

APPENDIX 14

Aeronautical Impact Assessment and Obstacle Lighting Review, 2009

The Ambidji Group Pty Ltd

FINAL REPORT

AERONAUTICAL IMPACT ASSESSMENT AND OBSTACLE LIGHTING REVIEW

BOCO ROCK WIND FARM NEW SOUTH WALES

Project Number J0303

Prepared for
WIND PROSPECT CWP PTY LTD



8 October 2009



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1 EXECUTIVE SUMMARY

The Ambidji Group Pty Ltd (Ambidji) has been engaged by Wind Prospect CWP Pty Ltd (Wind Prospect) to undertake an aeronautical impact assessment and to review obstacle marking and lighting requirements for the proposed Boco Rock Wind Farm. The proposed wind farm site is located 10km south west of Nimmitabel and 30km north of Bombala, in the New South Wales Southern Highlands.

Fig. 1-1 below shows the proposed layout of the wind farm site.

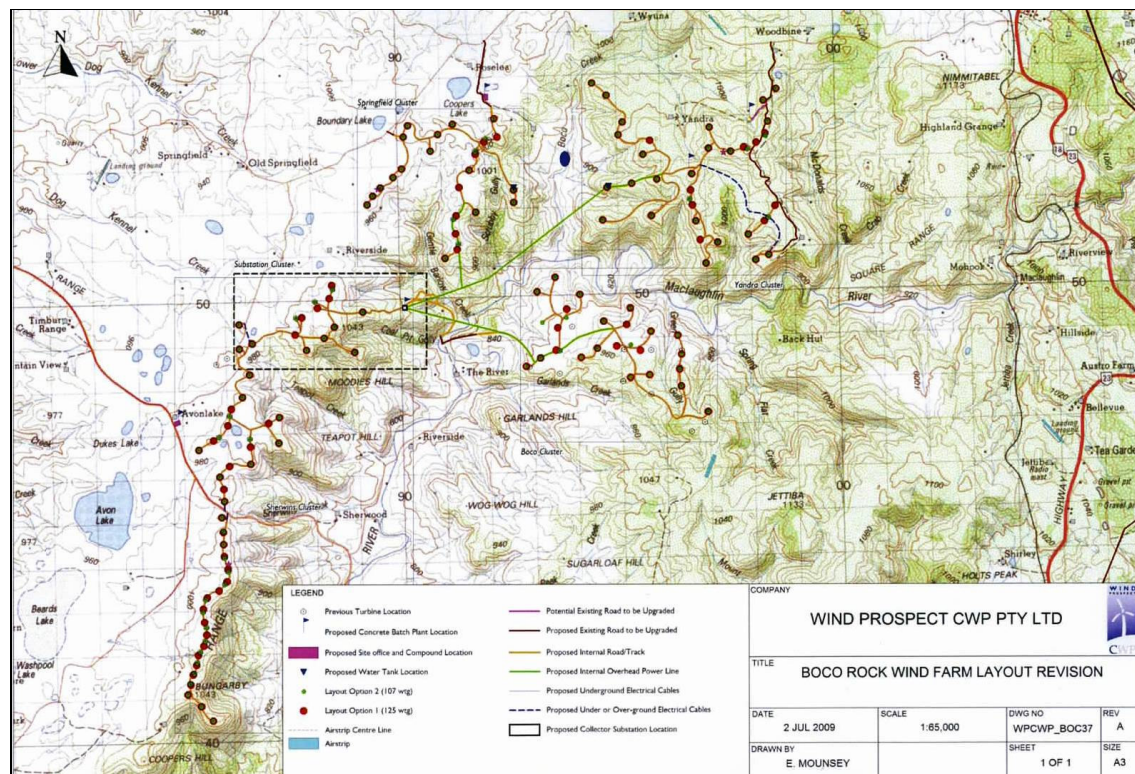


Fig 1-1 Boco Rock Wind Farm Location¹

Two layouts are being considered for the wind farm; one consisting of 107 wind turbines the other 125 wind turbines. The difference in the number of turbines relates to the rotor diameters for wind turbines available in the market place. The 107 turbine layout is linked to 100m rotors whereas the 125 turbine layout is linked to 90m rotors. Either turbine will be mounted on a mast with a hub height of up to 100m. The highest wind turbine (to rotor tip) being considered for this wind farm will therefore be 152m (500ft) AGL.

Examination of the proposed layout of the wind farm from data supplied by Wind Prospect indicates that the highest terrain on the site has a maximum elevation of 1100m (3609ft). The highest turbine will therefore be approximately 1252m (4110ft) AHD at the rotor tip.

Airfields considered as requiring assessment in this report include Cooma, Polo Flat, Bombala, Jindabyne and Delegate.

¹ Source: Wind Prospect CWP Pty Ltd, July 2009

A CASA certified airfield at Cooma is located approximately 35km north of the site. An uncertified airfield at Polo Flat is located approximately 40km north of the proposed development. Both of these airfields have published Instrument Approach Procedures with associated Procedures for Air Navigation Surfaces (PANS OPS) extending out to 55km (30nm) from near the centre of the airfield. PANS OPS allows aircraft to conduct an instrument approach to these airports in poor weather conditions. These two airfields also have Obstacle Limitation Surfaces (OLS) extending to 4km from the runway ends. There are no other airfields with instrument approach procedures within 55.6km (30nm) of any part of the wind farm development.

Unlicensed airfields at Jindabyne (47km north-west), Bombala (35km south) and Delegate (40km south) are shown on aeronautical charts but do not have PANS OPS surfaces or OLS. These airfields are sufficiently distant from the wind farm site to ensure that takeoff and landing procedures at these airstrips will not be affected by the proposed wind farm.

Other private airstrips and landing grounds may be located within 30km of the boundary of the proposed wind farm. These airstrips and landing grounds do not require OLS and are not included in aeronautical charts for the region. Pilots operating at such private airstrips are responsible for ensuring that they are aware of the conditions on and surrounding these landing sites.

Evaluation of the potential aeronautical impact and obstacle marking and lighting review has been undertaken in accordance with relevant civil aviation safety regulations. In summary, this aeronautical impact study and obstacle marking and lighting review has determined that:

1. The highest turbine in this proposed wind farm will be approximately 1252m (4110ft) AMSL and, as such:
 - Will not penetrate any OLS surfaces;
 - Will not penetrate any PANS OPS surface;
 - Will not have an impact on nearby designated air routes; and
 - Will not have an adverse impact on local aviation activities.
2. The proposed Boco Rock Wind Farm is:
 - Not located within the vicinity of a regulated aerodrome. The nearest regulated aerodrome (Cooma) is some 35km to the north of the wind farm site;
 - Located in a remote and mountainous area where there is higher and unlit terrain to the north-east of the site and very little aviation activity at low altitudes due to its remoteness;
 - Located outside the clearance zones associated with Air Traffic Control radar facilities and aviation navigation aids; and
 - Sufficiently distant from airfields to not have an impact on contingency procedures and engine inoperative flight paths.

These findings show that the Boco Rock Wind Farm is not likely to be assessed as an "Obstacle" or hazard to the safety of aircraft and airport operations.

Additional factors and findings to be taken into consideration for this aeronautical impact assessment and review of obstacle marking and lighting requirements are:

1. Aircraft operating in the area, apart from those undertaking authorised low level operations, are required to be operating at heights in excess of the highest turbine. Australian IFR charts indicate a Lowest Safe Altitude of 5900ft (1799m), which is some 1800 ft (549m) higher than the highest wind turbine.
2. The World Aeronautical Chart (WAC) for the area shows a lit tower on top of Brown Mountain, approximately 7km east of the wind farm at 4591 ft (1399m) AHD, which is some 481 ft (147m) higher than the highest wind turbine. Another lit tower is shown at Hudsons Peak, approximately 11km north of the wind farm at 4129ft (1259m), which is slightly higher than the highest turbine at Boco Rock Wind Farm.
3. Pilots undertaking authorised low level operations such as crop dusting, fire fighting, cattle mustering, search and rescue, power line and gas pipe line monitoring undergo specialised training and are required to take account of obstacles when planning and conducting low level operations
4. Australian policy, standards and recommended practices for obstacle marking and lighting of wind farms are currently under review. A current proposal includes a change to the criterion height of 110m (361 ft) to 152m (500ft) AGL for wind farms within the vicinity of a regulated aerodrome. The wind turbines for Boco Rock will be 152m AGL.
5. There are precedent examples of non-provision of obstacle lighting of wind turbines where it has been assessed that the wind farm:
 - Does not represent an “Obstacle” or a hazard to the safety of aircraft and airport operations;
 - Is not located in the vicinity of a regulated aerodrome; and
 - There is higher terrain in the vicinity of the wind farm.

