FINAL REPORT

INITIAL HEIGHT ASSESSMENT

PROPOSED DEVELOPMENT

AT

112 TALAVERA ROAD, MACQUARIE PARK, NSW

LB00059

MERITON

9 November 2017

AMBIDJI

The Ambidji Group
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THE AMBIDJI GROUP

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1. INTRODUCTION

The Ambidji Group Pty Ltd has been tasked by the Meriton Group to make an initial assessment of the aeronautical height limitations for the proposed building development at 112 Talavera Road, Macquarie Park NSW. The development location is shown in Figure 3.1 on Page 2.

The methodology employed for the preparation of this report focuses on the consideration of the key elements of:

- the Airports Act 1996 (Part 12, Protection of airspace around airports);
- the Airports (Protection of Airspace) Regulations 1996;
- Civil Aviation (Building Control) Regulations 1988; and
- Civil Aviation Safety Regulations (CASR) Part 139 Manual of Standards (MOS), Chapter 7 Obstacle Restriction and Limitation, Chapter 9 Obstacle Lighting and Chapter 11 Standards for Other Aerodrome Facilities.

This assessment considers the following:

- The Prescribed Airspaces for Sydney and Bankstown Aerodromes, including:
  - Obstacle Limitation Surfaces (OLS);
  - Procedures for Air Navigation Services – Aircraft Operations (PANS-OPS) surfaces;
  - Radar Terrain Clearance Chart (RTCC) surfaces;
  - Obstacle Lighting requirements;
- The protection areas and planes for Navigation Aids, Communication Facilities and Air Traffic Services Airspace Surveillance Systems in the Sydney area; and
- Roof top exhaust plume rises.

Note that the proposed Western Sydney Airport is 35.3 km from the development site, and OLS and PANS-OPS surfaces for this airport were not considered for this report as these surfaces are not expected to extend as far as the development site. The RAAF Base Richmond is 37.26 km from the site and was also not considered in the report.

The site layout drawing is shown in Appendix A, and a glossary of aviation terms and abbreviations is shown in Appendix B.

The current proposal as at the date of this initial assessment is for a building maximum height of 200 m AHD.

2. SUMMARISED RESULTS

This Initial Height Assessment shows that the limiting heights (AHD) over the development site are:

Sydney PANS-OPS Surface: 246.8 m AHD

Requests to penetrate PANS-OPS surfaces are normally not approved.

Radar Terrain Clearance Chart (RTCC) Surface: 244 m AHD

Requests to penetrate RTCC surfaces are normally not approved.

Sydney Terminal Airspace Radar (TAR) Clearance Plane: 214.7 m AHD

If proposed building heights exceed 214.7 m AHD, this will be referred to Airservices Australia which will determine if there will be any impact on the performance of the TAR. Numerous buildings in the Sydney area already penetrate the radar clearance plane, and it is not expected that the proposed building will have any additional impact on radar performance.

The proposed development will not impact on the performance of Navigation Aids, Radars and Communication Facilities in the Sydney area airports and airspace.

Roof top exhaust plumes in excess of 4.3 m/s must be referred to CASA to determine if there is any hazard to aircraft operations.

Building and Crane Height Limitation

The RTCC surface height of 244 m AHD is the limiting height over the development site. The building height (including roof top plant and equipment) will need to be adjusted by subtracting the construction crane height above the building from the 244 m height limitation.

Summary

The current proposal for a building maximum height of 200 m AHD will not infringe the prescribed airspace of Sydney and Bankstown airports.

3. DEVELOPMENT SITE LOCATION

The development site is located 19.72 km north of the Sydney Airport Aerodrome Reference Point (ARP), and 20.68 km north east of the Bankstown Aerodrome ARP. Figure 3.1 shows the site in relation to the ARPs.

Figure 3.1 Development Site in relation to Sydney and Bankstown Aerodromes

4. ANALYSIS OF OBSTACLE LIMITATION SURFACES (OLS)

The object of the OLS is to define a volume of airspace in proximity to the airport which should be kept free of obstacles that may endanger aircraft in visual operations, or during the visual stages of an instrument approach. The intention is not to restrict or prohibit all obstacles, but to ensure that either existing or potential obstacles are examined for their impact on aircraft operations and that their presence is properly taken into account.

Since these are relevant to visual operations, it may sometimes be sufficient to ensure that the obstacle is conspicuous to pilots, and this may require that they be marked or lit.

Analysis of the proposed development in relation to the OLS and any relief that may be provided by shielding of the development by existing obstacles has been undertaken with reference to APARs and CASR Part 139 Manual of Standards.

