

SGS HART AVIATION

AVIATION IMPACT ASSESSMENT

SITE:	Alberton Wind Farm
ON BEHALF OF:	Synergy Wind Pty Ltd
PROJECT NUMBER:	15-0572-01
ASSESMENT DATE:	16 December 2015
ADVISOR:	Mel Dunn

CONFIDENTIAL





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6.9. NASAG – National Airports Safeguarding Framework – Guideline D “Managing the Risk to Aviation Safety of Wind Turbine Installations (wind farms) / wind Monitoring Towers” 38

6.10. References 45

This document is confidential and intended for the sole use of Synergy Wind Pty Ltd. The information and any assessments contained within are based on the information provided by Synergy Wind Pty Ltd, observations made during a visit to the proposed Alberton Wind Farm site and independent research. Because of the sampling nature and other inherent limitations of what is presented for review or seen during an inspection, there is an unavoidable risk that some material or other irregularities may remain undiscovered. The report relates to specific operations only in the vicinity of the Alberton Wind Farm and may not reflect the position at other locations, on different operations, or at some other time in the future. Notwithstanding anything contained in this Report, SGS HART Aviation is not liable for any loss, damage or injury caused by or as a result of activities of or the negligence of a third party claiming to be relying on this Report. This Report shall not be disclosed to or used by any third party without first obtaining Synergy Wind Pty Ltd's and SGS HART Aviation's written permission.



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EXECUTIVE SUMMARY

SGS HART Aviation undertook an aviation assessment, including investigating local aircraft movements and locations of nearby airfields, to determine the potential impact on aviation operations of the proposed Alberton Wind Farm and the need or otherwise for obstacle lighting.

SGS HART Aviation reached the considered view that the overall risk to aviation operations in the vicinity of the proposed Alberton Wind Farm is sufficiently low such that the installation of obstacle lights is not necessary, even if the maximum height of the wind turbines were 200m (~656ft).

Further, at the appropriate time, it is considered that CASA needs to be advised of the proposed wind farm development in accordance with CASR 139.365. Note that it is also considered likely that CASA would likely make its own “determination” in accordance with CASR 139.370. Whilst SGS HART Aviation considers that obstacle lights are not necessary in this particular case, CASA may very well take a different view. One can not anticipate that, or any other matter which might be determined by CASA.

Airservices also needs to be advised of the proposed wind farm development as it will likely also wish to assess the matter.


Whilst the risk is considered to be low now for the proposed Alberton Wind Farm plan, the overall risk to aviation operations would be further reduced if, in the fullness of time, the wind turbines were identified on the relevant aeronautical charts, i.e., both the civil WACs and the RAAF produced chart series. This is considered essential associated risk mitigation.

Pending such identification on maps, at the appropriate time it would be advisable to ensure that all aviation operators are also made aware of the proposed existence of the wind farm.

Airservices, if they were made aware of the wind farm, would normally implement action via a NOTAM covering both the construction phase and prior to identification on maps. It is, therefore, essential that the wind farm developer advises both Airservices and the RAAF AIS.

It is considered that advice to CASA, Airservices and the Department of Defence should also include details of the Met Masts – both existing and any proposed. It was noted that, following consultation with and advice being received from CASA and Airservices, Synergy Wind Pty Ltd has already reported the presence of the existing Met Mast to the RAAF.

Further, the Aerial Agriculture Association of Australia (AAAA) should also be advised of the Met Masts.

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1. TERMS OF REFERENCE

The **principal objectives** have been identified as follows: -

Undertake a detailed assessment of the potential aviation impacts of the proposed wind farm development, in accordance with relevant guidelines.

The assessment should meet the requirements of statutory regulations, aviation and transport industry requirements and guidelines, and government policies.


Such requirements should include, but not be limited to relevant CASA regulations and recommendations in relation to rural structures and specifically wind turbines including management, avoidance or mitigation of potential risks.

The assessment should also present a clear recommendation with regards to any potential requirements for aviation lighting.

2. SCOPE OF CONSIDERATIONS

The **Assessment Scope** was defined as follows: -

- 1) Identify the nearest registered aerodrome and other airfields to the proposed wind farm site, including those located within thirty kilometres (or other relevant distance) of the proposed wind farm site and assess the risks the proposed wind farm could pose to activities at these airfields;
- 2) Identify and assess any CASA and other relevant civil aviation regulations and, in particular, any regulations that relate to wind farms, obstacles and aerodromes;
- 3) Assess the potential risks the proposed wind farm could have on relevant instrument approach procedures for the relevant region around the proposed wind farm site;
- 4) Examine existing air routes in relation to the proposed wind farm development to determine if there would be any influence on the Lowest Safe Altitudes published for these routes;
- 5) Identify and assess any risks the proposed wind farm development could pose for:
 - a) aeronautical navigation aids;
 - b) air traffic services;
 - c) Obstacle Limitation Surfaces;
 - d) any military aircraft conducting low flying operations in the area and the operation of civilian aircraft undertaking recognised low flying activities (in consultation with RAAF);
 - e) any aerial fire fighting activities that may be undertaken in the region;
 - f) any rural air ambulance activities that may be undertaken in the region;

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- g) any aerial agricultural and agricultural activities that may be undertaken in the region;
 - h) any contingency procedures and engine inoperative flight paths (in the context of a scenario where an aircraft suffers an engine failure after takeoff from an aerodrome in the region); and
 - i) any other relevant factor.
- 6) Assess and advise on applicable Civil Aviation Regulations in regard to notification of tall structures that may present obstacles and hazards to aviation activities;
 - 7) Assess the potential cumulative impact of the proposed wind farm in combination with any other approved and constructed wind farms in the region;
 - 8) Assess and make recommendations with regards to obstacle lighting requirements for the proposed wind farm development;
 - 9) Document any limitations associated with the aeronautical impact and obstacle marking and lighting assessment;
 - 10) The assessment should consider the theoretical maximum turbine tip height of 200 metres. The actual turbine type remains to be decided.
 - 11) Assess and discuss any other relevant matter;
 - 12) Provide recommendations to manage, mitigate or avoid identified risks;
 - 13) Provide conclusions.

3. REVIEW OF PROPOSED ALBERTON WIND FARM

3.1. Methodology

Consistent with the **Assessment Scope** as detailed above, SGS HART Aviation approached the tasks using the following methodology: -

- 1) Exchanged information with Synergy Wind Pty Ltd personnel to: -
 - a. discuss the aviation assessment process / methodology,
 - b. collect all the background information and materials, and
 - c. arrange a mutually suitable time to visit the proposed wind farm site.
- 2) Undertook an assessment investigating aircraft movements and airfields in the surrounding area, including both civil and military operations.

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- a. In addressing this element of the **Assessment Scope**, SGS HART Aviation identified the extent to which aviation activities in the proposed wind farm area may, or may not be an issue for concern, which included, inter alia: -

- i. Review of Alberton Wind Farm proposed layout, taking particular note of:-

1. map of area,
2. surrounding terrain,
3. site plan,
4. number of wind turbines, positions, and heights.

- ii. Review of relevant aviation charts for the area concerned, including: -

1. relevant World Aeronautical Chart (WAC),
2. designated airspace (including PRDs) and other airspace considerations,
3. relevant En Route Charts (ERC),
4. departure & arrival procedures for any aerodromes in the vicinity,
5. relevant Visual Terminal Charts (VTC) if any, for the area,
6. available airfield and airstrip guides / directories for the area, and
7. any other matter considered relevant.

- iii. Visit to proposed wind farm site and surrounding areas to assess issues, including: -

1. identifying any nearby aviation related sites / airfields / Aircraft Landing Areas (ALA), etc, which may be, or may not be, evident on available maps, and
2. Identifying and assessing whether any risks the proposed wind farm development could pose on any aviation related matter, including those particular issues identified in the Aviation Scope as detailed in Section 2 5) above.


- 3) Reviewed relevant aviation legislation, including: -

- a. CASA's current position: -

- i. Recognising the CASA requirements as reflected in the Manual of Standards 139, and
- ii. the implications of Advisory Circular AC 139-08(0) dealing with the Reporting of Tall Structures.

- b. Including consideration of the following guidelines, standards and frameworks: -

- i. Department of Planning and Community Development (DPCD) "Policy and planning guidelines for development of wind energy facilities in Victoria", July 2012,
- ii. Clean Energy Council Best Practice Guidelines for Implementation of Wind Energy Projects in Australia, 2013,
- iii. NASAG - National Airports Safeguarding Framework – Guideline D – "Managing the Risk to Aviation Safety of Wind Turbine Installations (Wind Farms) / Wind Monitoring Towers" July 2012
- iv. Relevant provisions of the Victorian State Planning Policy Framework (SPPF) October 2015 and the Local Planning Policy Framework (LPPF)
- v. Airspace Act 2007
- vi. Airspace Regulations 2007 (updated 9 August 2013), and
- vii. Any previous aviation investigations with relevant areas,

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1. including aviation assessments undertaken for other relevant proposed developments in the region for proposed wind farm developments and power plants where available.
- 4) Reviewed and updated Australian and International literature regarding wind farm projects, aviation safety and aircraft safety, as appropriate to the particular aviation assessment.
- 5) Assessed the potential cumulative impact of the construction of approved and constructed wind farms in the region, if any.
- 6) Assessed other relevant matters as considered relevant.
- 7) Based on the above, provided conclusions and recommendations to manage, mitigate or avoid identified risks,
 - a. Including the need, or otherwise, for obstacle marking and / or aviation safety lights at the wind farm.

3.2. Assumptions, Limitations & Exclusions

No specific assumptions, limitations and exclusions exist.

The information and any assessments contained within are based on the information provided by Synergy Wind Pty Ltd, observations made during a visit to the proposed Alberton Wind Farm site and independent research.


3.3. Overview Of Proposed Wind Farm

The site of the proposed Alberton Wind Farm is south west of the township of Yarram in the South Gippsland area of Victoria as shown in Appendix 6.2.

The proposed wind farm is situated in an open plain area which would seem to be primarily used for cattle and sheep grazing, although some cropping, e.g. wheat, may also be in existence.



Typical of area for proposed Alberton Wind Farm.

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Another view of the area where the proposed Alberton Wind Farm is planned showing the rolling hills to the North of the site which dictate the lowest safe altitudes (LSALT) over the area.

As will be seen from the map at Appendix 6.3, the proposed turbine layout is situated either side of the South Gippsland Highway.

The nearest township is Yarram, some 8.3km to the north east from the closest planned wind turbine at the site; viz: turbine No. 11 on the Nicol property.

The interim proposal for the Alberton Wind Farm is for 28 turbines distributed as shown in Appendix 6.3.

A decision as to the type of turbine has yet to be made but a maximum tip height of 200m is being considered and this will form part of the assessment.

