Final Report

Hexham Wind Farm

Aeronautical Impact Assessment

CCP16

6 October 2025

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EXECUTIVE SUMMARY

The proposed Hexham Wind Farm (HWF) will comprise up to 106 turbines with a tip height of 260m Above Ground Level (AGL).

There are two certified aerodromes within 30nm (56km) of the boundary of the HWF. These are Hamilton (YHML) and Warrnambool (YWBL). Each of these aerodromes have Pilot Activated Lighting (PAL) and non-precision RNP Instrument Approach Procedures.

There are known uncertified airstrips within 30nm of the wind farm.

The Aviation Impact Statement [Section 4] concluded that the HWF will not impact upon the following:

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

The HWF will impact the YWBL 10nm MSA because a significant number of turbines, with a LSALT of 2300ft are within the 5nm buffer. This will necessitate raising the YWBL 10nm MSA from 2200ft to 2300ft to maintain the required PANS-OPS safety clearance.

The Qualitative Risk Assessment [Section 5] demonstrates that for the HWF:

- By day the wind turbines are conspicuous by their size and colour;
- Night operations of aircraft do not occur below protected airspace;
- Aerodromes equipped for night operations are sufficiently distant; and
- The HWF is assessed as a LOW risk to aviation and is therefore not a hazard to aircraft safety.

Obstacle Lighting Review [Section 6] for the HWF finds that in accordance with the 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 proposed HWF wind turbines and meteorological monitoring masts are tall structures, therefore they must be reported to the Vertical Obstacle Database, managed by Airservices Australia in accordance with CASA Advisory Circular AC 139.E-01 v1.0 *Reporting tall structures*.

The Environmental Effects Statement [Section 9] criteria for aviation are considered to be met.

1. INTRODUCTION

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

1.1 Location

The project is approximately 15 kilometres west of Mortlake and approximately 15 kilometres north-east of Woolsthorpe in the Moyne Shire of south-west Victoria. The closest townships are Hexham, Caramut and Ellerslie, located approximately 3 kilometres north-east, 4 kilometres north-west and 3 kilometres south-west, respectively. Refer to Figure 1 below.

The proposed HWF will comprise up to 106 turbines with a tip height of 260m Above Ground Level (AGL).

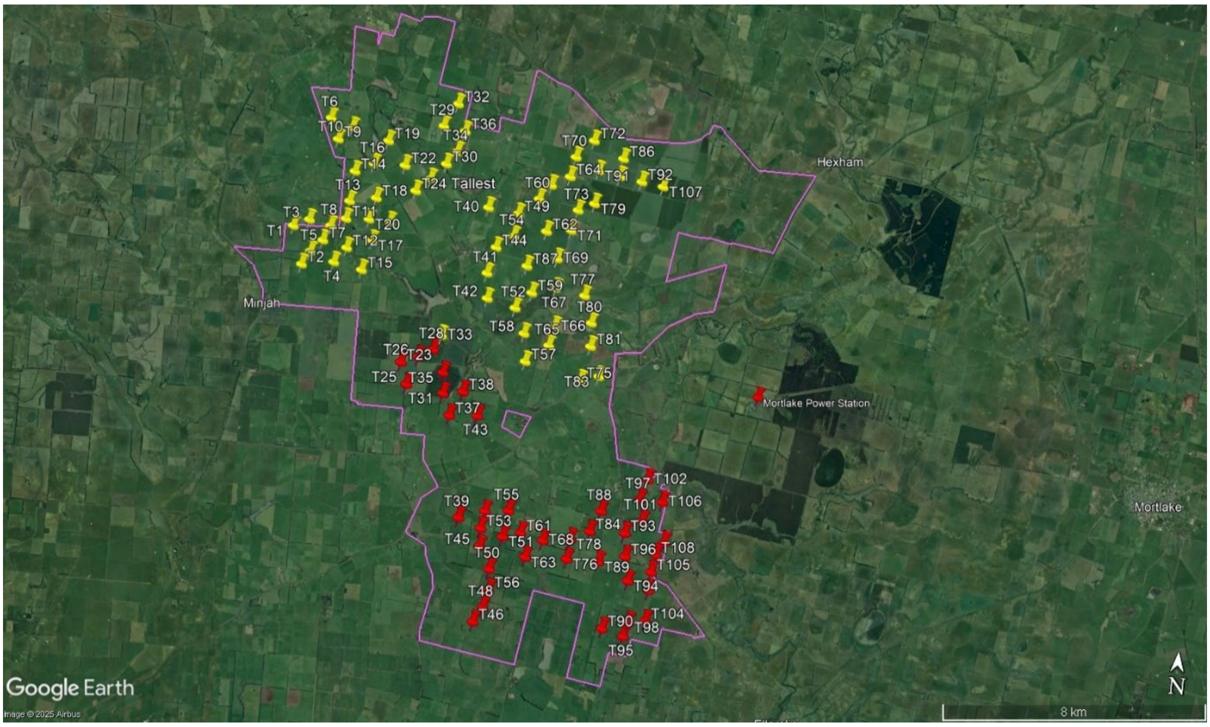

Figure 1 – Hexham Wind Farm Location.

1.2 Aerodromes and Airstrips

Aerodromes fall into three categories:

- Military or Joint (combined military and civilian)
- Certified and
- 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 Certified aerodrome is regulated under Civil Aviation Safety Regulation (CASR) 139.030. An aerodrome with a published instrument flight procedure must be certified.

An 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 Certified 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.

Uncertified 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 Uncertified aerodrome information is published in the AIP EnRoute Supplement Australia (ERSA)[3] it is clearly annotated as Uncertified and 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 discernable on satellite mapping services such as Google Earth.

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[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

Certified aerodromes have Obstacle Limitation Surfaces (OLS) for each runway. A Certified aerodrome with a published Instrument Approach Procedure has Procedures for Air Navigation Services – Aircraft Operations (PANS-OPS) surfaces protecting the airspace associated with the published instrument approach and landing procedures.

An Uncertified aerodrome is not regulated by CASR Part 139, is not protected by an OLS, cannot have a published instrument approach procedure, and does not have PANS-OPS protected airspace. All operations into uncertified aerodromes, therefore, must be conducted in accordance with the Visual Flight Rules (VFR) and in Visual Meteorological Conditions (VMC).

1.3 Aerodromes in the Area

For this report known aerodromes within 30nm (56km) of the HWF are considered as within the area. The figure of 30nm is used to encompass the PANS-OPS protected airspace associated with published instrument approach procedures at Certified aerodromes. Uncertified aerodromes do not have associated protected airspace.

There are two Certified Aerodromes at: -

- Hamilton (YHML) situated 29.85nm (55.28km) Northwest of turbine T6; and
- Warrnambool (YWBL) situated 11.62nm (21.52km) Southwest of turbine T46.

There are Uncertified Aerodromes (ALA) at:

- Cobden (YCDE)[5] situated 23.36nm (43.27km) Southeast of turbine T104;
- Derrinallum (YDER) (Western Aerial airstrip) situated 28.39nm (52.58km) East of turbine T107
- Camperdown (Border Airservices airstrip) is located 24nm (44.5km) east of turbine T70.
- Farm airstrip #1, situated 3.3nm (6.1km)) North northeast of turbine T107; and
- Farm airstrip #2, situated 5.35nm (9.92km) North northeast of turbine T107.

[5] Listed in ERSA

1.4 Air Routes in the Area

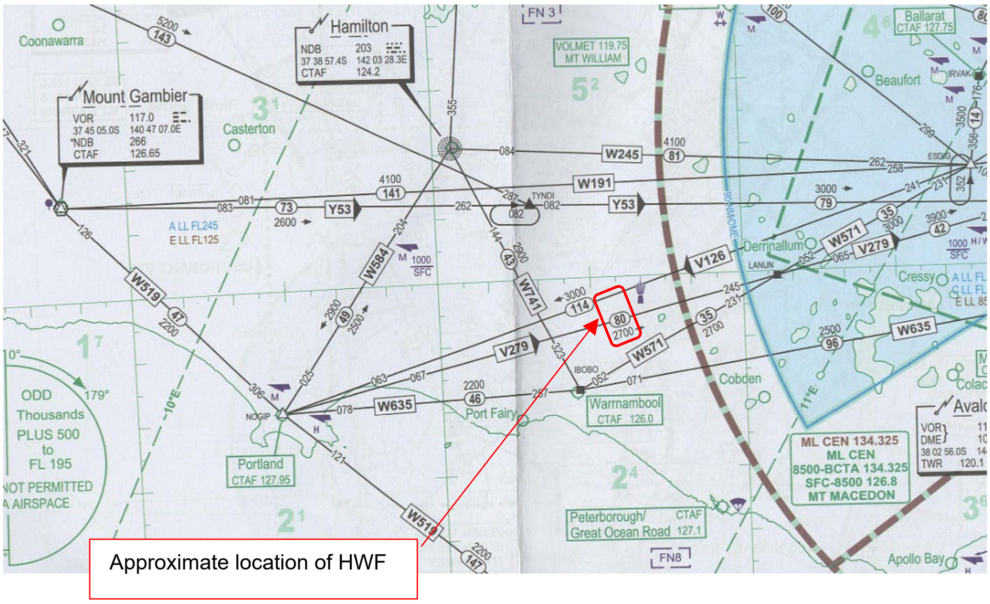

Figure 2 – Nearby Air Routes[6]

The HWF sits below two nearby air routes as shown in Figure 2.

1.5 Airspace in the Area

The HWF is in Class G airspace.

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

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 300m from a point on the terrain directly below the aircraft.

For a wind farm this equates to 500ft above the tallest turbine tip height. For the HWF this is 853 + 500 = 1353ft Above Ground Level (AGL).

An aircraft flying in accordance with the Instrument Flight Rules (IFR) must operate at or above the published or a calculated Lowest Safe Altitude.

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

[6] AIP ERC L2, dated 12 June 2025

2. SCOPE

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

2.1 Aviation Impact Statement

Airservices Australia (AsA) requires that all developers of proposed wind farms prepare an Aviation Impact Statement and submit this to AsA for evaluation and consideration.

The Aviation Impact Statement 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, 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 qualitative risk assessment 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 Obstacle Lighting Review

The obstacle lighting review reviews the outcome of the qualitative risk assessment to determine the need or otherwise for risk mitigation by the lighting of turbines in the wind farm with aviation obstruction lighting.

2.4 Environment Effects Statement

The Victorian Department of Transport and Planning (DTP) has requested an Environment Effects Statement (EES) for the proposed HWF.

The *Scoping Requirements for Hexham Wind Farm Environment Effects Statement* specify the matters to be investigated and documented within the EES and include draft evaluation objectives for each of the topics to be addressed. The evaluation objectives relevant to this Aeronautical Impact Assessment is set out in Table 1.

This report provides the information regarding aviation safety. This report assesses any likely interference to civil and military air traffic control communications, navigation and surveillance facilities (CNS). That is; communication with aircraft (air/ground), ground and space based aircraft navigation facilities and aircraft surveillance (radar/ satellite) facilities. It does not consider electromagnetic interference with telephone, television or Global Positioning System (GPS) used for ground navigation (e.g. farming).