OLS ANALYSIS

SYDNEY AERODROME

Figure 4.1 shows the OLS for Sydney Airport and shows that the development site is beyond the Outer Horizontal and the RWY 16 L&R and RWY 34 L&R Approach Take-off Climb surfaces.

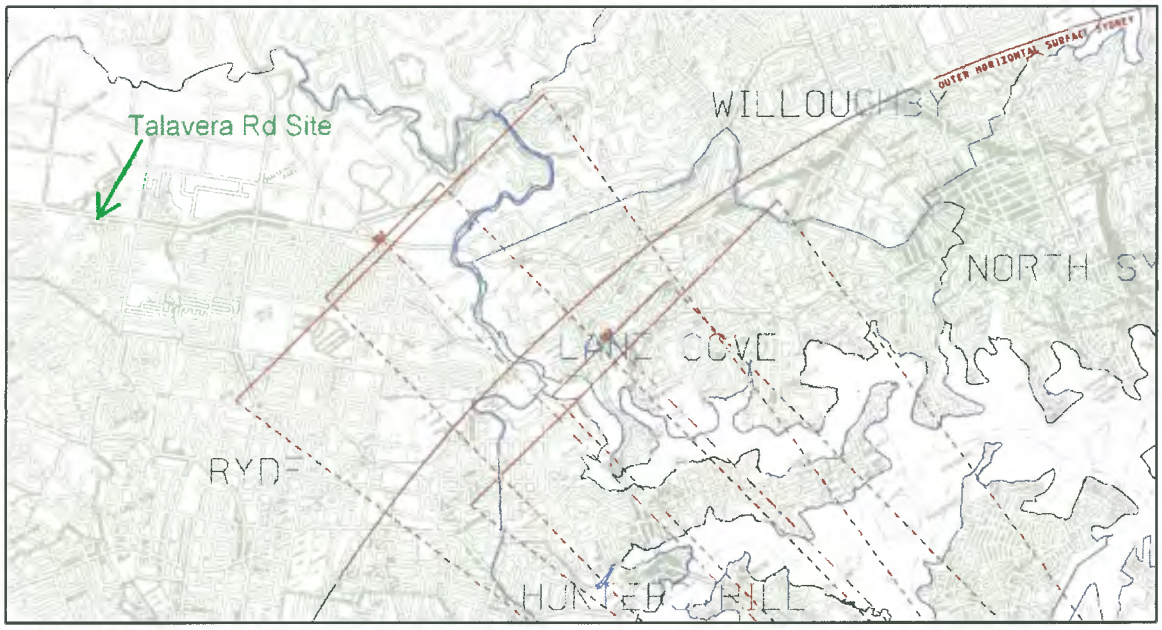


Fig 4.1: Sydney Aerodrome - Obstacle Limitation Surfaces (Source: SACL)

BANKSTOWN AERODROME

Figure 4.2 shows the OLS for Bankstown Airport and shows that the development site is 5.68 km beyond the boundary of the Outer Horizontal Surface.

