AERONAUTICAL IMPACT ASSESSMENT

TALLAWARRA B

GAS PEAKING POWER STATION

WOLLONGONG, NSW.

CLOSED CYCLE GAS TURBINE

PLUME INVESTIGATION

J0306

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Client

TRUenergy Tallawarra Pty Ltd

29 March 2010

AMBIDJI
AIR TRANSPORT INNOVATION

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TALLAWARRA B GAS PEAKING POWER STATION
CCGT PLUME ASSESSMENT

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TABLE OF CONTENTS

1. EXECUTIVE SUMMARY

The Ambidji Group Pty Ltd (Ambidji) has been engaged by TRUenergy Tallawarra (TRUenergy) to prepare this aeronautical impact assessment for the proposed Tallawarra B Gas Peaking Power Station, near Wollongong, NSW.

The site of the new power plant (Tallawarra B) is located adjacent to the existing Tallawarra Power Station near Wollongong in NSW. The site coordinates, as advised by TRUenergy, are MGA Zone 56, 298,876E 6177714N. This location is approximately 3.8km north east of the RWY 19 Threshold at Illawarra Regional Airport (Wollongong Aerodrome). Figure 1-1 below shows the location of the development site and its proximity to Wollongong Aerodrome.

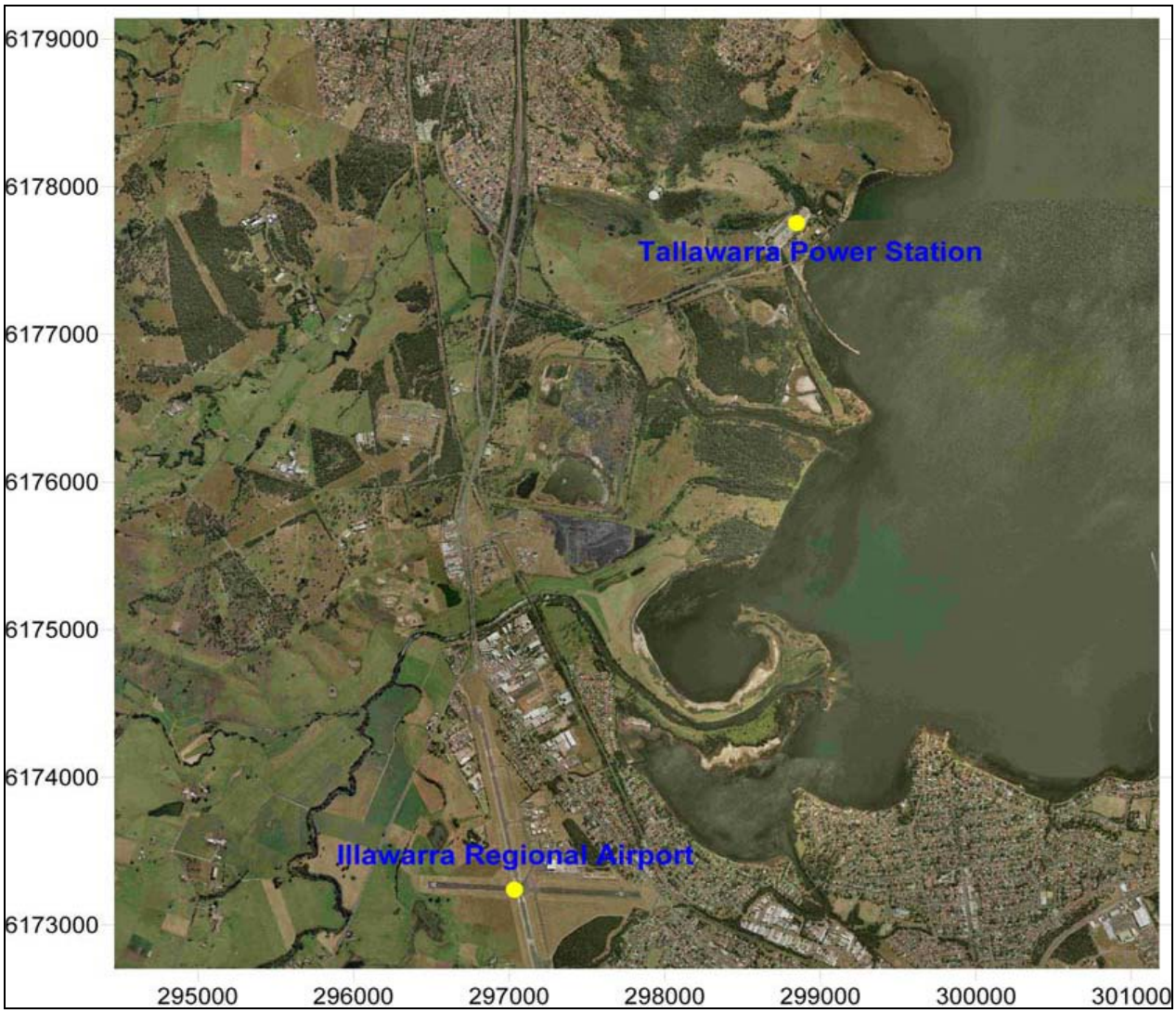

Fig 1-1 Power station location

The proposed Tallawarra B power station development may consist of a Closed Cycle Gas Turbine (CCGT) power station development with one 60 metre exhaust gas stack at a maximum height of 63.1m AHD. The Open Cycle Gas Turbine (OCGT) power station development is subject to a separate report.

