


# SGS HART AVIATION

## REPORT ON AVIATION RELATED ISSUES

SITE:	SILVERTON WIND FARM
ON BEHALF OF:	AGL
PROJECT NUMBER:	16-0264-01
ASSESSMENT DATE:	9 July 2016
ADVISOR:	Mel Dunn


CONFIDENTIAL



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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 Silverton Wind Farm and the need or otherwise for obstacle lighting.

As a result of this aviation assessment, SGS HART Aviation reached the considered view that the risk to civil aviation operations in the vicinity of the proposed Silverton Wind Farm is very low.

The proposed maximum height of the wind turbines (180m) being above 500 ft (~152.4m) is such that the tips of the blades will penetrate navigable airspace and, whilst this is a cause for concern, the overall risk is such that SGS HART Aviation considers that the installation of obstacle lights is not required in accordance with CASA MOS 139.

Even though the overall risks to aviation operations is considered very low in the vicinity of the proposed Silverton Wind Farm, SGS HART Aviation recommends that, if it has not already been done, the top 1/3rd of the existing and any proposed Meteorological (met) masts / wind monitoring towers be painted in alternating contrasting bands of colour and marker balls or high visibility flags or sleeves be placed on the outside guy wires consistent with the recommendations of the National Airports Safeguarding Advisory Group (NASAG) Guideline D.

Even though there is no evidence of any aerial agricultural operations occurring in the region, SGS HART Aviation is of the view that AGL should notify, at least as a matter of courtesy, the Aerial Application Association of Australia (AAAA) of any met masts / wind monitoring masts at the proposed Silverton Wind Farm site.


CASA should also be advised of the proposed Silverton Wind Farm so it has the opportunity to comment as to whether there are any potential problems in respect of air routes over the site or any Prohibited, Restricted and Danger (PRD) areas which might be in the vicinity. Whilst no such areas of concern have been identified by SGS HART Aviation, CASA's comments in these matters should not be overlooked.

It has been assessed that there may be an effect on two high level en route LSALTs as a result of the establishment of the Silverton Wind Farm as proposed and Airservices should be advised of that. Whilst this is not considered of concern in respect of the establishment of the wind farm in the sense that it will not inhibit the establishment, Airservices will likely undertake its own assessment in respect of LSALTs which could lead to a variation in the published LSALTs. There may very well be a charge for this Airservices' assessment and amendment to the associated maps.

An essential risk mitigation feature is for the wind turbines to be identified on the relevant aeronautical charts i.e. both the civil WACs and the RAAF produced chart series.

Pending such identification on maps, it is advisable to ensure that all potentially affected aviation operators are made aware of the planned 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. Such NOTAMs could include advice as to the presence of met masts / wind monitoring towers as well. It is, therefore, essential that the wind farm developer advise both Airservices and the RAAF AIS.

A copy of this report was passed to CASA, Airservices, the Department of Defence, the AAAA and the Broken Hill City Council for information on 20 June 2016. Acknowledgments have since been received from CASA, Airservices and the Department of Defence. The Department of Defence has also responded in detail expressing no concerns subject to an assessment by CASA as to the need or otherwise for obstacle lighting. No other comments have yet been forthcoming.

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## 1. TERMS OF REFERENCE

AGL commissioned SGS HART Aviation to undertake a review of aviation-related issues potentially associated with the proposed Silverton Wind Farm, situated northwest of Broken Hill.

As part of this review, SGS HART Aviation was particularly requested to provide specialist advice in relation to any lighting requirements for the project.

## 2. SCOPE OF CONSIDERATION

SGS HART Aviation was required to address the following scope of works: -


- Assessment of all the aviation-related issues relevant to the Silverton Wind Farm area:
  - i. Including risk assessment issues; and
  - ii. Liaison with AGL as necessary.
- Review the need, or otherwise, for obstacle lighting:
  - iii. Assessment of risks associated with aviation operations and the need or otherwise for obstacle lighting:
    - a. Using AS/NZ 4360 risk assessment methodology as necessary.
  - iv. Liaison with CASA and Airservices regarding requirements, if necessary.

## 3. REVIEW OF SILVERTON WIND FARM

### 3.1. Methodology

In SGS HART Aviation's considerations of the issues, the following approach was taken: -

- Assessment and review of all aviation related elements associated with the site including:
  - Charts, maps, airspace (including Prohibited, Restricted and Danger areas [PRDs]), airfield and airstrip guides / directories, en route and visual terminal charts, Notices to Airmen (NOTAMs), etc.
- Review all aviation activities and potential aviation activities occurring or likely to occur within the boundaries of the proposed wind farm or potentially affected by the presence of the wind farm, including both civil and military operations.
- Consideration of the relevance of any Australian regulatory authority requirements and international standards, recommendations and guidelines.
- On the basis of the above assessments, assessment of risks associated with aviation operations and the need or otherwise for obstacle lighting.

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### 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 AGL and independent research of the Silverton Wind Farm and its surrounds.

### 3.3. Overview of Proposed Wind Farm

Project Approval for the Silverton Wind Farm was granted to Silverton Wind Farm Developments Proprietary Limited (SWDPL) on 24 May 2009. The approved project included the construction and operation of 282 wind turbines, and associated infrastructure including a 24km transmission line from the site to Broken Hill (NSW Government Department of Planning 2009).

A Modification Report (the third for this project) is being prepared to consider changes to the approved project including:

- Changed capacity, height and number of turbines; increasing the capacity and height while decreasing the overall turbine number.

The turbines now being considered are larger than those described for the approved project.

In summary, the turbines would be modified as follows:

- Increase capacity of turbines utilised to 5 MW.
- Increase rotor diameter to approximately 140m.
- Increase the maximum turbine tip height to 180m.
- Decrease number of Stage 1 turbines.
- Removal of Stage 2 turbines and associated infrastructure.

The changes have been identified as having potential for increased aviation impacts. This assessment considers these impacts for the new layout.

An inspection of the site indicated that it is largely in an undeveloped area to the east of the Mundi Mundi Plain northwest of Broken Hill where there is little evidence of any development at all, nor any aviation-related activity.



**Typical landscape where Silverton Wind Farm is proposed to be established**

### 3.4. Specific Issues and Associated Risk Assessment

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

In assessing the impact on aviation operations it was necessary to identify what aviation operations exist within, or in the vicinity of, the nominated area.

As a matter of principle, an area of 30km from any proposed wind farm site is normally investigated for any aviation-related activities even though Obstacle Limitation Surfaces (OLS) do not extend beyond 15km from even the largest aerodromes. Whilst this is recognised as a conservative approach, to meet Airservices' needs consistent with the policy as stated in Appendix 7.8, the area investigated was extended to 30nm (55.56km).

As will be seen from later comments, no airfields or aerodromes were identified in the vicinity of the proposed wind farm site which would be impacted, nor would any associated obstacle limitation surfaces be affected.