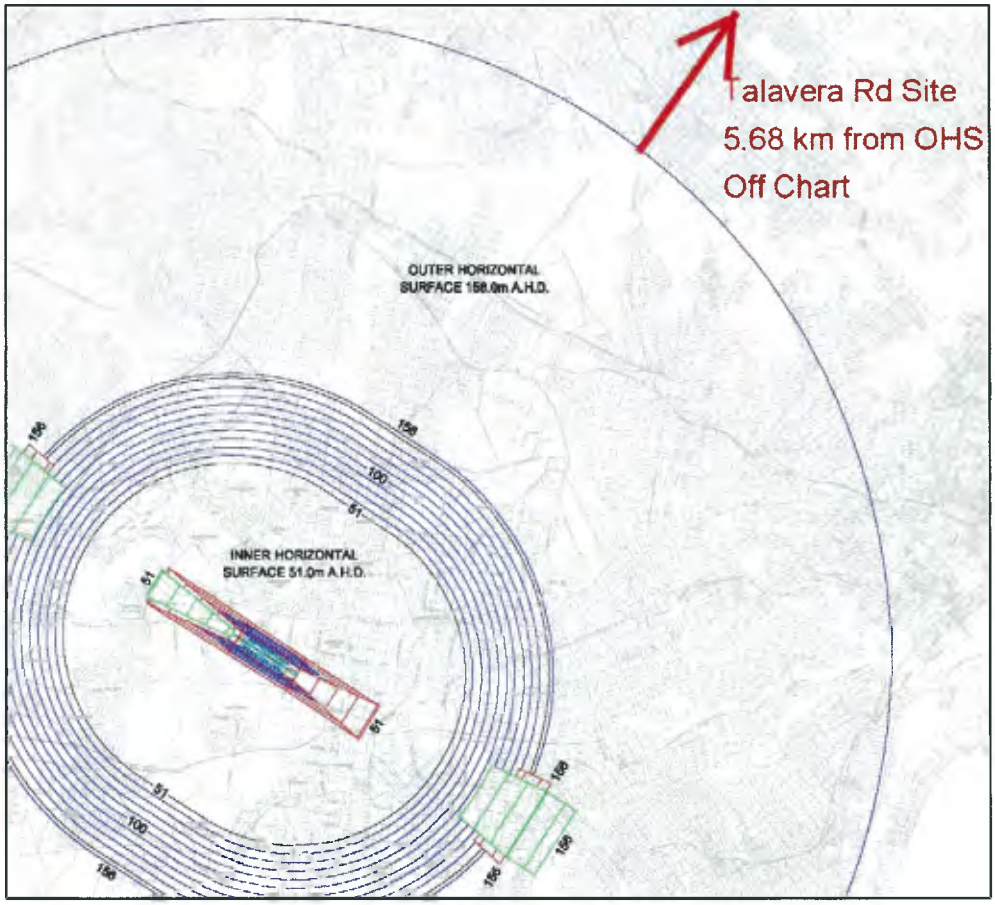


Fig 4.2 Bankstown Aerodrome - Obstacle Limitation Surfaces (Source: Bankstown Master Plan)

OLS SUMMARY

The site is clear of the OLS for all airports in the Sydney area.

5. ANALYSIS OF PANS OPS SURFACES

This analysis considers the PANS OPS surfaces of Sydney and Bankstown Aerodromes.

PANS OPS surfaces detail essential areas and obstacle clearance requirements for the achievement of safe, regular instrument flight operations. The instrument flight procedures enable pilots to either descend from the high en-route environment of cruise type flight to establish visual contact with the landing runway, or climb from the runway to the en-route environment, with a prescribed safe margin above terrain and obstacles, by use of aircraft instruments and radio navigation aids or GNSS in conditions where the pilot cannot maintain visual contact with the terrain and obstacles due to inclement weather conditions.

SYDNEY PANS-OPS

The Sydney PANS-OPS surfaces in the vicinity of the development site are shown in Figure 5.1 below. This drawing is based on the SACL PANS-OPS surfaces chart. The development site location is also shown. Elevations are in metres AHD or AMSL.

The PANS-OPS surface over the site is 246.8 m AHD, and requests to penetrate this surface are normally not approved.