Scoping requirement	Matter to be addressed	Addressed in this assessment
Key issues	Potential adverse effects of wind turbines and associated infrastructure from an aviation perspective, including but not limited to impacts on aerial safety, air traffic control equipment, obstruction and turbulence	Section 4 – Aviation Impact Statement
	Potential interference with communication systems that use electromagnetic waves as the transmission medium (e.g. television, radio, mobile reception)	Section 4.7 Air Traffic Control Communications, Navigation and Surveillance facilities only.
Existing environment	Identify and describe the nearest aerodromes, air navigation and air traffic management services, transiting air routes, and designated airspace such as Prohibited, Restricted and Danger Areas.	Section 4 – Aviation Impact Statement. (Note: the air traffic management services are located at Melbourne Centre. This report assesses the Communication, Navigation and Surveillance facilities that are relevant to the project, as used by Melbourne Centre to facilitate air traffic control.)
	Characterise current use of aerial spraying by district farmers and aerial firefighting that could be affected by the project (including any significant water resource that may be used for aerial firefighting in the region.)	Section 5.9 aerial applications Section 5.12 aerial firefighting
Likely effects	Identify potential long and short terms effects of the project on existing and potential land uses (such as aerial spraying and other agricultural activities), public infrastructure (such as roads, transport routes) and fire and emergency management (such as aerial firefighting).	Section 5.9, 5.11 and 5.12
	Identify potential effects and risks to aviation safety from the project	Section 4 – Aviation Impact Statement and Section 5 Qualitative Risk Assessment.
	Identify the potential for electromagnetic interference to radio-communications services from the project.	Section 4.7 – CNS Aviation Impact Statement (This report assesses the Communication, Navigation and Surveillance facilities, as used by Melbourne Centre to facilitate air traffic control that are relevant to the project)
Design and mitigation	Describe consultation undertaken with Civil Aviation Safety Authority and Country Fire Authority regarding potential merits of mitigation measures and propose design responses and/or other mitigation measures to reduce potential effects to aviation safety	Section 3.2
Performance	Describe any further measures that are proposed to mitigate, offset or manage social, land use and economic outcomes for communities living within or in the vicinity of the project area, as well as proposed measures to enhance beneficial outcomes.	Sections: - 5.16; 6.2; 7.3; and 8

Table 1 – EES scoping requirements HWF

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 certified 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;
  - Prohibited, Restricted, Danger and Military Operating Area airspace.

- 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 qualitative risk assessment 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 D 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 in regard to;

  - 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 qualitative risk assessment findings.

3.3 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 qualitative risk assessment, assess the need for aviation obstruction lighting as a risk mitigator.

4. AVIATION IMPACT STATEMENT

The Aviation Impact Statement (AIS) meets the requirements of Airservices Australia for their assessment of the potential impact of the proposed HWF 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 HWF is located between the towns of Caramut, Hexham, and Ellerslie and is approximately 32km north northeast of Warrnambool.

4.2 Obstacles

The HWF will comprise up to 106 turbines with a tip height of 260m AGL. The tallest turbine is T24 at 412m (1351.36ft) AHD. This gives a tip height of 1342ft; add the Minimum Obstacle Clearance (MOC) of 1000ft gives a height of 2342ft, rounded up to the nearest hundred the LSALT over the HWF is 2400ft.

The turbine locations and elevations are shown at Appendix A.

4.3 Drawings

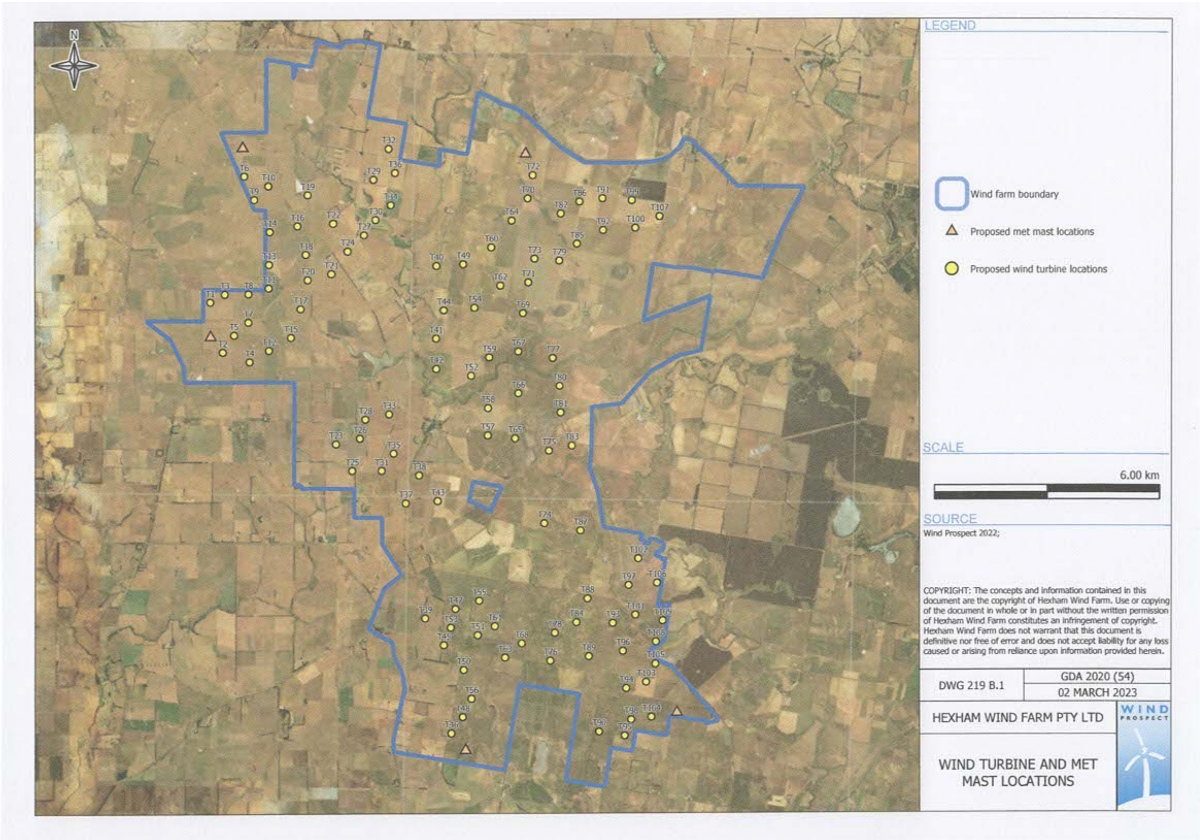

Figure 3 – Location of Hexham Wind Farm[7]

4.4 Aerodromes within 30nm

There are two Certified Aerodromes within 30nm (56km) of the proposed HWF as detailed below.

4.4.1 Hamilton (YHML)

Hamilton (YHML) is a Certified Aerodrome located 29.85nm (55.28km) northwest of turbine T6.

The main runway, RWY 17/35 is 1704m long, sealed and equipped with Pilot Activated Lighting (PAL). YHML has published Instrument Approach Procedures (IAP); being non-precision satellite based Required Navigation Performance (RNP) and a ground based Non Directional Beacon (NDB) radio navigation aid. YHML has Obstacle Limitation Surfaces (OLS) and Procedures for Air Navigation Services – Aircraft Operations (PANS-OPS) surfaces protecting the airspace at the aerodrome. The HWF is beyond

[7] Supplied by Hexham Wind Farm Pty Ltd

the OLS and below the 25nm Minimum Safe Altitude (MSA) of 2,700ft for YHML.

The HWF does not affect the OLS or PANS-OPS protected airspace at YHML.

4.4.2 Warrnambool (YWBL)

Warrnambool (YWBL) is a Certified Aerodrome situated 11.62nm (21.52km)southwest of turbine T46.

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 published non-precision RNP IAP.

YWBL has Obstacle Limitation Surfaces (OLS) and Procedures for Air Navigation Services – Aircraft Operations (PANS-OPS) surfaces protecting the airspace at the aerodrome. The HWF is beyond the OLS.

The closest HWF turbine T46 is 20,900m from the Runway 22 threshold and is therefore beyond the 5,500m Conical surface for this runway.

The HWF does not affect the YWBL OLS.

The tallest turbine is T24 at 401m (1316ft) AHD. Add the Minimum Obstacle Clearance (MOC) of 1000ft gives a figure of 2316ft, rounded up to the nearest hundred feet, the LSALT over the HWF is 2400ft. The YWBL 25nm MSA is 3300ft and the 10nm MSA is 2200ft. The 10nm MSA was increased from 2100ft to 2200ft in the 20MAR2025 edition of the AIP.

The HWF is below the 25nm MSA and beyond the 10nm MSA, however, a significant number of turbines are within the 5nm buffer for the 10nm MSA. The turbines within 15nm of YWBL all have a LSALT of 2300ft. See Appendix A yellow hatched turbine numbers.

The YWBL 10nm MSA will need to be raised from 2200ft to 2300ft to clear the HWF.

4.4.3 Other aerodromes and airstrips

The Cobden (YCDE) Uncertified Aerodrome is 23.08nm (42.75km) SE of turbine T104, with a 900m sealed runway with a 18/36 orientation. YCDE has Pilot Activated Lighting (PAL), however it is not CASA inspected. YCDE is a comparatively busy aerodrome that is home to approximately 12 light aircraft.

The HWF does not affect YCDE as it is considered sufficiently distant, that is beyond 30km.

The Derrinallum (YDER) Aeroplane Landing Area is 28.87nm (53.46km) East of turbine T107, with a 1300m natural surface runway with a 18/36 orientation. This ALA is the base for an Aerial Agricultural Applications operator. There are no details for this ALA listed in ERSA or the DAH.

The HWF does not affect YDER as it is considered sufficiently distant, that is beyond 30km.

The Camperdown Aeroplane Landing Area is 24nm (44.44km) east of turbine T104 with an 800m runway with a 18/36 orientation. The ALA is the base for an Aerial Agricultural Applications operator. There are no details for this ALA listed in ERSA or the DAH.

The HWF does not affect the Camperdown ALA as it is considered sufficiently distant, that is beyond 30km.

- Farm airstrip #1, situated 3.3nm (6.1km)) North northeast of turbine T107 has a runway oriented 10/28 [west northwest/east southeast]; and
- Farm airstrip #2, situated 5.35nm (9.92km) North northeast of turbine T107 has a runway oriented 18/36 [north/south].

The farm airstrips #1 at 3.3nm (6.1km) and #2 at 5.35nm (9.92km) from the HWF are used occasionally for aerial agricultural applications aircraft. These airstrips are considered sufficiently distant from the nearest turbine for the HWF to have no impact on their continued operation.

4.5 Air Routes and Lowest Safe Altitudes

The significant published air routes in the vicinity of the HWF and their LSALT are shown in Table 2 and Figure 4 below.

Route	Segment	LSALT
GRID		2400
V279	One Way NOGIP/LANUN	2700
V126	One Way ESDIG/NOGIP	3000

Table 2 – Published LSALT

The tallest turbine tip is T24 at 401m (1315.28ft) AHD. The LSALT over the HWF is, therefore, 2400ft. This is below the lowest published LSALT and therefore does not impact any published LSALT for air routes in the vicinity.

