REVISED FINAL REPORT V5.0

AERONAUTICAL IMPACT ASSESSMENT AND SAFETY CASE

COMPASS CENTRE

AT

BANKSTOWN, NSW

J0453

For:

FIOSON PTY LTD

23 September 2016

AMBIDJI

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V3.0	Draft Revised Final Report - height changes	22 August 2016	BR	BWS
V4.0	Final Report -minor changes	26 August 2016	BR	BWS
V5.0	Revised Final Report – building height and OLS changes	23 September 2016	BR	BWS

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1. INTRODUCTION

The Ambidji Group Pty Ltd has been tasked by H3Architects on behalf of Fioson Pty Ltd to prepare an Aeronautical Impact Assessment (AIA) and Safety Study for the proposed building development of the Compass Centre Site, Bankstown NSW.

This assessment considers the following:

- The Prescribed Airspaces (OLS, PANS-OPS and RTCC) for Sydney, Bankstown, Camden, RAAF Base Richmond and Western Sydney aerodromes;
- The protection areas and planes for Navigation Aids, Communication Facilities and ATS Surveillance Systems in the Sydney Basin;
- Airspace Operations at Bankstown Airport;
- Roof top exhaust plume rises; and
- The Airports (Protection of Airspace) Regulations 1996.

Several buildings are proposed at the site. The maximum building and construction crane heights are:

- Building: 105.3 m AHD; and
- Crane: 123.1 m AHD.

The site is bounded by The Mall, The Appian Way, North Terrace and Featherstone Street, Bankstown. The site building layout and heights are shown in Figure 6.4, Page 11.

The crane heights and location coordinates are shown in Figure 6.5, Page 12.

Building and Crane height approval submissions will be made to Bankstown Airport Limited which will refer the submission to Airservices Australia (AsA), Civil Aviation Safety Authority (CASA) and the Department of Infrastructure and Regional Development (DIRD).

The PANS-OPS surface calculation process is shown in Appendix A.

A glossary of aviation terms and abbreviations is shown in Appendix B.

2. RESULTS OF THE AIA AND SAFETY STUDY

The AIA and Safety Study shows that:

The limiting heights (AHD) over the development site are:

- SYDNEY OLS: 156 m
- BANKSTOWN OLS: 51 m
- BANKSTOWN PANS-OPS: 128.4 m to 133.6 m
- RTCC: 152 m
- SYDNEY PANS-OPS: 335.2 m

Other significant surface heights are those for the Sydney and Cecil Park TARs:

- SYDNEY TAR: 156.4 m
- CECIL PARK TAR: 161.27 m

The only limiting height that will be penetrated by the maximum building and crane heights of 105.3 m AHD and 123.1 m AHD respectively is the Bankstown OLS IHS surface of 51m as follows:

- Building height penetration is 54.3 m;
- Temporary crane height penetration is 72.1 m.

An aeronautical study has been conducted to show that the penetrations of the IHS by the buildings and cranes *"would not adversely affect safety or significantly affect the regularity of operations of aeroplanes."*

Penetrations of the IHS are subject to gaining the requisite approvals by Bankstown Airport Limited, Airservices Australia, Civil Aviation Safety Authority and Department of Infrastructure and Regional Development.

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

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

3. THE PROPOSED DEVELOPMENT SITE LOCATION

The site is located 13.48 km and 4.39 km respectively from the Aerodrome Reference Points (ARPs) at Sydney and Bankstown Airports. Figure 3.1 shows the location of the development site in relation to the ARPs.

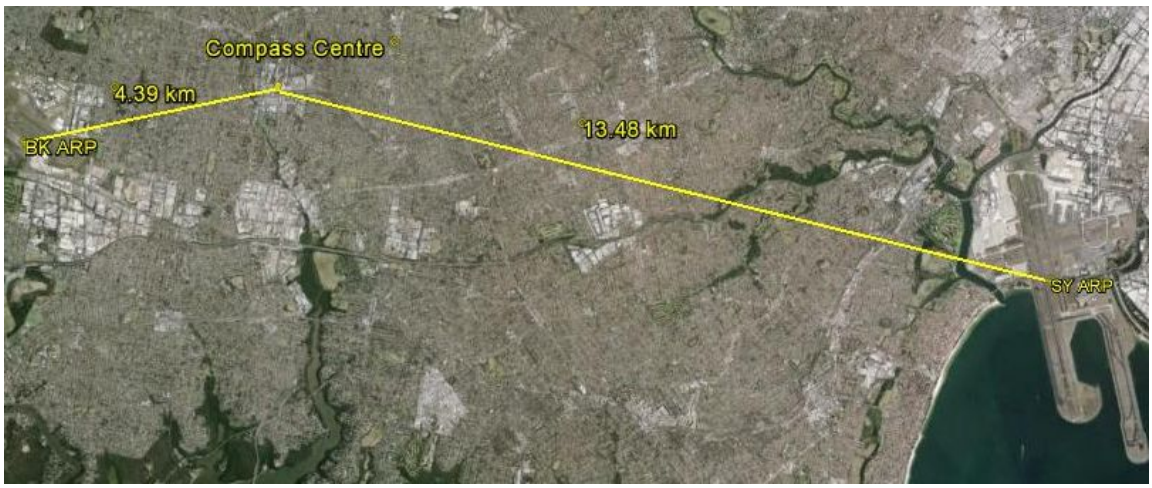

Figure 3.1 Development site in relation to Sydney and Bankstown ARPs.

4. OLS EXAMINATION

Aerodrome Operators are required to publish details of Prescribed Airspace in accordance with CASA MOS Part 139 Aerodromes Chapter 7. Publication can be made in Airport Masterplans or by the issuing of maps or charts showing the horizontal and vertical dimensions.

The OLS Prescribed Airspaces for Sydney, Bankstown, Camden, RAAF Base Richmond and Western Sydney aerodromes were examined in the preparation of this AIA to determine if the proposed building and crane heights penetrated any OLS surfaces. If penetrations did occur aeronautical studies were conducted to support submissions for approvals.