3.4. Specific Issues


3.4.1. Airfields in the vicinity of the proposed wind farm.

A comprehensive search of all available documentation on airfields (including the En Route Supplement Australia [ERSA], the Aircraft Owners and Pilots Association [AOPA] National Airfield Directory and the FightAce[®] Country Airstrip Guide) was undertaken. This was supported by a visit to the proposed site and surrounding areas.

Appendix 6.1 shows the proposed Alberton Wind Farm site and the position of one neighbouring wind farm; viz: Toora Wind Farm, some 23km to the west. Toora Wind Farm was commissioned in 2002. It consists of 12 turbines each with a total height of 100m. It is not considered to be a competitor to the Alberton Wind Farm and its existence will have no influence at all on the establishment of the Alberton Wind Farm.

Appendix 6.3 also shows airfields identified within the vicinity of the proposed Alberton Wind Farm as a result of the above-mentioned search, with specific emphasis on those within 30km from the wind farm site itself.

No airstrips or wind socks were identified during the on-site inspection of the proposed Alberton Wind Farm site which would indicate the possible presence of aerial agricultural, or ad hoc private operations, in existence on the site. This is not to say that ad-hoc airfields may appear in the vicinity from time to time to support, such as, aerial agricultural operations. See also Section 3.4.7.

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Yarram Airport / Aerodrome.

The nearest Registered or Certified aerodrome is Yarram Airport, a Registered aerodrome which is approximately 8.3km to the north east of the most eastern edge of the proposed wind farm site; viz: turbine No. 11 on the Nicol property, as indicated before. It is 5.6km to the north east of the township of Yarram.



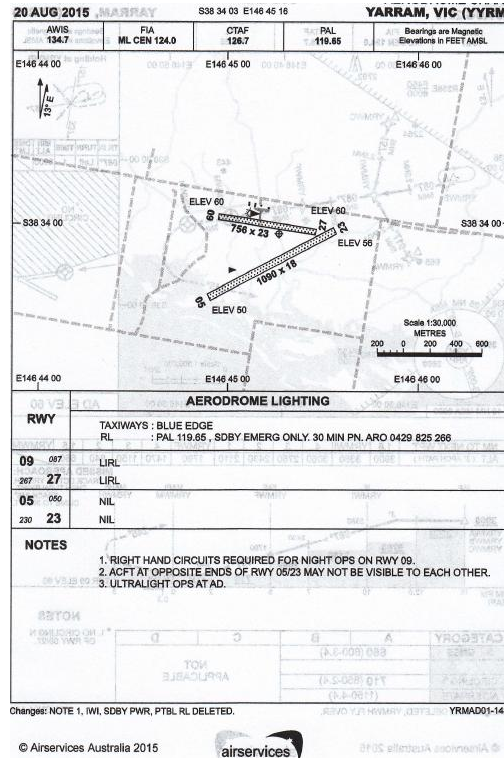
Yarram Airport from Google Earth.

Yarram Airport / Aerodrome, also identified as Parkside Aerodrome according to local street signs, would seem to be largely used for ultralight aircraft, light aircraft and some aerial agricultural operations. The aerodrome has two runways; viz: 05/23, 1,090m long constructed of grass grey sand silt, and 09/27, 756m long constructed of yellow granitic sand.




Views of Yarram Aerodrome.

At the time of the inspection of Yarram Aerodrome, no aircraft were operating, nor were any evident on the aerodrome and all hangars were locked. Clearly, this aerodrome is not extensively used for aircraft operations.



Yarram Aerodrome chart from Airservices Departure & Approach procedures.

This airfield site is situated approximately 15km west of the proposed Alberton Wind Farm site.

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The airfield is closed.

Fish Creek.

This airfield site is situated approximately 40km west of the proposed Alberton Wind Farm site.

The airfield is closed.

McDonald Hill (Boolarra South).

This airfield site is situated approximately 35km north west of the proposed Alberton Wind Farm site.

This airstrip is unlicensed and has an unsealed grass runway 12/30, 380m long. The airstrip is owned by Hancock Plantations Corporation and leased to N. W. Littlejohn and Son and is used for spreading fertiliser. Permission is required prior to use. For all practical purposes it is only available for external parties for emergency use only.

Operations from this airfield will not be affected by the presence of the proposed Alberton Wind Farm.

Yinnar South (Riverdale).

This airfield site is situated approximately 35km north west of the proposed Alberton Wind Farm site.

In any event, even if operations existed from any of the above mentioned airfields, they would not be affected by the presence of the proposed Alberton Wind Farm.

3.4.2. Aviation Operations – General.

Visual Flight Rules (VFR) Operations


Whilst there are some exceptions in respect of operations that require low flying (e.g., during takeoff and landing, search & rescue and agricultural spraying operations) pilots undertaking VFR operations (i.e., during daylight hours) must not fly over: -

- any city, town or populous area, at a height lower than 1,000ft; or
- any other area at a height lower than 500ft.

The regulations define the height specified above as the height above the highest point of the terrain vertically below the aircraft, and any object in it, within a radius of 600m for aircraft and 300m for helicopters. In principle, therefore, all VFR aircraft operations should be above the level of any wind turbines. However, any objects extending higher than 500ft above the terrain clearly penetrate navigable airspace and this should not be overlooked in assessing the potential impact of wind farms on aviation operations.

In any event, the wind turbines should be clearly visible to pilots undertaking VFR operations.

It should be noted that any aviation operations from those other airstrips identified as in the vicinity of the proposed Alberton Wind Farm site would all be under visual flight rules (VFR).

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Instrument Flight Rules (IFR) and Night VFR Operations.

Such operations would be undertaken under either Night VFR or IFR flight plan conditions, which require operations not below the lowest safe altitude (LSALT), except when landing or taking off.

In principle: -

- where the highest obstacle is more than 360ft above the height determined for terrain, the LSALT must be 1,000ft above the highest obstacle; or
- where the highest obstacle is less than 360ft above the terrain, or there is no charted obstacle, the LSALT must be 1,360ft above the elevation determined for terrain; except that
- where the elevation of the highest terrain or obstacle in the tolerance area is not above 500ft, the LSALT must not be less than 1,500ft.

Civil Aviation Regulations require that, unless it is necessary for takeoff or landing, a Night VFR aircraft must not be flown at a height less than 1,000ft above the highest obstacle within a 10nm (~18.5km) radius of the aircraft in flight.

In the circumstances, the proposed Alberton Wind Farm should have no impact on civil Night VFR or IFR operations which may occur in the vicinity, possibly originating from the only close Registered Aerodrome at Yarram.


As per VFR operations, the altitude limitations in respect of both civil Night VFR and IFR operations as mentioned above are important in the context of assessing whether obstacle lights are required or not for the wind turbines.

Night operations and IFR operations can occur from the aerodrome at Yarram.

Under the Civil Aviation Regulations, VFR operations, except during take off and landing, are required to maintain a minimum height above ground level (AGL) of 500ft outside of built up areas and 1,000ft over built up areas.

It was noted that the maximum height of the wind turbines potentially to be used for the proposed Alberton Wind Farm will be higher than 152m (~ 500ft) AGL; {i.e. 200m [~656ft] - See Section 2 10)}. This is important to note in the context as to whether obstacle lighting might be required or not. {See Section 3.4.11} For wind turbines of a height less than 152m (~500ft) AGL, with the exception of special low level operations as would occur with, such as, agricultural operations, VFR operations should be clear of any such wind turbines. For wind turbines of a height more than 152m (~500ft) AGL, the situation in respect of VFR operations is in doubt.

The Civil Aviation Regulations further require that, unless it is necessary for takeoff and landing, an instrument flight rules (IFR) or a Night VFR aircraft must not be flown at a height less than 1,000ft above the highest obstacle within a 10nm radius of the aircraft in flight. This defines the Lowest Safe Altitude (LSALT) for any such operation which, by definition, will be higher than any wind turbine in the proposed Alberton Wind Farm development.

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3.4.3. High Voltage Transmission Lines.

During the inspection of the proposed Alberton Wind Farm site no high voltage transmission lines were identified running through the proposed site. As such, there are no issues of concern in respect of this matter.

The issue is raised as there is often a need for the proposed positions of the wind turbines themselves to be well clear of existing high voltage transmission lines.

Existing low voltage transmission lines identified on the wind farm site, principally running along side the South Gippsland Highway, are not of any concern in respect of the development of the Alberton Wind Farm.

However, in the event that the positions of the wind turbines may change, and high voltage lines may become a part of the power distribution network for the development, it is worthwhile noting that an electricity company does not prescribe a minimum set back for the wind turbines from the power lines.

If high voltage power lines are to be installed as a part of the development, it would seem wise to adopt a set back figure in excess of the maximum wind turbine height to blade tips (say, 10% more) for those wind turbines close to the transmission lines. This would nominally protect against a worst case scenario should the turbine fall.

It should also be noted that some electricity providers use helicopters for live line maintenance and insulator washing.




Washing insulators using a MD 500 helicopter.

For such operations the minimum clearance usually required when working between circuits is 25m from the outside wire of one circuit to the outside wire of another circuit. This advice is based on operator experience when positioning a helicopter safely between circuits with the lines energised. Prima facie, therefore, a set back as suggested above would enable such aviation operations to be undertaken, but not without the necessary due care, of course.

However, whether or not such operations could be undertaken would be an operational decision for the particular operator. Informal advice indicates that most would prefer not to work near wind farms and, in the cases they do, they fly well above the wind turbines / wind farms.

It is understood that electricity authorities, when building new high voltage lines, either avoid wind farms or install the high voltage lines underground in these areas.

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3.4.4. Reference Towers for Meteorological Monitoring.

Prior to visiting the proposed wind farm site, SGS HART Aviation was advised of the presence of one 80m Met Mast (wind monitoring tower / anemometry mast) in the southern section of the site.

This mast was identified south of the South Gippsland Highway, off the road to Gelliondale / Forest Nursery as indicated in Appendix 6.3.



Existing 80m Met Mast (close up)



Met Mast as seen from Gippsland Highway


As will be observed from the photos above, the 80m Met Mast is quite difficult to pick out, particularly from a distance. For this reason, such towers are of particular concern to any local aerial agricultural operators; if indeed there would be any in the area concerned, as no evidence was found of such during this assessment. Nevertheless, it is very important that advice as to the presence of these towers is readily available.

In accordance with the NASAG - National Airports Safeguarding Framework Guideline D (copy at Appendix 6.9) wind farm developers should take appropriate steps to minimise the potential hazards of wind monitoring towers, particularly in areas where aerial agricultural operations occur and recommends such measures include: -

- the top 1/3 of wind monitoring towers to be painted in alternating contrasting bands of colour.