Consideration of all the above findings indicates that there is no operational justification for the provision of obstacle lighting of the proposed Boco Rock Wind Farm as:

- the wind farm is unlikely to be assessed as presenting an “Obstacle” or hazard to the safety of aircraft and airport operations;
- the wind farm is located more than 30km from the nearest regulated aerodrome;
- the wind farm is located in an area where there is significant mountainous terrain;
- IFR pilots operating in the area are required to operate at currently published altitudes that are well in excess of the highest turbine; and
- VFR pilots operating in the area are required to operate at altitudes that are well in excess of the highest turbine. In addition, the rugged terrain in the area requires VFR pilots to exercise additional terrain clearances.

Obstacle marking of the wind turbines is not required as CASA considers that wind turbines are sufficiently conspicuous by day due to their shape size and colour. Marking would only be

required if the turbine colour is such that they are not visually conspicuous against the prevailing background.

Notwithstanding the above findings, as the Boco Rock Wind Farm turbine tip heights will exceed 110m AGL, formal notification to CASA and the Department of Defence is to be provided in accordance with:

- CASA Advisory Circular AC 139-08(0) "Reporting of Tall Structures" to enable inclusion of the wind farm location and height of turbines in relevant aeronautical information publications; and
- CASA Form 406 – "Operational Assessment of Existing and Proposed Structures".

Both of these notifications would be supported by this aeronautical impact assessment and review of obstacle marking and lighting requirements.

Formal notification should also be provided to local aviation interested parties and relevant aviation stakeholders of the intention to construct a wind farm at Boco Rock.

Additional and separate notification to CASA will be required in relation to the use of cranes (temporary obstacles) during the on-site wind farm development and the wind turbine construction process if the crane height exceeds 110m AGL.

Post-construction information to be provided to CASA and the Department of Defence includes:

3. "As constructed" coordinates of each tower (latitude and longitude);
4. The final height in M AHD of each turbine; and
5. The ground level of the site in M AHD for each tower.

2 INTRODUCTION

The Ambidji Group Pty Ltd (Ambidji) has been engaged by Wind Prospect CWP Pty Ltd (Wind Prospect) to undertake an aeronautical impact assessment and to review the requirement for obstacle marking and lighting for the proposed Boco Rock Wind Farm. The proposed wind farm project is located 10km south west of Nimmitabel and 30km north of Bombala, in the New South Wales Southern Highlands.

Two layouts are being considered for the wind farm; one consisting of 107 wind turbine generators (WTG), the other 125 WTG. The difference in the number of turbines relates to the rotor diameters for wind turbines available in the market place. The 107 turbine layout is linked to 100m rotors whereas the 125 turbine layout is linked to 90m rotors. Either of the turbines will be mounted on a mast with a hub height of up to 100m. The highest wind turbine (to rotor tip) being considered for this wind farm will be 152m (500ft) AGL. Appendix A provides the wind farm site details and topography.

Examination of the proposed layout of the wind farm from data supplied by Wind Prospect, (refer to Appendix B – Turbine Coordinates and Elevations), indicates that the highest terrain on the site has a maximum elevation of 1100m. The highest turbine will therefore be approximately 1252m (4110ft) AHD at the rotor tip.

3 METHODOLOGY

This aeronautical impact assessment and obstacle marking and lighting review included the following evaluations and assessments:

- The location of the proposed site in relation to Obstacle Limitation Surfaces was determined accurately based on the wind farm siting information as provided by Wind Prospect;
- Consideration was given to Civil Aviation Safety Regulations (CASR) Part 139 Manual of Standards (MOS), particularly:
 - Chapter 7: Obstacle Restriction and Limitation; and
 - Chapter 11: Standards for Other Aerodrome Facilities;
- Relevant instrument approach procedures were examined in detail to determine whether the development would impose any restriction on those procedures. Any restriction on the instrument approach procedures would need to be examined by Airservices Australia to determine if a change to the instrument approach procedures is possible without restricting aviation movements. It is likely that any restriction on the PANS OPS surfaces would preclude further consideration of an application for development of the wind farm unless appropriate mitigation measures are effected;
- Consideration was given to Defence (Area Control) Regulations (DACR), the operation of military aircraft conducting low flying operations in the area, and the operation of civilian aircraft during recognised low flying activities in the area;
- Existing designated air routes were examined in relation to the proposed modifications, to determine if there would be any influence on the Lowest Safe Altitudes published for these routes;
- Civil Aviation Order 20.7.1B relates to the minimum requirements for clearance of obstacles by an aircraft that has suffered a failure of a critical engine during take-off. These contingency procedures analyse the minimum safe altitudes (and therefore relate to maximum allowable obstacle heights) required in such a circumstance. The influence that development on the site would have on contingency (CAO 20.7.1B) procedures was considered;
- Assessment of applicable Civil Aviation Regulations, standards and recommended practices in respect to notification of tall structures that may present obstacles and hazards to aviation activities, including obstacle marking and lighting requirements;
- A preliminary assessment of potential impacts on navigational aids and air traffic control radar coverage; and
- A concise summary was made of the findings and conclusion as to whether the proposal should be approved.

4 CONSULTATIONS AND CONSIDERATION OF LOCAL AVIATION ACTIVITIES

The increase in wind farm development throughout Australia in recent years as a result of alternative energy requirements has involved inputs from aviation interests. Airport and airway infrastructure and aviation safety requirements associated with wind farms and other building developments are “protected” by CASA regulations, and the aviation industry, when invited to comment on specific wind farm developments, will frequently indicate that, provided the requirements of CASA are observed, they have no further comment. In general, this means that the wind farm is to be assessed in terms of potential aeronautical impact, that marking and lighting of the wind farm, if required, is to be provided in accordance with CASA regulations, and that notification of any Tall Structure is effected to enable inclusion of the wind farm location on relevant aeronautical charts. Inclusion of the wind farm on aeronautical charts enables pilots and support personnel to adequately plan and therefore consider the impact of the wind farm on their operations.

The minimum level for flight by civilian aircraft, in accordance with the Visual Flight Rules (VFR), other than during take-off and landing manoeuvres, is determined by CASA at 500ft (approximately 152m) above ground in areas outside urban development in daylight visibility conditions. At night and in low visibility conditions, the minimum height is 1000ft (approximately 305m) above ground or the highest obstacle in the area. Civilian VFR flight operations below 500ft may be carried out by specifically trained and endorsed pilots conducting crop dusting, cattle mustering, pipeline or power line surveys, fire fighting, helicopter operations, search and rescue, etc. Pilots undertaking these low level operations undergo special training and are required to take obstacles into account when planning and conducting low flying operations. The general view of pilots conducting these operations is that wind farms are more readily visible than power lines, masts and towers, and inclusion of the location and existence of the wind farms on aeronautical charts further enables them to appropriately plan their operations.

Crop dusting or aerial application of fertilisers does occur in the area surrounding the proposed Boco Rock wind farm. As the identification and avoidance of obstacles is a routine part of planning for aerial application activities, the wind farm would be assessed as an additional obstacle that pilots are trained to deal with as part of their operations.

Fire bombing activities in the area may also take place from private airfields or paddocks considered suitable. These activities are precision planned and take into account all obstacles and smoke areas. Wind turbine locations in relation to any possible landing strip, would be considered prior to any operations occurring at temporary strips.

Search and rescue and aeromedical services, which can be conducted at low levels, may also be conducted during day or night operations.

VFR glider flying and hang glider operations are conducted irregularly within the area. This wind farm site is located within rugged mountainous terrain requiring special consideration of the need to fly into such remote and rugged areas. Pilot preparation and sound airmanship practices should ensure that the wind turbines do not provide an increased hazard for pilots flying in such rugged terrain conditions.

Airline operations (and other aircraft operations) are conducted under the Instrument Flight Rules (IFR) requiring aircraft to establish a cruising altitude of at least 1000ft above the highest terrain or obstacles within a varying tolerance area either side of the route. This Lowest Safe Altitude (LSALT) is published on IFR aeronautical charts. IFR aircraft can operate in cloud and poor visibility conditions and are not dependent on visual contact with terrain. For IFR aircraft

operations where there is no designated air-route, the pilot applies a complex formula to determine the lowest safe altitude above the highest terrain, according to the preferred track, or the pilot applies a published GRID LSALT shown on IFR aeronautical charts. During descent for landing or climbing on take-off, the IFR pilot follows published Instrument Approach and Departure Procedures which apply varying minimum altitude requirements (PANS OPS) above terrain.