4.1 SYDNEY AIRPORT OLS

The Sydney Airport OLS Outer Horizontal Surface (OHS) extends over the site. The height of the OHS is 156 m AHD, and as the maximum crane height is 123.1 m AHD, the OHS will not be penetrated.

Figure 4.1 shows an extract from the Sydney Airport Corporation Limited (SACL) OLS chart and the Compass Centre site.

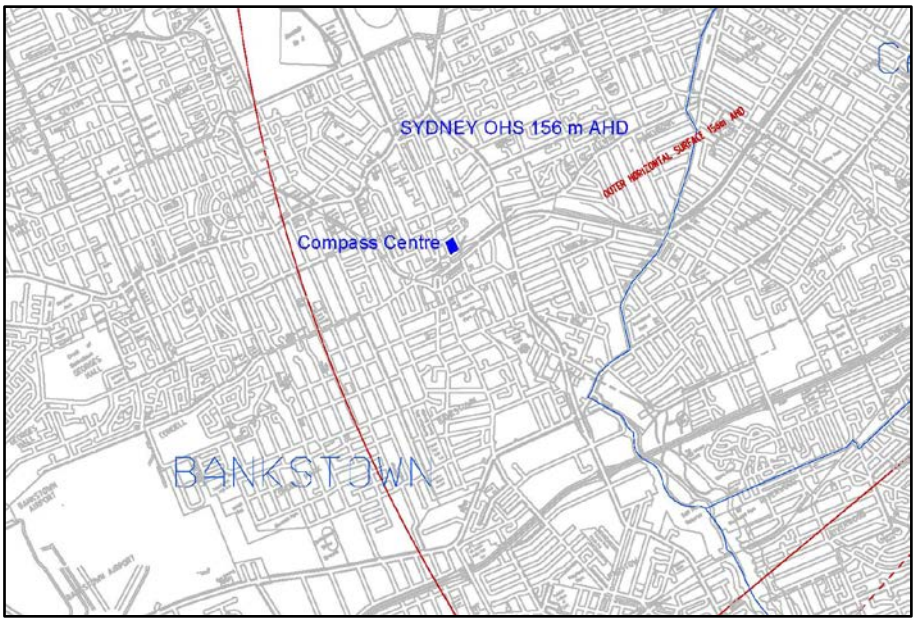

Figure 4.1 Sydney Airport OLS and the Compass Centre site (from the SACL OLS chart)

The Sydney Airport OLS is not impacted by the Compass Centre site.

4.2 BANKSTOWN AIRPORT OLS

The development site is located in the area of the OLS Inner Horizontal Surface (IHS) as published in the OLS chart by the Bankstown Airport Management. The height of the IHS is 51 m AHD. An extract from the OLS chart is shown in Figure 4.2 below.

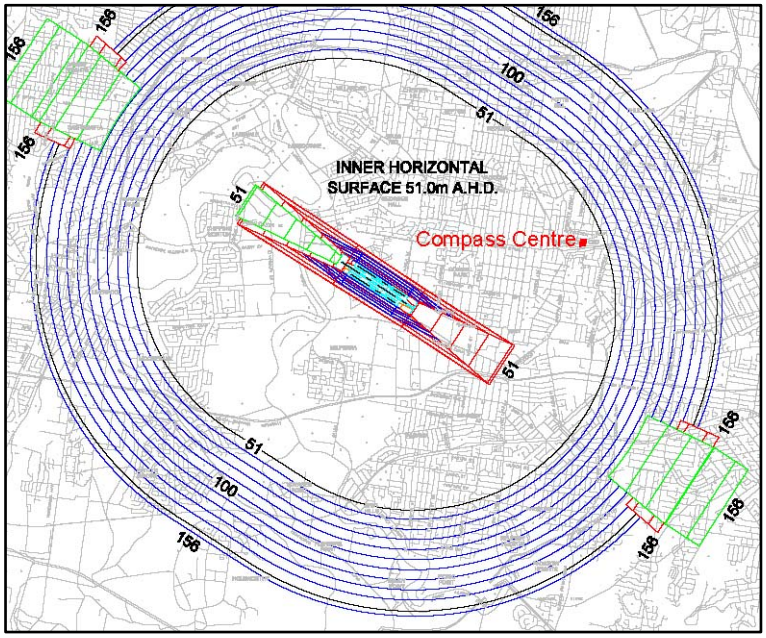

Figure 4.2 Compass Centre site in relation to the Bankstown Airport OLS surfaces (From Bankstown Airport Management OLS Chart)

The proposed maximum building and crane heights will penetrate the 51 m AHD IHS as follows:

Building height 105.3 m AHD - IHS penetration 54.3 m;

Crane height 123.1 m AHD - IHS temporary penetration 72.1 m:

There are conditions for allowing the penetration of the IHS; however any application for approval would have to be supported by an Aeronautical study. Previous studies conducted for airports in the Sydney Basin have been successful and permanent and temporary penetrations of the IHS have been approved.

A detailed aeronautical study and safety case has been conducted and is shown in Section 5 of this report. This shows that the IHS penetration by the building and crane heights *"would not adversely affect safety or significantly affect the regularity of operations of aeroplanes."*

4.3 CAMDEN AIRPORT OLS

This airport is 34 km to the South West of the development site.

As the OLS for Camden will not extend beyond 10 km, the site will be outside of the OLS for this aerodrome.

4.4 RICHMOND AERODROME OLS

This aerodrome is 42 km to the North West of the development site.

As the OLS for Richmond will not extend beyond 30 km, the site will be outside of the OLS for this aerodrome.

4.5 WESTERN SYDNEY AIRPORT – WSA OLS

This airport is not yet constructed; however planning is well advanced including the layout of runways, which are proposed to be aligned north east/south west. This proposed airport is 29.4 km to the west of the development site.

The indicative OLS is published in Para 2.2.5 of the October 2015 Western Sydney Airport Draft Plan and Figure 4.3 shows the indicative WSA OLS in relation to the site.