Examples of effective measures can be found in the Manual of Standards for Part 139 of the Civil Aviation Safety Regulations 1998. In areas where aerial agriculture operations take place, marker balls or high visibility flags can be used to increase the visibility of the towers;

- marker balls or high visibility flags or high visibility sleeves placed on the outside guy wires;
- ensuring the guy wire ground attachment points have contrasting colours to the surrounding ground/vegetation; or
- a flashing strobe light during daylight hours.

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SGS HART Aviation observed that the 80m Met Mast does not apparently have any of the recommended provisions of the afore-mentioned NASAG Guideline D. However, SGS HART Aviation was advised by Synergy Wind Pty Ltd that it consulted CASA and Airservices Australia with regard to their requirements and was advised that it would only be necessary to register the object with the RAAF using the Tall Structure Report Form and that was done on 29 October 2014.

Since the height of the existing temporary Met Mast is 80m, this mast is not required to be reported to the Civil Aviation Safety Authority (CASA) under CASR 139.365, which requires CASA to be informed of structures 110m or more above ground level.

The action to advise the RAAF is consistent with the CASA Advisory Circular AC 139-08 (0) of April 2005 "Reporting of Tall Structures" which refers to the need to have a database of tall structures and the fact that the RAAF Aeronautical Information Service (AIS) has been assigned the task of maintaining that database of tall structures defined as those structures, the top of which is above: -

- 30m or more above ground level, that are within 30km of an aerodrome, or
- 45m or more above ground level elsewhere.

See also Section 3.4.5 d) below.

Surrounding land owners should also be advised of the existence of the Met Mast.

SGS HART Aviation considers it would also be appropriate to notify the Aerial Agriculture Association of Australia (AAAA) of the afore-mentioned existing and any proposed Met Masts.

3.4.5. Airspace Considerations.

a) General.


In assessing the potential impact on aviation operations the En Route Charts (ERC). Visual Terminal Charts (VTC), Visual Navigation Charts (VNC) and Terminal Area Charts (TAC) potentially relevant to the area concerned were studied in depth.

In addition, the Designated Airspace Handbook and the relevant World Aeronautical Chart [WAC] (3470) MELBOURNE were studied for any issues of concern.

The proposed Alberton Wind Farm is outside any designated airspace and any airport control zones. Hence there are no aircraft traffic control issues nor is there any potential influence on aeronautical navigation aids.

Details of Prohibited, Danger and Restricted areas (PRD) are shown in Appendices 6.4, 6.5 and 6.6.

There are no Prohibited areas (PRD) within the vicinity of the proposed Alberton Wind Farm site.

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There is one Danger Zone (PRD) some 18km north east of the proposed Alberton Wind Farm site. This is D392 WOODSIDE, associated with the Omega Tower and associated wires. It has lateral limits of 3nm and vertical limits of surface to 2,000ft. It will have no influence at all on the development of the proposed Alberton Wind Farm site.

There is one Restricted Area (PRD) overlapping the proposed Alberton Wind Farm site. This is designated R358D and is associated with military operations from the East Sale Aerodrome. The vertical limits for the military operations within this Restricted Area are 4,000ft to Flight Level 450 (i.e. 45,000ft). The lower vertical limit of 4,000ft is above the LSALT over the proposed Alberton Wind Farm site {see Section 3.4.5 c) below} and, as such, the presence of R358D will not have any effect on the development of the proposed Alberton Wind Farm.

There are two active Notices to Airmen (NOTAM) discovered which are relevant to the area. These are: -

YARRAM (YYRM)

C8/15 REVIEW C7/15

RWY 05 AND RWY 09 DECLARED DIST AND GRADIENT CHANGES
RWY TODA
05 1150(4.40)
09 816(2.62)
SUPPLEMENTARY TAKE OFF DISTANCES
RWY 05 860(2.5) 1025(3.3)
RWY 09 802(2.2) 813(2.5)
AMD EN ROUTE SUP AUSTRALIA
FROM 10 080449 TO PERM

The above advises of declared distance and gradient changes for the runways at Yarram Airport.

EAST SALE AIRSPACE (ESX)


C421/15

R358BD ACT (RA1)
4000FT AMSL TO FL450
FROM 12 062145 TO 12 100600
DAILY 2145/0600

The above advises when the East Sale airspace covered under R358BD is active.

Neither of the above has any impact on the proposed development of the Alberton Wind Farm.

Although no general airspace issues of concern have been identified, it is considered that there is still a need for consultation with CASA, Airservices and the Department of Defence and particular comments on this follow.

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b) CASA.

It is considered essential that CASA be informed of the proposed Alberton Wind Farm in due course, particularly since it is assessed that the proposed wind turbines may very well be as high as 200m (~656ft); i.e. above 152m (viz: ~500ft). This will give an opportunity to CASA to comment.

It will also serve to alert CASA as to the number and proposed heights of the wind turbines in anticipation of the formal requirement to advise CASA of any obstacles which will be 110m or more above ground level – CASR 139.365 refers. Whilst this is not designed to anticipate any requirements for obstacle lights or to seek a CASA view on such, advice to CASA may very well lead to a “determination” being given by CASA consistent with the requirements of CASR 139-370. The need or otherwise for obstacle lights is discussed further in Section 3.4.11.

c) Airservices.

The proposed Alberton Wind Farm will not affect any sector altitude.

Equally, as advised earlier, the proposed Alberton Wind Farm will have no effect on altitudes associated with the established RNAV (GNSS) instrument approach and missed approach procedures as mentioned above.

It is necessary to consider in some more detail the possible effect on en route lowest safe altitudes (LSALT).

The highest candidate wind turbine being considered could have a tip height of up to 200m (~656ft).


The small village of Alberton directly to the East of the proposed Alberton Wind Farm site is variously reported to be between 1m and 15m above sea level. Assuming the area where the proposed Alberton Wind Farm is on the same general level (which, prima facie, it would seem to be from observation) then this would mean that the potential highest wind turbine would be estimated to be at 215m (~705ft) Above Mean Sea Level (AMSL).

By definition, the minimum LSALT required to ensure clearance of the all the wind turbine “obstacles” would then be 705ft + 1,000ft = 1,705ft.

In reviewing the particular routes which pass over or within 10nm of the proposed wind farm, the following have been identified: -

Route	Way points	LSALT
W457	Latrobe Valley to Flinders Island	3,900ft
W219	Latrobe Valley to Launceston	3,900ft

The above routes are identified on the En Route Chart (ERC) Low L1 – excerpt shown at Appendix 6.5.

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The ERC High H1 covering the area concerned was also studied. An excerpt is shown at Appendix 6.6. In reviewing the particular routes, it is clear that there are none which pass over or within 10nm of the proposed wind farm. The closest is some 40km+ (~22.7nm) away as follows: -

Route	Way points	LSALT
H215	Wonthaggi to Launceston	3,900ft

It will be seen that in all cases the defined LSALT for the listed routes is more than 1,000ft higher than the highest proposed wind turbine, even if the estimate of the AMSL for the land itself is less than conservative. As such, the proposed Alberton Wind Farm development will not impact on the LSALT of any of the identified routes which pass over or within 10nm of the proposed wind farm.

Following the above considerations, therefore, SGS HART Aviation is of the view that there will be no effect on any en route LSALTs as a result of the establishment of the Alberton Wind Farm as proposed.

It is well appreciated that Airservices will likely undertake its own independent assessment after receiving the data on the proposed wind farm. Whilst considered to be very unlikely in this case, Airservices may very well reach a different view regarding the effect on established LSALTs for the various routes. In that event, there may be a charge imposed on the proponent for any assessment exercise and any necessary changes which Airservices might consider need to be made to the relevant aeronautical charts. Again, it is considered that such an action would be very unlikely in this case.


Regardless, any changes to LSALTs that might arise would have limited, if any, adverse impact on aircraft operations over the routes concerned.

The proposed Alberton Wind Farm will not impact on Precision/Non-Precision Navigational Aids, HF/VHF Communications, Advanced Surface Movement Guidance and Control Systems, Radar or Satellite/Links. No such devices exist anywhere near the vicinity of the proposed wind farm site.

In respect of civil radar sites, the nearest radar identified is at East Sale, (Military) some 75km to the north east of the proposed Alberton Wind Farm site. The remoteness of this radar from the proposed Alberton Wind Farm site is such that SGS HART Aviation is of the view that the presence of the wind farm will have no adverse effect on the operation of that radar.

Whilst Airservices works closely with CASA in respect of airspace considerations and other matters, there is value in advising that organisation separately, in respect of the proposed wind farm development and for any met masts / wind monitoring masts. Sometimes Airservices chooses, in consultation with CASA, to issue a Notice to Airmen (NOTAM) advising of associated hazards. There is also a close link between Airservices Aeronautical Information Service (AIS) and the RAAF AIS.

As indicated earlier, SGS HART Aviation undertook a search of the Airservices' web site and, apart from those NOTAMs specifically identified in respect of Yarram and East Sale Airports as indicated above, did not discover any other NOTAMs relevant to the proposed Alberton Wind Farm site.

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d) Department of Defence & RAAF AIS.

Among other things, the RAAF (AIS) issues (military) aviation charts defining low level operational routes used by the RAAF aircraft. These often cover low level jet aircraft operations.

SGS HART Aviation has held discussions with the Department of Defence in an endeavour to obtain specific information on the above matters in respect of proposed wind farm but the Department of Defence has proved reluctant to provide specific information and has advised formally as follows: -

“Land Planning & Spatial Information (LPSI) coordinates the Defence assessment of wind farm proposals. The Defence assessment not only ascertains any impact on the aviation activities of RAAF, Army and Navy but also any impact on Defence communications and the operation of Defence Radars. Please forward any proposals to LPSI.Director@defence.gov.au for Defence assessment.”

Despite the above formal position, which clearly needs to be taken into account, SGS HART Aviation undertook its own assessment of the situation.

It is noted that in one other wind farm development known to SGS HART Aviation the RAAF raised one concern to do with the marking of temporary meteorological masts and improved marking was implemented.

As noted above in Section 3.4.4 there is one 80m Met Mast present now in the area of the proposed Alberton Wind Farm and the RAAF has been advised of the existence of that mast consistent with the guidance given within CASA Advisory Circular AC 139-08 (0) of April 2005 “Reporting of Tall Structures”.


Existing civil charts show no evidence of any military operations in the vicinity of the proposed Alberton Wind Farm.

As indicated in Section 3.4.5 a) above, there are no Prohibited areas (PRD) within the vicinity of the proposed Alberton Wind Farm site. There is one Danger Zone (PRD) some 18km north east which will have no influence at all on the development of the proposed Alberton Wind Farm and there is one Restricted Area (PRD) overlapping the proposed site which will also not have any effect of the development.

SGS HART Aviation has not identified any adverse effects on primary radar (civil or military) or secondary surveillance radar which would arise as a result of the establishment of the Alberton Wind Farm.

