May 2024

AVIATION IMPACT ASSESSMENT

POTTINGER WIND FARM

Prepared for RPS Group AAP Consulting Pty Ltd

DOCUMENT CONTROL

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS

AAAA	Aerial Application Association of Australia
AC	Advisory Circular
AGL	above ground level
AHD	Australian Height Datum
AIA	aviation impact assessment
AIP	Aeronautical Information Package
AIS	aviation impact statement
ALA	aircraft landing area
AMSL	above mean sea level
ARP	Aerodrome Reference Point
AS	Australian Standards
AsA	Airservices Australia
ATSB	Australian Transport Safety Bureau
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
EIS	environmental impact statement
ERC-H	en-route chart high
ERC-L	en-route chart low
ERSA	En Route Supplement Australia
GA	General Aviation
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
OLS	obstacle limitation surface
PANS-OPS	Procedures for Air Navigation Services - Aircraft Operations
RAAF	Royal Australian Air Force
RSR	route surveillance radar
SSR	secondary surveillance radar
VFR	visual flight rules
VMC	visual meteorological conditions
WMTs	wind monitoring towers
WTGs	wind turbine generators

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

Nil

EXECUTIVE SUMMARY

Introduction

Pottinger Renewables Pty Ltd (the Applicant) seeks to construct, operate, maintain, and decommission the Pottinger Wind Farm (the Project). Someva Pty Ltd (Someva Renewables) will develop the Project.

Located 60 km south of Hay in NSW and within the rural locality of Booroorban, the Project is located entirely within the Southwest Renewable Energy Zone (REZ). The Project includes the construction, operation and decommissioning of a wind farm and associated infrastructure with a targeted electricity generation capacity of 1.3 GW.

Aviation Projects has been engaged by RPS to conduct an Aviation Impact Assessment (AIA) for the Project to support the development application and formally consult with aviation agencies.

The Project requires an AIA to be undertaken in accordance with the:

- NSW DPE Planning Secretary's Environmental Assessment Requirements (SEARS) number SSD-59235464
- Civil Aviation Safety Regulations 1998 and associated Manuals of Standards and guidance material provided by CASA
- National Airports Safeguarding Framework (NASF) Guideline D: *Managing the Risk to aviation safety of wind turbine installations (wind farms)/Wind Monitoring Towers*
- Specific requirements as advised by Airservices Australia for the information contained within an Aeronautical Impact Study (AIS)
- The likely cumulative impacts of other energy projects and aviation activity in the area.

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

The impacts and proposed mitigation for the AIA from the proposed construction, operation and decommissioning phases of the Project are addressed in this report in accordance with relevant regulatory requirements and guidelines (this assessment).

This report supports a State Significant Development (SSD) Development Consent application under Part 4, Division 4.7 of the Environmental Planning and Assessment Act 1979 (SSD-59235464), as an appendix to the Environmental Impact Statement (EIS) for the Project.

This AIA report includes an AIS and a qualitative risk assessment to determine the need for obstacle lighting on Wind Turbine Generators (WTGs) and/or Wind Monitoring Towers (WMTs).

Project description

The Applicant seeks in perpetuity approval for the construction, operation and decommissioning of a 1.3 GW wind farm, electrical infrastructure, other infrastructure and ancillary activities generally including the following components:

- Up to 247 Wind Turbine Generators (WTGs) of which each has a tip height of up to 280 m and capacity up to 8 MW;
- Electrical reticulation network:

    - Up to six substations and 13 transformers;
        - One BESS 33/330kV substation with three transformers;
        - Internal 33 kV, 66 kV, 132 kV, or 330 kV electrical reticulation network and infrastructure connecting to the 330 kV Project EnergyConnect line via a switchyard and collector station;
    - Approximately 500 MW / 2 gigawatt hours (GWh) Battery Energy Storage (BESS);
- Other temporary and permanent infrastructure including:
    - Operations and Maintenance (O&M) facilities and infrastructure including site office, control room, storage facilities, car parking and fencing;
    - Accommodation facilities;
    - Construction and operational compounds;
    - Hardstands for WTGs and other infrastructure;
    - Internal access tracks and road turning head connecting Project infrastructure;
    - Meteorological masts; and
    - Concrete batching plants, crushing facilities, gravel / borrow pits, construction laydown areas;
- Ancillary activities including sourcing of materials and equipment for construction; sourcing of water for construction; subdivision and boundary adjustments, visual screening and associated ancillary works;
- Access road use via four locations and Project-required upgrades:
    - Project Area access: via the Cobb Highway from Jerilderie Road in the north east, from Wargam Road in the west, from East West Road in the south and West Burrabogie Road in the west, as well as emergency access; and
    - Wind farm major components transported via Port of Adelaide;
- Operational workforce of up to 50 Full Time Equivalent (FTE) and construction up to 900 FTE;
- Construction generally within standard construction hours and operations 24 hours per day 7 days per week; and
- Preliminary disturbance footprint of up to 1,066 ha.

No external transmission lines or associated easements are currently anticipated for the Project. Some of the Project-associated infrastructure will be shared with the Pottinger Solar Farm. (the subject of a separate application)

Based on the proposed Project WTG layout and maximum blade tip height of 280 m AGL, the highest WTGs # 105, 106, 107 and 108 each have an overall height of 376 m AHD / 1233.6 ft AMSL.

The Project is located within the NSW Local Government Areas of:

- Hay Shire Council
- Edward River Council.

Conclusions

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

Planning considerations

1. The Project satisfies both the Hay Local Environmental Plan 2011 and Edward River Local Environmental Plan 2013. It will not create incompatible intrusions, adversely affect or compromise the safety of existing airports and associated navigation and communication facilities.

Certified airports

2. The Project is located within 30 nm (55.56 km) of one Certified airport – Hay Airport (YHAY)
3. The Project would infringe the YHAY 25 nm MSA PANS-OPS surface and would require an increase of the minimum altitude to 2300 ft to accommodate the Project.
4. The Project is located beyond the horizontal extent of circling areas at Hay Airport
5. The Project would not infringe the two YHAY instrument approach procedures but amendments would be required due to the 25 nm MSA increase requirement. The amendments will not affect the safe and efficient operation of flight operations using these approaches.

Obstacle Limitation Surfaces

6. The Project is located outside the horizontal extent of obstacle limitation surfaces (OLS) of certified airports.

Aircraft Landing Areas (ALAs) – Uncertified aerodromes

7. The Project is not located within 3 nm of any active ALAs.

Air Routes and Lowest Safe Altitude (LSALT)

8. Would have an impact on the grid LSALTs, requiring an increase to 2300 ft AMSL for the particular Grids.
9. The WTGs will impact the LSALT related for several air routes requiring an increase to the route LSALT. The increases to the LSALTs will not create an adverse impact to flight operations on those routes.

Airspace

10. The Project is located in uncontrolled airspace (Class G) and outside all Special Use Airspace

Aviation Navigation Facilities

11. The Project WTGs will not infringe any protection areas associated with aviation navigation facilities.

ATC Radar

12. The Project area is located outside of the area of interest for assessment of surveillance radars and will not impact any ATC radars.

Aviation Impact Statement (AIS)

Based on the proposed Project WTG layout and maximum blade tip height of 280 m AGL, the highest wind turbines (105,106,107,108) will not exceed 376 m (1233.6 ft AMSL).

The Project WTGs and WMTs:

- Would not infringe any OLS surfaces
- Would infringe the YHAY 25 nm MSA PANS-OPS surface and would require an increase of the minimum altitude to 2300 ft to accommodate the Project
- Would not infringe the two YHAY instrument approach procedures but amendments would be required due to the 25 nm MSA increase requirement
- Would not have a significant impact upon the Wargam ALA and the unidentified ALA as they have been confirmed with the owners as non-operational
- Would have an impact on the grid LSALTs, requiring an increase to 2300 ft AMSL for the particular Grids
- Would impact air route LSALT for H247, W762, requiring an increase to 2300 ft AMSL for the particular route segments
- Would be wholly contained within Class G airspace
- Would be outside the clearance zones associated with civil aviation navigation aids and ATC surveillance facilities.

Obstacle lighting risk assessment

- Aviation Projects has undertaken a safety risk assessment of the Project and concludes that WTGs and WMT located within the wind farm, would not require obstacle lighting to maintain an acceptable level of safety to aircraft
- Over the period from 2010, no aircraft has collided with a WTG or a WMT in Australia
- There is no regulatory requirement to mark or light power poles or overhead transmission lines for this Project.

Consultation

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

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

Summary of key recommendations

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

Notification and reporting

1. CASR 139.165 requires the owner of a structure (or applicants of a structure) that will 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 timeframe for construction. This is to allow CASA to assess the effect of the structure on aircraft operations and determine whether or not the structure will be hazardous to aircraft operations.
   The applicant is required to report the WMT to CASA in accordance with CASR 139.165, as soon as practicable after forming the intention to construct or erect the proposed object or structure. The notification should be provided to CASA via email to Airspace.Protection@casa.gov.au

2. 'As constructed' details of WGTs and the WMT coordinates and elevation should be provided to Airservices Australia, by submitting the form located 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 . Ideally this should only be done if potential impacts have been considered – through an aviation impact assessment or by sending the details to Airservices Australia in advance of the mast being erected, at this email address: airport.developments@airservicesaustralia.com .

3. Any obstacles above 100 m AGL (including temporary construction equipment) should be reported to Airservices Australia NOTAM office for notification to pilots by NOTAM, 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 will operate and/or the planned route with timelines that crane operations will 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 WTGs, WMTs 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 Applicant should consider engaging with any local aerial agricultural operators and aerial firefighting operators in developing procedures for such aircraft operations in the vicinity of the Project.

Marking of WTGs

7. The rotor blades, nacelle and the supporting mast of the WTGs should be painted white, typical of most WTGs operational in Australia. No additional marking measures are required for WTGs.

Lighting of WTGs

8. Aviation Projects' Lighting Risk Assessment has concluded that the Project will not require obstacle lighting to maintain an acceptable level of safety to aircraft operating in the area both by day and by night.

Marking of wind monitoring towers

9. Consideration should be given to marking the WMTs according to the requirements set by the guidance in NASF Guideline D. Specifically:

    a. marker balls or high visibility flags or high visibility sleeves should be placed on the outside guy wires

    b. paint markings should be applied in alternating contrasting bands of colour to at least the top 1/3 of the mast

    c. ensuring the guy wire ground attachment points have contrasting colours to the surrounding ground/vegetation.

Lighting of WMTs

10. Consideration should be given to lighting WMTs installed prior to WTG installation and those that are not in close proximity to a WTG, with medium intensity steady red obstacle lighting at the top of the WMT mast. Characteristics for medium-intensity obstacle lighting are contained in MOS 139, Section 9.33.

Micrositing

11. The potential micrositing of the WTGs and WMTs during construction has been considered in the assessment with the estimate of the overall maximum height being based on the highest ground level within 300 m of the nominal WTG and WMT positions. Providing the micrositing is within 300 m of the WTGs and WMTs, it 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 AIA would remain the same.

Overhead transmission line

12. 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 application operators and marked in accordance with Part 139 MOS 2019 Chapter 8 Division 10 section 8.110 (7) and section 8.110 (8).

Triggers for review

13. 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.

1. INTRODUCTION

1.1. Situation

RPS is assisting Pottinger Renewables Pty Ltd to secure approvals to develop The Pottinger Wind Farm (the Project), located between approximately 35.2 km / 19 nm to approximately 60 km / 32 nm southwest of Hay Airport in New South Wales.

RPS has engaged Aviation Projects to prepare an Aviation Impact Assessment (AIA) for the Project to support the proposed application and formally consult with aviation agencies.

This AIA assesses the potential aviation impacts created by the Project, 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 report includes an Aviation Impact Statement (AIS) (for Airservices Australia) and a qualitative risk assessment to inform the need for obstacle lighting.

1.2. Purpose and Scope

The purpose and scope of work is to:

- prepare an AIA to allow the Applicant to understand the aviation environment surrounding the Project
- prepare and provide an AIS for consideration by Airservices Australia, CASA and Department of Defence; and
- support the development application.

The AIA specifically responds to the following key legislation, approvals, and guidance material:

- National Airspace Safeguarding Framework Guideline D: *Managing the Risk to aviation safety of wind turbine installations (wind farms)/Wind Monitoring Towers* effective July 2012
- NSW DPE SSD SEARS (SSD-59235464)
- Civil Aviation Safety Regulation (CASR) Part 139 Manual of Standards (MOS)
- CASR Part 173 MOS
- Specific requirements as advised by Airservices Australia.

1.3. Methodology

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

- Confirm the scope and deliverables with the Applicant (or representative)
- Review material provided by RPS
- A site visit to the area was conducted in September 2023 to properly investigate aviation safety aspects of the area to the southeast of Hay
- Review relevant regulatory requirements and information sources
- Prepare 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
- Include an AIS for assessment by Airservices Australia
- Include a qualitative risk assessment to determine need for obstacle lighting and marking that Identifies risk mitigation strategies that could provide an acceptable alternative to night lighting. The risk assessment will be completed following the guidelines in *ISO 31000:2018 Risk Management – Guidelines*
- Consult with Airservices Australia and the Department of Defence
- Consult with relevant aerodrome operators to seek endorsement of the proposal to change instrument approach procedures (if applicable)
- Consult/engage with aviation stakeholders to negotiate acceptable outcomes (if required)
- Finalise the AIA report for acceptance by RPS when responses received from stakeholders for review and acceptance by RPS.

CASA has indicated that they will only provide advice related to renewable energy projects to the appropriate planning authority as part of the DA process.

1.4. Aviation Impact Statement (AIS)

The AIS included in this report (see Section 6) 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 procedures at these aerodromes
- Specify identifiable uncertified aerodromes within 3 nm of the boundary of the wind farm
- Review the potential effect of the Project operations on the operational airspace of the aerodrome(s).

Air Routes:

- Nominate air routes published in AIP 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, B, C, D, E, G etc where the Project area is located.

Navigation/Radar:

- Nominate radar navigation systems with coverage overlapping the Project area.

1.5. Material reviewed

Material provided by the Applicant for preparation of this assessment include:

- Pottinger Wind Farm Scoping Report, V1.2, AU8318, 8 June 2023.pdf
- WTG_V9.1_20240219_EIS_Coordinates
- Operational Mast Locations ID.xlsx dated 14 February 2024.

Multiple files provided via file transfer protocols on 25 October 2023 and 23 November 2023.

2. BACKGROUND

2.1. Project overview

The Project area boundary is located between approximately 35.2 km / 19 nm to approximately 60 km / 32 nm southwest of Hay Airport in New South Wales.

An overview of the Project area relative to Hay in NSW is provided in Figure 1 (source: RPS, Google Earth).

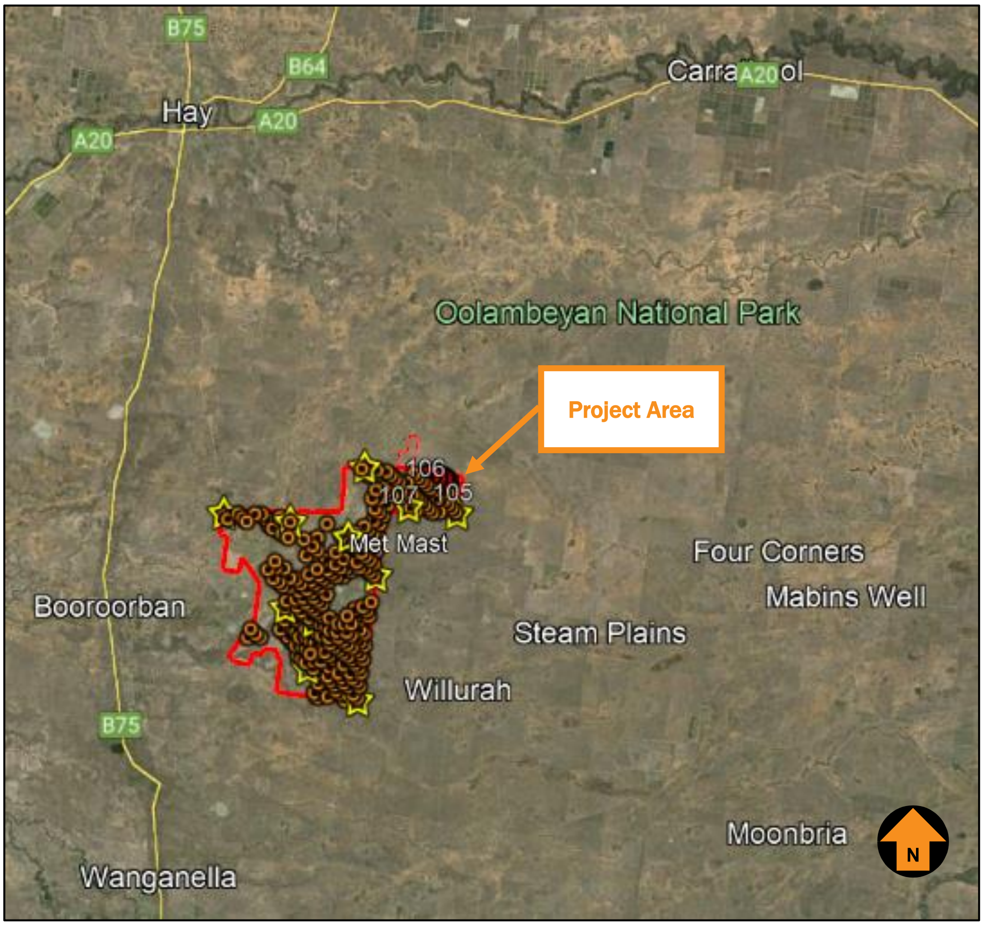

Figure 1 Project area overview

2.2. Project Description

The Applicant seeks in perpetuity approval for the construction, operation and decommissioning of a 1.3 GW wind farm, electrical infrastructure, other infrastructure and ancillary activities generally including the following components:

- Up to 247 Wind Turbine Generators (WTGs) of which each has a tip height of up to 280 m and capacity up to 8 MW;
- Electrical reticulation network:
    - Up to six substations and 13 transformers;

        - One BESS 33/330kV substation with three transformers;
        - Internal 33 kV, 66 kV, 132 kV, or 330 kV electrical reticulation network and infrastructure connecting to the 330 kV Project EnergyConnect line via a switchyard and collector station;
    - Approximately 500 MW / 2 gigawatt hours (GWh) Battery Energy Storage (BESS);
- Other temporary and permanent infrastructure including:
    - Operations and Maintenance (O&M) facilities and infrastructure including site office, control room, storage facilities, car parking and fencing;
    - Accommodation facilities;
    - Construction and operational compounds;
    - Hardstands for WTGs and other infrastructure;
    - Internal access tracks and road turning head connecting Project infrastructure;
    - Meteorological masts; and
    - Concrete batching plants, crushing facilities, gravel / borrow pits, construction laydown areas;
- Ancillary activities including sourcing of materials and equipment for construction; sourcing of water for construction; subdivision and boundary adjustments, visual screening and associated ancillary works;
- Access road use via four locations and Project-required upgrades:
    - Project Area access: via the Cobb Highway from Jerilderie Road in the north east, from Wargam Road in the west, from East West Road in the south and West Burrabogie Road in the west, as well as emergency access; and
    - Wind farm major components transported via Port of Adelaide;
- Operational workforce of up to 50 Full Time Equivalent (FTE) and construction up to 900 FTE;
- Construction generally within standard construction hours and operations 24 hours per day 7 days per week; and
- Preliminary disturbance footprint of up to 1,066 ha.