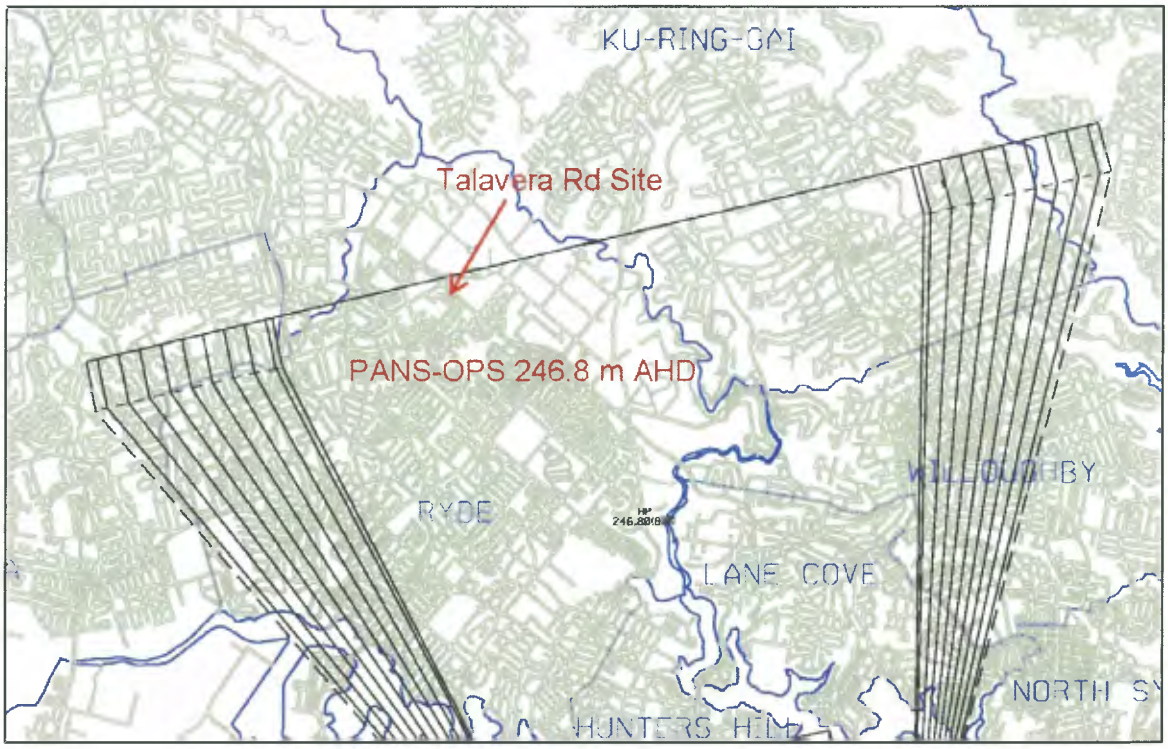


Figure 5.1 Sydney PANS OPS Surfaces (Source: SACL)

BANKSTOWN PANS-OPS

The Bankstown PANS OPS surfaces in Figure 5.2 below. This drawing is based on the Bankstown Master Plan PANS-OPS surfaces chart. The development site location is also shown. Elevations are in metres AHD or AMSL.

The development site is well clear of the Bankstown PANS-OPS surfaces.

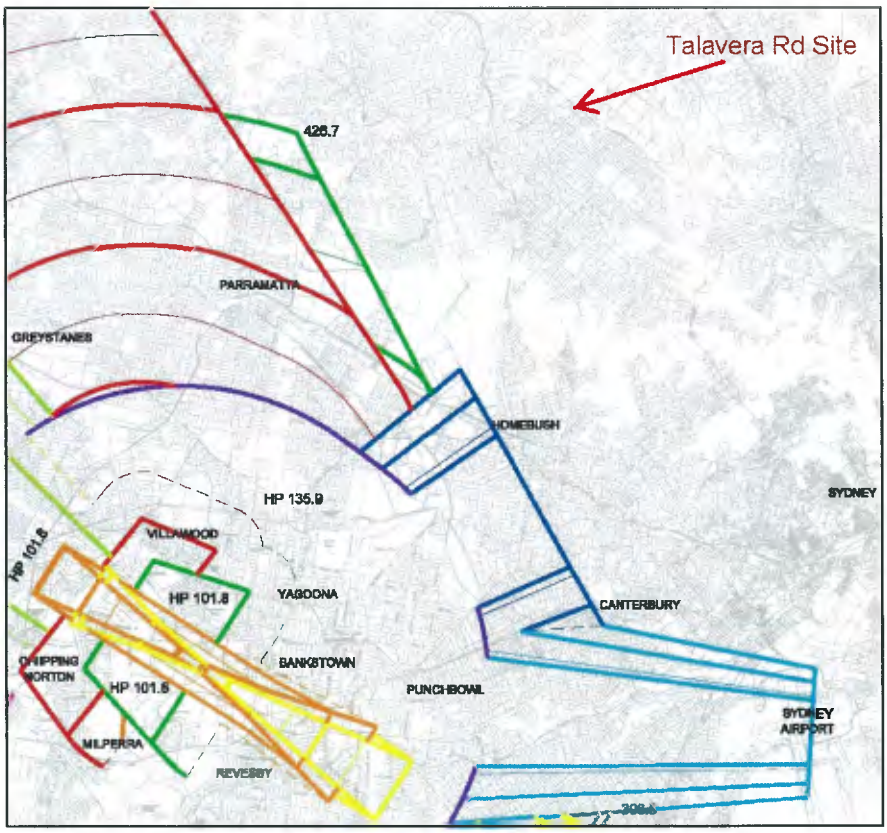


Figure 5.2 Bankstown PANS OPS Surfaces (Source: Bankstown Airport Master Plan)

6. RADAR TERRAIN CLEARANCE CHART (RTCC)

RTCCs are shown on Air Traffic Controller (ATC) Workstation displays, and are used by controllers to assign altitudes which provide terrain and obstacle clearance in depicted areas when radar vectoring aircraft. RTCC assignable altitudes provide 1000 ft Minimum Obstacle Clearance (MOC) within 3 nm of the aircraft position, and are displayed in hundreds of feet.

Note that altitudes used by controllers and pilots are in feet (ft) and distances are in Nautical Miles (nm).

Figure 6.1 is based on the RTCC chart published by SACL, and shows the RTCC surfaces in the vicinity of the development site and the site location.

The RTCC surface over the site is 244 m AHD, and requests to penetrate this surface are normally not approved.