The nearest military radar identified is at East Sale. The remoteness of this radar from the proposed Alberton Wind Farm site (some 75km to the north east) is such that SGS HART Aviation is of the view that the presence of the wind farm will have no adverse effect on the operation of that radar.

The above view has not the least been influenced by a decision of the US Federal Aviation Administration (FAA) in September 2012 in respect of a wind farm planned off the coast of Massachusetts. In this case the FAA said that, because the wind farm will be located more than 2.4nm (4.4km) from the closest radar sites, there will be no effect on radar images.

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Consequently, SGS HART Aviation considers that there will be no adverse effects on any Defence-related operations associated with the presence of the proposed Alberton Wind Farm.

Note that it is the RAAF AIS which keeps and manages a central aeronautical data base of tall structures, including those reported in accordance with the advice detailed within the AC 139-08(0), mentioned in Section 3.4.4 above. This data base is made available for use by other mapping agencies and the RAAF AIS liaises closely with Airservices' AIS in this respect.

3.4.6. Aerial Fire Fighting Activities

Some concern is often raised about the potential adverse impact on the possible need for aerial fire fighting services, should such be needed in the vicinity of wind farms.

Aerial fire fighting activities can be separated into two elements – those using helicopters and those using fixed wing aircraft.

SGS HART Aviation is of the opinion that any operations of fixed wing aircraft for fire fighting purposes within the confines of the proposed Alberton Wind Farm would be hazardous and are not recommended, particularly if the wind turbines were operating. This is a position held in respect of all wind farms.

The operation of helicopters within the confines of a wind farm is perhaps possible.

It is also possible that aerial fire fighting could be undertaken above the level of the wind turbines {i.e., above the potential maximum turbine height of 200m (~656ft)}, but dropping water or retardant from this height would reduce the effectiveness. This is a matter for the expert fire fighting operators to assess.


The position in respect of the proposed Alberton Wind Farm is no different from any other wind farm.

Helicopter or fixed wing aircraft operations within the confines of any wind farm and below the top of the wind turbines are potentially hazardous and not recommended.

3.4.7. Aerial Agricultural Operations

As indicated earlier, the wind farm site is predominantly low level flat land, which would seem to be principally used for cattle and sheep farming, although some of the properties may also be used for crops. It is possible that aerial agricultural operations have occurred in this area in the past. Although no evidence was found of any airstrips within the proposed site, it is not unusual for temporary aerial agricultural airstrips to appear overnight and be established on existing farm land. Certainly the site and immediate surrounds as observed have sufficient flat areas for such temporary airstrips. Yarram Airport could be used, of course, but this is somewhat remote for usual aerial agricultural operations.

The Aerial Agricultural Association of Australia (AAAA) holds the view that wind farms and their pre-construction wind monitoring towers are a direct threat to aviation safety and especially aerial application.

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It should be noted that aerial application includes not only spraying but also seeding and the spreading of fertilisers.

From the perspective of the AAAA, there are two quite distinct issues arising from wind farms that affect aerial application: -

- safety of the aircraft and pilot, and
- economic impact on aerial applications.

Aerial agricultural operations generally occur between 20 – 30m from the ground. There is no doubt, therefore, that any objects that penetrate the airspace above 20 – 30m will impact on aerial agricultural operations and will need to be taken into account in planning to undertake such operations.

SGS HART Aviation agrees that the presence of wind turbines will adversely impact the ability of aerial agricultural operators to safely undertake aerial spraying, seeding or fertilising within the confines of a wind farm. As it is for fire fighting activities, this position in respect of the proposed Alberton Wind Farm is no different from that for any other wind farm.

However, the safety issue can be addressed by “seeing and avoiding” the wind turbines or, preferably in SGS HART Aviation’s view, not undertaking any aerial agricultural operations within the confines of a wind farm and amongst the wind turbines. The latter action would address any concerns with respect to the safety of the operation. It needs to be recognised, though, that any aerial agricultural operations undertaken within the confines of a wind farm would be constrained to ensure avoidance of the wind turbines and any cessation of any such operations would have the potential to decrease the productivity of, not only the agricultural operator, but also the land owner. In SGS HART Aviation’s view, this is probably a prime reason for the AAAA’s opposition to wind farms in general – the issues being largely of a “commercial” nature as opposed to “safety”, per se.

Aerial agricultural operations from airstrips on the fringes of the proposed wind farm and clear of any wind turbines could be undertaken satisfactorily as agricultural operators are familiar with operating from constrained areas.

It should be added that some aerial agricultural operations occur at night related to special crops, e.g. peas. This is mainly to spray for destructive grubs which rise to the top of such crops in the cool of the night. Such operations are considered quite unlikely to be necessary in the vicinity of the proposed Alberton Wind Farm and are, therefore, excluded from considerations.


In summary, aerial spraying, seeding or fertilising operations, be they by helicopter or fixed wing aircraft, within the confines of any wind farm and below the top of the wind turbines is potentially hazardous and not recommended.

3.4.8. Rural Air Ambulance Services

It has been suggested that the presence of wind farms may impact on the ability for rural air ambulance services to operate in the region.

Certainly, the existence of wind turbines has the potential to limit the flexibility of operations of helicopter ambulance services within the confines of a wind farm and there is little that can be done about that. This is a common factor for all wind farms.

For fixed wing air ambulance operations it is an issue which is not considered relevant to proposed Alberton Wind Farm. Such services do not exist within the confines of the area proposed for the

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wind farm site now and the presence of the wind farm will not change that position. In the event that an air ambulance operation is required, it is almost certain that Yarram Airport would be used and transfer of any patients arranged either via helicopter or road transport to and from that aerodrome. This option is available now and will not change with the construction of the Alberton Wind Farm.

3.4.9. Contingency Procedures and Engine Inoperative Flight Paths

These issues are considered to be of questionable relevance in respect of the proposed Alberton Wind Farm but are addressed for completeness.

In the event of an engine failure, aerial agricultural aircraft and any other single engine aircraft would force land in the nearest suitable field. This is standard practice.

Helicopters would auto-rotate down to the nearest available field. This is also standard practice.

Twin engine aircraft may be taking off in the direction of the proposed Alberton Wind Farm site from Yarram Airport, particularly from runway 23, but in the event of an engine failure occurring to any such twin engine aircraft, a return to Yarram Airport would be the most likely action. Procedures for such an event are not usually defined; rather the consequential action required is left to the judgement of the operating pilot. It is considered that the presence of the proposed Alberton Wind Farm would not place any constraints on such operations.

In the remote case of a complete engine failure (either for a single engine or a twin engine aircraft operating from Yarram Airport) a forced landing in the paddocks east of the township of Yarram would be most likely rather than there being any adverse influence from the presence of the proposed Alberton Wind Farm.

As indicated before in Section 3.4.1, missed approach procedures are a feature of the established RNAV-Z (GNSS) procedures and any aircraft involved in using such procedures should be well clear of any wind turbine within the proposed Alberton Wind Farm.

3.4.10. Wind Farm Layout Issues


a) Micro-siting of wind turbine positions

SGS HART Aviation has noted that Synergy Wind Pty Ltd has established a (tentative) set layout for the wind turbines as shown in Appendix 6.3.

It is understood to be not unusual for wind farm developers to seek a micro-siting variation from the turbine coordinates submitted to the relevant Planning Authority for approval. Such micro-siting can be up to 50m, or more.

It is further noted that the type of wind turbines to be used, on the proposed Alberton Wind Farm site has not been formally defined.

SGS HART Aviation is of the view that, subject to previous comments regarding necessary clearances from any airstrips and high voltage transmission lines that may be established, the actual positions of the wind turbines within the proposed Alberton Wind Farm site boundaries will have little, if any, effect on the risk profile associated with aviation operations identified in the vicinity.

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b) Cumulative impact of wind farms in region

As will be seen from the map at Appendix 6.1, (and mentioned in Section 3.4.1) there is one other wind farm within the 30km boundary of the proposed Alberton Wind Farm site; viz: Toora Wind Farm, some 23km to the west. The presence of this wind farm will have no influence at all on the establishment of the Alberton Wind Farm.

Whilst it is considered that each individual wind farm needs to be assessed from an aviation risk perspective to ensure that no special aspects are present, SGS HART Aviation is of the view that the cumulative effect of the presence of two wind farms within the shown 30km site boundary would have little, if any, effect on the overall risk profile to aviation operations in the area concerned.

It is an essential risk mitigation requirement that all wind farms be identified on all aeronautical maps.

3.4.11. Obstacle Lighting Needs

Before commenting on the need, or otherwise, for obstacle lighting on the proposed wind turbines within the Alberton Wind Farm, it is thought necessary to summarise the current regulatory position in this respect within Australia.

The Civil Aviation Safety Authority (CASA) powers in respect of the control of obstacles in and around aerodromes flow from the Civil Aviation Regulations 1988 (CAR), Part 9, Subpart 95, which provides for the marking or removal of hazardous objects within the obstacle limitation surfaces (OLS) of any aerodrome.

Civil Aviation Safety Regulation 1998 (CASR) Subpart 139.E covers the specific definitions of hazardous objects and the reporting requirements.


In summary CASR 139.E requires: -

1. Aerodrome operators to monitor the surrounding airspace for any object that might infringe the OLS and to notify CASA;
2. Any person who proposes to construct any structure which will be 110m or more AGL to inform CASA; and
3. CASA may determine whether the proposed structure(s) will be a hazardous object because of its location, height or lack of marking or lighting.

Detailed aerodrome design requirements are within the CASA Manual of Standards Part 139 – Aerodromes. Chapter 7 covers the detailed requirements for Obstacle Restriction and Limitation.

In support of the above regulations, CASA issued two Advisory Circulars; viz:

- AC 139-08(0) “Reporting of Tall Structures” April 2005
- AC 139-18(0) “Obstacle Marking and Lighting of Wind Farms” December 2005.
 - This was subsequently withdrawn.

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There is no doubt that CASA has the necessary regulatory powers to control the marking and removal of hazardous objects in and around aerodromes and for the reporting of tall structures. However, there is some question as to CASA's powers to insist on marking and / or lighting of obstacles outside the immediate area of an aerodrome. Further, the approach by CASA which was expressed within the AC 139-18(0) raised concerns amongst the wind farm industry. This was particularly raised in those cases where independent expert aviation advice recommended that marking and lighting was not needed because of low risks, yet CASA recommended to the contrary and noted that failure to follow the CASA advice would mean that the proponent of the wind farm would be "responsible for creating the hazard to aircraft safety and may be liable for their actions".

As a consequence, in September 2009, CASA withdrew Advisory Circular AC139-18(0) after CASR 139 (Aerodromes) was found not to be applicable to areas located away from aerodromes regulated under CASR 139. CASA then embarked on a review of the risk to aviation by wind farms located away from aerodromes. The Department of Infrastructure and Transport (now Department of Infrastructure and Regional Development) then chose to address the impact of wind farms on aviation through The National Airports Safeguarding Framework – specifically issuing Guideline D "Managing the Risk to Aviation Safety of Wind Turbine Installations (Wind Farms) / Wind Monitoring Towers" – a copy of which is at Appendix 6.9.