Low level flight operations are conducted by Australian Defence Force aircraft throughout Australia. Military aircraft can operate at very low level by day and by night, but only after thorough investigation of the intended flight paths in relation to terrain, obstacles, airfields and populous areas that need to be avoided or accounted for in the conduct of the flight. These flights are subject to precise planning by military aircrew. The Department of Defence has advised the proponent that the proposed Boco Rock Wind Farm is located “outside any areas affected by the Defence (Area Control) Regulations” and “will not cause any unacceptable interference to Defence communications”. Once construction of the wind farm is approved, and the wind farm reported to CASA and RAAF AIS prior to construction under the “Notification of Tall Structure” provisions, the wind farm will be shown on aeronautical charts and included in military obstruction databases, accessible by all military aircrew, allowing them to plan a safe flight operation in the area. Defence also require to be advised of the “as installed” details of the wind farm. Defence has indicated they have no objection to the proposed wind farm, subject to the notification of the details as outlined above.

CASA has determined that by 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. Accordingly, unless the colour of the turbine is likely to blend in with the background, the characteristic obstacle marking colours and/or patterns, detailed in MOS Part 139, are not required. Experience has shown that the white colour universally adopted for wind turbines installed so far in Australia, satisfies the requirements for daytime conspicuity.

Table 4.1 below summarises the approximate distances to the operational airfields nearest to the proposed Boco Rock wind farm.

| AIRFIELD | Approximate Distance to Wind Farm | Direction from Wind Farm | OLS/PANS OPS |
|-----------|-----------------------------------|--------------------------|--------------|
| Cooma | 35km | 355 Deg True | Both |
| Polo Flat | 40km | 360 Deg True | Both |
| Jindabyne | 47km | 340 Deg True | No |
| Bombala | 35km | 170 Deg True | No |
| Delegate | 50km | 210 Deg True | No |

Table 4.1 Approximate Distances of Nearest Airfields from Wind Farm

As indicated in the table above, the proposed wind farm site is more than 30km from airfields shown in aeronautical information publications. It is acknowledged that there may be other airstrips in the vicinity, particularly private operators. There is also significant higher and unlit terrain in the area. Given that the highest turbine will be 152m (500ft) and that currently CASA has indicated they expect wind turbines exceeding 110m AGL should be fitted with obstacle lighting unless there are unusual circumstances, it is necessary to give further consideration to obstacle lighting requirements. It should be noted that CASA and the Department of Infrastructure, Transport, Regional Development and Local Government are currently reviewing marking and lighting requirements for obstacles remote from airfields.

5 ANALYSIS OF OBSTACLE LIMITATION SURFACES (OLS)

Obstacle Limitation Surfaces (OLS) protect aircraft operations in the vicinity of airfields from obstacle intrusion into safety margins. The OLS at Cooma and Polo Flat airfields extend to a radius of 4km from the Aerodrome Reference Point (ARP). As the closest point of the proposed wind farm is approximately 35km and 40km from the airfields at Cooma and Polo Flat respectively, the OLS at both airfields are not infringed by the proposed Boco Rock Wind Farm. Fig. 5.1 below shows superimposed on an aeronautical chart for the area, the approximate location of the wind farm and its proximity to nearby airports and their associated OLS.

There are no other airfields with Obstacle Limitation Surfaces that are affected by this wind farm proposal.

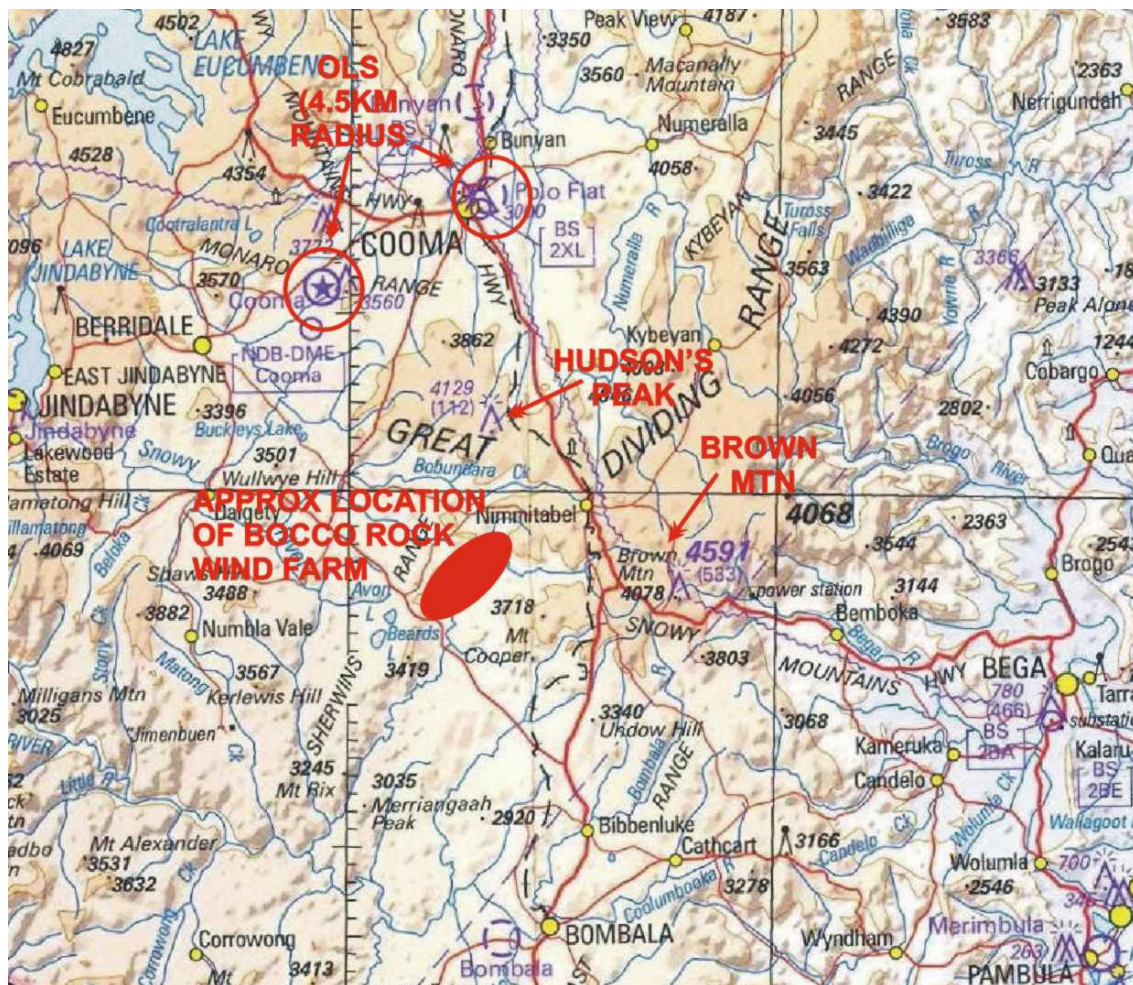


Fig 5.1 – Boco Rock Wind Farm and Proximity to Nearby Airports and Associated OLS

6 ANALYSIS OF PANS OPS SURFACES

Assessment of the impact on PANS OPS surfaces by the proposed Boco Rock Wind Farm development was undertaken with respect to published Minimum Descent Altitudes, Circling Minima and Minimum Sector Altitudes (MSA) as published in the Australian Aeronautical Information Publication, Departures and Approach Procedures (AIP DAP) effective 27 August 2009, associated Aeronautical Information Circulars (AIC), Aeronautical Information Supplements and NOTAMS relevant to this edition of AIP DAP.

At the calculated maximum height of the highest turbine at 1252m (4110ft) AHD, the Boco Rock Wind Farm development will not affect the PANS OPS surfaces at Cooma or Polo Flat airfields. The minimum clearance between the highest turbine and prescribed airspace is 490ft for the DME ARRIVAL Sector B for Cooma and 506ft for the 25nm MSA for Polo Flat.

A full and detailed PANS OPS assessment considering all operational procedures applicable to the area was undertaken and is included at Appendix C.

7 NEARBY AIR-ROUTES

In the context of the published air-routes in the area of the proposed Boco Rock Wind Farm and the physical environment, the proposed wind farm is located underneath the protection surfaces for three air-routes and within an area containing a Grid Lowest Safe Altitude. Table 7.1 below shows the amount of clearance between the proposed Boco Rock Wind Farm and the protection surfaces of the air-routes overlaying the wind farm.

| AIR –ROUTE | LSALT | PROTECTION SURFACE ALTITUDE | PROTECTION SURFACE CLEARANCE ABOVE WIND FARM |
|----------------------------|--------|--------------------------------|---|
| W290 (Cooma- East Sale) | 7500ft | 6500ft | 2390ft |
| W675 (Cooma-Mallacoota) | 6100ft | 5100ft | 990ft |
| V20 (Cooma-Eildon Weir) | 8700ft | 7700 ft | 4590ft |
| GRID LSALT | 5900ft | 4900ft | 790ft |

Table 7.1 Air Routes

The minimum clearance between the highest turbine located on the highest terrain and the protection surface of the lowest designated air-route in the area is 790ft; therefore the proposed Boco Rock Wind Farm does not have an impact on designated routes in the vicinity of the project.