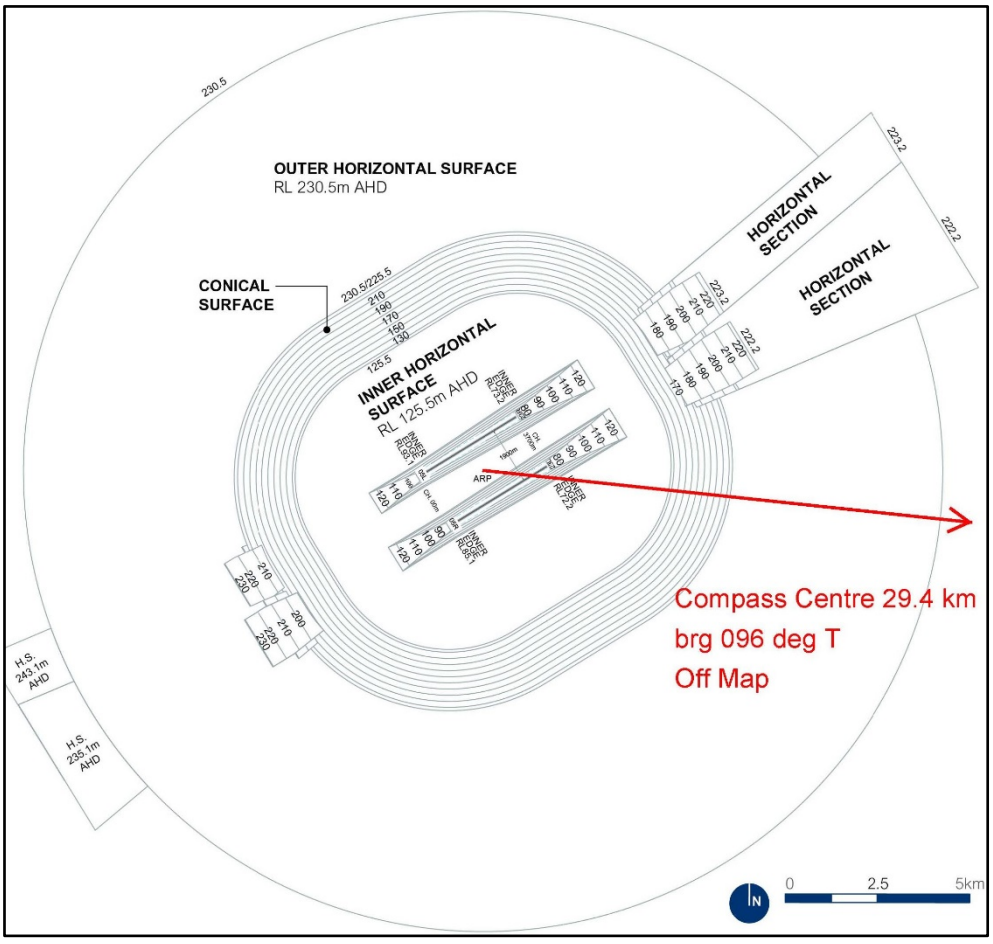

Figure 4.3 Proposed Western Sydney Airport OLS and the Compass Centre site

The Bankstown Compass Centre site is expected to be well outside the OLS areas for this airport.

5. PENETRATION OF THE BANKSTOWN INNER HORIZONTAL SURFACE

As discussed in Section 4, the proposed maximum building and crane heights will penetrate the IHS as follows:

- Building height 105.3 m AHD - IHS penetration is 54.3 m;
- Crane height 123.1 m AHD – IHS temporary penetration is 72.1 m.

The conditions for OLS IHS penetration are discussed in the following sections which also include an aeronautical study and safety case.

5.1 PENETRATION OF THE INNER HORIZONTAL SURFACE – ICAO DOCUMENT REFERENCES

ICAO Airport Services Manual Part 6 Control of Obstacles states in Para 1.2.2.4:

In assessing the operational effect of proposed new construction, tall structures would not be of immediate significance if they are proposed to be located in:

a) *An area already substantially obstructed by terrain or existing structures of equivalent height*
b) *An area which would be safely avoided by prescribed procedures associated with navigational guidance where appropriate*

The Inner Horizontal Surface and Conical Surface can be penetrated in accordance with the recommendations of ICAO Doc ANNEX 14 Volume 1 Aerodrome Design and Operations, Para 4.2.20, which states:

> *New objects or extensions of existing objects should not be permitted above the Conical Surface and the Inner Horizontal Surface except when, in the opinion of the appropriate authority, an object would be shielded by an existing immovable object, or after an aeronautical study it is determined that the object would not adversely affect safety or significantly affect the regularity of operations of aeroplanes.*

As part of this assessment, a basic aeronautical study and safety case has been conducted by the consultants to show that the penetrations of the IHS by the proposed maximum building height of 105.3 m AHD and Crane height of 123.1 m AHD *"would not adversely affect safety or significantly affect the regularity of operations of aeroplanes."*

5.2 AERONAUTICAL STUDY PRECEDENTS

It is common for both the Inner Horizontal and Conical Surfaces to be penetrated at many airports in the world, especially those located close to metropolitan areas.

The control towers at most of the new airport developments in Asia (Bangkok, Kuala Lumpur, Jakarta, Singapore, Incheon, Beijing etc.), and Brisbane in Australia all penetrate the Inner Horizontal Surface.

5.3 IMPACT ON INSTRUMENT APPROACH PROCEDURES

The Inner Horizontal and Conical Surfaces were originally established by ICAO to protect the obstacle clearance of aircraft circling the airport in visual flight conditions prior to landing. When these surfaces were first established in the 1950s and 1960s, the majority of airports and aircraft were not equipped for straight in approaches, and circling approaches were necessary.

With the implementation and extensive use of procedures for approaches aligned with the runway (ILS, GLS, RNP, RNAV (GNSS), VOR and Locator), the use of circling approaches has decreased considerably. At many airports the restrictions imposed by noise avoidance procedures prevent the use of circling approaches.

Bankstown is serviced by two published straight in approaches, the RWY 11C RNAV-Z (GNSS) approach and the RWY 11C NDB approach. The current Bankstown Airport Master Plan includes the provision for straight in ILS approach procedures for RWY11C and RWY 29C. Circling procedures are also published.