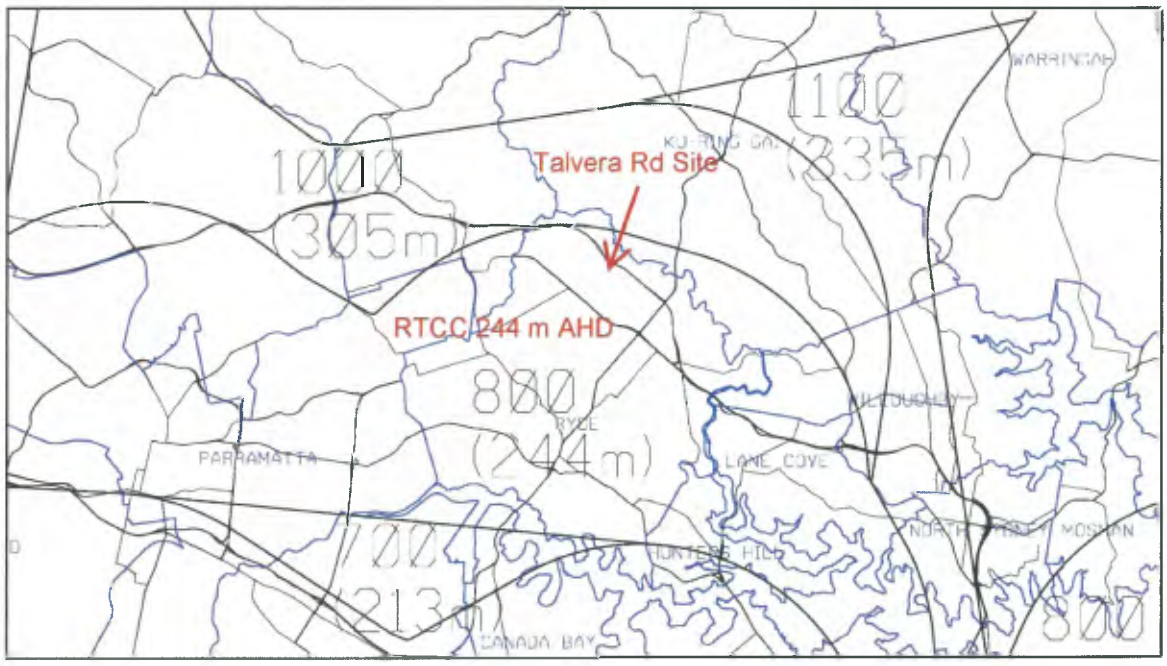


Figure 6.1 RTCC Chart and the development site

7. RADAR INTERFERENCE AND SHADOWING

The proposed development is located 20.22 km from the Terminal Area Radar (TAR) site on Sydney Airport. CASR Part 139 MOS establishes the clearance requirements for high rise structures within the vicinity of air traffic control radars.

The TAR clearance plane at the proposed development site occurs at an elevation of 214.7 m AHD. Any building development height above 214.7 m AHD will infringe the 0.5 degree elevation clearance.

Existing buildings in the Sydney area already infringe this clearance plane, and these buildings may also have an impact on the performance of the TAR. Airservices Australia would need to evaluate any additional impact of the proposed development upon the ATC radar performance in the Sydney Area.

Another TAR is located at Cecil Park at an antenna elevation of 200.5 m AHD, 28.9 km to the south west of the development site. The clearance plane from this radar is 452.5 m AHD, and will pass well over any permitted building height at the site.

8. POTENTIAL IMPACT ON AIRPORT NAVIGATION AIDS

The Building Restricted Area (BRA) for the GBAS installation is within 3000 m of the GBAS, all other BRAs are less than 3000 m.

As the site is 21900 m from the Sydney Airport GBAS site, and the site is 20000 m from the nearest Bankstown Airport boundary, the BRAs for all airport navigation aids will not be impacted.

9. OBSTACLE LIGHTING REQUIREMENTS

Obstacles that are located outside of the OLS and that are higher than 110 metres AGL are required, in accordance with CASR Part 139, Chapter 9, to be provided with obstacle lighting unless it is of no operational significance.

Police, ambulance and other helicopter operations occur in the vicinity of the site both by day and night. As the buildings will be the only significant high rise building in the area, and are above 110 metres AGL, then it would be considered to be operationally significant. Early warning of the building's presence to pilots is required.

Obstacle lighting needs to be considered for building D and building B.

Please refer to Section 9.4 of the CASR MOS Part 139 for details of the lighting requirements.

10. ATC COMMUNICATION FACILITIES

Reliable VHF communications require a clear line of sight path between the base station and aircraft using the facilities.

The Sydney and Bankstown Tower and Approach Control VHF communications antenna are located on the respective control tower roofs and at high elevation remote locations in the Sydney basin.