Further, CASA moved to amend the MOS 139 to include reference to wind farms, specifically within Section 9.4: Obstacle Lighting (copy at Appendix 6.7) with obstacle lighting requirements basically consistent with those within ICAO Annex 14 – copy of relevant part at Appendix 6.8.

In assessing the proposed Alberton Wind Farm, SGS HART Aviation reached the view that there will be no penetration of the Obstacle Limitation Surfaces (OLS) in respect of current operations from the Yarram Airport.


Further, even though Yarram Airport is equipped with Low Intensity Runway Lighting (LIRL), which is pilot activated (PAL) and, associated with that, has defined departure and approach procedures (see Section 3.4.1), aircraft operating in accordance with those procedures will be well clear of the proposed Alberton Wind Farm site area.

In addition, it is clear that there is a very low level of aircraft operations in the vicinity, evidenced by the lack of any active aerodromes / airstrips within 30km of the proposed site itself. Indeed, operations to and from the Yarram Airport would also seem to be quite small.

In all the circumstances, SGS HART Aviation has adjudged that the overall risk to aviation operations in the vicinity of the proposed Alberton Wind Farm site is sufficiently low such that obstacle lights on the wind turbines themselves are not warranted even though the proposed maximum height of the turbines could be up to 200m (i.e. ~656ft).

This latter view is based on the following: -

- Apart from Yarram Airport / Aerodrome (which is some 8.3km north east of the most eastern edge of the proposed wind farm site and outside of the OLS for that aerodrome) there are no certified or registered aerodromes within the wind farm area or in the near vicinity.
- There are no active unlicensed airfields / airstrips identified in available airfield and airstrip guides / directories existing within 30km of the proposed Alberton Wind Farm site.
- With the exception of approved low level operations (such as aerial agricultural spraying, search and rescue, fire fighting, etc.) aircraft are required to operate at minimum heights above the highest point of any of the wind turbines.

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- Any approved low level operations, by their very nature, are required to check for any obstacles which might impact on such operations, before undertaking any such operations. All such operations will be day VFR.
- The proposed Alberton Wind Farm turbines, even at the maximum height under consideration (200m), will not affect any sector altitude, or any enroute or grid lowest safe altitudes (LSALT). They will also not impact on Precision/Non-Precision Navigational Aids, HF/VHF Communications, Advanced Surface Movement Guidance and Control Systems, Radar or Satellite/Links.
- Existing Prohibited, Danger and Restricted (PRD) zones would not be affected by the presence of the proposed Alberton Wind Farm.

There are no known low level military flight routes within the vicinity.

It is, however, mandatory as a corollary that the wind farm (when established) be identified on the relevant civil (WACs) and RAAF produced aviation charts through the required advice to CASA, Airservices and the Department of Defence as previously advised within this report. This is considered essential risk mitigation. Airservices, if they were made aware of the wind farm, would normally do this via NOTAM action covering both the construction phase and prior to identification on maps.

Pending such identification on maps, it would be advisable to ensure that all aviation operators are also made aware of the existence of the wind farm at the appropriate time.

Note that, in circumstances where there is clear evidence of regular aircraft operations in the area of a wind farm, and it is proposed that the wind turbines to be used would be higher than 152.4m (i.e. 500ft), the installation of obstacle lights consistent with the requirements detailed in the CASA MOS 139 Section 9.4 (a copy of which is at Appendix 6.7) is usually proposed as the appropriate conservative and duty of care approach to be taken. However, such is not considered to be the case for the proposed Alberton Wind Farm because of the adjudged low level of aircraft operations in the region and the clear separation of such aircraft operations which would occur from Yarram Airport.

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4. SUMMARY COMMENTS AND RECOMMENDATIONS

SGS HART Aviation is of the view that the overall risk to aviation operations in the vicinity of the proposed Alberton Wind Farm is sufficiently low such that the installation of obstacle lights is not necessary, even if the maximum height of the wind turbines were 200m (~656ft).

At the appropriate time, CASA needs to be advised of the proposed wind farm development in accordance with CASR 139.365. Note that it is considered likely that CASA would make its own “determination” in accordance with CASR 139.370. Whilst SGS HART Aviation considers that obstacle lights are not necessary in this particular case, CASA may very well take a different view. One can not anticipate that or any other matter which might be determined by CASA.

Airservices also needs to be advised of the proposed wind farm development as it is also likely to wish to assess the matter.


Whilst the risk is considered to be low now for the proposed Alberton Wind Farm plan, the overall risk to aviation operations would be further reduced if, in the fullness of time, the wind turbines were identified on the relevant aeronautical charts, i.e., both the civil WACs and the RAAF produced chart series. This is considered essential risk mitigation.

Pending such identification on maps, at the appropriate time it would be advisable to ensure that all aviation operators are made aware of the proposed existence of the wind farm.

Airservices, if they were made aware of the wind farm, would normally do this via NOTAM action covering both the construction phase and prior to identification on maps. It is, therefore, essential that the wind farm developer advises both Airservices and the RAAF AIS.

It is considered that advice to CASA, Airservices and the Department of Defence should also include details of the Met Masts – both existing and any proposed. It was noted that, following consultation with and advice being received from CASA and Airservices, Synergy Wind Pty Ltd has already reported the presence of the existing Met Mast to the RAAF.

Further, the Aerial Agriculture Association of Australia (AAAA) should also be advised of the Met Masts.

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5. ABBREVIATIONS USED IN THIS REPORT

AAAA	Aerial Agricultural Association of Australia	LPPF	Local Planning Policy Framework
AC	Advisory Circular	LPSI	Land Planning & Spatial Information
AGL	Above Ground Level	LSALT	Lowest Safe Altitude
AIS	Aeronautical Information Services	m	Metre
ALA	Authorised Landing Area	MOS	Manual of Standards
AMSL	Above Mean Sea Level	NASAG	NATIONAL AIRPORTS SAFEGUARDING FRAMEWORK – GUIDELINE
AOPA	Aircraft Owners and Pilots Association of Australia	NDB	Non Directional Radio Beacon
CAR	Civil Aviation Regulation	NOTAM	Notice to Airmen
CASA	Civil Aviation Safety Authority (Australia)	OLS	Obstacle Limitation Surfaces
CASR	Civil Aviation Safety Regulation	PAL	Pilot Activated Lights / Lighting
DPCD	Department of Planning and Community Development	PRD	Prohibited, Restricted, Danger areas
ERC	En Route Chart	PSR	Primary Surveillance Radar
ERSA	En Route Supplement Australia	RAAF	Royal Australian Air Force
FAA	Federal Aviation Administration	RNAV	Area Navigation
ft	Feet	SPPF	Victorian State Planning Policy Framework
GNSS	Global Navigation Satellite System	SSR	Secondary Surveillance Radar
GPS	Global Positioning System	TAC	Terminal Area Chart
ICAO	International Civil Aviation Organisation	VFR	Visual Flight Rules
IFR	Instrument Flight Rules	VHF	Very High Frequency
HF	High Frequency	VNC	Visual Navigation Chart
km	Kilometre	VTC	Visual Terminal Chart
LIRL	Low Intensity Runway Lighting / Lights	WAC	World Aeronautical Chart

6. APPENDICES

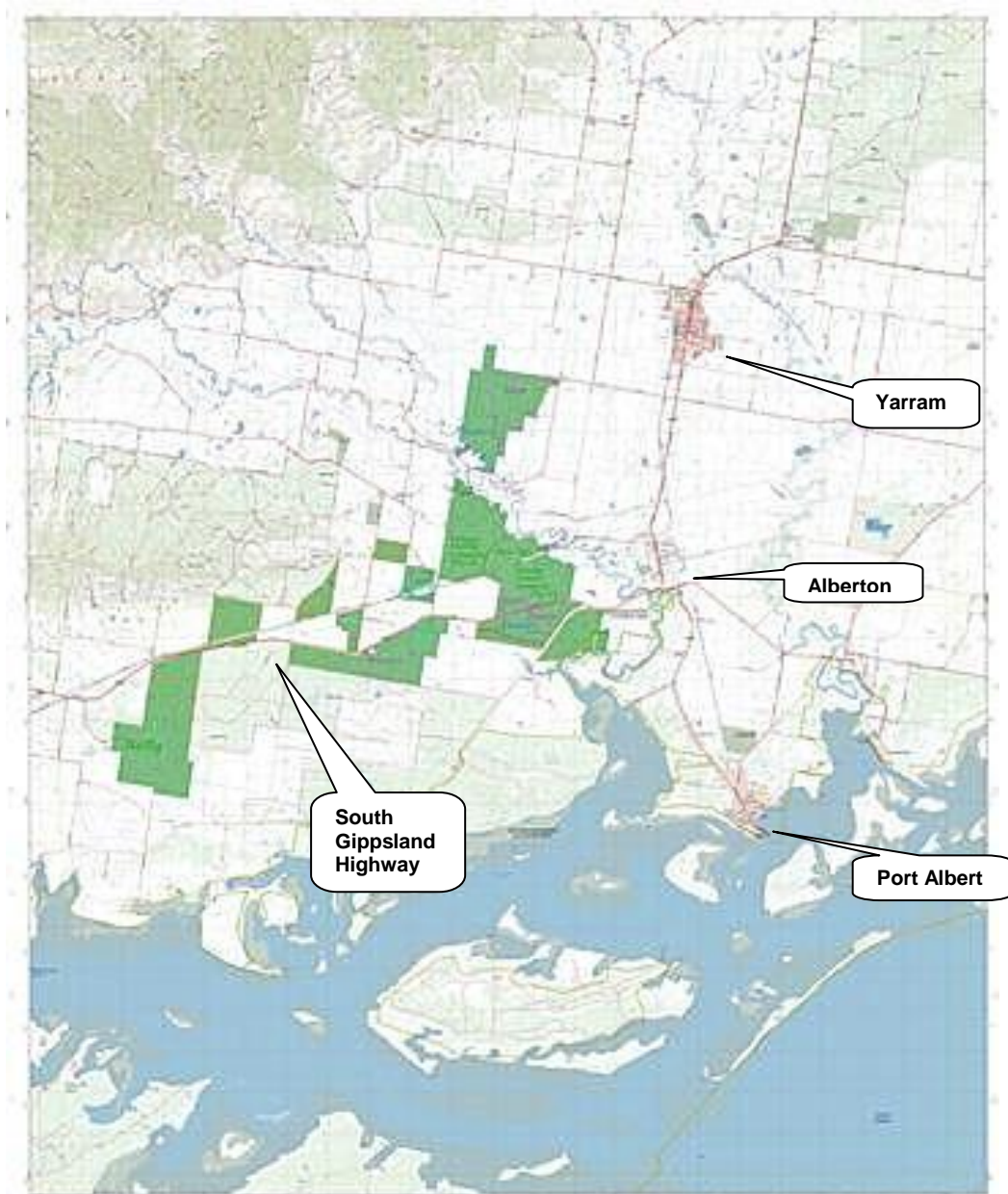
6.1. Excerpt from WAC 3470 – Melbourne

(Also showing approximate positions of airfields / aerodromes identified within ~30km+ of proposed Alberton Wind Farm site.)

