WILLATOOK WIND FARM

Planning Application Report

Appendix O Aviation

APRIL 2022

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FINAL REPORT

WILLATOOK WIND FARM

AERONAUTICAL IMPACT ASSESSMENT

CCP06W

12 April 2022
V2.0

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EXECUTIVE SUMMARY

The proposed wind farm will comprise of 59 turbines with a tip height of 250m Above Ground Level (AGL). The locations and heights of the 59 turbines are within the volume of airspace assessed by Airservices Australia for the original 86 turbine Aviation Impact Statement (September 2021), therefore the results of the original assessments remain valid.

There are three Regulated (certified) aerodromes within 30nm (56km) of the boundary of the Willatook Wind Farm (WWF). These are Portland (YPOD), Hamilton (YHML) and Warrnambool (YWBL). There are several known unregulated airstrips within 30nm of the wind farm.

The Aviation Impact Statement (AIS) concluded that the WWF will not impact upon the following:

- The Obstacle Limitation Surface (OLS) of any Regulated (certified) aerodrome;
- The Lowest Safe Altitude (LSALT) for air routes in the vicinity;
- The Procedures for Air Navigation Services ï Aircraft Operations (PANS-OPS) surfaces associated with the Instrument Approach Procedures (IAP) at:
  - Portland; or
  - Hamilton;
- The performance of civil Air Traffic Control (ATC) Communications, Navigation Aids and Surveillance (CNS) Facilities.
- The performance of Department of Defence CNS facilities

The AIS concluded that the WWF would impact upon the following:

- The PANS-OPS surface for the Warrnambool YWBL RNAV-Z RWY 13 non-precision instrument approach procedure

An amendment to this Instrument Approach Procedure is required to overcome the PANS-OPS penetration. Consultation with the Warrnambool aerodrome operator seeking support to have the amendments made to the YWBL RNAV-Z RWY 13 non-precision instrument approach procedure is taking place. Alternately, turbine heights could be reduced to remain under the PANS-OPS airspace.

A review of the known airstrips (unregulated aerodromes) in the vicinity of the WWF demonstrates that they will remain safe and usable for the current occasional aerial applications operations.

The Qualitative Risk Assessment demonstrates that for the WWF:

- By day, the wind turbines are conspicuous by their size and colour;
- Night operations of aircraft do not occur below prescribed airspace;
- Aerodromes equipped for night operations are sufficiently distant.

Obstacle Lighting Review for the WWF finds that in accordance with the National Airports Safeguarding Framework (NASF) Guideline D risk assessment:

- Obstacle lighting is not required as the risk to aviation is LOW and no additional mitigating strategies are necessary.

The WWF proponent will report the wind turbines and meteorological monitoring masts, as tall structures, to the Vertical Obstacle Database, managed by Airservices Australia in accordance with CASA Advisory Circular AC 139.E-01 v1.0 *Reporting of tall structures*.

The WWF is assessed as a LOW risk to aviation and is therefore not a hazard to aircraft safety.

1. INTRODUCTION

Willatook Wind Farm Pty. Ltd. has requested Chiron Aviation Consultants to undertake an Aeronautical Impact Assessment for the proposed Willatook Wind Farm in Western Victoria.

1.1 Location

The Willatook Wind Farm (WWF) is located between the towns of Willatook, Orford, Broadwater and Hawkesdale and is approximately 32km Northwest of Warrnambool. See Figure 1 below.

The proposed wind farm will comprise of 59 turbines with a tip height of 250m Above Ground Level (AGL). This turbine layout is within the boundaries of the original 83 turbine layout.

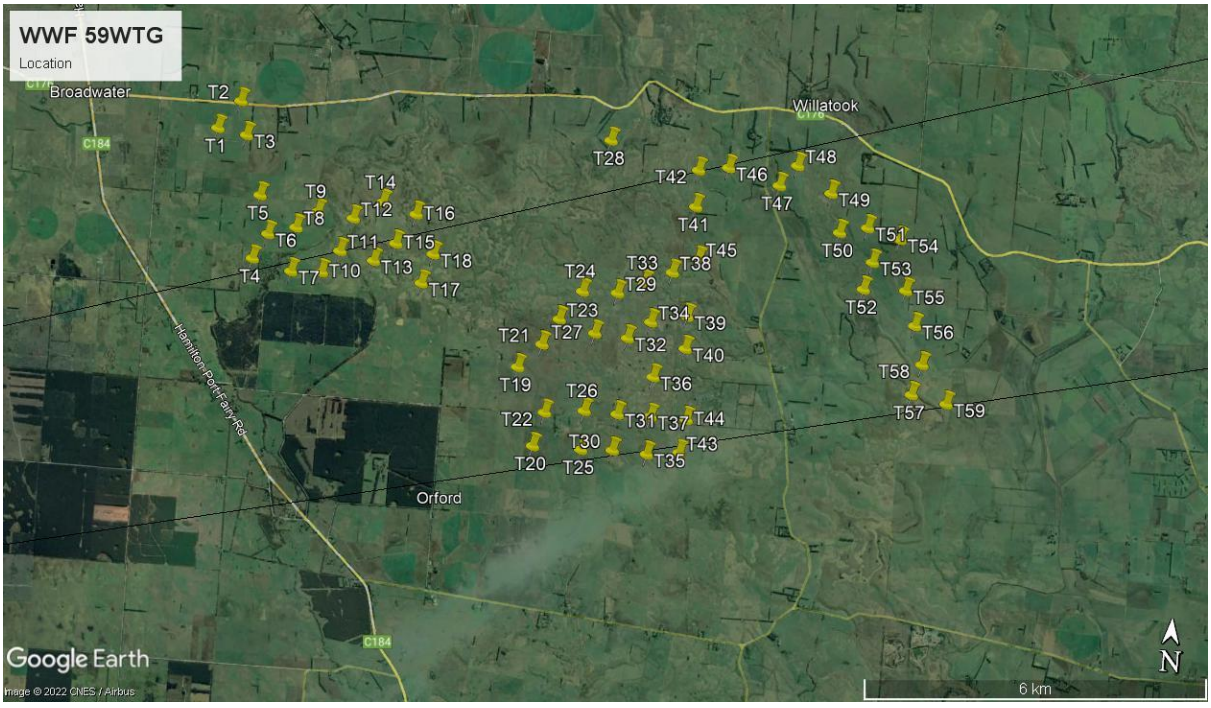

Figure 1 – Willatook Wind Farm Location

1.2 Aerodromes and Airstrips

Aerodromes fall into three categories:

- Military or Joint (combined military and civilian)
- Regulated (Certified) and
- Unregulated (Uncertified)

A Military aerodrome is operated by the Department of Defence and is suitable for the operation of military aircraft. A Joint User aerodrome is a Military aerodrome used by both military and civilian aircraft, for example Darwin International and Townsville International Airports.

A Regulated (certified) aerodrome is regulated under Civil Aviation Safety Regulation (CASR) 139.030. An aerodrome with a published instrument flight procedure must be regulated.

An Unregulated (uncertified) aerodrome is any other aerodrome, Aeroplane Landing Area (ALA) or airstrip. These range in capability and size from having a sealed runway with lighting capable of accommodating corporate jet aircraft to a grass paddock that is smooth enough to land a single engine light aircraft or a purpose built aerial agricultural aircraft.

Military, Joint and Regulated aerodromes are listed in the Aeronautical Information Publication[1] (AIP) and are subject to a NOTAM[2] service that provides the aviation industry with current information on the status of the aerodrome facilities. This information is held in the public domain, is available through aeronautical publications and charts and is kept current by mandatory reporting requirements.

Unregulated aerodromes are not required to be listed in the AIP, although many are, so information about them is not necessarily held in the public domain, may not be available through aeronautical publications and charts and is not required to be reported. Where Unregulated aerodrome information is published in the AIP EnRoute Supplement Australia (ERSA)[3] it is clearly annotated that a *full NOTAM service is not available*.

The AIP Designated Airspace Handbook (DAH)[4], at Section 20, lists *Aeroplane Landing Areas (ALA) without an ERSA entry – verified*. This listing of verified ALA indicates that Airservices Australia have a registered responsible person providing verified information about the ALA. These verified ALA are also depicted on AIP Charts.

ALA can come into use and fall out of use without any formal notification to CASA or any other authority. Airstrips that appear on survey maps often no longer exist; others exist but do not feature on maps. Similarly, a grass paddock used as an ALA is not usually

[1] AIP; a mandatory worldwide distribution system for the promulgation of aviation rules, procedures, and information
[2] NOTAM (Notice to Airmen); a mandatory reporting service to keep aerodrome and airways information current and available to the aviation industry worldwide
[3] ERSA, part of the AIP that lists aerodrome information in accordance with standards and legislative requirements to ensure integrity.
[4] DAH, part of the AIP that lists the pertinent details of Australian airspace and aerodromes

discernable on satellite mapping services such as Google Earth.

Military, Joint and Regulated aerodromes usually have Obstacle Limitation Surfaces (OLS) and Procedures for Air Navigation Services ï Aircraft Operations (PANS-OPS) surfaces prescribed to protect the airspace associated with published instrument approach and landing procedures. An unregulated aerodrome cannot have a published instrument approach and landing procedure so does not have associated prescribed airspace protected by OLS or PANS-OPS. All operations into ALA, therefore, must be conducted in accordance with the Visual Flight Rules (VFR) and in Visual Meteorological Conditions (VMC).

1.3 Aerodromes in the Area

There are three Regulated aerodromes at: -

- Portland (YPOD) situated 30.53nm (56.54km) West Southwest of the WWF at turbine T1
- Hamilton (YHML) situated 27.94nm (51.74km) Northwest of the WWF at T67; and
- Warrnambool (YWBL) situated 12.46 nm (23.07km) Southeast of the WWF at T57.

There is an Unregulated airstrip at Port Fairy, 11.14nm (20.64km) South of T38.

There are other known unregulated airstrips (ALA) on properties close to the wind farm. These airstrips are used occasionally for aerial applications flying.

1.4 Air Routes in the Area

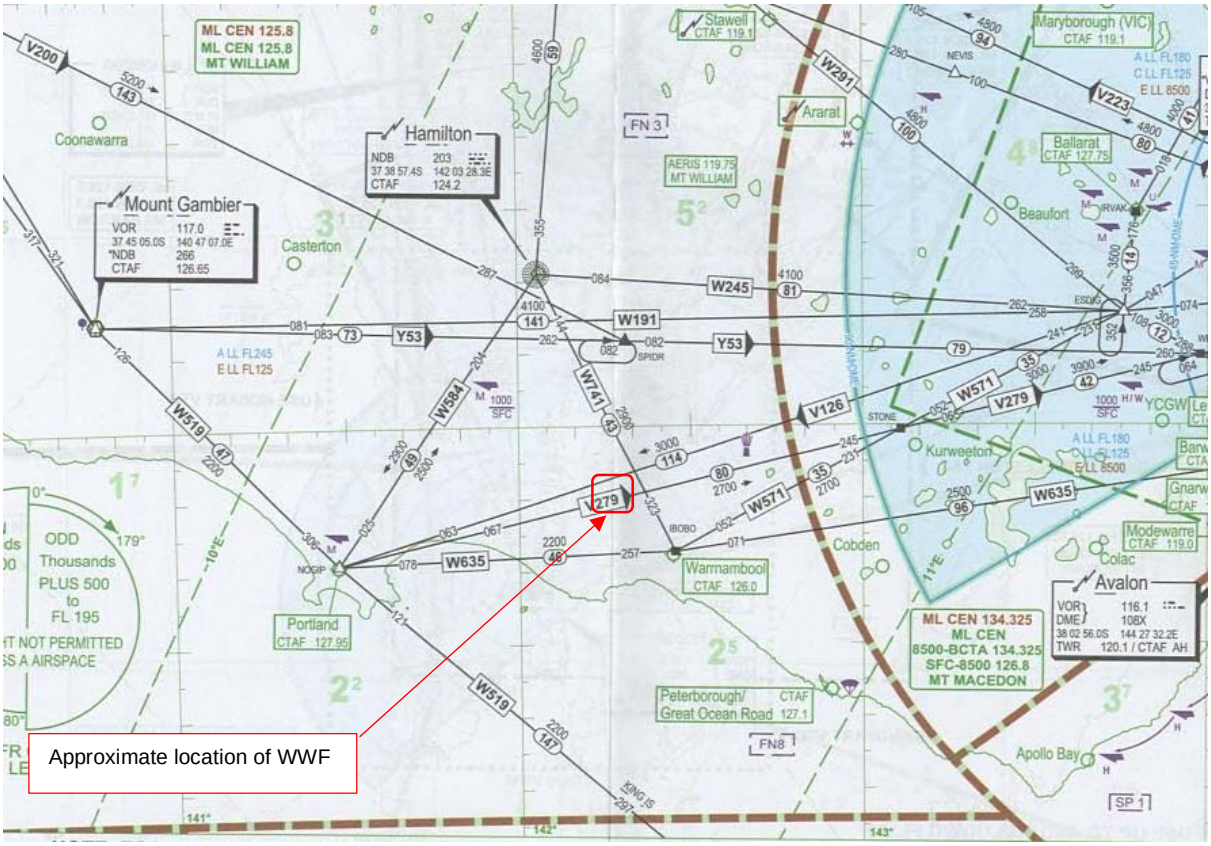

Figure 2 – Nearby Air Routes[5]

The WWF sits below three nearby air routes as shown in Figure 2.

1.5 Airspace in the Area

The WWF is in Class G airspace with Class E airspace above having a lower limit of FL125 (12,500ft).

Class G airspace is non-controlled airspace where aircraft may operate without an Air Traffic Control (ATC) clearance. Aircraft may operate in accordance with both Instrument Flight Rules (IFR) and Visual Flight Rules (VFR) within Class G airspace.

Class E airspace is controlled airspace open to both IFR and VFR flights. IFR aircraft must have an ATC clearance and communicate with the ATC Centre.

A Control Area (CTA) is defined as a ñcontrolled airspace extending upwards from a

[5] AIP ERC L2, dated 02 December 2021

specified limit above the earth.[6]ò

Within Class G airspace an aircraft flying in accordance with the Visual Flight Rules (VFR) away from a populous area is, when flying below 3000ft, required by Civil Aviation Safety Regulation (CASR) 91.267 to remain at 500ft above the highest point of the terrain and any obstacle on it within a radius of 600m [300m for a helicopter] from a point on the terrain directly below the aircraft. For a wind farm this equates to 500ft above the turbine tip height. For the WWF this is 820 + 500 = 1320ft Above Ground Level (AGL).

There are no Prohibited, Restricted or Danger (PRD) areas, nor published flying training areas in the vicinity of the WWF.

[6] AIP Enroute, ENR 1.4 ï 3, para 1.2.1, 02 December 2021

2. SCOPE

To meet the requirements of Willatook Wind Farm Pty Ltd, the study required Chiron Aviation Consultants to examine the WWF development in relation to any impacts on aviation activity in the area and undertake the following tasks.

2.1 Aviation Impact Statement

In August 2014, Airservices Australia (AsA) re-released a letter detailing requirements for an Aviation Impact Statement (AIS) for wind farm developments. The AsA letter requires that all developers of proposed wind farms prepare an Aviation Impact Statement and submit this to AsA for evaluation and consideration. A copy of this letter is shown at Appendix A.

The AIS required the following tasks to be undertaken: -

- Provide the coordinates and elevations of the Obstacles and associated topographical drawings;
- Specify all registered and certified aerodromes within 30nm (55.6km):
  - Nominate all instrument approach and landing procedures;
  - Confirm that the obstacles do not penetrate the Annex 14 OLS;
  - Confirm that the obstacles do not penetrate the PANS-OPS;
- Specify any published air routes over or near the obstacles
- Specify the airspace classification of the airspace surrounding the development
- Investigate any impact on aviation Communications, Navigation and Surveillance (CNS) facilities

Details of Aerodromes, OLS, PANS-OPS procedures, Lowest Safe Altitudes (LSALT), Navigation and Airspace Surveillance facilities were obtained from the Australian Aeronautical Information Publications (AIP), AsA sources and CASA publications.

2.2 Qualitative Risk Assessment

The QRA required the following tasks to be undertaken: -

- The identification and assessment of potential aviation risk elements through:
  - Reference to CASA publications;
  - Reference to the AIP;
  - Reference to the National Airports Safeguarding Framework (NASF) guidelines;
  - Consultations with key relevant stakeholders;
- Assessment of the perceived impacts of the turbines on the operation of aerodromes and airstrips in the immediate vicinity of the wind farm;

- Assessment of the perceived impacts of the turbines on aviation activity including:
  - General Aviation training;
  - Recreational/Commercial flying activity;
  - Air Ambulance Operations;
  - Police Aviation Operations;
  - Aerial Fire Fighting Operations;
  - Aerial Agricultural Operations;
  - Known highly trafficked VFR routes;
  - Night flying for light aircraft;
- Assessment of any implications for the above from topographical, weather and visibility issues;
- Assessment of other issues as identified through stakeholder consultations and the assessment process;
- Conclusions on the degree of aviation risk posed by the above described issues with commensurate recommendations on any mitigating actions; and
- An assessment of the need, against the outcomes of the Qualitative Risk Assessment, for obstacle lighting of the wind farm.

2.3 Airstrip Review

The airstrip review study required Chiron Aviation Consultants to examine the WWF development in relation to any impacts on existing use of the known airstrips in the area.

2.4 Obstacle Lighting Review

The OLR reviews the outcome of the QRA to determine the need or otherwise for risk mitigation by the lighting of turbines in the wind farm with aviation obstruction lighting.

3. METHODOLOGY

The following methodology was used to complete the tasks outlined in the scope.