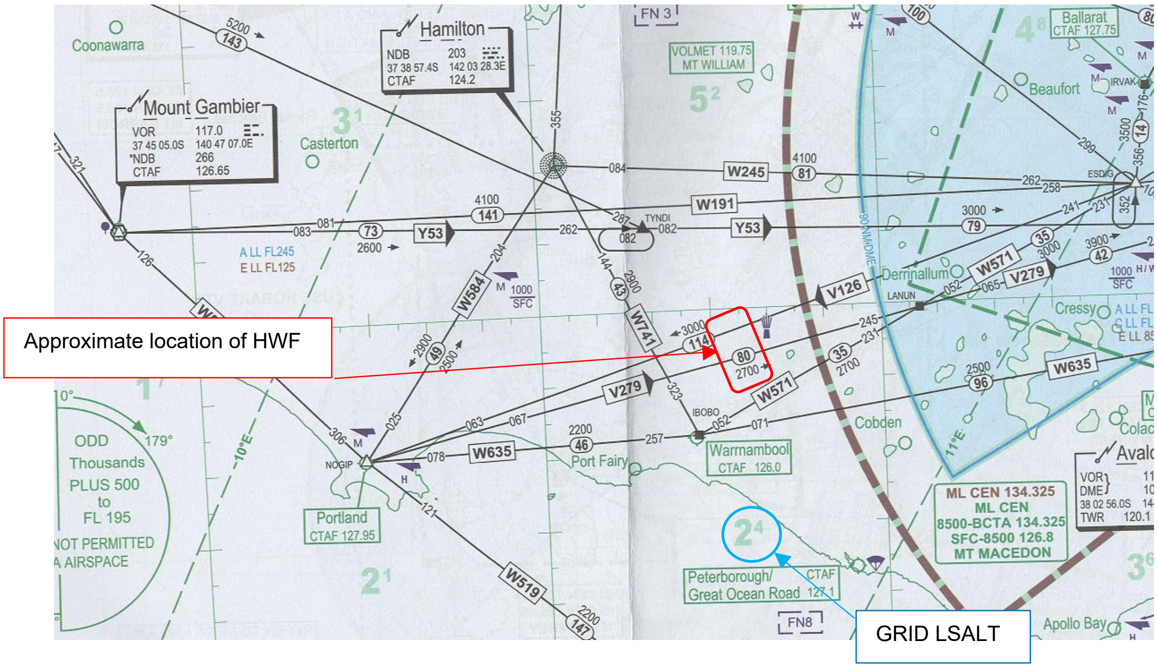

Figure 4 – Nearby Air Routes[8]

4.6 Airspace

The HWF is in Class G airspace.

There is no Special User Airspace nor Prohibited, Restricted or Danger Areas (PRD) within the vicinity of the HWF.

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

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*[9].

The CASR Part 139 Manual of Standards – 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.

[8] AIP ERC L2, dated 12 June 2025

[9] Available at http://www.eurocontrol.int/sites/default/files/publication/files/20140909-impact-wind-turbines-sur-sensors-guid-v1.2.pdf

4.7.1 Communications

There is an Airservices Australia ATC communications facility at Mt William at an elevation of 3740ft (1140m) and 52nm to the north of the HWF. The HWF will have no impact on the operations of these facilities as it is below the antennae elevation and sufficiently distant.

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 HWF turbines some 30nm (56km) distant.

4.7.3 Surveillance

The nearest civil aviation surveillance facility is a Secondary Surveillance Radar (SSR) at Mt Macedon 184km (99nm) northeast. The Primary Surveillance Radar (PSR) at Gellibrand Hill (Tullamarine airport) is 200km (108nm) northeast.

The applicable document, as referred to in the Airservices assessment, 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.

Zone	Zone 1	Zone 2	Zone 3	Zone 4
Description	0 – 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 – 500m	500m – 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 184km (99nm) northeast is well beyond the 16km distance, therefore no assessment is required.

The Primary Surveillance Radar (PSR) at Gellibrand Hill (Tullamarine airport) is 200km (108nm) northeast. The antenna height is 228m AHD. The maximum tip height of the HWF is 397m AHD, however there is high ground of approximately 480m AHD between the PSR site and the HWF turbines. This will put the HWF outside the line of site of the Gellibrand Hill PSR, therefore no assessment is required.

The HWF 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 HWF will not impact upon the following:

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

The HWF will impact the YWBL 10nm MSA because a significant number of turbines, with a LSALT of 2300ft are within the 5nm buffer. This will necessitate raising the YWBL 10nm MSA from 2200ft to 2300ft to maintain the required PANS-OPS safety clearance.

4.9 Airservices Australia Response

The response from Airservices Australia is shown at Appendix D.

The Airservices Australia response VIC-WF-043-P2 is dated 22 June 2023. Since then the HWF layout has changed, however the LSALT of the turbines within the 10nm MSA and buffer remains at 2300ft.

Airservices Australia advise that the southern group of turbines proposed for the HWF are within the tolerance zone for the 10nm MSA and will require a change to the 10nm MSA from 2100 to 2300 for the YWBL non-precision instrument approach procedure.

The YWBL 10nm MSA was amended from 2100ft to 2200ft in the 20MAR2025 edition of the AIP DAP.

The HWF will not affect any CNS facilities.

4.10 Department of Defence Response

The response from the Department of Defence is shown at Appendix E.

The Department of Defence advise, by e-mail dated 2 March 2023 that their original assessment response stands.

5. QUALITATIVE RISK ASSESSMENT

The expression "in the vicinity of the aerodrome" is considered by CASA to mean within the boundaries of either the OLS or the PANS-OPS surfaces of a certified aerodrome.

The NASF Guideline D considers 30km (16.2nm) from a certified aerodrome to be "in the vicinity."

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

More generally the impact on any certified aerodrome within 56km (30nm) of a wind farm is considered to incorporate the protected airspace associated with any published Instrument Approach Procedure at the aerodrome.

5.1 Certified Aerodromes

As noted in Section 4.4 there are two Certified aerodromes, Hamilton (YHML) and Warrnambool (YWBL), within 30nm of the proposed HWF.

The HWF does not affect the OLS or PANS-OPS protected airspace for YHML.

The HWF does not affect the OLS for YWBL, however the 10nm MSA will need to increase from 2200 to 2300ft to maintain the required PANS-OPS safety clearance.

5.1.1 Warrnambool aerodrome master plan

The Warrnambool aerodrome master plan (2021) refers to the extension of runway 13/31 by 350m to the northeast. This runway extension is not impacted by the HWF.

The current operations at Warrnambool require prior permission for any aircraft with a Maximum Take Off Weight (MTOW) of greater than 5,700kg. This is the MTOW of the fixed wing air ambulance Beechcraft Super Kingair aircraft. Sustained operations of heavier aircraft, such as a SAAB 340 or Dash8 airliner will require a strengthening of the runway pavement as well as the runway extension.

The HWF will not impact future aerodrome development as outlined in the master plan.

5.2 Identified Uncertified Aerodromes (ALA)

Section 4.4.3 lists the known Uncertified aerodromes (ALA) within 30nm of the HWF. These are:

- Cobden (YCDE);
- Derrinallum (YDER);
- Camperdown; and
- Two known farm airstrips.

Derrinallum and Camperdown are private airstrips owned by Aerial Agricultural contractors. The HWF does not affect any of these uncertified aerodromes as they are considered sufficiently distant, that is greater than 30km.

Private farm airstrips #1 and #2 are used occasionally for aerial applications operations. They are considered sufficiently distant from the HWF for the type of use to continue unaffected by the HWF.

5.3 Airspace

The HWF is in Class G airspace.

There is no Special User Airspace nor Prohibited, Restricted or Danger Areas (PRD) within the vicinity of the HWF.

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

5.4 Relevant Air Routes

The HWF sits below the air routes listed in Table 2, Section 4.5.

The LSALT over the HWF is 2400ft which is below the lowest published LSALT.

The HWF does not impact any LSALT for nearby published 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 YHML and YWBL are equipped with Pilot Activated Lighting (PAL) and non-precision RNP Instrument Approach Procedures and therefore are available for night operations by both IFR and VFR at Night capable aircraft.

Night operations into YHML and YWBL are not affected by the HWF.

5.6 General Aviation Flying Training

Wind turbines, by their size and colour are considered to be 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 basic pilot training 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 HWF.

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 highest obstacle. Ultra-light aircraft have a Maximum Take-Off Weight (MTOW) of 600kgs or less. A small General Aviation aircraft such as a Cessna C172 has a MTOW of 1110kg. The cruising speed of these aircraft is generally lower than for a GA aircraft thus giving more time to see and avoid obstacles. *The photo shows an Australian built Lightwing ultra-light aircraft.*

5.8 Approved Low Flying Training Activities

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

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.

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[10]."*

[10] Expert opinion obtained by the author during previous QRA work

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."*[11]

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

The author has verified video of an aerial agricultural aircraft spraying within the Bald Hills wind farm in Victoria.

All the operators consider meteorological monitoring masts to be "killers" because they are very difficult to see. The agreement amongst them was that as a minimum they 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 HWF.

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. The pilot in command has the ultimate responsibility for the safety of the aircraft.

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, and the use of Night Vision Imaging Systems (NVIS).

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 NVIS enabling the pilot "to see" in reduced light conditions.

5.11.2 Helicopter Emergency Medical Services

The Helicopter Emergency Medical Service (HEMS) helicopters are capable of IFR flight

[11] Stakeholder interview with aerial applications operators.

and flown by suitably IFR rated pilots who are also qualified for low level flight, and the use of Night Vision Imaging Systems (NVIS). 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."*[12] 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 HWF 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)."*[13]

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. Aerial firefighting is just one of the resources available and its use may or may not be appropriate to the current fire ground situation. There will be times when aerial firefighting is not possible due to turbulence, smoke, strong wind or erratic fire behaviour.

5.12.1 Aerial Firefighting

At all times the pilot in command has the ultimate responsibility for the safety of the aircraft.[14]

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 and will remain clear of smoke so that they can accurately and safely drop the fire retardant.

"It is important to remember that aircraft alone do not extinguish fires."[15]

[12] Stakeholder interview Senior Base Pilot, HEMS Victoria.
[13] Stakeholder interview, Senior Base Pilot, Fixed Wing Air Ambulance.
[14] This is part of the Civil Aviation Safety Regulations 1998, and a point reiterated in an interview by the author with a Victorian Forest Fire Management Fire Ground Manager, CFA Officers and aerial firefighting pilots.
[15] NSW Rural Fire Service submission to the Senate Select Committee on Wind Turbines, 6 March 2015, page 2

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 'just another hazard' that has to 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[16]:

a) Wind turbines must be located no less than 300 metres apart.

b) Wind turbines must be provided with automatic shut-down, and the ability to be completely disconnected from the power supply in the event of fire.

c) Installed weather monitoring stations (sic) [Masts] must be notified to the Civil Aviation Safety Authority (CASA) as per CASA Advisory Circular AC 139.E-05 v1.1, October 2022

d) All guy wires and monitoring towers must be clearly marked, even where marking is not required by CASA.

Modifications to Model Requirements must be in consultation with CFA.