The proposed development is unlikely to impact upon ATC communication facilities in the area.

11. DEPARTMENT OF DEFENCE REQUIREMENTS

The nearest Department of Defence airport is RAAF Base Richmond. Due to its distance from the proposed development site (approximately 37.26 km), it is unlikely to impact on Defence operations. Nevertheless, due to the height of the proposed development, the developer is required to advise the Department in accordance with CASA AC139-08(0) for the Reporting of Tall Structures. This will enable inclusion of the development in the Aeronautical Information Service Tall Structure data base.

12. ROOF TOP EXHAUST PLUMES

Any roof top exhaust plume rises in excess of 4.3 m/s will be referred to CASA for their assessment of risk to aircraft operations. CASA may require the effective building height to be increased to the height where the plume rises falls below 4.3 m/s

13. CONCLUSION

1. The airspace limiting heights at the 112 Talavera Road, Macquarie Park site are:

   Sydney PANS-OPS Surface: 246.8 m AHD

   Requests to penetrate PANS-OPS surfaces are normally not approved.

   Radar Terrain Clearance Chart (RTCC) Surface: 244 m AHD

   Requests to penetrate RTCC surfaces are normally not approved.

   Sydney Terminal Airspace Radar (TAR) Clearance Plane: 214.7 m AHD

   The current building maximum height of 200 m AHD will not infringe this clearance plane. Airservices Australia may require an analysis to be undertaken to determine any potential impact on radar coverage should the construction crane(s) exceed this clearance plane height of 214.7 m AHD.

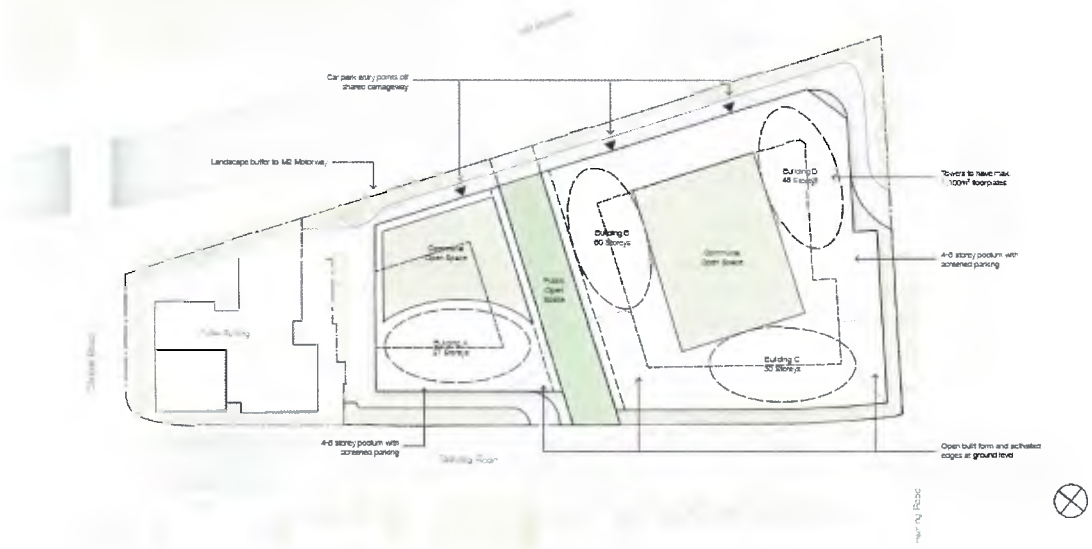
2. This Initial Height Assessment concludes that the current proposed building maximum height of 200 m AHD will not infringe prescribed airspace. Consideration of the construction crane(s) will be required when details are known.