3.1 Aviation Impact Statement

To meet Airservices Australia requirements for an Aviation Impact Statement the following methodology was used: -

- The obstacle (turbines and meteorological masts) coordinates and elevations were listed to the requisite accuracy and associated drawings and charts were obtained;
- The AIP was reviewed to determine;
  - All regulated and military/joint aerodromes located within 30nm (55.6km) of the wind farm
  - Any associated Instrument Departure and Approach Procedures (DAP);
  - The extent of the OLS and PANS-OPS surfaces for the identified DAP;
  - Published air routes located over or near the wind farm;
  - The classification of the airspace surrounding the wind farm;
- Ascertain the locations of CNS facilities that may be impacted and analyse the impact on;
  - Communications facilities;
  - Navigation facilities;
  - Surveillance facilities (in accordance with EUROCONTROL Guidelines); and
- Compile a report for review by Airservices Australia and Department of Defence.

3.2 Qualitative Risk Assessment

A Qualitative Risk Assessment is the analysis for risks, through facilitated interviews or meetings with stakeholders and outside experts, as to their probability of occurrence and impact expressed using non-numerical terminology, for example low, medium and high. The basis for the QRA is ASNZS ISO 31000-2018 *Risk Management –Guidelines.*

The methodology for the Qualitative Risk Assessment was as follows:

- The Australian AIP and CASA documents were reviewed to identify relevant physical and operational aviation issues that may impact on the requirement for lighting of the wind farm;
- Current topographical maps were studied to assess the local terrain and identify any local airstrips and any other relevant features;

- Key stakeholders, including local operators, recreational aviation groups and State Government Police Air Wing, Air Ambulance and Fire Services, were identified, contacted and interviewed to ascertain the extent of local aviation activity in the vicinity of the proposed wind farm. See Appendix G for a Stakeholder List. This included any informal low flying areas and highly trafficked unpublished air routes that may exist within the vicinity of the proposed wind farm;
- Based on the above, the nature of any impacts as a consequence of the operation of the wind farm was considered and discussed regarding;
  - General Aviation training;
  - Recreational and sport aviation activities;
  - Approved low flying activities (including aerial agricultural applications)
  - Any known highly trafficked VFR routes; and
  - Emergency Services (air ambulance, police and fire service);
- In addition, further consideration was given to the consequences (for the above elements) of the potential influence of topography and poor weather; and
- Consideration of the NASF, Guideline D *Managing the Risk to Aviation Safety of Wind Turbine Installations (Wind Farms)/Wind Monitoring Towers* in relation to the QRA findings.

3.3 Airstrip Review

The airstrip review utilises data provided by Willatook Wind Farm Pty Ltd; that obtained from aeronautical charts and survey maps; as well as electronic means such as Google Earth®. Google Earth was used to verify data from the other sources such as the VicMap 1:50,000 series survey maps and that provided by Willatook Wind Farm Pty Ltd.

Google Earth was used to plot the airstrip length and direction from the data obtained above. The location of the airstrip in relation to the nearest turbines was then plotted. From this data any likely impediment to the continued use of the airstrip was assessed.

3.4 Obstacle Lighting Review

The Obstacle Lighting Review investigates the current Australian standards and regulatory requirements for obstacle lighting of wind farms. From this review an assessment of the need or otherwise for aviation obstruction lighting is made.

The methodology for the Obstacle Lighting Review was as follows: -

- Review the Australian regulatory requirements and standards;
- Review the NASF Guidelines for wind farms; and
- From the QRA, assess the need for aviation obstruction lighting as a risk mitigator.

4. AVIATION IMPACT STATEMENT

The Aviation Impact Statement meets the requirements of Airservices Australia for their assessment of the WWF potential impact on the items listed in paragraph 3.1 above. The AIS is submitted to both Airservices Australia and the Department of Defence for assessment in relation to civil and military facilities.

4.1 Location

As noted in section 1.1 the WWF is located between the towns of Willatook, Orford, Broadwater and Hawkesdale and is approximately 32km Northwest of Warrnambool aerodrome (YWBL).

4.2 Obstacles

The WWF will comprise 59 turbines with a tip height of 250m AGL. The tallest turbine is T2 at 367m (1204.07ft) AHD. Rounded up this gives a tip height of 1204ft; add the Minimum Obstacle Clearance (MOC) of 1000ft gives a LSALT of 2204ft rounded up to the nearest hundred the LSALT over the WWF is 2300ft.

The turbine locations and elevations are shown at Appendix B. This appendix shows two versions of the WWF layout. The 59 turbine layout (V162_6_v080) is current.

The original 86 turbine layout tallest turbine T70 had a tip height of 372.8m AHD.

The current 59 turbine layout occupies a smaller area and has a lower maximum tip height AHD; therefore, it occupies a smaller volume within that originally assessed by Airservices Australia, therefor the original AIS assessment remains valid.

4.3 Drawings

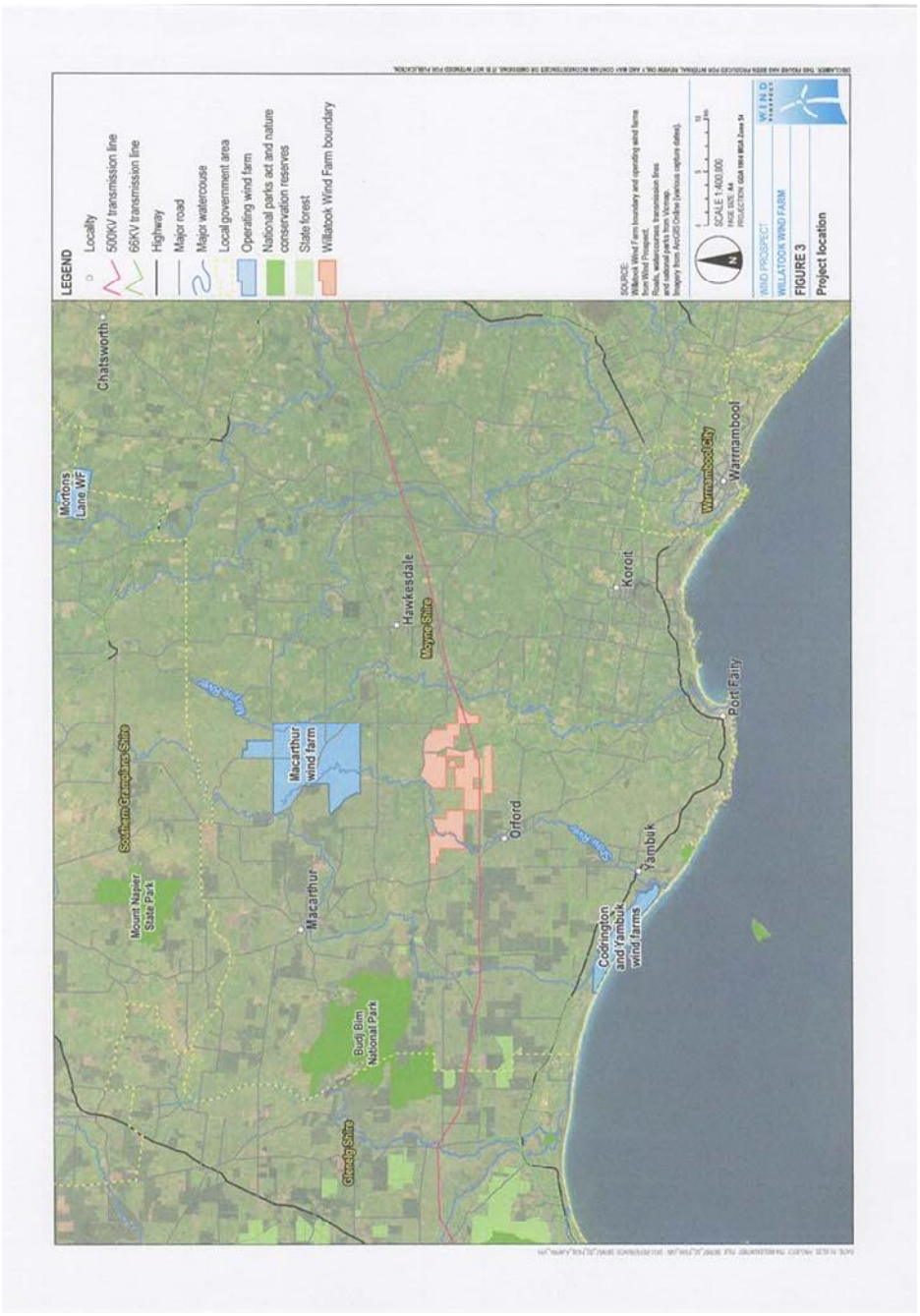

Figure 3 – Location of Willatook Wind Farm[7]

The drawing above shows the location of the WWF to the North of Port Fairy and Southeast of Macarthur.

[7] Supplied by Willatook Wind Farm Pty Ltd

4.4 Aerodromes within 30nm

There are three Regulated aerodromes within 30nm (55.56km) of the proposed WWF as detailed below.

4.4.1 Portland (YPOD)

Portland (YPOD) is located 30.53nm (56.54km) west southwest of WWF turbine T1. The main runway, RWY 08/26 is 1616m sealed and equipped with Pilot Activated Lighting (PAL). YPOD has non-precision RNAV-Z Instrument Approach Procedures (IAP) for Runways 08 and 26. The WWF is beyond the 15km Obstacle Limitation Surface (OLS) and the 25nm Minimum Safe Altitude (MSA) for YPOD.

The WWF does not affect the OLS, or PANS-OPS prescribed airspace of the IAP for YPOD.

4.4.2 Hamilton (YHML)

Hamilton (YHML) is located 29.48nm (56.40km) north northwest of WWF turbine T2. The main runway, RWY 17/35 is 1704m sealed and equipped with PAL. YHML has non-precision RNAV-Z IAP and an NDB-A ground based radio navigation aid IAP. The WWF is beyond the 15km OLS and the 25nm MSA for YHML. It is also below the 25nm MSA of 2700ft.

The WWF does not affect the OLS, or PANS-OPS prescribed airspace for the IAP at YHML.

4.4.3 Warrnambool (YWBL)

Warrnambool (YWBL) is located 12.43nm (23.03km) southeast of WWF turbine T59. The main runway, RWY 13/31 is 1372m sealed and equipped with PAL. YWBL is not available to aircraft with a Maximum Take Off Weight (MTOW) exceeding 5700kg without prior permission from the aerodrome operator. YWBL has non-precision RNAV-Z (GNSS) IAP.

The WWF does not penetrate the YWBL OLS.

The tallest WWF turbine, T2 at 1204.07ft AHD is 19.52nm northwest of the ARP. Adding the MOC of 1000ft gives a LSALT of 2300ft over the WWF. The YWBL 25nm Minimum Safe Altitude (MSA) is 3300ft and the 10nm MSA is 2100ft.

The minimum holding altitude at WBLWE is 3300ft which is above the WWF LSALT.

The WWF sits below the outer segments of the YWBL RNAV-Z RWY 13 Instrument Approach, between Initial Approach Fixes (IAF) WBLWD and WBLWE with the closest turbine T59 being 3.46nm from the Intermediate Fix (IF) WBLWI. This is shown in Figures 4 and 5 below.

Whilst the WWF is beyond the 10nm MSA several turbines are within the 5nm buffer zone (orange line ï Figure 4) for calculating this MSA.

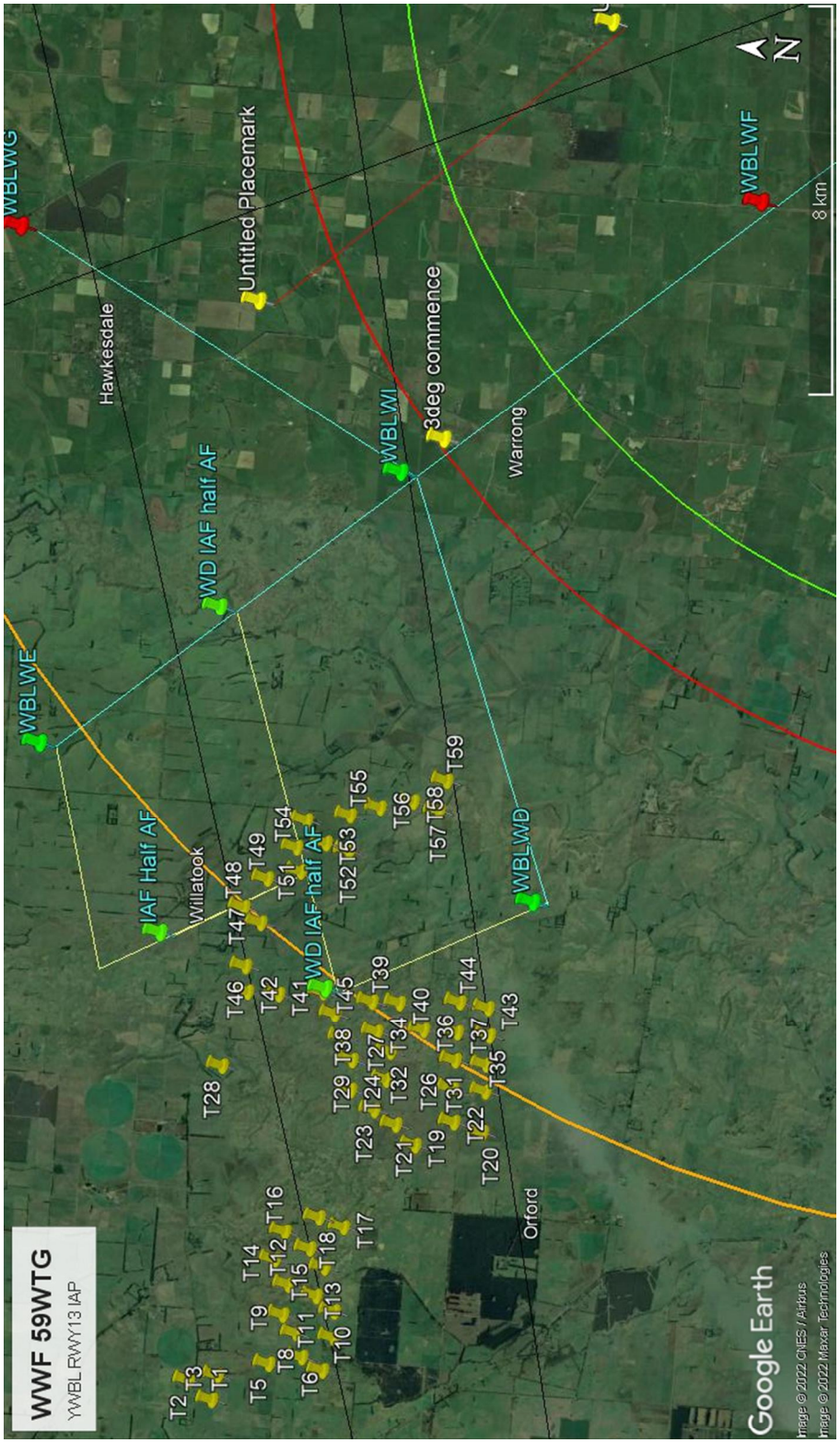

Figure 4 – YWBL RNAV-Z RWY 13 (Depicted by blue line) overlayed on WWF

Red line is 10nm MSA; Orange line is 15nm (10nm MSA buffer)

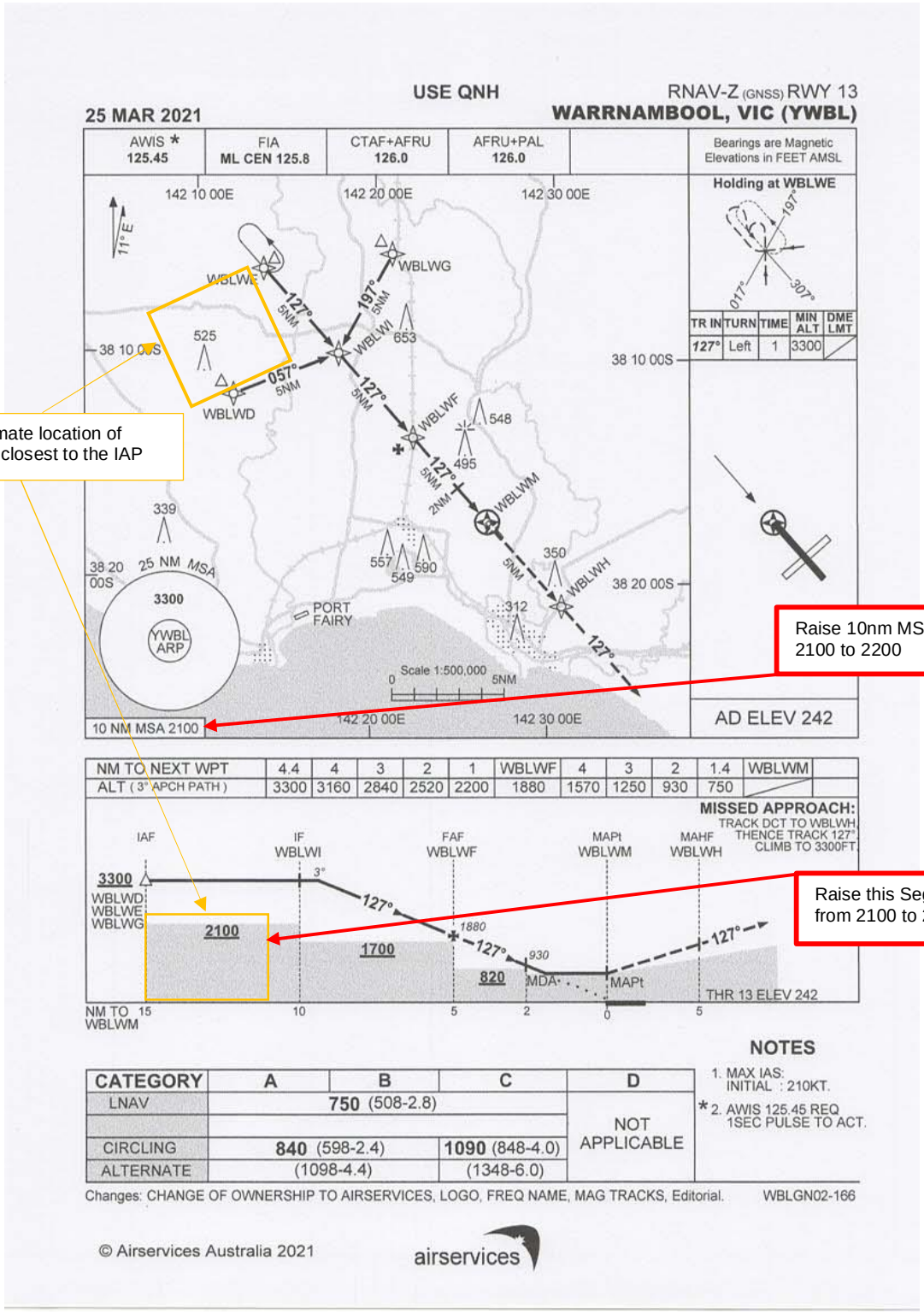

Figure 5 – YWBL RNAV-Z RWY 13 IAP[8]

[8] AIP DAP WBLGN02-166, 24 March 2022,

There are five turbines within the 15nm radius of the ARP that have a LSALT of 2200ft. This will require the 10nm MSA to be raised from 2100ft to 2200ft to satisfy the requirements of ICAO PANS-OPS document 9905. It is noted that a turbine tip height of 335m (1099.08ft) AHD gives a LSALT of 2100ft (1099+1000=2099).