There will be times when aerial firefighting is not possible due to heat, turbulence, smoke, strong wind or erratic fire behaviour. During such conditions aerial firefighting aircraft (fixed wing and helicopter) are grounded because it is too dangerous to fly.

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, [Boeing 737, Bombardier Dash 8 and Bae 146] in Victoria is the limited number of suitable aerodromes. For the B737, the only suitable aerodromes are Melbourne, Avalon, Mildura and East Sale RAAF Base. Consequently the "turnaround time" between retardant drops can be considerable.

16 Design Guidelines and Model Requirements, Renewable Energy Facilities v4, August 2023 para 4.2.6.1

NSW RFS B737 VLAT – Based at RAAF Richmond – Registered as N138CG

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.

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. Night aerial firefighting by fixed wing aircraft is currently undertaken only by the foreign registered Large Aerial Tankers such as the Boeing 737 or Dash 8 -400.

The number of firefighting aircraft capable of scooping water to refill whilst flying is small.

These aircraft require approximately 1000m of obstacle free airspace and water to safely descend, scoop fill and climb out of the suitable water source. The closest lakes; *Keilambete* 22km southeast of turbine T104 and *Colongulac* 45km east of turbine T104 are sufficiently distant from the HWF. These lakes may or may not be suitable water sources due to their depth during summer. All other fixed wing aircraft land at the nearest suitable aerodrome to refill. Helicopters use any water source they can access with a snorkel or bucket to refill. This includes swimming pools through to sewage ponds.

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 act 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.

The CFA recommends:

> *Construction of a four (4)-metre perimeter road is not required for wind energy facilities. However, suitable fire truck access is required to each turbine and building on-site.*
>
> *Constructed roads developed during the construction phase of facilities must be maintained post-commissioning and throughout the operational life of the facility, to allow access to each turbine for maintenance and emergency management purposes. The number and location of vehicle access points must be determined in consultation with CFA.*
>
> *Modifications to Model Requirements must be in consultation with CFA.*

The CFA further recommends:

> *Vehicle access to a hardstand should be designed to allow for a fire truck to leave the hardstand in a forward direction. This can be achieved with loop roads, perimeter roads and the like. Where this cannot be achieved, the maximum distance that a fire truck can be expected to reverse safely is 60m.*
>
> *Where vehicle access to a hardstand is greater than 60m, such as dead-end roads or a single access, a turning area complying with one of the following options should be provided. No parking is*

permitted in the turning area and appropriate 'NO PARKING' signage is to be provided.

Providing adequate fire truck access to and within facilities assists CFA to safely and effectively respond to areas within the site that may be threatened by fire.[17]

5.13 Topographical and Marginal Weather Conditions

The topography of the area of the HWF is generally sloping coastal hinterland rising from sea level to 200m AHD[18]. 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.

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 LSALT's that are designed to keep the aircraft clear of obstacles and terrain.

CASR 91.267, Minimum Height Rules – 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 "stress of weather or any other unavoidable cause."

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.[19]

[17] Design Guidelines and Model Requirements, Renewable Energy Facilities v4, August 2023 para 4.2.1, CFA

[18] World Aeronautical Chart (WAC) 3469 HAMILTON, 22nd edition hypsometric tints.

[19] Accidents involving Visual Flight Rules pilots in Instrument Meteorological Conditions, Australian Transport Safety Bureau, 22 August 2019,

5.14 Advisory Circular AC139.E-05 v1.1

AC139.E-05 v1.1 *Obstacles (including wind farms) outside the vicinity of a CASA certified aerodrome* was issued in October 2022.

This AC states in the introduction: -

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

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 HWF 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 – 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

The turbines and meteorological monitoring towers used in the HWF must be reported to Airservices Australia in accordance with AC 139.E-01 v1.0 *Reporting of Tall Structures* to ensure their position is held in the Vertical Obstacles Database and marked on aeronautical charts.

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 within 30km of a certified aerodrome and have been notified to Airservices Australia and CASA.

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 HWF 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 HWF turbines are conspicuous by their size and colour. The HWF 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 protected 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 11.59nm (21.46km) to the south southwest of turbine T46.

Given the above, the HWF 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 HWF 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 HWF will not penetrate any PANS-OPS surfaces when the YWBL 10nm MSA is raised to 2300ft, 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 HWF.

> *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 HWF 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 HWF is not sited within the OLS of any certified aerodrome and does not penetrate any PANS-OPS airspace, once the YWBL 10nm MSA is amended, and is assessed as a LOW risk to aviation and is therefore *not a hazard to aircraft safety.*

5.16 Qualitative Risk Assessment Findings

Risk Element	Assessed Level of Risk	Comment
Airport Operations	LOW	
Aircraft Landing Area Operations	LOW	Suitability for use is a pilot responsibility.
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 exist 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 3 – Risk Assessment Summary

The basis for the qualitative risk assessment 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 qualitative risk assessment for the Hexham Wind Farm assesses it as *not a hazard to aircraft safety*.

6. OBSTACLE LIGHTING REVIEW

6.1 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 – Aerodromes are applicable to certified 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.*[20]

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

6.1.1 *Civil Aviation Safety Regulations*

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

6.1.2 *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 HWF is outside the obstacle limitation surface of any military or certified aerodrome MOS 139 does not apply.

6.1.3 *Advisory Circular AC139.E-05 v1.1*

The AC139.E-05 v1.1 *Obstacles (including wind farms) outside the vicinity of a CASA certified aerodrome* recommends that an aeronautical study be conducted by the wind

[20] Senate Select Committee on Wind Turbines, Final Report, August 2015, paragraph 5.38

farm 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 HWF is a LOW risk to aviation and is therefore *not a hazard to aircraft safety.* Consequent to this, aviation obstacle lighting is not required.

6.1.4 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 HWF is not sited within the OLS of any certified aerodrome and does not penetrate any OLS or PANS-OPS airspace, once the YWBL 10nm MSA is amended, and is assessed as a LOW risk to aviation and is therefore *not a hazard to aircraft safety.*

Given the above, the HWF 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 (in heavy cloud), therefore it is not required.

6.2 Obstacle Lighting Summary

The HWF is not sited within the OLS of any certified aerodrome and does not penetrate any PANS-OPS airspace, once the YWBL 10nm MSA is amended, and is assessed as a LOW risk to aviation and is therefore *not a hazard to aircraft safety.*

The HWF does not require aviation obstacle lighting.

7. 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 aerial applications operators and the emergency services pilots all note the danger of meteorological monitoring masts to low flying aircraft. All these pilots made comment that “met masts are extremely dangerous.” 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 photograph in Fig 5 shows a Meteorological Monitoring Mast as seen from the ground.

Figure 5 – A Meteorological Monitoring Mast photographed from the ground[21]

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 applications 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.

7.1 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*

[21] Author photo

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.*

7.2 Reporting of Tall Structures

The turbines proposed for the HWF have a tip height of 260m (854ft) 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 and documentation.

The procedure for reporting tall structures is contained in Advisory Circular AC 139.E-01 v-1.0 *Reporting of Tall Structures*[22]*.*

Meteorological Monitoring Masts for the HWF should also be reported to the Aerial Application Association of Australia (admin@aaaa.org.au).

Consideration should be given to ensuring an AIP Supplementary[23] advice 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.

7.3 Recommendation

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

- Appropriately marked as per guidelines above except for strobe light;
- Reported as tall structures in accordance with AC139.E-01;
- Notified to the Aerial Agricultural Association of Australia.

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

[23] A section of the AIP used to notify ongoing or permanent changes.

8. CONCLUSIONS - AERONAUTICAL IMPACT ASSESSMENT

8.1 Aviation Impact Statement

The Aviation Impact Statement concluded that the HWF will not impact upon the following:

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

The HWF will impact on the PANS-OPS surfaces associated with Warrnambool. To maintain the safety assured by PANS-OPS surfaces the YWBL 10nm MSA will have to increase from 2200ft to 2300ft to accommodate the HWF.

8.1.1 Airservices Response to AIS

The response from Airservices Australia is shown at Appendix C.

Airservices Australia advise that the southern group of turbines of the HWF are within the tolerance zone for the 10nm MSA and will require a change to the 10nm MSA from 2100 to 2300 for the YWBL IAP.

The YWBL 10nm MSA was amended from 2100ft to 2200ft in the 20MAR2025 edition of the AIP DAP.

The HWF will not affect any CNS facilities.

8.1.2 Department of Defence Response to AIS

The response from the Department of Defence is shown at Appendix C.

The Department of Defence has no objections to the proposed Hexham Wind Farm.

The Department of Defence advise, by e-mail dated 2 March 2023 that the original assessment response stands.

8.2 Risk Assessment

The Qualitative Risk Assessment demonstrates that the HWF will *“not be a hazard to aircraft safety”* and therefore “*not of operational significance”* to aircraft operations.

8.3 Obstacle Lighting

The risk assessment finds that the overall risk to aviation in the area of the HWF is LOW and therefore not a hazard to aircraft safety. On this basis no further mitigation is required.

Obstacle lighting is not required.

8.4 Met Masts

Meteorological Monitoring Masts used on the HWF 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.

8.5 Reporting of Tall Structures

The HWF 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*.

9. ENVIRONMENT EFFECTS STATEMENT

9.1 Aviation safety

The EES objectives for aviation are presented in Table 1 Section 2.4.

9.1.1 Key issues

Refer to section 4 Aviation Impact Statement.

Current research on turbine turbulence indicates that it is not an issue for aerial applications aircraft due to the wind velocities they need for safe and efficient applications. Recent research indicates that the effects of downwind turbulence from wind turbines is considerably less than originally anticipated two decades ago.

9.1.2 Existing environment

Refer to section 4 Aviation Impact Statement and section 5 Qualitative Risk Assessment.

Refer to section 5.9 for aerial agricultural applications and section 5.12 for aerial firefighting.

9.1.3 Likely effects

Refer to section 4, sections 5.9, 5.11 and 5.12

This report only deals with aviation CNS. Refer to section 4.

9.1.4 Design and mitigation

As per Civil Aviation Safety Authority Advisory Circular AC 139.E-05 v1.1 *Obstacles (including wind farms) outside the vicinity of a CASA certified aerodrome*, consultation with CASA has not occurred because the HWF is outside the vicinity of a CASA certified aerodrome.

9.1.5 Performance

The Warrnambool 10nm Minimum Safe Altitude (MSA) requires raising from 2200ft to 2300ft to maintain aviation safety for aircraft using the Warrnambool certified aerodrome.

A Minimum Safe Altitude is dependent on geography and the built environment. As the name implies, it is the minimum safe altitude for an aircraft operating to the Instrument Flight Rules (IFR), to ensure operations in obstacle free airspace. An IFR aircraft using Warrnambool aerodrome at night or during periods of inclement weather will utilise the published non-precision instrument approach procedure to facilitate a landing. Amending an MSA is done by the instrument approach design authority on behalf of the owner of the approach procedure, usually the aerodrome.

Risk Element	Assessed Level of Risk	Comment
Airport Operations	LOW	
Aircraft Landing Area Operations	LOW	Suitability for use is a pilot responsibility.
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 exist 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 3 – Risk Assessment Summary

9.2 AIS Conclusions

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

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

The HWF will impact the YWBL 10nm MSA because a significant number of turbines, with a LSALT of 2300ft are within the 5nm buffer. This will necessitate raising the YWBL 10nm MSA from 2200ft to 2300ft to maintain the required PANS-OPS safety clearance.