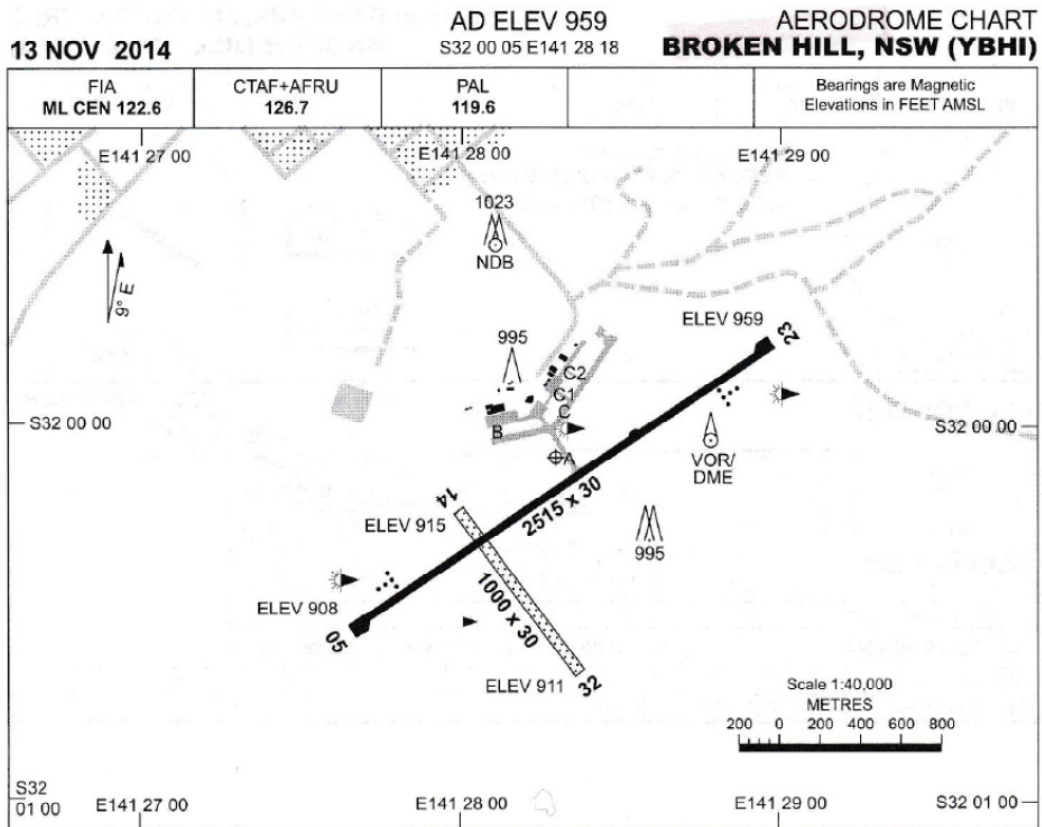
Aerodromes or airfields outside a radius of approximately 30km from a wind farm site are not generally specifically considered of concern. Operations from aerodromes beyond 30km are covered under general comments later under Aviation Operations – General.

#### Licensed aerodromes:


It was determined that there is only one licensed aerodrome anywhere near the proposed wind farm site.

That aerodrome is Broken Hill, a Certified Aerodrome approximately 26km south east of the nearest point of proposed wind farm site on a direct line from the aerodrome to the wind farm site itself.

A copy of the aerodrome chart for Broken Hill is shown below.





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The aerodrome is south of the city of Broken Hill and its main runway is the sealed 05 – 23 runway (basically southeast – northwest).

Departure and approach procedures are in place for the main runway and all such operations remain, in principle, south of the city and will not be affected at all by the presence of the proposed wind farm site.

No such operational procedures are in effect for the secondary, unsealed runway.

Any obstacle limitation surfaces which may exist for either the main runway of the secondary runway will not be affected at all by the presence of the wind farm. Those that may exist for the main runway will be well clear and south of the wind farm site. If any exist for the secondary runway, they would fall well short of being influenced at all by the presence of the wind farm.

**Unlicensed aerodromes:**

The following unlicensed aerodromes were identified within approximately 30nm (~55km) from the wind farm site. These are shown on the WAC (3355) map at Appendix 7.4.

Whilst the quoted distances from the wind farm are approximate, they are of the correct order and, regardless, do indicate that the overall impact on any aviation operations likely to be in the area is largely negligible.

**Corona Station**

This is a private station strip approximately 42km north of the northern edge of the proposed wind farm site.

The airstrip consists of a single unsealed red quartz stone strip, 700m long in the direction 16 – 34 (i.e. ~north – south).

Permission is required prior to use.

This airstrip is suitable for private small light aircraft VFR operations only and the presence of the Silverton Wind Farm would have no impact on any such operations. See also later comments re VFR operations.

**Mount Woowoolahra Station.**


This is a private station strip approximately 45km northwest of the northern edge of the proposed wind farm site.

The airstrip consists of two unsealed clay and gravel strips, one 450m in the direction of 01 – 19 (i.e. ~ north – south) and the other 1,150m long in the direction 10 – 28 (i.e. ~ east - west).

Permission is required prior to use.

This airstrip is suitable for private small light aircraft VFR operations only and the presence of the Silverton Wind Farm would have no impact on any such operations. See also later comments re VFR operations.



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### Yalcowinna Station

Little detail is available on this strip which is some 38km due east of the proposed wind farm site.

However, it is expected to be a private station airstrip suitable for VFR operations only and its distance from the proposed wind farm site is such that any operations would not be affected by the presence of the proposed wind farm.

### Mawarra Station

Like Yalcowinna Station, little detail is available on this strip which is some 50km due east of the proposed wind farm site.

However, it is expected to be a private station airstrip suitable for VFR operations only and its distance from the proposed wind farm site is such that any operations would not be affected by the presence of the proposed wind farm.

### Acacia Downs Station

This airstrip is approximately 46km northeast of the proposed wind farm site.

It is reported to be closed.

### Mulyungarie Station

This airstrip is approximately 45km west of the proposed wind farm site.

The station is equipped with two airstrips: 07 – 25 (i.e. ~ east – west) 700m unsealed brown loam and 18 – 36 (i.e. ~ north – south) 1,100m unsealed brown loam.

Permission is required prior to use.

This airstrip is suitable for private small light aircraft VFR operations only and the presence of the Silverton Wind Farm would have no impact on any such operations. See also later comments re VFR operations.

### Honeymoon Station


This airstrip is approximately 50km due west of the proposed wind farm site.

The station is equipped with one strip 1,300m unsealed gravel 01 – 19 (i.e. ~ north – south).

This is a Uranium Mine strip only available for mining operations.

Permission is required prior to use.

This airstrip is suitable for private small light aircraft VFR operations only and the presence of the Silverton Wind Farm would have no impact on any such operations. See also later comments re VFR operations.

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### Fowlers Gap Station

This airstrip is approximately 75km to the north of the proposed wind farm site.

The station is equipped with two airstrips: 07 – 25 (i.e. ~ northeast – southwest) 1,095m unsealed limestone and 15 – 33 (i.e. ~ southeast – northwest) unsealed limestone.

Permission is required prior to use.

This airstrip is suitable for private small light aircraft VFR operations only and the presence of the Silverton Wind Farm would have no impact on any such operations. See also later comments re VFR operations.

### Yarramba Station

This airstrip is approximately 57km due west of the proposed wind farm site.

The station is equipped with two strips 06 – 24 (i.e. ~ northeast – southwest) 1,100m unsealed dirt and clay and 13 - 31 (i.e. ~ southeast – northwest) 900m unsealed dirt and clay. Limited lighting in the form of kerosene flares is available.

Permission is required prior to use.

This airstrip is suitable for private small light aircraft VFR operations only (except in an emergency with the kerosene flares) and the presence of the Silverton Wind Farm would have no impact on any such operations. See also later comments re VFR operations.

### Other aerodromes

Whilst there are other station airstrips within the vicinity of the proposed wind farm site, none were considered close enough to warrant attention and none would be impacted by the presence of the wind farm itself.

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 FightAce® Country Airstrip Guide, failed to identify any other airstrips within the immediate vicinity of the proposed Silverton Wind Farm site which would be in any way affected by the presence of the proposed wind farm.


## 3.4.2. Aviation Operations - General

### 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.

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

### 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: -

- a. 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
- b. 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
- c. 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 Silverton Wind Farm should have no impact on civil Night VFR or IFR operations which may occur in the vicinity, possibly originating from the closest certified aerodrome at Broken Hill.

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.

### Gliding operations


Gliding operations are not known to occur within the vicinity of the proposed Silverton Wind Farm.

However, if gliding operations did occur they would be subject to the same constraints as VFR operations mentioned above and the presence of the wind farm should not have any impact on such operations. Be that as it may, knowledge of the presence of the wind farm is essential to ensure that gliding operators avoid the area in the event of a need for an outlanding. See Section 3.4.4 re airspace considerations and the need for advice to Airservices Australia and the RAAF.

### Hang Gliding and Paragliding operations

No evidence was found of any hang gliding and paragliding occurring in the region. However, such operations are often launched from ridges on hills in areas similar to that where the Silverton Wind Farm is proposed to be built.

There are precedents where safe launch areas have been provided within a wind farm complex by, for example, ensuring the nearest turbine being a minimum of 1,000m forward of the launch area and with more than 300m between the blade tips of wind turbines on either side of the designated launch area. If such becomes an issue, it is advised to liaise with the local hang gliding association, if such indeed exists, to establish an agreed position.

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### Ultralight operations

Ultralight operations are known to exist originating from Broken Hill Aerodrome. See the ultralight icon near Broken Hill Aerodrome in Appendix 7.5.

Should such occur within the local area they would, in effect, be subject to the same fundamental limitations as per VFR aircraft.

