Aviation Safety Authority, Advisory Circular (AC) 139.E-05 v1.0 Obstacles (including wind farms) outside the vicinity of a CASA certified aerodrome
- Department of Infrastructure and Regional Development, Australian Government, National Airport Safeguarding Framework, Guideline D Managing the Risk of Wind Turbine Farms as Physical Obstacles to Air Navigation, dated June 2013
- EUROCONTROL, European Organisation for the safety of air navigation, *EUROCONTROL Guidelines, How to assess the potential impact of wind turbines surveillance sensors*, edition 1.2, ISBN: 978-2-87497-043-6, Reference number: EUROCONTROL-GUID-130, September 2014
- International Civil Aviation Organization (ICAO), *Doc 8168 Procedures for Air Navigation Services—Aircraft Operations (PANS-OPS)*
- ICAO Standards and Recommended Practices, Annex 14—Aerodromes
- ISO 31000:2018 *Risk management—Guidelines*, Standards Australia
- Northern Grampians Planning Scheme
- Stawell Aerodrome Master Plan (Draft *Stawell Aerodrome Master Plan Review 2014*)
- OzRunways, aeronautical navigation chart extracts, dated 18 January 2021.

1.3. Client material

RES Australia provided the following materials for the purposes of this analysis:

- Temporary Mast location, KMZ, WW_Temporary_Mast_Location, 20 May 2021
- Coordinates of the Wind Monitoring Tower's location, WW_WTG_WMT_Ground_Elev_200521.xlsx received via email on the 20 May 2021.

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1.4. Site overview

The Project site is located along Landsborough Road approximately 12 km (6.5 nm) east of the town of Stawell and approximately 26 km (13.6 nm) north of the town of Ararat. The Project is located within the local government area (LGA) of Northern Grampians Shire Council. Figure 1 shows an indicative location of the Project site relative to the council boundaries and nearest towns (source: Google Earth).

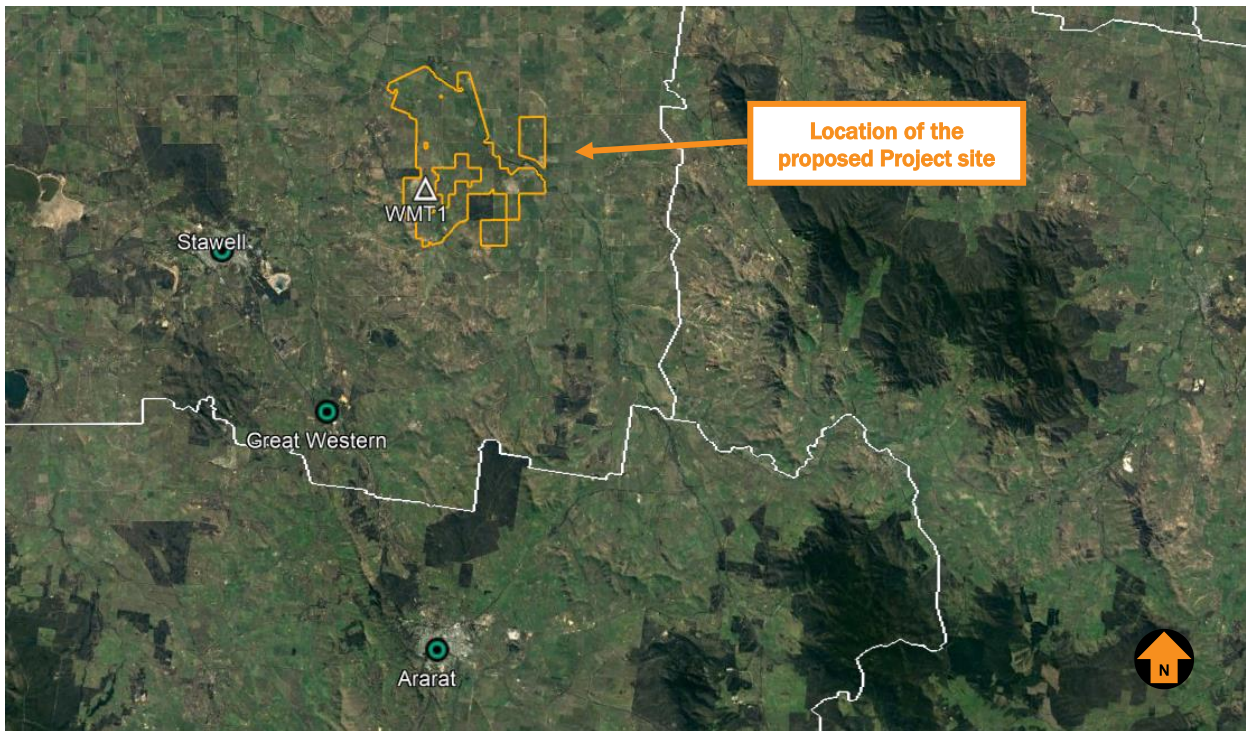


Figure 1 Project site overview (Source: Google Earth)

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Figure 2 shows the location of the Project site relative to the closest certified airports Stawell Aerodrome (YSWL), Ararat Aerodrome (YARA) and Saint Arnaud Aerodrome (YSTA) illustrating a 30 nm buffer ring around all airports (source: Google Earth).