APPENDIX A

SITE LAYOUT DRAWING

Design Scheme

4.1 Illustrative Master Plan



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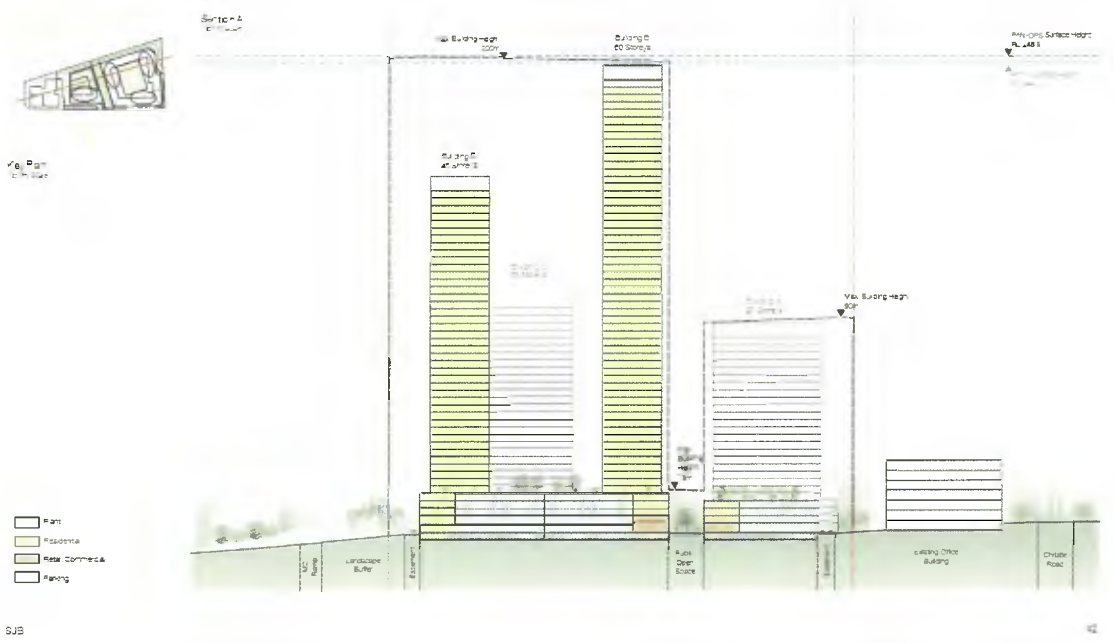
Design Scheme

4.2 Section A



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Appendix

APENDIX B

GLOSSARY OF AERONAUTICAL TERMS AND ABBREVIATIONS

To facilitate the understanding of aviation terminology used in this report, the following is a glossary of terms and acronyms that are commonly used in aeronautical impact assessments and similar aeronautical studies.

AC (Advisory Circulars) are issued by CASA and are intended to provide recommendations and guidance to illustrate a means, but not necessarily the only means, of complying with the *Regulations*.

Aeronautical study is a tool used to review aerodrome and airspace processes and procedures to ensure that safety criteria are appropriate.

AIPs (Aeronautical Information Publications) are publications promulgated to provide operators with aeronautical information of a lasting character essential to air navigation. They contain details of regulations, procedures and other information pertinent to flying and operation of aircraft. In Australia, AIPs may be issued by CASA or Airservices Australia.

Air routes exist between navigation aid equipped aerodromes or waypoints to facilitate the regular and safe flow of aircraft operating under IFR.

Airservices Australia is the Australian government-owned corporation providing safe and environmentally sound air traffic management and related airside services to the aviation industry.

Altitude is the vertical distance of a level, a point or an object, considered as a point, measured from mean sea level.

ATC (Air Traffic Control) service is a service provided for the purpose of:

a. preventing collisions:

    1. between aircraft; and

    2. between aircraft and obstructions on the manoeuvring areas of controlled aerodromes; and

b. expediting and maintaining an orderly flow of air traffic.

CASA (Civil Aviation Safety Authority) is the Australian government authority responsible under the *Civil Aviation Act 1988* for developing and promulgating appropriate, clear and concise aviation safety standards. As Australia is a signatory to the ICAO *Chicago Convention,* CASA adopts the standards and recommended practices established by ICAO, except where a difference has been notified.

CASR (Civil Aviation Safety Regulations) are promulgated by CASA and establish the regulatory framework *(Regulations)* within which all service providers must operate.

Civil Aviation Act 1988 (the Act) establishes the CASA with functions relating to civil aviation, in particular the safety of civil aviation and for related purposes.

ICAO (International Civil Aviation Organization) is an agency of the United Nations which codifies the principles and techniques of international air navigation and fosters the planning and development of international air transport to ensure safe and orderly growth. The ICAO Council adopts standards and recommended practices concerning air navigation, its infrastructure, flight inspection, prevention of unlawful interference, and facilitation of border-crossing procedures for international civil aviation. In addition, the ICAO defines the protocols for air accident investigation followed by transport safety authorities in countries signatory to the Convention on International Civil Aviation, commonly known as the Chi*cago Convention*. Australia is a signatory to the *Chicago Convention.*

IFR (Instrument Flight Rules) are rules applicable to the conduct of flight under IMC. IFR are established to govern flight under conditions in which flight by outside visual reference is not safe. IFR flight depends upon flying by reference to instruments in the flight deck, and navigation is accomplished by reference to electronic signals. It is also referred to as, "a term used by pilots and controllers to indicate the type of flight plan an aircraft is flying," such as an IFR or VFR flight plan.

IMC (Instrument Meteorological Conditions) are meteorological conditions expressed in terms of visibility, distance from cloud and ceiling, less than the minimum specified for visual meteorological conditions.

