



Preliminary Height Assessment
260-300 Church St Parramatta NSW
28 September 2017

For

JHJ Group Pty Ltd

**Preliminary Height Assessment**
286-300 Church St Parramatta

Landrum & Brown Worldwide (Aust) Pty Ltd, 2017

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1. Introduction

Landrum and Brown has been tasked by JHJ Group Pty Ltd to prepare a Preliminary Height Assessment (PHA) for the proposed building development at 286-300 Church St Parramatta NSW. The following items were considered in the preparation of the PHA:

- Consideration of relevant Acts and Regulations applicable to developments in the vicinity of airports and air traffic routes. The major relevant documents include: The *Airports Act 1996*, *Airports (Protection of Airspace) Regulations 1996* and *CASR Part 139 Manual of Standards - Aerodromes*.
- Analysis of Obstacle Limitation Surfaces (OLS);
- Analysis of Procedures for Air Navigation Services – Aircraft Operations (PANS-OPS);
- Radar Terrain Clearance Charts (RTCC);
- Impacts on Navigation Aids, communications and Airspace Surveillance facilities; and
- Roof Top Exhaust Plumes.

Note that the proposed Western Sydney Airport is 24 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 site. The RAAF Base Richmond is 32 km from the site and was also not considered in the report.

Details of Aerodromes, Navigation Aids, Surveillance Sensors and Airspace were obtained from the Australian Information Publications (AIP), Airservices Australia (AsA) sources and Civil Aviation Safety Authority (CASA) publications.

A Glossary of Aeronautical terms and Abbreviations is shown at Appendix A.

2. Proposed Development Location

The 286-300 Church St site location in relation to the local area is shown in Figure 2.1.



Figure 2.1 286 – 300 Church St site and local area



3. Nearby Airports and Helicopter Landing Sites (HLS)

The Aerodrome Reference Points (ARPs) for Sydney and Bankstown Airports, and the Westmead Hospital HLS are the following distances from the development site:

- Sydney (YSSY): 21.83 km to the south east;
- Bankstown (YSBK): 12.49 km to the south; and
- Westmead HLS (YWST): 1.71 km to the north west.

Figure 3.1 shows the location of the YSSY and YSBK ARPs and the YWST HLS relative to the development site.