The site development to the proposed building and crane heights was examined in the study to confirm that there would be no changes required to the circling minimum altitudes.

5.4 Examination of Circling Approaches

Note 1: In the Aeronautical Information Publication (AIP) all distances are shown in Nautical Miles (nm) and Altitudes in feet (ft) for instrument flight procedures. Displays to pilots are in the same format.

Note 2: The aircraft category (CAT) depends on a number of aircraft performance parameters, and is published in the ICAO PANS-OPS document.

The minimum altitudes published for circling approaches at Bankstown are:

- CAT A and B aircraft: 910 ft AMSL(AHD); and
- CAT C aircraft: 940 ft AMSL (AHD)

5.5 PANS-OPS Circling Area Criteria

The circling area radii from the runway thresholds and Minimum Obstacle Clearance (MOC) for circling approaches are published in the PANS-OPS document, as follows:

- CAT A and B: Area radius 2.66 nm, MOC 295 ft, and
- CAT C: Area radius 4.2 nm, MOC 394 ft.

As the site is located 2.06 nm from the threshold of RWY 29C (the nearest threshold), it is therefore located in the circling area for all aircraft categories.

5.6 Application of MOC

Table 5.1 shows the application of the MOC to the building height of 346 ft AHD and crane height of 404 ft AHD.

	m	ft
Building Height AHD	**105.3**	**346**
Crane Height AHD	**123.1**	**404**
OLS	51	168
Building Height Penetration	**54.3**	**179**
Crane Height Penetration	**72.1**	**237**
Circling MDA A&B		910
MOC A&B		295
Building Height + MOC A&B		**641**
Crane height +MOC A&B		**699**
Circling MDA C		940
MOC C		394
Building Height + MOC C		**740**
Crane height +MOC A&B		**798**

Table 5.1 Application of MOC to Building and Crane Heights

5.7 IMPACT ON CIRCLING MINIMUM ALTITUDES

CAT A and B:

Published minimum circling altitude is 910 ft. Building height + MOC = 641 ft, and Crane height + MOC = 699 ft.

There is no impact on the CAT A and B circling altitude.

CAT C:

Published minimum circling altitude is 940 ft. Building height + MOC = 740 ft, and crane height + MOC = 798 ft.

There is no impact on the CAT C circling altitude.

5.8 CONCLUSION OF AERONAUTICAL STUDY AND SAFETY CASE

The penetration of the OLS Inner Horizontal Surface by the building and construction cranes will not impact on the circling altitudes at Bankstown and will *"not adversely affect safety or significantly affect the regularity of operations of aeroplanes."*

As the IHS will be penetrated, CASA may require the buildings and cranes to be marked and equipped with obstruction lighting.

6. PANS-OPS EXAMINATION

The Sydney Airport Corporation Limited (SACL) Prescribed Airspace PANS-OPS chart dated March 5 2015, and the Bankstown 2014 Master Plan PANS-OPS chart were examined to determine the PANS-OPS surface heights for these airports.

6.1 SYDNEY AIRPORT PANS-OPS EXAMINATION

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

The maximum building height limitation of 105.3 m AHD and crane height of 123.1 m AHD will not penetrate the Sydney PANS-OPS surface.

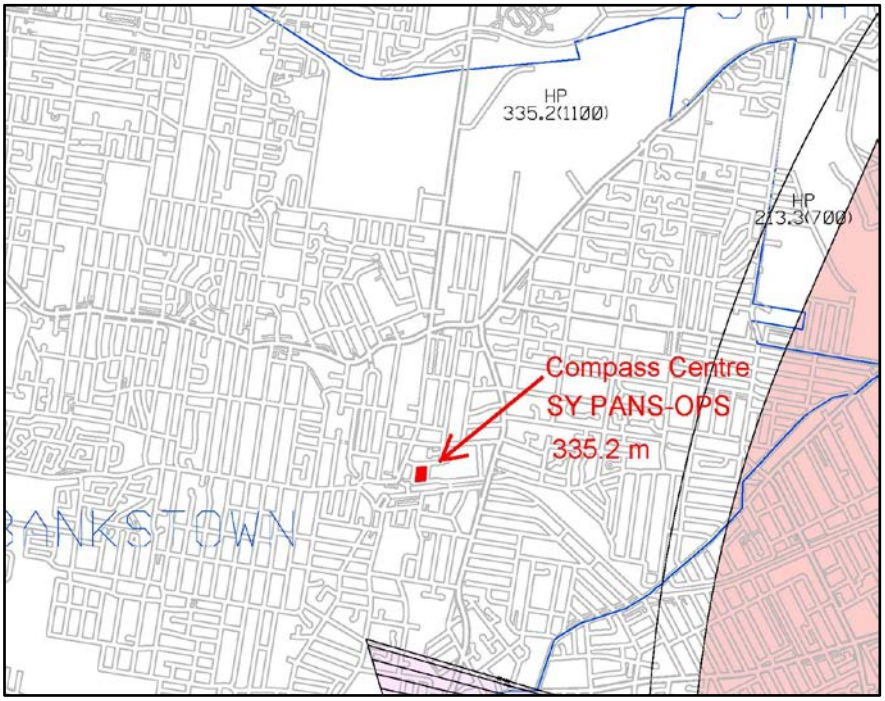

Figure 6.1 Sydney PANS-OPS and the Development Site (from SACL PANS-OPS Chart)

6.2 BANKSTOWN AIRPORT PANS-OPS EXAMINATION

An extract from the Bankstown 2014 Master Plan PANS-OPS chart is shown in Figure 6.2 below. The approach surface height at the Compass Centre site is 135.9 m AHD.