8 CONTINGENCY PROCEDURES – ENGINE INOPERATIVE FLIGHT PATHS

In the context of the aircraft and airport operations in the area of the proposed wind farm and the physical environment, the proposed Boco Rock Wind Farm is considered to be sufficiently distant from nearby airfields to not have an impact on contingency procedures and engine inoperative flight paths in the area.

9 EVALUATION OF OBSTACLE MARKING AND LIGHTING REQUIREMENTS

9.1 Obstacle Marking of Boco Rock Wind Farm

Marking of wind farm turbines in accordance with obstacle marking requirements is not normally required as CASA considers that wind turbines installed in Australia are sufficiently conspicuous by day due to their shape, size and colour. Marking would only be required if the turbine colour is such that they are not visually conspicuous against the prevailing background².

It is understood that the turbines proposed for Boco Rock will be of an appropriate colour that will not require painting or marking to increase conspicuity.

9.2 Obstacle Lighting of Boco Rock Wind Farm

The aeronautical requirements for marking and lighting of wind farms are currently undergoing review by the International Civil Aviation Organization (ICAO), the Department of Infrastructure, Transport, Regional Development and Local Government (DITRD LG) and CASA. It is understood that ICAO will be issuing an amendment to ICAO Annex 14 (Aerodromes) later this year that addresses, *inter alia*, wind farms. DITRD LG recently issued a Discussion Paper “Safeguards for airports and the communities around them” that implies an amendment to the criteria for wind turbine heights from 110m to 152m AGL as being applicable to wind farms in the vicinity of aerodromes. In addition, CASA is currently reviewing its withdrawn Advisory Circular AC139-181 “Obstacle Marking and Lighting of Wind Farms”. The outcomes of these various reviews may result in:

- Revised criteria for wind farms; and
- Wind farms such as Boco Rock Wind Farm not requiring obstacle lighting, depending on the findings of a qualitative risk assessment to be undertaken by the proponent.

While the DITRD LG Discussion Paper applies specifically to wind farms within the vicinity (generally accepted as 30km) of aerodromes, CASA is also currently reviewing the requirements for marking and lighting of obstacles and hazards remote from aerodromes. CASA has informally advised the wind farm industry that a qualitative risk assessment approach to the potential hazards, as presented by wind farms, may be considered.

CASA’s current position on obstacle lighting of wind farms that are remote from an aerodrome (which is the situation for Boco Rock Wind Farm) is summarised as:

- CASA cannot mandate obstacle lighting for wind farms that are “not within the vicinity” of an aerodrome (within 30km);
- Provision of obstacle lighting is the responsibility of the proponent;

² Source: CASA Advisory Circular AC139-18(0). (Note: Although this AC has been withdrawn pending review, the technical requirements are considered to still apply.)

- Any associated requirements placed on proponents by planning authorities, insurers or financiers are beyond CASA's scope;
- A wind farm proponent may have a duty of care to the aviation industry and local operators in terms of ensuring obstacles are made conspicuous; and
- Obstacle marking and lighting requirements as specified in the CASA Manual of Standards Part 139, Chapters 8 and 9 applies.

CASA Manual of Standards (MOS) 139, Chapter 9, Section 9.4 indicates that for structures more than 110m AGL, the proponent should expect that obstacle lighting will be required unless there are unusual circumstances. The turbines to be installed at Boco Rock will have a maximum height of 152m AGL. However, there have been precedent examples where CASA has acknowledged non-provision of obstacle lighting of wind farms in Australia where the turbine height exceeds 110m AGL. Such installations have been the subject of a hazard risk assessment that takes into account such factors as location of the wind farm with respect to nearby airfields and air routes, potential impact on navigable airspace, surrounding terrain, local aviation activity in the area, and environmental considerations. The wind farms concerned are Capital Wind Farm and Gunning Wind Farm, both of which are sited in mountainous area to the north of Goulburn in NSW, are remote from regulated airports, and were assessed as not presenting a hazard to aircraft operations.

The World Aeronautical Chart³ (WAC) covering the area of the Boco Rock Wind Farm site indicates the existence of lit towers closer to Cooma and Polo Flat airports; i.e. Brown Mountain at 4591ft AHD and Hudsons Peak at 4129 ft AHD, both of which are higher than the highest turbine at Boco Rock. As pilots are required to plan for a minimum clearance at night of 1000ft above the highest obstacle, then the minimum height of aircraft operating in the vicinity of the wind farm should be some 1481 ft (451m) above the highest turbine.

As indicated above, Australian policy, standards and recommended practices for obstacle marking and lighting of wind farms are currently under review. A current proposal includes a change to the criterion height of 110m (361ft) to 152m (500ft) AGL for wind farms within the vicinity of a certified or registered aerodrome. Although the Boco Rock Wind Farm is not within the vicinity of a certified or registered aerodrome, the proposed turbines align with this revised criterion height.

The above aeronautical impact assessment determined that the Boco Rock wind Farm will not be assessed as an "Obstacle" or potential hazard to aviation as the wind farm turbines:

1. Do not penetrate OLS or PANS OPS surfaces, or Lowest Safer Altitudes (LSALT) associated with nearby designated air routes;
2. Are located more than 30km from the nearest regulated aerodrome; and
3. Are sited in remote and rugged mountainous terrain where there is terrain higher than the wind farm site and where prudent pilots would be expected to increase clearances from terrain.

In view of the above findings and considerations, this review of obstacle lighting requirements for the Boco Rock Wind Farm therefore submits that there is no operational justification for the provision of obstacle lighting.

³ WAC 3470 (Melbourne)

10 OTHER ISSUES

10.1 Radar Interference and Shadowing

Radar interference and shadowing was assessed in accordance with CASR Part 139 Manual of Standards⁴. The nearest ATC Radar is located at Canberra, ACT, and the Boco Rock Wind Farm proposed development is located outside the clearance zones associated with ATC Radar Facilities.

10.2 Potential Impact on Airport Navigation Aids

Potential impact on airport navigational aids was assessed in accordance with CASR Part 139 Manual of Standards⁵. The nearest aviation navigation aids are at Cooma. The Boco Rock Wind Farm development is located outside the clearance zones associated with these Navigation Aids and therefore will not be affected by the wind farm proposal.

10.3 Potential Impact on ATC Communication Facilities

Airservices Australia has a VHF radio outlet located on Brown Mountain, approximately 26km east of the proposed wind farm. This radio facility will not be affected by the wind farm proposal.

10.4 Future Developments

It is unlikely that any future developments of the PANS OPS surfaces at Cooma and Polo Flat Airports will be affected by the wind farm due to the runway configuration and surrounding terrain.

Any future development of Instrument Approach Procedures at any airfields within 55.6KM (30NM) of the wind farm will be required to take the wind farm characteristics into account during the design process.

10.5 Reporting of Tall Structures

As the proposed wind farm contains wind turbines which will exceed 110m AGL, the developer is required to inform CASA of the development in accordance with AC 139-08(0) so that the wind farm details can be included on relevant aeronautical charts and databases.

The information to be provided to CASA by the developer includes:

- “As constructed” coordinates of each tower (in latitude and longitude);
- Final height in M AHD of each tower; and

⁴ Refer MOS Chapter 11, Section 11.1.14

⁵ Refer MOS Chapter 11, Section 11

- The ground level of the site, in M AHD for each tower.

Subsequent to the grant of any approval for this development, an additional and related approval will need to be sought from CASA for cranes (temporary obstacles) that exceed 110m AGL during the on-site wind farm development and the wind turbine construction process.

10.6 Notification to Local Aviation Interested Parties and Stakeholders

CASA does not have statutory powers over the requirement for obstacle marking or lighting of obstacles that are not within the vicinity (approximately 30km) of a regulated aerodrome. The nearest regulated aerodrome to Boco Rock Wind Farm is Cooma, which is 35km to the north. Nevertheless, CASA advises that the proponents of high rise structures may have a duty of care to local aviation interested parties and relevant stakeholders. Similarly, State and local government planning regulations for wind farms generally include a requirement for the proponent to notify local aviation interested parties and relevant stakeholders of a proposed wind farm. This notification is usually achieved by the proponent conducting direct correspondence with nearby airports and aviation interests and by holding Public Information Days or meetings to advise local communities of the wind farm proposal. In the case of Boco Rock, in addition to notifying the airports as identified in this report and local aviation operators, it is recommended that the proponent formally advise the following relevant aviation interested stakeholders; emergency services operators (aerial ambulance, fire services, police), aviation peak councils and aviation industry associations.