The presence of the Silverton Wind Farm would have no effect of any such operations.

### 3.4.3. Reference masts for meteorological monitoring

Wind monitoring masts are usually present on proposed wind farm sites as a source of preliminary wind data for the project.

SGS HART Aviation was advised that four onsite monitoring met masts have been installed at the site of the proposed Silverton Wind Farm. Further, data has been procured from a nearby offsite monitoring mast to confirm the quality of wind speeds onsite. A total of approximately 10 permanent meteorological met masts / wind monitoring masts are proposed for the site to assist with operations. The existing development met masts would be removed.

The coordinates and heights of these met masts were not provided to SGS HART Aviation and, during the inspection of the site, no such wind monitoring masts were seen.


SGS HART Aviation comments that wind monitoring masts, particularly those of a light lattice structure, can be quite difficult to see. For this reason, these masts may be of particular concern to any local aerial agricultural operators. Whilst SGS HART Aviation found no evidence of any aerial agricultural operations present in the area proposed for the Silverton Wind Farm, it is still considered to be important that advice as to the presence of these masts is readily available.

SGS HART Aviation draws particular attention to the measures recommended in the National Airports Safeguarding Advisory Group (NASAG) Guideline D {excerpt at Appendix 7.7}, which, among other things, recommends as a minimum contrasting colours and marker balls should be used. The NASAG Guideline also suggests a flashing strobe light during daylight hours as an alternative. Since the area is considered to be a very low risk area from an aviation operational perspective, SGS HART Aviation considers that a flashing strobe light is not necessary. However, SGS HART Aviation recommends that, if it has not already been done, the top 1/3<sup>rd</sup> of the wind monitoring towers be painted in alternating contrasting bands of colour and marker balls or high visibility flags or sleeves be placed on the outside guy wires. This is consistent with the NASAG Guideline D and such action will assist in allaying some of the fears of the aerial agricultural community.

Since the height of the met masts / wind monitoring masts is understood to be less than 110m, these monitoring towers are not required to be reported to the Civil Aviation Safety Authority (CASA) under Civil Aviation Safety Regulation (CASR) 139.365, which requires CASA to be informed of structures 110m or more above ground level.

However, the CASA Advisory Circular AC 139-08(0) of April 2005 "Reporting of Tall Structures" refers to the fact that the RAAF Aeronautical Information Services (AIS) has been assigned the task of maintaining a database of tall structures the top measurement of which is: -

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

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The principles of the Advisory Circular are sound and it is strongly recommended that the existence of any such met masts / wind monitoring towers is advised in accordance with the procedures mentioned in the referenced Advisory Circular. (See also Section 3.4.4 c).

#### 3.4.4. **Airspace considerations**

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] (3355) BROKEN HILL were studied for any issues of concern.

The proposed Silverton Wind Farm is well clear of any the airspace control zones and the operating height of aircraft over the area is such that the presence of the wind farm would have no effect at all. There are no aircraft traffic control issues nor is there any potential influence on any instrument approach procedures or aeronautical navigation aids.

There are no Restricted or Danger Areas anywhere in the vicinity of the proposed Silverton Wind Farm site. Those that do exist are too far away to be of any concern.

No active Notices to Airmen (NOTAM), which might impact on the development of the wind farm, were found.

Although no particular issues of concern have been identified in respect of airspace considerations, 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.

##### **a) CASA**


It is considered advisable that CASA be informed of the proposed Silverton Wind Farm. 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. This is not designed to anticipate any requirements for obstacle lights or to seek a CASA view on such. This is a matter for later consideration. (See 3.5 below).

Note that a copy of this report was passed to CASA for information on 20 June 2016. An acknowledgment has since been received from CASA. No other comments have yet been forthcoming.

##### **b) Airservices**

The proposed Silverton Wind Farm will not affect any sector or circling altitude, nor any approach or departure altitudes. It is, however, necessary to consider in some more detail the possible effect on en route LSALT.

In reviewing the proposed location of the wind turbines SGS HART Aviation received advice that the highest wind turbine within the proposed wind farm will be A 030 in the northern section of the proposed wind farm site positioned on a small hill 446m (~1,463ft) above mean sea level (amsl). This means that the highest wind turbine proposed to be installed (i.e. 180m high, ~ 590ft) would be 626m (i.e. ~2,054ft) amsl at the tips (i.e. ground level + ~590ft). By definition the minimum LSALT required to ensure clearance of all the wind turbine “obstacles” would then be 2,054ft + 1,000ft = 3,054ft.

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In reviewing the particular routes which pass over or within 10nm of the proposed wind farm, the principal one of concern is: -

Route	Way points	LSALT
W584	Broken Hill to Arana	LSALT 4,900ft

The LSALT for this particular route would require no change as the presence of the wind farm would have no effect.

There are three other routes which were considered as possibly affected and these are: -

W325	Broken Hill to Banca	LSALT 2,900ft
W428	Broken Hill to Laroo	LSALT 2,600ft
W428	Laroo to Broken Hill	LSALT 3,200ft

These routes were not considered to be of particular concern as it is adjudged that they fall outside 10nm from the proposed wind farm.

The above routes are identified on the En Route Chart (ERC) Low L5 – excerpt shown at Appendix 7.5.

The ERC High H3 covering the area concerned was also studied. An excerpt is shown at Appendix 7.6. In reviewing the particular routes which pass over or within 10nm of the proposed wind farm, there are two which would appear to be potentially relevant: -

Route	Way points	LSALT
J19	Broken Hill to Saped	LSALT none recorded in this section, but 2,600ft prior
J141	Newmo to Saped	LSALT 3,000ft

There may be a need for Airservices to review the LSALTs for the above routes, in which case the matter should be referred to them for consideration. 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.

Note that a copy of this report was passed to Airservices for information on 20 June 2016. An acknowledgment has since been received from Airservices with advice that it usually takes up to six weeks to assess such matters. No other comments have yet been forthcoming.

The proposed Silverton 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.


In respect of civil radar sites, the nearest radar identified is at Mildura (shared with Windfinding) some 140nm south of the proposed Silverton Wind Farm site. The remoteness of this radar from the proposed Silverton 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 such 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 AIS and the RAAF AIS.

It is noted that the presence of Purnamoota Wind Farm is already identified on the WAC 3355 – see Appendix 7.4.

As indicated earlier, SGS HART Aviation undertook a search of the Airservices' web site and did not discover any NOTAMs relevant to the proposed Silverton Wind Farm site.



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**c) Department of Defence & RAAF AIS.**

Among other things, the RAAF Aeronautical Information Service (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. The Department of Defence proved reluctant to provide specific information and 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 [DSRGIDEP.ExecutiveSupport@defence.gov.au](mailto:DSRGIDEP.ExecutiveSupport@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 3.4.3, it is understood that there are four temporary wind monitoring masts present in the area of the proposed Silverton Wind Farm. Consequently, there is a need to advise the RAAF of those masts, if it has not already been done.

There is no evidence of any military activity in the vicinity of the proposed Silverton Wind Farm.

There is no known military Restricted or Danger Areas identified anywhere near the proposed Silverton Wind Farm site.

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 Silverton Wind Farm.


The nearest military radar identified is at Oakey, approximately 1,300km to the east of the proposed Silverton Wind Farm site. The remoteness of this radar from the proposed Silverton 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 such radars.

The above view has not the least been influenced by a decision of the US Federal Aviation Administration (FAA) 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.

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 3.4.3 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.

Note that a copy of this report was passed to the Department of Defence for information on 20 June 2016. An acknowledgment has since been received from the Department of Defence with advice as to the new contact email – as recorded above. The Department of Defence has also responded in detail expressing no concerns subject to an assessment by CASA as to the need or otherwise for obstacle lighting. A full copy of the Department of Defence response is attached at Appendix 7.11. No other comments have yet been forthcoming.



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### 3.4.5. Aerial fire fighting activities

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 Silverton Wind Farm would be hazardous and are not recommended. This is a position held in respect of all wind farms.

The operation of helicopters within the confines of the wind farm is perhaps possible, but not desirable.

It is also possible that aerial fire fighting could be undertaken above the level of the wind turbines (i.e. above the highest possible turbine, viz: ~590ft in the case of the proposed Silverton Wind Farm), 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 Silverton 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.