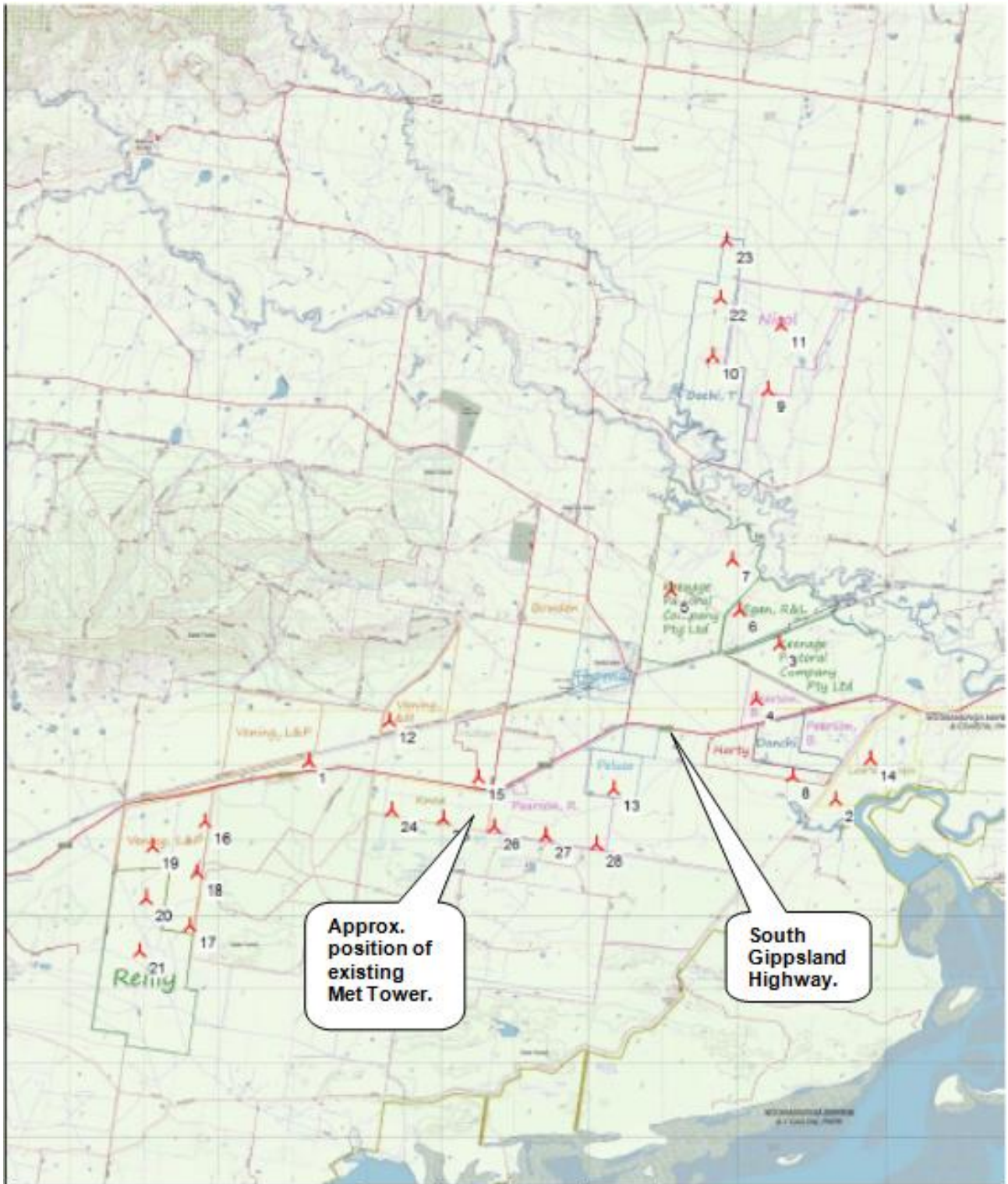


6.2. Project Area Map Showing Outline of Proposed Alberton Wind Farm Area

(Wind farm area shown in green.)



6.3. Alberton Wind Farm Proposed 28 Turbine Layout.

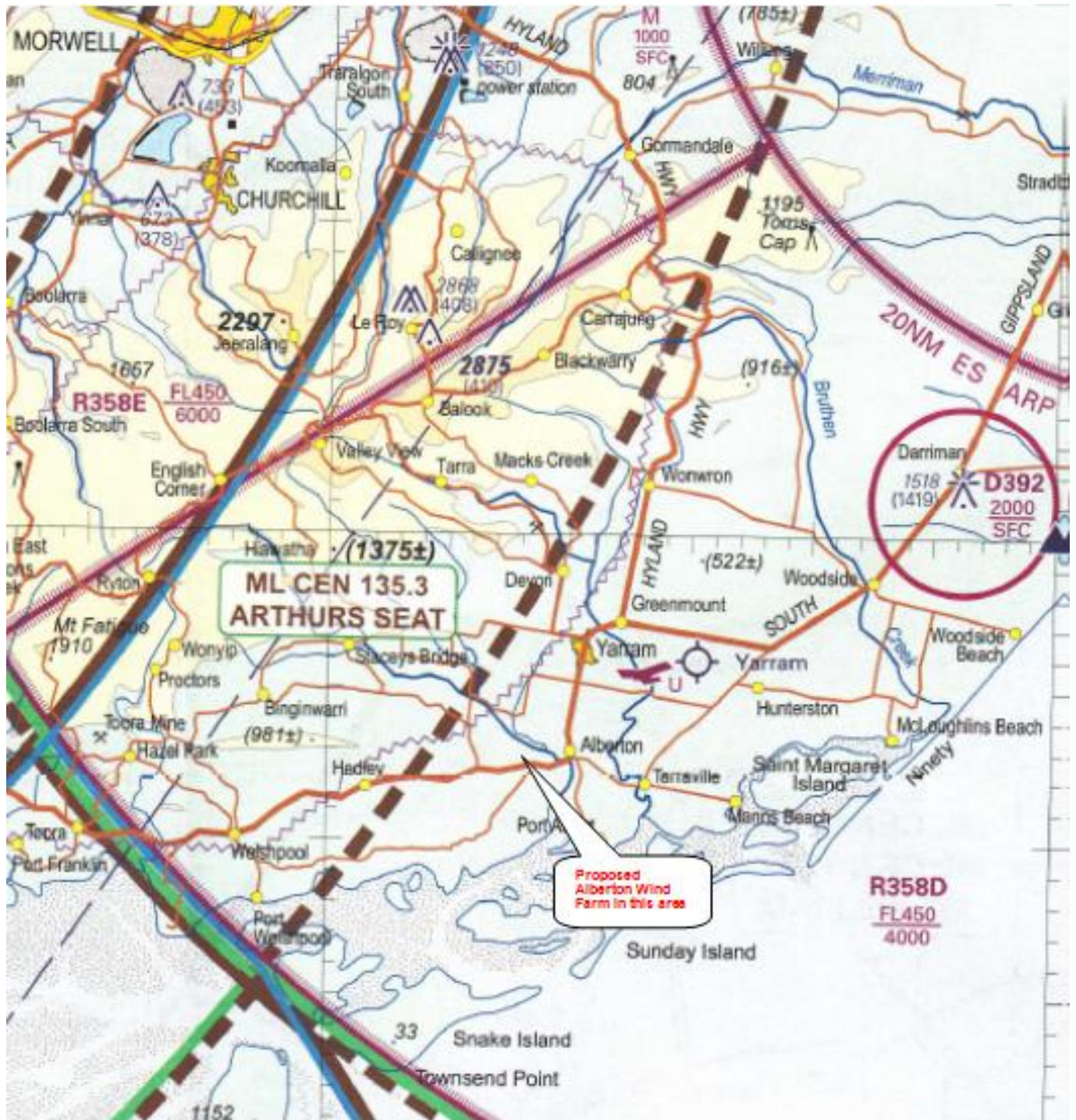


0 1 2 3 4 km

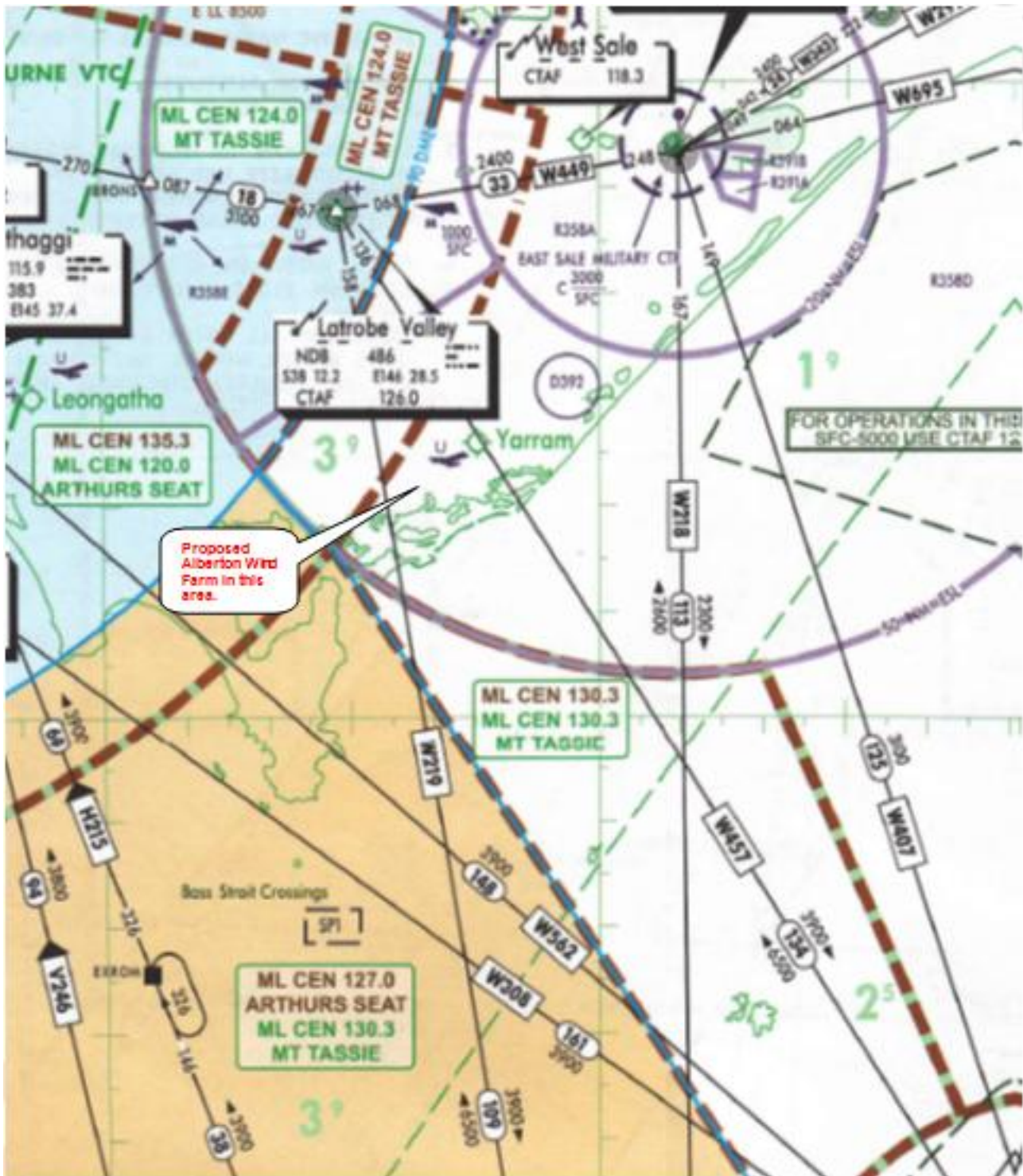
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▲ New WTG