No external transmission lines or associated easements are currently anticipated for the Project. Some of the Project-associated infrastructure will be shared with the Pottinger Solar Farm. (the subject of a separate application)

Based on the proposed Project WTG layout and maximum blade tip height of 280 m AGL, the highest WTGs # 105, 106, 107 and 108 each have an overall height of 376 m AHD / 1233.6 ft AMSL.

The Project is located within the NSW Local Government Areas of:

- Hay Shire Council
- Edward River Council.

3. EXTERNAL CONTEXT

3.1. National Airports Safeguarding Framework

The National Airports Safeguarding Advisory Group (NASAG) was established by Commonwealth Department of Infrastructure and Transport to develop a national land use planning framework called the National Airports Safeguarding Framework (NASF). The purpose of the NASF 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.

NASF Guideline D: *Managing the Risk to Aviation Safety of Wind 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.

3.2. NSW DPIE SEARS SSD-59235464

The NSW Department of Planning and Environment (DPIE) Secretary's Environmental Assessment Requirements (SEARS) sets out the key issues to be addressed when applying for planning approval.

The issued SEARS for the Pottinger Wind Farm include hazards and risks to be assessed in relation to aviation safety.

Table 1 provides a reference to the assessment requirements contained in this AIA.

Table 1 SEARS assessment references

SEARS Assessment requirement	*Section*
Assess the impact of the development under the National Airports Safeguarding Framework Guideline D: Managing Wind Turbine Risk to Aircraft	Section 6
Provide associated height and co-ordinates for each turbine assessed	Annex 5
Assess potential impacts on aviation safety, including cumulative effects of wind farms in the vicinity, potential wake / turbulence issues, the need for aviation hazard lighting and marking, including of wind monitoring masts, considering, defined air traffic routes, aircraft operating heights, approach / departure procedures, radar interference, communication systems, navigation aids, and use of emergency helicopter access	Section 3.9 Section 6 Section 7
Identify aerodromes within 30 km of the turbines and consider the impact to nearby aerodromes and aircraft landing areas	Section 6.2.1 – 6.2, 6.4
Address impacts on obstacle limitation surfaces	Section 3.7.2
Assess the impact of the turbines on the safe and efficient aerial application of agricultural fertilisers and pesticides in the vicinity of the turbines and transmission line	Section 3.7.2
Potential impacts on the aerial fighting of bushfires and demonstrate compliance with Planning for Bush Fire Protection 2019	Section 3.8.2. NSW RFS response. FRNSW response.
Cumulative Impacts	Section 3.3

3.3. Hay Shire Council

The Hay Shire Council published the Hay Local Environmental Plan 2011, which includes guidelines and performance outcomes for airspace operations to ensure new developments do not create incompatible intrusions or compromise the safety of existing airports and associated navigation facilities.

6.3 Airspace operations

1) *The objectives of this clause are as follows:*

   a. *to provide for the effective and ongoing operation of the Hay Aerodrome by ensuring that such operation is not compromised by proposed development that penetrates the Limitation or Operations Surface for that airport,*

   b. *to protect the community from undue risk from that operation.*

2) *If a development application is received and the consent authority is satisfied that the proposed development will penetrate the Limitation or Operations Surface, the consent authority must not grant development consent unless it has consulted with the relevant Commonwealth body about the application.*

3) *The consent authority may grant development consent for the development if the relevant Commonwealth body advises that:*

    a. *the development will penetrate the Limitation or Operations Surface but it has no objection to its construction, or*

    b. *the development will not penetrate the Limitation or Operations Surface.*

4) *The consent authority must not grant development consent for the development if the relevant Commonwealth body advises that the development will penetrate the Limitation or Operations Surface and should not be constructed.*

3.4. Edward River Council

The Deniliquin Local Environmental Plan 2013 published by Edward River Council includes guidelines and performance outcomes for airspace operations to ensure new developments do not create incompatible intrusions or compromise the safety of existing airports and associated navigation facilities.

6.6 Airspace operations

1) The objectives of this clause are as follows:

    a. to provide for the effective and ongoing operation of the Deniliquin Airport by ensuring that such operation is not compromised by proposed development that penetrates the Limitation or Operations Surface for that airport,

    b. to protect the community from undue risk from that operation.

2) If a development application is received and the consent authority is satisfied that the proposed development will penetrate the Limitation or Operations Surface, the consent authority must not grant development consent unless it has consulted with the relevant Commonwealth body about the application.

3) The consent authority may grant development consent for the development if the relevant Commonwealth body advises that—

    a. the development will penetrate the Limitation or Operations Surface, but it has no objection to its construction, or

    b. the development will not penetrate the Limitation or Operations Surface.

4) The consent authority must not grant development consent for the development if the relevant Commonwealth body advises that the development will penetrate the Limitation or Operations Surface and should not be carried out.

The Project is located approximately 75 km north of Deniliquin and does not impact upon flight operations at Deniliquin Airport.

3.5. Aircraft operations at non-controlled aerodromes

There are several uncontrolled aerodromes in the vicinity of the Project Area including one within the project boundary.

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 v1.1 *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.

A conventional circuit pattern and heights are provided in AC 91-10 v1.1. 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 AC 91-10 v1.1. are shown in Figure 2 and Figure 3.

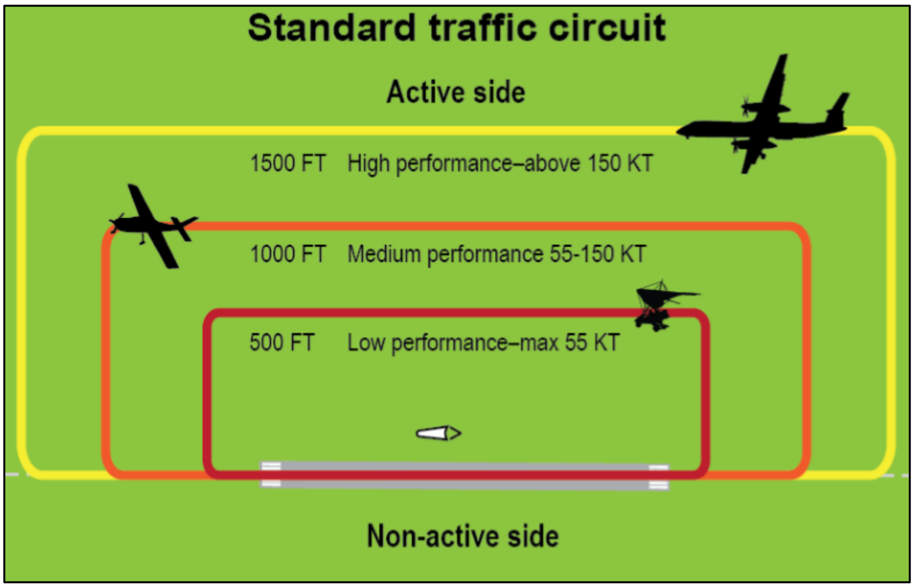

Figure 2 Standard traffic circuit altitudes

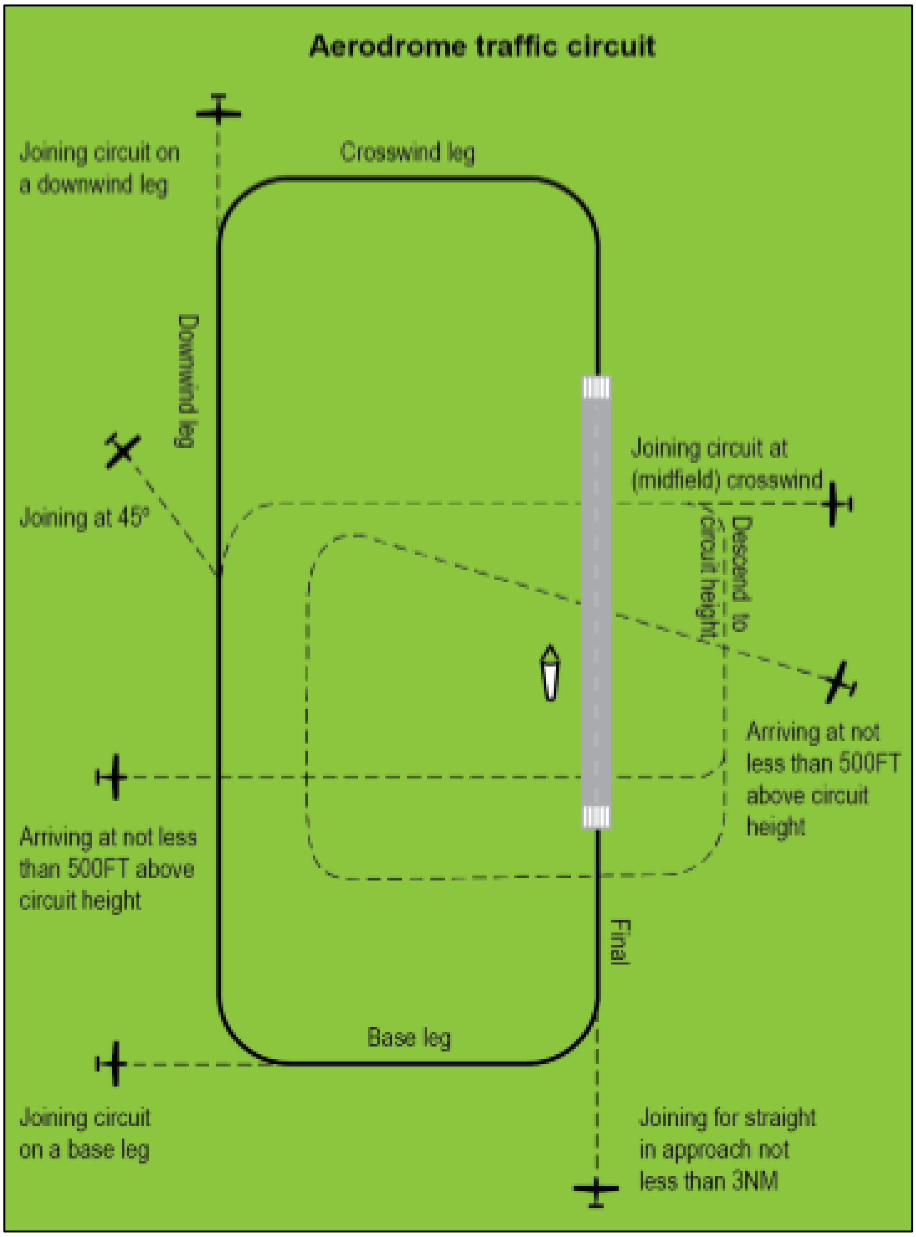

Figure 3 Aerodrome traffic circuit legs

The following CASA publications inform pilots of their obligations at non-certified aerodromes (ALA).

3.5.1. Advisory Circular (AC) 91-02 V1.1, Guidelines for aeroplanes with MTOW not exceeding 5700 kg – suitable places to take off and land, dated November 2021

This AC provides guidance to assist pilots when making a determination about the suitability of a place for an aeroplane to safely take off and land. It provides an overview of the pilot's responsibilities and discusses some, but not all, circumstances, including prevailing weather conditions, that are recommended to be considered. It also provides general information and advice to enhance the safety of taking off and landing at any place.

2 Introduction

2.2 Use of Aerodromes

2.2.1 Regulation 91.410 authorises a place for use as an aerodrome if:

(i) it is suitable for the landing and taking-off of aircraft; and

(ii) an aircraft can land at or take off from the place safely, having regard to all the circumstances of the proposed landing or take-off (including the prevailing weather conditions).

3.3 Performance Information

3.3.1 The AFM, POH, owner's manual or placarding should provide relevant performance information, but presentations are not standardised. Learning how to find and interpret a particular aircraft's performance information should be part of a pilot's familiarisation with the aeroplane.

4 Information about aerodrome publications

4.1.3 There are no standards for aerodromes that are not certified but noting regulation 91.410 requires the aerodrome to be suitable. CASA has published recommended criteria for landowners or operators of these aerodromes, but these recommendations are guidelines only.

Pilots and operators must consider ownership and management requirements for aircraft operations into any aerodrome. Unless a landing place is unambiguously open for public use for aviation purposes, the pilot should assume that permission is required from the land owner or occupier before using land or water for take-off and landing.

3.5.2. AC 91-10 v1.1, Operations in the vicinity of non-controlled aerodromes, dated November 2021

This AC provides guidance on procedures that, when followed, will improve situational awareness and safety for all pilots when flying at, or in the vicinity of, non-controlled aerodromes.

2.1.3 This AC provides guidance on procedures that, when followed, will improve situational awareness and safety for all pilots when flying at, or in the vicinity of, non-controlled aerodromes.

4 Related safety actions at non-controlled aerodromes

4.1.1 Subdivision D.4.6 of CASR Part 91 (prescribes the requirements for operating in the vicinity of a non-controlled aerodrome. Prior to flight, pilots should consult the current ERSA and NOTAMs to ascertain whether carriage of radio is required, special circuit procedures apply or, in the case of NOTAMs, whether the information contained within the ERSA has been modified.

4.1.5 Prior to operating at any non-controlled aerodrome, pilots should satisfy themselves that it is suitable for their operation by reference to ERSA, other commercial aerodrome guides, the company operations manual or by contacting the aerodrome operator.

7.2 Traffic circuit direction

7.2.1 The standard aerodrome traffic circuit facilitates the orderly flow. Unless an alternative requirement for an aerodrome is stated in the ERSA or NOTAMs, all turns must be made to the left (regulation 91.385).

7.2.2 When arriving at an aerodrome to land, the pilot will normally join the circuit on upwind, crosswind (midfield), or at or before mid-downwind. Landings and take-offs should be made on the active runway or the runway most closely aligned into wind.

7.2.3 If a secondary runway is being used (e.g. for crosswind or low-level circuits), pilots using the secondary runway should not impede the flow of traffic using the active runway.

7.2.4 Aerodromes that have right-hand circuits are listed in the ERSA.

7.4 Circuit Heights

7.4.1 By convention, aircraft should fly the standard traffic circuit at the heights shown.

7.4.2 During initial climb-out, the turn onto crosswind should be appropriate to the performance of the aircraft but, in any case, not less than 500 ft above terrain so as to be at circuit height when turning downwind (regulation 91.390). Pilots may vary the size of the circuit depending on:

– the performance of the aircraft

– AFM/Pilot's Operating Handbook requirements

– company standard operating procedures

– other safety reasons.

7.7 Final approach

7.7.1 The turn onto final approach should be:

– completed by a distance and height that is common to all operations at the aerodrome

– commensurate with the speed flown in the circuit for all aircraft of the same type.

AC 91-10 v1.1. paragraph 7.10 refers to a distance that is "normally" well outside the circuit area and where no traffic conflict exists, which is at least 3 nm.

The paragraph is copied below:

7.10 Departing the circuit area

7.10.1 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.

3.6. Rules of flight

3.6.1. Flight under Day Visual Flight Rules (Day VFR)

According to Australia's Aeronautical Information Package (AIP) the meteorological conditions required for visual flight in the applicable (class G) airspace at or below 3,000 ft AMSL or 1,000 ft AGL (whichever is the higher) are: 5,000 m visibility, clear of clouds and in sight of ground or water.

Civil Aviation Safety Regulation (1998) 91.267 prescribes the minimum height for flight.

Generally speaking, and unless otherwise approved, 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 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 (within a horizontal radius of

600 m of the point on the ground or water immediately below the aeroplane), except during the take-off and landing phases of flight.