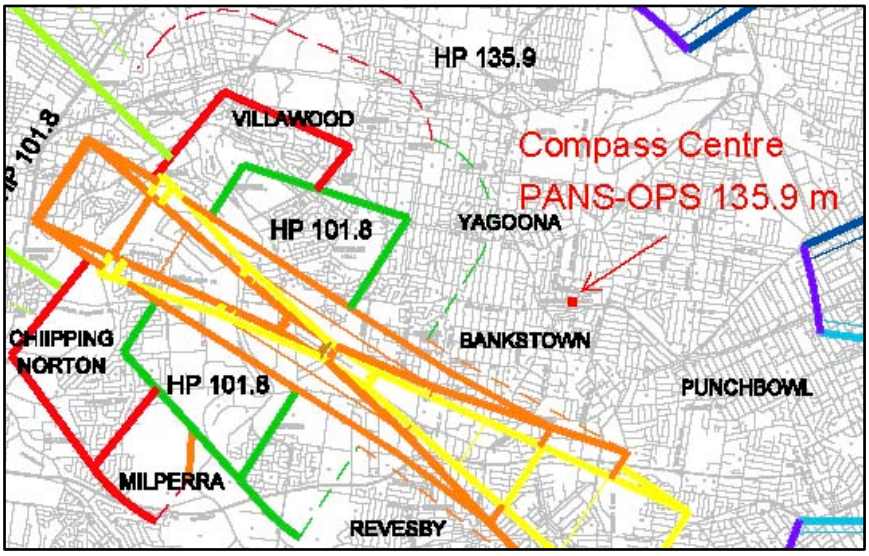

Figure 6.2 Bankstown PANS-OPS and the Development Site (from 2014 Bankstown Master Plan PANS-OPS Chart)

However, PANS-OPS surfaces for departures are not shown on this chart. The lowest surface heights for departures (RWY 11C SID) have been estimated to be 128.4 m (422 ft) AHD to 133.6 m (439ft) AHD by Ambidji in accordance with CASA MOS Part 173 Standards Applicable to Instrument Flight Procedure Design, and the ICAO Document 8168 PANS-OPS Volume II Construction of Visual and Instrument Flight Procedures. However this height will require confirmation by Airservices Australia.

As shown in Figure 6.3 the PANS-OPS surface height for departures slopes at 3.3% from 128.4 m AHD at the south west corner of the site to 133.6 m AHD at the northern corner of the site. The yellow line on the image is aligned 109.3°/289.3° (T), and is shown for the 131 m PANS-OPS surface. Intermediate surface heights can be interpolated @ 3.3% at right angles to the yellow line sloping down to 128.4 m, and sloping up to 133.6 m

Details of the PANS-OPS surface calculations are shown at Appendix A.