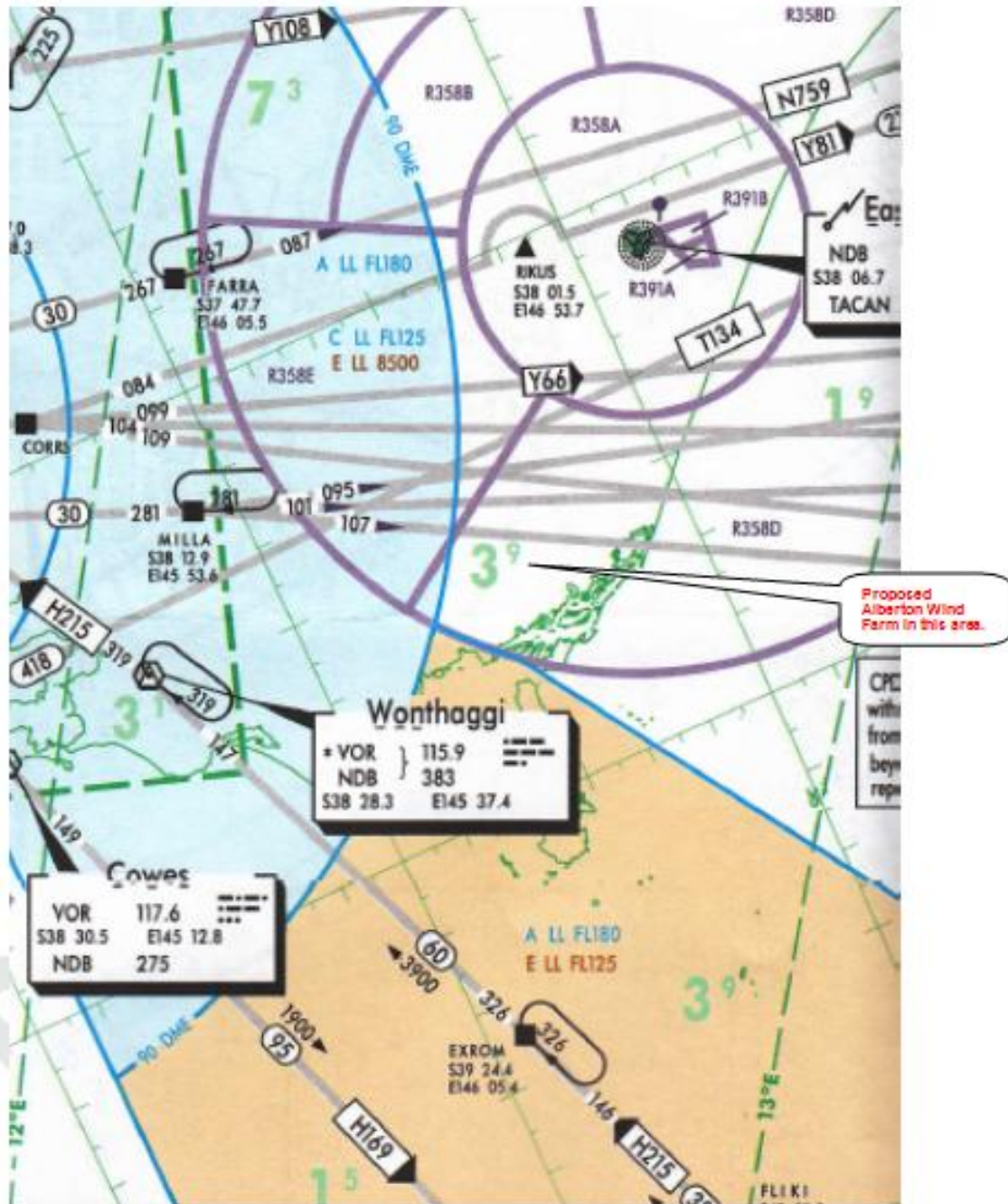
6.4. Excerpt from Visual Navigation Chart Melbourne




6.5. Excerpt from En Route Chart (ERC) Low L1



6.6. Excerpt from En Route Chart (ERC) High H1



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6.7. Excerpts from Casa Manual of Standards (MOS) 139

Section 9.4: Obstacle Lighting

9.4.1 General

9.4.1.1 Under the Civil Aviation Regulations, CASA may determine that an object or a proposed object which intrudes into navigable airspace requires, or will be required to be provided with, obstacle lighting. Responsibility for the provision and maintenance of obstacle lighting on a building or structure rests with the owner of the building or structure. Within the limits of the obstacle limitation surfaces of an aerodrome, responsibility for the provision and maintenance of obstacle lighting on natural terrain or vegetation, where determined necessary for aircraft operations at the aerodrome, rests with the aerodrome operator.

9.4.1.2 In general, an object in the following situations would require to be provided with obstacle lighting unless CASA, in an aeronautical study, assesses it as being shielded by another lit object or that it is of no operational significance:

(b) outside the obstacle limitation surfaces of an aerodrome, if the object is or will be more than 110m above ground level.

9.4.3.4A In the case of a wind farm whose wind turbines must have obstacle lighting, medium intensity lights are to be installed as follows:

(a) if any part of the wind turbine, including the rotating blades, penetrates the obstacle limitation surface (OLS) of an aerodrome, top lights must mark the highest point reached by the rotating blades;

Note: Because it is not practicable to install obstacle lights at the tip of the blades, these lights may be located on a separate structure, adjacent to the wind turbine, at a height that corresponds to the highest point of the rotating blade of the turbine.

(b) if the rotating blades do not penetrate the OLS, the top lights must be placed on top of the generator housing;

(c) obstacle lights must be provided on a sufficient number of individual wind turbines to indicate the general definition and extent of the wind farm, with intervals between lit turbines not exceeding 900m;


(d) all of the obstacle lights on a wind farm must be synchronised to flash simultaneously;

(e) the downward component of obstacle lighting may be shielded to the extent mentioned in either or both of the following sub-subparagraphs:

(i) so that no more than 5% of the nominal light intensity is emitted at or below 5° below horizontal;

(ii) so that no light is emitted at or below 10° below horizontal;

(f) to prevent obstacle light shielding by the rotating blades, 2 lights must be provided on top of the generator housing in a way that allows at least 1 of the lights to be seen from every angle in azimuth.

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6.8. Excerpt from ICAO Annex 14 Re Wind Farm Lighting

4.3 Objects outside the obstacle limitation surfaces

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

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

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

6.4 Wind turbines

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

Note.— *See 4.3.1 and 4.3.2.*

Markings


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

Lighting

6.4.3 Recommendation.— *When lighting is deemed necessary, medium-intensity obstacle lights should be used. In the case of a wind farm, i.e. a group of two or more wind turbines, it should be regarded as an extensive object and the lights should be installed:*

- a) to identify the perimeter of the wind farm;*
- b) respecting the maximum spacing, in accordance with 6.3.14, between the lights along the perimeter, unless a dedicated assessment shows that a greater spacing can be used;*
- c) so that, where flashing lights are used, they flash simultaneously; and*
- d) so that, within a wind farm, any wind turbines of significantly higher elevation are also identified wherever they are located.*

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

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6.9. NASAG – National Airports Safeguarding Framework – Guideline D “Managing the Risk to Aviation Safety of Wind Turbine Installations (wind farms) / wind Monitoring Towers”

REVISION DATE	VERSION NUMBER	CHANGES MADE	APPROVED BY
Feb 2012	4.1.1	Document Creation	NASAG
Apr 2012	4.1.2	Drafting changes post consultation process	SCOTT
15/7/12	4.1.3	Version control table added. Page numbers added.	S. Stone, GM Aviation Environment, DOIT.

Purpose of Guideline

1. This document provides guidance to State/Territory and local government decision makers, airport operators and developers of wind farms to jointly address the risk to civil aviation arising from the development, presence and use of wind farms and wind monitoring towers.

Why it is important

2. The *Principles for a National Airports Safeguarding Framework* acknowledge the importance of airports to national, state/territory and local economics, transport networks and social capital.
3. Wind farms can be hazardous to aviation as they are tall structures with the potential to come into conflict with low flying aircraft. Temporary and permanent wind monitoring towers can be erected in anticipation of, or in association with, wind farms and can also be hazardous to aviation, particularly given their low visibility. These structures can also affect the performance of Communications, Navigation and Surveillance equipment operated by Airservices Australia (Airservices) and the Department of Defence (Defence).

How it should be used

4. Some States/Territories already have planning guidelines or policies in place and this document provides guidance for review. For those without policies in place, these Guidelines (in addition to the associated Safeguarding Framework) will provide input to new policies.
5. These guidelines provide general information and advice to:
 - a) proponents of wind farms (including single wind turbines); and
 - b) planning authorities with jurisdiction over the approval of such structures.
6. These guidelines also provide specific advice on measures to reduce hazards to aviation, and how to implement them.

7. The guidelines are intended to provide information to proponents of wind farms and planning authorities to help identify any potential safety risks posed by wind turbine and wind monitoring installations from an aviation perspective.
8. The guidelines rely on an approach of risk identification and management to ensure risks to aviation are minimised in the most effective and efficient manner possible. It is not the intention to adopt an overly restrictive approach to wind farm development, rather to ensure risks are identified early and mitigation measures are able to be planned and implemented at an early stage.