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

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

3.6.2. Flight under Night Visual Flight Rules (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. Flight under Instrument Flight Rules (Day or Night) (IFR)

According to CASR Part 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. The minimum heights are described as PANS-OPS surfaces for each segment of the IFR flight operation.

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 such as ambulance flights and charter flights operate under either IFR or VFR are also conducted at various aerodromes in the area.

3.8. Passenger transport operations

Scheduled and non-scheduled passenger transport 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 in areas outside city and township built-up areas.

Generally private travel flights between aerodromes are conducted at a much higher altitude to cater for fuel efficiency, comfort (away from low level turbulence) and to recognise navigation features along the route taken.

3.10. Military operations

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

Military operations can be conducted under separate but compatible regulations and standards, including obstacle separation requirements.

Low level military flight operations require a considerable pre-flight assessment of the planned route or operation to enable aircrew to be aware of the terrain and obstacle environment that could create a hazard to the operation.

Refer to Section 5 for a detailed response from Department of Defence, when the response is provided.

3.11. Aerial application operations

Aerial application operations including such activities as fertiliser, pest and crop spraying are generally conducted under day VFR below 500 ft AGL: usually lower than 100 ft AGL.

Aerial application operations are conducted in the area.

Due to the nature of the operations conducted, aerial agriculture pilots are subject to rigorous training and assessment requirements 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) to assess the risks associated with their operations and implement applicable treatments to ensure an acceptable level of safety can be maintained.

3.11.1. Aerial Agricultural Association of Australia (AAAA)

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

> *As a result of the overwhelming safety and economic impact of wind farms and supporting infrastructure on the sector, AAAA opposes all wind farm developments in areas of agricultural production or elevated bushfire risk.*
>
> *In other areas, AAAA is also opposed to wind farm developments unless the developer is able to clearly demonstrate they have:*
>
> *1. consulted honestly and in detail with local aerial application operators;*
>
> *2. sought and received an independent aerial application expert opinion on the safety and economic impacts of the proposed development;*
>
> *3. clearly and fairly identified that there will be no short or long term impact on the aerial application industry from either safety or economic perspectives;*
>
> *4. if there is an identified impact on local aerial application operators, provided a legally binding agreement for compensation over a fair period of years for loss of income to the aerial operators affected; and*
>
> *5. adequately marked any wind farm infrastructure and advised pilots of its presence.*

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.

3.11.2. Local aerial application operators

Based on previous studies for other wind farm Projects undertaken by Aviation Projects, and the results of consultation with AAAA and local aerial application operators, it is reasonable to conclude that safe aerial application operations would be possible on properties within the Project area and on neighbouring properties, subject to final WTG locations and by implementing recommendations provided in this report at Section 11.

To facilitate the flight planning of aerial application operators, details of the Project, including location and height information of WTGs, WMTs and overhead powerlines should be provided to landowners so that, when asked for hazard information on their property, the landowner can provide the aerial application pilot with all relevant information.

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.

3.12. Emergency services

3.12.1. Royal Flying Doctor Service

Royal Flying Doctor Service (RFDS) and other emergency services operations are generally conducted under the IFR, except when arriving/departing a destination that is not serviced by instrument approach procedures, in which case they would be operating within the provisions of day or night VFR.

Aircraft arriving or departing from Hay Airport are able to conduct their flights under the IFR using the two published instrument approach procedures.

Emergency aviation service 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.

3.12.2. Aerial firefighting

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

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 approvals, additional equipment is installed in the aircraft, and special procedures are developed.

Each fire is assessed according to the unique conditions present in and around the fire.

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 section extracted from under the '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:*
>
> - *liaison with the relevant fire and land management agencies is ongoing and effective*
> - *access is available to the wind farm site by emergency services response for on-ground firefighting operations*
> - *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.*

3.13. Cumulative impacts to aviation activity in the Southwest REZ

There are many renewable energy projects being planned in the Southwest REZ, including the Pottinger Wind Farm. Details are provided in Table 2.

Table 2 Projects in proximity with Cumulative Impact Potential

Project Name	*Distance to Project Area*	*Key Dates*
Pottinger Wind Farm	N/A	• Construction: Q1 2026 to Q3 2030 date (55 months) • Operations: Q3 2028 (from month 30) to perpetuity • Life: 35 years
Pottinger Solar Farm	N/A	• Construction: Q4 2028 to Q2 2030 (18 months from month 35 of Pottinger Wind Farm construction schedule) • Operations: Q3 2029 to perpetuity date • Life: 35 years
Project Energy Connect (NSW – Eastern Section)	< 1 km (within Project Area)	• Construction: underway • Operation: 2025
Bullawah Wind Farmq	< 1 km (adjacent)	• Construction: Q3 2025 to Q3 2027 date (24 months) • Operations: 2027 to 2057 date (360 months) • Life: 30 years
The Plains Wind Farm	< 1 km (adjacent)	• Construction: 2026 to 2028 date (24 months) • Operations: 2028 to 2058 date (360 months) • Life: 30 years
The Plains Solar Farm	< 1 km (adjacent)	• Construction: 2026 to 2028 date (18-24 months) • Operations: 2028 to 2058 date (360 months) • Life: 30 years
Dinawan Energy Hub	25 km	• Construction: 2025 to 2028 date (36 months) • Operations: 2028 to 2058 date (360 months) • Life: 25-30 years
Dinawan Solar Farm	25 km	• Construction: 2025 to 2028 date (36 months) • Operations: 2028 to 2058 date (360 months) • Life: 25-30 years

The WTGs, generally with maximum heights up to 950 ft AGL will require due consideration by pilots considering operating to some of the private and uncertified aerodromes that are located within 3 nm of the WTGs.

Pilots will need to consider:

- Wind direction and likely downwind turbulence from WTGs created in the nominal circuit area
- Departure and arrival flight paths in order to remain clear of WTGs.

Landowners upon whose land the WTGs are located, and who engage aerial application companies will need to ensure that the pilots are aware of the WTGs in their initial contact with them to ensure the safe operation of their aircraft at those ALAs within the windfarm boundaries, and upon nearby neighbouring properties, with or without WTGs.

Windfarms do provide an obvious navigation feature and wind direction indicators to assist pilots to determine their position accurately by visual reference to them and not just the local ground and water features which can be moderately difficult to identify in some circumstances.

The cumulative impact in particular areas will differ across the REZ but the main safety aspect is for pilots to be made aware of the existence of the windfarms prior to their planned operations in the area.

The windfarms will not have an impact on aircraft conducting “travel flights” from areas outside the REZ to destinations outside the REZ as they will generally flying at altitudes well above the WTGs for fuel efficiency and passenger comfort reasons.

Whilst some IFR protection surfaces for instrument approaches and air route LSALTs will need to be increased to accommodate the windfarms (in some areas) the impact to their operations is reasonable and minimal, and will not impact existing flight paths and descent gradients.

For night flying operations under the VFR there will be minimum impact due to minimum altitudes required to be flown will be at least 1000 ft above the maximum height of the WTGs until within 3 nm of the destination aerodrome. The certified airports in this area are the only ones equipped with runway and aerodrome lights.

Aerial application activities within the REZ will require careful consideration of the local area in which they are about to operate, but as the majority of these operations are conducted in very light wind conditions to ensure chemical containment within the property boundary to which they are being applied, the WTGs may not be turning. The WTGs would just be another obstacle to consider and plan their flight operation around.

4. INTERNAL CONTEXT

4.1. Wind farm area description

The Applicant seeks in perpetuity approval for the construction, operation and decommissioning of a 1.3 GW wind farm, electrical infrastructure, other infrastructure and ancillary activities generally including the following components:

- Up to 247 Wind Turbine Generators (WTGs) of which each has a tip height of up to 280 m and capacity up to 8 MW;
- Electrical reticulation network:
    - Up to six substations and 13 transformers;
        - One BESS 33/330kV substation with three transformers;
        - Internal 33 kV, 66 kV, 132 kV, or 330 kV electrical reticulation network and infrastructure connecting to the 330 kV Project EnergyConnect line via a switchyard and collector station;
    - Approximately 500 MW / 2 gigawatt hours (GWh) Battery Energy Storage (BESS);
- Other temporary and permanent infrastructure including:
    - Operations and Maintenance (O&M) facilities and infrastructure including site office, control room, storage facilities, car parking and fencing;
    - Accommodation facilities;
    - Construction and operational compounds;
    - Hardstands for WTGs and other infrastructure;
    - Internal access tracks and road turning head connecting Project infrastructure;
    - Meteorological masts; and
    - Concrete batching plants, crushing facilities, gravel / borrow pits, construction laydown areas;
- Ancillary activities including sourcing of materials and equipment for construction; sourcing of water for construction; subdivision and boundary adjustments, visual screening and associated ancillary works;
- Access road use via four locations and Project-required upgrades:
    - Project Area access: via the Cobb Highway from Jerilderie Road in the north east, from Wargam Road in the west, from East West Road in the south and West Burrabogie Road in the west, as well as emergency access; and
    - Wind farm major components transported via Port of Adelaide;
- Operational workforce of up to 50 Full Time Equivalent (FTE) and construction up to 900 FTE;
- Construction generally within standard construction hours and operations 24 hours per day 7 days per week; and

- Preliminary disturbance footprint of up to 1,066 ha.

No external transmission lines or associated easements are currently anticipated for the Project. Some of the Project-associated infrastructure will be shared with the Pottinger Solar Farm. (the subject of a separate application)

The only other external development that the Project will require is additional access to is EnergyConnect.

Based on the proposed Project WTG layout and maximum blade tip height of 280 m AGL, the highest WTGs # 105, 106, 107 and 108 each have an overall height of 376 m AHD / 1233.6 ft AMSL.

The Project is located within the NSW Local Government Areas of:

- Hay Shire Council
- Edward River Council.

Micrositing' of WTGs means an alteration to the siting of a WTG by not more than 300 m and any consequential changes to access tracks and internal power cable routes. The potential micrositing of the WTGs during construction has been considered in the assessment with the estimate of the overall maximum height being based on the highest ground level is within 300 m of the nominal WTG position.

The micrositing of the WTGs is not likely to result in a change in the maximum overall blade tip height of the Project.

Figure 4 presents the Pottinger Wind Farm Conceptual Project Layout provided by Someva Renewables.

4.2. Wind monitoring tower description

Up to 10 wind monitoring towers with a maximum height of up to 180 m AGL are proposed throughout the Project.

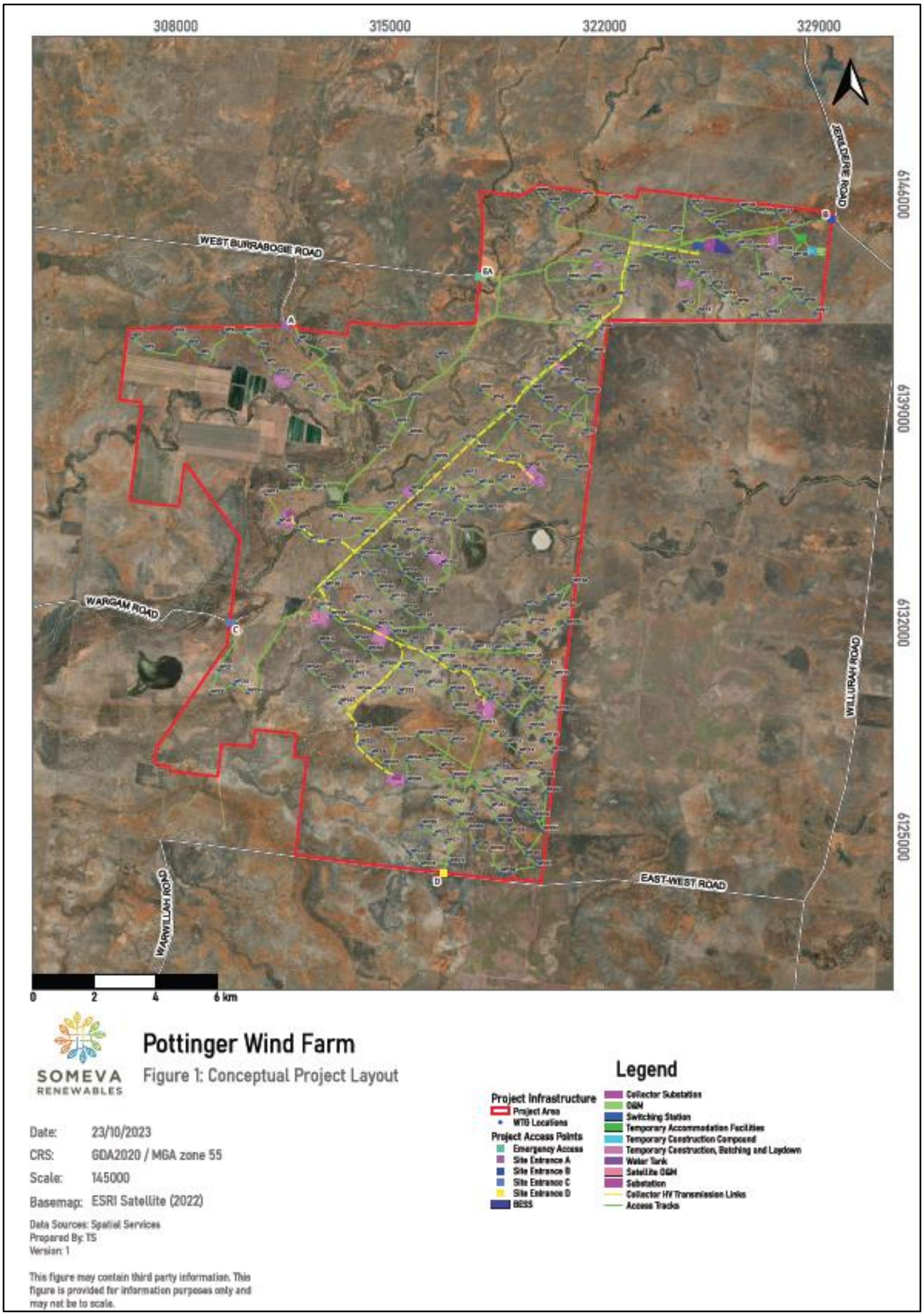

Figure 4 Conceptual Project Layout

5. CONSULTATION

The following list of stakeholders were identified as requiring consultation:

1. Airservices Australia
2. Department of Defence
3. Hay Shire Council
4. Edward River Council
5. Royal Flying Doctor Service.

Aviation Projects has conducted the initial consultations and provide details and results of the consultation activities in Table 3.

The final draft version of the AIA was provided to each identified stakeholder upon approval from the RPS to proceed.

Some agencies have not provided a response as of 2 May 2024. They can be provided to RPS at a later date or when contacted by the local planning authority.

Responses to the consultation have been included in the table following their receipt and provided in the Final Report.

The following organisation have provided feedback related to the issued SEARS directly to RPS:

- CASA
- Fire Rescue NSW
- NSW Rural Fire Service.

Consultation by Aviation Projects with these 3 organisations is not required.

Table 3 Stakeholder consultation details

Agency/Contact	*Request/Date*	*Response/ Date*	*Issues Raised During Consultation*	*Action Proposed*
Airservices Australia	26 February 2024	2 May 2024	I refer to your request for an Airservices assessment of the proposed Pottinger Wind Farm. **Airspace Procedures** With respect to procedures designed by Airservices in accordance with ICAO PANS-OPS and Doc 9905, at a maximum height of 376m (1234ft) AHD, the wind farm turbines will affect the 25 nm MSA instrument procedure at Hay aerodrome. The wind farm will affect the lowest safe altitude for the air routes H247 and W762. The maximum height of wind farm turbines without affecting any procedures at Hay aerodrome is 218.2m (716ft) AHD. Note: Procedures not designed by Airservices at Hay aerodrome were not considered in this assessment. **Grid lowest safe altitude (LSALT)** It is our view that the proposed wind turbines and met masts will impact the published Grid LSALT. The maximum height without affecting the published Grid LSALT is as follows: • For all obstacles north of 35 degrees South and west of 145 degrees East: 213m (700ft) AHD • For all obstacles south of 35 degrees South and west of 145 degrees East: 335m (1100ft) AHD • For all obstacles south of 35 degrees South and east of 145 degrees East: 366m (1200ft) AHD	Provide Airservices Australia with information requested in their response at the appropriate time. Obtain permission from Hay Aerodrome operator for changes to the PANS-OPS surfaces.