The Civil Aviation Safety Authority (CASA) is responsible for the safe conduct of all civilian aviation operations in Australia and they have established that an exhaust plume with a vertical velocity in excess of 4.3metres per second (m/s) may cause damage to an aircraft airframe, or upset an aircraft when flying at low level, typically when conducting the following phases of flight operations:

- Approach, landing and take-off;
- Specialist flying activities such as crop dusting, cattle mustering, pipeline or power-line inspections, fire fighting, etc;
- Search and rescue operations; and
- Military low-level manoeuvres.

The risk posed by an exhaust plume to an aircraft during low level flight can be managed or reduced if information is available to pilots so that they can avoid the area of likely air disturbance. As such CASA requires the proponent of a facility with an exhaust plume which has an average vertical velocity exceeding the limiting value of 4.3m/s at the aerodrome Obstacle Limitation Surface (OLS) or at 110m above ground level anywhere else, to be assessed for the potential hazard to aircraft operations. CASA Advisory Circular AC139-05(0) details the guidelines for conducting plume rise assessments.

The recently built Tallawarra A CCGT gas turbine power station exists on the site with one 60m exhaust stack. CASA was involved in the planning associated with this power station.

A plume rise analysis of the proposed power plant undertaken by SKM in accordance with AC139-05(0) indicates that the proposed power station will generate exhaust gas plumes that will reduce in velocity to 4.3m/s at the altitudes shown in Table 1-1 below.

Site	Maximum Altitude (AHD) at which the Plume reduces to 4.3m/s	Average Altitude (AHD) at which the plume reduces to 4.3m/s	Theoretical 0.1% Exceedence Altitude (AHD) at which plume reduces to 4.3m/s
Tallawarra B CCGT	509.1m/1670ft	98m/321ft	308.1m/1011ft

Table 1-1: Altitudes at which the plume velocity reduces to 4.3m/s

Recent advice from CASA Office of Airspace Regulation have confirmed that the assessment of the affect of the plume is only required to the theoretical height at which the velocity of a plume will be less that 4.3 m/sec for 99.9% of the duration of the plume.

In its current form, the proposed power station development will have an impact upon:

- The OLS surfaces at Wollongong Aerodrome;
- Take-off and Landing operations at Wollongong Aerodrome; and
- Visual Flight Rule (VFR) operations in the vicinity of the power station.

TRUenergy will need to undertake appropriate mitigation action acceptable to the aviation authorities to reduce the risk and hazard to aircraft and airport operations.

1.1 Summarised Results

1.1.1 Obstacle Limitation Surfaces

Protected airspace around airports includes Obstacle Limitation Surfaces that are defined by the International Civil Aviation Organisation (ICAO). Their purpose is to protect aircraft conducting landing and take-off operations from obstacle and hazardous activity intrusions into defined airspace. ICAO Annex 14 defines the OLS.

The existing and the proposed power station plant are located within the Inner Horizontal Surface (IHS) of Wollongong Aerodrome's OLS. The elevation of the IHS is 52m/175ft AHD. The physical characteristics (i.e. the height) of the existing and the proposed CCGT power station exhaust stack penetrate the OLS.

Examination of the plume rise analysis indicates that the proposed power plants will generate an exhaust plume that, at the specified benchmark velocity of 4.3m/s, discharges into the Inner Horizontal Surface.

1.1.2 PANS OPS Surfaces

The physical heights of the existing and proposed 60m CCGT power station exhaust stacks will not penetrate the PANS OPS Surfaces.

The existing and proposed exhaust plume associated with both the CCGT will not discharge above the Instrument Approach Procedure, Minimum Sector and Circling Altitudes at Wollongong, as published in Aeronautical Information Publications (AIP DAP East).

1.1.3 Siting and Clearance Areas for Airways Facilities

The existing and proposed development will not affect the performance of the Non-Directional Beacon (NDB) located on the eastern side of the aerodrome at Wollongong.

1.1.5 Overlying Air Routes

This development proposal lies beneath two air routes, H65 and W430 used by airline traffic to fly into and out of Sydney. Air Route Q15 lies just to the east of these routes and is a high level air route that does not have a LSALT.

The maximum extent of the hazardous portion of the exhaust plume (at 1011ft) for the proposed Tallawarra B CCGT power station will not discharge into the LSALT for these air routes.