11 CONCLUSION

11.1 Aeronautical Impact Assessment

This aeronautical impact assessment was conducted in accordance with the relevant aviation and aeronautical regulations, standards and recommended practices to consider:

- The potential impacts of the Boco Rock Wind Farm on the safety of aircraft and airport operations; and
- The requirement for obstacle marking and lighting.

The aeronautical impact assessment has determined that the highest turbine in this proposed wind farm is 1252m (4110ft) AMSL and as such:

- Will not penetrate any OLS surfaces;
- Will not penetrate any PANS OPS surface;
- Will not have an impact on nearby designated air routes;
- Will not have an adverse impact on local aviation activities;
- Will require notification to CASA and RAAF AIS under Reporting of Tall Structure requirements; and
- Will require consideration of obstacle marking and lighting requirements.

The proposed Boco Rock Wind Farm site is:

- Located outside the clearance zones associated with Air Traffic Control radar facilities and aviation navigation aids;
- Located outside Defence (Area Control) Regulation areas; and
- Located at a sufficient distant from airfields not to have an impact on contingency procedures and engine inoperative flight paths.

As the height of the turbines exceed 110m AGL, it will be necessary to notify CASA and RAAF AIS in accordance with Advisory Circular AC 139-08(0) "Reporting of Tall Structures".

The proposed Boco Rock Wind Farm has been assessed as not having an impact on prescribed airspace and is therefore considered approvable in accordance with the relevant regulations, subject to the consideration of the obstacle marking and lighting requirements and the notification to CASA of the wind farm being a "Tall Structure". This Aeronautical Study can be used as supporting documentation to an application to CASA using CASA Form 406 – Operational Assessment of Existing and Proposed Structures.

11.2 Obstacle Marking and Lighting Requirements

Obstacle marking of the wind turbines to increase daytime conspicuity is not considered necessary provided the turbines are of an appropriate colour that will not require painting or marking to increase conspicuity.

This review of obstacle lighting has determined that there is no operational justification for the provision of obstacle lighting on the grounds that the Boco Rock Wind Farm:

1. Does not penetrate protected airspace and has been assessed as not presenting an obstacle or hazard to the safety of aircraft and airport operations;
2. Is not sited within the vicinity of a regulated aerodrome; and
3. Is located in an area where there is higher terrain.

11.3 Notification to Local Aviation Interested Parties and Stakeholders

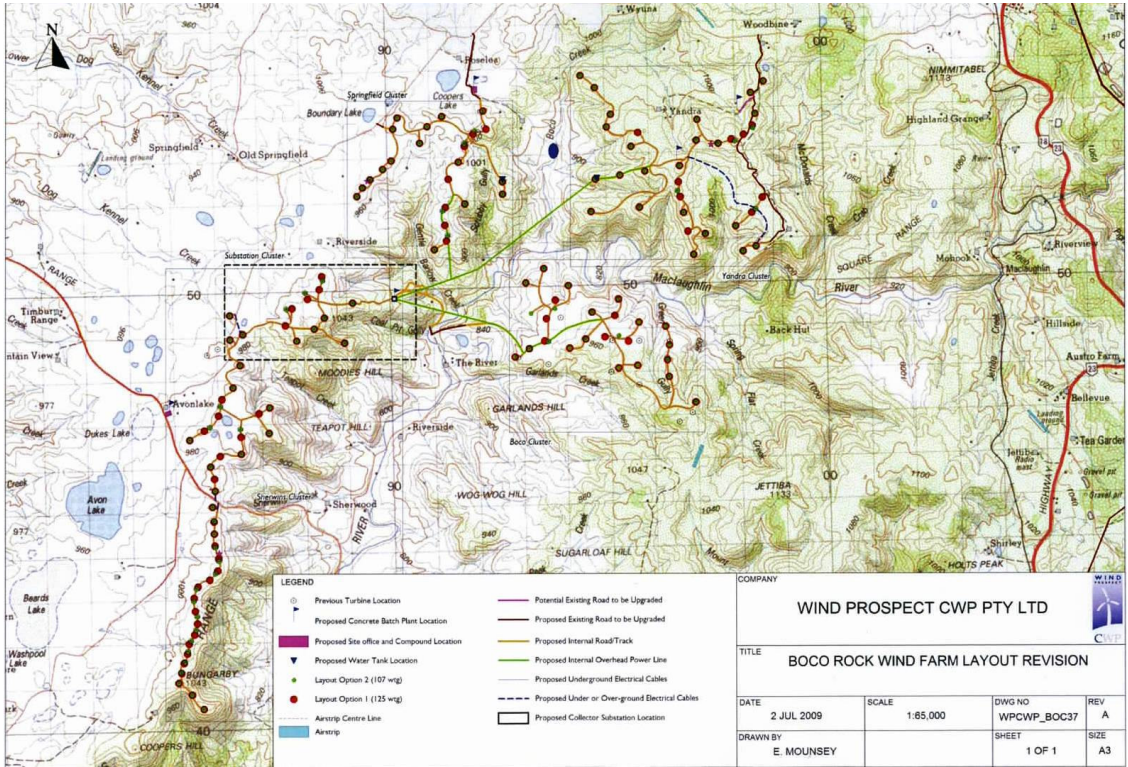
To meet government planning regulations and CASA recommendations, the proponent should provide formal advice to local aviation interested parties and associated stakeholders of the proposal to construct the wind farm at Boco Rock.

APPENDIX A

BOCO ROCK WIND FARM – SITE LOCATION

APPENDIX A

BOCO ROCK WIND FARM – SITE LAYOUT



Boco Rock Wind Farm – Site Topography (Source – Wind Prospect, July 2009)

APPENDIX B
TURBINE COORDINATES AND ELEVATIONS

APPENDIX B

BOCO ROCK WIND FARM – TURBINE COORDINATES & ELEVATIONS⁶

Wind Farm Layout – 107 Turbines

Coordinate System: Geodetic Datum of Australia 1994 Map Grid of Australia Zone 55

NOTE - Total height of turbines could be +/- 3m due to construction

| Turbine ID | EAST | NORTH | ELEV (AHD) | Turbine Height | Blade | Total Height |
|------------|--------|---------|------------|----------------|-------|--------------|
| 1 | 697079 | 5947458 | 1040 | 100 | 52 | 152 |
| 2 | 687735 | 5949793 | 1030 | 100 | 52 | 152 |
| 3 | 689060 | 5948990 | 1010 | 100 | 52 | 152 |
| 4 | 686429 | 5949123 | 1000 | 100 | 52 | 152 |
| 5 | 685314 | 5942019 | 1020 | 100 | 52 | 152 |
| 6 | 685239 | 5941774 | 1020 | 100 | 52 | 152 |
| 7 | 685391 | 5942261 | 1025.8 | 100 | 52 | 152 |
| 8 | 685471 | 5943164 | 1014.2 | 100 | 52 | 152 |
| 9 | 685544 | 5942813 | 1030 | 100 | 52 | 152 |
| 10 | 685548 | 5943443 | 1030 | 100 | 52 | 152 |
| 11 | 696481 | 5948045 | 1020 | 100 | 52 | 152 |
| 12 | 686480 | 5948025 | 1010 | 100 | 52 | 152 |
| 13 | 688607 | 5949577 | 1040 | 100 | 52 | 152 |
| 14 | 693737 | 5948912 | 915.7 | 100 | 52 | 152 |
| 15 | 685924 | 5946234 | 1000 | 100 | 52 | 152 |
| 16 | 688177 | 5950155 | 1030 | 100 | 52 | 152 |
| 17 | 689264 | 5949903 | 990 | 100 | 52 | 152 |
| 18 | 687305 | 5947553 | 1000 | 100 | 52 | 152 |
| 19 | 685086 | 5941303 | 1040 | 100 | 52 | 152 |
| 20 | 685462 | 5946852 | 990 | 100 | 52 | 152 |
| 21 | 685950 | 5945309 | 1000 | 100 | 52 | 152 |
| 22 | 688582 | 5950428 | 1030 | 100 | 52 | 152 |
| 23 | 696428 | 5949201 | 951 | 100 | 52 | 152 |
| 24 | 695344 | 5949857 | 950 | 100 | 52 | 152 |
| 25 | 694743 | 5949566 | 960 | 100 | 52 | 152 |
| 26 | 694588 | 5948950 | 960 | 100 | 52 | 152 |
| 27 | 692960 | 5948576 | 910 | 100 | 52 | 152 |
| 28 | 686184 | 5947607 | 1004.6 | 100 | 52 | 152 |
| 29 | 696452 | 5948431 | 1000 | 100 | 52 | 152 |
| 30 | 693291 | 5948764 | 910 | 100 | 52 | 152 |
| 31 | 687965 | 5949062 | 1030 | 100 | 52 | 152 |
| 32 | 685387 | 5941027 | 1020 | 100 | 52 | 152 |
| 33 | 685651 | 5940690 | 1030 | 100 | 52 | 152 |