Agency/Contact	Request/Date	Response/ Date	Issues Raised During Consultation	Action Proposed
			• For all obstacles north of 35 degrees South and east of 145 degrees East: 366m (1200ft) AHD **Communications/Navigation/Surveillance (CNS) Facilities** We have assessed the proposed activity to the above specified height for any impacts to Airservices Precision/Non-Precision Navigation Aids, Anemometers, HF/VHF/UHF Communications, A-SMGCS, Radar, PRM, ADS-B, WAM or Satellite/Links and have no objections to it proceeding. **Air Traffic Control (ATC) Operations** There are no additional instructions or concerns from our ATC. **Summary – permanent impact** It is our view is that the proposed Wind Farm impacts Airservices designed airspace procedures, CNS facilities or ATC operations at Hay aerodrome. Please consult with the aerodrome and aviation operators to ensure that they accept the proposed changes. We need confirmation from the aerodrome before we make any changes. All amendments to airspace procedures are on a commercial basis. It is our view that the proposed Wind Farm impacts Airservices designed Grid LSALT as currently presented. The Grid LSALT will need to increase to 2300 ft. Please advise the Vertical Obstacle Data (VOD) team at VOD@airservicesaustralia.com of any need to increase Grid LSALT heights at least two (2) weeks before construction commencing by supplying the below information: • Approved wind turbine locations • Elevations at the top of the highest point of the turbine in metres AHD • A copy of this email	

Agency/Contact	Request/Date	Response/ Date	Issues Raised During Consultation	Action Proposed
			Vertical Obstacle Notification This proposed wind farm is more than 30m (99ft) AGL. Please follow the below notification process: 1. Complete the Vertical Obstacle Notification Form: ATS-FORM-0085_Vertical_Obstruction_Data_Form.pdf (airservicesaustralia.com 2. Submit completed form to: VOD@airservicesaustralia.com as soon as the development reaches the maximum height. For further information regarding the reporting of tall structures, please contact the VOD team: • Phone - (02) 6268 5622 • Email - VOD@airservicesaustralia.com • Or refer to: Civil Aviation Safety Regulation Part 175 — Airservices and You - Airservices (airservicesaustralia.com) If you have any further queries, please let me know. Kind regards, Alex Blight Airspace Development & Protection Coordinator	
Department of Defence	26 February 2024	Nil received by 1 May 2024	Details will be provided when received.	Followed up 1 May 2024
Hay Shire Council	26 February 2024	Nil received by 1 May 2024	Details will be provided when received.	Followed up 1 May 2024
Edward River Council	26 February 2024	26 February 2024	From Mark Dalzell - Edward River Council Thanks for sending through this information relating to Pottinger Wind Farm and likely impacts on nearby airports.	Nil.

Agency/Contact	Request/Date	Response/ Date	Issues Raised During Consultation	Action Proposed
			As noted in the report, Deniliquin Regional Airport is located approximately 75km south of the subject area and the development will not impact operations of the Deniliquin Regional Airport. Based on this information, Edward River Council has no comments regarding the development with respect to impacts on the Deniliquin Regional Airport.	
Royal Flying Doctor Service	26 February 2024	Nil received by 1 May 2024	Details will be provided when received.	Followed up 1 May 2024

6. AVIATION IMPACT STATEMENT

6.1. Overview

The NASF Guideline D: *Managing the Risk to Aviation Safety of Wind Turbine Installations (Wind Farms)/Wind Monitoring Towers* provides information to applicants and planning authorities to help identify any potential safety risks posed by WTG 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 Aviation Impact Statement (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 (ALA)
- Grid and air route Lowest Safe Altitudes (LSALTS)
- Airspace protection
- Aviation facilities
- Radar installations
- Local aircraft operations.

6.2. Nearby certified aerodromes

The Project area is located within 30 nm (55.56 km) of one certified airport – Hay Airport (YHAY).

The 30 nm radius area represents the boundary of the 25 nm Minimum Segment Altitude (MSA) and the 5 nm buffer area in which obstacles are assessed to determine minimum safe altitudes. The 25 nm MSA altitude also determines the altitude that each instrument approach procedures commences and the relevant holding altitudes if applicable. (See Figure 5)

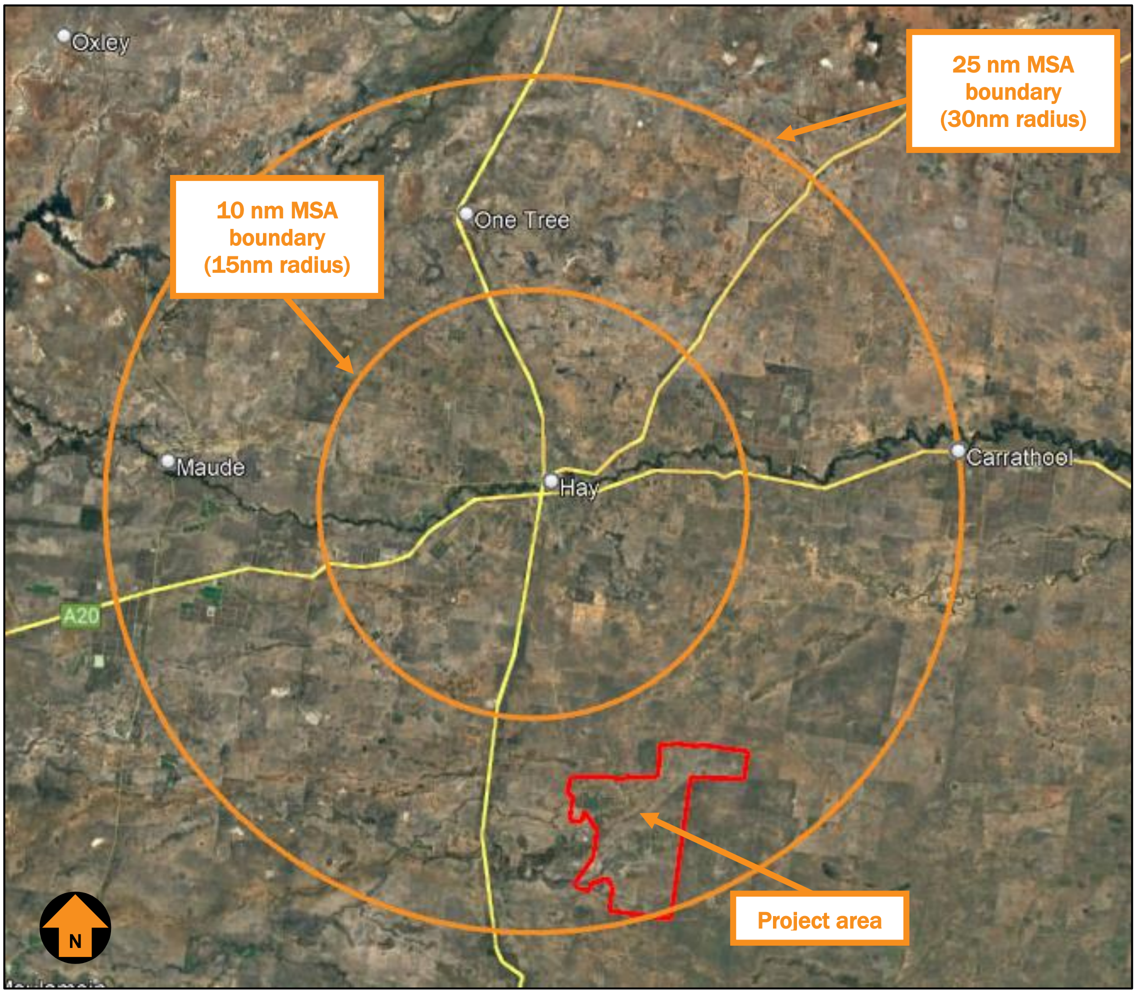

Figure 5 25 nm MSA and 10 nm MSA boundaries

6.2.1. Hay Airport

Hay Airport is a certified aerodrome operated by Hay Shire Council with a published aerodrome elevation of 93 m AHD (305 ft AMSL) (source: Airservices Australia (AsA) AIP, dated 30 November 2023).

Hay Airport has two runways:

- runway 04/22 is a sealed runway 1463 x 30 m and runway strip 90 m
- runway 15/33 is an unrated red sandy clay runway 1140 m x 30 m and runway strip 90 m.

Figure 6 shows the runway layout of Hay Airport (source: AsA, Aerodrome Chart, 15 August 2019).

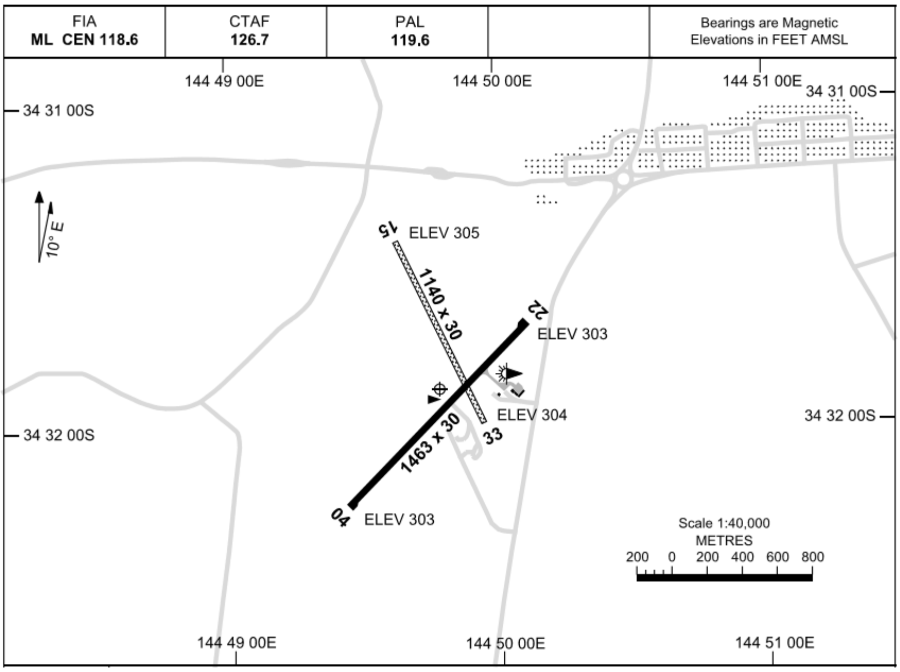

Figure 6 Hay Airport (YHAY) runway layout

YHAY aerodrome reference point (ARP) coordinates published in Airservices Australia's Designated Airspace Handbook (DAH) are Latitude 34°31'53"S and Longitude 144°49'47"E.

6.2.2. Instrument flight procedures

A check of Aeronautical Information Package (AIP) via the Airservices Australia (AsA) website showed that YHAY is served by non-precision instrument flight procedures (source: AsA, effective 21 March 2024).

Table 4 identifies the aerodrome and procedure charts for Hay Airport, designed by Airservices Australia (AsA) as indicated.

Table 4 Hay Airport (YHAY) aerodrome and procedure charts

Chart name	*Effective date*
AERODROME CHART	15 August 2019 (Am 160)
RNP RWY 04	15 June 2023 (Am 175)
RNP RWY 22	15 June 2023 (Am 175)

6.2.3. MSA surfaces

The minimum sector altitudes (MSA) is applicable for each instrument approach procedure at Hay Airport. An image of the MSA published for Hay Airport is shown in Figure 7 (source: AsA, 30 November 2023).

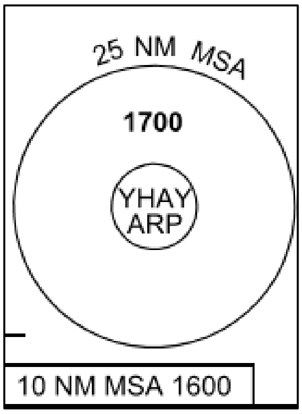

Figure 7 MSA at Hay Airport

The Manual of Standards 173 Standards Applicable to Instrument Flight Procedure Design (MOS 173), requires that a minimum obstacle clearance (MOC) of 300 m / 984 ft above the highest terrain or obstacle within the MSA areas.

Obstacles within 15 nm (10 nm MSA + 5 nm buffer) and within 30 nm (25 nm MSA + 5 nm buffer) of the YHAY ARP define the height at which an IFR aircraft can fly when within 10 nm and 25 nm and when weather conditions do not allow the pilot to see the ground.

The majority of the proposed Project WTGs are located within the 25 nm MSA.

The 25 nm MSA has a minimum altitude of 1700 ft AMSL with a PANS-OPS surface elevation of 716 ft AMSL.

The highest WTGs at a maximum elevation of 1233.6 ft AMSL, infringes the 25 nm MSA by 534.6 ft.

The 10 nm MSA, with a protection area extending to 15 nm from the reference point, is not infringed by the Project.

An impact analysis of YHAY MSA is provided in Table 5

Table 5 Hay Airport MSA Impact analysis

MSA	*Minimum altitude*	*Protection Surface*	*Impact on airspace*	*Potential solution*	*Impact on aircraft ops*
10 nm	1600ft AMSL	616 ft AMSL	Nil. The Project is located outside the protection area for the 10 nm MSA.	N/A	Nil
25 nm	1700 ft AMSL	716 ft AMSL	WTGs at 1233.6 ft infringes the 10 nm MSA by 517.6 ft. WMTs at a maximum height of 901.43 ft do not infringe the 25 nm MSA	Increase 25 nm MSA minimum altitude to 2300 ft.	Minor N/A for WMTs

The increase to the 25 nm MSA would require a commensurate increase in the commencement altitude and the minimum holding altitude for the two RNP approach procedures at YHAY.

6.2.4. IFR Circling areas

A circling approach is an extension of an instrument approach to the specified circling minimum descent altitude (MDA) at which point the pilot will visually manoeuvre the aircraft to align with the runway for landing. Typically, a circling approach is only conducted where there is no runway-aligned instrument procedure, or if the runway used for the approach procedure is not suitable for landing.

Both runways at Hay have runway aligned approach procedures so the requirement to circle to the other runway is seldom required.

Circling areas are established by the instrument flight procedure designer based on ICAO specifications and related to the performance category of the design aircraft. The circling area is determined by drawing an arc centred on the threshold of each usable runway and joining these arcs by tangents. The most demanding aircraft category provided for YHAY instrument flight procedure's is Category C.

The radii for each relevant category of aircraft represented are provided below:

- Category A – 1.68 nm / 3.11 km
- Category B – 2.66 nm / 4.93 km
- Category C – 4.20 nm / 7.78 km.

The Project is located approximately 35.2 km from the Runway 04 threshold and is therefore beyond the circling area and would not impact circling areas established for instrument approach procedures.

6.2.5. YHAY Instrument approach PANS-OPS Surfaces

Two GPS based instrument approach procedures are published for the use of IFR aircraft arriving at YHAY:

- RNP RWY 04
- RNP RWY 22.

A detailed assessment of the PANS-OPS surfaces associated with these two published instrument approach procedures has determined that the PANS-OPS surfaces associated with them are not located overhead the Project area.

The 25 nm MSA minimum altitude determines the altitude that aircraft commence the instrument approach from the Initial Approach Fix (IAF). As the 25 nm MSA minimum altitude needs to be increased to 2300 ft AMSL the commencement altitudes must also be increased to 2300 ft AMSL, requiring an editorial amendment to each instrument approach procedure.

There is sufficient distance within the procedure for aircraft to conduct the normal 3° final approach path of the RNP procedure from 2300 ft AMSL without affecting aircraft operations or efficiency.

The final missed approach altitude would also need to be increased to 2300 ft and would not impact the approach procedures.

The increase would still allow normal IFR flight operations using this procedure to operate efficiently and safely.

Figure 8 details the YHAY RNP RWY 04 instrument approach chart as an example to show the altitudes that would need to be amended to accommodate the Project are circled in orange.

The wind farm would likely be depicted on the plan view of this chart in the correct location for pilot reference.

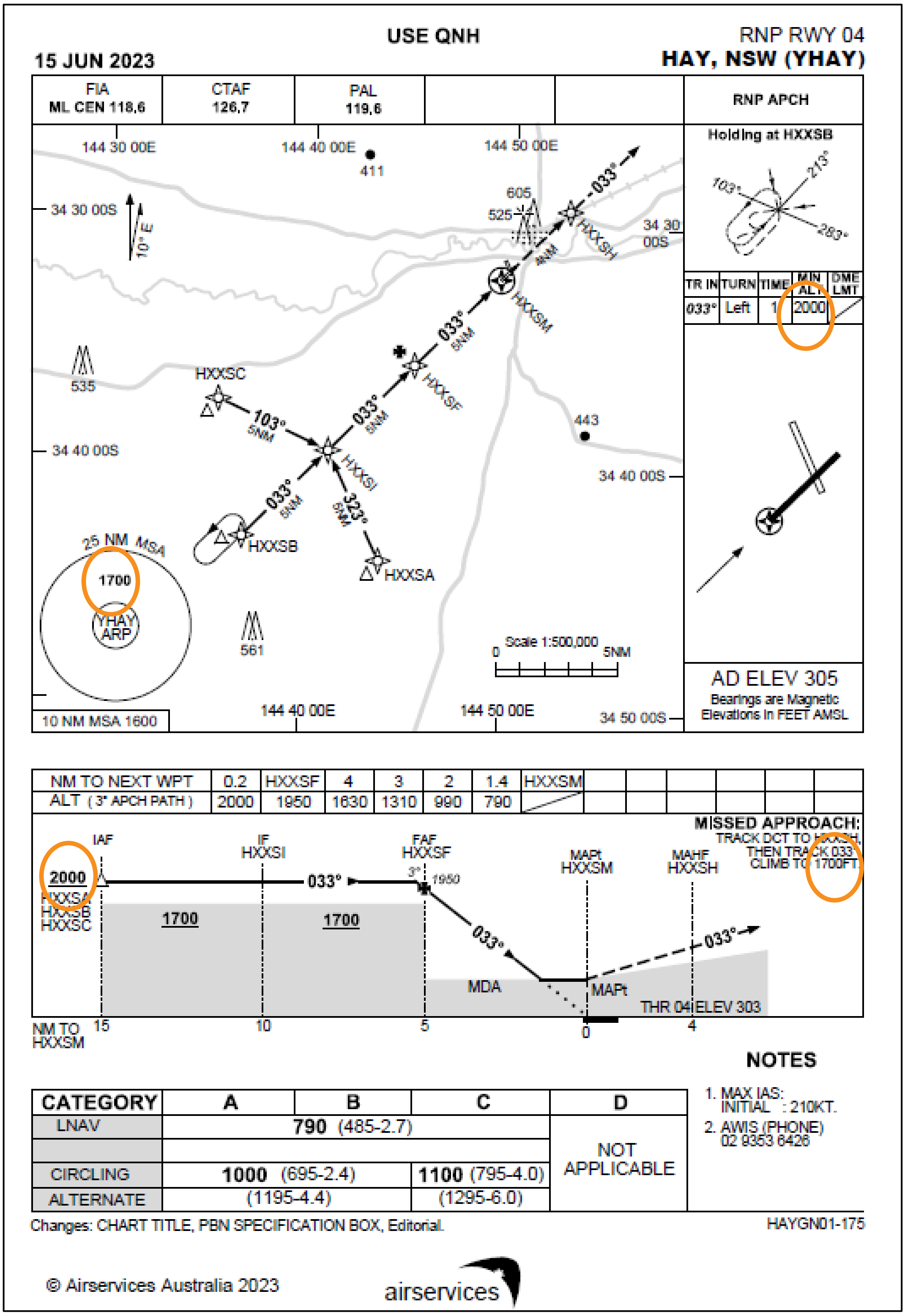

Figure 8 YHAY RNP RWY 04

6.3. Obstacle Limitation Surfaces

Obstacle Limitation Surface (OLS) are established for each runway at YHAY.