9.3 Residual Impacts

Residual impacts to aviation safety, following the implementation of design measures and management controls, including raising the 10nm Minimum Safe Altitude (MSA) from 2200ft to 2300ft at Warrnambool certified aerodrome and the reporting of tall structures in accordance with CASA Advisory Circular AC 139.E-01 v1.0, are assessed to be low.

9.4 Cumulative Impacts

Cumulative impacts on aviation activities in the region may result from the construction, operation, or decommissioning of this project in conjunction with other existing or planned activities that include tall structures.

Each additional wind farm that is constructed creates additional tall structures (i.e., wind turbines) that pilots must consider when planning to fly in the area. Flying over several proximate wind farms is not unlike flying over a forest; both have tall obstacles to be avoided and neither place is conducive to a forced or crash landing. Pilots flight plan accordingly. However, given that the permitting of wind farms in Victoria must consider the impact of wind farm developments on aircraft safety under Clause 52.32-5 of the Victoria Planning Provisions, these projects have been, or will be, subject to individual aeronautical assessments and risk mitigation measures. As a result, cumulative impacts to aviation safety are not anticipated to be significant.

Scoping requirement	Matter to be addressed	Addressed in this assessment	
Key issues	Potential adverse effects of wind turbines and associated infrastructure from an aviation perspective, including but not limited to impacts on aerial safety, air traffic control equipment, obstruction and turbulence	Section 4 – Aviation Impact Statement	Aviation Impact Statement addresses the requirements of Airservices Australia and the Department of Defence for their analysis of the impact on Civil and Military aviation.
	Potential interference with communication systems that use electromagnetic waves as the transmission medium (e.g. television, radio, mobile reception)	Section 4.7 Air Traffic Control Communications, Navigation and Surveillance facilities only.	This section addresses any potential Electromagnetic Interference on Air Traffic Control Communications, Navigation and Surveillance facilities.
Existing environment	Identify and describe the nearest aerodromes, air navigation and air traffic management services, transiting air routes, and designated airspace such as Prohibited, Restricted and Danger Areas.	Section 4 – Aviation Impact Statement. (Note: the air traffic management services are located at Melbourne Centre. This report assesses the Communication, Navigation and Surveillance facilities that are relevant to the project, as used by Melbourne Centre to facilitate air traffic control.)	Certified aerodromes within 56km of HWF are: Warrnambool Hamilton Uncertified aerodromes within 56km are: Cobden Derrinallum Camperdown Farm strips #1 & 2 Transiting air routes are V279 and V126 and the GRID. There are no Prohibited, Restricted or Danger areas
	Characterise current use of aerial spraying by district farmers and aerial firefighting that could be affected by the project (including any significant water resource that may be used for aerial firefighting in the region.)	Section 5.9 aerial applications Section 5.12 aerial firefighting	Aerial spraying is used on an “as required basis.” Aerial firefighting is used if considered effective and available. Significant water sources exist outside the HWF boundary.
Likely effects	Identify potential long and short terms effects of the project on existing and potential land uses (such as aerial spraying and other agricultural activities), public infrastructure (such as roads, transport routes) and fire and emergency management (such as aerial firefighting).	Section 5.9, 5.11 and 5.12	Aerial spraying will continue with some minor changes needed to avoid the turbine towers. Aerial firefighting is used if considered effective and available. Other emergency management flying will continue within the parameters set by Civil Aviation Safety Regulations.

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APPENDIX A

Hexham Wind Farm
Turbine Locations and Heights

Version
v183 250513

Turbine ID	Elevation [m]	Latitude deg S	Longitude deg E	Tip Elevation [m]	Tip Elevation [ft]	Add MOC 1000ft	LSALT
T10	139	38.029091	142.502443	399	1308.72	2308.72	2400
T12	141	38.039308	142.506498	401	1315.28	2315.28	2400
T9	139	38.027039	142.507770	399	1308.72	2308.72	2400
T11	138	38.037938	142.517539	398	1305.44	2305.44	2400
T2	139	38.035566	142.509191	399	1308.72	2308.72	2400
T13	145	37.999003	142.512021	405	1328.4	2328.4	2400
T15	138	38.032295	142.513068	398	1305.44	2305.44	2400
T20	138	38.028169	142.515280	398	1305.44	2305.44	2400
T3	150	38.004569	142.515143	410	1344.8	2344.8	2400
T24	152	38.001066	142.519663	412	1351.36	2351.36	2400
T6	140	38.025882	142.520311	400	1312	2312	2400
T18	131	38.033728	142.521497	391	1282.48	2282.48	23600
T8	140	38.021032	142.520998	400	1312	2312	2400
T36	140	38.012841	142.521904	400	1312	2312	2400
T27	133	38.039347	142.527278	393	1289.04	2289.04	2300
T32	140	38.010324	142.528209	400	1312	2312	2400
T30	138	38.031109	142.529961	398	1305.44	2305.44	2400
T14	140	38.019520	142.530076	400	1312	2312	2400
T22	133	38.003732	142.532433	393	1289.04	2289.04	2300
T16	141	38.025436	142.528250	401	1315.28	2315.28	2400
T34	138	38.025682	142.535458	398	1305.44	2305.44	2400
T21	136	38.009956	142.538900	396	1298.88	2298.88	2300
T7	128	38.063252	142.543804	388	1272.64	2272.64	2300

Turbine ID	Elevation [m]	Latitude deg S	Longitude deg E	Tip Elevation [m]	Tip Elevation [ft]	Add MOC 1000ft	LSALT
T17	136	38.016575	142.543367	396	1298.88	2298.88	2300
T5	128	38.069113	142.546447	388	1272.64	2272.64	2300
T19	129	38.061411	142.549616	389	1275.92	2275.92	2300
T75	130	38.012941	142.548097	390	1279.2	2279.2	2300
T54	129	38.059047	142.554565	389	1275.92	2275.92	2300
T83	129	37.998299	142.550933	389	1275.92	2275.92	2300
T81	130	38.008501	142.553019	390	1279.2	2279.2	2300
T80	130	38.070596	142.559303	390	1279.2	2279.2	2300
T58	130	37.991978	142.555196	390	1279.2	2279.2	2300
T107	130	38.055046	142.556892	390	1279.2	2279.2	2300
T69	130	38.004862	142.556436	390	1279.2	2279.2	2300
T72	130	38.064994	142.558688	390	1279.2	2279.2	2300
T62	129	37.999221	142.558422	389	1275.92	2275.92	2300
T64	130	38.076427	142.562204	390	1279.2	2279.2	2300
T86	130	38.069688	142.566142	390	1279.2	2279.2	2300
T40	130	38.103824	142.568685	390	1279.2	2279.2	2300
T57	130	38.019199	142.568937	390	1279.2	2279.2	2300
T73	129	38.037006	142.570550	389	1275.92	2275.92	2300
T91	128	38.043815	142.571448	388	1272.64	2272.64	2300
T77	130	38.075767	142.571847	390	1279.2	2279.2	2300
T79	129	38.029815	142.572826	389	1275.92	2275.92	2300
T82	130	38.111105	142.576858	390	1279.2	2279.2	2300
T67	128	38.131694	142.576989	388	1272.64	2272.64	2300

Turbine ID	Elevation [m]	Latitude deg S	Longitude deg E	Tip Elevation [m]	Tip Elevation [ft]	Add MOC 1000ft	LSALT
T71	130	38.101485	142.577580	390	1279.2	2279.2	2300
T66	131	38.127546	142.579910	391	1282.48	2282.48	2300
T44	130	38.020087	142.579408	390	1279.2	2279.2	2300
T70	130	38.117005	142.580878	390	1279.2	2279.2	2300
T37	130	38.107904	142.584493	390	1279.2	2279.2	2300
T31	124	38.045720	142.581312	384	1259.52	2259.52	2300
T52	130	38.106165	142.576620	390	1279.2	2279.2	2300
T25	130	38.026289	142.578512	390	1279.2	2279.2	2300
T23	130	38.100750	142.585681	390	1279.2	2279.2	2300
T26	130	38.122634	142.581434	390	1279.2	2279.2	2300
T49	131	38.059943	142.586565	391	1282.48	2282.48	2300
T42	131	38.052400	142.585231	391	1282.48	2282.48	2300
T65	127	38.041181	142.586553	387	1269.36	2269.36	2300
T33	127	38.015590	142.586103	387	1269.36	2269.36	2300
T38	130	38.106396	142.590541	390	1279.2	2279.2	2300
T92	124	38.024187	142.589621	384	1259.52	2259.52	2300
T35	130	38.112883	142.592899	390	1279.2	2279.2	2300
T60	125	38.008784	142.595984	385	1262.8	2262.8	2300
T84	130	38.055033	142.594136	390	1279.2	2279.2	2300
T88	130	38.049781	142.595554	390	1279.2	2279.2	2300
T104	123	38.039364	142.594713	383	1256.24	2256.24	2300
T39	130	38.107903	142.598458	390	1279.2	2279.2	2300
T47	121	38.031319	142.594193	381	1249.68	2249.68	2300

Turbine ID	Elevation [m]	Latitude deg S	Longitude deg E	Tip Elevation [m]	Tip Elevation [ft]	Add MOC 1000ft	LSALT
T55	127	38.003318	142.597371	387	1269.36	2269.36	2300
T78	121	38.023297	142.598078	381	1249.68	2249.68	2300
T102	127	37.998425	142.603083	387	1269.36	2269.36	2300
T93	122	38.017668	142.599812	382	1252.96	2252.96	2300
T106	124	38.063579	142.606210	384	1259.52	2259.52	2300
T95	130	38.112296	142.607261	390	1279.2	2279.2	2300
T51	117	38.040617	142.604824	377	1236.56	2236.56	2300
T103	130	38.106803	142.607880	390	1279.2	2279.2	2300
T61	121	38.015473	142.605232	381	1249.68	2249.68	2300
T97	130	38.047854	142.608014	390	1279.2	2279.2	2300
T63	128	38.054192	142.608540	388	1272.64	2272.64	2300
T108	122	38.007455	142.613144	382	1252.96	2252.96	2300
T90	114	38.062092	142.612368	374	1226.72	2226.72	2300
T105	130	38.104246	142.614301	390	1279.2	2279.2	2300
T109	124	38.002563	142.613709	384	1259.52	2259.52	2300
T45	129	38.034066	142.584027	389	1275.92	2275.92	2300
T76	122	38.098470	142.617504	382	1252.96	2252.96	2300
T96	124	38.112293	142.618243	384	1259.52	2259.52	2300
T89	119	38.130197	142.621707	379	1243.12	2243.12	2300
T43	124	38.006460	142.605548	384	1259.52	2259.52	2300
T59	121	38.008341	142.620754	381	1249.68	2249.68	2300
T28	118	38.103820	142.626381	378	1239.84	2239.84	2300
T101	118	38.116638	142.628993	378	1239.84	2239.84	2300