Turbine ID.	Tip Height AHD (m)	Tip Height AHD (ft)	Add MOC 1000ft	LSALT
T39	337	1105.64	2105.64	2200
T48	349	1145.01	2145.01	2200
T49	340	1115.49	2115.49	2200
T51	343	1125.33	2125.33	2200
T54	346	1135.17	2135.17	2200

Table 1 – Turbines within 10nm MSA buffer with LSALT 2200m

The 25nm MSA is 3300ft. The tallest turbine, T2 has an LSALT of 2300ft. This is below the 25nm MSA for the YWBL RNAV non-precision instrument approaches.

The entry altitude for the RWY 13 IAP is 3300ft and this altitude is maintained until 9.4nm from the Missed Approach Point (MAPt) WBLWM, where the 3^0 descent profile is commenced.

The closest turbine to the descent point on the WBLWE/WBLWI path is T59 at 3.05nm abeam the path, which is 11.39nm from MAPt. The closest turbine to the descent point on the WBLWD/WBLWI track is T59 at 3.8nm from WBLWI.

The RNAV-Z RWY 13 plate shows a Segment Minimum Safe Altitude between 15nm and 10 nm from the MAPt as 2100ft. This segment safe altitude would need to be raised to 2200ft to ensure the WWF does not penetrate the PANS-OPS airspace for this IAP. Redesign of the RNAV-Z RWY 13 IAP will need to be undertaken by *Airservices Australia*.

Raising the 10nm MSA and the 15 to 10nm Segment MSA from 2100 to 2200ft will ensure clearance of the PANS-OPS surfaces for this instrument approach at Warrnambool. These changes, with the support of the aerodrome operator, are achieved as a clerical exercise by Airservices Australia, whereby the levels are amended on the published instrument approach plate. Decreasing the tip height or relocating the turbines listed in Table 1 provides a less efficient method of achieving the PANS-OPS airspace clearance.

4.4.4 Other aerodromes and airstrips

There are nine airstrips known to exist on properties near the WWF. These airstrips, from the information provided by WWF are used infrequently for aerial agricultural applications operations.

The impact of the WWF on these known airstrips is reviewed in Section 6 of this report.

There is an uncertified aerodrome at Port Fairy, 11.10nm (20.56km) south of T38. There are no details for this ALA listed in ERSA. This ALA is considered sufficiently distant to be unaffected.

4.5 Air Routes and Lowest Safe Altitudes

The significant published air routes in the vicinity of the WWF and their LSAT are shown in Table 1 and Figure 6 below.

Route	Segment	LSALT
Grid		2500
W635	NOGIP/IBOBO	2200
W741	WBL/HML	2900
V279	One Way NOGIP/STONE	2700
V126	One Way ESDIG/NOGIP	3000

Table 2 – Published LSALT[9]

The tallest turbine tip is T2 at 1204ft AHD. Adding the required MOC of 1000ft gives a lowest safe altitude of 2300ft. The published LSALT for W635 is 2200ft. The LSALT for W635 will not require raising as the nearest turbine is beyond the RNP 2[10] criteria used to calculate LSALT.

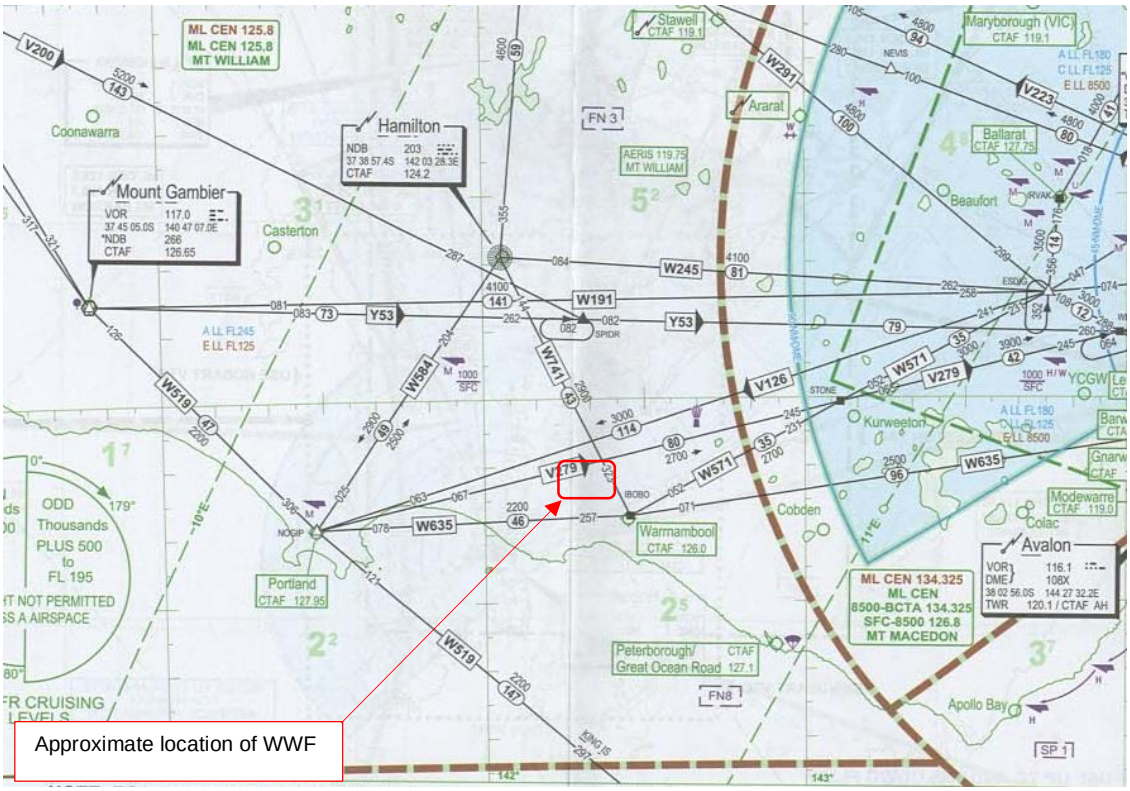

Figure 6 – Nearby Air Routes[11]

The WWF does not penetrate the published LSALT for air routes in the vicinity.

[9] AIP Chart, ERC L2, 02 December 2021
[10] RNP 2 is Required Navigation Performance category 2, which uses 2nm either side of track tolerance for calculating LSALT
[11] AIP Chart, ERC L2, dated 02 December 2021

4.6 Airspace

The WWF is in Class G airspace below Class E airspace with a lower limit of FL125.

There are no Prohibited, Restricted or Danger Areas (PRD) within the vicinity of the WWF.

There are no published flying training areas in the vicinity of the WWF.

4.7 Communications, Navigation and Surveillance

Wind turbines by their size and construction may cause interference to air traffic control communications, navigation and surveillance (CNS) facilities. Airservices Australia (AsA) recommends the use of the *EuroControl Guidelines on How to Assess the Potential Impact of Wind Turbines on Surveillance Sensors*[12].

The CASR Part 139 Manual of Standards ï Aerodromes, Chapter 11, sets out the general requirements for navigation aid sites and air traffic control (ATC) facilities, including the clearance planes for planned and existing facilities.

4.7.1 Communications

There is an Airservices Australia ATC communications facility at Mt William 52nm to the North of the WWF. The WWF will have no impact on the operations of these facilities.

4.7.2 Navigation

The nearest ground based navigation aid is the Non Directional Beacon (NDB) at YHML. This NDB has a range of 45nm. An NDB is a low frequency (203 kHz) radio transmitter and will not be affected by the WWF turbines some 27nm distant.

4.7.3 Surveillance

The nearest civil aviation surveillance facility is a Secondary Surveillance Radar (SSR) at Mt Macedon 238km (120nm) Northeast. The Primary Surveillance Radar (PSR) at Gellibrand Hill (Tullamarine airport) is 238km (129nm) Northeast.

The applicable document, as referred to in the Airservices letter, is the Eurocontrol Guidelines *"How to Assess the Potential Impact of Wind Turbines on Surveillance Sensors"* edition 1.2, September 2014 (EUROCONTROL-GUID-130).

This guideline nominates the following four zones (shown below) and the associated level of assessment for PSR installations.

[12] Available at http://www.eurocontrol.int/sites/default/files/publication/files/20140909-impact-wind-turbines-sur-sensors-guid-v1.2.pdf last accessed 10 January 2018

Zone	Zone 1	Zone 2	Zone 3	Zone 4
Description	0 ï 500m	500m 0 15km and in radar line of sight	Further than 15km but within maximum instrumented range and in line of sight	Anywhere within maximum instrumented range but not in line of sight or outside the maximum instrumented range
Assessment Requirements	Safeguarding	Detailed assessment	Simple assessment	No assessment

The guideline nominates the following three zones (shown below) for the assessment of SSR.

Zone	Zone 1	Zone 2	Zone 4
Description	0 ï 500m	500m ï 16km but within maximum instrumented range and in radar line of sight	Further than 16km or not in radar line of sight
Assessment Requirements	Safeguarding	Detailed Assessment	No assessment

Note: There is no Zone 3 for SSR

The Mt Macedon SSR, at 238km (120nm) Northeast is well beyond the 16km distance, therefore no assessment is required.

The Primary Surveillance Radar (PSR) at Gellibrand Hill (Tullamarine airport) is 238km (129nm) Northeast. The antenna height is 228m AHD. The maximum tip height of the WWF is 347m AHD, however there is high ground of approximately 480m AHD between the PSR site and the WWF turbines. This will put the WWF outside the line of site of the Gellibrand Hill PSR, therefore no assessment is required.

The WWF is beyond the line of site of both the Mt. Macedon and Gellibrand Hill radars and will not affect their operation.

4.8 AIS Conclusions

The AIS concluded that the WWF will not impact upon the following:

- The OLS of any Regulated (certified) aerodrome;
- The PANS-OPS surfaces associated with the Instrument Approach Procedures at:
  - Portland; or
  - Hamilton;
- The performance of Navigation Aids and Communication Facilities; or
- The performance of any surveillance radars and satellite facilities.

The AIS concluded that the WWF would impact upon the following:

- The PANS-OPS surface for the Warrnambool YWBL RNAV-Z RWY 13 non-precision approach.
- The 10nm MSA at YWBL.

The recommended changes detailed above will ensure the WWF does not penetrate the PANS-OPS surfaces associated with this instrument approach procedure.

The amendment will require raising:

- The Segment Minimum Safe Altitude between the IAF and the IF from 2100 to 2200ft.;
- The 10nm MSA from 2100 to 2200ft.

Consultation with the aerodrome operator is being undertaken to gain their support for the recommended changes to the YWBL RNAV-Z RWY 13 instrument approach procedure.

4.9 Airservices Australia Response

The response from Airservices Australia is shown at Appendix C.

The WWF will require changes to:

- 10nm MSA from 2100 to 2200;
- RWY 13 RNAV-Z Approach designed by Airservices Australia

Airservices Australia advise that the LSALT for W635 will not require raising as the nearest turbine is beyond the RNP 2[13] criteria used to calculate LSALT.

The WWF will not affect any CNS facilities.

4.10 Department of Defence Response

The Department of Defence response is shown at Appendix D.

The Department of Defence has no objections to the WWF. Defence note that the turbines and meteorological masts must be reported in accordance with AC 139-08 v2.0 *Reporting tall structures.* (Note AC139-08 v2.0 has been replaced by AC139.E-01 v1.0 *Reporting tall structures,* December 2021.)

[13] RNP 2 is Required Navigation Performance category 2, which uses 2nm either side of track tolerance for calculating LSALT

5. QUALITATIVE RISK ASSESSMENT

The expression ñn the vicinity of the aerodromeòis considered by CASA to mean within the boundaries of either the OLS or the PANS-OPS surfaces of a certified or registered aerodrome.

The NASF Guideline D considers 30km (16.2nm) from a certified or registered aerodrome to be ñn the vicinity.ò

Within Victoria, the Planning Authority refers to aerodromes within 15km (8nm) of a wind farm for consideration.

More generally the impact on any regulated aerodrome within 56km (30nm) of a wind farm is considered. The 30nm distance ensures that the PANS-OPS prescribed airspace protecting published instrument approach procedures is included.

5.1 Regulated Aerodromes

As noted in Section 4.4 there are three Regulated aerodromes, Portland (YPOD), Hamilton (YHML), and Warrnambool (YWBL), within 30nm of the proposed WWF.

The WWF does not affect the OLS, or PANS-OPS prescribed airspace for YHML and YPOD.

The WWF does not affect the OLS for YWBL, however it does affect the PANS-OPS surfaces for the Runway 13 RANV-Z (GNSS) Instrument Approach as detailed in Section 4.4.3.

When the required amendments have occurred, the WWF will no longer affect the PANS-OPS surfaces for YWBL.

5.2 Identified Unregulated Aerodromes

There is an Unregulated aerodrome (ALA) at Port Fairy, 11.10nm South of T38. There are no details for this ALA listed in ERSA. This ALA is considered sufficiently distant to be unaffected.

The Cobden (YCDE) Unregulated aerodrome (ALA) is 40.2nm (74.44km) SE of WWF and is sufficiently distant to be unaffected.

There are several known airstrips on properties close to the wind farm. The impact on these ALA is dealt with in Section 6.

5.3 Airspace

The WWF is in Class G airspace below Class E airspace with a lower limit of FL125.

There are no Prohibited, Restricted or Danger Areas (PRD) within the vicinity of the WWF.

There are no published flying training areas in the vicinity of the WWF.

5.4 Relevant Air Routes

Section 4.5 assesses the impact of the WWF on the LSALT of nearby published air routes.

The LSALT for air route W635 does not require amendment as it is beyond the track criteria used to calculate lowest safe altitudes for RNP 2 criteria air routes.

5.5 Night Flying

Aircraft flying at night under either IFR, or VFR are protected by published or calculated LSALT. Descent below the LSALT for a VFR at Night flight is restricted to within 3nm (5.4km) of the aerodrome and with it in sight. Where an IFR aircraft is using a published instrument approach it is protected by PANS-OPS surfaces.

The aerodromes at YPOD, YHML and YWBL are equipped with Pilot Activated Lighting (PAL) and non-precision RNAV (GNSS) Instrument Approach Procedures and therefore are available for night operations by aircraft in accordance with both IFR and VFR at Night flights.

Night operations into YPOD and YHML are not affected by the WWF.

When the amendments listed in Section 4.4.3 for YWBL have occurred, night operations at YWBL will not be affected by the WWF.

5.6 General Aviation Flying Training

Wind turbines, by their size and colour are highly conspicuous and therefore not an issue for VFR flight by day. Flying training is conducted in accordance with VFR for a major part of the ab ï initio course. In the latter stages of training student airline pilots progress to night flying in accordance with VFR at Night procedures and then to IFR training. Flying training is usually conducted in light General Aviation (GA) aircraft such as Cessna C182 or Diamond DA40 aircraft. As discussed previously night flying is undertaken at or above the LSALT and therefore is above the WWF.

5.7 Recreational and Sport Aviation

Recreational and Sport aircraft, particularly ultra-lights registered with Recreational Aviation Australia (RA-Aus) are limited to daytime flight in accordance with the Visual Flight Rules (VFR). This requires the aircraft to remain clear of cloud and a minimum of 500ft above the ground or highest obstacle. Ultra-light aircraft have a Maximum Take-Off Weight (MTOW) of 600kgs or less. By comparison, a small GA aircraft such as a Cessna C172 has a MTOW of 1110kg. The cruising speed of ultra-light aircraft is generally lower that for a GA aircraft thus giving the pilot more time to see and avoid obstacles. *The photo shows an Australian built Lightwing ultra-light aircraft.*

5.8 Approved Low Flying Activities

There are no published flying training areas within the vicinity of the WWF.

5.9 Aerial Applications Activity

The Aerial Application Association of Australia opposes wind farm developments unless the developer has (inter alia):

- Consulted in detail with local operators;
- Received independent expert advice on safety and economic impacts; and
- Considered the impacts on the aerial application industry.[14]

An aerial application operator made the comment that *"the decision to host wind turbines is one made by the landholder who must accept that there will most probably be limitations to any aerial applications on the property[15]."*

Another operator made the comment that *"wind farms are becoming common, they're a fact of life, we know more about them and can operate safely in their vicinity."*[16]

One aerial application operator indicated that the WWF may impact on aerial applications in the area, however it is dependent on the seasons, pests and the needs of the farmers.