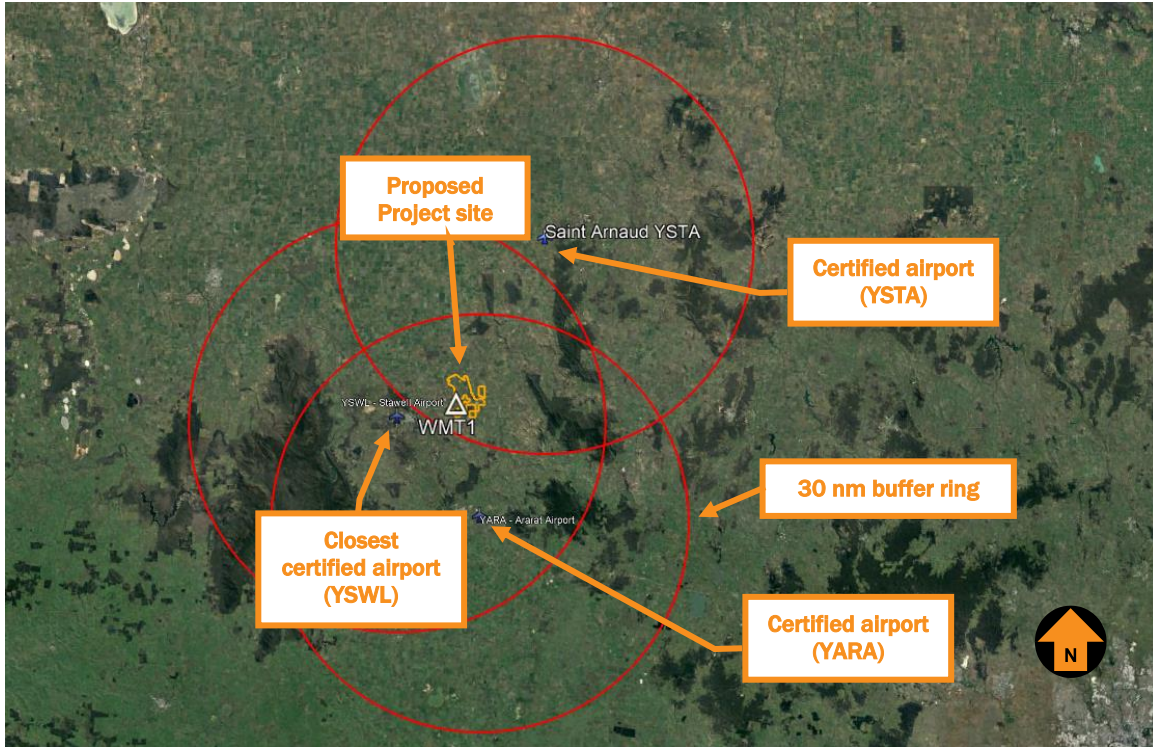


Figure 2 Project site layout relative to the closest certified airports (source: Google Earth)

1.5. Planning context

The Department on Environment, Land, Water and Planning (DELWP) has published Policy and Planning Guidelines for Development of Wind Energy Facilities in Victoria.

These guidelines provide advice to inform planning decisions about a wind energy facility proposal.

The purpose of these guidelines is to set out:

- a framework to provide a consistent and balanced approach to the assessment of wind energy
- a set of consistent operational performance standards to inform the assessment and operation of a wind energy facility project; and
- guidance as to how planning permit application requirements might be met.

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The guidelines also provide advice about locations in the state that are not appropriate for wind energy facilities. They also give a framework to ensure proposals for wind energy facilities are thoroughly assessed, including other considerations and approvals required in the process.

1.6. Northern Grampians Shire Council

The planning scheme applicable to the proposed Project site is the Northern Grampians Shire Council Planning Scheme, dated 14 May 2021.

The Planning Scheme outlines key issues and overview in protecting the safe operation and future expansion of the Stawell Airport.

In particular, the Objective 1 for the protection of the Stawell Airport operations aims:

To ensure that future development does not infringe the current and future use of the Stawell Aerodrome.

This objective is also supported by the following strategies:

Strategy 1.1 Ensure future development does not restrict the use of the aerodrome.

Strategy 1.2 Ensure tall structures do not impact any designated existing or future obstacle limitation surfaces (OLS).

Strategy 1.3 Facilitate the future extension of Stawell Aerodrome Runway 11/29.

Strategy 1.4 Ensure that the use and development of hangar sites supports the safe operation and future expansion of the airport.

The Planning Scheme incorporates the Stawell Airport's Airport Environs Overlay. The purpose of this overlay is to:

- *Apply the Airport Environs Overlay to protect the ongoing operation and future expansion of the Stawell Airport.*
- *Apply the Design and Development Overlay to maintain the efficiency and safety of aircraft operations at the Stawell Aerodrome*

Schedule 4 to the Design and Development Overlay of the Planning Scheme includes the design objectives for the protection of the Stawell Airport's obstacle limitation surfaces (OLS) which are copied below:

To maintain the efficiency and safety of aircraft operations at the Stawell Aerodrome.

To ensure development and landscaping does not present a hazard to aircraft take offs and landings at the Stawell Aerodrome.

To ensure that development is appropriately sited and compatible with the operation of the Stawell Aerodrome.

To ensure that all buildings and works minimise impacts on the safe operation of the Stawell Aerodrome.

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To recognise and implement any approved Obstacle Surface Limitation chart.

1.7. Stawell Aerodrome Master Plan (Draft review 2014)

The Draft *Stawell Aerodrome Master Plan Review* was prepared by Airports Plus Pty Ltd in November 2014. Airports Plus Pty Ltd undertook the Master Plan in 2008 which was adopted by the Northern Grampians Shire Council in January 2009. The review of the master plan was initiated to bring the master plan document up to date and consider any future development. Council adopted the review in 2015.

The Master Plan provides guidance and strategies for the current and future uses of Stawell Aerodrome. There is reference in the 2014 review about potentially lengthening the main runway 11/29 to accommodate large aircraft associated with aerial fire-fighting operations. The runway extension is constrained by land ownership issues. There is no reference in the master plan review of upgrading the aerodrome to a Code 4 and therefore expanding the applicable Obstacle Limitation Surface dimensions.

The Project is located outside of the OLS associated with current and future Stawell Aerodrome operations.

1.8. Wind Monitoring Tower Description

The maximum height of the proposed wind monitoring tower will be up to 97 m AGL. The ground elevation for the proposed WMT is 244 m AHD (including 5 m error budget), which results in a maximum overall height of 341 m AHD (1118 ft AMSL).

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1.9. Nearby aerodromes

The Project is located within a nominal 30 nm buffer zone of 3 Certified Aerodromes - Stawell Airport (YSWL), Ararat Airport (YARA) and Saint Arnaud Airport (YSTA). Stawell Airport is the closest certified aerodrome to the project, located 17 km (9 nm) to the south-west from the WMT.

1.10. Stawell Airport – Overview

Stawell Airport (YSWL) is a certified aerodrome operated by Northern Grampians Shire Council, with a published aerodrome elevation of 246 m AHD (807 ft AMSL) (source: Airservices Australia, Aerodrome Chart SWLAD01-166, 25 March 2021).

Stawell Airport has two runways:

- Runway 11/29 sealed runway with a length of 1403 m, width 30 m and runway strip 90 m
- Runway 18/36 sealed runway with a length of 854 m, width 18 m and runway strip 90 m

Figure 3 shows the runway layout of Stawell Aerodrome (source: AsA, Aerodrome Chart, 21 March 2021).