⁶ Source. Wind Prospect CWP Pty Ltd, July 2009

| Turbine ID | EAST | NORTH | ELEV (AHD) | Turbine Height | Blade | Total Height |
|------------|--------|---------|------------|----------------|-------|--------------|
| 34 | 686437 | 5949679 | 1000 | 100 | 52 | 152 |
| 35 | 686725 | 5949239 | 1000 | 100 | 52 | 152 |
| 36 | 689544 | 5952531 | 980 | 100 | 52 | 152 |
| 37 | 689720 | 5952714 | 981.6 | 100 | 52 | 152 |
| 38 | 690021 | 5952945 | 999.5 | 100 | 52 | 152 |
| 39 | 690269 | 5953865 | 1010 | 100 | 52 | 152 |
| 40 | 690378 | 5954117 | 1010 | 100 | 52 | 152 |
| 41 | 691064 | 5953898 | 1000 | 100 | 52 | 152 |
| 42 | 690882 | 5953523 | 1000 | 100 | 52 | 152 |
| 43 | 691404 | 5954122 | 1000 | 100 | 52 | 152 |
| 44 | 692762 | 5952598 | 960 | 100 | 52 | 152 |
| 45 | 692760 | 5952311 | 950 | 100 | 52 | 152 |
| 46 | 691378 | 5951957 | 950.3 | 100 | 52 | 152 |
| 47 | 691478 | 5951394 | 960 | 100 | 52 | 152 |
| 48 | 691168 | 5951077 | 950 | 100 | 52 | 152 |
| 49 | 695888 | 5951937 | 1010 | 100 | 52 | 152 |
| 50 | 697108 | 5950831 | 1000 | 100 | 52 | 152 |
| 51 | 697385 | 5951300 | 1010 | 100 | 52 | 152 |
| 52 | 696773 | 5952291 | 1060 | 100 | 52 | 152 |
| 53 | 696828 | 5952868 | 1080 | 100 | 52 | 152 |
| 54 | 697727 | 5953359 | 1090 | 100 | 52 | 152 |
| 55 | 697254 | 5953921 | 1070 | 100 | 52 | 152 |
| 56 | 697222 | 5953441 | 1080 | 100 | 52 | 152 |
| 57 | 698530 | 5953698 | 1090 | 100 | 52 | 152 |
| 58 | 698582 | 5954018 | 1090 | 100 | 52 | 152 |
| 59 | 698490 | 5954502 | 1070 | 100 | 52 | 152 |
| 60 | 696503 | 5948774 | 972.3 | 100 | 52 | 152 |
| 61 | 695808 | 5949311 | 950 | 100 | 52 | 152 |
| 62 | 692153 | 5953783 | 1000 | 100 | 52 | 152 |
| 63 | 692349 | 5954226 | 1000 | 100 | 52 | 152 |
| 64 | 696897 | 5951793 | 1040 | 100 | 52 | 152 |
| 65 | 698556 | 5951837 | 1020 | 100 | 52 | 152 |
| 66 | 698243 | 5950882 | 1010 | 100 | 52 | 152 |
| 67 | 698114 | 5953399 | 1100 | 100 | 52 | 152 |
| 68 | 694594 | 5954992 | 974.8 | 100 | 52 | 152 |
| 69 | 695268 | 5954084 | 993.4 | 100 | 52 | 152 |
| 70 | 694917 | 5954701 | 990 | 100 | 52 | 152 |
| 71 | 695166 | 5953796 | 1000 | 100 | 52 | 152 |
| 72 | 695722 | 5953341 | 1040 | 100 | 52 | 152 |
| 73 | 685998 | 5944387 | 1025 | 100 | 52 | 152 |
| 74 | 688370 | 5949329 | 1040 | 100 | 52 | 152 |
| 75 | 689417 | 5952335 | 980 | 100 | 52 | 152 |
| 76 | 686630 | 5946509 | 1000 | 100 | 52 | 152 |

| Turbine ID | EAST | NORTH | ELEV (AHD) | Turbine Height | Blade | Total Height |
|------------|--------|---------|------------|----------------|-------|--------------|
| 77 | 696029 | 5952768 | 1030 | 100 | 52 | 152 |
| 78 | 698084 | 5951461 | 1013.8 | 100 | 52 | 152 |
| 79 | 698787 | 5954759 | 1080 | 100 | 52 | 152 |
| 80 | 690216 | 5953133 | 1000 | 100 | 52 | 152 |
| 81 | 691905 | 5953488 | 998.1 | 100 | 52 | 152 |
| 82 | 691890 | 5952113 | 960 | 100 | 52 | 152 |
| 83 | 691759 | 5953070 | 1000 | 100 | 52 | 152 |
| 84 | 685987 | 5943787 | 1030 | 100 | 52 | 152 |
| 85 | 693350 | 5949564 | 890 | 100 | 52 | 152 |
| 86 | 694775 | 5951867 | 990 | 100 | 52 | 152 |
| 87 | 685982 | 5944993 | 1010 | 100 | 52 | 152 |
| 88 | 686073 | 5944069 | 1029.3 | 100 | 52 | 152 |
| 89 | 698542 | 5950987 | 1015.1 | 100 | 52 | 152 |
| 90 | 686647 | 5948528 | 1000 | 100 | 52 | 152 |
| 91 | 687282 | 5946971 | 1020 | 100 | 52 | 152 |
| 92 | 686019 | 5945675 | 1000 | 100 | 52 | 152 |
| 93 | 685510 | 5942510 | 1030 | 100 | 52 | 152 |
| 94 | 685145 | 5941548 | 1017.3 | 100 | 52 | 152 |
| 95 | 685929 | 5947130 | 1000 | 100 | 52 | 152 |
| 96 | 685973 | 5944698 | 1007.8 | 100 | 52 | 152 |
| 97 | 695350 | 5949014 | 960 | 100 | 52 | 152 |
| 98 | 695325 | 5948274 | 960 | 100 | 52 | 152 |
| 99 | 695761 | 5948324 | 960 | 100 | 52 | 152 |
| 100 | 694221 | 5948752 | 940 | 100 | 52 | 152 |
| 101 | 695453 | 5952686 | 990 | 100 | 52 | 152 |
| 102 | 694890 | 5952608 | 960 | 100 | 52 | 152 |
| 103 | 693244 | 5950271 | 880 | 100 | 52 | 152 |
| 104 | 693662 | 5950592 | 870 | 100 | 52 | 152 |
| 105 | 694217 | 5950185 | 890 | 100 | 52 | 152 |
| 106 | 686627 | 5947073 | 1000 | 100 | 52 | 152 |
| 107 | 693904 | 5949660 | 906.9 | 100 | 52 | 152 |

Table D-1. Turbine Coordinates and Elevations – 107 Turbine Layout

Wind Farm Layout – 125 Turbines

Coordinate System: Geodetic Datum of Australia 1994 Map Grid of Australia Zone 55