[14] http://www.aerialag.com.au/ResourceCenter/Policies.aspx
[15] Expert opinion obtained by the author during previous QRA work
[16] Stakeholder interview with aerial applications operator.

There are four known aerial applications operators that work in the general area of southwestern Victoria. Aerial application is used for spraying and spreading in some of the rougher, less accessible areas where ground applications is limited. The operators interviewed all accept that wind farms will impose some limitations on aerial applications, however, they agree that their knowledge of operating near wind farms has improved and that the ñlimitations are not considered as severe as they used to beò

All the operators consider meteorological monitoring masts to be ñkillersòbecause they are very difficult to see. The agreement amongst them was that as a minimum the masts should be marked in accordance with the NASF Guideline D, except for the strobe light, and that the base around the outer guy wires should be marked in a contrasting colour to the ground.

5.10 Known Highly Trafficked Areas

There are no known highly trafficked areas in the vicinity of the WWF.

5.11 Emergency Services Flying

All Emergency Services flying is subject to ongoing dynamic risk assessment throughout the flight. The safety of the aircraft and its crew is paramount.

5.11.1 Police Air Wing

The Police Air Wing helicopters are capable of IFR flight and flown by suitably IFR rated pilots who are also qualified for low level flight, for example, search and rescue operations.

From previous work done by the author for other wind farms in Victoria the Police Air Wing utilise dynamic risk assessment for all operations and the pilot in command has the final say as to whether the operation is aborted because of the risk to the aircraft and crew. For low level night operations, the aircraft are equipped with Night Vision Imaging Systems (NVIS) enabling the pilot ñto seeòin reduced light conditions. For the final descent and landing the onboard searchlight is used to illuminate the landing area.

5.11.2 Helicopter Emergency Medical Services

The Helicopter Emergency Medical Service (HEMS) utilise helicopters capable of IFR flight. For low level night operations, the aircraft are equipped with NVIS enabling the pilot ñto seeòin reduced light conditions. For the final descent and landing the onboard searchlight is used to illuminate the landing area. All HEMS operations are subject to a dynamic risk assessment and the pilot in command has the final say as to whether the operation is aborted due to the risk to the aircraft and crew.

The Senior Base Pilot made the comment that *"There are lots of them (wind farms) around and we are conscious of their locations. The presence of a wind farm will not*

stop our operations, we know they are there and fly accordingly."[17] The presence of tall obstacles influences the cruising level of the helicopters in known aircraft icing conditions due to the capabilities of the aircraft anti-icing equipment.

5.11.3 Fixed Wing Air Ambulance

Fixed wing Air Ambulance operations in Victoria are undertaken in twin engine turbo-prop aircraft in accordance with IFR. The aircraft are usually Beechcraft Super Kingair (BE200) which have a MTOW of 5700kg and use suitable aerodromes. The primary use of these aircraft is for patient transfer from regional to major city hospitals. The WWF will not affect fixed wing Air Ambulance operations due to the nature of the operations and the aircraft size.

The Senior Base Pilot made the comment that *"The wind farm does not need lights. In solid IMC (Instrument Meteorological Conditions) you can't see them (the lights), and in VMC (Visual Meteorological Conditions) you don't need them."*[18]

5.12 Fire Fighting

Firefighting is a multi-faceted operation utilising multiple resources and equipment appropriate to the circumstances. A fire ground is a dynamic place where resources are continually being reassigned to have the best effect.

"Aircraft support, firefighters suppress"[19]

Firefighters on the ground use aircraft and other aerial resources to help them fight bushfires. Firefighting aircraft, regardless of their size or type, do not extinguish a bushfire on their own.

5.12.1 Aerial Firefighting

At all times, the pilot in command has the ultimate responsibility for the safety of the aircraft.[20]

Aerial firefighting operations are only effective when followed up with intense firefighting activities by ground firefighting crews.

ñFirebombingò is used to slow or halt the rate of spread of a fire edge long enough for ground crews to access the fire line and mop up or supplement the knockdown process.

Aerial firefighting flying is conducted at low level using specialist aircraft flown by appropriately rated pilots in accordance with the Visual Flight Rules. The pilot is required to maintain forward visibility with the ground, therefore they will remain clear of smoke

[17] Stakeholder interview Senior Base Pilot, HEMS Victoria.
[18] Stakeholder interview, Senior Base Pilot, Pelair, Fixed Wing Air Ambulance.
[19] CFS *Aerial Firefighting*, CFS website https://www.cfs.sa.gov.au/about-cfs/what-we-do/aerial-firefighting/
[20] This is part of the Civil Aviation Regulations 1988 and a point reiterated in an interview by the author with a Victorian Forest Fire Management Fire Ground Manager, 6 August 2019.

so that they can accurately and safely drop the fire retardant.

From previous work undertaken by the author regarding firefighting within wind farms it is noted that the rural firefighting agencies in Victoria, New South Wales, South Australia and Western Australia all view wind turbines and wind farms to be ójust another hazardô that must be considered in the risk management process associated with aerial firefighting.

The photograph above shows an AT802 dropping retardant next to a power line.

The Victorian Country Fire Authority (CFA) recommends:

> *"… … a minimum distance between turbines of 300 metres. This provides adequate distance for aircraft to operate around a wind energy facility given the appropriate weather and terrain conditions. Fire suppression aircraft operate under the 'Visual Flight Rules.' As such, fire suppression aircraft only operate in areas where there is no smoke and can operate during the day or night."*[21]

There will be times when aerial firefighting is not possible due to heat, turbulence, smoke, strong wind or erratic fire behaviour.

Aircraft operate more efficiently in denser air. As temperature increases, air density decreases. This has a dramatic effect on aircraft performance. On very hot days, aircraft may need to reduce their load capacities to operate safely. High air temperatures and low relative humidity will also reduce the overall effectiveness of firebombing operations on the ground as water content rapidly evaporates.

Even the Boeing 737 very large air tanker (VLAT) operated by the NSW Rural Fire Service has had to abort retardant dropping operations due to severe turbulence over the fireground. This is a 70 tonne aircraft the same as that used by QANTAS and Virgin to carry up to 180 passengers.

One of the issues with VLAT in Victoria is the limited number of suitable aerodromes. For the B737, the only suitable aerodromes are Melbourne, Avalon, Mildura and East Slae RAAF Base. Consequently the ñturnaround timeòbetween retardant drops can be considerable.

[21] CFA Design Guidelines & Model Requirements for Renewable Energy Facilities, March 2022

NSW RFS B737 VLAT – Based at RAAF Richmond

Certified video evidence of an Air Tractor AT802 flying firefighting operations within a wind farm was presented to the South Australian Environment, Resources, and Development court in 2017. The video evidence also demonstrated the improved access for large ground based firefighting appliances due to the wind farm.

A Hercules Large Air Tanker operating in the Waubra Wind Farm January 2019
Photo courtesy The Ballarat Courier.

There have been trials of night flying for aerial firefighting conducted in Victoria. At present there is a small number of organisations authorised by CASA to conduct aerial firefighting at night. These organisations utilise specific helicopters equipped for night flight that are flown as a two-pilot operation who are both appropriately rated. Night aerial firefighting by fixed wing aircraft is currently undertaken only by the foreign registered Large Aerial Tankers such as the Boeing 737.

5.12.2 Ground Based Firefighting

From previous work done regarding firefighting within wind farms it is noted that the rural fire fighting agencies in Victoria, New South Wales, South Australia, and Western Australia all make the point that access for fire trucks and personnel, and consequently their ability to fight the fire within a wind farm, is greatly enhanced by the access roads built for the construction and maintenance of the turbines. These roads also function as fire breaks which can slow or contain the fire spread across the open ground. The area around the base of each tower is kept clear of vegetation and as such offers a refuge for fire fighters and their vehicles. There are often water storages associated with the wind farm that are available for firefighting purposes.

The CFA recommends:

> *"To enable access for fire appliances the following provisions should be considered:*
>
> - *Constructed roads should be a minimum of 3.5 metres in trafficable width (with 0.5m each side) with a four (4) metre vertical clearance for the width of the formed road surface*
> - *Roads should be of all-weather and capable of accommodating a vehicle of 15 tonnes."*[22]

The CFA further recommends:

> *Facility operators are to undertake the following fuel management measures are included in their plans during the Fire Danger Period:*
>
> - *Grass to be maintained at below 100mm in height during the declared Fire Danger Period;*
> - *A fire break area of ten (10) metres width is to be maintained around the perimeter of the facilities, electricity compounds and substations."*[23]

[22] CFA Design Guidelines & Model Requirements for Renewable Energy Facilities, March 2022
[23] CFA Design Guidelines & Model Requirements for Renewable Energy Facilities, March 2022

5.13 Topographical and Marginal Weather Conditions

The topography of the area of the WWF is generally sloping coastal hinterland rising from sea level to 200m AHD[24]. As such the area is subject to areas of low cloud. It is an area known for periods of forecast marginal and/or non VMC. Pilots flying VFR are aware of this and plan their flight accordingly.

VMC are the weather conditions required for VFR flight at or below either 3000ft AMSL or 1000ft AGL, namely: -

- Clear of cloud;
- In sight of the ground or water; and
- With a forward visibility of 5000m[25].

The rules governing VFR flight require that pilots remain clear of cloud and not get into such situations by turning away from the low cloud and terminating the flight at the nearest suitable aerodrome.

Aircraft operating under Instrument Flight Rules (IFR) can operate in poor weather conditions and in cloud which precludes visual acquisition of obstacles and terrain. These operations are protected by PANS OPS surfaces and LSALTôs that are designed to keep the aircraft clear of obstacles and terrain.

CASR 91.267, Minimum Height Rules ï other areas states that an aircraft must not be flown below 500 ft above the highest feature or obstacle within a horizontal radius of 300 m of the point on the ground or water immediately below the aircraft; and none of the circumstances mentioned in subregulation (3) applies. Subregulation (3) includes such items as approved low flying activity, taking off and landing, practice forced landings, circuit area flying and determining the suitability of an aerodrome for landing. CASR 91.267 does not provide an exemption for ñstress of weather or any other unavoidable cause.ò

Flying into marginal or non VMC weather is entirely avoidable. It should be noted that a non-instrument rated pilot flying in cloud almost always has a fatal outcome.[26]

5.14 Advisory Circular AC139.E-05 v1.0

AC139.E-05 v1.0 *Obstacles (including wind farms) outside the vicinity of a CASA certified aerodrome* was issued in May 2021.

This AC states in the introduction: -

> *CASA provides advice about lighting of wind farms and other tall structures in submissions to planning authorities who are considering*

[24] World Aeronautical Chart (WAC) 3469 HAMILTON, 19th edition hypsometric tints.
[25] CASR, MOS Part 91, Division 2.4 *Definition of VMC Criteria*, table 2.07(3) dated 8 December 2021
[26] Accidents involving Visual Flight Rules pilots in Instrument Meteorological Conditions, Australian Transport Safety Bureau, 22 August 2019,

a wind farm or tall structure proposal.

Regardless of CASA advice, planning authorities make the final determination whether a wind farm or tall structure not in the vicinity of a CASA regulated aerodrome will require lighting or not.

The AC defines: -

outside the vicinity of an aerodrome is outside the limits of the obstacle limitation surface (OLS) of a CASA certified aerodrome

The AC recommends that an aeronautical study be conducted by the wind farm proponent including a risk analysis using AS/NZS ISO 31000:2018 *Risk Management and Guidelines*.

This Aeronautical Impact Assessment risk assessment uses the standard and follows the same process as CASA as outlined in the advisory circular.

The result of the risk assessment shows that the WWF is a LOW risk to aviation and is therefore *not a hazard to aircraft safety.* Consequent to this, aviation obstacle lighting is not required.

5.15 NASF Guidelines

The National Airports Safeguarding Framework ï Guideline D *Managing the Risk to Aviation Safety of Wind Turbine Installations (Wind Farms)/Wind Monitoring Towers* provides guidance for the siting and marking of the turbines and meteorological monitoring towers associated with wind farms.

5.15.1 Notification to Authorities

Paragraph 20 of Guideline D advises that:

When wind turbines over 150m above ground level are to be built within 30km (16.2nm) of a certified or registered aerodrome, the proponent should notify the Civil Aviation Safety Authority and Airservices. If the wind farm is within 30km of a military aerodrome, Defence should be notified.

The turbines are greater than 150m and are not within 30km of a military, certified or registered aerodrome.

The turbines and meteorological monitoring towers used in the DWF must be reported to Airservices Australia and the RAAF in accordance with AC 139-08(1) *Reporting of Tall Structures* to ensure their position is marked on aeronautical charts.

5.15.2 Risk Assessment

The NASF Guideline has the following requirements for a risk assessment.

> *26. Following preliminary assessment by an aviation consultant of potential issues, proponents should expect to commission a formal assessment of any risks to aviation safety posed by the proposed development. This assessment should address any issues identified during stakeholder consultation.*

The risk assessment for the WWF indicates that the overall risk to aviation is LOW. A risk assessment of LOW indicates that the wind farm is *'not a hazard to aircraft safety.'*

> *27. The risk assessment should address the merits of installing obstacle marking or lighting. The risk assessment should determine whether or not a proposed structure will be a hazardous object. CASA may determine, and subsequently advise a proponent and relevant planning authorities that the structures have been determined as:*
>
> *(a) Hazardous but that the risks to aircraft safety would be reduced by the provision of approved lighting and/or marking; or*
>
> *(b) Hazardous and should not be built, either in the location and/or to the height proposed as an unacceptable risk to aircraft safety will be created; or*
>
> *(c) Not a hazard to aircraft safety.*

By day, the WWF turbines are conspicuous by their size and colour. The WWF does not impact on any LSALT in the area. Night operations for aircraft do not occur below the LSALT for IFR and VFR at Night. IFR aircraft are protected by the LSALT, and PANS-OPS prescribed airspace at each aerodrome. Where an approach to land is undertaken operating to VFR at Night, descent below the LSALT does not occur until within 3nm of the airport and in VMC. The nearest aerodrome equipped for night operations is Warrnambool 12.46nm (22.07km) to the southeast.

Given the above, the WWF does not require obstacle lighting as the risk to aviation is LOW and no additional mitigating strategies are required.

Overall, the risk assessment demonstrates that the WWF is a LOW risk to aviation and is therefore *not a hazard to aircraft safety.*

> *28 If CASA advice is that the proposal is hazardous and should not be built, planning authorities should not approve the proposal. If a wind turbine will penetrate a PANS-OPS surface, CASA will object to the proposal. Planning decision makers should not approve a wind turbine to which CASA has objected.*

The WWF will not penetrate any OLS or PANS-OPS surfaces either civil or military, once the YWBL RWY 13 RNAV-Z is amended, therefore CASA has no reason to determine that it is hazardous.

> *29 In the case of military aerodromes, Defence will conduct a similar assessment to the process described above if required. Airservices, or in the case of a military aerodrome, Defence, may object to a proposal if it will adversely impact on Communications, Navigation or Surveillance (CNS) infrastructure. Airservices/ Defence will provide detailed advice to proponents on request regarding the requirements that a risk assessment process must meet from the CNS perspective.*

There is no civil or known military CNS infrastructure that will be impacted by the WWF.

> *30 During the day, large wind turbines are sufficiently conspicuous due to their shape and size, provided the colour of the turbine is of a contrasting colour to the background. 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. Other colours are also acceptable unless the colour of the turbine is likely to blend in with the background.*

The WWF turbines will be appropriately painted to ensure they are conspicuous by day.

5.15.3 Lighting of Wind Turbines

> *33 Where a wind turbine 150m or taller in height is proposed away from aerodromes, the proponent should conduct an aeronautical risk assessment.*
>
> *34. The risk assessment, to be conducted by a suitably qualified person(s), should examine the effect of the proposed wind turbines on the operation of aircraft. The study must be submitted to CASA to enable an assessment of any potential risk to aviation safety. CASA may determine that the proposal is:*
>
> > *(a) hazardous, but that the risks to aircraft safety would be reduced by the provision of approved lighting and/or marking; or*
> >
> > *(b) not a hazard to aircraft safety.*

The WWF is not sited within the OLS of any certified or registered aerodrome and does not penetrate any PANS-OPS airspace, once the YWBL RNAV non-precision approach is amended, and is assessed as a LOW risk to aviation and is therefore *not a hazard to aircraft safety.*

5.16 QRA Findings

The basis for the QRA is ASNZS ISO 31000-2018 *Risk Management –Guidelines.*

A Qualitative Risk Assessment is the analysis for risks, through facilitated interviews or meetings with stakeholders and outside experts, as to their probability of occurrence

and impact expressed using non-numerical terminology, for example low, medium and high.

For example, a hazard that may cause a catastrophic outcome, but is unlikely to occur is a LOW risk. Given that wind turbines, by their size and colour are conspicuous by day and that VFR pilots fly by visual reference to the ground at least 500ft above the tallest obstacle, it is unlikely that an aircraft will collide with a turbine. Therefore, the risk to aviation safety is LOW.

The QRA for the Willatook Wind Farm assesses it as *not a hazard to aircraft safety*.