Turbine ID	Elevation [m]	Latitude deg S	Longitude deg E	Tip Elevation [m]	Tip Elevation [ft]	Add MOC 1000ft	LSALT
T68	118	38.131789	142.629124	378	1239.84	2239.84	2300
T29	115	38.110140	142.627282	375	1230	2230	2300
T56	101	38.094360	142.630501	361	1184.08	2184.08	2200
T94	119	38.127858	142.630531	379	1243.12	2243.12	2300
T46	109	38.100011	142.632030	369	1210.32	2210.32	2300
T4	102	38.088790	142.632593	362	1187.36	2187.36	2300
T1	116	38.118718	142.636408	376	1233.28	2233.28	2300
T53	120	38.127039	142.636320	380	1246.4	2246.4	2300
T98	111	38.113671	142.636698	371	1216.88	2216.88	2300
T41	108	38.094486	142.638387	368	1207.04	2207.04	2300
T87	123	38.009113	142.628225	383	1256.24	2256.24	2300
T48	109	38.108923	142.637681	369	1210.32	2210.32	2300
T50	109	38.105315	142.640256	369	1210.32	2210.32	2300
T110	126	38.011567	142.589838	386	1266.08	2266.08	2300
	42 Turbines within 15nm YWBL			YWBL 10nm MSA 2200			
				YWBL 25nm MSA 3300			

APPENDIX B

Hexham Wind Farm
Turbine Locations and Heights

Superseded

APPENDIX B

Turbine ID	Elevation [m]	Elevation [ft]	longitude	latitude	Easting	Northing	Tip Elevation [m]	Tip Elevation [ft]	Add MOC	LSALT
T10	144.9559937	475.571624	-38.00106613	142.519663	633424	5792977	404.9559937	1328.579624	2328.579624	2400
T15	136.1940002	446.825276	-38.03731051	142.526904	633994	5788944	396.1940002	1299.833276	2299.833276	2300
T9	148.7350006	487.96979	-38.00456855	142.5151425	633021	5792594	408.7350006	1340.97779	2340.97779	2400
T11	131.1829987	430.385182	-38.02588171	142.5203112	633436	5790222	391.1829987	1283.393182	2283.393182	2300
T2	142.5410004	467.648514	-38.04098149	142.5064118	632189	5788566	402.5410004	1320.656514	2320.656514	2400
T13	137.2769928	450.378358	-38.02103152	142.5209983	633505	5790759	397.2769928	1303.386358	2303.386358	2400
T12	137.947998	452.579792	-38.03993812	142.5217744	633539	5788660	397.947998	1305.587792	2305.587792	2400
T20	141.0010071	462.596104	-38.02621338	142.5282496	634132	5790174	401.0010071	1315.604104	2315.604104	2400
T3	135.871994	445.768838	-38.02703882	142.50777	632333	5790112	395.871994	1298.776838	2298.776838	2300
T24	134.3630066	440.818152	-38.01657503	142.5433671	635477	5791221	394.3630066	1293.826152	2293.826152	2300
T6	149.647995	490.965142	-37.99900318	142.5120214	632757	5793216	409.647995	1343.973142	2343.973142	2400
T18	138.9089966	455.732636	-38.01954517	142.5300817	634305	5790911	398.9089966	1308.740636	2308.740636	2400
T8	132.9029999	436.028162	-38.02830443	142.5152805	632990	5789961	392.9029999	1289.036162	2289.036162	2300
T36	128.9579926	423.085382	-37.99922523	142.5584124	636830	5793125	388.9579926	1276.093382	2276.093382	2300
T27	131.6660004	431.969814	-38.01294079	142.5480968	635898	5791618	391.6660004	1284.977814	2284.977814	2300
T32	130.4609985	428.016444	-37.99197838	142.5551957	636561	5793933	390.4609985	1281.024444	2281.024444	2300
T30	124.4680023	408.354622	-38.00850118	142.5530186	636339	5792103	384.4680023	1261.362622	2261.362622	2300
T14	139.2920074	456.989218	-38.01284062	142.521904	633599	5791667	399.2920074	1309.997218	2309.997218	2400
T22	135.5659943	444.764914	-38.00995564	142.5388999	635097	5791962	395.5659943	1297.772914	2297.772914	2300
T16	141.451004	464.072454	-38.01032399	142.5282089	634157	5791937	401.451004	1317.080454	2317.080454	2400
T34	126.3320007	414.470028	-38.00486191	142.5564359	636645	5792502	386.3320007	1267.478028	2267.478028	2300
T21	133.0509949	436.513704	-38.02568245	142.5354581	634766	5790222	393.0509949	1289.521704	2289.521704	2300

Turbine ID	Elevation [m]	Elevation [ft]	longitude	latitude	Easting	Northing	Tip Elevation [m]	Tip Elevation [ft]	Add MOC	LSALT
T7	139.1360016	456.477394	-38.03378232	142.5140124	632869	5789354	399.1360016	1309.485394	2309.485394	2400
T17	137.345993	450.604734	-38.03171709	142.5295318	634234	5789561	397.345993	1303.612734	2303.612734	2400
T5	139.4160004	457.396014	-38.03690987	142.509781	632492	5789013	399.4160004	1310.404014	2310.404014	2400
T19	134.3059998	440.631124	-38.00373228	142.5324333	634540	5792662	394.3059998	1293.639124	2293.639124	2300
T75	119.875	393.2859	-38.06357868	142.6062102	640903	5785912	379.875	1246.2939	2246.2939	2300
T54	128.3840027	421.202236	-38.02628892	142.5785119	638543	5790092	388.3840027	1274.210236	2274.210236	2300
T83	115.9079971	380.270957	-38.06209172	142.612368	641446	5786068	375.9079971	1233.278957	2233.278957	2300
T81	124.5429993	408.600672	-38.05419155	142.6085397	641126	5786950	384.5429993	1261.608672	2261.608672	2300
T80	128.2510071	420.765904	-38.04785433	142.6080136	641092	5787654	388.2510071	1273.773904	2273.773904	2300
T58	128.901001	422.898404	-38.05240046	142.5852308	639084	5787184	388.901001	1275.906404	2275.906404	2300
T107	123.9000015	406.491125	-38.00911289	142.6282251	642940	5791923	383.9000015	1259.499125	2259.499125	2300
T69	120.3570023	394.867253	-38.03131922	142.5941926	639910	5789510	380.3570023	1247.875253	2247.875253	2300
T72	123.6610031	405.707019	-37.99849795	142.6038829	640824	5793137	383.6610031	1258.715019	2258.715019	2300
T62	122.0090027	400.287136	-38.02418668	142.5896212	639523	5790308	382.0090027	1253.295136	2253.295136	2300
T64	123.6480026	405.664367	-38.00878356	142.5959845	640110	5792008	383.6480026	1258.672367	2258.672367	2300
T86	123.8000031	406.16305	-38.0025631	142.6137092	641679	5792671	383.8000031	1259.17105	2259.17105	2300
T40	131.8079987	432.435682	-38.01919865	142.5689374	637716	5790893	391.8079987	1285.443682	2285.443682	2300
T57	130.2890015	427.452156	-38.05994251	142.5865648	639187	5786345	390.2890015	1280.460156	2280.460156	2300
T73	122.9840012	403.485911	-38.01864167	142.599203	640374	5790909	382.9840012	1256.493911	2256.493911	2300
T91	123.3209991	404.591534	-38.00645988	142.6055484	640955	5792251	383.3209991	1257.599534	2257.599534	2300
T77	121.211998	397.672323	-38.04061743	142.6048236	640825	5788462	381.211998	1250.680323	2250.680323	2300
T79	122.6360016	402.344194	-38.01684333	142.6050325	640889	5791100	382.6360016	1255.352194	2255.352194	2300
T82	123.5100021	405.211615	-38.00745537	142.6131444	641620	5792129	383.5100021	1258.219615	2258.219615	2300

Turbine ID	Elevation [m]	Elevation [ft]	longitude	latitude	Easting	Northing	Tip Elevation [m]	Tip Elevation [ft]	Add MOC	LSALT
T67	120.2360001	394.470269	-38.0393636	142.5947127	639941	5788617	380.2360001	1247.478269	2247.478269	2300
T71	121.9059982	399.949199	-38.02354292	142.5981224	640270	5790367	381.9059982	1252.957199	2252.957199	2300
T66	126.8949966	416.317105	-38.04960054	142.5956225	640001	5787479	386.8949966	1269.325105	2269.325105	2300
T44	128.6620026	422.114298	-38.02981543	142.572826	638038	5789709	388.6620026	1275.122298	2275.122298	2300
T70	122.2730026	401.153267	-38.00331793	142.5973707	640243	5792612	382.2730026	1254.161267	2254.161267	2300
T37	129.8619995	426.051248	-38.07642736	142.5622043	637019	5784552	389.8619995	1279.059248	2279.059248	2300
T31	131.7369995	432.202748	-38.06958219	142.5570716	636581	5785320	391.7369995	1285.210748	2285.210748	2300
T52	129.7330017	425.628032	-38.0457203	142.5813119	638753	5787931	389.7330017	1278.636032	2278.636032	2300
T25	131.6049957	431.76967	-38.0688931	142.5458681	635600	5785412	391.6049957	1284.77767	2284.77767	2300
T23	132.9409943	436.152814	-38.06254283	142.5408216	635169	5786124	392.9409943	1289.160814	2289.160814	2300
T26	133.7559967	438.826674	-38.06112378	142.5479956	635801	5786271	393.7559967	1291.834674	2291.834674	2300
T49	128.3950043	421.23833	-38.02008659	142.5794077	638634	5790779	388.3950043	1274.24633	2274.24633	2300
T42	121.4629974	398.495802	-38.04381472	142.5714477	637890	5788158	381.4629974	1251.503802	2251.503802	2300
T65	128.0119934	419.981748	-38.0549624	142.5941252	639859	5786887	388.0119934	1272.989748	2272.989748	2300
T33	131.2720032	430.677188	-38.05522304	142.5567043	636576	5786913	391.2720032	1283.685188	2283.685188	2300
T38	129.0619965	423.426598	-38.06968806	142.566142	637377	5785294	389.0619965	1276.434598	2276.434598	2300
T92	123.3730011	404.762142	-38.00834101	142.6207536	642286	5792020	383.3730011	1257.770142	2257.770142	2300
T35	129.3470001	424.361638	-38.06458869	142.5587313	636736	5785871	389.3470001	1277.369638	2277.369638	2300
T60	123.3190002	404.584976	-38.01559013	142.5861025	639230	5791268	383.3190002	1257.592976	2257.592976	2300
T84	122	400.2576	-38.10424582	142.6143015	641535	5781387	382	1253.2656	2253.2656	2300
T88	117.2519989	384.680358	-38.09847021	142.6175044	641827	5782023	377.2519989	1237.688358	2237.688358	2300
T104	125.6829987	412.340782	-38.12703852	142.6363198	643421	5778824	385.6829987	1265.348782	2265.348782	2300
T39	130.0209961	426.572884	-38.10381831	142.5686952	637537	5781503	390.0209961	1279.580884	2279.580884	2300