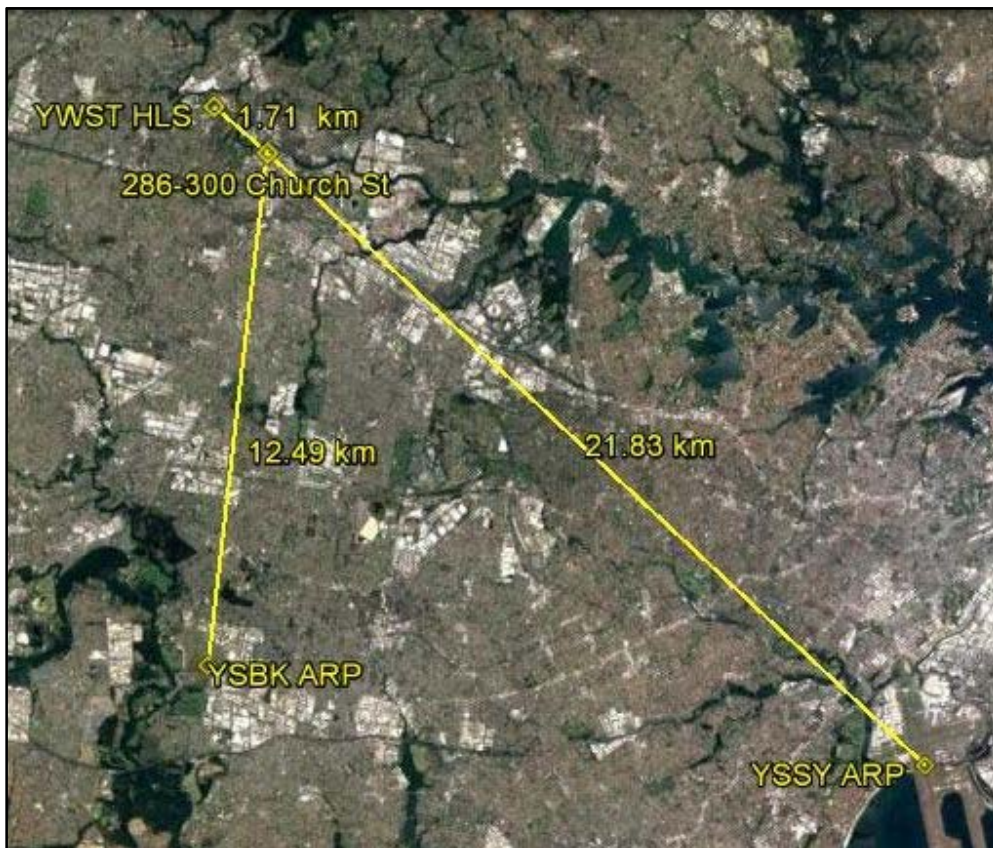


Figure 3.1 Sydney and Bankstown ARPs and the Westmead HLS sites and 286-300 Church St

4. Obstacle Limitation Surfaces (OLS) - Sydney Airport

Figure 4.1 is an extract from the Sydney Airport Corporation Limited (SACL) OLS chart and shows the development site in relation to the OLS surfaces.

The site is beyond the outer boundary of the OLS Outer Horizontal Surface (OHS).

The 286-300 Church St site will not impact on the Sydney Airport OLS.

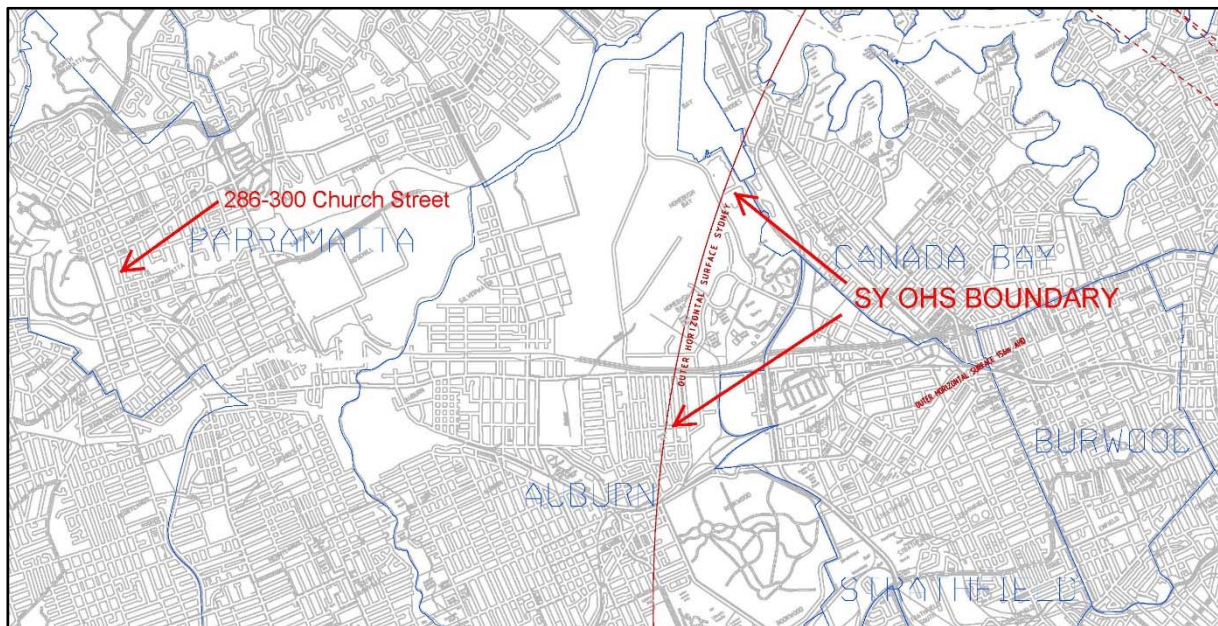


Figure 4.1 Sydney Airport OLS and the 286-300 Church St site
(Note this chart is aligned 327°/147°)

5. Obstacle Limitation Surfaces - Bankstown Airport

Figure 5.1 is an extract from the Bankstown Airport Limited OLS chart and shows the development site in relation to the OLS surfaces.