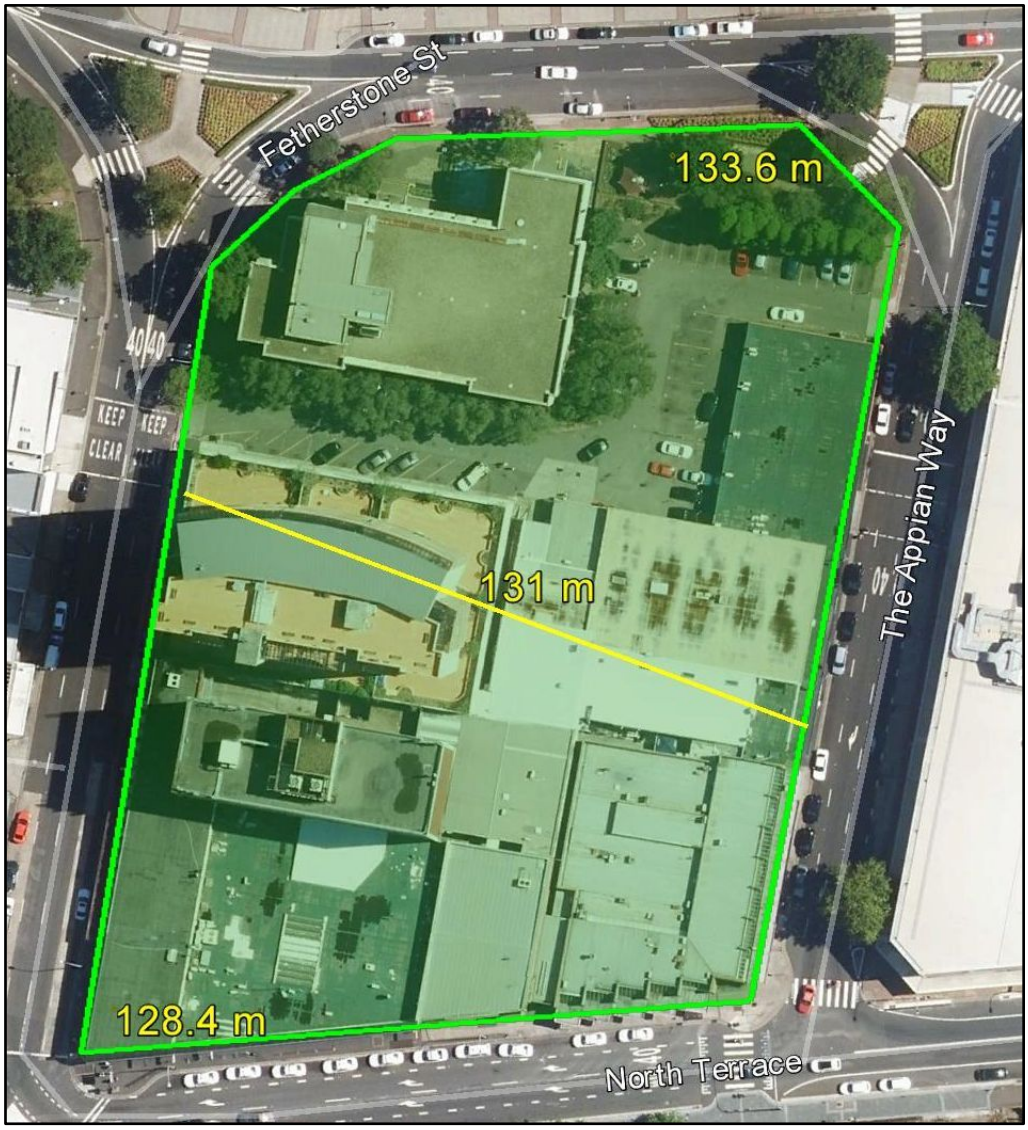

Figure 6.3 PANS-OPS surface heights over the Compass Centre site

BUILDING HEIGHTS AND THE PANS-OPS SURFACES

Figure 6.4 shows the building locations and heights AHD m at the site**.**

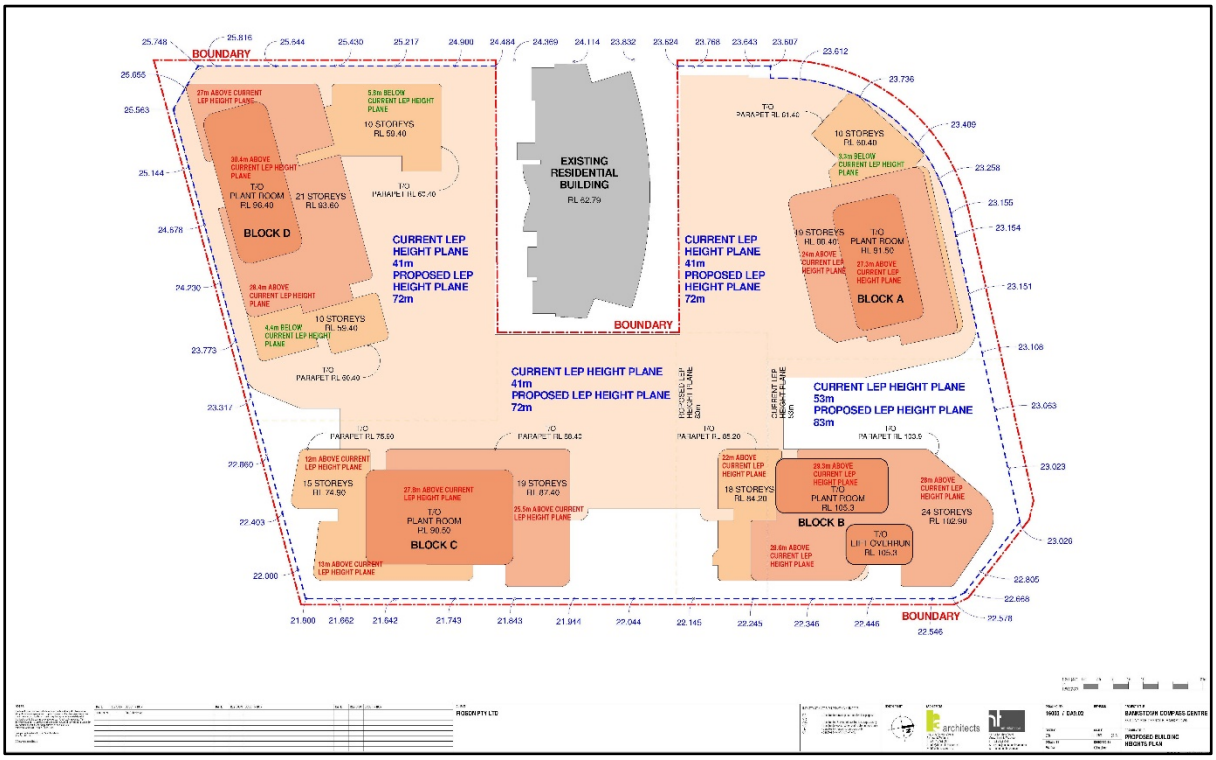

Figure 6.4 Building Locations and Heights AHD m

As the highest building height is 105.3 m AHD, all of the buildings are below the lowest PANS-OPS surface height of 128.4 m

CRANE HEIGHTS AND THE PANS-OPS SURFACES

Figure 6.5 shows the upper levels of the buildings and crane locations (MGA) and heights in m AHD**.** The highest crane height of 123.1 m AHD is below the lowest PANS-OPS surface height of 128.4 m AHD.

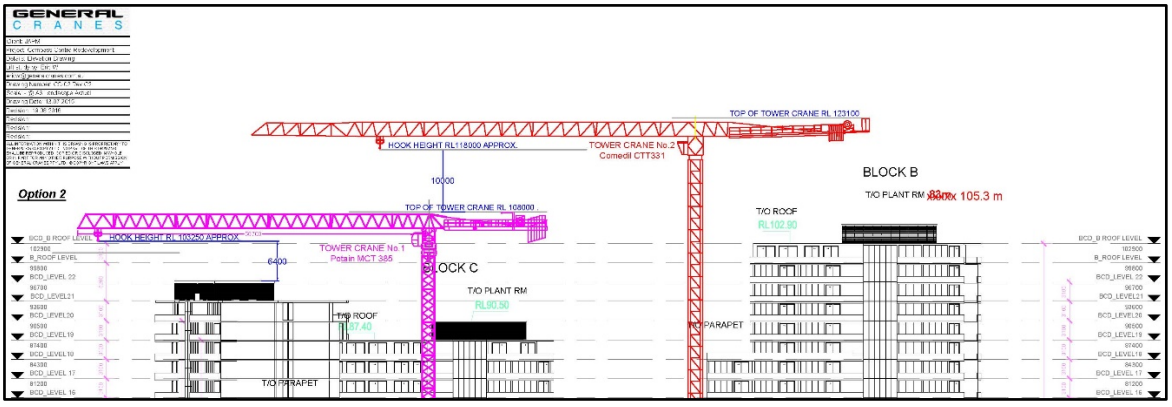

Figure 6.5 Crane Locations and Heights in m AHD

Figure 6.6 shows a plan view of the crane locations (C1 and C2), and the maximum distances of the crane jibs in the direction of the RWY 11C departure navigation tolerances (see Appendix A). The crane locations are approximate, and require confirmation when exact coordinates are available.

The C2 jib remains within the site boundaries, and at 123.1.m AHD is below the lowest PANS-OPS surface of 128.4 m AHD.

The C1 jib extends beyond the site boundary. The PANS-OPS surface at the jib extension has been calculated as 128.17 m as follows:

> Distance from the 131 m PANS-OPS surface = 94.5 m @ 3.3% = 3.11 m. 131 m – 2.83 m = 128.17 m.