NOTE - Total height of turbines could be +/- 3m due to construction

| Turbine ID | EAST | NORTH | ELEV (AHD) | Turbine Height | Blade | Total Height |
|------------|--------|---------|------------|----------------|-------|--------------|
| 1 | 697079 | 5947458 | 1040 | 100 | 46 | 146 |
| 2 | 687869 | 5949807 | 1030 | 100 | 46 | 146 |
| 3 | 689060 | 5948990 | 1010 | 100 | 46 | 146 |
| 4 | 686429 | 5949123 | 1000 | 100 | 46 | 146 |
| 5 | 686007 | 5945949 | 1000 | 100 | 46 | 146 |
| 6 | 685297 | 5941966 | 1020 | 100 | 46 | 146 |
| 7 | 685215 | 5941754 | 1020 | 100 | 46 | 146 |
| 8 | 685343 | 5942192 | 1021.4 | 100 | 46 | 146 |
| 9 | 685480 | 5943238 | 1012.8 | 100 | 46 | 146 |
| 10 | 685472 | 5942402 | 1030 | 100 | 46 | 146 |
| 11 | 685501 | 5942933 | 1030 | 100 | 46 | 146 |
| 12 | 685575 | 5943492 | 1030 | 100 | 46 | 146 |
| 13 | 685845 | 5943645 | 1020 | 100 | 46 | 146 |
| 14 | 696481 | 5948045 | 1020 | 100 | 46 | 146 |
| 15 | 686480 | 5948025 | 1010 | 100 | 46 | 146 |
| 16 | 687062 | 5947430 | 1006.4 | 100 | 46 | 146 |
| 17 | 688607 | 5949577 | 1040 | 100 | 46 | 146 |
| 18 | 693651 | 5948929 | 911.7 | 100 | 46 | 146 |
| 19 | 685924 | 5946234 | 1000 | 100 | 46 | 146 |
| 20 | 688233 | 5950012 | 1030 | 100 | 46 | 146 |
| 21 | 689264 | 5949903 | 990 | 100 | 46 | 146 |
| 22 | 687305 | 5947553 | 1000 | 100 | 46 | 146 |
| 23 | 685086 | 5941303 | 1040 | 100 | 46 | 146 |
| 24 | 685462 | 5946852 | 990 | 100 | 46 | 146 |
| 25 | 685950 | 5945309 | 1000 | 100 | 46 | 146 |
| 26 | 688569 | 5950519 | 1025.1 | 100 | 46 | 146 |
| 27 | 696428 | 5949201 | 951 | 100 | 46 | 146 |
| 28 | 695343 | 5949867 | 950 | 100 | 46 | 146 |
| 29 | 694743 | 5949566 | 960 | 100 | 46 | 146 |
| 30 | 694588 | 5948950 | 960 | 100 | 46 | 146 |
| 31 | 692960 | 5948576 | 910 | 100 | 46 | 146 |
| 32 | 686219 | 5947764 | 1001.8 | 100 | 46 | 146 |
| 33 | 686134 | 5947390 | 1000 | 100 | 46 | 146 |
| 34 | 686634 | 5946898 | 1000 | 100 | 46 | 146 |
| 35 | 696452 | 5948431 | 1000 | 100 | 46 | 146 |
| 36 | 693291 | 5948764 | 910 | 100 | 46 | 146 |
| 37 | 687965 | 5949062 | 1030 | 100 | 46 | 146 |
| 38 | 685387 | 5941027 | 1020 | 100 | 46 | 146 |
| 39 | 685651 | 5940690 | 1030 | 100 | 46 | 146 |
| 40 | 686437 | 5949679 | 1000 | 100 | 46 | 146 |

| Turbine ID | EAST | NORTH | ELEV (AHD) | Turbine Height | Blade | Total Height |
|------------|--------|---------|------------|----------------|-------|--------------|
| 41 | 686725 | 5949239 | 1000 | 100 | 46 | 146 |
| 42 | 695263 | 5949473 | 960 | 100 | 46 | 146 |
| 43 | 689544 | 5952531 | 980 | 100 | 46 | 146 |
| 44 | 689720 | 5952714 | 981.6 | 100 | 46 | 146 |
| 45 | 690021 | 5952945 | 999.5 | 100 | 46 | 146 |
| 46 | 690269 | 5953865 | 1010 | 100 | 46 | 146 |
| 47 | 690378 | 5954117 | 1010 | 100 | 46 | 146 |
| 48 | 691064 | 5953898 | 1000 | 100 | 46 | 146 |
| 49 | 690882 | 5953523 | 1000 | 100 | 46 | 146 |
| 50 | 691404 | 5954122 | 1000 | 100 | 46 | 146 |
| 51 | 692111 | 5953706 | 1000 | 100 | 46 | 146 |
| 52 | 692762 | 5952598 | 960 | 100 | 46 | 146 |
| 53 | 692760 | 5952311 | 950 | 100 | 46 | 146 |
| 54 | 691523 | 5952688 | 962.2 | 100 | 46 | 146 |
| 55 | 691417 | 5951635 | 960 | 100 | 46 | 146 |
| 56 | 691452 | 5951277 | 956.5 | 100 | 46 | 146 |
| 57 | 691168 | 5951077 | 950 | 100 | 46 | 146 |
| 58 | 696989 | 5951367 | 1010 | 100 | 46 | 146 |
| 59 | 695888 | 5951937 | 1010 | 100 | 46 | 146 |
| 60 | 697108 | 5950831 | 1000 | 100 | 46 | 146 |
| 61 | 691437 | 5952042 | 960 | 100 | 46 | 146 |
| 62 | 697385 | 5951300 | 1010 | 100 | 46 | 146 |
| 63 | 696829 | 5952159 | 1052.8 | 100 | 46 | 146 |
| 64 | 696793 | 5952502 | 1060 | 100 | 46 | 146 |
| 65 | 696828 | 5952868 | 1080 | 100 | 46 | 146 |
| 66 | 697727 | 5953359 | 1090 | 100 | 46 | 146 |
| 67 | 697254 | 5953921 | 1070 | 100 | 46 | 146 |
| 68 | 697222 | 5953441 | 1080 | 100 | 46 | 146 |
| 69 | 698520 | 5953754 | 1090 | 100 | 46 | 146 |
| 70 | 698582 | 5954018 | 1090 | 100 | 46 | 146 |
| 71 | 698490 | 5954502 | 1070 | 100 | 46 | 146 |
| 72 | 696503 | 5948774 | 972.4 | 100 | 46 | 146 |
| 73 | 695769 | 5948322 | 960 | 100 | 46 | 146 |
| 74 | 692370 | 5953842 | 1000 | 100 | 46 | 146 |
| 75 | 692295 | 5954209 | 1000 | 100 | 46 | 146 |
| 76 | 696897 | 5951793 | 1040 | 100 | 46 | 146 |
| 77 | 698712 | 5952101 | 1020 | 100 | 46 | 146 |
| 78 | 698463 | 5951758 | 1020 | 100 | 46 | 146 |
| 79 | 698243 | 5950882 | 1010 | 100 | 46 | 146 |
| 80 | 698025 | 5953446 | 1100 | 100 | 46 | 146 |
| 81 | 694594 | 5954992 | 974.8 | 100 | 46 | 146 |
| 82 | 695268 | 5954084 | 993.4 | 100 | 46 | 146 |
| 83 | 694917 | 5954701 | 990 | 100 | 46 | 146 |

| Turbine ID | EAST | NORTH | ELEV (AHD) | Turbine Height | Blade | Total Height |
|------------|--------|---------|------------|----------------|-------|--------------|
| 84 | 695166 | 5953796 | 1000 | 100 | 46 | 146 |
| 85 | 695722 | 5953341 | 1040 | 100 | 46 | 146 |
| 86 | 685985 | 5944422 | 1028.7 | 100 | 46 | 146 |
| 87 | 688370 | 5949329 | 1040 | 100 | 46 | 146 |
| 88 | 689417 | 5952335 | 980 | 100 | 46 | 146 |
| 89 | 686630 | 5946509 | 1000 | 100 | 46 | 146 |
| 90 | 686152 | 5946469 | 990 | 100 | 46 | 146 |
| 91 | 696029 | 5952768 | 1030 | 100 | 46 | 146 |
| 92 | 698084 | 5951461 | 1013.8 | 100 | 46 | 146 |
| 93 | 698787 | 5954759 | 1080 | 100 | 46 | 146 |
| 94 | 687710 | 5949418 | 1028.3 | 100 | 46 | 146 |
| 95 | 688506 | 5950225 | 1030 | 100 | 46 | 146 |
| 96 | 690216 | 5953133 | 1000 | 100 | 46 | 146 |
| 97 | 691905 | 5953433 | 994 | 100 | 46 | 146 |
| 98 | 691890 | 5952113 | 960 | 100 | 46 | 146 |
| 99 | 691759 | 5953070 | 1000 | 100 | 46 | 146 |
| 100 | 686036 | 5943853 | 1030 | 100 | 46 | 146 |
| 101 | 693700 | 5949440 | 910 | 100 | 46 | 146 |
| 102 | 694775 | 5951867 | 990 | 100 | 46 | 146 |
| 103 | 698310 | 5953551 | 1090 | 100 | 46 | 146 |
| 104 | 685978 | 5944973 | 1011.4 | 100 | 46 | 146 |
| 105 | 686064 | 5944127 | 1026.6 | 100 | 46 | 146 |
| 106 | 698542 | 5950987 | 1015.1 | 100 | 46 | 146 |
| 107 | 686647 | 5948528 | 1000 | 100 | 46 | 146 |
| 108 | 687282 | 5946971 | 1020 | 100 | 46 | 146 |
| 109 | 686019 | 5945675 | 1000 | 100 | 46 | 146 |
| 110 | 685544 | 5942653 | 1030 | 100 | 46 | 146 |
| 111 | 685158 | 5941522 | 1019.6 | 100 | 46 | 146 |
| 112 | 685799 | 5947060 | 1000 | 100 | 46 | 146 |
| 113 | 695883 | 5953654 | 1034 | 100 | 46 | 146 |
| 114 | 685973 | 5944698 | 1007.8 | 100 | 46 | 146 |
| 115 | 695808 | 5949311 | 950 | 100 | 46 | 146 |
| 116 | 695023 | 5948990 | 960 | 100 | 46 | 146 |
| 117 | 695324 | 5948274 | 960 | 100 | 46 | 146 |
| 118 | 695561 | 5948880 | 960 | 100 | 46 | 146 |
| 119 | 694221 | 5948752 | 940 | 100 | 46 | 146 |
| 120 | 695453 | 5952686 | 990 | 100 | 46 | 146 |
| 121 | 694890 | 5952608 | 960 | 100 | 46 | 146 |
| 122 | 693244 | 5950271 | 880 | 100 | 46 | 146 |
| 123 | 693662 | 5950592 | 870 | 100 | 46 | 146 |
| 124 | 694217 | 5950185 | 890 | 100 | 46 | 146 |
| 125 | 693914 | 5949858 | 900 | 100 | 46 | 146 |