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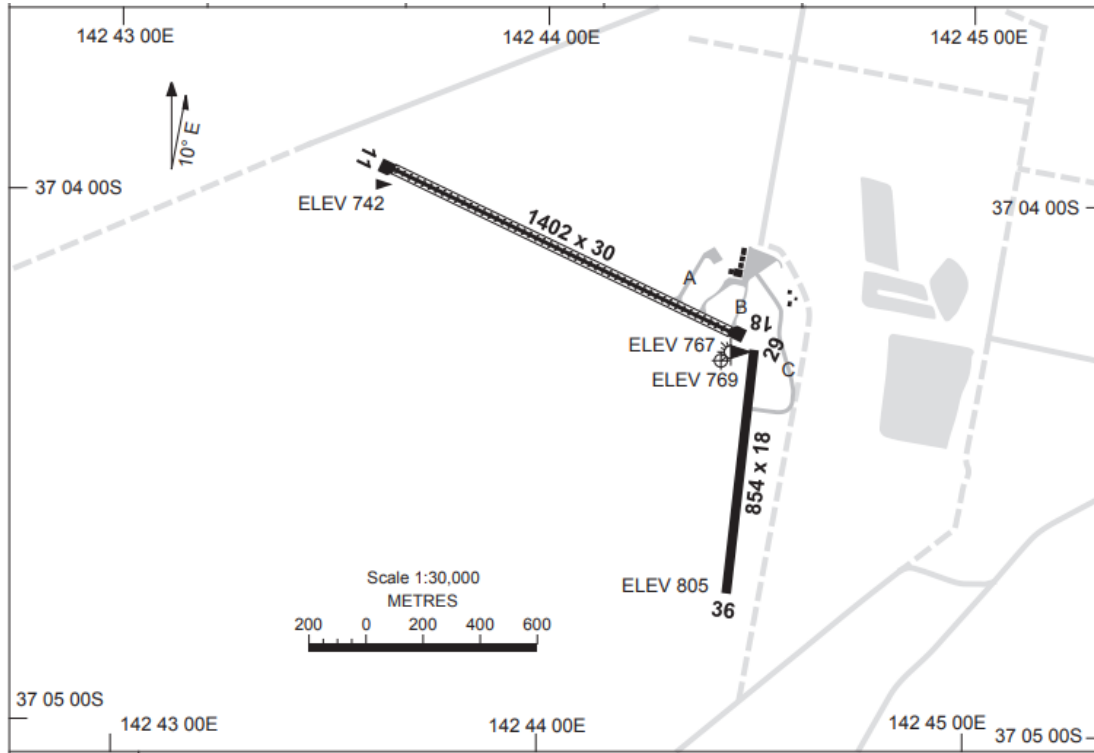


Figure 3 Stawell Airport layout

Stawell Airport’s Aerodrome Reference Point (ARP) coordinates published in Airservices Australia’s ERSA are Latitude 37°04'18"S and Longitude 142°44'25"E.

1.11. Instrument Procedures – Stawell Airport

A check of the aeronautical information package (AIP) via the Airservices Australia website showed that Stawell Airport is served by non-precision terminal instrument flight procedures, as per Table 1 (source: Airservices Australia March 2021).

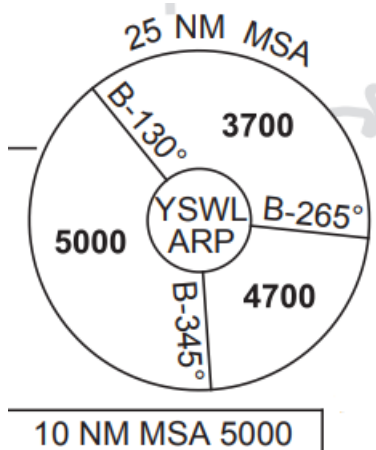
Procedure charts for Stawell Airport are designed by Airservices Australia and are noted accordingly.

Table 1 Stawell Airport (YSWL) aerodrome and procedure charts

<i>Chart name</i>	<i>Effective date</i>
AERODROME CHART (AsA)	25-Mar-2021 (SWLAD01-166)
RNAV-Z (GNSS) RWY 11 (AsA)	23-May 2019 (SWLGN01-159)
RNAV-Z (GNSS) RWY 29 (AsA)	23-May-2019 (SWLGN02-159)

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An image of the MSA published for Stawell Airport is shown in Figure 4



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Figure 4 MSA of Stawell Airport (Airservices)

The Manual of Standards 173 *Standards Applicable to Instrument Flight Procedure Design* (MOS 173), requires that a minimum obstacle clearance (MOC) of 1000 ft below the published MSA is maintained.

Obstacles within 15 nm (10 nm MSA + 5 nm buffer) and within 30 nm (25 nm MSA + 5 nm buffer) of Stawell Airport's ARP define the minimum height at which an aircraft can fly when within 10 nm and 25 nm.

The Project Site is located inside the 10 nm (+5nm buffer) MSA of Stawell Airport. The 10nm MSA is not sectorised.

Figure 5 shows the 10 nm (+ 5 nm buffer) and 25 nm (+ 5 nm buffer) MSAs of Stawell Airport relative to the WMT (source: Umwelt, Google Earth).