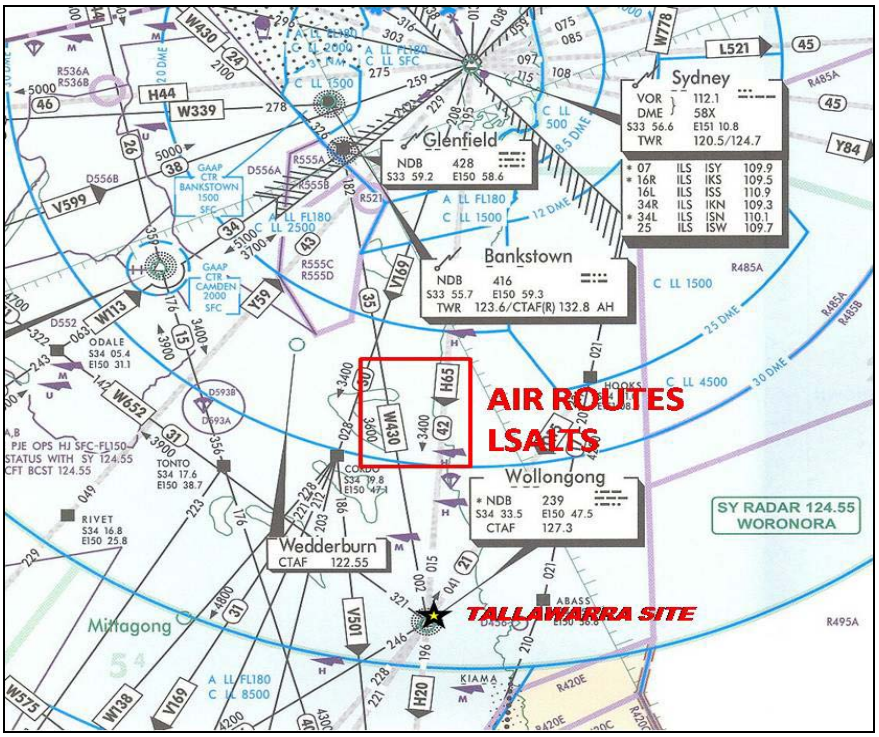

Fig 1-2 Air Routes overlying Wollongong

1.1.6 Local aviation activities

Illawarra Regional Airport (Wollongong Aerodrome) is a security controlled, CASA Certified airport that is owned and operated by Shellharbour City Council. The airport is serviced by regular public transport operations and it is the base for a growing light aeronautics Industry, which provides maintenance and engineering services for aircraft ranging from ultra light to medium size turbo prop and jet aircraft.

The aerodrome is capable of handling jet aircraft of Boeing 737 size and military jets including F/A-18 Hornets although these type of aircraft are occasional visitors.

The area surrounding Wollongong contains many scenic areas that attract light aircraft, helicopter and tourist activities. Such scenic flights are conducted in fair weather which allows pilots to navigate by visual reference to the ground and water.

The Historical Aircraft Restoration Society (HARS) museum, a flying training and charter operation, a business jet charter operation, a Search and Rescue/Aerial Surveillance operation, a Skydiving operation, the NSW Ambulance Helicopter Service, an ultralight flying training and club operation and a helicopter charter operation all currently share the aviation facilities at Wollongong Aerodrome with itinerant visiting aircraft.

As Tallawarra B CCGT plume rise and physical characteristics result in a penetration of the OLS and PANS OPS surfaces, these local aviation activities are likely to be impacted by Tallawarra B operations.

1.1.7 Mitigation of the adverse impact of the exhaust plume

In accordance with AC139-05(0), penetrations of the OLS and PANS OPS surfaces requires the proponent to consult with the aviation authorities in regard to the potential hazards to aircraft safety and to consider mitigation strategies that would enable the development of Tallawarra B to proceed.

Individual and/or combined impact mitigation strategies or options, which are detailed later in this report, include:

- Risk analysis and management of the likelihood of aircraft being affected by the plume, considering the limited amount of time that this plume will penetrate the prescribed airspace;
- Reduction of the theoretical 0.1% exceedence altitude of the 4.3m/s velocity plume;
- Redesign of affected Instrument Approach procedures (PANS OPS) to avoid the proposed development;
- Creation of a Danger Area by CASA;
- Installation of high or medium intensity obstacle lighting to allow VFR aircraft, both civil and military to identify and avoid the site; and
- Consideration of precedent in relation to similar and existing high velocity gas plumes.

1.1.8 Other Approvals

If the proposed power station development is to proceed at the nominated site, cranes to be used during the construction phase will be considered temporary obstructions and will require separate approval from the aviation agencies. Cranes to be used during the construction phase (temporary obstructions) could be approved under condition of the developer providing timely advice to the Aerodrome operator prior to the construction commencing so that appropriate Notice to Airman (NOTAM) action can be promulgated.

2. METHODOLOGY

The methodology employed for the preparation of this report focuses on the consideration and assessment of civil and military aviation protection of airspace and airport operations as outlined in the following:

- Civil Aviation Safety Authority (CASA) Advisory Circular AC139-05(0) – Guidelines for Conducting Plume Rise Assessments;
- The Obstacle Limitation Surfaces (OLS), also referred to as Obstacle Clearance Surface (OCS) by Defence;
- The Procedures for Air Navigation Services – Operations (PANS OPS) surfaces at Wollongong Aerodrome in conjunction with Civil Aviation Safety Regulations (CASR) Part 173 Manual of Standards (MOS);
- The instrument approach procedures contained in the Australian Aeronautical Information Publication (AIP), Departure and Approach Procedures (DAP) East effective 11 March 2010, and current NOTAMS,
- Civil Aviation Safety Regulations (CASR) Part 139 Manual of Standards (MOS), Chapter 7 Obstacle Restriction and Limitation and Chapter 11 Standards for Other Aerodrome Facilities; and
- Consideration of possible mitigation strategies to reduce the potential impacts of the proposed power station on aviation and airport activities with a view to making the proposed development acceptable to the aviation authorities.