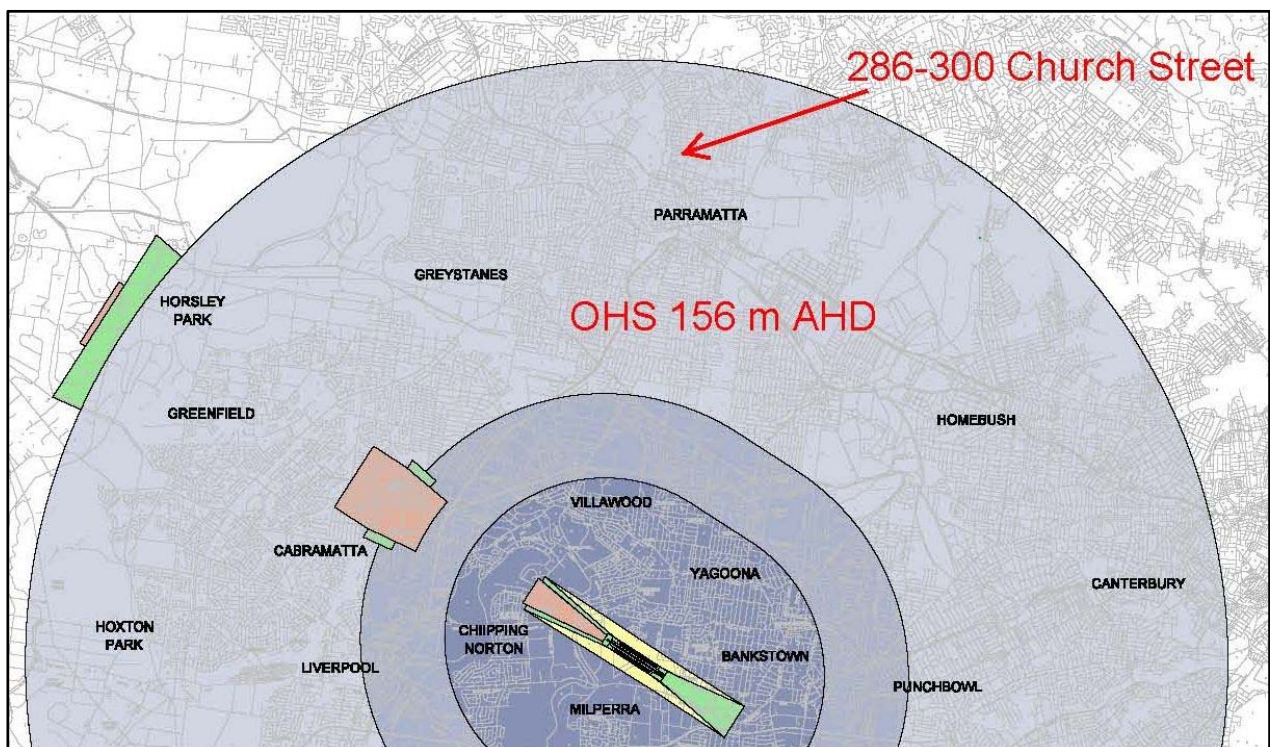


Figure 5.1 Bankstown Airport OLS and the 286-300 Church St site



The lowest Bankstown OLS surface at the building site is the OHS at 156 m AHD.

The proposed building height may penetrate the OLS OHS of 156 m.

There are conditions for approval of penetrations of the OHS, and the consultants will prepare an aeronautical study and safety case in the next stage of the study after the developer has confirmed the building and crane heights. The study will show that the building is *“located in an area which would be safely avoided by prescribed procedures associated with navigational guidance”*.

The study will be submitted for approval by the aviation authorities. Past experience has shown that approval is likely to be given.

6. PANS-OPS Examination – Sydney Airport

The development site is located in the PANS-OPS surface for Sydney as shown in an extract from the SACL PANS OPS chart in Figure 6.1 below. The surface height is shown as 335.2 m AHD.

The lowest Sydney PANS-OPS surface at the building site is 335.2 m AHD.