Risk Element	Assessed Level of Risk	Comment
Regulated aerodrome Operations	LOW	
Unregulated aerodrome Operations	LOW	Suitability for use is a pilot responsibility.
Port Fairy	LOW	RWY centreline clear WWF Dry weather only
Known airstrips in area	LOW	Current usage can continue safely
Known Highly Trafficked Routes	LOW	None identified
Published Air Routes	LOW	Nil impact
PRD Airspace	LOW	Nil exists in the area
Promulgated Flying Training Areas	LOW	Nil exists in the area
GA Flying	LOW	
Night Flying	LOW	
Emergency Services Flying	LOW	
Commercial Flying	LOW	
Recreational and Sport Aviation	LOW	
Recreational Pilot Training (RA-AUS)	LOW	
GA Pilot Training	LOW	
Weather and Topographical Issues	LOW	

Table 2 – Risk Assessment Summary

6. AIRSTRIP REVIEW

There are nine airstrips known to exist on properties near the WWF. These airstrips, from the information provided by WWF are used infrequently for aerial agricultural applications operations.

Figure 3 – An Air Tractor AT 502B taxiing.
Note the grass surface and its slope.
The aircraft is configured for spreading.

6.1 Airstrip Definition

An airstrip is an Unregulated aerodrome or Aeroplane Landing Area (ALA). The only Civil Aviation Safety Regulation (CASR) governing the use of an ALA is CASR 91.410 *Use of Aerodromes,* which at sub regulation 2, specifies the requirements and places the onus on the pilot in command and the operator to ensure the place is suitable for use as an aerodrome for the purpose of landing and taking-off an aircraft.

As noted in section 1.2 above, all operations into an ALA must be conducted in accordance with VFR and in VMC. A wind turbine, by its size and colour ñs considered

to be highly conspicuous[27] and is therefore readily discernible in VMC.

Unregulated aerodromes are not required to be listed in the AIP so information about them is not held in the public domain, is not available through aeronautical publications and charts and is not required to be reported. Where ALA information is published in the AIP it is clearly annotated that it is not kept current. A local example is Cobden Airport. Consequently, ALA can come into use and fall out of use without any formal notification to CASA or any other authority. Airstrips that appear on survey maps often no longer exist; others exist but do not feature on maps. Similarly, a grass paddock used as an ALA one or two days a year is not usually discernable on satellite mapping services such as Google Earth.

The Civil Aviation Safety Authority (CASA) has no regulatory authority or oversight on the construction, dimensions or obstacle free areas of an ALA.

6.2 Airstrip Locations

The following airstrip locations and dimensions were provided by Wind Prospect Pty Ltd.

Airstrip No.	Property Address	Location		Runway Direction	Runway Length (m)	Usage
		Latitude	Longitude			
1	3039 Woolsthorpe-Heywood Road, Hawkesdale, VIC, 3287	38 08 21.84S	142 06 36.36E	06/24	700	Not Used
2	2923 Woolsthorpe-Heywood Road, Hawkesdale, VIC, 3287	38 08 17.52S	142 07 38.28E	18/36	800	Infrequent use
3	2565 Woolsthorpe-Heywood Road, Hawkesdale, VIC, 3283	38 08 18.60S	142 09 21.60E	06/24	800	Twice a year
4	817 Kangertong Road, Hawkesdale, VIC, 3287	38 05 55.42S	142 11 13.05E	18/36	800	3.5km north of Woolsthorpe-Heywood Road.
5	2302 & 2340 Woolsthorpe-Heywood Road, Willatook, VIC, 3283	38 07 36.50S	142 12 45.42E	09/27	800	May be refurbished and used.
6	2403 Woolsthorpe-Heywood Road, Willatook, VIC, 3283	38 08 30.84S	142 11 04.20E	18/36	720	2 to 3 times year
7	Tarrone North Road (at Terminal Station)	38 10 33.96S	142 11 20.76E			Decommissioned
8	351 Threlfall Road, Tarrone, VIC, 3283	38 11 53.52S	142 13 20.64E	09/27	450	5 to 10 times year
9	760 Tarrone North Road, Tarrone, VIC, 3283	38 11 44.52S	142 11 24.00E	18/36	800	Twice a year

Table 1 – Known Aeroplane Landing Areas near WWF

[27] NASF Guideline D, paragraph 30, July 2012

None of the above ALA are listed in the Aeronautical Information Publication (AIP) nor on the associated aeronautical charts[28]. None of these ALA are depicted on the current VicMap 1:50,000 topographic maps[29]. It is noted that the nearby McArthur Wind Farm is shown on the *Hawkesdale [7321-N]* 1:50,000 topographic map.

6.3 Airstrip Assessment

The assessment of the continued use of the listed airstrips is based on data supplied by Wind Prospect Pty Ltd, assessment of the locations on Google Earth and a field trip to the area.

The airstrips are considered in the order listed in Table 1.

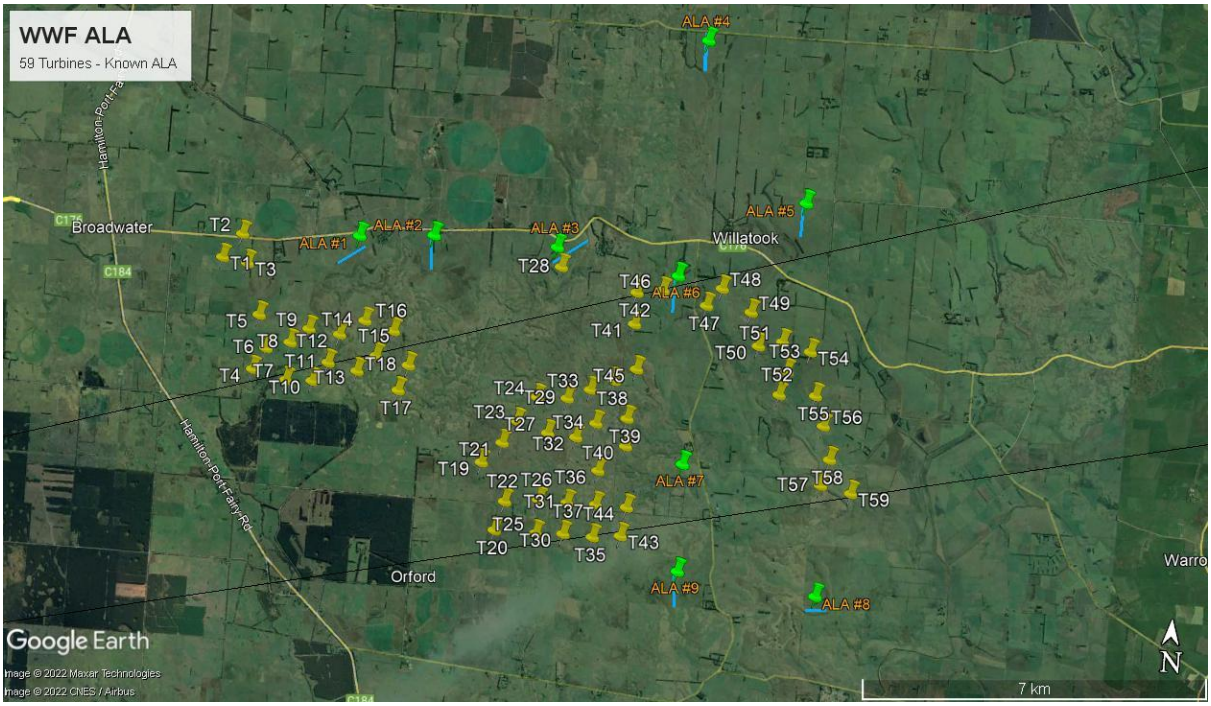

Figure 4 – ALA Locations (Denoted by Green Pin Marker)

The only data published regarding Unregulated aerodrome dimensions was in Civil Aviation Advisory Publication (CAAP) number 92-1(1) *Guidelines for Aeroplane Landing Area* dated July 1992. This CAAP has been removed from the CASA website (January 2022) and enquiries indicate that it has been withdrawn. Therefore, the information it contained is no longer officially available.

This report will refer to the information about obstacle free areas (OFA) outlined in CAAP 92-1(1) because it is a useful guide. The suggested OFA is a trapezoid area commencing at the runway threshold extending for 900m along the extended runway

[28] AIP ERSA, effective 23 May 2019: VNC Melbourne, effective 23 May 2019.
[29] Vicmap 1:50,000 Topographic Map Series. These maps are 3rd Edition dated 2015 based on 2015 geospatial data.

centreline, expanding from 60m to 150m width and sloping up with A 5% gradient. The OFA includes a 60m wide ñfly over areaò extending for the length of the runway.

6.3.1 Airstrip #1.

This airstrip is located on the property at 3039 Woolsthorpe - Heywood Road, Hawkesdale, VIC, 3287, just south of the Woolsthorpe ï Heywood Road 5km east of the Hamilton ï Port Fairy Road. This airstrip has a 700m runway oriented 06/24 (northeast/southwest).

The nearest turbine T14 is 1472m south southeast of the Runway 06 threshold (southwest end) and abeam the Runway 24 centreline. Turbines T3, at 1920m and T5, at 2104m are 758m north and 246m south respectively from the Runway 24 centreline. These turbines are outside the 900m long Obstacle Free Area (OFA). All the nearby turbines are considered sufficiently distant from the airstrip to facilitate its use by aerial applications aircraft.

From the information supplied this airstrip has not been used for 25 to 30 years, therefore, it is considered to no longer exist.

6.3.2 Airstrip #2.

This airstrip is located on the property at 2923 Woolsthorpe-Heywood Road, Hawkesdale, VIC, 3287, just south of the Woolsthorpe ï Heywood Road 6.5km east of the Hamilton ï Port Fairy Road. This airstrip has an 800m runway oriented 18/36 (north/south).

The nearest turbine T14 is 1910m southwest of the Runway 36 threshold (southern end) and 1420m west abeam the Runway 18 centreline. Turbines T16, at 1706m and T18 at 2255m are 827m west and 514m west respectively of the Runway 18 centreline.

These turbines are outside the 900m long Obstacle Free Area (OFA). All the nearby turbines are considered sufficiently distant from the airstrip to facilitate its use by aerial applications aircraft.

The landowner has advised that it is infrequently used and ñlast time it was used it was quite bumpy.ò

6.3.3 Airstrip #3.

This airstrip is located on the property at 2565 Woolsthorpe-Heywood Road, Hawkesdale, VIC, 3283, just south of the Woolsthorpe ï Heywood Road 9km east of the Hamilton ï Port Fairy Road. This airstrip has an 800m runway oriented 06/24 (northeast/southwest).

The nearest turbine T28 is 326m south southeast abeam the Runway 06 threshold. The nearest turbines along the runway 24 centreline are 3700m from the runway 06 threshold.

Caution would be needed when conducting a wide circuit for landing or departure on RWY24. Use of a right hand circuit for runway 24 would enhance clearance from turbine

T75. These turbines are outside the 900m long Obstacle Free Area (OFA) All the nearby turbines are considered sufficiently distant from the airstrip to facilitate its use by aerial applications aircraft.

Information provided by the landowner indicates that it is used by a neighbour ñonce or twice a year.ò

6.3.4 Airstrip #4.

This airstrip is located on the on the property at 817 Kangertong Road, Hawkesdale, VIC, 3287, approximately 2.9km west of the Nagorckas Road. This airstrip has an 800m runway oriented 18/36 (north/south). There is a powerline running inside the windbreak tree line along Kangertong Road from 3.2km to 2.5km from Nagorckas Road. At 2.5km from Nagorckas Road the powerline goes south parallel to the airstrip. The powerline crosses the runway 18 threshold inside the tree line.

This airstrip is north of the Woolsthorpe-Heywood Road with the nearest WWF turbines being 3700m to the south. The WWF will not impact on aerial agricultural aircraft operations at this ALA.

6.3.5 Airstrip #5.

This airstrip is located on the property at 2302 & 2340 Woolsthorpe-Heywood Road, Willatook, VIC, 3283, and is approximately 620m west of the Nagorckas Road, 330m south of the Nardoo Road intersection. The airstrip has an 800m runway oriented 18/36 (north/south).

This airstrip is north of the Woolsthorpe-Heywood Road with the nearest WWF turbines being 2100m to the south. The WWF will not impact on aerial agricultural aircraft operations at this ALA.

6.3.6 Airstrip #6.

This airstrip is located on the property at 2403 Woolsthorpe-Heywood Road, Willatook, VIC, 3283, approximately 1km south of the Woolsthorpe ï Heywood Road and 500m west of the Tarrone North Road. This airstrip has a 700m runway oriented 18/36 (north/south). See Figure 5.

The airstrip has four turbines T42, T46, T47, and T48 nearby.

The turbine T46, at 275m west abeam the runway centreline is 245m (275 ï 30) is outside the ñfly over area.ò Turbine T47, at 643m east abeam the Runway 36 threshold is 613m (643 ï 30) also outside the ñfly over area.ò

Turbines T41 and T42 are 800m west abeam the runway centreline. Turbines T47 and T48 are 630m and 920m east abeam the runway centreline. These turbines are sufficiently distant from the airstrip to allow for continued safe aerial applications aircraft operations.

Figure 5 –ALA #6 Location

These turbines are conspicuous and located such that they do not impact on the approach and departure paths of the airstrip.

6.3.7 Airstrip #7.

Information provided by the operator of this airstrip is that it has been ñdecommissionedò, therefore it is not considered.

6.3.8 Airstrip #8.

This airstrip is located on the property at 351 Threlfall Road, Tarrone, VIC, 3283. It is at the northern end of Tobruk Road approximately 1400m north of Tarrone Lane. The airstrip appears to have a 450m runway (from Google Earth) oriented 09/27 (east/west). The nearest turbines are approximately 2250m north of the airstrip. Information supplied by ñAir Applyò(aerial ag operator at Warrnambool) indicates that the airstrip is used 5 to 10 times per year.

The WWF is considered sufficiently distant from the airstrip not to impact on aerial agricultural applications aircraft landing or taking off.

6.3.9 Airstrip #9.

This airstrip is located on the property at 760 Tarrone North Road, Tarrone, VIC, 3283, approximately 750m west of the Tarrone North Road and 1km south of Riordans Road. The airstrip has an 800m runway oriented 18/36 (north/south). The nearest turbine T40 is approximately 1200m northwest of the airstrip and is considered sufficiently distant not to impact on aerial agricultural applications aircraft landing or taking off. The

landowner has indicated that the airstrip is used once or twice a year by a neighbour.

6.4 Conclusion

The Pilot-In-Command of an aircraft, in accordance with Civil Aviation Safety Regulation (1998) 91.410 *Use of aerodromes*, has the responsibility for determining if the airstrip is suitable for the type of operation and the aircraft being used.

Existing aerial applications operations at the known airstrips near the WWF will not be adversely affected by the wind farm.

The proximity of turbine T46 to airstrip #6 will require caution. All the turbines are outside the Obstacle Free Areas. Turbines, T41, T42, T47 and T48 are sufficiently distant from the ALA not to impact on aerial agricultural aircraft operations.

The type of aerial applications operations at the above airstrips are usually conducted by only one aircraft at a time so the aircraft utilize a "straight in approach" to minimise flying time and to speed up the applications operation.

7. OBSTACLE LIGHTING REVIEW

7.1 Australian regulatory Framework for Obstacle Lighting of Wind Farms

The Civil Aviation Safety Authority (CASA) has limited regulatory authority to require the lighting of obstacles (tall structures) away from an aerodrome. This is particularly applicable to wind farms, which are generally beyond the Obstacle Limitation Surface (OLS) of certified or registered aerodromes. It must be noted that Civil Aviation Safety Regulations (CASR) Part 139 ï Aerodromes are applicable to certified and registered aerodromes only [Military and Joint User apply the same general form].

CASA can only make recommendations regarding the lighting of wind farms, and not determinations/directions mandating lighting of wind farms that are not in the vicinity [beyond the OLS] of a certified or registered aerodrome. It is noted that in the Senate Select Committee on Wind Turbines (2015) CASA provided evidence to the Committee about the limited role it plays in regulating airspace around wind farms.

> *We know our responsibilities and the power of our legislation, which is very limited. For the most part, wind turbines are built away from aerodromes and certainly away from federally leased aerodromes. So, the only power we have is to make a recommendation to the planning authority about whether the turbine is going to be an obstacle and, if we decide it is an obstacle, we can make a recommendation as to whether it should be lighted and marked. This is the extent of our power.*[30]

In my experience, CASA has emphasised the view that *ñit is a matter for the appropriate Land Use Planning Authority to consider the implementation of our recommendations*[31]" regarding aviation obstacle lighting of wind farms.

7.1.1 Civil Aviation Safety Regulations

The Civil Aviation Safety Regulations (CASR) Part 139 ï Aerodromes, Section E contains the regulations governing obstacles. These regulations are applicable to the protection of airspace and aircraft operations in the vicinity of Regulated (certified) aerodromes. They are not applicable to obstacles that are beyond the vicinity of aerodromes; that is, beyond the OLS.

7.1.2 Manual of Standards Part 139 – Aerodromes

The Manual of Standards (MOS) Part 139 provides amplification and methods of compliance to the CASR Part 139 Aerodromes. As the Willatook Wind Farm is beyond the vicinity of any military, certified or registered aerodrome MOS 139 does not apply.

7.1.3 Advisory Circular AC139.E-05 v1.0

The AC recommends that an aeronautical study be conducted by the wind farm

[30] Senate Select Committee on Wind Turbines, Final Report, August 2015, paragraph 5.38
[31] Correspondence from CASA to the Author.

proponent, including a risk analysis using AS/NZS ISO 31000:2018 *Risk Management and Guidelines*.

The risk assessment in this Aeronautical Impact Assessment uses the same standard and follows the same process as CASA.

The result of the risk assessment shows that the WWF is a LOW risk to aviation and is therefore *not a hazard to aircraft safety.* Consequent to this, aviation obstacle lighting is not required.

7.1.4 National Airports Safeguarding Framework

The Australian National Airports Safeguarding Advisory Group (NASAG) produced a set of guidelines called the National Airports Safeguarding Framework (NASF) in 2012.

