Risk Assessment Woolsthorpe Windfarm – Impacts on local aviation operations at Warrnambool.

Prepared by:

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1 Background

Argus Consulting Group (Argus) was appointed to carry an analysis of a proposal to increase the tower height of the Woolsthorpe Wind Farm following an increase in the blade tip height from 168m to 230m. The following paragraphs were provided to Woolsthorpe Asset Pty Ltd as part of the review. Following the review, a further risk assessment was requested to analyse the risk in increasing the published 10 nm minimum safe altitude (MSA) for Warrnambool airport from 2100 feet to 2300 feet above mean sea level, as outlined in Review Findings at paragraph 7 below.

2 Review Findings

The analysis used information from the report WFD/AUD/10/15. New tower locations were plotted as set out in Table 1.

Table 1: Proposed layout for the Woolsthorpe Windfarm

LAYOUT 13 WT - 6 Diameters- Windfarmer		
Site ID	Lat	Long
WT_1	38°10'40.55"S	142°22'48.21"E
WT_2	38°10'28.03"S	142°23'25.54"E
WT_3	38°11'31.96"S	142°22'29.78"E
WT_4	38° 9'52.69"S	142°22'46.45"E
WT_5	38°10'48.96"S	142°23'12.62"E
WT_6	38° 9'3.29"S	142°22'16.96"E
WT_7	38°10'47.53"S	142°23'34.30"E
WT_8	38°11'47.36"S	142°22'17.20"E
WT_9	38° 9'28.20"S	142°22'17.84"E
WT_10	38°10'30.61"S	142°22'16.22"E
WT_11	38°09'22.45"S	142°22'52.46"E
WT_12	38°11'2.77"S	142°22'20.64"E
WT_13	38°11'6.55"S	142°22'50.23"E

The review identified the following points about the proposed towers, with reference to the original report:

1. Radar and navigation aid performance should not be affected by the proposed wind farm;
2. The instrument approaches to runways 13 and 31 will not be affected, in terms of regulatory requirements, by the proposed wind farm as the structures fall outside the protection areas associated with the instrument approaches and overshoot areas. The instrument approach flight profiles are well above any wake turbulence generated by the wind turbines. It was noted that the closest tower to the approach is approximately 1.2 nautical miles from the approach path. Particularly, points WBLWG, WBLWI, WBLWF and the path joining them was considered in its proximity to the proposed towers.
3. The missed approach for RNAV-Z (GNSS) RWY 31 has a missed approach holding point (WBLEH) that is 4.41nm from the southern most tower (tower 8). The approach appears to continue to comply with the relevant design criteria with approximately 3.3 nm between the expected missed approach flight path and tower 8. It is worth noting that, operationally, there is very limited reason to hold at the missed approach holding point. Under most operations, if a missed approach was carried out, the aircraft would proceed to recommence another approach or divert to an alternate aerodrome.
4. The climb gradient required for obstacle clearance to tower 8 appears to be in the order of 133 ft/nm which is slightly less than the 2.5% climb gradient (152 ft/nm) required for transport category aircraft in the event of and engine failure. However, tower 8 is outside the 15º splay from the upwind threshold of runway 31 which means that tower 8 does not need to be considered in terms of obstacle clearance.
5. Instrument Flight Rules routes V279, W741, V126, and W571 will be unaffected by the proposed increase in tower height on the Woolsthorpe Windfarm.
6. The construction of the wind farm will not impact on the aerodrome OLS surfaces or circling areas for Category A, B, C and D operations.

7. The published 10 nm minimum safe altitude (MSA) for Warrnambool airport will need to be raised again. Previously it was raised from 1900' above mean sea level to 2100' above mean sea level. It would appear that the new 10 nm would need to be 2300' above mean sea level.
8. There is no change in the categorisation of airspace within proximity to the wind farm or the airports within 30 km of the wind farm.
9. A pilot calculated minimum lowest safe altitude for flight under the instrument flight rules within 5 nautical miles from the boundary of the windfarm will be raised by the elevation of the tip above ground level.

3 Risk Assessment

The risk assessment only analyses increase in the published 10 nm minimum safe altitude (MSA) for Warrnambool airport from 2100 feet to 2300 feet above mean sea level, as outlined in Review Findings at paragraph 7. The risk analysis looks at the unmitigated risk followed by the risk mitigation and the resulting residual risk.

In developing the risk assessment, two local operators were consulted. One operates in IFR conditions, to the airport on a daily basis and did not anticipate any changes to their operation as a result of raising the 10 nm MSA.

The second operator is an aerial application operator and while windfarms generally affect their operations, specifically, the change in MSA would have no effect on their operation. That operator did not conduct night operations or routinely operate in conditions of poor visibility.