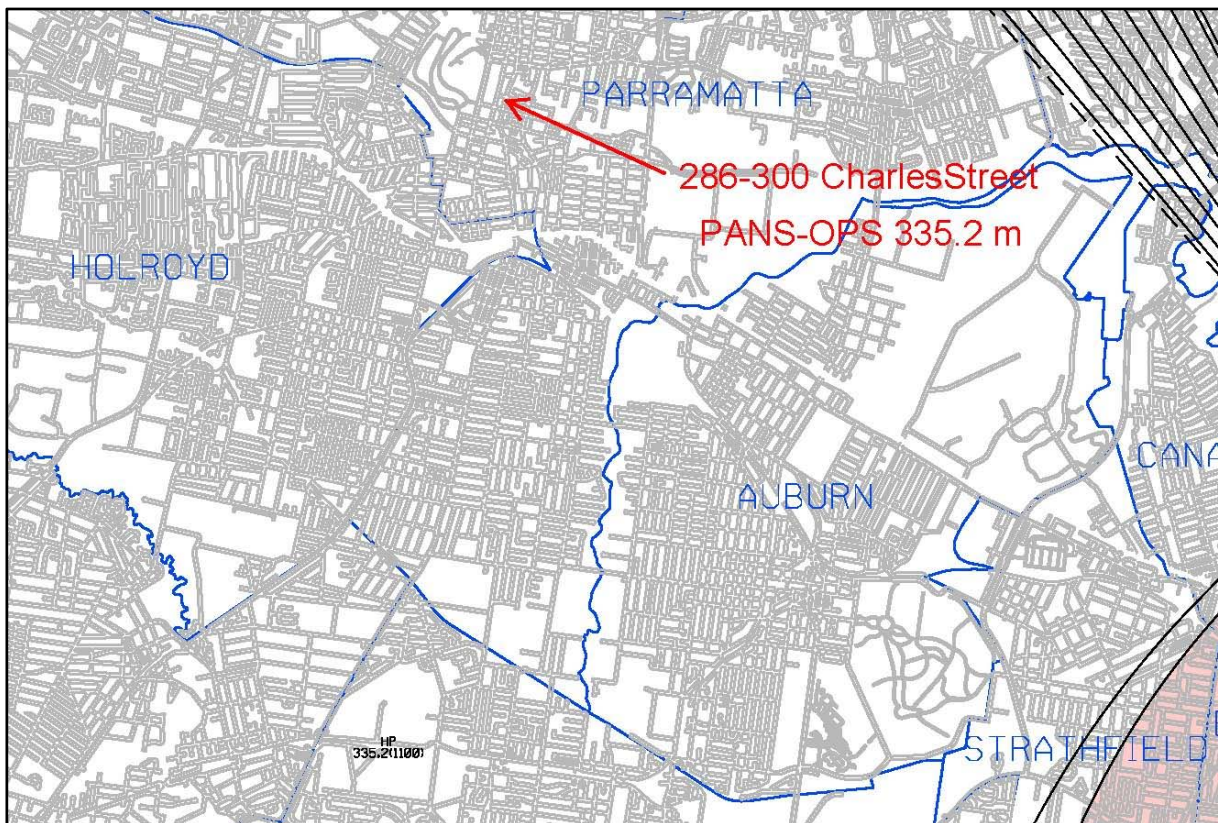


Figure 6.1 Sydney Airport PANS-OPS Surfaces

7. PANS-OPS Examination – Bankstown Airport

The development site is located beneath the PANS-OPS surfaces for Bankstown as shown in an extract from the Bankstown Airport published PANS-OPS chart in Figure 7.1 below. The PANS-OPS surface height has been interpolated as 315 m AHD.

The lowest Bankstown PANS-OPS surface at the building site is 315 m AHD.