Roles and Responsibilities

9. State/Territory and local governments are primarily responsible for land use planning in the vicinity of all airports.
10. Australia's 19 major airports are under Australian Government planning control and are administered under the Airports Act 1996 (the Airports Act). Planning on other airports is undertaken by State, Territory Governments and Local Governments or private operators.
11. Commonwealth airports are protected from tall structures in the vicinity of airports based on standards established by the International Civil Aviation Organization (ICAO). These standards have been implemented in Australia by the Airports Act 1996 and the Airports (Protection of Airspace) Regulations 1996 which apply at leased Commonwealth airports, and by the Defence (Areas Control) Regulations 1989 which apply at Defence airports.
12. This legislation can be used to ensure wind farms hazardous to aviation are not erected in the vicinity of Commonwealth airports. The implementation of these guidelines will have the outcome of conferring a similar level of protection to non-Commonwealth airports.
13. Australia is a signatory to the Convention on International Civil Aviation. Signatories are obliged to implement ICAO Standards unless they lodge a formal difference. ICAO Annex 14 specifically addresses the issue of wind turbines. In summary, ICAO has recommended the need for lighting of wind turbines if determined to be an obstacle.
14. Annex 14 includes a provision for an aeronautical study as to the need, or otherwise, for marking and/or lighting. This is consistent with provisions in Australia for risk-based assessments of potential hazards to aviation safety. These guidelines are consistent with ICAO Annex 14.

Key considerations for managing risks to aviation safety of wind turbine installations (wind farms)/wind monitoring towers

15. The guidelines apply to:
 - (a) a single wind turbine;
 - (b) a group of wind turbines, referred to as a wind farm, which may be spread over a relatively large area; and
 - (c) wind monitoring towers.
16. The height of a wind turbine is defined as the maximum height reached by the tip of the turbine blades at their highest point above ground level. The marking and lighting described in this document addresses aviation requirements only. For offshore wind farms, in addition

to these requirements, separate lighting and marking may be required for the safety of marine navigation.

17. Implementation of the guidelines will have the additional benefit of being applicable in areas away from airports to address the risk posed by wind farms to air navigation in those areas.
18. Adoption of the guidelines will ensure that aviation safety agencies can examine and address the risk to aviation safety from proposed wind turbine farms at the planning stage. This will enable the use of wind energy to continue to grow, while protecting aviation safety.
19. Wind farm operators should check if proposed wind turbines and wind monitoring towers will be located near areas where low flying operations are likely to be conducted, and if so, consider their duty of care to such activities.

GUIDELINES FOR LAND USE PLANNERS AND DEVELOPERS TO MANAGE THE RISK TO AVIATION SAFETY OF WIND TURBINE INSTALLATIONS (WIND FARMS) /WIND MONITORING TOWERS

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

CASA should be notified through the nearest CASA Regional or Field Office. Location and contact details of CASA Aerodrome Inspectors may be obtained by calling CASA on 131 757. Airservices should be notified through the Airports Relations Team on 02-6268-4111. Defence should be notified through the Defence Support Group on 02-6266-8191.

21. The Aeronautical Information Service of the Royal Australian Air Force (RAAF AIS) maintains a database of tall structures in the country. The RAAF AIS should be notified of all tall structures meeting the following criteria:
 - 30 metres or more above ground level for structures within 30km of an aerodrome; or
 - 45 metres or more above ground level for structures located elsewhere.
22. The contact details for the RAAF AIS are: Tel- 03-9282-5750; ais.charting@defence.gov.au.
23. Operators of certified aerodromes are required to notify CASA if they become aware of any development or proposed construction near the aerodrome that is likely to create an obstacle to aviation, or if an object will infringe the Obstacle Limitation Surfaces (OLS) or Procedures for Air Navigation Services –Operations (PANS-OPS) surfaces of an aerodrome. Operators of registered aerodromes should advise CASA if the proposal will infringe the OLS; CASA will ask Airservices to determine if there is an impact on published flight procedures for the aerodrome.
24. *Note: Obstacle Limitation Surfaces are a complex of virtual surfaces associated with an aerodrome. They are designed to protect aircraft flying in good weather conditions from colliding with tall structures. PANS-OPS surfaces are designed to protect aircraft flying in poor weather conditions from colliding with tall structures. Aerodrome operators can provide details for their particular aerodrome.*

Consultation

25. Consultation with aviation stakeholders is strongly encouraged in the early stages of planning for wind turbine developments. This should include:

- a) early identification of any nearby certified or registered aerodromes;
- b) immediate consultation with any nearby aerodrome owners;
- c) preliminary assessment by an aviation consultant of potential issues;
- d) confirmation of the extent of the OLS for any nearby aerodromes;
- e) registration of all wind monitoring towers on the RAAF AIS database;
- f) consultation with local agricultural pilots and nearby unlicensed airstrip owners; and
- g) consultation with CASA and Airservices.

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.

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 structure(s) 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.

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.

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 military aerodromes, Defence, may object to a proposal if it will adversely impact Communications, Navigations 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.

Marking of wind turbines in the vicinity of an aerodrome

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.

Lighting of wind turbines in the vicinity of an aerodrome

31. Siting of wind turbines in the vicinity of an aerodrome is strongly discouraged, as these tall structures can pose serious hazards to aircraft taking-off and landing. Where a wind turbine is proposed that will penetrate the OLS of an aerodrome, the proponent should conduct an aeronautical risk assessment. 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 should be made available to CASA to assist assessment of any potential risk to aviation safety.
32. CASA may determine that the proposal is:
 - (a) 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
 - (b) hazardous, but that the risks to aircraft safety would be reduced by the provision of approved lighting and/or marking.

Lighting of wind turbines not in the vicinity of an aerodrome, with a height of 150m or more

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.

Obstacle lighting standards for wind turbines

35. When lighting has been recommended by CASA to reduce risk to aviation safety, medium-intensity obstacle lights should be used. Where used, lighting on wind farms should be installed:
 - (a) to identify the perimeter of the wind farm;
 - (b) respecting a maximum spacing of 900m between lights along the perimeter, unless an aeronautical study shows that a greater spacing can be used;
 - (c) where flashing lights are used, they flash simultaneously; and
 - (d) within a wind farm, any wind turbines of significantly higher elevation are identified wherever located.
36. To minimise the visual impact on the environment, obstacle lights may be partially shielded, provided it does not compromise their operational effectiveness. Where obstacle lighting is

provided, lights should operate at night, and at times of reduced visibility. All obstacle lights on a wind farm should be turned on simultaneously and off simultaneously.

37. Where obstacle lighting is provided, proponents should establish a monitoring, reporting and maintenance procedure to ensure outages, including loss of synchronisation, are detected, reported and rectified. This would include making an arrangement for a recognised responsible person from the wind farm to notify the relevant CASA office, so that CASA can advise pilots of light outages.

Alternatives to fixed obstacle lighting


38. In some circumstances, it may be feasible to install obstacle lights that are activated by aircraft in the vicinity. This involves the use of radar to detect aircraft within a defined distance that may be at risk of colliding with the wind farm. When such an aircraft is detected, the wind farm lighting is activated. This option may allow aviation safety risks to be mitigated where obstacle lighting is recommended while minimising the visual impact of the wind farm at night.

Marking and lighting of wind monitoring towers

39. Before developing a wind farm, it is common for wind monitoring towers to be erected for anemometers and other meteorological sensing instruments to evaluate the suitability or otherwise of a site. These towers are often retained after the wind farm commences operations to provide the relevant meteorological readings. These structures 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 including aerial agricultural operations. Wind farm proponents should take appropriate steps to minimise such hazards, particularly in areas where aerial agricultural operations occur. Measures to be considered should include:
 - a) the top 1/3 of wind monitoring towers to painted in alternating contrasting bands of colour. Examples of effective measures can be found in the Manual of Standards for Part 139 of the Civil Aviation Safety Regulations 1998. In areas where aerial agriculture operations take place, marker balls or high visibility flags can be used to increase the visibility of the towers;
 - b) marker balls or high visibility flags or high visibility sleeves placed on the outside guy wires;
 - c) ensuring the guy wire ground attachment points have contrasting colours to the surrounding ground/vegetation; or
 - d) a flashing strobe light during daylight hours.

Reporting of structures less than 150m in height

40. There is no requirement for CASA to be notified if a proposed wind turbine or wind monitoring tower is less than 150m in height and does not infringe the OLS of an aerodrome. However, they should still be reported for inclusion in the national database of tall structures maintained by the Royal Australian Air Force (RAAF). Information on reporting of tall structures may be found in an advisory circular issued by CASA 'AC 139-08(0) Reporting of Tall Structures'.


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Voluntary provision of obstacle lights

41. CASA's regulatory regime for obstacle lighting provides an appropriate level of safety for normal aircraft operations. Certain flying operations, by their nature, involve lower than normal flying, for example aerial agricultural spraying, aerial mustering, power line inspection, helicopter operations including search and rescue, some sports aviation, and some military training. Pilots conducting such operations require special training and are required to take obstacles into account when planning and conducting low flying operations.
42. In making decisions regarding the marking and lighting of wind farms and wind monitoring towers, wind farm operators should take into account their duty of care to pilots and owners of low flying aircraft.

Turbulence

43. Wind farm operators should be aware that wind turbines may create turbulence which noticeable up to 16 rotor diameters from the turbine. In the case of one of the larger wind turbines with a diameter of 125 metres, turbulence may be present two kilometres downstream. At this time, the effect of this level of turbulence on aircraft in the vicinity is not known with certainty. However, wind farm operators should be conscious of their duty of care to communicate this risk to aviation operators in the vicinity of the wind farm. CASA will also raise awareness of this risk with representatives of aerial agriculture, sport aviation and general aviation.

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6.10. References

1. Airspace Act 2007.
2. Airspace Regulations 2007 (updated 9 August 2013).
3. Clean Energy Council Best Practice Guidelines for Implementation of Wind Energy Projects in Australia, 2013.
4. CASA Manual of Standards (MOS) 139 Version 1.12: November 2014.
 - a. In particular Section 9.4: Obstacle Lighting
5. Civil Aviation Safety Regulations (CASR),
 - a. In particular CASR Subpart 139.E – Obstacles and hazards.
6. CASA Advisory Circular AC 139-08(0) dealing with the Reporting of Tall Structures.
7. Department of Planning and Community Development (DPCD) “Policy and planning guidelines for development of wind energy facilities in Victoria”, July 2012.
8. NASAG - National Airports Safeguarding Framework – Guideline D – “Managing the Risk to Aviation Safety of Wind Turbine Installations (Wind Farms) / Wind Monitoring Towers” July 2012
9. Relevant provisions of the Victorian State Planning Policy Framework (SPPF) October 2015 and the Local Planning Policy Framework (LPPF).

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WHEN YOU NEED TO BE SURE