### 3.4.6. Aerial agricultural operations

Agricultural aerial spraying and, possibly, fertilising, may occur in the region, although the inspection of the site area would suggest that such is quite unlikely – at least it would unlikely be a regular matter. Nevertheless, it is, perhaps, important to understand the position of the aerial agricultural fraternity in respect of wind farms.

The Aerial Application 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.

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


Aerial agricultural operations generally occur between 20 – 30m from the ground. Any objects, such as a wind turbine, which penetrate the airspace above 20 – 30m, will need to be taken into account if planning to undertake any such aerial agricultural operations.

It should be noted, of course, that it is standard operating practice that 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. Except in special cases where night spraying of crops is deemed necessary, all such operations would be day VFR. No such “special cases” are deemed to exist in the region.

Aerial agricultural operations from any airstrips which might be established 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.

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.

Note that a copy of this report was passed to the AAAA for information on 20 June 2016. No acknowledgement or any other comments have yet been forthcoming.

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### 3.4.7. Rural ambulance services

The existence of wind turbines does have the potential to limit the flexibility of operations of helicopter ambulance services within the confines of the wind farm, but it would not be an issue outside the boundaries of the wind farm.

For fixed wing air ambulance operations it is an issue which is not considered relevant to the proposed Silverton Wind Farm. Such services do not exist within the confines of the proposed wind farm site now and the presence of the wind farm would not change that position. In the event that an air ambulance operation is required, it is probable that the runway at Broken Hill would be used. These available options will not change with the construction of the Silverton Wind Farm.

The potential impact on either helicopter or fixed wing ambulance services are common factors for all wind farms. The situation in respect of the proposed Silverton Wind Farm does not raise any different or special issues.

## 3.5. Silverton Wind Farm and Aviation Safety

### 3.5.1. Obstacle lighting – current regulatory situation

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

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 OLS of any aerodrome. For major aerodromes, the OLS could extend up to 15 km from the aerodrome.

CASR 1998, 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 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; and
- AC 139-18(0) “Obstacle Marking and Lighting of Wind Farms” December 2005.

There is no doubt that CASA has the necessary regulatory powers to control the marking and removal of hazardous objects within the OLS 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 OLS of an aerodrome. As a consequence, in mid 2008, CASA withdrew Advisory Circular AC139-18(0) and initiated an internal review process to look at how wind farms located near aerodromes are assessed and regulated. Subsequently, following the release of

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the Australian Government's National Aviation Policy White Paper in December 2009, the Department of Infrastructure and Transport, which was then the policy department of Government overseeing CASA (it is now the Department of Infrastructure and Regional Development), established a National Airports Safeguarding Advisory Group (NASAG). Amongst other things, NASAG developed a draft Guideline D "Managing the Risk of Aviation Safety of Wind Turbine Installations (Wind Farms)/Wind Monitoring Towers". This was first released in draft form in February 2012 as Version 4.1.1. The latest version is 4.1.3, dated 15 July 2012.

The principles of the NASAG Guideline D (an excerpt of which is included at Appendix 7.7) are being upheld in this aviation assessment.

### 3.5.2. Risk to aviation operations – general

In an overall sense, the view is that the risk to aviation operations due to the presence of the proposed Silverton Wind Farm is low based on the following: -

- There are no certified or registered aerodromes within the wind farm area or in the near vicinity. The nearest certified or registered aerodrome is at Broken Hill, approximately 26km (~14nm) southeast of the area. As such, there are no issues of concern regarding the possibility of any penetration on the OLS of any licensed aerodrome.
- There are several private unlicensed airfields surrounding the proposed Silverton Wind Farm, mainly at Station properties, but none closer than 30km. The closest of these is Yalcowina Station, some 38km east of the proposed Silverton Wind Farm site. None of the identified airstrips are suitable for other than ad hoc VFR traffic, except, perhaps, Yarramba (57km west of the site) which has kerosene lamps on request so that strip could accept limited night traffic. Operations from these airfields will not be affected by the presence of the wind farm.
- Other aerodromes / airstrips are further away and would not be affected.
- VFR operations should be above the height of the wind turbines if such are operated strictly in accordance with the Regulations, but the actuality of such operations are such that SGS HART Aviation considers there will be some degree of doubt concerning this in practice.
- Civil Night VFR or IFR aircraft operations are required to abide by lowest safe altitude requirements, which ensure all such operations, should be above the highest point of any of the wind turbines within the Silverton Wind Farm.
- 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 would be day VFR.
- The proposed Silverton Wind Farm turbines will not affect any sector or circling altitude, nor any approach or departure altitudes. They will not impact on Precision/Non-Precision Navigational Aids, HF/VHF Communications, Advanced Surface Movement Guidance and Control Systems, Radar or Satellite/Links.
- There is a possibility that the proposed Silverton Wind Farm turbines at 180m will affect two en route high level LSALTs {J19 & J141 - see 3.4.4.b)} and this matter needs to be referred to Airservices for consideration. Nevertheless, this will have no impact on the operation of the wind farm itself and will not have any real significance on any aircraft operations over the wind farm.

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In effect, there are no regular aviation operations within 30km (indeed within 30nm) from the proposed Silverton Wind Farm and no obstacle limitation surfaces associated with any aerodrome will be affected.

Indeed, a site survey would indicate that the overall level of aircraft operations in the area of the proposed Silverton Wind Farm was very small - almost non-existent - certainly minimal.

It is considered that the overall risk to aviation operations in the vicinity of the proposed Silverton Wind Farm is likely to be very low.

There is one area where the risk to aviation operations is slightly higher than normal and that is the nominal maximum turbine tip height is such that the wind turbines would extend into navigable airspace by some 90ft. In the normal course of events, therefore, SGS HART Aviation would recommend the installation of obstacle lights since the wind turbines would extend into navigable airspace. However, in the case of the proposed Silverton Wind Farm, the presence of any aviation activity in the vicinity is so low that such is not considered to be required.

SGS HART Aviation holds the view that suitable identification on aviation maps of the Silverton Wind Farm (once established) should be sufficient to minimise the risk of any collisions to the wind turbines by any aircraft.

It has been commented that the frequency of aircraft operations in the area can vary. A particular event where an increase in operations occurs is during the horse races in Birdsville, Queensland, when many aircraft operate to there via Broken Hill. SGS HART Aviation remains of the view that operations from Broken Hill Aerodrome would be remote from the Silverton Wind Farm and would not be affected. In any event, the relevant aviation maps would identify the presence of the wind farm and operators should, therefore, be aware. In the worst case scenario, an alert NOTAM could be issued.

**What is meant by “navigable airspace”?**

Under the Civil Aviation Regulations, aircraft undertaking VFR operations, except during take off and landing, are required to maintain a minimum height of 500ft AGL outside of built up areas and 1,000ft over built up areas. Any aircraft undertaking VFR operations outside controlled airspace is, therefore, legally entitled to operate as low as 500ft AGL.


The Civil Aviation Regulations further require that, unless it is necessary for takeoff and landing, an IFR or a Night VFR aircraft operation 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 LSALT for any such operation which, by definition, would be higher than any wind turbine in the proposed Silverton Wind Farm development.

In principle, therefore, this defines “navigable airspace”.

Whilst the proposed maximum tip height of the wind turbines within the proposed Silverton Wind Farm is 180m (i.e. ~590ft) and the risk profile for aviation operations would increase, principally because obstacles above 500ft (~152m) start to penetrate *navigable airspace*, it is repeated that the extent to which operations occur in the region is so small that SGS HART Aviation is of the view that the risk can be accepted without obstacle lights being installed.

**Additional risk mitigation**

The 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 an essential risk mitigation element. Pending such identification on

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maps, it would be advisable to ensure that all aviation operators are made aware of the 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 advise both Airservices and the RAAF AIS not only of the wind farm itself but also of any temporary or permanent met masts / wind monitoring towers.

Note that, as advised above, a copy of this report was passed to Airservices and the Department of Defence (including the RAAF AIS) for information on 20 June 2016. An acknowledgment has since been received from Airservices and the Department of Defence. No other comments have yet been forthcoming.

### 3.5.3. Comparisons with other wind farm developments.

To assist in comparing the Silverton Wind Farm with others throughout Australia, attention is drawn to the fact that there are many examples of wind farms currently in operation, which have no obstacle lights installed, or have had the obstacle lights turned off as a result of a low aviation risk assessment.