For the existing Code 3 non-precision runways, the maximum lateral extent of the OLS is up to 5.5 km radius for the conical surface and 15km from each runway threshold for the take-off climb surfaces and the approach surfaces.

The closest WTGs in the Project area to Hay Airport is located beyond the horizontal extent of the obstacle limitation surfaces.

Based on the Hay Aerodrome Master Plan 2022, Runway 04/22 will be extended to a length of 2300 m and upgraded to a Code 4 non-precision instrument runway.

For a Code 4 non-precision runway, the maximum lateral extent of the OLS is up to 6 km for the conical surface and 15km for the take-off and approach surfaces.

The closest WTGs in the Project area to Hay Airport are located beyond the horizontal extent of the obstacle limitation surfaces of the future proposed extended runway.

6.4. Nearby aircraft landing areas (ALA) (uncertified aerodromes)

A search of various aviation datasets identified Aircraft Landing Areas (ALAs) in proximity to the Project area. The aviation datasets used are:

- OzRunways - which sources its aeronautical data from Airservices Australia (AIP) and is approved under CASA CASR Part 175.
- Australian Government National Map online
- NSW Planning Portal.

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

Two ALAs were identified in the vicinity of the Project, one of which is located within the Project area, Wargam ALA. The Wargam ALA is located within an Associated Dwelling and an agreement with the landholder has been reached. Both are shown on the NSW Planning Portal website.

The Applicant has contacted the landowners associated with both ALAs and both have been confirmed as not in currently operational use and are not maintained.

There are no operational ALAs located within 3 nm of the Project boundary.

6.5. Potential wake turbulence impacts

National Airports Safeguarding Framework (NASF) Guideline D – *Managing the Risk to Aviation Safety of Wind 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 WMTs.

NASF Guideline D provides guidance regarding WTG wake turbulence which states:

> *Wind farm operators should be aware that wind turbines may create turbulence which noticeable up to 16 rotor diameters from the turbine. In the case of one of the larger wind turbines with a diameter of 150 metres, turbulence may be present two kilometres downstream. At this time, the effect of this*

level of turbulence on aircraft in the vicinity is not known with certainty. However, wind farm operators should be conscious of their duty of care to communicate this risk to aviation operators in the vicinity of the wind farm…

For the purpose of the wake turbulence analysis, a 220 m rotor diameter has been used. Based on this scenario, the effects of wake turbulence could be noticeable at 3520 m from the WTGs.

Aviation Projects, through research, has determined that any adverse turbulence would most likely be confined to within 7 rotor diameters of a WTG, but considers that a conservative area of 10 rotor diameters is likely to be the maximum area where wake turbulence from WTGs would be felt by pilots operating downstream of a WTG. This area would therefore extend to a distance of 2200 m.

Adverse turbulence from any source is most critical during initial climb after take-off until the aircraft is established in a climb and at the appropriate speed, and during final approach where the aircraft is configured for landing and operating at a slow speed prior to landing.

There are no operational ALAs within any of the distances referred to above.

6.6. Grid and Air routes LSALT

MOS 173 requires that the published lowest safe altitude (LSALT), for a particular airspace grid or air route, provides a minimum of 1000 ft clearance above the controlling (highest) obstacle within the relevant airspace grid or air route tolerances.

6.6.1. Grid LSALT

The Project area is located within four Grid LSALT areas of:

- Northwest - 1700 ft AMSL with a protection surface of 700 ft AMSL
- Northeast and southeast – 2200 ft AMSL with a protection surface of 1200 ft AMSL
- Southwest – 2100 ft AMSL with a protection surface of 1100 ft AMSL.

Figure 9 shows the grid LSALTs in proximity to the Project area (source: ERC Low OzRunways, 30 November 2023, Google Earth).

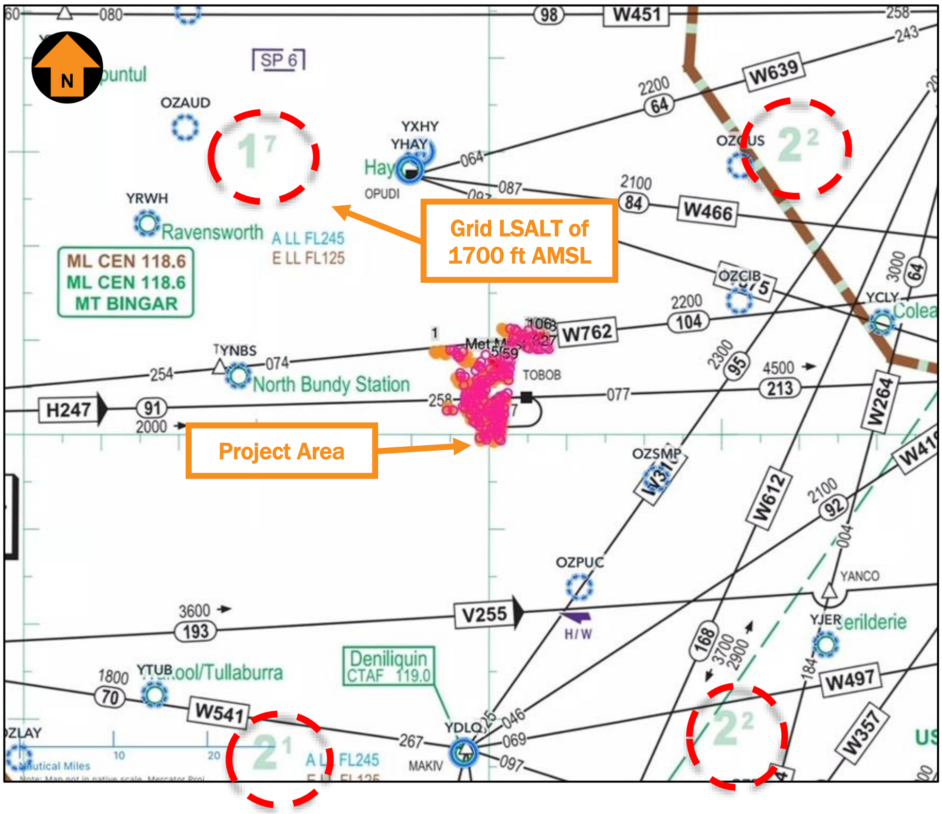

Figure 9 Grid LSALTs in proximity to the Project area

An impact analysis of the surrounding air routes is provided in Table 6.

The WTGs will require the GRID LSALTs to be increased to 2300 ft AMSL to accommodate the project. Increments of 100 ft are applicable for LSALTs.

Airservices Australia will be provided with this AIA and then assess this proposed change and amend aeronautical charts relevant to the Project as appropriate.

Table 6 Grid ISALT impact analysis

Grid ISALT	*Protection Surface*	*Highest WTG*	*Impact on Grid LSALT*	*Potential solution*	*Impact on aircraft ops*
1700 ft AMSL	700 ft AMSL	1233.6 ft AMSL	533.6 ft infringement	Raise to 2300 ft AMSL	Minor
2100 ft AMSL	1100 ft AMSL	1233.6 ft AMSL	133.6 ft infringement	Raise to 2300 ft AMSL	Minor
2200 ft AMSL	1200 ft AMSL	1233.6 ft AMSL	33.6 ft infringement	Raise to 2300 ft AMSL	Minor

6.6.2. Air Route LSALTs

A protection area 7 nm laterally either side of an air route is used to assess the LSALT for an air route.

There are several air routes within 7 nm of the Project Area shown in below Figure 10. (source: Ozrunways).

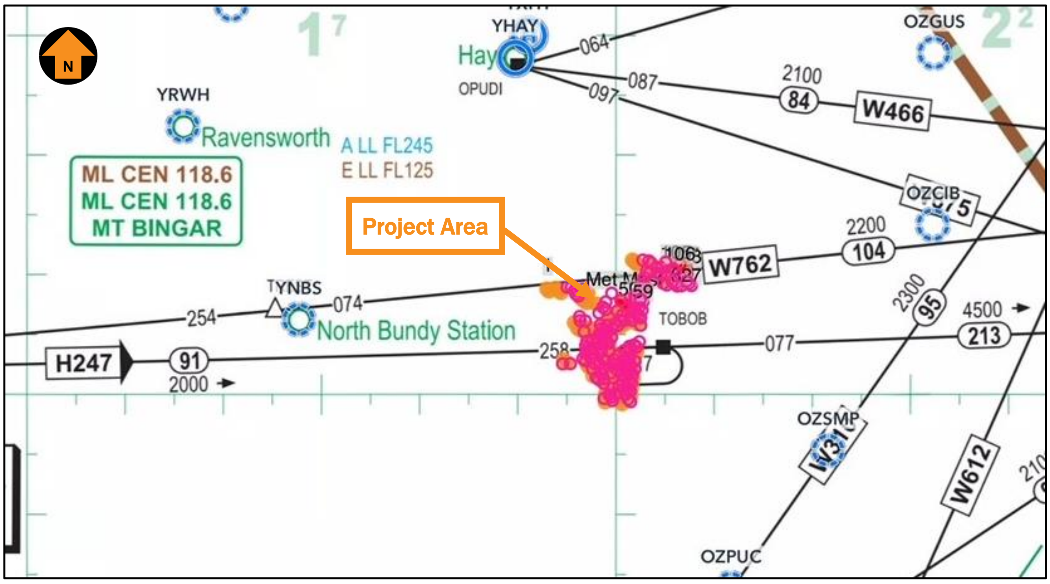

Figure 10 Low Level air routes in proximity to the Project area - ERCL National (Source: Ozrunways)

An impact analysis of the surrounding air routes is provided in Table 7.

Table 7 Air route impact analysis

Air route	*Waypoint pair*	*Route LSALT*	*Protection Surface*	*Impact on airspace design*	*Potential solution*	*Impact on aircraft ops*
H247	NATYA to TOBOB	2000 ft AMSL	1000 ft AMSL	Highest WTG will exceed by 234.6 ft	LSALT raised by 300 ft to 2300 ft AMSL	N/A
W762	TREST to VINOP	2200 ft AMSL	1200 ft AMSL	Highest WTG will exceed by 34.6 ft	LSALT raised by 100 ft to 2300 ft AMSL	N/A
H21	NATYA – WG VOR	3200	2200	Nil	N/A	N/A

Note: Hi-level air route H21 is not shown due to clutter on ERC-Hi depiction.

6.7. Airspace Protection

The Project Area is located outside of controlled airspace (wholly within Class G airspace) and is not located within in any Special Use Airspace.

Therefore, the Project area will not have an impact on controlled or designated airspace.

6.8. Aviation navigation facilities

The nearest aviation navigation aid is located at Griffith Airport, approximately 64 nm northeast of the Project.

The Project WTGs are located a sufficient distance away from aviation facilities and will not have an impact.

6.9. ATC Radar installations

Airservices Australia requires an assessment of the potential for the WTGs to affect radar line of sight.

The closest radar facility to the Project area is the Mount Bobbara Route Surveillance Radar (RSR), which is located approximately 317 km to the south-east.

The Project area is located outside the clearance zones associated with the Mount Bobbara RSR and therefore will not impact this facility.

6.10. AIS Summary

Based on the proposed Project WTG layout and maximum blade tip height of 280 m AGL, the highest wind turbines (105,106,107,108) will not exceed 376 m (1233.6 ft AMSL).

The Project WTGs and WMTs:

- Would not infringe any OLS surfaces
- Would infringe the YHAY 25 nm MSA PANS-OPS surface and would require an increase of the minimum altitude to 2300 ft to accommodate the Project
- Would not infringe the two YHAY instrument approach procedures but amendments would be required due to the 25 nm MSA increase requirement
- Would not have any impact upon the Wargam ALA and the unidentified ALA as they have been confirmed with the owners as non-operational
- Would have an impact on the grid LSALTs, requiring an increase to 2300 ft AMSL for the particular Grids
- Would impact air route LSALT for H247, W762, requiring an increase to 2300 ft AMSL for the particular route segments
- Would be wholly contained within Class G airspace
- Would be outside the clearance zones associated with civil aviation navigation aids and ATC surveillance facilities.

7. HAZARD LIGHTING AND MARKING

Based on the risk assessment set out in Section 9 it is concluded that aviation lighting is not likely to be required for WTGs and WMTs.

For completeness, relevant lighting standards and guidelines are summarised in Annexure 3.

Once the details of the wind farm, along with this report, are provided by the planning authority to CASA, CASA is likely to recommend obstacle lighting be fitted to sufficient obstacles to delineate the outline of the wind farm and the highest WTGs within it.

7.1. Wind monitoring towers (WMTs)

Given that aerial operators are likely to use the airspace within the Project area and that it is expected that WMTs will be constructed prior to WTGs, the WMTs may be free-standing and not surrounded by any other obstacles.

WMTs are very difficult to identify due to their slender structure and are known to be the significant hazard to low level aircraft operations.

To make them more conspicuous, the proposed WMT should be marked with red/white/red bands as per the guidelines within NASF Guideline D.

WMTs are proposed to have a maximum height of 180 m AGL. CASA are likely to recommend obstacle lighting.

The Project is located outside the extent of the CASR Part 139 requirements for obstacle lighting. Details of the CASR Part 139 requirements are included in Annex 3 for context only.

In terms of obstacle marking and lighting requirements, relevant requirements are set out in the NASF are provided below.

Planning authorities have regularly set conditions on windfarms directly related to the recommendations contained in the NSAF.

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.*

Marking is preferred to strobe lights for local community amenity.

For WMTs installed prior to WTG installation and for those WMTs that are not in close proximity to a WTG, there will be an acceptable level of aviation safety risk associated with the potential for an aircraft collision provided obstacle lighting is fitted with medium intensity lighting at the top of the mast to ensure visibility in low light and deteriorating atmospheric conditions.

Characteristics of medium-intensity lights are specified in MOS 139 Section 9.33 as shown below:

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 ☐ 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 lower 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 ± 25% cd when the background luminance is 50 cd/m² or greater.*

7.2. Overhead transmission lines

There is no regulatory requirement to mark or light the Project power poles or overhead transmission lines.

According to the AAAA *Powerlines Policy* dated March 2011:

> *Most agricultural land in Australia is crisscrossed with powerlines and aerial application companies and pilots put enormous effort into managing these hazards safely, generally using a risk identification, assessment and management process in line with Australian Standard AS4360/ISO 3[1]000.*
>
> *The agricultural pilot curriculum mandated by CASA includes training for the safe management of powerlines and AAAA has been active in providing ongoing professional development for application pilots that includes a focus on planning, risk management and a knowledge of human factors relevant to managing powerlines in a low-level aviation environment.*
>
> *AAAA runs a specific training course for aerial application pilots entitled 'Wire Risk Management' to address these issues.*

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 application operators and marked in accordance with MOS 139 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 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.*

Following consultation with aerial operators, if a risk assessment is required, the Applicant should follow standards outlined in the AS 3891.2:2018 *Air navigation – Cables and their supporting structures – Marking and safety requirements Part 2: Low level aviation operations.*

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.

8.3. National aviation occurrence statistics 2010-2019

The Australian Transport Safety Bureau (ATSB) recently published a summary of aviation occurrence statistics for the period 2010-2019 (AR-2020-014, Final - 29 April 2020).

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, and 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, almost two thirds (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 to 177:1. 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 will be multiple fatalities.

A breakdown of aircraft and fatalities by general aviation sub-categories is provided in Table 8 (source: ATSB).

Table 8 Number of fatalities by General Aviation sub-category – 2010 to 2019

Sub-category	*Aircraft assoc. with fatality*	*Fatalities*	*Fatalities to aircraft ratio*
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 11 refers to Fatal Accident Rate by operation type per million departures over the 6-year period (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 these years. According to the ATSB report, the number of fatal accidents per million departures for GA aircraft over the 6-year reporting period ranged between 6.6 in 2014 and 4.9 in 2019.

No collisions with wind farm components have occurred since 2019.