The client has provided a revised draft plume rise assessment (refer Appendix A) which provides the necessary data relating to plume height rise, velocity and dispersal that is necessary to undertake the aeronautical impact assessment.

The following aviation assessments and examinations were undertaken:

- Obstacle Limitation Surface infringements were determined accurately, based on the siting information provided by the client;
- Relevant instrument approach procedures were examined in detail to determine whether the development would impose any restriction on those procedures;
- Existing flight paths were examined, in relation to the proposed development, to determine any impacts on those procedures;
- 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 (Contingency Procedures). The 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. The consideration was extended to include

any impediment to these procedures as a result of existing obstacles and possible and feasible flight paths from the airport over the power station development site;

- A preliminary assessment of potential impacts on navigational aids and air traffic control radar coverage; and
- A concise summary of findings and conclusion as to whether the proposal should be approved.

Subject to the findings of this assessment and consideration of mitigation options, this aeronautical impact assessment may form part of an application to CASA, for assessment as to whether or not the plume rise and physical characteristics of Tallawarra B could be deemed acceptable to the aviation authorities, including, if appropriate, classification of the power station and associated plume rise as a hazardous object to civil aviation activities under CASR Part 139. Consideration was also given to development of possible mitigation strategies to reduce the potential impacts with a view to making the proposed development acceptable to the aviation authorities.

3. ANALYSIS OF OBSTACLE LIMITATION SURFACES (OLS)

Protected airspace around airports includes Obstacle Limitation Surfaces that are defined by the International Civil Aviation Organisation (ICAO). Their purpose is to protect aircraft conducting landing and take-off operations from obstacle and hazardous activity intrusions into defined airspace. ICAO Annex 14 defines the OLS.

The existing and the proposed power stations are located within the Inner Horizontal Surface (IHS) of Wollongong Aerodrome's OLS.

The elevation of the IHS is 52m/175ft AHD.

The physical characteristics of the existing and the proposed CCGT power station 60m exhaust stack penetrates the OLS by 4.9m/16ft.

Examination of the plume rise analysis indicates that the proposed CCGT plants will generate a theoretical 0.1% exceedence exhaust plume to 308.1m/1011ft at the specified benchmark velocity of 4.3m/s, which is above the Inner Horizontal Surface of the OLS.

Cranes used during the construction phase that penetrate the OLS (temporary obstructions) will require separate approval from the aviation agencies.

4. ANALYSIS OF PANS OPS SURFACES

Assessment of the impact by the proposed development was undertaken with respect to PANS OPS procedures for Wollongong aerodrome and Wollongong Hospital Helipad. This assessment considered Decision Altitudes, Minimum Descent Altitudes, Circling Minima and Minimum Sector Altitudes and the Obstacle Infringement Surfaces (protection surfaces) as published in:

- Australian Aeronautical Information Publication, Departures and Approach Procedures (AIP DAP) effective 11 March 2010; and
- Associated Aeronautical Information Circulars (AIC), Aeronautical Information Supplements and NOTAMS relevant to current editions of AIP DAP and TERMA current as of 11 March 2010.

A full and detailed PANS OPS assessment considering all operational procedures was undertaken and the results are summarised in the following Tables 4-1 to 4-3 for Wollongong Airport and Tables 4-4 and 4-5 for the Wollongong Hospital Helipad procedures.

WOLLONGONG AERODROME

APPROACH PROCEDURE	IMPACT/COMMENTS
GPS ARRIVAL SECTOR A	The proposed CCGT is located beneath the last step of the Final Approach Segment. The 99.9% extent of the revised CCGT exhaust plume at 1011ft will not discharge above the Minimum Descent Altitude (1730ft).
GPS ARRIVAL SECTOR B	The proposed CCGT is located beneath the last step of the Final Approach Segment. The 99.9% extent of the revised CCGT exhaust plume at 1011ft will not discharge above the Minimum Descent Altitude (1730ft).
RNAV (GNSS) RWY 16	The exhaust plume is located outside of all of the segments for this approach.
RNAV(GNSS) RWY 34	The proposed CCGT is located beneath the final missed approach surface. The 99.9% extent of the revised CCGT exhaust plume at 1011ft will not discharge into the final missed approach surface (1445ft). (Missed Approach PANS OPS surface above the stack = 1445ft)
NDB -A	The proposed CCGT is located beneath the Initial Approach Segment. The 99.9% extent of the revised CCGT exhaust plume at 1011ft will not discharge above the minimum initial approach altitude of 2200ft. Holding at 4300ft is not affected. The exhaust stack is located outside of the protection area for Final Approach.