Such examples include: Brown Hill Wind Farm (Hallett 1), Hallett Hill Wind Farm (Hallett 2) North Brown Hill Wind Farm (Hallett 4) and the Snowtown Wind Farm (all in South Australia north of Adelaide). Wind farms outside South Australia include the Oaklands Hill Wind Farm, the Capital Wind Farm on the eastern edge of Lake George in the Australian Capital Territory and the Codrington Wind Farm in Victoria west of Warrnambool. The latter has been operational since 2001.

It should be added that the wind turbines present in all the above-mentioned wind farms have turbine heights less than 500ft AGL and are, therefore, below navigable airspace.

## 4. SUMMARY COMMENTS

The following summary comments and recommendations are made: -

- Airfields in the vicinity.
  - There are no certified or registered aerodromes within the wind farm area or in the near vicinity. The nearest certified or registered aerodrome is at Broken Hill, approximately 26km (~14nm) southeast of the area. As such, there are no issues of concern regarding the possibility of any penetration on the OLS of any licensed aerodrome.
  - There are several private unlicensed airfields surrounding the proposed Silverton Wind Farm, mainly at Station properties, but none closer than 30km. The closest of these is Yalcowina Station, some 38km east of the proposed Silverton Wind Farm site. None of the identified airstrips is suitable for other than ad hoc VFR traffic, except, perhaps, Yarramba (57km west of the site) which has kerosene lamps on request so that strip could accept limited night traffic. Operations from these airfields will not be affected by the presence of the wind farm.
  
- Aviation operations – general.
  - The extent of aviation operations in the area of the proposed Silverton Wind Farm was determined to be very low – almost non-existent.


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- With the exception of special low level operations as would occur with, such as, agricultural operations if they were required, Night VFR and IFR operations should be clear of any wind turbines.
  - VFR operations may be at risk as some of the turbines will penetrate navigable airspace by some 90ft, but there was little evidence of any VFR operations, including aerial agricultural operations, in the area proposed.
- Reference towers for meteorological monitoring.
    - Meteorological (met) / wind monitoring masts can be difficult to see and their presence should be advised to the RAAF AIS in accordance with the advice given within Advisory Circular AC 139-08(0) "Reporting of Tall Structures".
      - Despite the evident low level of operations in the area, SGS HART Aviation is of the view that any such met masts / wind monitoring masts should be marked consistent with the recommendations of the National Airports Safeguarding Advisory Group (NASAG) Guideline D.
    - Even though there is no evidence of any aerial agricultural operations occurring in the region, SGS HART Aviation is of the view that AGL should notify, at least as a matter of courtesy, the Aerial Application Association of Australia (AAAA) of any met masts / wind monitoring masts at the proposed Silverton Wind Farm site.
      - Note that a copy of this report was passed to the Department of Defence (including the RAAF AIS) for information on 20 June 2016. The Department of Defence has responded in detail expressing no concerns subject to an assessment by CASA as to the need or otherwise for obstacle lighting. A full copy of the Department of Defence input is included at Appendix 7.11. No other comments have yet been forthcoming.
- Airspace considerations.
    - CASA.
      - CASA should be advised of the proposed Silverton Wind Farm so it has the opportunity to comment as to whether there are any potential problems in respect of air routes over the site or any Prohibited, Restricted and Danger (PRD) areas which might be in the vicinity. Whilst no such areas of concern have been identified by SGS HART Aviation, CASA's comments in these matters should not be overlooked.
      - The advice to CASA will also serve as an alert 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.
        - Note that a copy of this report was passed to CASA for information on 20 June 2016. An acknowledgment has since been received. No other comments have yet been forthcoming.
    - Airservices.
      - The proposed Silverton Wind Farm will not affect any sector or circling altitude nor any approach or departure. The farm will not impact on Precision/Non-Precision Navigational Aids, HF/VHF Communications, Advanced Surface Movement Guidance and Control Systems, Radar or Satellite/Links.







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the confines of any wind farm and below the top of the wind turbines is potentially hazardous and not recommended.

- The situation in respect of the proposed Silverton Wind Farm is no different from that for any other wind farm.
- Rural air ambulance services.
  - The existence of wind turbines has the potential to limit the flexibility of operations of helicopter ambulance services within the confines of the wind farm and there is little that can be done about that. This is a common factor for all wind farms.
  - Otherwise, the proposed Silverton wind farm will have little effect on the provision of rural air ambulance services currently available in the region.

## 5. CONCLUSIONS

The risk to aviation operations in the vicinity of the proposed Silverton Wind Farm is considered to be very low.

Whilst the maximum height of the proposed wind turbines (180m) is such that the tips of the blades will penetrate navigable airspace, and this is a potential cause of concern, the overall risk within the vicinity of the proposed Silverton Wind Farm is considered to be so low that obstacle lighting is not required.

Despite the low level of aircraft operations in the vicinity, it is recommended that temporary or permanent met masts / wind monitoring towers be marked consistent with the recommendations of the National Airports Safeguarding Advisory Group (NASAG) Guideline D.

Even though there is no evidence of any aerial agricultural operations occurring in the region, SGS HART Aviation is of the view that AGL should notify, at least as a matter of courtesy, the Aerial Application Association of Australia (AAAA) of any met masts / wind monitoring masts at the proposed Silverton Wind Farm site.


CASA should also be advised of the proposed Silverton Wind Farm so it has the opportunity to comment as to whether there are any potential problems in respect of air routes over the site or any Prohibited, Restricted and Danger (PRD) areas which might be in the vicinity. Whilst no such areas of concern have been identified by SGS HART Aviation, CASA's comments in these matters should not be overlooked.

The advice to CASA will also serve as an alert 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.

It has been assessed that there may be an effect on two high level en route LSALTs as a result of the establishment of the Silverton Wind Farm as proposed and Airservices should be advised of that. Whilst this is not considered of concern in respect of the establishment of the wind farm in the sense that it will not inhibit the establishment, Airservices will likely undertake its own assessment in respect of LSALTs which could lead to a variation in the published LSALTs. There may very well be a charge for this Airservices' assessment and amendment to the associated maps.

Airservices should be advised of the proposed wind farm development and any temporary met mast / wind monitoring towers.

Airservices may choose, in consultation with CASA, to issue a Notice to Airmen (NOTAM) advising of the presence of any such towers.

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Whilst SGS HART Aviation found no evidence of any military operations in the vicinity of the proposed Silverton Wind Farm site, the RAAF AIS should be advised on the proposed Silverton Wind Farm development and any temporary or permanent met masts / wind monitoring towers.

An essential risk mitigation feature is for the wind turbines to be identified on the relevant aeronautical charts i.e. both the civil WACs and the RAAF produced chart series.

Pending such identification on maps, it is advisable to ensure that all potentially affected aviation operators are made aware of the presence of any temporary or permanent met masts / wind monitoring towers and of the planned existence of the wind farm itself. Airservices, if they were made aware of such matters, would normally advise the aviation industry via NOTAM action covering both the construction phase and prior to identification on maps. It is, therefore, essential that the wind farm developer advise both Airservices and the RAAF AIS.