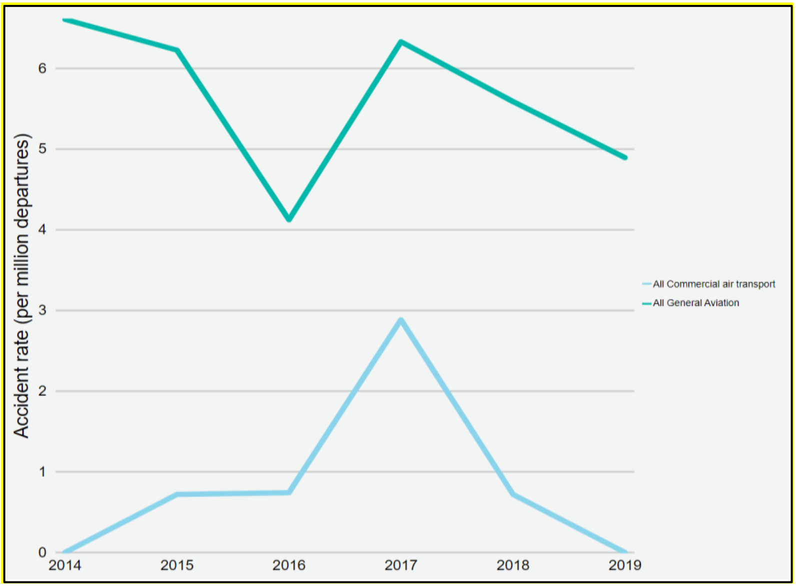

Figure 11 Fatal Accident Rate (per million departures) by Operation Type

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 9 (source: ATSB).

Table 9 Fatal accidents by GA sub-category – 2010 -2019

Sub-category	*Fatal accidents*	*Fatalities*
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

Over the 10-year period, no aircraft collided with a WTG or a WMT in Australia.

Of the 20,529 incidents, serious incidents and accidents in GA operations in the 10-year period, 1,404 (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

Worldwide since aviation accident statistics have been recorded, there have been a total of 4 aviation accidents involving a wind farm (i.e. where WTGs were erected). To provide some perspective on the likelihood of a VFR aircraft colliding with a WTG, a summary of the 4 accidents and the relevant factors applicable to this assessment is incorporated in this section.

Based on the statistics set out in the Global Wind Energy Council (GWEC) report 2016, there were 341,320 WTGs 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 102 wind farms in Australia at the end of 2019. 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 4 recorded aviation accidents involving a wind farm are summarised as follows:

- 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.
    - 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).

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 flight to a destination alternate not performed by the pilot. No mention in the NTSB database is made of WTGs or a wind farm.

A summary of the 4 accidents is provided in Table 10.

Table 10 Summary of accidents involving collision with a WTG

ID	Description	Date	Location	Fatalities	Flight rules	WTG height	Obstacle lighting	Cause of accident	Relevant to obstacle lighting at night
1	Diamond DA320-A1 D-EJAR Collided with a WTG approximately 20 m above the ground, during the day in good visibility. The mast was grey steel lattice, rather than white, although the blades were painted in white and red bands.	02 Feb 2017	Melle, Germany	1	Day VFR No cloud and good visibility	Not specified	Not specified	Not specified	Not applicable

ID	Description	Date	Location	Fatalities	Flight rules	WTG height	Obstacle lighting	Cause of accident	Relevant to obstacle lighting at night
2	The Piper PA-32R-300, N8700E, was destroyed during an impact with the blades of a WTG, at night in IMC. The wind farm was not marked on either sectional chart covering the accident location; however, the pilot was reportedly aware of the presence of the wind farm.	27 Apr 2014	10 miles south of Highmore, South Dakota	4	Night IMC Low cloud and rain	420 ft AGL overall	Fitted but reportedly not operational on the WTG that was struck	The NTSB determined the probable cause(s) of this accident to be the pilot's decision to continue the flight into known deteriorating weather conditions at a low altitude and his subsequent failure to remain clear of an unlit WTG. Contributing to the accident was the inoperative obstacle light on the WTG, which prevented the pilot from visually identifying the WTG.	An operational obstacle light may have prevented the accident.

ID	Description	Date	Location	Fatalities	Flight rules	WTG height	Obstacle lighting	Cause of accident	Relevant to obstacle lighting at night
3	Beechcraft B55 The pilot was attempting to remain in VMC by descending the aircraft through a break in the clouds. The pilot, distracted by trying to visually locate the aerodrome, flew into an area of known presence of WTGs. After sighting the WTGs, he was unable to avoid them. The tip of the left wing struck the first WTG blade, followed by the tip of the right wing striking the blade of a second WTG. The pilot was able to maintain control of the aircraft and landed safely.	04 Apr 2008	Plouguin, France	0	Day VFR The weather in the area of the WTGs had deteriorated to an overcast of stratus cloud, with a base between 100 ft to 350 ft and tops of 500 ft.	328 ft AGL hub height, 393 ft AGL overall	Not specified	This pilot reported having been distracted by a troubling personal matter which he had learned of before departing for the flight. The wind farm was annotated on aeronautical charts.	Not applicable

ID	Description	Date	Location	Fatalities	Flight rules	WTG height	Obstacle lighting	Cause of accident	Relevant to obstacle lighting at night
4	VariEze N25063 The aircraft collided with a WTG following in-flight separation of the majority of the right canard and all of the right elevator.	20 July 2001	Palm Springs, USA	2	Day VFR	N/A	N/A	The failure of the builder to balance the elevators per the kit manufacturer's instructions. The cause of this accident is not attributable to the wind farm.	Not applicable

9. RISK ASSESSMENT

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 and risk event description is provided in **Annexure 4.**

9.1. Risk Identification

The primary risk being assessed is that of aviation safety associated with the height and location of WTGs and WMT proposed by the Project.

Based on an extensive review of accident statistics data (see summary in Section 8 above) and stakeholders who were consulted during the preparation of this AIA (see Section 0), 5 identified risk events associated with WTGs and WMTs relate to aviation safety or potential visual impact, and are listed as follows:

1. potential for an aircraft to collide with a WTG, controlled flight into terrain (CFIT) (related to aviation safety).
2. potential for an aircraft to collide with a WMT (CFIT) (related to aviation safety).
3. potential for a pilot to initiate manoeuvring in order to avoid colliding with a WTG or WMT resulting in collision with terrain (related to aviation safety).
4. potential for the hazards associated with the Project to invoke operational limitations or procedures on operating crew (related to aviation safety).
5. Potential effect of obstacle lighting on neighbours (related to potential visual impact).

It should be noted that according to guidance provided by the Commonwealth Department of Infrastructure Transport, Regional Development, Communications and the Arts (Airspace and Air Traffic Management Risk Management Policy Statement) and in line with generally accepted practice, the risk to be assessed should primarily be associated with passenger transport services. Therefore, 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.

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

9.2. 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 residual level of risk to an acceptable level.

A summary of the level of risk associated with the Project, under the proposed treatment regime, with specific consideration of the effect of obstacle lighting, is provided in Table 11 through to Table 15.

Table 11 Aircraft collision with wind turbine generator (WTG)

Risk ID:	1. **Aircraft collision with wind turbine generator (WTG) (CFIT)**

Discussion

An aircraft collision with a WTG would result in harm to people and damage to property. Property could include the aircraft itself, as well as the WTG.

There have been 4 reported occurrences worldwide of aircraft collisions with a component of a WTG structure since the year 2000 as discussed in Section 9. 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.

In consideration of the circumstances that would lead to a collision with a WTG:

- GA VFR aircraft operators generally don't 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.
- If the aircraft was flown through the wind farm, there is still a very small chance that it would hit a WTG.

Refer to the discussion of worldwide accidents in Section 8.

There are no known aerial application operations conducted at night in the vicinity of the Project area.

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:

(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.

Project WTGs are located within 3 nm of the ALAs and may well be considered an obstacle that is hazardous to aircraft operations, whether lit or unlit, due to their light colour and readily visible size.

The Project area is clear of the obstacle limitation surfaces (OLS) of any certified aerodrome.

Consequence

If an aircraft collided with a WTG, the worst credible effect would be multiple fatalities and damage beyond repair. This would be a Catastrophic consequence.

Consequence	Catastrophic

Untreated Likelihood

There have been 4 reports of aircraft collisions with WTGs worldwide, which have resulted in a range of consequences, where aircraft occupants sustained minor injury in some cases and fatal injuries in others (see Section 8). Similarly, aircraft damage sustained ranged from minor to catastrophic. One of these accidents resulted from structural failure of the aircraft before the collision with the WTG. Only two relevant accidents occurred during the day, and only one resulted in a single fatality. It is assessed that collision with a WTG resulting in multiple fatalities and damage beyond repair is unlikely to occur.

Untreated Likelihood	Unlikely

Current Treatments (without lighting)

- The Project area is clear of the obstacle limitation surfaces (OLS) of any certified aerodrome.
- Consider removing WTGs within 3 nm of any ALA if possible.
- 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 WTGs will be a maximum of 280 m (919 ft) AGL at the top of the blade tip. The rotor blade at its maximum height will be approximately 127.6m (419 ft) above aircraft flying at the minimum altitude of 152.4 m AGL (500 ft).
- In the event that descending cloud forces an aircraft lower than 500 ft (152.4 m) AGL, the minimum visibility of 5,000 m required for visual flight during the day should provide adequate time for pilots to observe and manoeuvre their aircraft clear of WTGs.
- At night, aircraft are restricted to a minimum height of 304.8 m (1,000 ft) above obstacles (including terrain) which are within 10 nm of the aircraft in visual flight and potentially even higher during instrument flight (day or night.
- 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 thorough risk management activities undertaken specifically for and prior to undertaking such authorised flights. Any obstacle including WTGs in the path of the authorised flight would be specifically risk assessed during that process.
- The WTGs are typically coloured white so they should be visible to pilots during the day.
- The 'as constructed' details of WTGs are required to be notified to Airservices Australia so that the location and height of all WTGs can be noted on aeronautical maps and charts.
    - Because the Project WTGs are proposed to be above 100 m AGL, there is a statutory requirement to report the WTGs to CASA and notified to Airservices Australia prior to construction.

Level of Risk

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

Current Level of Risk	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.

Risk Decision	Unacceptable

Recommended Treatments

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

- Details of the Project should be communicated to local and regional aircraft prior to construction to heighten their awareness of its location and so that they can plan their operations accordingly. Specifically: - Engage with local aerial agricultural and aerial firefighting operators to develop procedures, which may include, for example, stopping the rotation of the WTG blades prior to the commencement of the subject aircraft operations within the Project area. - Arrangements should be made to publish details of the Project in ERSA for surrounding aerodromes, which would involve notification to Airservices Australia.		
Residual Risk With the implementation of the Recommended Treatments listed above, the likelihood of an aircraft collision with a WTG 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

Table 12 Aircraft collision with wind monitoring tower (WMT)

Risk ID:	2. Aircraft collision with a wind monitoring tower (WMT) (CFIT)

Discussion

An aircraft collision with a WMT would result in harm to people and damage to property.

It is proposed to install up to 11 WMTs with a maximum height of 180 m (590.6 ft) AGL.

The final location of the WMT will be determined as part of the final construction design and the details will be reported to Airservices Australia.

There are only a few worldwide instances of aircraft colliding with a WMT, but they were all during the day with good visibility, and no instance was in Australia.

There is a relatively low rate of aircraft activity in the vicinity of the wind farm.

There are no known aerial application operations conducted at night in the vicinity of the wind farm.

If a proposed object or structure is identified as likely to be an obstacle, details of the relevant proposal will be referred to CASA for CASA to determine, in writing:

- 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.

Consequence

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.

Consequence	Catastrophic

Untreated Likelihood

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 WMT 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.

Untreated Likelihood	Possible

Current Treatments

- The temporary and permanent WMT locations will be advised to CASA and Airservices Australia prior 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 highest permanent WMT could be at a height of up to 180 m (590.6 ft), which will be 2706 m (90.6 ft) above the minimum height of 500 ft AGL for an aircraft flying at this height.
- In the event that descending cloud forces an aircraft lower than 152.4 m (500 ft) AGL, the minimum visibility of 5,000 m required for visual flight during the day should provide adequate time for pilots to observe and manoeuvre their aircraft clear of the tower.

• Aircraft are restricted to a minimum height of 304.8 m (1,000 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. • As the WMTs will be higher than 100 m AGL, there is a statutory requirement to report them to CASA and Airservices Australia prior to construction.	
Level of Risk The level of risk associated with a Possible likelihood of a Catastrophic consequence is 8.	
Current Level of Risk	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.	
Risk Decision	Unacceptable
Recommended Treatments The following treatments which can be implemented at little cost will provide an acceptable level of safety: • Details of any WMTs when they are constructed should be advised to Airservices Australia. • Consideration could be given to marking any wind monitoring towers according to the requirements set in MOS 139 Chapter 8 Division 10 Obstacle Markings (as modified by the guidance in NASF Guideline D); specifically: 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. • WMTs that are installed prior to WTG installation and WMTs that are not in close proximity to a WTG, should be fitted with a medium intensity steady red obstacle light at the top of the tower to ensure visibility in low light and deteriorated atmospheric conditions. Characteristics of medium-intensity lights are specified in MOS 139 Section 9.33: *5) Medium-intensity obstacle lights must:* *c) be visible in all directions in azimuth; and* *d) if flashing — have a flash frequency of between 20 and 60 flashes per minute.*	

6) *The peak effective intensity of medium-intensity obstacle lights must be 2 000 ☐ 25% cd with a vertical distribution as follows:*

   d) *for* **vertical beam spread** *— a minimum of 3 degrees;*

   e) *at -1 degree elevation — a minimum of 50% of the lower tolerance value of the peak intensity;*

   f) *at 0 degrees elevation — a minimum of 100% of the lower tolerance value of the peak intensity.*

7) *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.*

8) *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 ± 25% cd when the background luminance is 50 cd/m² or greater.*

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

Residual Risk

With the additional Recommended Treatments listed above, the likelihood of an aircraft collision with a WMT 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.

Under these circumstances, the level of risk under the proposed treatment plan is considered **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 Project permanent WMTs that are in close proximity to a WTG without obstacle lighting on the WMTs.

For temporary WMTs installed prior to WTG installation and WMTs that are not in close proximity to a WTG, there will be an acceptable level of aviation safety risk associated with the potential for an aircraft collision provided obstacle lighting is fitted to ensure visibility in low light and deteriorating atmospheric conditions.

Residual Risk	7 - Tolerable

Table 13 Harsh manoeuvring leading to controlled flight into terrain

Risk ID:	3. **Harsh manoeuvring leads to controlled flight into terrain (CFIT)**

Discussion

An aircraft colliding with terrain as a result of manoeuvring to avoid colliding with a WTG would result in harm to people and damage to property.

There are a few ground collision accidents resulting from manoeuvring to avoid wind farms, but none in Australia, and all were during the day.

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.

The proposed WTGs will be a maximum of 280 m (919 ft) AGL at the top of the blade tip. The rotor blade at its maximum height will be approximately 127.6m (419 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 WTGs.

If cloud descends below the WTG 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 (500 ft) AGL (day) or below safety height (night) are operated in accordance with procedures developed as an outcome of thorough risk management activities.

Assumed risk treatments

- The WTGs are typically coloured white so they should be visible during the day.
- The 'as constructed' details of WTGs are required to be notified to Airservices Australia so that the location and height of WTGs can be noted on aeronautical maps and charts.
- Since the WTGs will be higher than 100 m AGL, there is a statutory requirement to report the WTG to CASA.

Consequence

If an aircraft collided with terrain, the worst credible effect would be multiple fatalities and damage beyond repair. This would be a Catastrophic consequence.

Consequence	Catastrophic

Untreated Likelihood

There are a few ground collision accidents resulting from manoeuvring to avoid WTGs, but none in Australia, and all were during the day (see Section 8). It is assessed that a ground collision accident following manoeuvring to avoid a WTG is unlikely to occur.

Untreated Likelihood	Unlikely

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. • The proposed WTGs will be a maximum of 280 m (919 ft) AGL at the top of the blade tip. The rotor blade at its maximum height will be approximately 127.6m (419 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 WTGs. • The WTGs and masts will be shown on aeronautical charts at the next publication cycle date available and NOTAMS prior to the publication date. This allows pilots to be aware of the existence of the wind farm at the pre-flight planning stage and during flight with reference to the aeronautical chart. • If cloud descends below the WTG 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) (day) or below safety height (night) are operated in accordance with procedures developed as an outcome of thorough risk management activities. • The WTGs are typically coloured white, typical of most WTGs operational in Australia, so they should be visible during the day. • The 'as constructed' details of WTGs 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 WTGs will be higher than 100 m AGL, there is a statutory requirement to report the WTGs to CASA.	
Level of Risk The level of risk associated with a Possible likelihood of a Catastrophic consequence is 8.	
Current Level of Risk	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.	
Risk Decision	Unacceptable
Recommended Treatments The following treatments which can be implemented at little cost will provide an acceptable level of safety: • Ensure details of the Project WTGs have been communicated to Airservices Australia, and local and regional aerodrome and aircraft operators prior to construction.	