Turbine ID	Elevation [m]	Elevation [ft]	longitude	latitude	Easting	Northing	Tip Elevation [m]	Tip Elevation [ft]	Add MOC	LSALT
T47	123.2109985	404.230644	-38.10148472	142.5775802	638320	5781749	383.2109985	1257.238644	2257.238644	2300
T55	129.8450012	425.99548	-38.10075047	142.5856805	639032	5781819	389.8450012	1279.00348	2279.00348	2300
T78	130.9170074	429.512518	-38.10680315	142.6078795	640967	5781113	390.9170074	1282.520518	2282.520518	2300
T102	104.5110016	342.879694	-38.08879001	142.6325932	643169	5783074	364.5110016	1195.887694	2195.887694	2200
T93	117.7190018	386.212501	-38.10429231	142.6253083	642500	5781365	377.7190018	1239.220501	2239.220501	2300
T106	104.375	342.4335	-38.09448596	142.6383874	643666	5782433	364.375	1195.4415	2195.4415	2200
T95	126.6330032	415.457557	-38.13178866	142.629124	642781	5778308	386.6330032	1268.465557	2268.465557	2300
T51	125.7310028	412.498274	-38.10789382	142.5844945	638914	5781028	385.7310028	1265.506274	2265.506274	2300
T103	117.8089981	386.507761	-38.11871762	142.6364083	643445	5779748	377.8089981	1239.515761	2239.515761	2300
T61	127.7850037	419.23704	-38.10652833	142.5908322	639472	5781170	387.7850037	1272.24504	2272.24504	2300
T97	104.8690033	344.054226	-38.09435955	142.6305011	642974	5782460	364.8690033	1197.062226	2197.062226	2200
T63	124.8980026	409.765367	-38.11288299	142.5928995	639642	5780461	384.8980026	1262.773367	2262.773367	2300
T108	104.5479965	343.001067	-38.10892279	142.6376809	643575	5780833	364.5479965	1196.009067	2196.009067	2200
T90	123.4140015	404.896656	-38.13019709	142.621707	642134	5778496	383.4140015	1257.904656	2257.904656	2300
T105	115.8740005	380.159421	-38.11367064	142.6366984	643480	5780307	375.8740005	1233.167421	2233.167421	2300
T109	103.6949997	340.202555	-38.10531511	142.6402565	643808	5781229	363.6949997	1193.210555	2193.210555	2200
T45	124.3980026	408.124967	-38.11139245	142.5770294	638253	5780651	384.3980026	1261.132967	2261.132967	2300
T76	127.6780014	418.885987	-38.11229552	142.6072611	640902	5780505	387.6780014	1271.893987	2271.893987	2300
T96	116.4850006	382.16399	-38.11071379	142.6280111	642724	5780649	376.4850006	1235.17199	2235.17199	2300
T89	123.7570038	406.021978	-38.11229327	142.6182427	641865	5780488	383.7570038	1259.029978	2259.029978	2300
T43	132.9609985	436.218444	-38.07576706	142.5718465	637866	5784611	392.9609985	1289.226444	2289.226444	2300
T59	129.2350006	423.99419	-38.04118147	142.5865528	639221	5788427	389.2350006	1277.00219	2277.00219	2300
T28	134.5090027	441.297136	-38.0565968	142.5495871	635949	5786771	394.5090027	1294.305136	2294.305136	2300

Turbine ID	Elevation [m]	Elevation [ft]	longitude	latitude	Easting	Northing	Tip Elevation [m]	Tip Elevation [ft]	Add MOC	LSALT
T101	111.1579971	364.687157	-38.10001102	142.6320301	643097	5781830	371.1579971	1217.695157	2217.695157	2300
T68	128.848999	422.727796	-38.10790323	142.5984582	640138	5781006	388.848999	1275.735796	2275.735796	2300
T29	131.5330048	431.533482	-37.99829938	142.5509332	636175	5793238	391.5330048	1284.541482	2284.541482	2300
T56	125.4420013	411.550118	-38.12280286	142.5830647	638761	5779375	385.4420013	1264.558118	2264.558118	2300
T94	117.6179962	385.881122	-38.11619872	142.6284353	642751	5780039	377.6179962	1238.889122	2238.889122	2300
T46	127.987999	419.903027	-38.13111973	142.5771176	638224	5778461	387.987999	1272.911027	2272.911027	2300
T4	141.779007	465.148566	-38.04319348	142.5145138	632896	5788309	401.779007	1318.156566	2318.156566	2400
T1	139.1730042	456.598792	-38.02909128	142.5024426	631862	5789891	399.1730042	1309.606792	2309.606792	2400
T53	121.8809967	399.867174	-38.10616321	142.5766214	638227	5781232	381.8809967	1252.875174	2252.875174	2300
T98	125.8539963	412.901791	-38.127858	142.6305311	642912	5778742	385.8539963	1265.909791	2265.909791	2300
T41	127.526001	418.387304	-38.03700579	142.5705503	637825	5788914	387.526001	1271.395304	2271.395304	2300
T87	120.3399963	394.81146	-38.03406634	142.5840266	639013	5789221	380.3399963	1247.81946	2247.81946	2300
T48	121.9970016	400.247763	-38.12720861	142.5804674	638525	5778890	381.9970016	1253.255763	2253.255763	2300
T50	126.4499969	414.85715	-38.11720741	142.5810927	638598	5779999	386.4499969	1267.86515	2267.86515	2300
T110	123.5080032	405.205057	-38.01156691	142.5898383	639566	5791708	383.5080032	1258.213057	2258.213057	2300

Turbines with ochre background are within 15nm of YWBL ARP Require 10nm MSA of 2300ft
Tallest turbine is T9 at 1342ft AHD
LSALT over the HWF is 2400ft

APPENDIX C

Superseded
Hexham Wind Farm
Turbine Locations and Heights

APPENDIX C

Hexham Turbine Locations and Heights

Turbine ID	Easting GDA2020-Z54	Southing GDA2020-Z54	Elevation [m]	Tip Height (m) AGL	Tip Height (m) AHD	Tip Height (ft) AHD	Add MOC 1000ft	LSALT
T1	631862.002778465	5789892.33656183	139	260	399	1308.72	2308.72	2400
T2	632189.468964204	5788566.90105486	142	260	402	1318.56	2318.56	2400
T3	632248.885453208	5790102.25637922	139	260	399	1308.72	2308.72	2400
T4	632896.412921791	5788310.18075713	140	260	400	1312	2312	2400
T5	632492.055501217	5789013.99713279	140	260	400	1312	2312	2400
T6	632757.067303963	5793216.51462874	145	260	405	1328.4	2328.4	2400
T7	632868.541806205	5789355.28088938	137	260	397	1302.16	2302.16	2400
T8	632872.858857833	5790104.71539174	139	260	399	1308.72	2308.72	2400
T9	633020.567828111	5792594.55937706	150	260	410	1344.8	2344.8	2400
T10	633395.474883143	5792954.54604388	152	260	412	1351.36	2351.36	2400
T11	633408.837975903	5790257.08227345	140	260	400	1312	2312	2400
T12	633412.061090140	5788607.60136226	140	260	400	1312	2312	2400
T13	633415.330997329	5790876.52881885	140	260	400	1312	2312	2400
T14	633434.007971620	5791745.19817885	140	260	400	1312	2312	2400
T15	633994.165758153	5788945.37580815	130	260	390	1279.2	2279.2	2300
T16	634164.913161359	5791895.29504272	140	260	400	1312	2312	2400
T17	634247.127593376	5789701.68208769	139	260	399	1308.72	2308.72	2400
T18	634388.007266999	5791136.77094189	140	260	400	1312	2312	2400
T19	634432.285339639	5792712.80006772	131	260	391	1282.48	2282.48	2300
T20	634433.557589930	5790467.74412095	140	260	400	1312	2312	2400
T21	635053.417122196	5790627.02939056	139	260	399	1308.72	2308.72	2400
T22	635097.473148637	5791962.71156111	136	260	396	1298.88	2298.88	2300
T23	635168.751068958	5786125.43729572	129	260	389	1275.92	2275.92	2300
T24	635477.402370877	5791221.51271463	136	260	396	1298.88	2298.88	2300
T25	635600.105741214	5785412.72142726	128	260	388	1272.64	2272.64	2300
T26	635800.603702720	5786271.81926249	129	260	389	1275.92	2275.92	2300
T27	635911.704713179	5791653.65890119	130	260	390	1279.2	2279.2	2300
T28	635949.313264768	5786771.86484746	129	260	389	1275.92	2275.92	2300
T29	636159.182086627	5793117.52845418	129	260	389	1275.92	2275.92	2300
T30	636213.917112140	5792053.73184910	129	260	389	1275.92	2275.92	2300
T31	636376.766087047	5785414.75753948	129	260	389	1275.92	2275.92	2300
T32	636560.725120801	5793934.36319861	130	260	390	1279.2	2279.2	2300
T33	636576.131374224	5786913.55849279	130	260	390	1279.2	2279.2	2300
T34	636616.687197921	5792445.80274496	130	260	390	1279.2	2279.2	2300
T35	636698.930572651	5785878.79734128	130	260	390	1279.2	2279.2	2300
T36	636733.335115540	5793295.21472357	130	260	390	1279.2	2279.2	2300
T37	637019.363717342	5784553.01906857	130	260	390	1279.2	2279.2	2300

Turbine ID	Easting GDA2020-Z54	Southing GDA2020-Z54	Elevation [m]	Tip Height (m) AGL	Tip Height (m) AHD	Tip Height (ft) AHD	Add MOC 1000ft	LSALT
T38	637376.695180071	5785295.13903198	130	260	390	1279.2	2279.2	2300
T39	637536.590183369	5781503.83142027	130	260	390	1279.2	2279.2	2300
T40	637841.244541291	5790832.73471498	130	260	390	1279.2	2279.2	2300
T41	637824.668483708	5788915.48353593	129	260	389	1275.92	2275.92	2300
T42	637831.069560685	5788114.02009646	126	260	386	1266.08	2266.08	2300
T43	637866.484116177	5784612.11035157	130	260	390	1279.2	2279.2	2300
T44	638029.302852458	5789661.96119890	129	260	389	1275.92	2275.92	2300
T45	638031.730737426	5780796.50463551	130	260	390	1279.2	2279.2	2300
T46	638223.957494406	5778462.00706351	129	260	389	1275.92	2275.92	2300
T47	638333.929696251	5781749.25812797	130	260	390	1279.2	2279.2	2300
T48	638524.919399052	5778891.20849926	131	260	391	1282.48	2282.48	2300
T49	638542.412451509	5790877.29623687	130	260	390	1279.2	2279.2	2300
T50	638553.722577309	5780139.13555319	130	260	390	1279.2	2279.2	2300
T51	638922.411733913	5781056.33491835	130	260	390	1279.2	2279.2	2300
T52	638753.426874176	5787931.52893560	124	260	384	1259.52	2259.52	2300
T53	638209.333398473	5781256.90376273	130	260	390	1279.2	2279.2	2300
T54	638839.901357311	5789731.96556363	128	260	388	1272.64	2272.64	2300
T55	638959.294952429	5781972.22494717	130	260	390	1279.2	2279.2	2300
T56	638760.829811362	5779375.50636714	130	260	390	1279.2	2279.2	2300
T57	639187.432012041	5786345.52220173	131	260	391	1282.48	2282.48	2300
T58	639196.068289273	5787068.68992748	132	260	392	1285.76	2285.76	2300
T59	639224.542597196	5788415.23299375	127	260	387	1269.36	2269.36	2300
T60	639283.498390300	5791317.76354113	127	260	387	1269.36	2269.36	2300
T61	639372.115619263	5781292.85148528	130	260	390	1279.2	2279.2	2300
T62	639522.574907303	5790309.21421632	124	260	384	1259.52	2259.52	2300
T63	639642.169936298	5780461.59054122	130	260	390	1279.2	2279.2	2300
T64	639817.007015844	5792027.24857204	126	260	386	1266.08	2266.08	2300
T65	639906.443187206	5786268.85873454	130	260	390	1279.2	2279.2	2300
T66	639995.126421687	5787459.86936986	130	260	390	1279.2	2279.2	2300
T67	639996.849079642	5788566.37980337	121	260	381	1249.68	2249.68	2300
T68	640085.567402237	5780835.31233402	130	260	390	1279.2	2279.2	2300
T69	640119.455641271	5789578.94404000	120	260	380	1246.4	2246.4	2300
T70	640243.434861519	5792612.70962359	127	260	387	1269.36	2269.36	2300
T71	640266.538304400	5790395.17288615	121	260	381	1249.68	2249.68	2300
T72	640380.868970646	5793221.95185521	128	260	388	1272.64	2272.64	2300
T73	640429.577574578	5791016.93693293	122	260	382	1252.96	2252.96	2300
T74	640688.231703933	5784018.52695359	131	260	391	1282.48	2282.48	2300
T75	640810.717150693	5785938.63896483	127	260	387	1269.36	2269.36	2300
T76	640848.019659850	5780377.17105658	130	260	390	1279.2	2279.2	2300
T77	640911.490100226	5788393.46691153	117	260	377	1236.56	2236.56	2300