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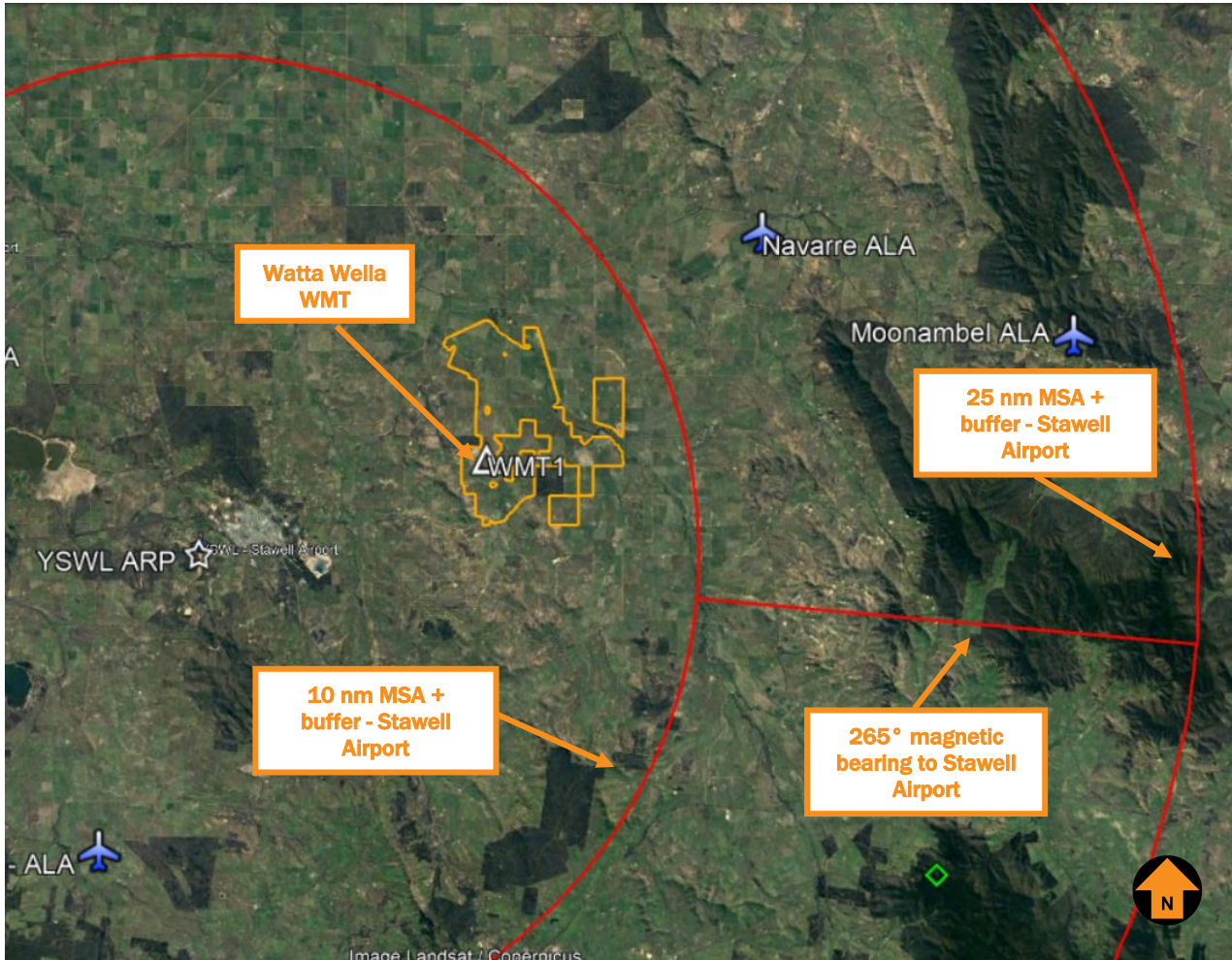


Figure 5 Stawell Airport (YSWL) MSA Sectors

The WMT is located inside the horizontal extent of the 10 nm MSA + 5 nm buffer. The height of the WMT (with 5 m buffer) is 341 m AHD (1118 ft AMSL).

An impact analysis of Stawell Airport's MSA is provided in Table 2.

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Table 2 Stawell Airport MSA impact analysis

<i>MSA</i>	<i>Minimum altitude</i>	<i>MOC</i>	<i>Impact on airspace design</i>	<i>Potential solution</i>	<i>Impact on aircraft ops</i>
10 nm	5000ft AMSL	4000 ft AMSL	Nil – below the controlling altitude by approx. 2882 ft	N/A	N/A
25 nm (sector B265° and B345°)	4700 ft AMSL	3700 ft AMSL	Nil – below controlling surface and outside horizontal extent	N/A	N/A
25 nm (sector B345° and B130°)	5000 ft AMSL	4000ft AMSL	Nil – below controlling surface and outside horizontal extent	N/A	N/A
25nm (sector 130° and 265°)	3700 ft AMSL	2700 ft AMSL	Nil - below controlling surface and outside horizontal extent	N/A	N/A

1.12. Circling Areas – Stawell Airport

The maximum horizontal distance that category C circling area may extend for an aerodrome in Australia is 4.2 nm (7.7778 km) from the threshold of each usable runway.

The WMT is located beyond the horizontal extent of category A, category B and category C circling areas at Stawell Airport.

1.13. Obstacle Limitation Surfaces – Stawell Airport

The maximum horizontal distance that an obstacle limitation surface (OLS) may extend for an aerodrome in Australia is 15 km (8.1 nm) from the edge of a runway strip.

The WMT is located beyond the horizontal extent of the obstacle limitation surfaces of Stawell Airport.

1.14. Ararat Airport (YARA)

Ararat Airport is a certified aerodrome operated by Ararat Rural City Council, with a published aerodrome elevation of 307 m AHD (1008 ft AMSL) (source: Airservices Australia, ERSA-FAC, 25 March 2021). The aerodrome is located approximately 32 km (17.3 nm) south of the WMT.

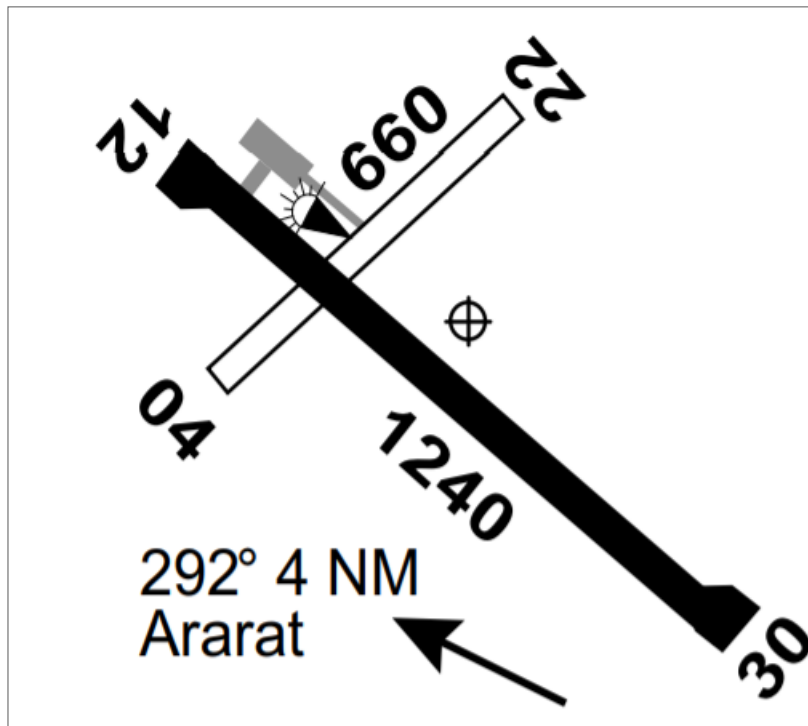
Ararat Airport has two runways:

- Runway 12/30 Code 1 sealed runway with a length of 1240 m, width 30 m and runway strip 90 m
- Runway 04/22 Code 1 grass runway with a length of 660 m, width 18 m and runway strip 90 m.