• Although there is no requirement to do so, the Applicant may consider engaging with local aerial agricultural and aerial firefighting operators to develop procedures for their safe operation within the Project area.		
Residual Risk 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**. 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 **ALARP**. **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.**		
	Residual Risk	7 - Tolerable

Table 14 Effect of the Project on operating crew

Risk ID:	4. Effect of the Project on operating crew
Discussion Introduction or imposition of additional operating procedures or limitations can affect an aircraft's operating crew. There are no known aerial application operations conducted at night in the vicinity of the Project area.	
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 • 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. • The WTGs and masts will be shown on aeronautical charts at the next publication cycle date available and NOTAMS prior to the publication date. This allows pilots to be aware of the existence of the wind farm at the pre-flight planning stage and during flight with reference to the aeronautical chart. • The proposed WTGs will be a maximum of 280 m (919 ft) AGL at the top of the blade tip. The rotor blade at its maximum height will be approximately 127.6m (419 ft) above aircraft flying at the minimum altitude of 152.4 m AGL (500 ft). • In the event that descending cloud forces an aircraft lower than 500 ft (152.4 m) AGL, 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 WTGs. • 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 WTGs. • If cloud descends below the WTG 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) (day) or below safety height (night) are operated in accordance with procedures developed as an outcome of thorough risk management activities. • The WTGs are typically coloured white so they should be visible during the day. • The 'as constructed' details of WTGs 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 WTGs will be higher than 100 m AGL, there is a statutory requirement to report the WTGs to CASA.	
Level of Risk The level of risk associated with a Possible likelihood of a Moderate consequence is 5.	
Current Level of Risk	5 - Tolerable
Risk Decision A risk level of 6 is classified as Tolerable: Treatment action possibly required to achieve ALARP - conduct cost/benefit analysis. Relevant manager to consider for appropriate action.	
Risk Decision	Accept, conduct cost benefit analysis
Recommended Treatments WMTs installed prior to WTG installation and those that are not in relatively close proximity to a WTG should be lit to ensure they are visible in low light and deteriorating atmospheric conditions. (see Risk ID: 2) The following additional treatments will provide an additional margin of safety: • Ensure details of the Project WTGs and WMTs have been communicated to Airservices Australia, and local and regional aerodrome and aircraft operators prior to construction. • Although there is no requirement to do so, the Applicant may consider engaging with local aerial agricultural and aerial firefighting operators to develop procedures for such aircraft operations in the vicinity of the Project area.	
Residual Risk Notwithstanding the current level of risk is considered **Tolerable,** the additional Recommended Treatments listed above will enhance aviation safety. The likelihood remains **Possible**, and consequence remains **Minor**. In the circumstances, the risk level of 5 is considered **Tolerable.** **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 Project WTGs and Permanent WMTs in close proximity to a WTG, and with obstacle lighting for temporary WMTs installed prior to WTG installation and WMTs that are not in close proximity to a WTG.**	
Residual Risk	5 – Tolerable

Table 15 Effect of obstacle lighting on neighbours

Risk ID:	5. Effect of obstacle lighting on neighbours

Discussion

This scenario discusses the consequential impact of a decision to install obstacle lighting on the wind farm.

Installation and operation of obstacle lighting on WTGs or WMT can have an effect on neighbours' visual amenity and enjoyment, specifically at night and in good visibility conditions.

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:

(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.

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.

Consequence

The worst credible effect of obstacle lighting specifically at night in good visibility conditions would be:

- 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.

This would be a Moderate consequence.

Consequence	Moderate

Untreated Likelihood

The likelihood of moderate site impact, minimal local impact is Almost certain - the event is likely to occur many times (has occurred frequently).

Untreated Likelihood	Almost certain

Current Treatments

If the WTGs or WMTs will be higher than 150 m (492 ft) AGL, they must be regarded as obstacles unless CASA assess otherwise. 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.

Level of Risk

The level of risk associated with an Almost certain likelihood of a Moderate consequence is 8.

Current Level of Risk	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.

Risk Decision	Unacceptable

Recommended Treatments Not installing obstacle lighting would completely remove the source of the impact. As per the above safety risk assessment, the provision of lighting for the WTGs and permanent WMTs is not necessary to provide an acceptable level of safety. For temporary WMTs installed prior to WTG installation and WMTs that are not in close proximity to a WTG, obstacle lighting is recommended to ensure visibility in low light and deteriorating atmospheric conditions. If CASA or a planning authority decide that obstacle lighting is required there are impact reduction measures that can be implemented to reduce the impact of lighting on surrounding neighbours, including: • reducing the number of WTGs 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. These measures are designed to optimise the benefit of the obstacle lights to pilots while minimising the visual impact to residents within and around the Project area. Consideration may be given to activating the obstacle lighting via a pilot activated lighting system. An option is to consider using Aircraft Detection Lighting Systems (referred in the United States Federal Aviation Administration Advisory Circular AC70/7460-1L CHG1 – *Obstruction Marking and Lighting*). 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.
Residual Risk Not installing obstacle lights would clearly be an acceptable outcome to those potentially affected by visual impact. If lighting is required, consideration of visual impact in the lighting design should enable installation of lighting that reduces the impact to neighbours. The likelihood of a **Moderate** consequence remains **Likely**, with a resulting risk level of **7 – Tolerable**. **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.

Residual Risk	7 - Tolerable

10. CONCLUSIONS

The key conclusions of this AIA are summarised as follows:

10.1. Planning considerations

The Project as proposed satisfies both the Hay Local Environmental Plan 2011 and Edward River Local Environmental Plan 2013.

The Project will not create incompatible intrusions or compromise the safety of existing certified airports and associated navigation and communication facilities.

10.2. Aviation Impact Statement

Based on the proposed Project WTG layout and maximum blade tip height of 280 m AGL, the highest wind turbines (105,106,107,108) will not exceed 376 m (1233.6 ft AMSL).

The Project WTGs and WMTs:

- Would not infringe any OLS surfaces
- Would infringe the YHAY 25 nm MSA PANS-OPS surface and would require an increase of the minimum altitude to 2300 ft to accommodate the Project
- Would not infringe the two YHAY instrument approach procedures but amendments would be required due to the 25 nm MSA increase requirement
- Would not have a significant impact upon the Wargam ALA and the unidentified ALA as they have been confirmed with the owners as non-operational
- Would have an impact on the grid LSALTs, requiring an increase to 2300 ft AMSL for the particular Grids
- Would impact air route LSALT for H247, W762, requiring an increase to 2300 ft AMSL for the particular route segments
- Would be wholly contained within Class G airspace
- Would be outside the clearance zones associated with civil aviation navigation aids and ATC surveillance facilities.

10.3. Aircraft operator characteristics

Aircraft will be required to navigate around the Project area in low cloud conditions where aircraft need to fly at 500 ft AGL.

Aircraft flying at night in visual conditions are permitted to descend or climb to an appropriate minimum altitude when within 3 nm of the aerodrome.

WTGs 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.

10.4. Hazard marking and lighting

The following conclusions apply to hazard marking and lighting:

- Aviation Projects has undertaken a safety risk assessment of the Project and concludes that WTGs and WMTs located within the wind farm, would not require obstacle lighting to maintain an acceptable level of safety to aircraft
- With respect to marking of WTGs, a white colour will provide sufficient contrast with the surrounding environment to maintain an acceptable level of safety while lowering visual impact to the neighbouring residents
- WMTs should be marked according to the requirements set out in Manual of Standards (MOS) 139 Section 8.10 (as modified by the guidance in NASF Guideline D). Aviation marker balls and painting the top 1/3 of WMTs structures in red and white bands is considered to be an acceptable mitigation strategy
- For WMTs installed prior to WTG installation and for those WMTs that are not in close proximity to a WTG, there will be an acceptable level of aviation safety risk associated with the potential for an aircraft collision provided obstacle lighting is fitted with medium intensity lighting at the top of the mast to ensure visibility in low light and deteriorating atmospheric conditions.

10.5. Summary of risks

A summary of the level of residual risk associated with the Project with the Recommended Treatments implemented, is provided in Table 16.

Table 16 Summary of Residual Risks

Identified Risk	*Consequence*	*Likelihood*	*Risk*	*Actions Required*
Aircraft collision with wind turbine generator (WTG)	Catastrophic	Unlikely	7	**Acceptable without obstacle lighting (ALARP).** Communicate details of the Project WTGs to local and regional operators and make arrangements to publish details in ERSA for surrounding aerodromes before, during and following construction.
Aircraft collision with wind monitoring tower (WMT)	Catastrophic	Unlikely	7	**Acceptable without obstacle lighting (ALARP).** Although there is no obligation to do so, consideration has been made for marking the WMTs according to the requirements set out in MOS 139 Chapter 8 Division 10 Obstacle Markings, specifically 8.110 (5), (7) and (8). Communicate details of WMTs to local and regional operators and make arrangements to publish details in ERSA for surrounding aerodromes following construction.
Avoidance manoeuvring leads to ground collision	Catastrophic	Unlikely	7	**Acceptable without obstacle lighting (ALARP).** Communicate details of the Project WTGs and WMTs to local and regional operators and make arrangements to publish details in ERSA for

Identified Risk	Consequence	Likelihood	Risk	Actions Required
				surrounding aerodromes before, during and following construction.
Effect on crew	Minor	Possible	5	**Acceptable without obstacle lighting (ALARP)** Communicate details of the Project WTGs and WMTs to local and regional operators and make arrangements 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.

11. RECOMMENDATIONS

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

Notification and reporting

1. CASR 139.165 requires the owner of a structure (or applicants of a structure) that will 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 timeframe for construction. This is to allow CASA to assess the effect of the structure on aircraft operations and determine whether or not the structure will be hazardous to aircraft operations.
   The applicant is required to report the WMT to CASA in accordance with CASR 139.165, as soon as practicable after forming the intention to construct or erect the proposed object or structure. The notification should be provided to CASA via email to Airspace.Protection@casa.gov.au

2. 'As constructed' details of WTGs and the WMT coordinates and elevation should be provided to Airservices Australia, 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 . Ideally this should only be done if potential impacts have been considered – through an aviation impact assessment or by sending the details to Airservices Australia in advance of the mast being erected, at this email address: airport.developments@airservicesaustralia.com .

3. Any obstacles above 100 m AGL (including temporary construction equipment) should be reported to Airservices Australia NOTAM office for notification to pilots by NOTAM, 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:

   c. The planned operational timeframe and maximum height of the crane; and

   d. Either the general area within which the crane will operate and/or the planned route with timelines that crane operations will 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 WTGs, WMTs 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 Applicant 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 WTGs

7. The rotor blades, nacelle and the supporting mast of the WTGs should be painted white, typical of most WTGs operational in Australia. No additional marking measures are required for WTGs.

Lighting of WTGs

8. Aviation Projects' Lighting Risk Assessment has concluded that the Project will not require obstacle lighting to maintain an acceptable level of safety to aircraft operating in the area both by day and by night.

Marking of wind monitoring towers

9. Consideration should be given to marking the WMTs according to the requirements set by the guidance in NASF Guideline D. Specifically:

    d. marker balls or high visibility flags or high visibility sleeves should be placed on the outside guy wires

    e. paint markings should be applied in alternating contrasting bands of colour to at least the top 1/3 of the mast

    f. ensuring the guy wire ground attachment points have contrasting colours to the surrounding ground/vegetation.

Micrositing

10. The potential micrositing of the WTGs and WMTs during construction has been considered in the assessment with the estimate of the overall maximum height being based on the highest ground level within 300 m of the nominal WTG and WMT positions. Providing the micrositing is within 300 m of the WTGs and WMTs 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 AIA would remain the same.

Overhead transmission line

11. 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 application operators and marked in accordance with Part 139 MOS 2019 Chapter 8 Division 10 section 8.110 (7) and section 8.110 (8).

Triggers for review

12. Triggers for review of this risk assessment are provided for consideration:

    d. prior to construction to ensure the regulatory framework has not changed

    e. following any significant changes to the context in which the assessment was prepared, including the regulatory framework

    f. following any near miss, incident or accident associated with operations considered in this risk assessment.

AVIATION PROJECTS

ANNEXURES

1. References
2. Definitions
3. CASA regulatory requirements – Lighting and Marking
4. Risk Framework
5. WTG and WMT coordinates and heights

ANNEXURE 1 – REFERENCES

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

- Airservices Australia, Aeronautical Information Package dated 30 November 2023 and 21 March 2024
- Hay Hire Council - Local Environmental Plan 2011
- Edward River Council - Local Environmental Plan 2013
- Civil Aviation Safety Authority:
    - Civil Aviation Regulations 1988 (CAR)
    - Civil Aviation Safety Regulations 1998 (CASR)
    - Advisory Circular (AC) 91-10 v1.1: *Operations in the vicinity of non-controlled aerodromes*, dated November 2021
    - Advisory Circular 139.E-01 v1.0—Reporting of Tall Structures , dated December 2021
    - Advisory Circular (AC) 139.E-05 v1.0 Obstacles (including wind farms) outside the vicinity of a CASA certified aerodrome
    - CASR Part 139 Manual of Standards 2019 (Aerodromes), dated 5 September 2019
    - CASR Part 173 Manual of Standards– Standards Applicable to Instrument Flight Procedure Design, version 1.5, dated March 2016
- NSW Government Department of Planning and Environment – SEARS SSD-59235464 dated 10 July 2023
- 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
- 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, effective 14 February 2024
- Standards Australia, ISO 31000:2018 *Risk management – Guidelines*

ANNEXURE 2 – DEFINITIONS

Term	*Definition*
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: 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
Applicant	Someva Pty Ltd
Application	Application for Development Consent under Part 4.7 of the EP&A Act; and Determination under Part 9 of the EPBC Act
Associated Dwelling	Habitable dwelling which does have an agreement with the Project
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

Term	*Definition*
National Airports Safeguarding Framework (NASF)	The 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.
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.
Pottinger Energy Park	Combination of the Solar Farm and Wind Farm projects for which separate Applications are being made
Project	The Pottinger Wind Farm to which the Application applies
Project Area	Red boundary shown on key figures to which the Application applies (unless otherwise stipulated)
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: 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.

ANNEXURE 3 – 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 applicants of a structure) that will 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 timeframe for construction. This is to allow CASA to assess the effect of the structure on aircraft operations and determine whether the structure will 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.

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*

    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. RAAF and Airservices Australia require information on structures which are:

a) 30 metres or more above ground level—within 30 kilometres of an aerodrome; or

b) 45 metres or more above ground level elsewhere for the RAAF, or

c) 30 m or more above ground level elsewhere for Airservices Australia.

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 WTGs 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 WTGs, 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;*
> >
> > *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 at half the nacelle height of at least three low-intensity Type E lights, as specified in 6.2.1.3, 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

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;*
    - 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 ☐ 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 lower 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 ± 25% cd when the background luminance is 50 cd/m² or greater.*

Visual impact of night lighting

Annex 14 Section 6.2.4 and Part 139 MOS 2019 Chapter 9 are specifically intended for WTGs 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;
- 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 WTG.

Marking of WTGs

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 WTGs should be painted a shade of white, unless otherwise indicated by an aeronautical study.

It is generally accepted that a shade of white colour will provide sufficient contrast with the surrounding environment to maintain an acceptable level of safety while lowering visual impact to the neighbouring residents.

Wind monitoring towers

The details of the WMT were introduced in **Section 4** of this report.

Consideration could be given to marking any WMTs according to the requirements set out in Part 139 MOS 2019 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:

- 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 application 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.

Temporary WMTs installed prior to WTG installation and WMTs not in close proximity to a WTG should be lit with medium-intensity steady red obstacle lighting at the top of the WMT mast. Characteristics of medium-intensity obstacle lighting is contained in MOS 139, Section 9.33

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 application operators and marked in accordance with 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 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.

ANNEXURE 4 – RISK 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 1.

Table 1 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 2.

Table 2 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.

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 5
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.