As the C2 jib height is 105.3 m AHD, it is below the PANS-OPS surface height of 127.9 m AHD.

The cranes and jibs are below all of the PANS-OPS surface heights.

The buildings and cranes do not penetrate the PANS-OPS surfaces. However at these heights, there is still a significant penetration of the Inner Horizontal Surface (IHS) of the Obstacle Limitation Surface (OLS), and approvals will be required from Bankstown Airport, CASA, AsA and DIRD for this penetration.

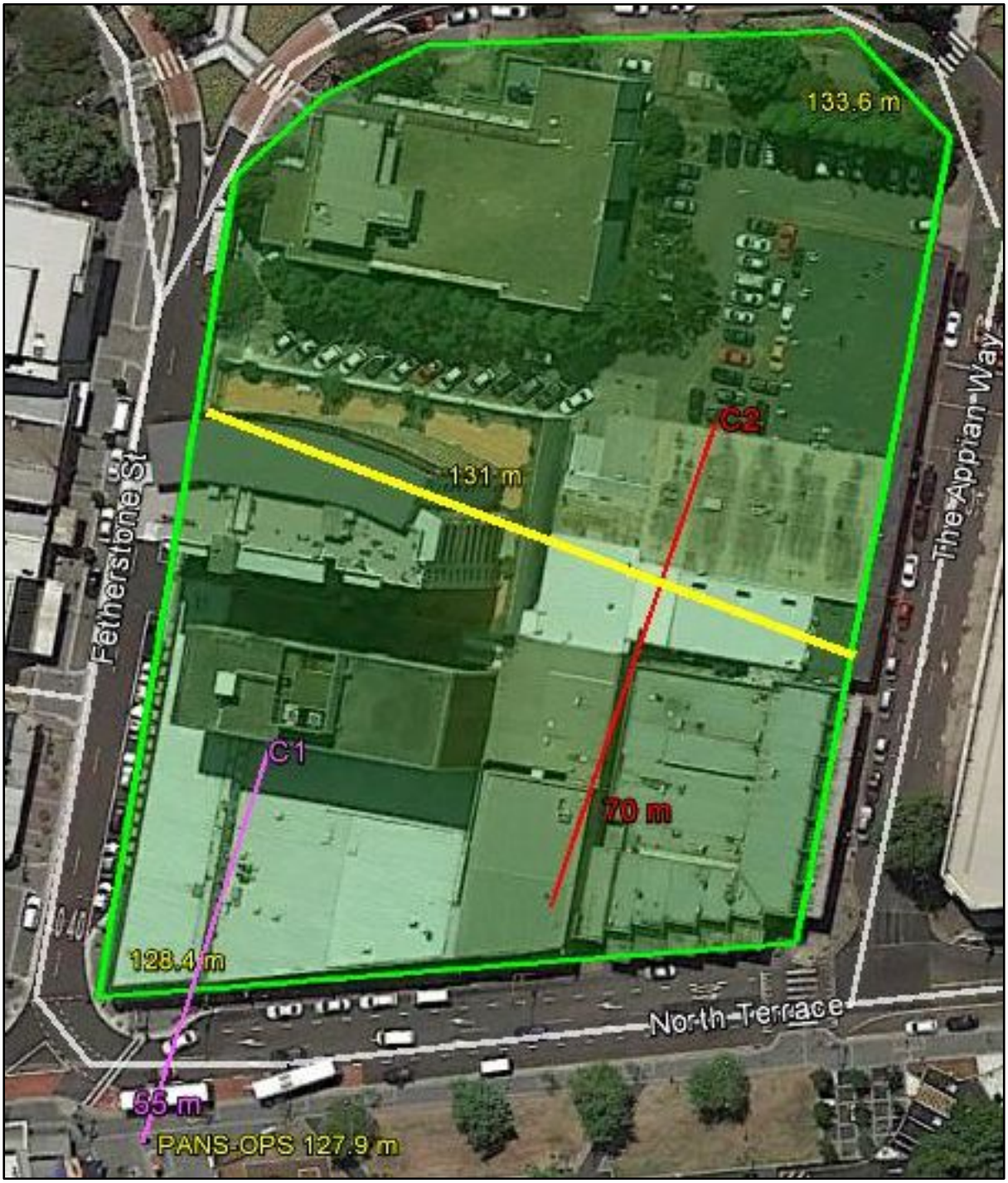

Figure 6.6 Crane and jib locations and the PANS-OPS surfaces

6.3 CAMDEN, RICHMOND AND WESTERN SYDNEY AIRPORT PANS-OPS EXAMINATION

The PANS-OPS surfaces for these aerodromes do not extend over the development site.

7. RADAR TERRAIN CLEARANCE CHART (RTCC) SURFACES

SACL has published RTCC surfaces, and an extract of the RTCC chart is shown in Figure 7.1 below. The RTCC surface at the development site is 152 m (500 ft) AHD.

The maximum building and crane heights of 105.3 m AHD and 123.1 m AHD respectively will not penetrate the RTCC surface.