Table 4-1 Approach Procedures

CIRCLING PROCEDURE	IMPACT/COMMENTS
CAT A/B	The development site is within the CAT A/B Circling Area. The 99.9% extent of the revised CCGT plume at 1011ft will not discharge above the procedure altitude of 1730ft.
CAT C	The development site is also within the CAT C Circling Area. The 99.9% extent of the revised CCGT plume at 1011ft will not discharge above the procedure altitude of 1830ft.

Table 4-2 Circling Areas

The CAT A/B area encompasses an area of 4.9km radius from each THR. The CAT C circling area encompasses the CAT A/B circling area and beyond out to a distance of 7.8km.

CAT A/B aircraft are typically light single engine and twin engine aircraft generally operating with less than 15 people on board.

CAT C aircraft are generally of the Boeing 737, or Airbus A320 size as operated by domestic airlines.

MSA PROCEDURE	IMPACT/COMMENTS
25NM MSA	The 99.9% extent of the revised CCGT exhaust plume at 1011ft will not discharge into the 25nm MSA altitude (3700ft).
10NM MSA	The worst case plume will not discharge into the procedure altitude of 1280m/4300ft.

Table 4-3 Minimum Sector Altitudes

WOLLONGONG HOSPITAL HELIPAD

APPROACH PROCEDURE	IMPACT/COMMENTS
RNAV(GNSS) – 212 (HELICOPTER)	The development site is 6nm from the Hospital Helipad and does not infringe upon the approach splays.

Table 4-4 Approach Procedure

MSA PROCEDURE	IMPACT/COMMENTS
25NM MSA	None of the plumes penetrate the southern sector 4300ft 25NM MSA.
10NM MSA	The 99.9% extent of the CCGT plume at 1011ft will not discharge into the 10NM MSA Altitude of 4000ft.

Table 4-5 Minimum Sector Altitudes

Circling Areas do not exist for helicopter instrument approaches of this type.

The CCGT plume does not infringe upon the PANS OPS surfaces.

The following Figures 4-1 to 4-4 indicate the proximity of the power station to the various PANS OPS surfaces.

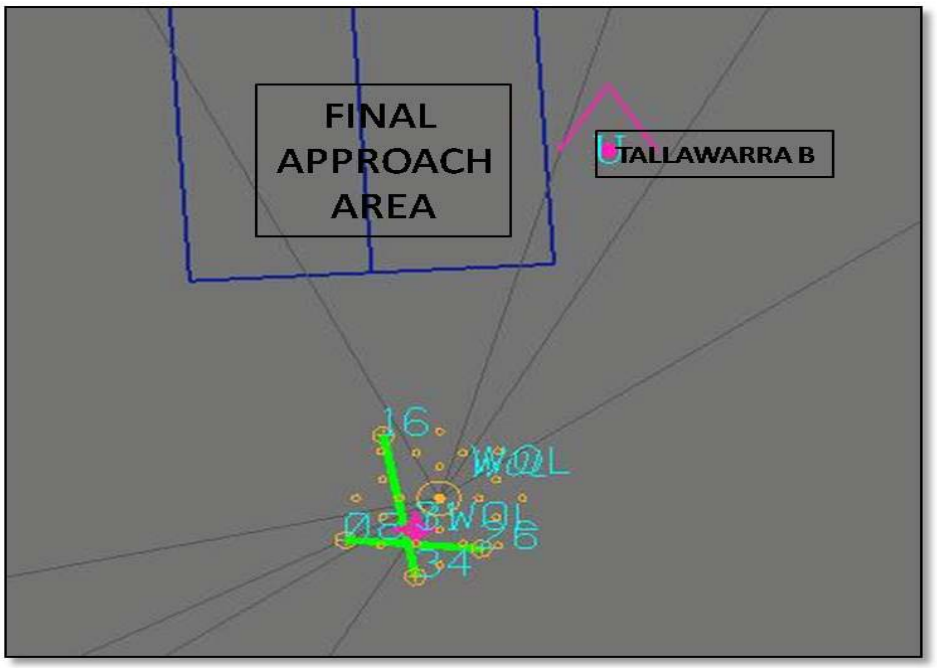

Fig 4-1 Power station location outside of the RWY 16 RNAV final approach PANS OPS protection area