AVIATION PROJECTS

ANNEXURE 5 – PROJECT WTG AND WMT COORDINATES AND HEIGHTS

WTG details provided by RPS - Reference file: WTG V9.120240219 EIS Coordinates.xlsx

GDA2020 MGA 55

WTG #	X	Y	Terrain elevation (m AHD)	WTG Height AGL (m)	Maximum Height (m AHD)	Maximum Height (ft AMSL)
WP1	306583.3	6141314	89.14	280	369.1	1211.1
WP2	306977.7	6140944	89.01	280	369.0	1210.6
WP3	307977.2	6141474	89.24	280	369.2	1211.4
WP4	308421.4	6141102	89.05	280	369.0	1210.8
WP5	308809.7	6140773	89.36	280	369.4	1211.8
WP6	309605.6	6141492	89.80	280	369.8	1213.2
WP7	310258.9	6141485	90.13	280	370.1	1214.3
WP8	310754.3	6141023	90.15	280	370.2	1214.4
WP9	310966.4	6140490	90.37	280	370.4	1215.1
WP10	311344.7	6140157	90.38	280	370.4	1215.2
WP11	311889.9	6139995	90.78	280	370.8	1216.5
WP12	312276.2	6139662	90.48	280	370.5	1215.5
WP13	312846.6	6139303	91.08	280	371.1	1217.5
WP14	312026	6141242	91.07	280	371.1	1217.4
WP15	312995.6	6140825	92.58	280	372.6	1222.4
WP16	311627.2	6137019	90.33	280	370.3	1215.0
WP17	311704.6	6136406	90.32	280	370.3	1215.0
WP18	312526.1	6136351	90.35	280	370.3	1215.0
WP19	310961.2	6136205	89.99	280	370.0	1213.9
WP20	311372	6135274	89.87	280	369.9	1213.5
WP21	312021.2	6135041	90.01	280	370.0	1214.0
WP22	312383.4	6134684	90.19	280	370.2	1214.5
WP23	312991.9	6134593	90.26	280	370.3	1214.8
WP24	313074.4	6135420	90.48	280	370.5	1215.5
WP25	313704.4	6135316	90.72	280	370.7	1216.3

WTG #	*X*	*Y*	*Terrain elevation (m AHD)*	*WTG Height AGL (m)*	*Maximum Height (m AHD)*	*Maximum Height (ft AMSL)*
WP26	314125.4	6134910	90.77	280	370.8	1216.4
WP27	314884.4	6135812	91.14	280	371.1	1217.6
WP28	315681.2	6136342	91.10	280	371.1	1217.5
WP29	316480.2	6137366	91.22	280	371.2	1217.9
WP30	317442.8	6137999	91.66	280	371.7	1219.4
WP31	317833	6137672	91.80	280	371.8	1219.8
WP32	318228.6	6137344	91.84	280	371.8	1219.9
WP33	318845.1	6137353	92.37	280	372.4	1221.7
WP34	319499.8	6137094	92.42	280	372.4	1221.8
WP35	314618.3	6137640	90.72	280	370.7	1216.3
WP36	314353.8	6139169	91.44	280	371.4	1218.6
WP37	315223.2	6138528	91.21	280	371.2	1217.9
WP38	315653	6138169	91.49	280	371.5	1218.8
WP39	315655	6139362	91.38	280	371.4	1218.4
WP40	316539.1	6140713	91.78	280	371.8	1219.7
WP41	317973.1	6139629	91.97	280	372.0	1220.4
WP42	318364.7	6139308	92.27	280	372.3	1221.4
WP43	318756.8	6138977	91.89	280	371.9	1220.1
WP44	319152.8	6138650	92.16	280	372.2	1221.0
WP45	319544.2	6138326	92.65	280	372.7	1222.6
WP46	319933.2	6138005	92.73	280	372.7	1222.9
WP47	320324.6	6137676	92.82	280	372.8	1223.1
WP48	320727.2	6137338	92.71	280	372.7	1222.8
WP49	321111.7	6137019	91.92	280	371.9	1220.2
WP50	319229.2	6139900	92.19	280	372.2	1221.1
WP51	319647.8	6139623	92.16	280	372.2	1221.0
WP52	320033.7	6139266	92.19	280	372.2	1221.1
WP53	320419.1	6138953	92.10	280	372.1	1220.8
WP54	320903.5	6138696	92.62	280	372.6	1222.5

WTG #	*X*	*Y*	*Terrain elevation (m AHD)*	*WTG Height AGL (m)*	*Maximum Height (m AHD)*	*Maximum Height (ft AMSL)*
WP55	321309.7	6138200	92.86	280	372.9	1223.3
WP56	320137.1	6140519	92.40	280	372.4	1221.8
WP57	320530.4	6140192	92.44	280	372.4	1221.9
WP58	320983.2	6139850	92.48	280	372.5	1222.0
WP59	321448.1	6139521	92.72	280	372.7	1222.8
WP60	321044.2	6141109	92.92	280	372.9	1223.5
WP61	321641.4	6140824	92.97	280	373.0	1223.7
WP62	321120.8	6142238	92.71	280	372.7	1222.8
WP63	321503.8	6141921	92.71	280	372.7	1222.8
WP64	321896.2	6141616	92.54	280	372.5	1222.3
WP65	320837.2	6143242	92.87	280	372.9	1223.3
WP66	321540.4	6143242	93.12	280	373.1	1224.2
WP67	322340.3	6142678	93.14	280	373.1	1224.2
WP68	321185	6144066	93.20	280	373.2	1224.4
WP69	321897.5	6144220	93.29	280	373.3	1224.7
WP70	322350.3	6143977	93.27	280	373.3	1224.6
WP71	322796	6143553	93.19	280	373.2	1224.4
WP72	324522.2	6142408	92.78	280	372.8	1223.0
WP73	325072.3	6142155	93.48	280	373.5	1225.3
WP74	323574.3	6143940	93.43	280	373.4	1225.2
WP75	324146	6143820	93.61	280	373.6	1225.7
WP76	324715.6	6143687	93.40	280	373.4	1225.1
WP77	325100.5	6143357	93.50	280	373.5	1225.4
WP78	325493.6	6143024	93.26	280	373.3	1224.6
WP79	325889.3	6142691	92.84	280	372.8	1223.2
WP80	326345.6	6142454	93.93	280	373.9	1226.8
WP81	326733.1	6141966	94.21	280	374.2	1227.7
WP82	327339.7	6142073	94.25	280	374.3	1227.9
WP83	327072.7	6143290	94.06	280	374.1	1227.2

WTG #	X	Y	Terrain elevation (m AHD)	WTG Height AGL (m)	Maximum Height (m AHD)	Maximum Height (ft AMSL)
WP84	327751	6143149	94.35	280	374.4	1228.2
WP85	328125.3	6142802	94.39	280	374.4	1228.3
WP86	328512	6142468	94.47	280	374.5	1228.6
WP87	328889.4	6142129	94.76	280	374.8	1229.5
WP88	319786.9	6146061	93.81	280	373.8	1226.4
WP89	320151	6145746	93.54	280	373.5	1225.5
WP90	320507.9	6145432	93.36	280	373.4	1224.9
WP91	321274	6145934	93.68	280	373.7	1226.0
WP92	322193.2	6145821	93.75	280	373.7	1226.2
WP93	322583.5	6145489	93.97	280	374.0	1226.9
WP94	322976	6145159	93.87	280	373.9	1226.6
WP95	323387.6	6144838	93.78	280	373.8	1226.3
WP96	324192	6144817	93.92	280	373.9	1226.8
WP97	324826.5	6145686	94.36	280	374.4	1228.2
WP98	325215	6145350	94.64	280	374.6	1229.1
WP99	325595.9	6145011	94.53	280	374.5	1228.8
WP100	325980	6144677	94.34	280	374.3	1228.1
WP101	326364.2	6144338	94.00	280	374.0	1227.0
WP102	326932.3	6144202	94.11	280	374.1	1227.4
WP103	327654	6144157	94.26	280	374.3	1227.9
WP104	328162.4	6143956	94.52	280	374.5	1228.7
WP105	326451.8	6145566	95.21	280	375.2	1231.0
WP106	327024.5	6145404	95.20	280	375.2	1231.0
WP107	327647.3	6145376	96.03	280	376.0	1233.7
WP108	328025.2	6144992	95.45	280	375.5	1231.8
WP132	317436.4	6136849	91.79	280	371.8	1219.8
WP133	317904.5	6136531	91.78	280	371.8	1219.7
WP134	318601.3	6136687	92.07	280	372.1	1220.7
WP135	318974	6136267	91.90	280	371.9	1220.2

WTG #	*X*	*Y*	*Terrain elevation (m AHD)*	*WTG Height AGL (m)*	*Maximum Height (m AHD)*	*Maximum Height (ft AMSL)*
WP136	316656	6136287	91.43	280	371.4	1218.6
WP137	317113.2	6136034	91.43	280	371.4	1218.6
WP138	317539.6	6135714	91.72	280	371.7	1219.6
WP139	318190.7	6135723	91.36	280	371.4	1218.4
WP140	315861.4	6135755	90.76	280	370.8	1216.4
WP141	316305.2	6135471	91.56	280	371.6	1219.0
WP142	316720.7	6135261	91.66	280	371.7	1219.4
WP143	315075.5	6135218	91.09	280	371.1	1217.5
WP144	315521.9	6134946	91.17	280	371.2	1217.7
WP145	315969.5	6134669	91.38	280	371.4	1218.4
WP146	316200.9	6134183	91.30	280	371.3	1218.2
WP147	316650.1	6133914	91.32	280	371.3	1218.3
WP148	314740.8	6134408	90.79	280	370.8	1216.5
WP149	315187	6134137	90.63	280	370.6	1216.0
WP150	315413.6	6133641	91.09	280	371.1	1217.5
WP151	315837.9	6133320	91.04	280	371.0	1217.3
WP152	316210.5	6132983	90.87	280	370.9	1216.8
WP153	314009.1	6134204	90.45	280	370.5	1215.4
WP154	314410	6133579	90.50	280	370.5	1215.5
WP156	314624.4	6133095	90.29	280	370.3	1214.9
WP157	315046.5	6132798	90.51	280	370.5	1215.6
WP158	315427.6	6132456	90.26	280	370.3	1214.8
WP159	315885.6	6132167	90.07	280	370.1	1214.2
WP160	316258.5	6131821	90.10	280	370.1	1214.2
WP161	316945	6131703	90.80	280	370.8	1216.5
WP162	319439.9	6132576	91.68	280	371.7	1219.4
WP163	320179.9	6132818	91.69	280	371.7	1219.5
WP164	320964.9	6133302	91.74	280	371.7	1219.6
WP165	320565.8	6132478	92.54	280	372.5	1222.2

WTG #	*X*	*Y*	*Terrain elevation (m AHD)*	*WTG Height AGL (m)*	*Maximum Height (m AHD)*	*Maximum Height (ft AMSL)*
WP166	320750.4	6131943	92.40	280	372.4	1221.8
WP167	319958.5	6131668	91.97	280	372.0	1220.4
WP168	319582.1	6132009	91.96	280	372.0	1220.3
WP169	318673.7	6131925	91.45	280	371.4	1218.7
WP170	319078.5	6131177	91.56	280	371.6	1219.0
WP171	318408.5	6131123	91.00	280	371.0	1217.2
WP172	317799.8	6131155	91.17	280	371.2	1217.7
WP173	319461.1	6130834	92.00	280	372.0	1220.5
WP174	319953	6130606	92.24	280	372.2	1221.3
WP175	320359.2	6130279	92.69	280	372.7	1222.7
WP176	313725.6	6133528	90.19	280	370.2	1214.5
WP177	313851.3	6132749	90.00	280	370.0	1213.9
WP178	314254.4	6132270	89.72	280	369.7	1213.0
WP179	314609.8	6131897	89.63	280	369.6	1212.7
WP180	315079.9	6131640	89.71	280	369.7	1213.0
WP181	315719.7	6131414	90.32	280	370.3	1214.9
WP182	316160.1	6131083	90.21	280	370.2	1214.6
WP183	316639.3	6130834	90.24	280	370.2	1214.7
WP184	317044.6	6130499	90.34	280	370.3	1215.0
WP185	317730.2	6130393	90.73	280	370.7	1216.3
WP186	318661.6	6130350	91.27	280	371.3	1218.1
WP187	319108.7	6130078	91.62	280	371.6	1219.2
WP188	319570.7	6129771	91.89	280	371.9	1220.1
WP189	319985.8	6129459	92.17	280	372.2	1221.0
WP190	320390.8	6129132	92.42	280	372.4	1221.9
WP191	317880.5	6129857	91.19	280	371.2	1217.8
WP192	318328.2	6129551	91.39	280	371.4	1218.5
WP193	318750.1	6129180	91.77	280	371.8	1219.7
WP194	319182	6128902	92.00	280	372.0	1220.5

WTG #	X	Y	Terrain elevation (m AHD)	WTG Height AGL (m)	Maximum Height (m AHD)	Maximum Height (ft AMSL)
WP195	319588.5	6128585	92.21	280	372.2	1221.1
WP196	320009.6	6128256	92.14	280	372.1	1220.9
WP197	320283.6	6127796	92.09	280	372.1	1220.8
WP198	312884.7	6133185	89.45	280	369.4	1212.1
WP199	312653.7	6132517	89.29	280	369.3	1211.6
WP200	313071.2	6132242	89.24	280	369.2	1211.4
WP201	313480.7	6131933	89.26	280	369.3	1211.5
WP202	313827.5	6131454	89.39	280	369.4	1211.9
WP203	314293.5	6131087	89.46	280	369.5	1212.1
WP204	314714.5	6130608	89.83	280	369.8	1213.3
WP205	315371.3	6130569	90.06	280	370.1	1214.1
WP206	315874.9	6130308	90.22	280	370.2	1214.6
WP207	316256.2	6129996	90.37	280	370.4	1215.1
WP208	316966	6129791	90.70	280	370.7	1216.2
WP209	317110.5	6129232	91.28	280	371.3	1218.1
WP210	317545.8	6128956	91.53	280	371.5	1218.9
WP211	317976.8	6128686	91.57	280	371.6	1219.1
WP212	318350.3	6128345	91.80	280	371.8	1219.8
WP213	318800.2	6128056	91.71	280	371.7	1219.5
WP214	319216.6	6127760	91.96	280	372.0	1220.3
WP215	319505.1	6127327	91.79	280	371.8	1219.8
WP216	312695.7	6131390	88.60	280	368.6	1209.3
WP217	313051.9	6131013	88.77	280	368.8	1209.9
WP218	313505.6	6130649	88.96	280	369.0	1210.5
WP219	313858.3	6130264	89.37	280	369.4	1211.9
WP220	314154.2	6129787	89.83	280	369.8	1213.3
WP221	314790.5	6129759	89.98	280	370.0	1213.8
WP222	315287.2	6129718	90.17	280	370.2	1214.5
WP224	312259.1	6130494	88.52	280	368.5	1209.1

WTG #	X	Y	Terrain elevation (m AHD)	WTG Height AGL (m)	Maximum Height (m AHD)	Maximum Height (ft AMSL)
WP225	312701.6	6130209	88.73	280	368.7	1209.7
WP226	313058.3	6129813	88.66	280	368.7	1209.5
WP227	313374.8	6129391	88.79	280	368.8	1209.9
WP228	313908.2	6128543	89.90	280	369.9	1213.6
WP230	314769.6	6128418	90.56	280	370.6	1215.7
WP231	309411	6130469	88.86	280	368.9	1210.2
WP232	309139.1	6129666	89.02	280	369.0	1210.7
WP233	309913.8	6129999	89.06	280	369.1	1210.8
WP234	310348.4	6129714	89.01	280	369.0	1210.7
WP235	314019.5	6128049	90.07	280	370.1	1214.1
WP236	314404.2	6127701	90.23	280	370.2	1214.7
WP237	314789.6	6127361	89.92	280	369.9	1213.6
WP238	315217.1	6128210	90.77	280	370.8	1216.4
WP239	315910.3	6128325	91.01	280	371.0	1217.2
WP240	316579.6	6128382	91.36	280	371.4	1218.4
WP241	317011.8	6128106	91.42	280	371.4	1218.6
WP242	318428.7	6127238	90.98	280	371.0	1217.1
WP243	318720.8	6126806	90.95	280	370.9	1217.0
WP244	319096	6126458	91.17	280	371.2	1217.7
WP246	319883.3	6126981	91.32	280	371.3	1218.2
WP247	320093.4	6126473	91.31	280	371.3	1218.2
WP248	315533.1	6126810	89.76	280	369.8	1213.1
WP249	315560.6	6127513	90.20	280	370.2	1214.6
WP250	316228.9	6127562	90.55	280	370.6	1215.7
WP251	316646.3	6127270	90.48	280	370.5	1215.5
WP252	317078.7	6126963	90.41	280	370.4	1215.3
WP253	319306.8	6125949	91.12	280	371.1	1217.6
WP254	319734.1	6125659	91.04	280	371.0	1217.3
WP255	319998	6125202	91.52	280	371.5	1218.9

WTG #	X	Y	Terrain elevation (m AHD)	WTG Height AGL (m)	Maximum Height (m AHD)	Maximum Height (ft AMSL)
WP256	317940.9	6126406	90.70	280	370.7	1216.2
WP257	318308.6	6125974	90.99	280	371.0	1217.1
WP258	318509.6	6125454	91.37	280	371.4	1218.4
WP259	318924.3	6125137	91.50	280	371.5	1218.8
WP260	319420.5	6124390	91.94	280	371.9	1220.3
WP261	319807.1	6124050	91.99	280	372.0	1220.4
WP262	316386	6126222	89.99	280	370.0	1213.9
WP263	316936.7	6126090	90.38	280	370.4	1215.1
WP264	317238.7	6125662	90.29	280	370.3	1214.8
WP265	317571.7	6125263	90.76	280	370.8	1216.4
WP266	317751.9	6124732	90.64	280	370.6	1216.0
WP267	318283.6	6124557	91.72	280	371.7	1219.6
WP268	318612.5	6123839	91.59	280	371.6	1219.1
WP269	316041.1	6125400	89.28	280	369.3	1211.6
WP270	316454.9	6125083	89.43	280	369.4	1212.0
WP271	316829	6124828	89.60	280	369.6	1212.6
WP272	316969.9	6124153	89.46	280	369.5	1212.1
WP273	315679.7	6124466	89.12	280	369.1	1211.0
WP274	316004.4	6124053	89.19	280	369.2	1211.3

WMT details provided by RPS - Reference file: Operational Mast Locations ID.xlsx

ID	Latitude	Longitude	Terrain Elevation (m AHD)	WMT Height (m AGL)	WMT Elevation (m AMSL)	WMT Elevation (ft AMSL)
1	34°59'4.76"S	144°58'19.81"E	89.60	180	269.60	884.51
2	35° 0'44.16"S	145° 1'29.61"E	91.76	180	271.76	891.59
3	34°56'40.44"S	144°58'40.75"E	89.84	180	269.84	885.30
4	34°55'55.91"S	144°56'55.40"E	89.36	180	269.36	883.74
5	34°51'28.94"S	144°57'13.97"E	94.33	180	274.33	900.05
6	34°50'41.06"S	145° 4'41.87"E	93.35	180	273.35	896.81
7	34°51'2.01"S	145° 7'44.33"E	94.76	180	274.76	901.43
8	34°48'39.37"S	145° 1'55.82"E	93.77	180	273.77	898.19
9	34°54'16.47"S	145° 2'38.06"E	91.99	180	271.99	892.34
10	34°51'1.63"S	144°53'2.27"E	89.30	180	269.30	883.52
Met Mast	34°52'16.48"S	145° 0'53.70"E	92.36	138	230.36	755.78

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