The following risk assessment should not be construed as not affecting aviation operations. That is, this analysis only considers the increased in the 10 nm MSA from 2100 feet to 2300 feet above mean sea level, as outlined in Review Findings at paragraph 7.

Table 2: Risk Assessment

Risk Assessment Worksheet		Increase in MSA from 2100 feet to 2300								
Activity		**Hazard**	**Assessment (before controls)**			**Control comment**	**Procedures and comment**	**Assessment (after controls) - Residual risk**		
No	**Description**		**Probability**	**Consequence**	**Rank**			**Probability**	**Consequence**	**Rank**
1	**Collision with obstacle**	Damage to aircraft or pilot through collision during IFR operations	b	4	21	Proactive 1. removal of hazards where possible 2. location of all obstacles know and not operate in those areas. Education and work arounds. 1. NOTAM information initially, then incorporation in charts and documents through the regular AIRAC cycle	Removal of the obstacle is not an option. Need to inform pilots of the change through education. 1. Raise a NOTAM on the airport and the FIR detailing the increase in MSA/LSALT. 2. Incorporate the information into charts are documents in the first available AIRAC cycle.	e	4	10
2		Collision with obstacles at night	b	4	21	NOTAM information initially and incorpororation on charts and documents as the final control	. Raise a NOTAM on the airport and the FIR detailing the increase in MSA/LSALT. 2. Incorporate the information into charts are documents in the first available AIRAC cycle. 3. Lighting of tall structures in conditions of poor visibility and night	e	3	6

		Aircraft operating under the VFR at night not maintaining clearance with obstacles. VFR aircraft at night are required to maintain 1000 ft clearance between highest obstacle and the aircraft. However, they may not necessarily refer to RNC charts for MSAs.	c	4	18	Tall structures lighting, to make the obstacles visible at night.	Tips fitted with obstacle lighting at the construction phase	e	4	10
3	**Diversion of IFR aircraft due to higher MSA**	Operational exposure	e	2	3	Considered highly unlikely because the structures do not influence with operation of the instrument approaches to the airport.	Acceptable risk	e	2	3
4	**Increase in operating height**	Operational exposure to icing conditions in aircraft not equipped for flight in icing conditions.	e	2	3	Considered unlikely because of low likelihood of icing conditions in a maritime environment at 2300 ft. In a northerly stream, the temperature is likely to be above icing temperatures in the unlikely event of visible moisture	Acceptable risk	e	2	3
5		Engine Performance	e	3	6	Plan engine failure after takeoff paths on extended centre lines. Plan engine failure arrivals on instrument approach paths	Acceptable risk	e	2	3

4 Summary and conclusions

4.1 Wind Farm Lighting

The proposed wind farm would be classified as a tall structure. Current advisory information is that tall structures should be lit at night and in conditions of poor visibility. However, the advisory information also identifies the negative effects of constant lighting on people living within proximity of the light. With this in mind, systems to light the structures when aircraft are in the vicinity would be an acceptable mitigation in terms of a lit structure.

There are various options for lighting that could be considered. Various technologies are available to activate lighting when aircraft are in the proximity of the windfarm are available. A case can be made for lighting the perimeter of the wind farm and any higher turbines within the perimeter rather than every turbine in the development.

With the application of light activation technologies, lighting would only be used on an 'as required' basis. The frequency of use would be poisson distribution because flights at night and in marginal weather are not predictable, given there is no scheduled air transport operations to and from Warrnambool. The type of flights that would activate the lighting are occasional aeromedical flights, charter flights and any private aircraft operating into Warrnambool.

That said, one of the mitigation measures is the tip lighting for aircraft operating under the visual flight rules at night.

4.2 Risk Statement

The presence of any obstacle adds a hazard to aviation operations. However, the change in general safety, as a result of raising the Warrnambool airport 10 nm MSA from 2100 feet to 2300 feet, with the proposed mitigation strategies in place, will have a negligible effect on aviation safety and as thus appears to be an acceptable risk.

5 References

Aerial Agricultural Association of Australia, 2014, National Windfarm Operating Protocols.

Aerial Agricultural Association of Australia, 2017, Tall Structures Policy.

AS/NZS ISO 31000-2009 Risk Management.

CASA, 2021, Advisory Circular, AC 139.E-01v1.0

NASAG, 2012, Guideline D. Managing the risk to aviation safety of wind turbine installations (wind farms)/wind monitoring towers.

pers com. Malcolm Sharp, CEO, Sharp Airlines.

pers com. Troy Bentley, CEO, Aerial Apply, Warrnambool.