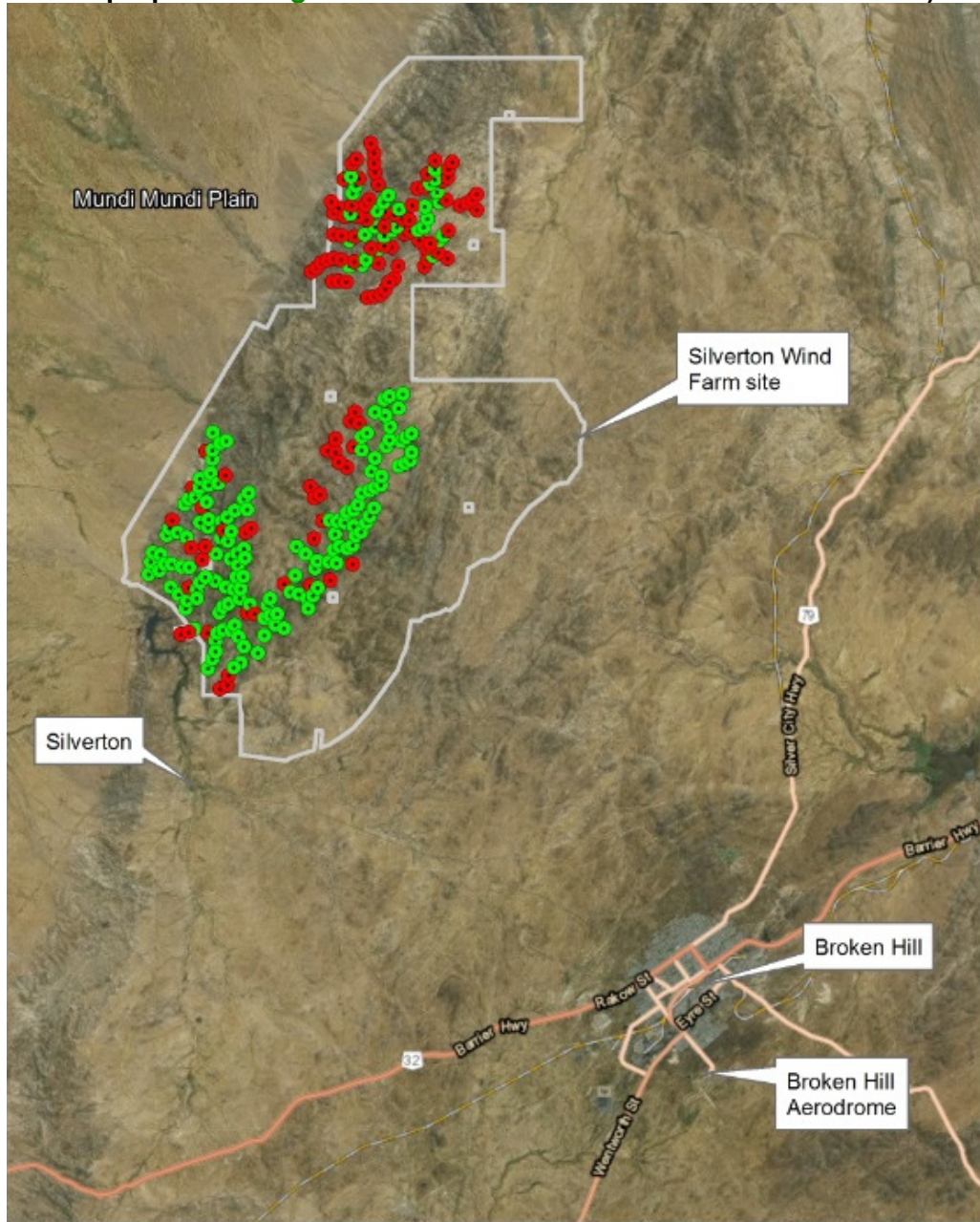
A copy of this report was passed to CASA, Airservices, the Department of Defence, the AAAA and the Broken Hill City Council for information on 20 June 2016. Acknowledgments have since been received from CASA, Airservices and the Department of Defence. The Department of Defence has also responded in detail expressing no concerns subject to an assessment by CASA as to the need or otherwise for obstacle lighting. No other comments have yet been forthcoming.

## 6. ABBREVIATIONS USED IN THIS REPORT

AAAA	Aerial Application Association of Australia	km	Kilometre
AC	Advisory Circular	LPSI	Land Planning & Spatial Information
AGL	Above Ground Level	LSALT	Lowest Safe Altitude
AIS	Aeronautical Information Services	m	Metre
ALA	Aircraft Landing Area	MOS	Manual of Standards
amsl	Above Mean Sea Level	MW	Megawatt
AOPA	Aircraft Owners and Pilots Association of Australia	nm	nautical mile
AS	Australian Standard	NASAG	National Airports Safeguarding Advisory Group
CAAP	Civil Aviation Advisory Publication	NOTAM	Notice to Airmen
CASA	Civil Aviation Safety Authority	NZ	New Zealand
CAR	Civil Aviation Regulation	OLS	Obstacle Limitation Surfaces
CASR	Civil Aviation Safety Regulation	PANS-OPS	Procedures for Air Navigation Services – Aircraft Operations
CID	Community Infrastructure Designation	PRD	Prohibited, Restricted, Danger areas
EIS	Environmental Impact Statement	RAAF	Royal Australian Air Force
ERC	En Route Chart	TAC	Terminal Area Chart
ERSA	En Route Supplement Australia	USA	United States of America
FAA	Federal Aviation Administration	VFR	Visual Flight Rules
ft	Feet	VNC	Visual Navigation Chart
GFA	Gliding Federation of Australia	VHF	Very High Frequency
ICAO	International Civil Aviation Organisation	VTC	Visual Terminal Chart
IFR	Instrument Flight Rules	WA	Western Australia
HF	High Frequency	WAC	World Aeronautical Chart

## 7. APPENDICES

### 7.1. Overview of Silverton Wind Farm (Red indicates those turbines that have been removed from the proposal and green indicates those which have been retained)