The purpose of the National Airports Safeguarding Framework (the Safeguarding Framework) is to enhance the current and future safety, viability and growth of aviation operations at Australian airports, by supporting and enabling:

- 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; and
- the publication and dissemination of information on best practice in land use and related planning that supports the safe and efficient operation of airports.

Guideline D *Managing the Risk to Aviation Safety of Wind Turbine Installations [Wind Farms] / Wind Monitoring Towers* provides information regarding wind farms. This guideline provides the following information: -

> *20 When wind turbines over 150m above ground level are to be built within 30km (16.2nm) of a certified or registered aerodrome, the proponent should notify the Civil Aviation Safety Authority and Airservices. If the wind farm is within 30km of a military aerodrome, Defence should be notified.*
>
> *33 Where a wind turbine 150m or taller in height is proposed away from aerodromes, the proponent should conduct an aeronautical risk assessment.*
>
> *34. The risk assessment, to be conducted by a suitably qualified person(s), should examine the effect of the proposed wind turbines on the operation of aircraft. The study must be submitted to CASA to enable an assessment of any potential risk to aviation safety. CASA may determine that the proposal is:*

(a) hazardous, but that the risks to aircraft safety would be reduced by the provision of approved lighting and/or marking; or

(b) not a hazard to aircraft safety.

The WWF is not sited within the OLS of any Regulated aerodrome and will not penetrate any PANS-OPS airspace, once the YWBL RNAV non-precision approach is amended, and is assessed as a LOW risk to aviation and is therefore *not a hazard to aircraft safety.*

Given the above, the WWF does not require obstacle lighting as the risk to aviation is LOW and no additional mitigating strategies are required. As noted in Section 5, several IFR rated pilots have made the statement that obstacle lighting cannot be seen in solid Instrument Meteorological Conditions, therefore it is not required.

7.2 Obstacle Lighting Summary

The WWF is not sited within the OLS of any certified or registered aerodrome and does not penetrate any PANS-OPS airspace, once the YWBL RNAV non-precision approach is amended, and is assessed as a LOW risk to aviation and is therefore *not a hazard to aircraft safety.*

The WWF does not require aviation obstacle lighting.

8. WIND MONITORING TOWERS

Meteorological Monitoring Masts are very difficult to see due to their slender construction and thin guy wires. The masts are often a grey (galvanised steel) colour that readily blends with the background.

The photograph in Fig 7 shows a Meteorological Monitoring Mast as seen from the ground.

Figure 7 – A Meteorological Monitoring Mast photographed from the ground

The aerial applications operators and the emergency services pilots all note the danger of meteorological monitoring masts to low flying aircraft. These pilots all made comment that ñmet masts are extremely dangerous.ò Each of these stakeholders requested that the NASF Guidelines, except for the strobe light, be used to make the masts more visible and that the markings be maintained in a serviceable condition.

The aerial applications pilots all requested that the outer guy wire ground anchor points be painted a contrasting colour to enhance their visibility. When low flying, particularly when spraying, the pilot is looking at the ground as their reference point. The contrasting ground anchor point is the most valuable visual cue in this situation.

It is generally considered by aerial agricultural pilots that a flashing strobe light is ineffective and as such should not be used.

All the markings used to make the masts more visible must be maintained in a serviceable condition. This is particularly important for balls, flaps and sleeves that deteriorate due to wind and sun damage.

8.1 NASF Guidelines – Marking of Meteorological Monitoring Masts

The NASF guideline also refers to the marking and lighting of wind monitoring towers. The relevant points are summarised as:

> *Wind monitoring towers are very difficult to see from the air due to their slender construction and guy wires. This is a particular problem for low flying aircraft, particularly aerial agricultural and emergency services operations.*
>
> *Measures to be considered to improve visibility include:*
>
> - *The top one third of wind monitoring towers be painted in alternating contrasting bands of colour. Examples can be found in the CASA MOS 139 sections 8 and 9;*
> - *Marker balls, high visibility flags or high visibility sleeves placed on the outer guy wires;*
> - *Ensuring the guy wire ground attachment points have contrasting colours to the surrounding ground and vegetation; or*
> - *A flashing strobe light during daylight hours*

8.2 Reporting of Tall Structures

The turbines proposed for the WWF have a tip height of 250m (820ft) AGL; therefore, they must be reported as per CASR 175.480.

CASR Part 175E requires that obstacles having a height of 100m AGL (turbines and

meteorological monitoring masts) be reported as tall structures for inclusion in the vertical obstacle database and on appropriate aeronautical charts.

The procedure for reporting tall structures is contained in Advisory Circular AC 139.E-01 v1.0 *Reporting of Tall Structures*[32].

Meteorological Monitoring Masts for the WWF must also be reported as per AC 139.E-01 and to the Aerial Application Association of Australia (admin@aaaa.org.au).

Consideration should be given to ensuring a NOTAM that provides the height and location of the structure is issued. This is due to the current lead time between reporting tall structures and the information appearing on aeronautical charts. The Airservices Australia Vertical Obstacles Database group will facilitate this as the masts are constructed and reported.

8.3 Recommendations

It is recommended that Willatook Wind Farm Pty Ltd ensure the wind monitoring towers used in the WWF are:

- Appropriately marked as per guidelines above except for strobe light;
- Reported as tall structures in accordance with AC139-08;
- Notified to the Aerial Application Association of Australia;
- Subject to a NOTAM specifying their location and height.

9. CONCLUSIONS – AERONAUTICAL IMPACT ASSESSMENT

9.1 Aviation Impact Statement

The WWF will not impact upon the following:

- The OLS surfaces for any Certified or Registered aerodrome;
- The LSALT for any published air routes in the vicinity;
- The PANS-OPS surfaces associated with the Instrument Approach Procedures at:
  - Portland or
  - Hamilton;
- The performance of Navigation Aids and Communications Facilities; or
- The performance of any surveillance radars.

[32] Advisory Circular AC 139.E-01 v1.0 December 2021

The WWF will impact on the PANS-OPS surfaces associated with Warrnambool. A change to the 10nm MSA from 2100ft to 2200ft is required for the YWBL Instrument Approach Procedures. Alternately the turbine tip height for those listed in Table 1 could be reduced to clear the PANS-OPS airspace.

9.1.1 Airservices Response to AIS

The response from Airservices Australia is shown at Appendix C.

The WWF will require changes to:

- 10nm MSA ï raise from 2100 to 2200;
- RWY 13 RNAV-Z Approach.

Airservices Australia advise that the LSALT for W635 will not require raising as the nearest turbine is beyond the RNP 2[33] criteria used to calculate LSALT.

The WWF will not affect any CNS facilities.

9.1.2 Department of Defence Response to AIS

The Department of Defence has no objections to the proposed WWF.

9.2 Risk Assessment

The QRA demonstrates that the WWF will *"not be a hazard to aircraft safety"* and therefore ñ*not of operational significance"* to aircraft operations.

9.3 Airstrip Review

The airstrip review demonstrated that the known airstrips, all used occasionally for aerial agricultural applications flying will remain operational. Airstrip #6 will may require some amendment to flight paths to remain clear of nearby turbines.

9.4 Obstacle Lighting

The Risk Assessment finds that the overall risk to aviation around the WWF is LOW and is therefore not a hazard to aircraft safety. On this basis no further mitigation is required.

Obstacle lighting is not required.

[33] RNP 2 is Required Navigation Performance category 2, which uses 2nm either side of track tolerance for calculating LSALT

9.5 Met Masts

Meteorological Monitoring Masts used on the WWF should have the:

- Top one third painted in alternating contrasting colour bands;
- Outer guy wires fitted with marker balls, high visibility flags or sleeves; and
- Outer guy wire ground attach points painted in contrasting colour.

9.6 Reporting of Tall Structures

The WWF wind turbines and meteorological monitoring masts are tall structures, therefore they must be reported to the Vertical Obstacle Database, managed by Airservices Australia. The procedure for reporting tall structures is contained in Advisory Circular AC 139.E-01 V1.0 *Reporting tall structures*.

Airservices Australia will facilitate the issue of a NOTAM that provides the height and location of the structure when construction of the first turbine or mast is completed and reported to the Vertical Obstacle Database.

9.7 Consultation with Warrnambool Airport Operator

The WWF impacts on the PANS-OPS airspace for Warrnambool aerodrome (YWBL) as discussed in section 4.4.3.

The Warrnambool City Council, as the aerodrome operator, and the Warrnambool Airport Reference Group have been engaged regarding the proposed changes to the published instrument approach procedures. Two key issues concerning the proposed changes were raised during this engagement. These were: -

- Raising the 10nm MSA by 100ft could change the ability to use an unpublished instrument (GNSS) arrival procedure
- The WWF project could impact future expansion of the Warrnambool airport runway 13.

As outlined in section 4.4.3, the proposed changes to the 10nm MSA only affect aircraft operating to the Instrument Flight Rules (IFR) when conducting an instrument approach to the aerodrome. Pilots conducting the published instrument approach procedure for runway 13 will not be affected as the changes refer to safety altitudes only. The safety altitude provides the minimum safe altitude for that segment of the flight and is below the published GNSS flight path.

The reference group expressed concern that raising the 10nm MSA by 100ft may impinge aircraft flying a non-published GNSS arrival procedure because they may be in cloud at the revised MSA and therefore cannot see the aerodrome to land using a visual flight rules procedure. This impact is minor a would apply to very few IFR flights arriving

at Warrnambool when low cloud and non-visual meteorological conditions exist. Flying the published instrument approach procedure allows the aircraft to descend to the Minimum Decision Altitude of 750ft. This is the preferable and safest procedure for IFR aircraft operating in low cloud and poor visibility conditions. The impact of raising the 10nm MSA by 100ft is assessed as low.

The WWF project will not impact on the redesign of the runway 13 instrument approach procedure to accommodate future planned expansion of the Warrnambool airport. An extension of runway 13 moves the threshold which is the reference point for the instrument approach. As such a new threshold requires a new instrument approach procedure to be designed.

The WWF project is more than 10nm from the runway 13 threshold, except for the change to the 10nm MSA, a runway extension of 500m or more could be accommodated without influence from the project. This is significantly greater than the proposed 300m extension.

Based on this engagement, it is the authorôs understanding that the Warrnambool City Council, as the aerodrome operator, will not consider endorsing and amendment to the 10nm MSA (or otherwise) until such time as a formal permit application has been received for consideration.

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APPENDIX A

Airservices Australia

Aviation Assessments for Wind Farm Developments

October 2019

APPENDIX A

airservices

To Whom It May Concern

Airservices Aviation Assessments for Wind Farm Developments

Guidelines to manage the risk to aviation safety from wind turbine installations (Wind Farms/Wind Monitoring Towers) have been developed by the National Airports Safeguarding Advisory Group (NASAG). NASAG is comprised of high-level Commonwealth, State and Territory transport and planning officials and has been formed to develop a national land use planning regime to apply near airports and under flight paths.

The wind farm guidelines provide information to proponents and planning authorities to help identify any potential safety risks posed by wind turbine and wind monitoring installations from an aviation perspective.

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

To facilitate these assessments all wind farm proposals submitted to Airservices must include an Aviation Impact Statement (AIS) prepared by an aeronautical consultant in accordance with the AIS criteria set out below.

AIS must be undertaken by an aeronautical consultant with suitable knowledge and capabilities to provide a reliable and comprehensive report. All data is to be supplied in electronic form. If you are not familiar with any aeronautical consultants, you may wish to view the member directory on the Australian Airports Association (AAA) website:

https://www.airports.asn.au/public/member-directory

AIS Criteria

The AIS must provide a detailed analysis covering, as a minimum:

Airspace Procedures:

1. Obstacles
   - Co-ordinates in WGS 84 (to 0.1 second of arc or better)
   - Elevations in metres (m) Australia Height Datum (AHD) (to 0.3m)
2. Drawings
   - Overlayed on topographical base not less than 1:250,000. Details of datum and level of charting accuracy to be noted.
   - Electronic format compatible with Microstation version V8i.
3. Aerodromes
   - Specify all registered/certified aerodromes that are located within 30NM (55.56km) from any obstacle referred to in (1) above.
   - Nominate all instrument approach and landing procedures at these aerodromes.

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- Confirmation that the obstacles do not penetrate Annex 14 or Obstacle Limitation Surface (OLS) for any aerodrome. If an obstacle does penetrate, specify the extent.

4. Air Routes
   - Nominate air routes published in ERC-L & ERC-H which are located near/over any obstacle referred to in (1) above.
   - Specify two waypoint names located on the routes which are located before and after the obstacles.
5. Airspace
   - Airspace classification – A, B, C, D, E, G etc where the obstacles are located.

Navigation/Radar:

1. Detect the presence of dead zones
2. False target analysis
3. Target positional accuracy
4. Probability of detection
5. Radar coverage implications
6. We would expect the analysis to follow the guidelines outlined in the latest version of the EUROCONTROL Guidelines on How to Assess the Potential Impact of Wind Turbines on Surveillance Sensors:

   https://www.eurocontrol.int/tags/guidelines

NOTE: Within the Eurocontrol Guidelines there are specific assumptions about the type of wind turbine for which the Guidelines are applicable (i.e. 3 blades, 30-200 m height, and horizontal rotation axis). For any deviations to the wind turbine characteristics listed within the Eurocontrol Guidelines, the proponent should justify to Airservices why these Guidelines are still applicable.

Airservices Review of AIS

Airservices will review the quality and completeness of an AIS and will undertake limited modelling and analysis to confirm the findings and recommendations of the report.

Provided the AIS is of sound quality and is complete in accordance with the above criteria, there is currently no charge for the review or limited modelling and analysis.

If the AIS is not of sound quality or is not complete in accordance with the above criteria, no modelling or analysis will be undertaken. Airservices will advise the proponent that the AIS does not meet the requirements and that the proposal cannot be assessed by Airservices.

If Airservices review of an AIS confirms impacts identified in the report (or identifies additional impacts), Airservices will advise the proponent of the impacts and the required mitigating actions (where mitigation is feasible). The proponent will also be advised that there will be charges for any mitigation actions to be undertaken by Airservices.

These charges may be advised at the time but it is likely that a detailed quote will be needed and this will only be provided on request from the proponent.

Please contact the Airport Developments Team on 03 9339 2182 or airport.developments@airservicesaustralia.com if you have any questions.

Current as at October 2019

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APPENDIX B

Willatook Wind Farm
Turbine Locations and Heights

APPENDIX B

The table below shows the 59 WWF turbine layout (V162_6_v080). The volume of airspace occupied by the turbines has not increased from that assessed for the previous layout, therefore the original assessment for the AIS and AIA remains valid.

WTG ID	Elev (m)	X (I)	Y (I)	Latitude (S)	Longitude (E)	250m WTG Tip Height AHD(m)	250m WTG Tip Height AHD (ft)	Add MOC 1000ft	LSALT
T40	83	602973.6584	5774260.39	38 10 25.29	148 10 32.21	333	1092.52	2092.52	2100
T39	87	602963.0559	5774822.01	38 10 07.073	148 10 31.49	337	1105.64	2105.64	2200
T23	81	600735.5939	5774615.87	38 10 14.67	148 09 00.06	331	1085.96	2085.96	2100
T33	83	602181	5775353	38 09 50.17	148 09 59.08	333	1092.52	2092.52	2100
T54	96	606583.5523	5776428.62	38 09 13.44	148 12 59.38	346	1135.17	2135.17	2200
T24	89	601107.0938	5775129.72	38 09 57.85	148 09 15.07	339	1112.20	2112.20	2200
T56	67	606959	5774946	38 10 01.38	148 13 15.61	317	1040.03	2040.03	2100
T2	117	594911.8799	5778008.34	38 08 26.89	148 04 59.13	367	1204.07	2204.07	2300
T21	79	600465.2245	5774157.76	38 10 29.63	148 08 49.19	329	1079.40	2079.40	2100
T43	67	602995.3704	5772438.99	38 11 24.36	148 10 24.06	317	1040.03	2040.03	2100
T45	89	603085	5775834	38 09 34.19	148 10 35.97	339	1112.20	2112.20	2200
T51	93	606007.2877	5776591.24	38 09 08.41	148 12 35.62	343	1125.33	2125.33	2200
T35	67	602429.801	5772373.75	38 11 26.71	148 10 10.84	317	1040.03	2040.03	2100
T18	94	598453.5869	5775587.48	38 09 44.06	148 07 25.81	344	1128.61	2128.61	2200
T53	77	606137.7868	5775998.83	38 09 27.57	148 12 41.30	327	1072.83	2072.83	2100
T59	71	607608	5773622	38 10 44.04	148 13 41.99	321	1053.15	2053.15	2100
T41	89	602978.2972	5776743.87	38 09 04.72	148 10 31.11	339	1112.20	2112.20	2200
T44	74	603078.996	5773025.39	38 11 05.30	148 10 37.19	324	1062.99	2062.99	2100
T25	64	601274.292	5772372.77	38 11 27.21	148 09 23.35	314	1030.18	2030.18	2100
T13	90	597418.3826	5775400.63	38 09 50.52	148 06 43.37	340	1115.49	2115.49	2200
T57	65	606986	5773741	38 10 40.45	148 13 17.37	315	1033.46	2033.46	2100
T20	63	600427	5772376	38 11 27.45	148 08 48.52	313	1026.90	2026.90	2100
T47	78	604412.6799	5777217.77	38 08 48.76	148 11 29.78	328	1076.12	2076.12	2100
T4	85	595295.3225	5775291.71	38 09 54.87	148 05 16.19	335	1099.08	2099.08	2100
T22	67	600595	5772972	38 11 08.05	148 08 55.13	317	1040.03	2040.03	2100
T9	91	596385.3098	5776184.31	38 09 25.50	148 06 00.54	341	1118.77	2118.77	2200
T58	66	607132	5774276	38 10 23.03	148 13 23.08	316	1036.75	2036.75	2100
T26	66	601286.5085	5773051.44	38 11 05.19	148 09 23.51	316	1036.75	2036.75	2100
T52	75	606013.3039	5775518.13	38 09 43.22	148 12 36.44	325	1066.27	2066.27	2100
T7	86	595987.3945	5775115.84	38 10 00.31	148 05 44.71	336	1102.36	2102.36	2200
T10	89	596523.8448	5775137.5	38 09 59.40	148 06 06.45	339	1112.20	2112.20	2200
T6	88	595539.092	5775735.76	38 09 40.37	148 05 25.99	338	1108.92	2108.92	2200
T48	99	604705.908	5777584.47	38 08 36.74	148 11 41.63	349	1145.01	2145.01	2200
T15	91	597785.8393	5775729.16	38 09 39.72	148 06 58.31	341	1118.77	2118.77	2200