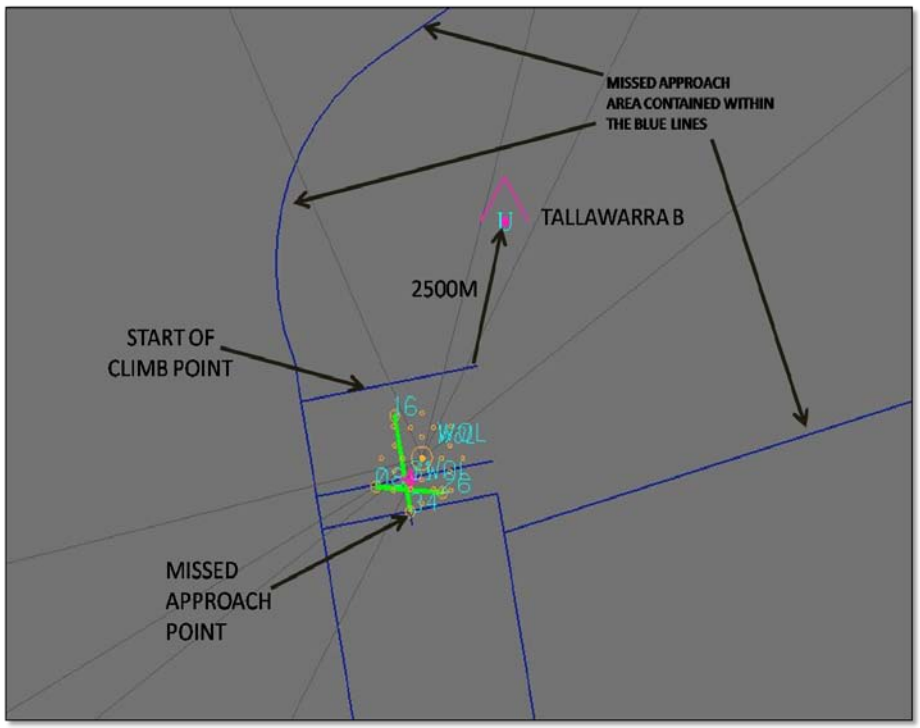

Fig 4-2 Power station location in relation to RWY 34 RNAV Missed Approach PANS OPS protection area

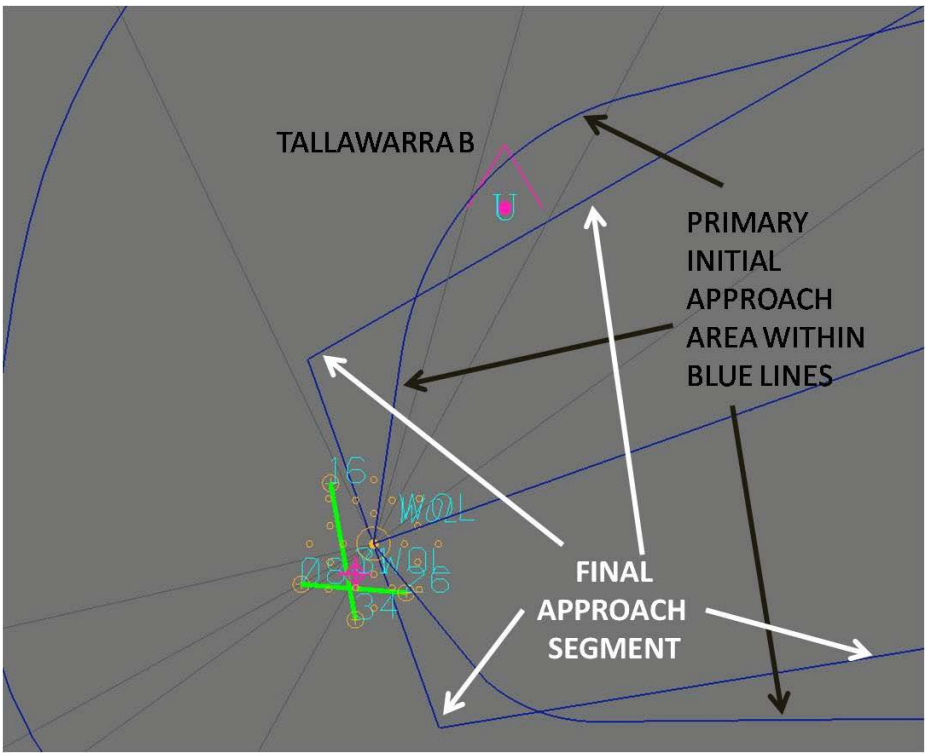

Fig 4-3 Power station development location in relation to NDB A PANS OPS protection areas