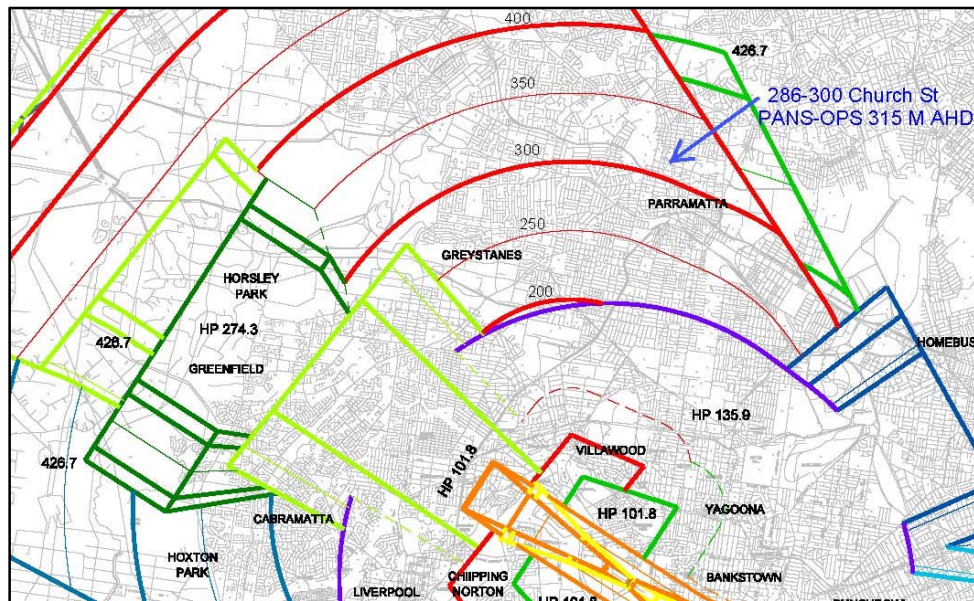


Figure 7.1 Bankstown Airport PANS-OPS Surfaces

8. PANS-OPS Examination - Westmead Hospital HLS

There are a number of HLS at Westmead, and two instrument approach procedures are published for one of the HLS. These are:

- RNAV-Z (GNSS) 052; and
- NDB 127.

PANS-OPS charts are not published for these procedures. In response to a previous study for another building in the vicinity, AsA advised that 207.8m (682ft) AHD is the maximum allowable building height without affecting instrument procedures at Westmead Hospital Heliport.

The lowest Westmead Hospital HLS PANS-OPS surface in the vicinity of the building site is 207.8 m AHD.

It is not possible to permanently penetrate a PANS-OPS surface. However, a temporary penetration of the surface for a maximum period of 3 months by construction cranes may be approved. A crane to a height of approximately 240 m AHD has been approved for a nearby development.

Temporary penetration of the PANS-OPS surface by cranes to a maximum height of approximately 240 m AHD may be approved.

However, as the hospital has proposed a new HLS site at the new CASB building, the instrument approach procedures will need to be revised by AsA and the location and heights of the building and crane will be assessed by AsA to determine if there is any impact on the revised procedures.

9. RTCC Surfaces

The development site is located in an area of the RTCC surface as shown in an extract from the SACL RTCC chart in Figure 9.1 below. The surface height is shown as 244 m AHD.

The lowest RTCC surface at the building site is 244 m AHD.