WTG ID	Elev (m)	X (I)	Y (I)	Latitude (S)	Longitude (E)	250m WTG Tip Height AHD(m)	250m WTG Tip Height AHD (ft)	Add MOC 1000ft	LSALT
T29	83	601720.192	5775144.83	38 09 57.11	148 09 40.25	333	1092.52	2092.52	2100
T34	81	602338.8407	5774679.84	38 10 11.94	148 10 05.91	331	1085.96	2085.96	2100
T36	74	602447.6091	5773726.48	38 10 42.87	148 10 10.87	324	1062.99	2062.99	2100
T8	88	596022.8786	5775884.55	38 09 35.36	148 05 45.80	338	1108.92	2108.92	2200
T14	89	597509.1747	5776427.72	38 09 17.17	148 06 46.59	339	1112.20	2112.20	2200
T11	89	596819.6707	5775529	38 09 46.59	148 06 18.71	339	1112.20	2112.20	2200
T37	71	602448.5613	5773036.04	38 11 05.22	148 10 11.27	321	1053.15	2053.15	2100
T30	69	601827	5772400	38 11 26.10	148 09 46.05	319	1046.59	2046.59	2100
T27	79	601372.7727	5774416.31	38 10 20.88	148 09 26.35	329	1079.40	2079.40	2100
T16	91	598102.2931	5776261.04	38 09 22.34	148 07 11.04	341	1118.77	2118.77	2200
T55	82	606753.3193	5775545.46	38 09 42.02	148 13 06.83	332	1089.24	2089.24	2100
T12	90	597011.6545	5776113.53	38 09 27.55	148 06 26.31	340	1115.49	2115.49	2200
T49	90	605324.2281	5777145.1	38 08 50.73	148 12 07.27	340	1115.49	2115.49	2200
T17	92	598280.5902	5775069.54	38 10 00.92	148 07 18.96	342	1122.05	2122.05	2200
T50	83	605522.582	5776473.9	38 09 12.42	148 12 15.77	333	1092.52	2092.52	2100
T42	91	602981.6674	5777383.01	38 08 43.99	148 10 30.92	341	1118.77	2118.77	2200
T1	116	594541.4029	5777512.05	38 08 43.13	148 04 44.15	366	1200.79	2200.79	2200
T31	71	601867.9658	5773034.19	38 11 05.52	148 09 47.41	321	1053.15	2053.15	2100
T19	83	600069.0369	5773732.93	38 10 43.57	148 08 33.12	333	1092.52	2092.52	2100
T32	77	601951.2991	5774372.66	38 10 22.06	148 09 50.15	327	1072.83	2072.83	2100
T3	116	595052.1934	5777425.48	38 08 45.75	148 05 05.18	366	1200.79	2200.79	2200
T38	87	602652	5775570	38 09 42.94	148 10 18.32	337	1105.64	2105.64	2200
T28	92	601416	5777791	38 08 31.39	148 09 26.40	342	1122.05	2122.05	2200
T5	96	595355.7736	5776399.03	38 09 18.93	148 05 18.14	346	1135.17	2135.17	2200
T46	84	603504	5777464	38 08 41.15	148 10 52.34	334	1095.80	2095.80	2100

*Layout V162_6_v080 – **Note** WTG ID numbering is not sequential*
Tallest turbine tip height – T2 at 367m

Willatook Turbine Locations and Heights

Original 86 turbine layout

This 86 turbine layout has been superseded by the 59 turbine layout

ID	Easting	Northing	Latitude (S)	Longitude (E)	Tip Hgt	Elevation	Tip AHD (m)	Tip AHD (ft)	Add MOC 1000ft	LSALT
1	606538.7	5776120.91	-38.1565	142.216	250	93.3	343.3	1126.31	2126.31	2200
2	606074.2	5776155.92	-38.1563	142.2107	250	83.7	333.7	1094.82	2094.82	2100
3	603931	5781257.14	-38.1105	142.1855	250	120	370	1213.91	2213.91	2300
4	603783	5781947.01	-38.1043	142.1837	250	120	370	1213.91	2213.91	2300
5	598943.2	5776056.59	-38.158	142.1294	250	98	348	1141.73	2141.73	2200
6	599406.7	5775371.64	-38.1641	142.1347	250	90	340	1115.49	2115.49	2200
7	600015.6	5775488.87	-38.163	142.1417	250	90.7	340.7	1117.78	2117.78	2200
8	603580.5	5780391.65	-38.1184	142.1816	250	110	360	1181.10	2181.10	2200
9	599454	5776016.01	-38.1583	142.1352	250	95	345	1131.89	2131.89	2200
10	606021.1	5775524.04	-38.162	142.2102	250	80	330	1082.68	2082.68	2100
11	607695.6	5778173.69	-38.1379	142.2289	250	99.5	349.5	1146.65	2146.65	2200
12	598380.9	5777198.43	-38.1477	142.1228	250	97.6	347.6	1140.42	2140.42	2200
13	606531.5	5775520.46	-38.1619	142.216	250	75.4	325.4	1067.59	2067.59	2100
14	603271.3	5781297.53	-38.1102	142.178	250	120	370	1213.91	2213.91	2300
15	598253.4	5775606.44	-38.1621	142.1215	250	95.4	345.4	1133.20	2133.20	2200
16	597700.2	5775579.82	-38.1624	142.1152	250	92.8	342.8	1124.67	2124.67	2200
17	596568.7	5775256.13	-38.1654	142.1024	250	90	340	1115.49	2115.49	2200
18	596043.4	5775235.12	-38.1657	142.0964	250	90	340	1115.49	2115.49	2200
19	594620.5	5777395.46	-38.1464	142.0798	250	120	370	1213.91	2213.91	2200
20	597147.3	5775237.89	-38.1655	142.109	250	90	340	1115.49	2115.49	2200
21	596786.5	5776972.63	-38.1499	142.1046	250	90	340	1115.49	2115.49	2200
22	597400.3	5776906.53	-38.1505	142.1116	250	92.3	342.3	1123.03	2123.03	2200
23	597785	5774928.78	-38.1682	142.1163	250	91.9	341.9	1121.72	2121.72	2200
24	606066.1	5776746.37	-38.1509	142.2105	250	100	350	1148.29	2148.29	2200
25	608153.1	5778349.53	-38.1362	142.2341	250	100	350	1148.29	2148.29	2200
26	597128.4	5776007.38	-38.1586	142.1087	250	91	341	1118.77	2118.77	2200
27	601190.3	5775530.76	-38.1624	142.1551	250	90	340	1115.49	2115.49	2200
28	601914.1	5775900.8	-38.159	142.1633	250	90	340	1115.49	2115.49	2200
29	603385.7	5772848.44	-38.1864	142.1805	250	73.5	323.5	1061.35	2061.35	2100
30	600720	5772510.84	-38.1897	142.1501	250	70	320	1049.87	2049.87	2100
31	600759	5775318.22	-38.1644	142.1502	250	90	340	1115.49	2115.49	2200
32	602321.5	5776732.41	-38.1515	142.1678	250	90	340	1115.49	2115.49	2200
33	602504.3	5775435.15	-38.1632	142.1701	250	90	340	1115.49	2115.49	2200
34	601490.3	5775855.82	-38.1595	142.1585	250	90	340	1115.49	2115.49	2200
35	601670.2	5776743.3	-38.1515	142.1604	250	90	340	1115.49	2115.49	2200
36	602010.2	5774501.51	-38.1716	142.1646	250	80	330	1082.68	2082.68	2100
37	600595.2	5774199.37	-38.1745	142.1485	250	83.7	333.7	1094.82	2094.82	2100

ID	Easting	Northing	Latitude (S)	Longitude (E)	Tip Hgt	Elevation	Tip AHD (m)	Tip AHD (ft)	Add MOC 1000ft	LSALT
39	601833.5	5777571.57	-38.144	142.1621	250	95.4	345.4	1133.20	2133.20	2200
40	598438.2	5776513.24	-38.1539	142.1235	250	98.3	348.3	1142.72	2142.72	2200
41	603917.6	5780647.86	-38.116	142.1855	250	112.6	362.6	1189.63	2189.63	2200
42	595421.3	5775349.51	-38.1647	142.0893	250	88.8	338.8	1111.55	2111.55	2200
43	603113	5775982.35	-38.1582	142.177	250	90	340	1115.49	2115.49	2200
44	601996.7	5775249.46	-38.1649	142.1643	250	89.1	339.1	1112.53	2112.53	2200
45	602534.3	5774749.37	-38.1693	142.1705	250	85.6	335.6	1101.05	2101.05	2200
46	601490.3	5774761.87	-38.1693	142.1586	250	81.8	331.8	1088.58	2088.58	2100
47	602542.6	5773999.02	-38.1761	142.1707	250	80	330	1082.68	2082.68	2100
48	606545	5776754.99	-38.1508	142.216	250	100	350	1148.29	2148.29	2200
49	607231.6	5778062.98	-38.1389	142.2236	250	99.5	349.5	1146.65	2146.65	2200
50	603086.1	5780846.47	-38.1143	142.1759	250	118	368	1207.35	2207.35	2300
51	604206.6	5781926	-38.1045	142.1886	250	120	370	1213.91	2213.91	2300
52	604519.4	5780121.14	-38.1207	142.1924	250	120	370	1213.91	2213.91	2300
53	597892.5	5777038.87	-38.1492	142.1172	250	95.1	345.1	1132.22	2132.22	2200
54	602227.9	5776195.71	-38.1563	142.1668	250	90	340	1115.49	2115.49	2200
55	601151.2	5774477.15	-38.1719	142.1548	250	85.2	335.2	1099.74	2099.74	2100
56	603291.4	5781933.74	-38.1045	142.1781	250	126.3	376.3	1234.58	2234.58	2300
57	608714.8	5778170.44	-38.1378	142.2405	250	90	340	1115.49	2115.49	2200
58	596316.2	5776164.04	-38.1573	142.0994	250	94.7	344.7	1130.91	2130.91	2200
59	595956.2	5775916.92	-38.1595	142.0953	250	93.3	343.3	1126.31	2126.31	2200
60	596160.4	5776894.67	-38.1507	142.0975	250	90	340	1115.49	2115.49	2200
61	595414	5776645.25	-38.153	142.089	250	100	350	1148.29	2148.29	2200
62	595408.3	5775981.38	-38.159	142.089	250	99.6	349.6	1146.98	2146.98	2200
63	598745.7	5774928.78	-38.1681	142.1273	250	90	340	1115.49	2115.49	2200
64	597766.7	5774246.14	-38.1744	142.1162	250	90	340	1115.49	2115.49	2200
65	598263.7	5774909.24	-38.1684	142.1218	250	92.7	342.7	1124.34	2124.34	2200
66	607089.6	5775102.77	-38.1656	142.2225	250	70	320	1049.87	2049.87	2100
67	607091.8	5774400.88	-38.1719	142.2226	250	70	320	1049.87	2049.87	2100
68	607089.5	5773750.04	-38.1778	142.2227	250	70	320	1049.87	2049.87	2100
69	604493.3	5781216.76	-38.1108	142.1919	250	120	370	1213.91	2213.91	2300
70	595585.5	5777179.4	-38.1482	142.0909	250	112.1	362.1	1187.99	2187.99	2200
71	598744.5	5775585.98	-38.1622	142.1272	250	95.3	345.3	1132.87	2132.87	2200
72	597855.4	5776282.25	-38.156	142.1169	250	94.8	344.8	1131.23	2131.23	2200
73	600900.5	5772930.43	-38.1859	142.1521	250	70	320	1049.87	2049.87	2100
74	601502	5772930.43	-38.1858	142.159	250	70	320	1049.87	2049.87	2100
75	602107.2	5772925.06	-38.1858	142.1659	250	70	320	1049.87	2049.87	2100
76	602890.9	5772895.57	-38.186	142.1749	250	71.6	321.6	1055.12	2055.12	2100
77	601344.2	5772490.31	-38.1898	142.1573	250	70	320	1049.87	2049.87	2100
78	601949.7	5772493.42	-38.1897	142.1642	250	70	320	1049.87	2049.87	2100
79	602627.5	5772493.18	-38.1897	142.1719	250	70	320	1049.87	2049.87	2100

ID	Easting	Northing	Latitude (S)	Longitude (E)	Tip Hgt	Elevation	Tip AHD (m)	Tip AHD (ft)	Add MOC 1000ft	LSALT
81	607481.5	5773747.63	-38.1778	142.2271	250	70	320	1049.87	2049.87	2100
82	597300.1	5776369.24	-38.1553	142.1106	250	92.2	342.2	1122.70	2122.70	2200
83	602081.9	5773754.66	-38.1783	142.1655	250	79.9	329.9	1082.35	2082.35	2100
84	603087.8	5776776.3	-38.151	142.1766	250	90	340	1115.49	2115.49	2200
85	603270.6	5777416.18	-38.1452	142.1785	250	90	340	1115.49	2115.49	2200
86	605031.9	5777308.96	-38.146	142.1987	250	97.2	347.2	1139.11	2139.11	2200

Note: *Turbine T56 is the tallest turbine at 376.3m.*
The 86 turbine layout was superseded by a 59 turbine layout

APPENDIX C

Airservices Australia
AIS Response

APPENDIX C

ian_jennings@netspace.net.au

From: Airport Developments <Airport.Developments@AirservicesAustralia.com>
Sent: Friday, 30 April 2021 3:30 PM
To: 'ian_jennings@netspace.net.au'
Cc: 'Airspace Protection (Airspace.Protection@casa.gov.au)'
Subject: AIRSERVICES RESPONSE: VIC-WF-011 P3 - Willatook Wind Farm [SEC=OFFICIAL]

Hi Ian,

I refer to your request for an Airservices assessment of the Willatook Wind Farm.

Airspace Procedures
With respect to procedures designed by Airservices in accordance with ICAO PANS-OPS and Document 9905, at the various heights provided, WTGs 46, 47, 49, 50, 58, 59, 60 and 61 will **affect** the 10NM minimum sector altitude (MSA). WTG 61 will affect the RNAV-Z (GNSS) RWY 13 procedure at Warrnambool aerodrome.

In order to accommodate the wind farm the 10NM MSA and the segment minimum altitude for the initial segment of RNAV-Z (GNSS) RWY13 will need to be permanently increased by 100ft from 2100ft to 2200ft.

The maximum height of WTGs 46, 47, 49, 50, 58, 59, 60 and 61 without affecting any procedures at Warrnambool aerodrome is **340.15m/1116ft AHD**.

The wind farm will not affect any air route LSALT.

Note: procedures not designed by Airservices at Warrnambool and Hamilton aerodromes were not considered in this assessment.

Communications/Navigation/Surveillance (CNS) Facilities
This wind farm, to a maximum height of 372.8m (1223ft) AHD, will not adversely impact the performance of Precision/Non-Precision Navigational Aids, HF/VHF Communications, A-SMGCS, Radar, PRM, ADS-B, WAM or Satellite/Links.

Summary
Based on the above assessment as it is currently presented with the existing instrument flight procedure at Warrnambool Airport, Airservices view is that the proposed Willatook Wind Farm would have an impact on the safety, efficiency or regularity of existing, or future air transport operations into or out of Warrnambool Airport.

Airservices recommends that both aviation operators and the airports are consulted to ensure that all stakeholders fully understand the extent of the impact of these proposed changes. Furthermore, any Airservices work associated with amending the impacted procedure will be undertaken on a commercial basis and require further consultation.

Vertical Obstacle Notification
If the wind farm receives approval, as soon as construction commences, the proponent must complete the Vertical Obstacle Notification Form for tall structures and submit the completed form to VOD@airservicesaustralia.com. For further information regarding the reporting of tall structures, please contact (02) 6268 5622, email VOD@airservicesaustralia.com or refer to the web link below:
http://www.airservicesaustralia.com/services/aeronautical-information-and-management-services/part-175/

If you have any further queries, please let me know.

Kind regards,

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APPENDIX D

Department of Defence AIS Response

APPENDIX D
Department of Defence AIS Response

Australian Government
Department of Defence
Estate and Infrastructure Group

Charles Mangion
Director Land Planning and Regulation
Estate Planning Branch
Brindabella Business Park (BP26-1-A053)
PO Box 7925
Department of Defence
CANBERRA BC ACT 2610
☎: (02) 6266 8291
💻: Charles.mangion@defence.gov.au

ID-EP-DLP&R/OUT/2019/BS7302661

Mr Ian Jennings
Chiron Aviation Consultants
27 Hilda Street
Essendon Vic 3040

Dear Mr Jennings

NOTIFICATION REGARDING WILLATOOK WIND FARM – AVIATION IMPACT STATEMENT

Thank you for referring the abovementioned wind farm proposal to the Department of Defence (Defence) for comment. Defence understands that the proposal is to construct up to 86 wind turbines at a site approximately 32 kilometres north-west of Warrnambool in western Victoria. The proposal includes turbines with an overall tip height of 250 metres above ground level (AGL).

Defence has conducted an assessment of the proposed wind farm for potential impacts on the safety of Defence flying operations as well as possible interference to Defence communications and radar.