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Figure 6 Ararat Airport runway layout shows the Ararat Airport (YARA) runway layout (source: AsA, ERSA-FAC, dated 25 March 2021).



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Figure 6 Ararat Airport runway layout

There are no instrument approach procedures published for Ararat Airport. The Obstacle Limitation Surface for Ararat Airport is not affected by the project.

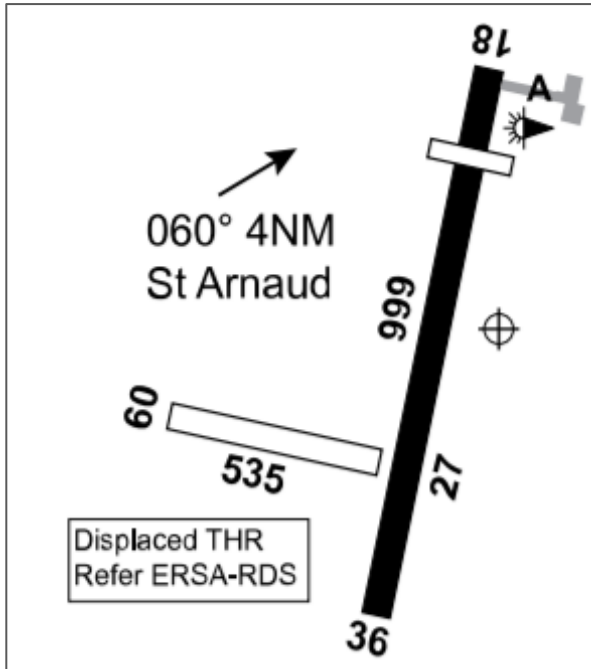
1.15. St Arnaud Airport (YSTA)

St Arnaud Airport is a certified aerodrome operated by Northern Grampians Shire Council, with a published aerodrome elevation of 195 m AHD (639 ft AMSL) (source: Airservices Australia, ERSA-FAC, 25 March 2021). The aerodrome is located approximately 48 km (26 nm) north-east of the WMT.

St Arnaud Airport has two runways:

- Runway 18/36 Code 1 sealed runway with a length of 999 m, width 18 m and runway strip 90 m
- Runway 09/27 Code 1 gravel runway with a length of 535 m, width 18 m and runway strip 90 m.

Figure 7 shows the St Arnaud Airport runway layout (source: AsA, ERSA-FAC, dated 25 March 2021).



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Figure 7 St Arnaud Runway layout

There are no instrument approach procedures published for St Arnaud Airport. The Obstacle Limitation Surface for St Arnaud Airport is not affected by the project.

1.16. Nearby aeroplane landing areas

As a guide, an area of interest within a 3 nm radius of an aeroplane landing area (ALA) is used to assess potential impacts of proposed developments on aircraft operations at or within the vicinity of the ALA.

A search on OzRunways, which sources its data from Airservices Australia (AIP), did not identify any unregulated aerodromes in close proximity to the Project Site. The aeronautical data provided by OzRunways is approved under CASA CASR Part 175.

A review of NationalMap (an online map-based tool allowing access to spatial data from Australian government agencies) was also undertaken.

The two closest ALAs observed in relation to the proposed WMT (as identified on OzRunways and NationalMaps) were Navarre and Ozmon (Moonambel). Figure 8 shows the location of these two ALAs (and 3 nm radius) in relation to the Project Site. (Source Umwelt, Google Earth) All ALAs identified via OzRunways are further than 3 nm from, and will not be adversely affected by, the proposed location of the WMT.

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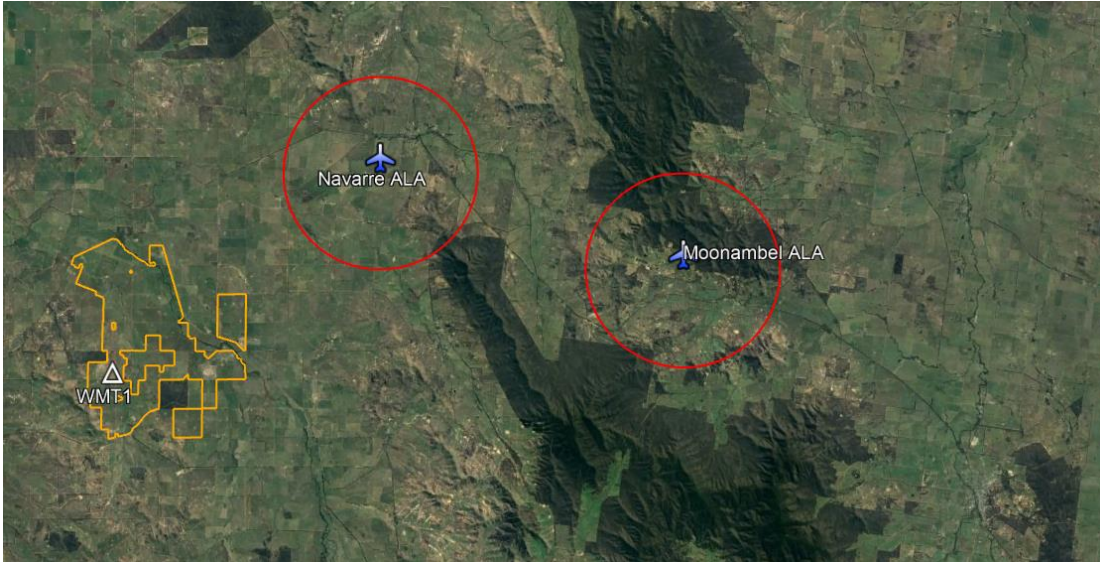


Figure 8 Proposed WMT location Project relative to closest ALAs identified on OzRunways and NationalMaps

An additional non-regulated aerodrome was identified near the project during the site visit conducted by Aviation Projects on 17 March 2021. Figure 9 shows the ALA site (source Google Earth), and Figure 10 is a photo taken by Aviation Projects from Landsborough Road during the site visit, looking north towards the ALA. Figure 11 shows the ALA location (and 3 nm radius) in relation to the WMT.