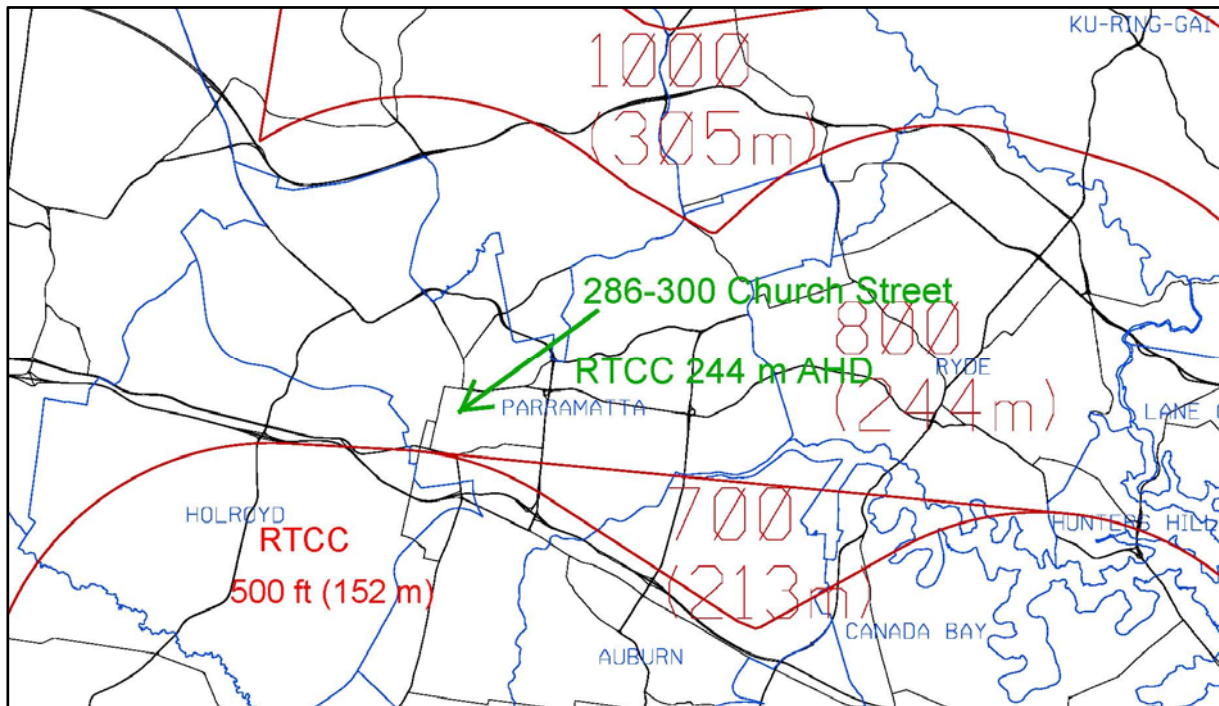


Figure 9.1 RTCC Surfaces

10. Radar Performance Impact

The Sydney Airport Terminal Area Radar (TAR), comprising of Primary Surveillance Radar (PSR) and Secondary Surveillance Radar (SSR) is located on the airport 22.372 km south east of the building site, at an antenna elevation of 38.2 m AHD

There is another TAR located at Cecil Park, 17.35 km to the south west of the building site, at an antenna elevation of 200.51 m AHD.

The following clearance requirements for radars apply to buildings not temporary cranes.

Clearance Requirements for Radars

CASA Manual of Standards (MOS) Part 139 Aerodromes publishes the clearance requirements for radars. The section of the MOS that applies to the site is:

11.1.14.4

"The following clearance requirements are to be maintained:

- (a) No intrusion within 1 km of the radar into a height surface 5 m below the bottom of the antenna. No intrusion between the radar and the possible location of any desired targets, i.e. roughly speaking above 0.5 degrees elevation at any distance.*
- (b) No metallic or other electrical reflective surfaces anywhere which subtend an angle of more than 0.5 degrees when viewed from the radar, e.g. fences, power lines, tanks as well as many buildings. All overhead power lines within 1 km must be aligned radially from the radar or be located at least 10 degrees below horizontal from the antenna."*



Clearance Requirements for the Sydney Airport TAR

The elevation of the Sydney airport TAR antenna is 38.2 m AHD, and the distance to the building site is 22372 m. The elevation of a 0.5° plane from the antenna at the site is:

$$22372 \times \tan 0.5^\circ = 195.24 \text{ m} + \text{TAR elevation of } 38.2 \text{ m} = 233.4 \text{ m (rounded down)}.$$

The lowest height limit for the Sydney TAR clearance plane is 233.4 m AHD.

Penetrations of the clearance plane may be approved subject to AsA assessment of any impacts on the radar performance.

Clearance Requirements for the Cecil Park TAR

The elevation of the Cecil Park TAR antenna is 200.51 m AHD, and the distance to the building site is 17350 m. The elevation of a 0.5° plane from the antenna at the site is:

$$17350 \times \tan 0.5^\circ = 151.4 \text{ m} + \text{antenna elevation of } 200.51 \text{ m} = 351.92 \text{ m AHD (rounded down)}.$$

The lowest height limit for the Cecil Park TAR clearance plane is 351.91 m AHD.