Project area

**Turbines**

Remove

Retain

0 2.5 5 10 Kilometres

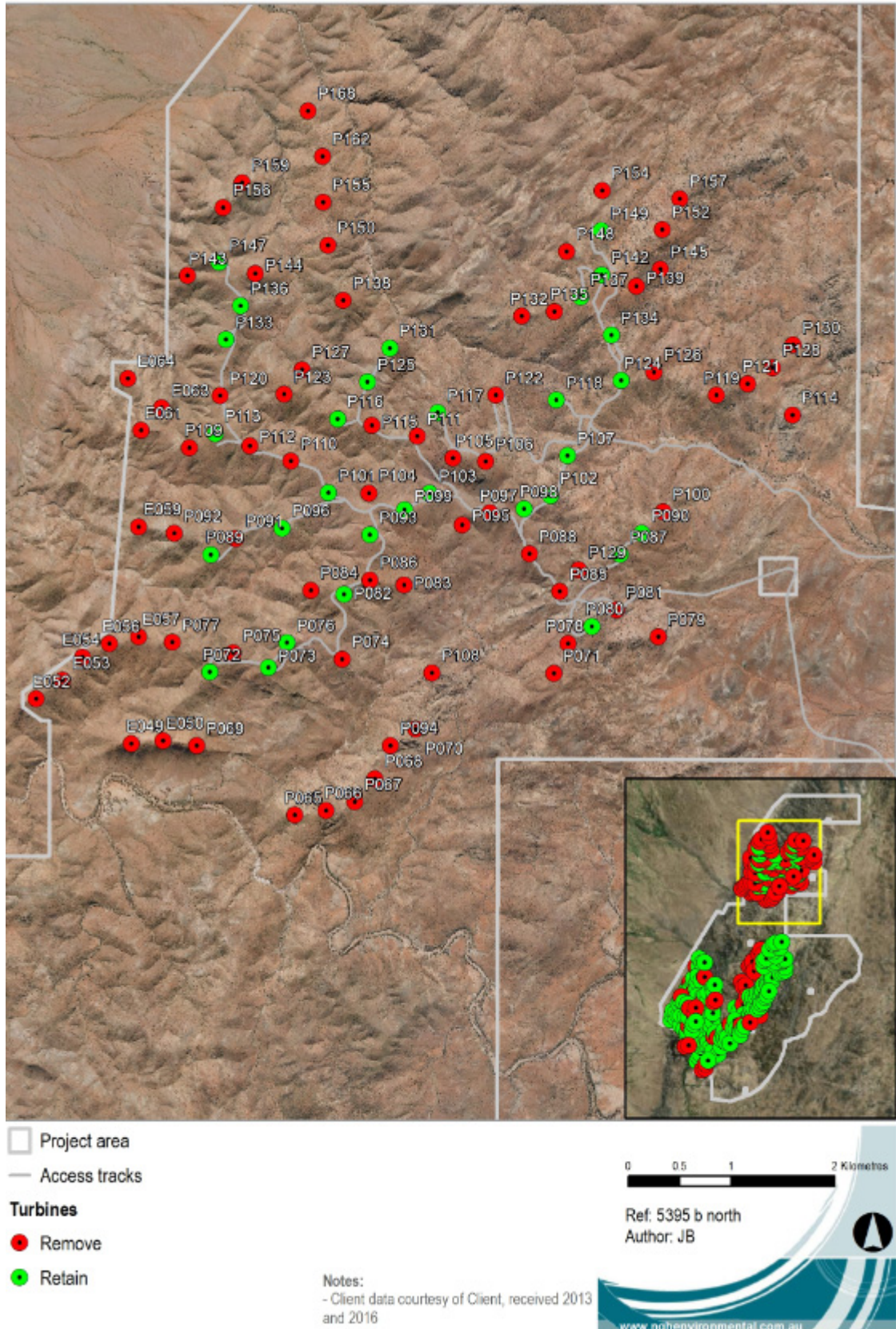
Ref: 5395 c  
 Author: JB



Notes:  
 - Client data courtesy of Client, received 2013

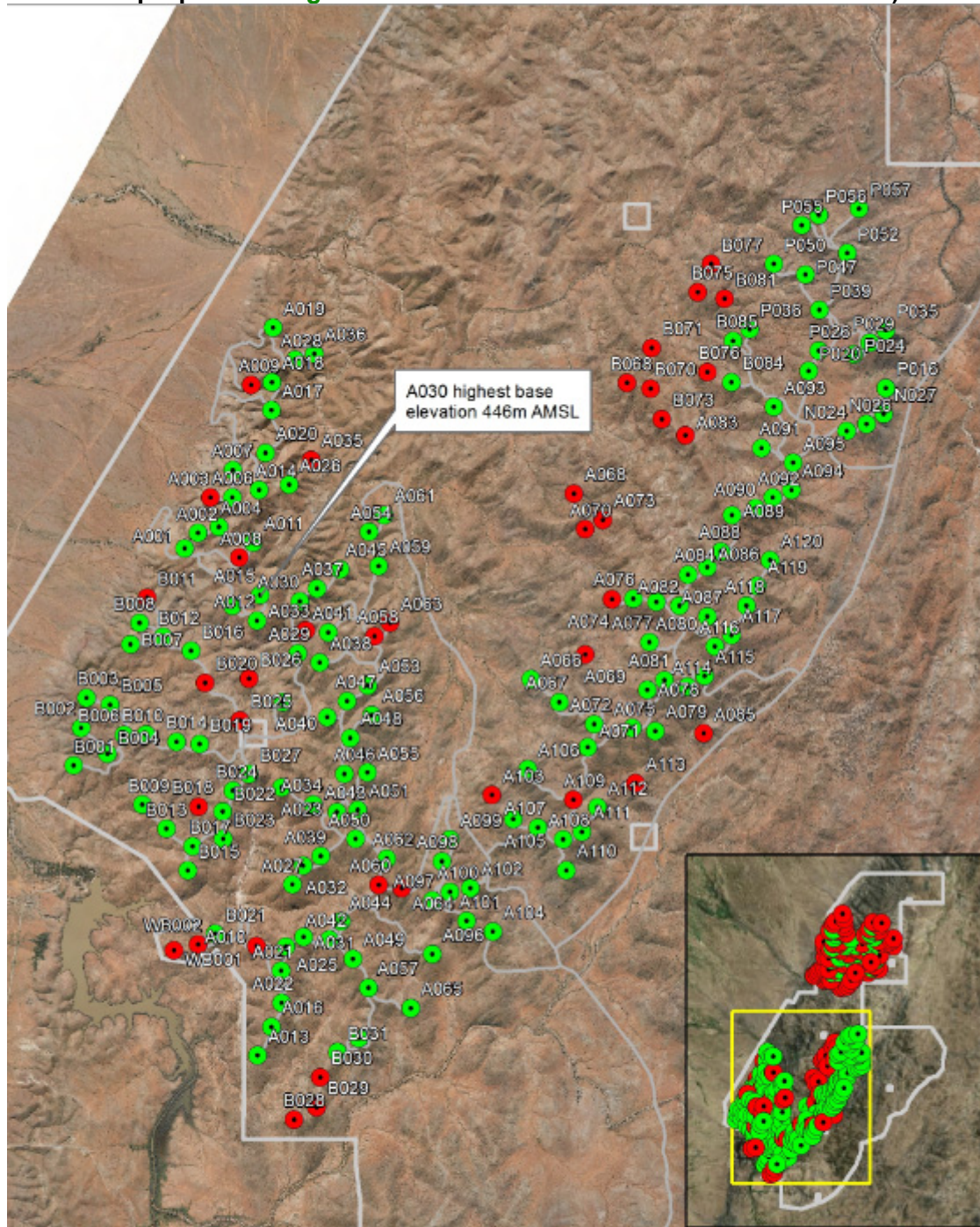


**7.2. Wind Turbine locations – North (Red indicates those turbines that have been removed from the proposal and green indicates those which have been retained)**





**7.3. Wind Turbine locations – South (Red indicates those turbines that have been removed from the proposal and green indicates those which have been retained)**



□ Project area  
 — Access tracks

**Turbines**  
 ● Remove  
 ● Retain

0 0.5 1 2 Kilometres

Ref. 5395 b south  
 Author: JB

Notes:  
 - Client data courtesy of Client, received 2013 and 2016

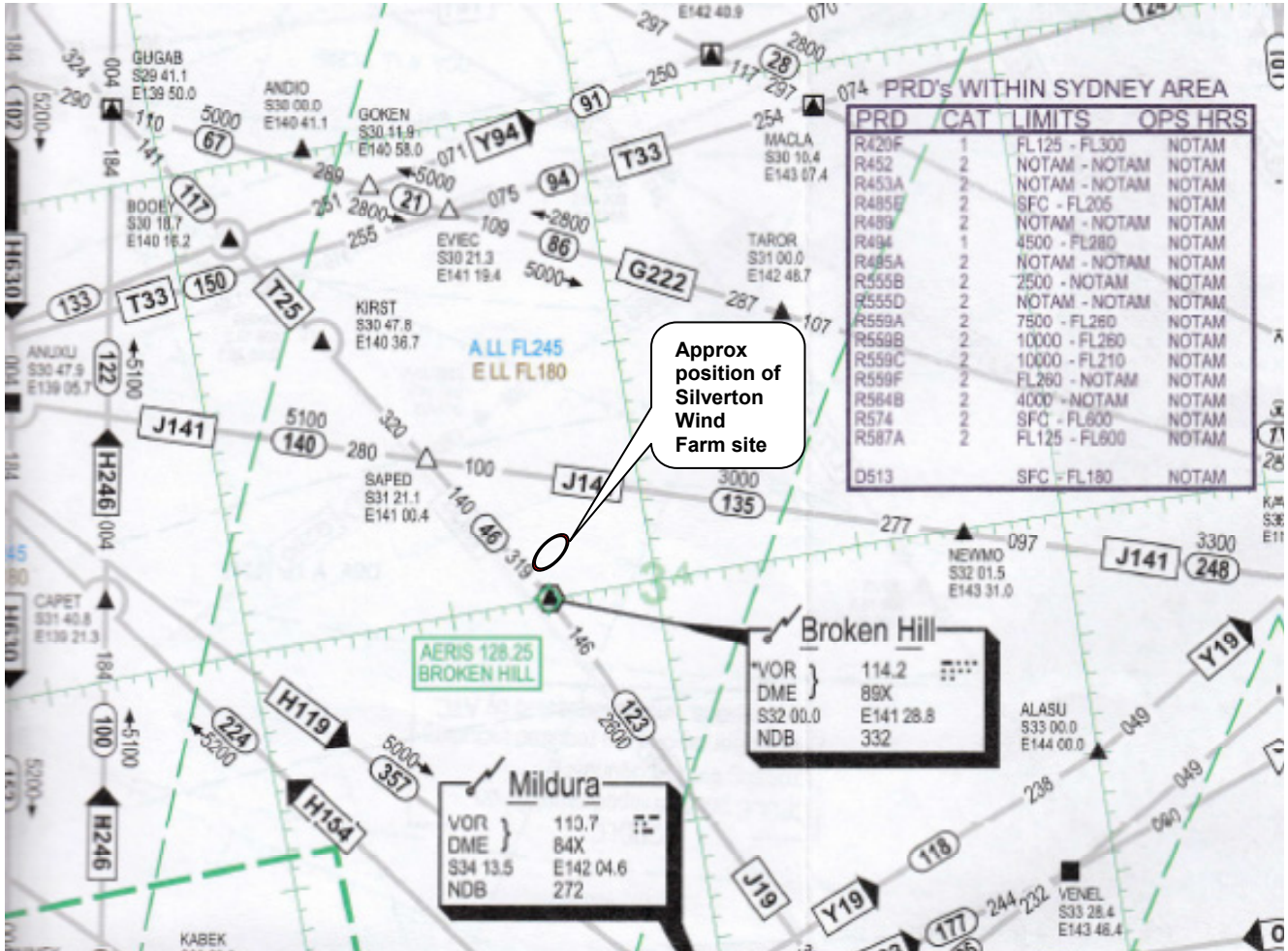
7.4. Excerpt from WAC (3355) – Broken Hill {16<sup>th</sup> Edition}








7.6. Excerpt from ERC High H3 {26 May 2016}



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## 7.7. NASAG Obstacle Lighting Standard for Wind Turbines & Wind Monitoring Towers

The following is an excerpt from the National Airports Safeguarding Framework Guideline D. It will be seen that there is direct equivalence with the ICAO Annex 14 Recommendations regarding wind turbines as noted in Appendix 7.10 below.