The proposed WMT is outside the 3 nm radius of the unidentified ALA and therefor will not affect the ALA.



Figure 9 unidentified ALA runway layout

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Figure 10 photo of ALA from Landsborough Road March 2021

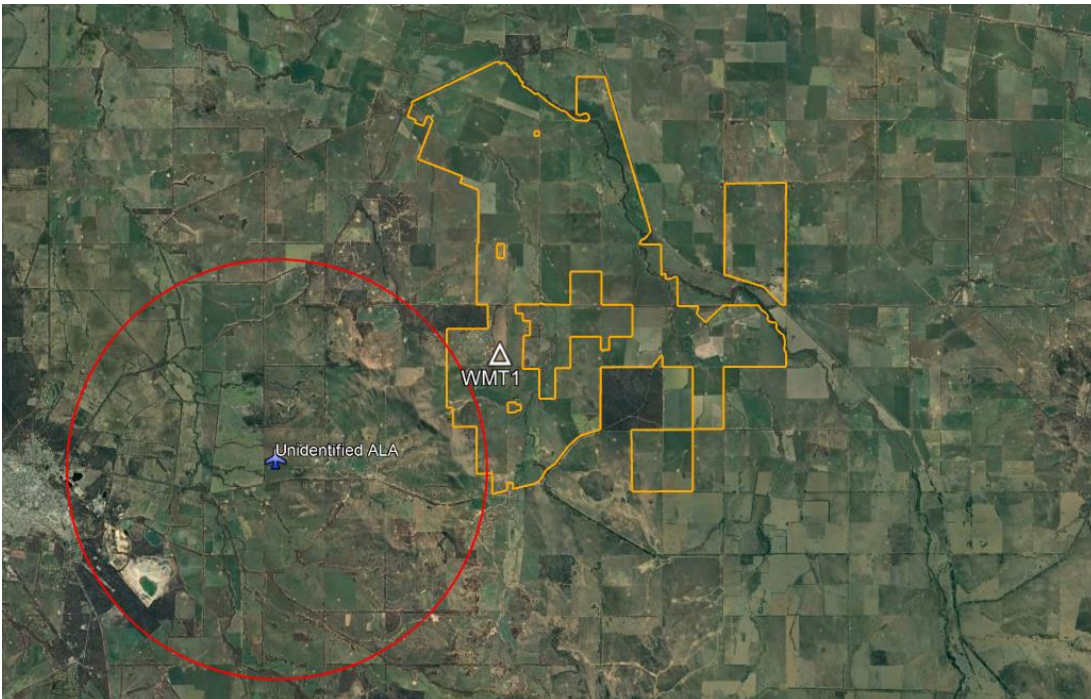


Figure 11 Location of unidentified ALA (and 3 nm radius) in relation to WMT

1.17. Aircraft operations at non-controlled aerodromes

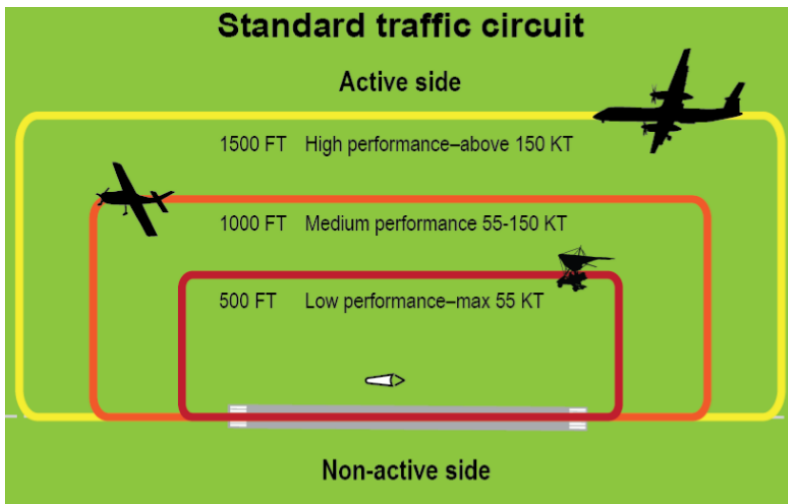
Civil Aviation Advisory Publications (CAAP) provide guidance, interpretation and explanation on complying with the Civil Aviation Regulations 1988 (CAR) or Civil Aviation Orders (CAO). CAAP 166-1(4.1) – Operations in the vicinity of non-controlled aerodromes – provides guidance with respect to CAR 166. The purpose of this CAAP is to support Common Traffic Advisory Frequency (CTAF) procedures. It provides guidance on a code of conduct (good airmanship) to allow flexibility for pilots when flying at, or in the vicinity of, non-controlled aerodromes.

CAAP 166-1(3) provides the following guidance:

3.4 CASA [Civil Aviation Safety Authority] strongly recommends the use of 'standard' traffic circuit and radio broadcast procedures by radio-equipped aircraft at all non-controlled aerodromes. These procedures are described in the Aeronautical Information Publication (AIP) and Visual Flight Rules Guide (VFRG), and discussed in Section 6 of this CAAP (Standard traffic circuit procedures) and Section 7 (Radio broadcasts).

6.4.1 Aircraft should depart the aerodrome circuit area by extending one of the standard circuit legs or climbing to depart overhead. However, the aircraft should not execute a turn to fly against the circuit direction unless the aircraft is well outside the circuit area and no traffic conflict exists. This will normally be at least 3 NM from the departure end of the runway, but may be less for aircraft with high climb performance. In all cases, the distance should be based on the pilot's awareness of traffic and the ability of the aircraft to climb above and clear of the circuit area.

The standard circuit consists of a series of flight paths known as legs when departing, arrival or when conducting circuit practice. Illustrations of the standard aerodrome traffic circuit procedures are provided in Figure 12 and Figure 13.