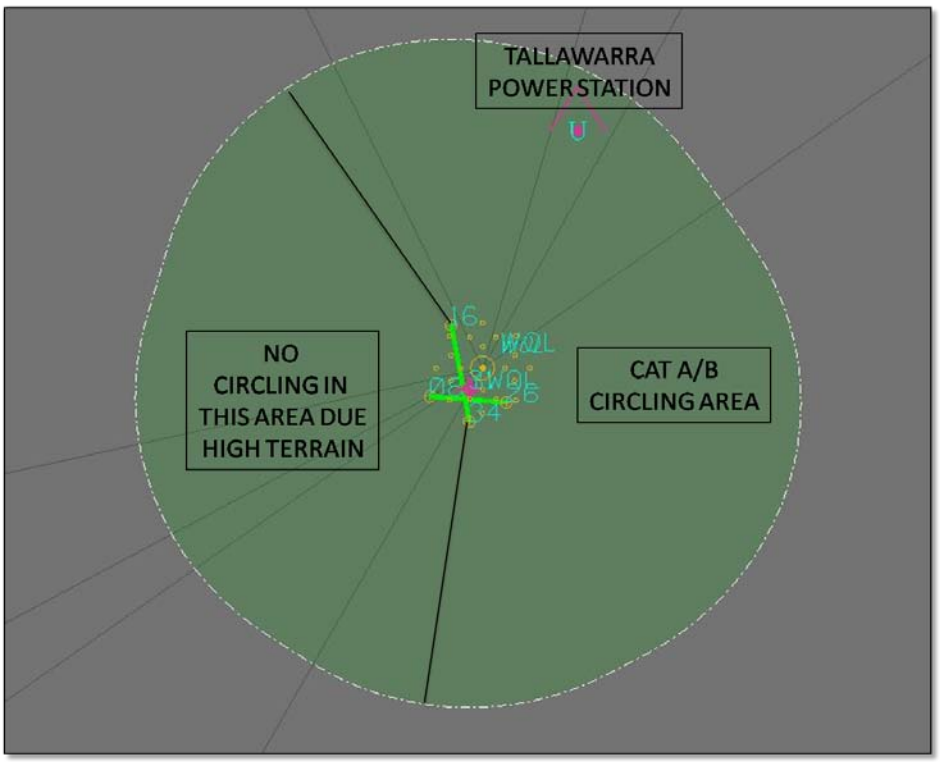

Fig 4-4 Power station location in relation to CAT A/B Circling Area

5. CONTINGENCY PROCEDURES - ENGINE INOPERATIVE FLIGHT PATHS

Multi-engine aircraft suffering from the loss of a critical engine during take-off or climb and those conducting an instrument approach with a critical engine inoperative cannot manoeuvre to the same extent as when all engines are operating normally. Aircraft operating agencies, including military units, plan and implement contingency procedures in relation to the aircraft that they operate.

In the case of Tallawarra B and operations from Wollongong aerodrome, the exhaust plume rise at the proposed development would need to be considered by local aircraft operating companies.

Twin engine aircraft suffering an engine failure shortly after take-off are likely to remain within the published circling area while attempting to return to the runway for an emergency landing. This is likely to bring such aircraft into close proximity with the power station and its high velocity exhaust plume. This aspect will need further consideration by the operators at Wollongong airport.

6. OTHER ISSUES

6.1 Radar Interference and Shadowing

The physical building development for the Tallawarra Power Station does not infringe upon any ATC Radar signal clearance planes.

The exhaust plume is invisible to the radar signal.

6.2 Potential Impact on Airport Navigation Aids

The building and the exhaust plume do not impact upon Radio Navigation Aids at Wollongong aerodrome, or any other navigation aids in the vicinity.

6.3 Future Developments

The increasing population and building development in the Illawarra region is likely to limit any expansion of the airport. Any future plans for additional Instrument Approach Procedures will need to take account of the exhaust plume, should the development be approved.

6.4 Lighting of Buildings

The proposed CCGT power station exhaust stack at 60m is planned at a height that exceeds the OLS. CASA is likely to recommend the installation of appropriate obstruction lighting on the tower in accordance with CASR Part 139 requirements.

Should CASA recommend establishment of a Danger or Restricted Area to identify the existence of the high rise plume, they may also recommend obstacle lighting of the power station stacks to enable pilots to identify the centre of the Danger or Restricted Area.

7. POSSIBLE MITIGATION STRATEGIES OR OPTIONS

The above assessment indicates that the proposed power plant is likely to impact upon the safety of aircraft operations and the project may be unacceptable to the aviation authorities unless appropriate mitigation action can be taken. This section proposes various mitigation strategies or options for consideration by the power plant proponent and for possible discussion with the aviation authorities.

This proposed power station generates an exhaust plume defined as high velocity by CASA.

An extract from the CASA Advisory Circular – AC 139-05(0) of June 2004 states:

*" **4.2** Aviation authorities have established that an exhaust plume with a vertical gust in excess of 4.3 metres/second (m/s) may cause damage to an aircraft airframe, or upset an aircraft when flying at low levels.*

***4.3** Low level flying operations are typically conducted during:*

- *approach, landing and take-off*
- *specialist flying activities such as, crop dusting, cattle mustering, pipeline inspection, power line inspections, fire-fighting, etc*
- *search and rescue operations*
- *military low-level manoeuvres*

***4.4** While approach, landing and take-off are normally conducted in the vicinity of an aerodrome, the other low level operations can be conducted anywhere across the country.*

***4.5** The risk posed by an exhaust plume to an aircraft during low level flight can be managed or reduced if information is available to pilots so that they can avoid the area of likely air disturbance.*

***4.6** As a result of this, CASA requires the proponent of a facility with an exhaust plume, which has an average vertical velocity exceeding the limiting value (4.3 m/s at the aerodrome Obstacle Limitation Surface (OLS) or at 110 metres above ground level anywhere else) to be assessed for the potential hazard to aircraft operations."*

The theoretical 0.1% exceedence level at which the CCGT exhaust plume reduces to a velocity of 4.3m/s occurs at 308.1m/1011ft AHD which is above the OLS but beneath the PANS OPS surfaces and procedure altitudes.

The average height at which the plume vertical velocity reduces to 4.3m/s or below is 98m, which is also above the OLS but beneath all PANS OPS surfaces and procedure altitudes.