There is an ongoing need to obtain and maintain accurate information about tall structures so that this information can be marked on aeronautical charts. Marking tall structures on aeronautical charts assists pilot navigation and enhances flight safety. Airservices Australia (ASA) is responsible for recording the location and height of tall structures. The information is held in a central database managed by ASA and relates to the erection, extension, or dismantling of tall structures, the top of which is above:

a. 30 metres AGL, that are within 30 kilometres of an aerodrome; and
b. 45 metres AGL elsewhere.

The proposed 250 metres AGL turbines meet the requirements for reporting of tall structures. Defence therefore requests that the applicant provide ASA with "as constructed" details. The details can be emailed to ASA at vod@airservicesaustralia.com.

Defence notes that the *National Airports Safeguarding Framework Guideline D – Managing the Risk to Aviation Safety of Wind Turbine Installations (Wind Farms)/Wind Monitoring Towers* recommends that where a wind turbine 150 metres or taller in height is proposed away from aerodromes, the proponent should conduct an aeronautical risk assessment. It also recommends that the risk assessment be submitted to the Civil Aviation Safety Authority (CASA) to determine whether the proposal is a hazard to aircraft safety and requires approved lighting or marking. Defence supports this requirement and believes that in this instance, it would be prudent for the risk assessment of this proposal to be sent to CASA for consideration.

Defending Australia and its National Interests

If CASA determines that obstacle lighting is to be provided, it should be compatible with persons using night vision devices. If LED lighting is proposed, the frequency range of the LED light emitted should be within the range of wavelengths 665 to 930 nanometres.

If wind monitoring towers are to be constructed as part of the proposal, Defence notes that the *National Airports Safeguarding Framework Guideline D – Managing the Risk to Aviation Safety of Wind Turbine Installations (Wind Farms)/Wind Monitoring Towers - Paragraph 39* recommends the top 1/3 of wind monitoring towers are painted in alternating contrasting bands of colour in accordance with the Manual of Standards for Part 139 of the Civil Aviation Safety Regulations 1998.

Defence has no objection to the proposed wind farm provided that the project complies with the above conditions.

Should you wish to discuss the content of this advice further, my point of contact is Mr Tim Hogan at land.planning@defence.gov.au or by telephone on (02) 6266 8193.

Yours sincerely

Charles.Mangion Digitally signed by Charles.Mangion
Date: 2019.12.03 14:56:40 +11'00'

Charles Mangion
Director Land Planning & Regulation

3 December 2019

Defending Australia *and its National Interests*

APPENDIX E

South Australian Country Fire Service

Aerial Firefighting Fact Sheet

APPENDIX E

CFS FACT SHEET
Aerial firefighting

Although aircraft are often the most visible part of the response to a fire, and therefore believed to be the most important, almost all fires are still extinguished by ground crews.

The Country Fire Service (CFS) currently has a base fleet of 26 aircraft which can be relocated across several airstrips across the state to offer aerial firefighting support to ground crews.

Aircraft are particularly valuable for fires in difficult terrain or fast moving fires that are too dangerous for ground crews to be placed in front of.

They may not be able to fly if wind speeds are too high, dust or smoke covers the fire, or when daylight is fading.

Firefighting aircraft will also be grounded if Remotely Piloted Aircraft (drones) are flown without permission over a fire ground.

Although other places in the world may be experimenting with night aerial firefighting, the Country Fire Service can only legally and safely operate during daylight hours.

Single Engine Air Tanker (SEAT)

The CFS currently contracts 14 SEATs, or fire bombers, throughout South Australia.

The SEATs can fly at almost 300kph and carry 3,200 litres of water and firefighting chemicals.

Tactical and Strategic Overview aircraft

Eight helicopters and three aeroplanes make up the CFS tactical and strategic overview fleet.

These aircraft are used to observe, collect information to help predict the path of the fire, gather and relay information, and map the perimeter of the fire. They also help to coordinate SEATs to specifically support firefighters at problematic parts of the fire ground where ground crews may not be able to access the fire, or where people, homes and buildings may be in danger.

Government of South Australia

South Australian Country Fire Service
cfs.sa.gov.au

Contact the Bushfire Information Hotline
1800 362 361 (TTY 133 677)
@Countryfireservice
@CFSalerts

CFS

Aerial firefighting

Erickson Aircrane (S-64E)

The Erickson Aircrane can carry 7,200 litres of water and firefighting chemicals and can use its pump to refill from open water sources in just 45 seconds.

The Erickson is based in the Mount Lofty Ranges, where it is close to multiple open water supplies.

Large Air Tankers (LATs) and Very Large Air Tankers (VLATs)

As part of a national firefighting agreement LATs may be requested from interstate.

LATs are currently operated by the New South Wales and Victorian firefighting organisations, and may carry between 15,000 and 38,000 litres of water and firefighting chemicals.

CFS air support teams work with the support of the Royal Australian Air Force at Edinburgh to refill LATs at the airbase if multiple drops are required.

Cleaning up if firefighting chemicals are used on your property

The concentrations of chemicals used in drops are not harmful to animals or humans and are biodegradable.

It is recommended that you wash in cold water with a mild soap as a precaution to avoid possible skin irritation if you come in contact with the products.

If your house is doused and your gutters run off to a rainwater tank, you should drain and flush the gutters and tank, then refill with fresh water.

The concentrations of chemicals used by the CFS do not pose health risks but may change the taste and potability of drinking water.

Water mixed with aerial drops in rainwater tanks can still be used for cleaning and firefighting.

Animals, cars or buildings that are doused in firefighting drops can also be washed with water and appropriate shampoos or soaps to remove residue.

If fruit trees or vegetables are doused it is recommended they are washed thoroughly before consuming to remove any possible residue taste.

Government of South Australia

South Australian Country Fire Service
cfs.sa.gov.au

Contact the Bushfire Information Hotline
1800 362 361 (TTY 133 677)
@Countryfireservice
@CFSalerts

CFS

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APPENDIX F

Stakeholder List

APPENDIX F

The following organisations were consulted.

Stakeholder	Contact
Warrnambool City Council	Aerodrome Operator
Air Apply	Chief Pilot
Rohan Flying Services	Chief Pilot
Border Air	Chief Pilot
Field Air	Chief Pilot
Police Air Wing	Senior Base Pilot
Fixed Wing Ambulance (Pelair)	Senior Base Pilot
Helicopter Emergency Medical Service	Senior Base Pilot

APPENDIX G

Glossary of Terms And Abbreviations

APPENDIX G

Glossary of Terms and Abbreviations

AERONAUTICAL STUDY GLOSSARY

To facilitate the understanding of aviation terminology used in this report, the following is a glossary of terms and acronyms that are commonly used in aeronautical impact assessments and similar aeronautical studies. A full list of terms and abbreviations used in this report is included as an Appendix.

AC (Advisory Circulars) are issued by CASA and are intended to provide recommendations and guidance to illustrate a means, but not necessarily the only means, of complying with the *Regulations*.

Aeronautical study is a tool used to review aerodrome and airspace processes and procedures to ensure that safety criteria are appropriate.

AHD (Australian Height Datum) is the datum to which all vertical control for mapping is to be referred. The datum surface is that which passes through mean sea level at the thirty tide gauges and through points at zero AHD height vertically below the other basic junction points.

AIP (Aeronautical Information Publication) is a publication promulgated to provide operators with aeronautical information of a lasting character essential to air navigation. It contains details of regulations, procedures and other information pertinent to flying and operation of aircraft. In Australia, the AIP may be issued by CASA or Airservices Australia.

Air routes exist between navigation aid equipped aerodromes or waypoints to facilitate the regular and safe flow of aircraft operating under Instrument Flight Rules (IFR).

Airservices Australia is the Australian government-owned corporation providing safe and environmentally sound air traffic management and related airside services to the aviation industry.

Altitude is the vertical distance of a level, a point or an object, considered as a point, measured from mean sea level.

AMSL (Above Mean Sea Level) is the elevation (on the ground) or altitude (in the air) of any object, relative to the average sea level datum. In aviation, the ellipsoid known as World Geodetic System 84 (WGS 84) is the datum used to define mean sea level.

ATC (Air Traffic Control) service is a service provided for the purpose of:

a. preventing collisions:

    1. between aircraft; and

    2. on the manoeuvring area between aircraft, vehicles and obstructions; and

b. expediting and maintaining an orderly flow of air traffic.

CASA (Civil Aviation Safety Authority) is the Australian government authority responsible under the *Civil Aviation Act 1988* for developing and promulgating appropriate, clear and concise aviation

safety standards. As Australia is a signatory to the ICAO *Chicago Convention,* CASA adopts the standards and recommended practices established by ICAO, except where a difference has been notified.

CASR (Civil Aviation Safety Regulations) are promulgated by CASA and establish the regulatory framework *(Regulations)* within which all service providers must operate.

Civil Aviation Act 1988 (the Act) establishes the CASA with functions relating to civil aviation, in particular the safety of civil aviation and for related purposes.

ICAO (International Civil Aviation Organization) is an agency of the United Nations which codifies the principles and techniques of international air navigation and fosters the planning and development of international air transport to ensure safe and orderly growth. The ICAO Council adopts standards and recommended practices concerning air navigation, its infrastructure, flight inspection, prevention of unlawful interference, and facilitation of border-crossing procedures for international civil aviation. In addition, the ICAO defines the protocols for air accident investigation followed by transport safety authorities in countries signatory to the Convention on International Civil Aviation, commonly known as the *Chicago Convention*. Australia is a signatory to the *Chicago Convention.*

IFR (Instrument Flight Rules) are rules applicable to the conduct of flight under IMC. IFR are established to govern flight under conditions in which flight by outside visual reference is not safe. IFR flight depends upon flying by reference to instruments in the flight deck, and navigation is accomplished by reference to electronic signals. It is also referred to as, ña term used by pilots and controllers to indicate the type of flight plan an aircraft is flying,òsuch as an IFR or VFR flight plan.

IMC (Instrument Meteorological Conditions) are meteorological conditions expressed in terms of visibility, distance from cloud and ceiling, less than the minimum specified for visual meteorological conditions.

LSALT (Lowest Safe Altitudes) are published for each low-level air route segment. Their purpose is to allow pilots of aircraft that suffer a system failure to descend to the LSALT to ensure terrain or obstacle clearance in IMC where the pilot cannot see the terrain or obstacles due to cloud or poor visibility conditions. It is an altitude that is at least 1,000 feet above any obstacle or terrain within a defined safety buffer region around a particular route that a pilot might fly.

MOS (Manual of Standards) comprises specifications *(Standards)* prescribed by CASA, of uniform application, determined to be necessary for the safety of air navigation.

NASAG (National Airports Safeguarding Advisory Group) set up in May 2010 to implement the Australian Governmentôs National Aviation Policy White Paper, *Flight Path to the Future* initiatives relating to safeguarding airports and surrounding communities from inappropriate development. NASAG comprises representatives from state and territory planning and transport departments, the Civil Aviation Safety Authority (CASA), Airservices Australia, the Department of Defence and the Australian Local Government Association (ALGA) and is chaired by the Department of Infrastructure and Transport (DoIT).

NASF (National Airports Safeguarding Framework) is the published guidelines from the NASAG.

NOTAMs (Notices to Airmen) are notices issued by the NOTAM office containing information or instruction concerning the establishment, condition or change in any aeronautical facility, service,

procedure or hazard, the timely knowledge of which is essential to persons concerned with flight operations.

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.

OLS (Obstacle Limitation Surfaces) are a series of planes associated with each runway at an aerodrome that defines the desirable limits to which objects may project into the airspace around the aerodrome so that aircraft operations may be conducted safely.

PANS-OPS (Procedures for Air Navigation Services - Aircraft Operations) is an Air Traffic Control term denominating rules for designing instrument approach and departure procedures. Such procedures are used to allow aircraft to land and take off under Instrument Meteorological Conditions (IMC) or Instrument Flight Rules (IFR). ICAO document 8168-OPS/611 (volumes 1 and 2) outlines the principles for airspace protection and procedure design which all ICAO signatory states must adhere to. The regulatory material surrounding PANS-OPS may vary from country to country.

PANS OPS Surfaces. Like an Obstacle Limitation Surface, the PANS-OPS protection surfaces are imaginary surfaces in space which guarantee the aircraft a certain minimum obstacle clearance. These surfaces may be used as a tool for local governments in assessing building development. Where buildings may (under certain circumstances) be permitted to penetrate the OLS, they cannot be permitted to penetrate any PANS-OPS surface, because the purpose of these surfaces is to guarantee pilots operating under IMC an obstacle free descent path for a given approach.

Prescribed airspace is an airspace specified in, or ascertained in accordance with, the Regulations, where it is in the interests of the safety, efficiency or regularity of existing or future air transport operations into or out of an airport for the airspace to be protected. The prescribed airspace for an airport is the airspace above any part of either an OLS or a PANS OPS surface for the airport and airspace declared in a declaration relating to the airport.

Regulations (Civil Aviation Safety Regulations)

VFR (Visual Flight Rules) are rules applicable to the conduct of flight under VMC. VFR allow a pilot to operate an aircraft in weather conditions generally clear enough to allow the pilot to maintain visual contact with the terrain and to see where the aircraft is going. Specifically, the weather must be better than basic VFR weather minima. If the weather is worse than VFR minima, pilots are required to use instrument flight rules.

VMC (Visual Meteorological Conditions) are meteorological conditions expressed in terms of visibility, distance from cloud and ceiling, equal or better than specified minima

ABBREVIATIONS

Abbreviations used in this report, and the meanings assigned to them for the purposes of this report are detailed in the following table:

Abbreviation	Meaning
AC	Advisory Circular (document support CASR 1998)
ACFT	Aircraft
AD	Aerodrome
AHD	Australian Height Datum
AHT	Aircraft height
AIP	Aeronautical Information Publication
Airports Act	Airports Act 1996, as amended
AIS	Aeronautical Information Service
ALA	Aeroplane Landing Area
Alt	Altitude
AMSL	Above Minimum Sea Level
A(PofA)R	Airports (Protection of Airspace) Regulations, 1996 as amended
APARs	Airports (Protection of Airspace) Regulations, 1996 as amended
ARP	Aerodrome Reference Point
AsA	Airservices Australia
ATC	Air Traffic Control(ler)
ATM	Air Traffic Management
CAO	Civil Aviation Order
CAR	Civil Aviation Regulation
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulation
Cat	Category
DAP	Departure and Approach Procedures (charts published by AsA)
DER	Departure End of (the) Runway
DEVELMT	Development
DME	Distance Measuring Equipment
Doc nn	ICAO Document Number nn
DITCRD	Department of Infrastructure, Transport, Cities and Regional Development
DIRDC	Department of Infrastructure, Regional Development and Cities See DIRCRD above
DIRD	Department of Infrastructure and Regional Development. (Formerly Department of Infrastructure and Transport)
DoIT	Department of Infrastructure and Transport. Also called ñInfrastructureò (Formerly Department of Infrastructure, Transport, Regional Development and Local Government (DITRDLG) and previously the Department of Transport and Regional Services (DoTARS))
DITRDLG	See DoIT above
DOTARS	See DITRDLG above
ELEV	Elevation (above mean sea level)

Abbreviation	Meaning
ENE	East Northeast
ERSA	Enroute Supplement Australia
FAF	Final Approach Fix
FAP	Final Approach Point
ft	feet
GA	General Aviation
GNSS	Global Navigation Satellite System
GP	Glide Path
IAP	Instrument Approach Procedure
IAS	Indicated Airspeed
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
IHS	Inner Horizontal Surface, an Obstacle Limitation Surface
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
ISA	International Standard Atmosphere
km	kilometres
kt	Knot (one nautical mile per hour)
LAT	Latitude
LLZ	Localizer
LONG	Longitude
LSALT	Lowest Safe Altitude
m	metres
MAPt	Missed Approach Point
MDA	Minimum Descent Altitude
MGA94	Map Grid Australia 1994
MOC	Minimum Obstacle Clearance
MOS	Manual of Standards, published by CASA
MSA	Minimum Sector Altitude
SSR	Monopulse Secondary Surveillance Radar
MVA	Minimum Vector Altitude
NASAG	National Airports Safeguarding Advisory Group
NASF	National Airports Safeguarding Framework
NDB	Non Directional Beacon
NE	Northeast
NM or nm	Nautical Mile (= 1.852 km)
nnDME	Distance from the DME (in nautical miles)
NNE	Northeast
NOTAM	NOtice To AirMen
OAS	Obstacle Assessment Surface
OCA	Obstacle Clearance Altitude
OCH	Obstacle Clearance Height
OHS	Outer Horizontal Surface

Abbreviation	Meaning
OIS	Obstacle Identification Surface
OLS	Obstacle Limitation Surface
PANS-OPS	Procedures for Air Navigation Services ï Aircraft Operations, ICAO Doc 8168
PRM	Precision Runway Monitor
PROC	Procedure
PSR	Primary Surveillance Radar
QNH	An altimeter setting relative to height above mean sea level
Rnnn	Restricted Airspace ï promulgated in AIP as R with 3 numbers
REF	Reference
RL	Relative Level
RNAV	aRea NAVigation
RNP	Required Navigation Performance
RPA	Rules and Practices for Aerodromes ð replaced by the MOS Part 139 ð Aerodromes
RPT	Regular Public Transport
RWY	Runway
SFC	Surface
SID	Standard Instrument Departure
SOC	Start Of Climb
SSR	Secondary Surveillance Radar
STAR	Standard ARrival
TAR	Terminal Area Radar
TAS	True Air Speed
THR	Threshold (Runway)
TNA	Turn Altitude
TODA	Take-Off Distance Available
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions
V_n	aircraft critical Velocity reference
VOR	Very high frequency Omni directional Range