Table D – 2. Turbine Coordinates and Elevations – 125 Turbine Layout

APPENDIX C
PANS OPS ASSESSMENT WORKSHEET

APPENDIX C

PANS OPS ASSESSMENT WORKSHEET

COOMA and POLO FLAT OBSTACLE ASSESSMENT

BOCO ROCK WIND FARM

Date: 2 October 2009

DAP EFF DATE: 27 August 2009

| OBSTACLE DETAILS | |
|------------------|--|
| Location | The proposed Boco Rock wind farm project is located near Nimmitabel in the NSW Southern Highlands. |
| Altitude (M/FT) | MAX ALT = 1252m (4110ft) AHD |

COOMA

| MINIMUM SECTOR ALTITUDE | | | | |
|---|------------------|------|--------------------------|--|
| | MSA | MOC | PANS OPS SFC ALT (FT) | RESULT |
| 25NM MSA North West | 8000 | 984 | 7016 | WIND FARM IS OUTSIDE PANSOPS SFC. |
| 25NM MSA South East | 5600 | 984 | 4616 | WIND FARM MAX ALT IS 506ft BELOW THE PANSOPS SFC. |
| 10NM MSA | 5700 | 984 | 4716 | WIND FARM IS OUTSIDE PANSOPS SFC. |
| NON-PRECISION APPROACH PROCEDURES (NPA) | | | | |
| | MDA (ACC QNH) | MOC | PANS OPS SFC ALT (FT) | RESULT |
| DME Arrival – Sector B | 5600* | 1000 | 4600 | *WIND FARM IS 490FT BELOW THE PROC ALT FOR THE SEGMENT ABOVE THE WIND FARM |
| ALL OTHER PROCEDURES | NA | NA | NA | WIND FARM IS OUTSIDE ALL PANSOPS SFCS |

POLO FLAT

| MINIMUM SECTOR ALTITUDE | | | | |
|---|------------------|-----|--------------------------|--|
| | MSA | MOC | PANS OPS SFC ALT (FT) | RESULT |
| 25NM MSA SOUTH | 5600 | 984 | 4616 | WIND FARM IS 506FT BELOW THE PANSOPS SFC. |
| 25NM MSA NORTH | 6800 | 984 | 5816 | WIND FARM IS OUTSIDE PANSOPS SFC. |
| 10NM MSA | 5500 | 984 | 4516 | WIND FARM IS OUTSIDE PANSOPS SFC. |
| NON-PRECISION APPROACH PROCEDURES (NPA) | | | | |
| | MDA (ACC QNH) | MOC | PANS OPS SFC ALT (FT) | RESULT |
| RNAV - N | NA | NA | NA | WIND FARM IS OUTSIDE ALL PANSOPS SFCS |

APPENDIX D

GLOSSARY OF TERMS AND ABBREVIATIONS

APPENDIX D

GLOSSARY OF TERMS and ABBREVIATIONS

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

| Abbreviation | Meaning |
|--------------|--|
| AC | Advisory Circular (document support CAR 1998) |
| ACFT | Aircraft |
| AD | Aerodrome |
| AHD | Australian Height Datum |
| AHT | Aircraft height |
| AIP | Aeronautical Information Publication |
| AIRPORTS ACT | Airports Act 1996, as amended |
| AIS | Aeronautical Information Service |
| ALT | Altitude |
| AMSL | Above Minimum Sea Level |
| A(PoFA)R | Airports (Protection of Airspace) Regulations, 1996 as amended |
| APARs | Airports (Protection of Airspace) Regulations, 1996 as amended |
| ARP | Aerodrome Reference Point |
| AsA | Airservices Australia |
| ATC | Air Traffic Control(ler) |
| ATM | Air Traffic Management |
| CAO | Civil Aviation Order |
| CAR | Civil Aviation Regulation |
| CASA | Civil Aviation Safety Authority |
| CASR | Civil Aviation Safety Regulation |
| Cat | Category |
| DAP | Departure and Approach Procedures (charts published by AsA) |
| DER | Departure End of (the) Runway |
| DEVELMT | Development |
| DME | Distance Measuring Equipment |
| Doc nn | ICAO Document Number nn |
| DITRDLG | Department of Infrastructure, Transport, Regional Development and Local Government. Also called "Infrastructure". (Formerly Department of Transport and Regional Services (DoTARS)) |
| DOTARS | See DITRDLG above |
| ELEV | Elevation (above mean sea level) |
| ENE | East North East |
| ERSA | Enroute Supplement Australia |
| FAF | Final Approach Fix |
| FAP | Final Approach Point |
| ft | feet |
| GA | General Aviation |
| GNSS | Global Navigation Satellite System |

| Abbreviation | Meaning |
|--------------|---|
| GP | Glide Path |
| IAS | Indicated Airspeed |
| ICAO | International Civil Aviation Organisation |
| IFR | Instrument Flight Rules |
| IHS | Inner Horizontal Surface, an Obstacle Limitation Surface |
| ILS | Instrument Landing System |
| ISA | International Standard Atmosphere |
| km | kilometres |
| kt | Knot (one nautical mile per hour) |
| LAT | Latitude |
| LLZ | Localizer |
| LONG | Longitude |
| LSALT | Lowest Safe Altitude |
| m | metres |
| MAPt | Missed Approach Point |
| MDA | Minimum Descent Altitude |
| MGA94 | Map Grid Australia 1994 |
| MOC | Minimum Obstacle Clearance |
| MOS | Manual of Standards, published by CASA |
| MSA | Minimum Sector Altitude |
| MVA | Minimum Vector Altitude |
| NDB | Non Directional Beacon |
| NE | North East |
| NM | Nautical Mile (= 1.852 km) |
| nnDME | Distance from the DME (in nautical miles) |
| NNE | North North East |
| NOTAM | NOtice To AirMen |
| OAS | Obstacle Assessment Surface |
| OCA | Obstacle Clearance Altitude |
| OCH | Obstacle Clearance Height |
| OHS | Outer Horizontal Surface |
| OIS | Obstacle Identification Surface |
| OLS | Obstacle Limitation Surface |
| PANS-OPS | Procedures for Air Navigation Services – Aircraft Operations, ICAO Doc 8168 |
| PRM | Precision Runway Monitor |
| PROC | Procedure |
| QNH | An altimeter setting relative to height above mean sea level |
| RAAF | Royal Australian Air Force |
| REF | Reference |
| RL | Relative Level |
| RNAV | aRea NAVigation |
| RNP | Required Navigation Performance |
| RPA | Rules and Practices for Aerodromes — replaced by the MOS Part 139 — Aerodromes |

| Abbreviation | Meaning |
|----------------|--|
| RPT | Regular Public Transport |
| RWY | Runway |
| SFC | Surface |
| SID | Standard Instrument Departure |
| SOC | Start Of Climb |
| STAR | Standard ARrival |
| TAR | Terminal Approach Radar |
| TAS | True AirSpeed |
| THR | Threshold (Runway) |
| TNA | Turn Altitude |
| TODA | Take-Off Distance Available |
| VFR | Visual Flight Rules |
| V _n | aircraft critical Velocity reference |
| VOR | Very high frequency Omni directional Range |
| WAC | World Aeronautical Chart |
| WTG | Wind Turbine Generator |