The following mitigation strategies or options have been considered. Some will reduce or eliminate the hazard to flight procedures and airport operations. All will need further consideration by the proponent and discussion with the aviation authorities as to reasonableness, acceptability and cost-effectiveness. It is not part of this study to undertake

mitigation studies, but to identify options available to the proponent that may make the proposed power station development more acceptable to the aviation authorities.

7.1 Risk based assessment of the impact of the exhaust plume

Advisory Circular AC 139-05(0) allows for a probability based risk assessment approach by proponents and it is understood that other power plant proponents have undertaken such assessments, taking into account the infrequent operation of the plant, the relatively low duration of operation, the infrequency of the plume achieving the maximum height, the probability of aircraft being in the vicinity of the worst-case plume rise and other factors that may reduce the risk to an acceptable level.

7.2 Reduction of the maximum height that the plume exceeds 4.3m/s

Control of the exhaust plume to limit the velocity of the plume as it exits the stack will reduce the height that the plume exceeds the critical velocity of 4.3m/s. (It is understood that reduction of plume height may be a limited option for peaking power plant operations.)

The critical PANS OPS surfaces are not infringed and the Wollongong OLS infringement may be acceptable to the aerodrome operator and to CASA.

7.3 Consideration of precedent in relation to similar gas peaking power stations

There are insufficient numbers of these types of power stations operating in close proximity to airfields to provide precedent determinations in respect of the approval of operating requirements for such plants.

7.4 Display of the location on Aeronautical Charts (Declaration or a 'Danger Area')

Regardless of the approved height for the operation of this proposed power station, display of the location of the power station on Aeronautical Charts (e.g. as a Danger Area) provides advice to pilots of an "obstacle" and assists pilots to avoid the area.

7.5 Mitigation conclusions

The mitigation options considered in this report will not completely eliminate the penetrations of OLS.

A risk based analysis and report of the real impact of the vertical extent of the hazardous component of the exhaust plume, taking into consideration the extremely low likelihood of an aircraft entering the plume at a time when worst-case plume height velocities prevail, may provide support for the approval of the operation of the proposed power station at the nominated site and altitudes.

8. CONCLUSION

The high velocity exhaust plume associated with the proposed Tallawarra B gas peaking power station development is considered to create a potential hazard to the safety of aviation procedures and activities at Wollongong aerodrome.

The major findings of this assessment are:

- The physical characteristics of the proposed CCGT plant option will penetrate the OLS at Wollongong Airport;
- The theoretical 0.1% exceedence height of the exhaust plume for the proposed CCGT plant will not discharge into PANS OPS procedures at Wollongong airport;
- The theoretical 0.1% exceedence height of the exhaust plume for the exhaust plume for the CCGT plant options will discharge above the Obstacle Limitation Surfaces of Wollongong airport; and
- The exhaust plume for the revised CCGT plant options will not exist above air routes to the north of Wollongong airport.

Some of the mitigations explored will reduce or eliminate the hazard to flight procedures and airport operations. All will need further consideration by the proponent and discussion with the aviation authorities as to their reasonableness, acceptability and cost-effectiveness.

A risk based analysis and report of the real impact of the vertical extent of the hazardous component of the exhaust plume, taking into consideration the extremely low likelihood of an aircraft entering the plume at a time when the theoretical 0.1% exceedence plume height velocities prevail, may provide support for the approval of the operation of the proposed power station at the nominated site.

To meet the requirements of CASA AC 139-05(0), the Tallawarra B power station proposal requires consultation and discussion with the aviation authorities to consider the potential hazards to aircraft safety and to agree on an acceptable mitigation strategy.

APPENDIX A

TALLAWARRA B
GAS PEAKING POWER STATION DEVELOPMENT

CLOSED CIRCUIT GAS TURBINE
PLUME RISE ASSESSMENT

SKM

APPENDIX B

GLOSSARY OF TERMS and ABBREVIATIONS

APPENDIX B

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
ADF	Australian Defence Force
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
DACR	Defence (Area Control) Regulations
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

Abbreviation	Meaning
FT/ft	feet
GA	General Aviation
GNSS	Global Navigation Satellite System
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/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
OCS	Obstacle Clearance Surface
OCH	Obstacle Clearance Height
OHS	Outer Horizontal Surface
OIS	Obstacle Identification Surface
OLS	Obstacle Limitation Surface
PANS-OPS	Procedures for Air Navigation Services – Operations, ICAO Doc 8168
PRM	Precision Runway Monitor

Abbreviation	Meaning
PROC	Procedure
QNH	An altimeter setting relative to height above mean sea level
REF	Reference
RL	Relative Level
RNAV	aRea NAVigation
RNP	Required Navigation Performance
RPA	Rules and Practices for Aerodromes — replaced by the MOS Part 139 — Aerodromes
RPT	Regular Public Transport
RWY	Runway
SACL	Sydney Airport Corporation Limited
SFC	Surface
SID	Standard Instrument Departure
SOC	Start Of Climb
STAR	Standard ARrival
TACAN	UHF Tactical Air Navigation Aid
TAPM	The Air Pollution Model (A CSIRO model for the assessment of exhaust plumes.)
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