### 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:
- to identify the perimeter of the wind farm;
  - respecting a maximum spacing of 900m between lights along the perimeter, unless an aeronautical study shows that a greater spacing can be used;
  - where flashing lights are used, they flash simultaneously; and
  - 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:
- 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;
  - 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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## 7.8. Airservices Aviation Assessments for Wind Farm Developments Policy



*To Whom It May Concern*

**Corporate & International Affairs**  
 25 Constitution Avenue  
 (GPO Box 367)  
 CANBERRA ACT 2600  
 t 02 6268 5101  
 f 02 6268 4233  
[www.airservicesaustralia.com](http://www.airservicesaustralia.com)  
 ABN 59 698 720 886

### Airservices Aviation Assessments for Wind Farm Developments

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

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

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

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

AIS must be undertaken by an aeronautical consultant with suitable knowledge and capabilities to provide a reliable and comprehensive report. All data is to be supplied in electronic form. If you are not familiar with any aeronautical consultants, you may wish to view the list on the Civil Aviation Safety Authority (CASA) website:


[http://www.casa.gov.au/scripts/nc.dll?WCMS:STANDARD::pc=PC\\_90412](http://www.casa.gov.au/scripts/nc.dll?WCMS:STANDARD::pc=PC_90412)

### AIS Criteria

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

#### Airspace Procedures:

1. Obstacles
  - Co-ordinates in WGS 84 (to 0.1 second of arc or better)
  - Elevations AMSL (to 0.3 metres)

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## 2. Drawings

- Overlaid on topographical base not less than 1:250,000. Details of datum and level of charting accuracy to be noted.
- Electronic format compatible with Microstation version 8i.

## 3. Aerodromes

- Specify all registered/certified aerodromes that are located within 30nm (55.56km) from any obstacle referred to in (1) above.
- Nominate all instrument approach and landing procedures at these aerodromes.
- Confirmation that the obstacles do not penetrate Annex 14 or OLS for any aerodrome. If an obstacle does penetrate, specify the extent.

## 4. Air Routes

- Nominate air routes published in ERC-L & ERC-H which are located near/over any obstacle referred to in (1) above.
- Specify two waypoint names located on the routes which are located before and after the obstacles.

## 5. Airspace

- Airspace classification – A, B, C, D, E, G etc where the obstacles are located.

### Navigation/Radar:

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


[http://www.eurocontrol.int/surveillance/public/standard\\_page/sur\\_WTTF.html](http://www.eurocontrol.int/surveillance/public/standard_page/sur_WTTF.html)

### **Airservices Review of AIS**

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

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



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

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

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

Please contact Joe Doherty, Airport Development Manager (02) 62685101 or alternatively [joseph.doherty@airservicesaustralia.com](mailto:joseph.doherty@airservicesaustralia.com) if you have any questions.

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## 7.9. Excerpts from CASA Manual of Standards (MOS) 139

### (FOR INFORMATION ONLY)

#### 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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## 7.10. ICAO ANNEX 14 Recommendations Re Wind Farms

### (FOR INFORMATION ONLY)

#### 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.*

6.3.14 In the case of an extensive object or of a group of closely spaced objects, top lights shall be displayed at least on the points or edges of the objects highest in relation to the obstacle limitation surface, so as to indicate the general definition and the extent of the objects. If two or more edges are of the same height, the edge nearest the landing area shall be marked. Where low-intensity lights are used, they shall be spaced at longitudinal intervals not exceeding 45 m. Where medium-intensity lights are used, they shall be spaced at longitudinal intervals not exceeding 900 m.

#### 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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## 7.11. Department of Defence comments.



Australian Government  
Department of Defence  
Estate and Infrastructure Group

Brenin Presswell  
A/Director Land Planning and Regulation  
Estate Planning Branch  
Brindabella Business Park (BP26-1-A053)  
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CANBERRA BC ACT 2610  
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ID-EP-DLP&R-OUT/2016/AF25495473

Ms Mel Dunn  
Certification & Business Enhancement  
SGS Australia (SGS HART Aviation)  
19/15 Eldridge Crescent  
Garran ACT 2605

Dear Ms Dunn

### RE: Silverton Wind Farm Draft Aviation Assessment

Thank you for your correspondence dated 20 June 2016 referring the abovementioned wind farm Draft Aviation Assessment to the Department of Defence (Defence) for comment. I understand that the Draft Aviation Assessment has been undertaken to determine the potential impact on aviation operations of the proposed Silverton Wind Farm and the need or otherwise for obstacle lighting.

Project approval for the Silverton Wind Farm was granted on 24 May 2009 for the operation of 282 wind turbines and Defence provided comments regarding the initial proposal. The Draft Aviation Assessment indicates that a Modification Report is being prepared to consider changes to the approved project including, changed capacity, increase in turbine height to 180m Above Ground Level (AGL) and number of turbines and increasing the capacity while decreasing the overall turbine numbers.

Defence has reviewed the response and notes that the exact final coordinates for the turbines have had some minor amendments, however the locations are still within the broad site area that was initially assessed by Defence, and the turbine heights remain the same. Defence's previous submission on the Silverton Wind Farm Project remains current.

At a height of 180m AGL the turbines will protrude into navigable airspace by some 90ft. I note, that the *National Airports Safeguarding Framework Guideline D - Managing the Risk to Aviation Safety of Wind Turbine Installations (Wind Farms)/Wind Monitoring Towers* recommends that where a wind turbine 150 metres or taller in height is proposed away from aerodromes, the proponent should conduct an aeronautical risk assessment. It also recommends that the risk assessment be submitted to the Civil Aviation Safety Authority (CASA) to determine whether the proposal is a hazard to aircraft safety and requires approved lighting or marking. Defence supports this requirement and believes that in this instance, it would be prudent for the risk assessment of this proposal to be sent to CASA for consideration.

If CASA determines that LED obstruction lighting is to be provided, it should be compatible with persons using night vision devices and that the frequency range of the LED light emitted should be within the range of wavelengths 655 to 930 nanometers.



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Defence has no objections to the wind turbine layout and increased height subject to the project complying with the above conditions and those previously identified in earlier correspondence.

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

Yours sincerely

**Brenin Presswell**  
A/Director  
Land Planning and Regulation  
Estate Planning Branch

8 July 2016





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Australian Government

Department of Defence  
Defence Support Group

2004/1044160/4  
LPSI/OUT/2009/34

Mr Neville Osborne  
Major Infrastructure Assessments  
NSW Department of Planning  
GPO Box 39  
Sydney, NSW, 2001

Dear Mr Osborne

**RE: PROPOSED SILVERTON WIND FARM - SUBMISSIONS REPORT (Your ref: S07/1462)**

Thank you for referring the abovementioned wind energy project to the Department of Defence (Defence) for comment. Defence previously commented on this proposal in October 2008.

Defence has no issues with the revised construction staging in the Report. Defence is pleased to note that the proponent intends to consult with the Civil Aviation Safety Authority (CASA) in regard to night lighting and aviation safety and will provide Defence with final 'as constructed' data on the location and height of turbines.

As such, Defence has no concerns with the Silverton Wind Farm at this time. Should you wish to discuss the content of this advice further, please contact Brenin Presswell, Executive Officer, Land Planning on ph. (02) 6266 8138 or by email at [brenin.presswell@defence.gov.au](mailto:brenin.presswell@defence.gov.au).

Yours sincerely

John Kerwan  
Director Land Planning & Spatial Information  
Department of Defence  
BP3-1-A052  
Brindabella Park  
Canberra ACT 2600

6 February 2009

Cc. DSG - ACT/NSW  
RAAF AIS  
CASA

**WWW.SGS.COM**

**WHEN YOU NEED TO BE SURE**