LSALT (Lowest Safe Altitudes) are published for each low level air route segment. Their purpose is to allow pilots of aircraft that suffer a system failure to descend to the LSALT to ensure terrain or obstacle clearance in IMC where the pilot cannot see the terrain or obstacles due to cloud or poor visibility conditions. It is an altitude that is at least 1,000 feet above any obstacle or terrain within a defined safety buffer region around a particular route that a pilot might fly.

MOS (Manual of Standards) comprises specifications *(Standards)* prescribed by CASA, of uniform application, determined to be necessary for the safety of air navigation.

NOTAMs (Notices to Airmen) are notices issued by the NOTAM office containing information or instruction concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to persons concerned with flight operations.

Obstacles. All fixed (whether temporary or permanent) and mobile objects, or parts thereof, that are located on an area intended for the surface movement of aircraft or that extend above a defined surface intended to protect aircraft in flight.

OLS (Obstacle Limitation Surfaces) are a series of planes associated with each runway at an aerodrome that defines the desirable limits to which objects may project into the airspace around the aerodrome so that aircraft operations may be conducted safely.

PANS-OPS (Procedures for Air Navigation Services - Aircraft Operations) is an Air Traffic Control term denominating rules for designing instrument approach and departure procedures. Such procedures are used to allow aircraft to land and take off under Instrument Meteorological Conditions (IMC) using the Instrument Flight Rules (IFR). ICAO document 8168-OPS/611 (volumes 1 and 2) outlines the principles for airspace protection and procedure design which all ICAO signatory states must adhere to. The regulatory material surrounding PANS-OPS may vary from country to country.

PANS OPS Surfaces. Similar to an Obstacle Limitation Surface, the PANS-OPS protection surfaces are imaginary surfaces in space which guarantee the aircraft a certain minimum obstacle clearance. These surfaces may be used as a tool for local governments in assessing building development. Where buildings may (under certain circumstances) be permitted to penetrate the

OLS, they cannot be permitted to penetrate any PANS-OPS surface, because the purpose of these surfaces is to guarantee pilots operating under IMC an obstacle free descent path for a given approach.

Prescribed airspace is an airspace specified in, or ascertained in accordance with, the Regulations, where it is in the interests of the safety, efficiency or regularity of existing or future air transport operations into or out of an airport for the airspace to be protected. The prescribed airspace for an airport is the airspace above any part of either an OLS or a PANS OPS surface for the airport and airspace declared in a declaration relating to the airport.

Regulations (Civil Aviation Safety Regulations)

VFR (Visual Flight Rules) are rules applicable to the conduct of flight under VMC. VFR allow a pilot to operate an aircraft in weather conditions generally clear enough to allow the pilot to maintain visual contact with the terrain and to see where the aircraft is going. Specifically, the weather must be better than basic VFR weather minima. If the weather is worse than VFR minima, pilots are required to use instrument flight rules.

VMC (Visual Meteorological Conditions) are meteorological conditions expressed in terms of visibility, distance from cloud and ceiling, equal or better than specified minima.

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 Mean Sea Level
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
BRA	Building Restricted Area
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
DIRD	Department of Infrastructure and Regional Development. (Formerly Dept. of Infrastructure, Transport, Regional Development and Local Government and Department of Transport and Regional Services (DoTARS))
ELEV	Elevation (above mean sea level)
ENE	East North East
ERSA	Enroute Supplement Australia
FAF	Final Approach Fix
FAP	Final Approach Point
ft	feet
FATO	Final Approach and Take-Off Area (Helicopters)
GBAS	Ground Based Augmentation System (satellite precision landing system)
GNSS	Global Navigation Satellite System

Abbreviation	Meaning
GP	Glide Path
IAS	Indicated Airspeed
ICAO	International Civil Aviation Organisation
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
LOC	Localizer
LONG	Longitude
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
NASAG	National Airports Safeguarding Advisory Group
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, an Obstacle Limitation Surface
OIS	Obstacle Identification Surface
OLS	Obstacle Limitation Surface
PANS-OPS	Procedures for Air Navigation Services – Operations, ICAO Doc 8168
PBN	Performance Based Navigation
PRM	Precision Runway Monitor
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
RTCC	Radar Terrain Clearance Chart

Abbreviation	Meaning
RWY	Runway
SACL	Sydney Airport Corporation Limited
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
TLOF	Touchdown and Lift Off Area (Helicopters)
TODA	Take-Off Distance Available
V_n	aircraft critical Velocity reference
VOR	Very high frequency Omni directional Range
WAC	World Aeronautical Chart