11. Navigation Aids Performance Impact

There are a number of navigation aids installed at Sydney Airport, including ILS, GBAS and DME. The Building Restricted Areas (BRA) specified in the Air Services Australia document Navigation Aid Building Restricted Areas and Siting Guidance AEI-7.1613 Issue 2 contain building development limitations.

The BRA for the GBAS installation is within 3000 m of this installation, all other BRAs are less than 3000 m.

As the site is 19865 m from the nearest airport boundary, the BRAs for all the Sydney airport Navigation Aids will not be impacted.

There is only an NDB installed at Bankstown Airport, however ILS installation is planned for RWY 11C/29C. As the site is 11786 m from the nearest airport boundary, the BRAs for all present and future Bankstown Navigation Aids will not be impacted.

The performance of the navigation aids at Sydney and Bankstown Airports will not be impacted by the Church Street building development.

12. Roof Top Exhaust Plumes

Roof top exhaust plume rises in excess of 4.3 m/s must be referred to CASA for their assessment of risk to aircraft operations.

13. High Density Traffic Airspace

The development site is situated in the lane of entry D539A, and the Parramatta CBD is a tracking point for aircraft departing Bankstown to the north. An extract from the Sydney Visual Terminal Chart (VTC) as published by AsA is shown in Figure 13.1.



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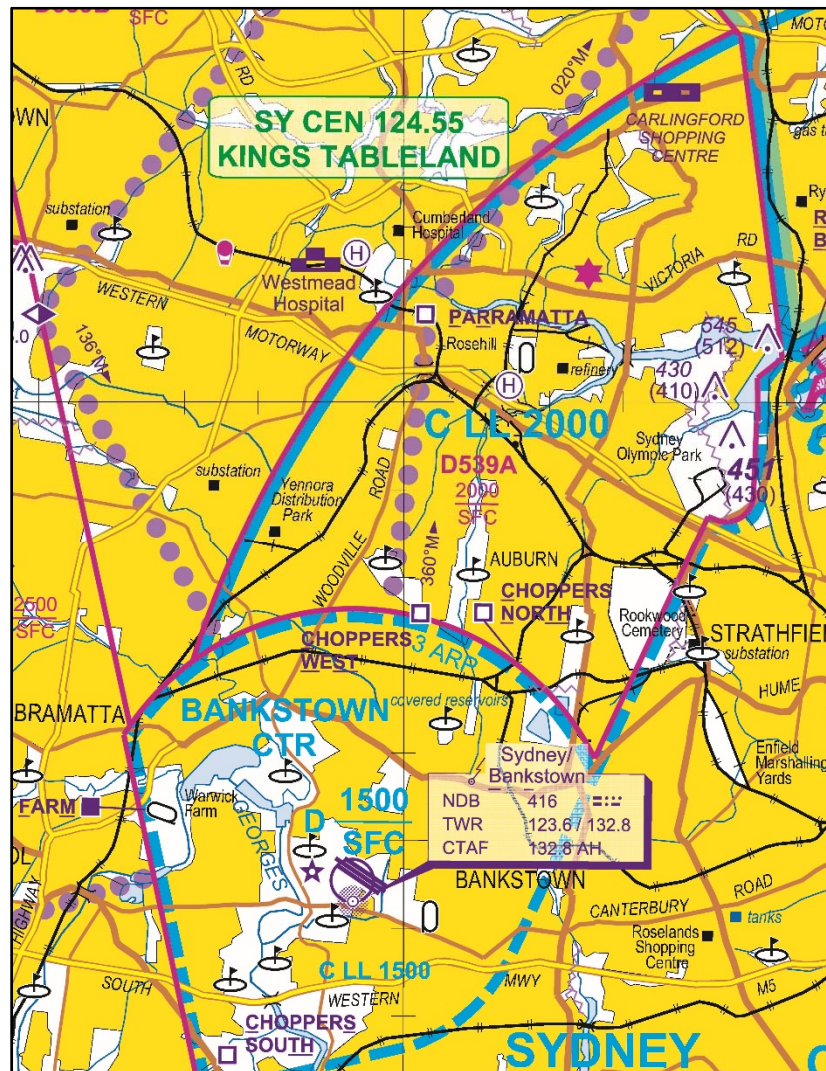