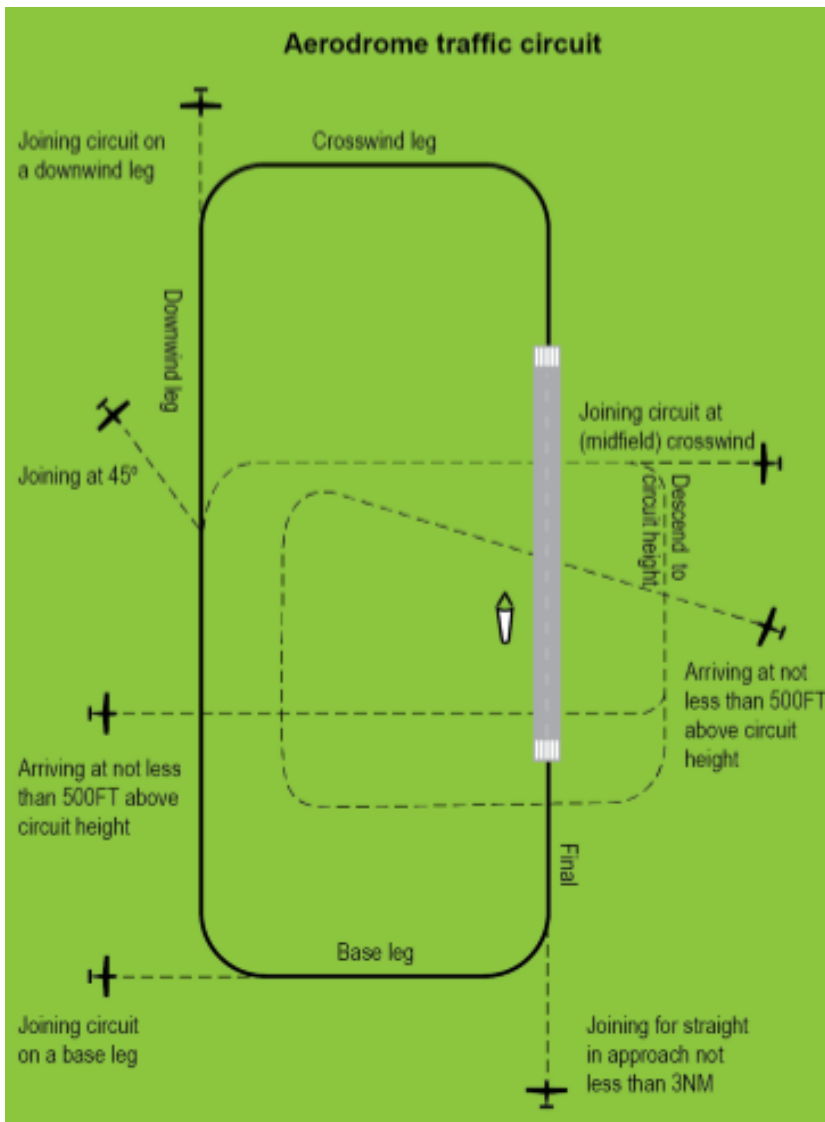


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Figure 12 Lateral and vertical separation in the standard aerodrome traffic circuit

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Figure 13 Aerodrome standard traffic circuit, showing arrival and joining procedures

The WMT is not located within 3 nm of an aerodrome and will not impact any approach and departure paths.

1.18. Rules of flight

1.18.1. Flight under Day Visual Flight Rules (VFR)

According to Aeronautical Information Publication (AIP) the meteorological conditions required for visual flight in the applicable (class G) airspace at or below 3000 ft AMSL or 1000 ft AGL whichever is the higher are: 5000 m visibility, clear of clouds and in sight of ground or water.

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Civil Aviation Regulation (1988) 157 (Low flying) prescribes the minimum height for flight. Generally speaking aircraft are restricted to a minimum height of 500 ft AGL above the highest point of the terrain and any object on it within a radius of 600 m (or 300 m for helicopters) in visual flight during the day when not in the vicinity of built-up areas, and 1000 ft AGL over built up areas.

These height restrictions do not apply if through stress of weather or any other unavoidable cause it is essential that a lower height be maintained.

Flight below these height restrictions is also permitted in certain other circumstances.

1.18.2. Night VFR

With respect to flight under the VFR at night, Civil Aviation Regulations (1988) 174B states as follows:

The pilot in command of an aircraft must not fly the aircraft at night under the V.F.R. at a height of less than 1000 feet above the highest obstacle located within 10 miles of the aircraft in flight if it is not necessary for take-off or landing.

1.18.3. IFR (Day or night)

According to CAR 178, flight under the instrument flight rules (IFR) requires an aircraft to be operated at a height clear of obstacles that is calculated according to an approved method. Obstacle lights on structures not within the vicinity of an aerodrome are effectively redundant to an aircraft being operated under the IFR.

1.19. Obstacle limitation surfaces

Runway 11/29 at Stawell Aerodrome is a Code 3 non-precision instrument runway. According to Part 139 MOS 2019 Chapter 7, the maximum horizontal distances that an obstacle limitation surface (OLS) may extend for a Code 3 non-precision instrument aerodrome in Australia is 15km (8.1 nm) from the edge of a runway strip.

The WMT is located approximately 16.6 km (9 nm) north-east from Stawell aerodrome. Therefore, the proposed WMT site is located outside the maximum horizontal extent and will not impact the OLS of Stawell aerodrome.

The OLS of Ararat and St Arnaud aerodromes are not affected.

1.20. Air routes and LSALT

MOS 173 requires that a minimum obstacle clearance of 1000 ft below the published lowest safe altitude (LSALT) is maintained along each air route.

The WMT is located within a grid with a lowest safe altitude of 1585 m AHD (5200 ft AMSL) with a minimum obstacle clearance (MOC) surface height of 1280 m AHD (4200 ft AMSL).

With a maximum overall height of 341 m AHD (1118 ft AMSL), the Watta Wella WMT will be below the grid LSALT MOC by 939.3 m (3082 ft). Therefore, grid LSALT will not be impacted by the development.

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Figure 14 illustrates the grid LSALT and air routes in proximity to the Project site (source: ERC Low National, Air Services Australia, 12 February 2021).



Figure 14 Air routes in proximity to the Project Site

An impact analysis of the surrounding air routes is provided in Table 3.

Table 3 Air route impact analysis

Air route	Waypoint pair	Route LSALT	MOC	Impact on airspace design	Potential solution	Impact on aircraft ops
H345	Nevis - Borto	5200 ft AMSL	1280 m AHD 4200 ft AMSL	Nil	N/A	N/A
W291	Ubgut - Esdig	4800 ft AMSL	1158 m AHD 3800 ft AMSL	Nil	N/A	N/A
V223	Burra - Ubgut	4700 ft AMSL	1128 m AHD 3700 ft AMSL	Nil	N/A	N/A

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Note: Minimum obstacle clearance (MOC) is the height above which obstacles would impact on LSALTs or air routes.