Turbine ID	Easting GDA2020-Z54	Southing GDA2020-Z54	Elevation [m]	Tip Height (m) AGL	Tip Height (m) AHD	Tip Height (ft) AHD	Add MOC 1000ft	LSALT
T78	640966.777495308	5781113.61636991	130	260	390	1279.2	2279.2	2300
T79	641087.723262587	5790963.54841904	120	260	380	1246.4	2246.4	2300
T80	641092.128837093	5787654.91130329	130	260	390	1279.2	2279.2	2300
T81	641126.427305132	5786950.55548046	128	260	388	1272.64	2272.64	2300
T82	641129.795144146	5792210.81018569	123	260	383	1256.24	2256.24	2300
T83	641416.613557521	5786072.20524584	114	260	374	1226.72	2226.72	2300
T84	641535.265745646	5781388.33715669	130	260	390	1279.2	2279.2	2300
T85	641558.530292413	5791408.66718824	120	260	380	1246.4	2246.4	2300
T86	641626.317686165	5792523.89567722	123	260	383	1256.24	2256.24	2300
T87	641644.478719485	5783822.41882135	129	260	389	1275.92	2275.92	2300
T88	641826.828662155	5782023.63427267	122	260	382	1252.96	2252.96	2300
T89	641865.465250213	5780488.53025004	124	260	384	1259.52	2259.52	2300
T90	642134.021128919	5778497.18570918	119	260	379	1243.12	2243.12	2300
T91	642234.591865129	5792608.83485877	124	260	384	1259.52	2259.52	2300
T92	642251.686021728	5791765.60562070	120	260	380	1246.4	2246.4	2300
T93	642500.113115974	5781366.33678054	119	260	379	1243.12	2243.12	2300
T94	642854.029306518	5779641.51929891	119	260	379	1243.12	2243.12	2300
T95	642811.976239837	5778389.82224599	118	260	378	1239.84	2239.84	2300
T96	642769.075176908	5780626.83976039	115	260	375	1230	2230	2300
T97	642916.889075391	5782371.37072138	103	260	363	1190.64	2190.64	2200
T98	642986.576504145	5778816.03254008	120	260	380	1246.4	2246.4	2300
T99	643010.619537835	5792555.80380605	126	260	386	1266.08	2266.08	2300
T100	643103.539569200	5791828.11185944	124	260	384	1259.52	2259.52	2300
T101	643093.247138943	5781584.69888424	110	260	370	1213.6	2213.6	2300
T102	643169.036025529	5783074.91883078	102	260	362	1187.36	2187.36	2200
T103	643377.688402089	5779805.86563135	116	260	376	1233.28	2233.28	2300
T104	643516.753754730	5778880.30015003	120	260	380	1246.4	2246.4	2300
T105	643623.297117202	5780291.71793772	110	260	370	1213.6	2213.6	2300
T106	643665.585861090	5782433.90732936	108	260	368	1207.04	2207.04	2300
T107	643741.404484957	5792130.83345512	129	260	389	1275.92	2275.92	2300
T108	643636.444224642	5780872.60279327	109	260	369	1210.32	2210.32	2300
T109	643815.339667313	5781428.49192336	109	260	369	1210.32	2210.32	2300

Notes

Tallest turbine is #10 at 412m (1351.36ft) LSALT 2400ft

The turbines with the yellow hatch are within the YWBL 10nm MSA buffer. Each has an LSALT of 2300ft.

APPENDIX D

Airservices Australia
AIS Response

APPENDIX D

From: Airport Developments <Airport.Developments@AirservicesAustralia.com>
Sent: Thursday, June 22, 2023 10:03 AM
To: ian_jennings@netspace.net.au
Cc: airspace.protection@casa.gov.au
Subject: AIRSERVICES RESPONSE: VIC-WF-043 P2 - Revised

OFFICIAL

Hi Ian,

We agree that there were some errors in our previous assessment, therefore please see our revised response below.

I refer to your request for an Airservices assessment of a windfarm at the Hexham Wind Farm.

Airspace Procedures
With respect to procedures designed by Airservices in accordance with ICAO PANS-OPS and Doc 9905, at a maximum height of 404m (1326ft) AHD the turbine mfd_ids listed below will affect the 10NM minimum sector altitude (MSA) at Warrnambool aerodrome:

54, 55, 57, 58, 59, 64, 66, 68, 69, 70, 71, 72, 73, 74, 76, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 96, 97, 99, 100, 101, 104, 105, 107, and 109.

In order to accommodate the windfarm, the 10NM MSA will need to be permanently raised by 200ft from 2100ft to 2300ft.

The maximum height of the above turbines without affecting any procedures at Warrnambool aerodrome is 340.1m (1116ft) AHD.

At a maximum height of 412m (1352ft) AHD all other turbines not mentioned above will not affect any instrument procedures at Warrnambool aerodrome.

At a maximum height of 412m (1352ft) AHD all turbines will not affect any instrument procedures at Hamilton aerodrome.

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

Communications/Navigation/Surveillance (CNS) Facilities
We have assessed the proposal to a maximum height of 412m (1352ft) AHD for any impacts to Airservices Precision/Non-Precision Navigation Aids, Anemometers, HF/VHF/UHF Communications, A-SMGCS, Radar, PRM, ADS-B, WAM or Satellite/Links and have no objections to it proceeding.

Air Traffic Control (ATC) Operations
There are no additional instructions or concerns from our ATC.

Summary – permanent impact (WF)
Based on the above assessment, our view is that the proposed Hexham Wind Farm would have an impact on Airservices designed instrument procedures, CNS facilities or ATC operations at Warrnambool aerodrome.

We request that you consult with Warrnambool Airport, along with aviation operators there to ensure that all stakeholders fully understand the proposed changes that are required to accommodate the Wind Farm. We will require comments from the airport stating they are comfortable for the project to proceed as is currently presented.

Note: All work we conduct to amend the 10NM MSA will be undertaken on a commercial basis and require further consultation.

If you have any further queries, please let our team know.

Kind regards,

airservices australia

Richard Tomlinson
airport developments & engagement advisor

Airservices response to 260m tip height VIC-WF-043 P2

APPENDIX E

Department of Defence
AIS Response

APPENDIX E

Department of Defence AIS Response

ian_jennings@netspace.net.au

From:	Murray, Adam MR 3 <adam.murray3@defence.gov.au> on behalf of SEG-EstatePlanningBranchExternalLandPlanning&Regulation <land.planning@defence.gov.au>
Sent:	Thursday, 2 March 2023 5:21 PM
To:	ian_jennings@netspace.net.au; Defence Land Management
Cc:	Hogan, Tim Mr 2
Subject:	RE: Hexham Wind Farm - Revised AIS [SEC=OFFICIAL]

OFFICIAL

Hi Ian,

The advice Defence provided on 3 December 2019 still stands.

Kind regards,
Adam

Adam Murray

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

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

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From: ian_jennings@netspace.net.au <ian_jennings@netspace.net.au>
Sent: Thursday, 2 March 2023 12:19 PM
To: Defence Land Management <dsrgidep.executivesupport@defence.gov.au>
Cc: Hogan, Tim Mr 2 <timothy.hogan2@defence.gov.au>
Subject: Hexham Wind Farm - Revised AIS

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

Team,
Attached is a revised AIS for the Hexham Wind Farm.
The original assessment was done as ID-EP-DLP&R/OUT/2019/BS6976460 on 3 December 2019.
The location and layout remains essentially the same.
The turbine tip height is now 260m AGL.
Ian

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

1

DoD Response email 2 March 2023

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/BS6976460

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

Dear Mr Jennings

NOTIFICATION REGARDING HEXHAM 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 123 wind turbines at a site approximately 30 kilometres north-east 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 10:02:14 +11'00'

Charles Mangion
Director Land Planning & Regulation

3 December 2019

Defending Australia and its National Interests

Original DoD Response 3 December 2019

APPENDIX F

Stakeholder List

APPENDIX F

The following organisations were consulted.

Stakeholder	Contact
Warrnambool City Council	Aerodrome Manager
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 Air 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 30 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, “a term used by pilots and controllers to indicate the type of flight plan an aircraft is flying,” such 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 Government’s 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. Similar to 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	Aircraft 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
ELEV	Elevation (above mean sea level)
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
GRID	The Lowest safe altitude calculated within a grid bounded by 1 degree of latitude and Longitude
GP	Glide Path
IAP	Instrument Approach Procedure

Abbreviation	Meaning
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 Safe Altitude Overall area of an Instrument approach – interchangeable
MSA	Minimum Sector Altitude Sectors of an Instrument approach - interchangeable
mSSR	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
OIS	Obstacle Identification Surface
OLS	Obstacle Limitation Surface
PANS-OPS	Procedures for Air Navigation Services – Aircraft Operations,
PRM	Precision Runway Monitor
PROC	Procedure
PSR	Primary Surveillance Radar
QNH	An altimeter setting relative to height above mean sea level
Rnnn	Restricted Airspace – promulgated in AIP as R with 3 numbers

Abbreviation	Meaning
REF	Reference
RL	Relative Level
RNAV	aRea NAVigation
RNP	Required Navigation Performance
RPA	Rules and Practices for Aerodromes — replaced by the MOS Part 139 — 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
YCDE	Cobden uncertified aerodrome
YDER	Derrinallum uncertified aerodrome
YHML	Hamilton certified aerodrome
YWBL	Warrnambool certified aerodrome