Figure 13.1 Location of Parramatta and the airspace shown in the Sydney VTC

In addition to traffic using the lane of entry for departures from Bankstown, there are a number of helicopter flight paths in the vicinity of Parramatta:

- to/from the Westmead and Cumberland hospitals to the north west;
- to/from the Rosehill Racecourse and Sydney Olympic Park helipads to the South East;
- helicopters flying on coded clearances "Rosehill 4" Inbound and Outbound via the racecourse and Rookwood Cemetery to and from Sydney Airport; and
- Choppers North and Choppers West tracking points for helicopters arriving and departing Bankstown.

Traffic operating in this airspace can fly up to 2000 ft AHD, which is the upper limit of D539A and lower limit of the CTA C protecting arrivals and departures for Sydney Airport.

Apart from IFR helicopters operating to and from the YWST, all other traffic is restricted to the Visual Flight Rules (VFR) in Visual Meteorological Conditions (VMC) by day, and therefore is required to see and avoid any obstacles.

CASA may require the building and construction cranes to be equipped with obstruction lighting and marking to enhance sighting.



14. Conclusions

This Preliminary Height Assessment study concludes that the following height limits apply to the 286-300 Church Street Parramatta site. All heights are AHD:

156 m - Bankstown OLS Outer Horizontal Surface (OHS). The consultants will prepare an aeronautical study and safety case for approval to penetrate the OHS after the developer has confirmed building and crane heights.

207.8 m - Westmead Hospital HLS PANS-OPS

233.3 m - Sydney Airport TAR clearance plane. Penetration may be approved subject to AsA assessment.

240 m (approximate) - Westmead Hospital HLS PANS-OPS for cranes on a temporary approval for 3 months.

244 m - RTCC

315 m - Bankstown PANS-OPS

335.2 m - Sydney PANS-OPS

351.92 m - Cecil Park TAR clearance plane.

To summarise the height limits impact, the maximum building height limit (including all roof top plant, equipment, exhaust stacks and masts) is 207.8 m AHD, and crane height is approximately 240 m AHD on a temporary approval basis for 3 months. These heights are subject to the approval of an aeronautical study and safety case to penetrate the Bankstown OHS of 156 m AHD.

Other conclusions are:

- The Sydney Airport OLS and the performance of the navigation aids and communication facilities in the Sydney region will not be impacted;
- Roof top exhaust plume rises in excess of 4.3 m/s must be referred to CASA for their assessment of risk to aircraft operations; and
- The 286-300 Church Street development site is located in a busy airspace for Bankstown Airport traffic departing to the north, and for helicopter traffic crossing the area. Most of this traffic will operate in Visual Meteorological Conditions by day and can see and avoid obstacles. CASA will most likely require the installation of obstruction lighting and marking to facilitate visibility of the building and crane.

Subsequent to the grant of any approval for this development, notification to Airservices Australia and Bankstown airport will need to be made for cranes (temporary obstacles) required during the building process.



APPENDICES



APPENDIX A

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. on the manoeuvring area between aircraft and obstructions; 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 *Chicago 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) or 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.



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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 (for GP)
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
DIT	Department of Infrastructure and Transport. (Formerly Dept. of Infrastructure, Transport, Regional Development and Local Government and Department of Transport and Regional Services (DoTARS))
DOTARS	See DIT 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
GBAS	Ground Based Augmentation System (satellite precision landing system)
GNSS	Global Navigation Satellite System
GP	Glide Path
IAS	Indicated Airspeed

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Abbreviation	Meaning
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
LLZ	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
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
RWY	Runway
SFC	Surface
SID	Standard Instrument Departure
SOC	Start Of Climb

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Abbreviation	Meaning
STAR	Standard ARrival
SGHAT	Solar Glare Hazard Analysis Tool
TAR	Terminal Approach Radar
TAS	True Air Speed
THR	Threshold (Runway)
TNA	Turn Altitude
TODA	Take-Off Distance Available
V _n	aircraft critical Velocity reference
VOR	Very high frequency Omni directional Range
WAC	World Aeronautical Chart