The Project will not impact LSALTs of the nearest air routes.

1.21. Airspace Protection

The Project site is located wholly within Class G airspace (meaning non-controlled airspace) and is not located in any Prohibited, Restricted and Danger areas. Therefore, the Project will not have an impact on controlled or designated airspace.

1.22. Aviation facilities

The Project site is outside aviation facilities of certified nearby airports.

1.23. Radar

Airservices Australia currently requires an assessment of the potential for wind monitoring towers in a Project to affect radar line of sight.

With respect to aviation radar facilities, the closest radars are Mount Macedon Secondary Surveillance Radar (SSR) which is located approximately 151 km (82 nm) east-south-east of the Project site.

It is anticipated that the Project will not impact the Mount Macedon SSR.

1.24. Aircraft Operations

Regular public transport (RPT) aircraft normally operate under instrument flying rules (IFR).

Flying training may be conducted under either the IFR or visual flying rules (VFR). Other general aviation operations under either IFR or VFR are also likely to be conducted at various aerodromes in the area including Hay Airport.

Operations conducted under the visual flight rules (VFR) are required to remain in visual meteorological conditions (VMC) and clear of the highest point of the terrain by 500 ft vertical distance and 600 m horizontal distance.

There may be some low-level military jet aircraft and helicopter operations conducted in the area.

1.25. Obstacle marking and lighting

In VMC, the wind monitoring tower may be difficult to see from the air due to their slender construction and guy wires. Further information on appropriate obstacle marking is contained within National Airport Safeguarding

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Framework Guideline D *Managing the Risk of Wind Turbine Farms as Physical Obstacles to Air Navigation*. Measures to be considered are:

- a) *the top 1/3 of wind monitoring towers to painted in alternating contrasting bands of colour. Examples of effective measures can be found in the Manual of Standards for Part 139 of the Civil Aviation Safety Regulations 1998. In areas where aerial agriculture operations take place, marker balls or high visibility flags can be used to increase the visibility of the towers;*
- b) *marker balls or high visibility flags or high visibility sleeves placed on the outside guy wires;*
- c) *ensuring the guy wire ground attachment points have contrasting colours to the surrounding ground/vegetation; or*
- d) *a flashing strobe light during daylight hours*

The proposed Watta Wella WMT is not located in the vicinity of any certified aerodromes (outside the OLS) and not within 3 nm of any ALAs. At a height of 97 m AGL, the WMT is well below applicable Grid and Air Route LSALT and will be located in the vicinity (less than 4 km north-west) of the nearest wind turbine of the existing Bulgana Green Power Hub.

Low level aircraft operations such as aerial application and/or aerial firefighting are likely to be conducted in the vicinity of the Project Site and although there is no regulatory requirement for the WMT to be lit, it is recommended to consider implementing the NASF Guideline D recommendation for voluntary provision of obstacle lights.

1.26. Notifying CASA of the WMT

CASR Part 139 (Aerodromes) Division 139.E.1 – 139.165(1)(a) requires that a person proposing to construct or erect an object or structure with a height of 100 metres or more above ground level to give written notice to CASA. The proposed height of the Project WMT at 97 m AGL does not initiate the requirement to report to provide written notice to CASA however consideration should be given to voluntarily reporting the WMT to CASA given the proximity of the WMT in relation to anticipated aerial firefighting and agriculture operations, and a proposed height only slightly lower than the regulatory requirement

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1.27. Summary

The following list of findings summarises the outcomes of this assessment:

- Stawell Airport, Ararat Airport and Saint Arnaud Airport are certified aerodromes located within 30 nm of the proposed Project site. Stawell is the nearest certified aerodrome, located approximately 17 km (9 nm) south-west of the WMT
- Stawell Aerodrome is a certified Code 3 non-precision instrument aerodrome, served by RNAV(GNSS) Approaches to Runway 11/29, operated by Northern Grampians Shire Council, with a published aerodrome elevation of 246 m AHD (807 ft AMSL). Instrument approach procedures for Runway 11/29 and its obstacle limitation surfaces will not be impacted by the WMT
- Three ALAs are located close to, but not within 3 nm of, the Project. The development of the WMT will not present an obstacle hazard to aircraft operations at the ALAs
- With a maximum overall height of 341 m AHD (1118 ft AMSL) the WMT is below the grid LSALT MOC by 3082 ft (939 m). Therefore, grid LSALT will not be impacted
- The WMT will not impact LSALT of the nearest air routes
- The Project site is located outside of controlled airspace (wholly within Class G airspace) and is not located in any Prohibited, Restricted and Danger areas. Therefore, the Project will not have an impact on controlled or designated airspace
- The Project site is outside aviation facilities of nearby certified airports
- The WMT is not expected to impact the Mount Macedon SSR
- The WMT is located less than 4 km from the nearest wind turbine of the Bulgana Green Power Hub
- Some low level operations, including aerial application and/or aerial firefighting are likely within the vicinity of the WMT.
- It is not mandatory to mark the WMT however the following markings are recommended to be implemented:
 - Marker balls or high visibility flags or high visibility sleeves should be placed on the outside guy wires;
 - Guy wire ground attachment points should be in contrasting colours to the surrounding ground/vegetation; and
 - Paint markings should be applied in alternating contrasting bands of colour to at least the top 1/3 of the mast. For ease of application, it would be reasonable to simplify the requirement to paint in bands with a width of approximately 1/7 of the longest dimension, by painting whole sections of the mast to the nearest whole section with an overall width of approximately 1/7 of the longest dimension, in three equal bands – red/orange, white, red/orange, so that at least the top 1/3 of the tower is marked as per Part 139 MOS 2019 8.110 (5).

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- It is not mandatory to report the WMT to CASA although consideration should be given to voluntarily reporting due to the proximity of the WMT in relation to anticipated aerial firefighting and agriculture operations and a proposed height only slightly lower than the regulatory requirement
- 'As constructed' details of WMT coordinates and elevations should be provided to Airservices Australia, by submitting the form at this webpage: https://www.airservicesaustralia.com/wp-content/uploads/Development-Application-Submission-Form_final_15May20.pdf to the following email address: vod@airservicesaustralia.com.

With respect to aviation impacts, further development of the Project remains feasible.

If you wish to clarify or discuss the contents of this correspondence, please contact me on 0417 631 681.

Kind regards



Keith Tonkin
Managing Director
28 June 2021

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