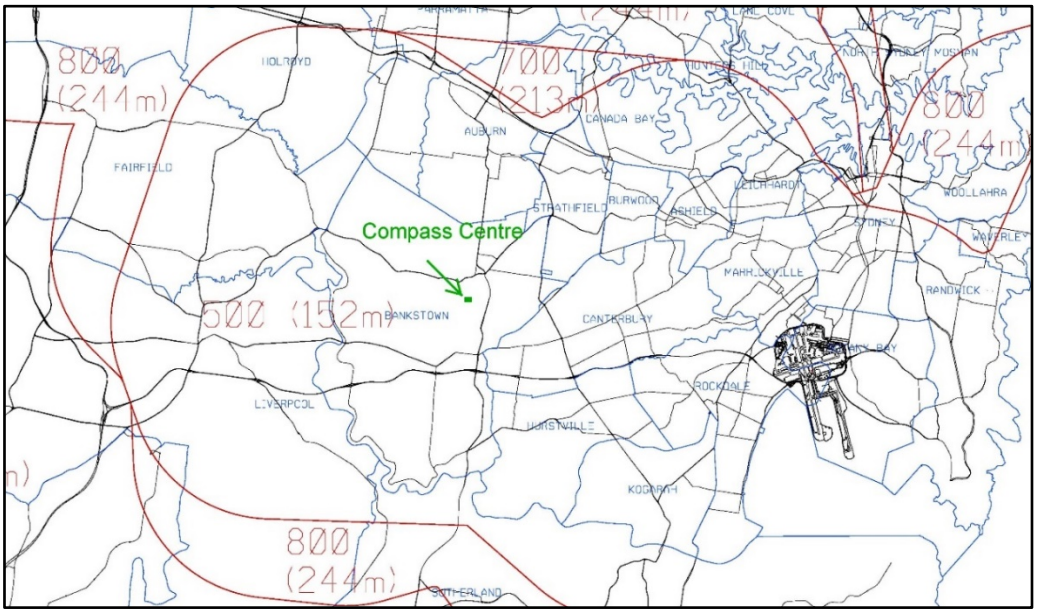

Figure 7.1 RTCC surfaces and the Compass Centre site (From SACL RTCC chart)

8. 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 13.538 km from the building site, at an antenna elevation of 34.5 m AHD

There is another TAR located at Cecil Park, 18.9 km from the building site, at an antenna elevation of 161.27 m AHD.

CASA Manual of Standards (MOS) Part 139 Aerodromes publishes the clearance requirements for radars. The section of the MOS that applies to the Bankstown Central 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.*

SYDNEY AIRPORT TAR

The elevation of the Sydney airport TAR antenna is 34.5 m AHD, and the distance to the building site is 13971 m. The elevation of a 0.5° plane from the antenna at the site is:

13971 x Tan 0.5° = 121.9 m + TAR elevation of 34.5 m = 156.4 m.

The maximum building height of 105.3 m AHD will not penetrate the clearance plane of the Sydney Airport TAR.

CECIL PARK TAR

This radar is located 18.9 km from the building site, at an elevation of 161.27 m AHD.

As the elevation of this radar is above the maximum building height of 105.3 m AHD, the clearance plane of this radar will not be penetrated.

9. IMPACT ON NAVIGATION AIDS AND COMMUNICATION FACILITIES

Sydney and Bankstown Navigation Aids

The Building Restricted Areas (BRA) specified in the Airservices Australia document Navigation Aid Building Restricted Areas and Siting Guidance AEI-7.1613 Issue 2 shows that the maximum BRA area is 3000m distance from an airport boundary.

As the site is located 3300 m from the nearest Bankstown Airport boundary and over 12000 m from the nearest Sydney Airport boundary, it is not within the BRAs for these airports.

The clearance planes, sensitive areas and Building Restricted Areas for the Navigation Aids at Sydney and Bankstown Airports (including future ILS and GBAS) are not infringed by this proposed development.

Air Traffic Control (ATC) Communication Facilities

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

The current configuration of the buildings surrounding Sydney and Bankstown Airports does not restrict the ATC communication facilities located on the Control Towers at Sydney and Bankstown Airports.

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

10. BANKSTOWN AIRPORT OPERATIONS

Flights operating at Bankstown under the Instrument Flight Rules (IFR) are provided with obstacle clearance by the PANS-OPS procedures discussed in Section 6.

Pilots operating under the Visual Flight Rules (VFR) at Bankstown are responsible for their own obstacle clearance by visual identification and avoidance if necessary. There are conditions of minimum flight visibility and distance from cloud imposed on VFR flights to ensure that obstacles

can be seen and avoided. In addition these flights are required to operate at a minimum of 1000 ft above the highest terrain over populated areas, unless in the flight stages of landing and take-off.

In the AIP ERSA FAC document Section 9 there is a requirement for circuit operations to be conducted at 1000 ft within 2 nm of the Bankstown ARP. As the development site is located 2.34 nm from the ARP, it is outside the Bankstown circuit area.

CASA may require obstruction lighting of buildings and cranes to assist pilots to see and avoid these obstacles as necessary.

11. ROOF TOP EXHAUST PLUMES

CASA Advisory Circular 139-5 (1) dated November 2012 requires that all plume rises in excess of 4.3 m/s are submitted to CASA for operational assessment to determine if there is a hazard to aircraft operations.

If the plume rise from exhaust systems on the roof of the building exceed 4.3 m/s, an operational assessment by CASA will be required. If the plume rise is less, then there will be no requirement to advise CASA.

12. CONCLUSIONS

This AIA and Safety Study show that:

The limiting heights (AHD) over the development site are:

- SYDNEY OLS: 156 m
- BANKSTOWN OLS: 51 m
- BANKSTOWN PANS-OPS: 128.4 m to 133.6 m
- RTCC: 152 m
- SYDNEY PANS-OPS: 335.2 m

Other significant surface heights are those for the Sydney and Cecil Park TARs:

- SYDNEY TAR: 156.4 m
- CECIL PARK TAR: 161.27 m

The only limiting height that will be penetrated by the maximum building and crane heights of 105.3 m AHD and 123.1 m AHD respectively is the Bankstown OLS IHS surface of 51m as follows:

- Building height penetration is 54.3 m; and
- Temporary crane height penetration is 72.1 m.

An aeronautical study has been conducted to show that the penetrations of the IHS by the buildings and cranes *"would not adversely affect safety or significantly affect the regularity of operations of aeroplanes."*

As the IHS will be penetrated, CASA may require the buildings and cranes to be marked and equipped with obstruction lighting.

Penetrations of the IHS are subject to gaining the requisite approvals by Bankstown Airport Limited, Airservices Australia, Civil Aviation Safety Authority and Department of Infrastructure and Regional Development.

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

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

APPENDIX A

PANS-OPS SURFACES CALCULATION PROCESS

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PANS-OPS SURFACES CALCULATION PROCESS

Figure A.1 shows a copy of the Bankstown SIX departure for RWY 11C/29C as published in the DAP section of the Australian AIP. Distances are in Nautical Miles, tracks are in degrees magnetic, variation is 13° East, and altitudes are in ft AHD. The RWY 11C departure is significant to the Compass Centre site as it can pass over the site.

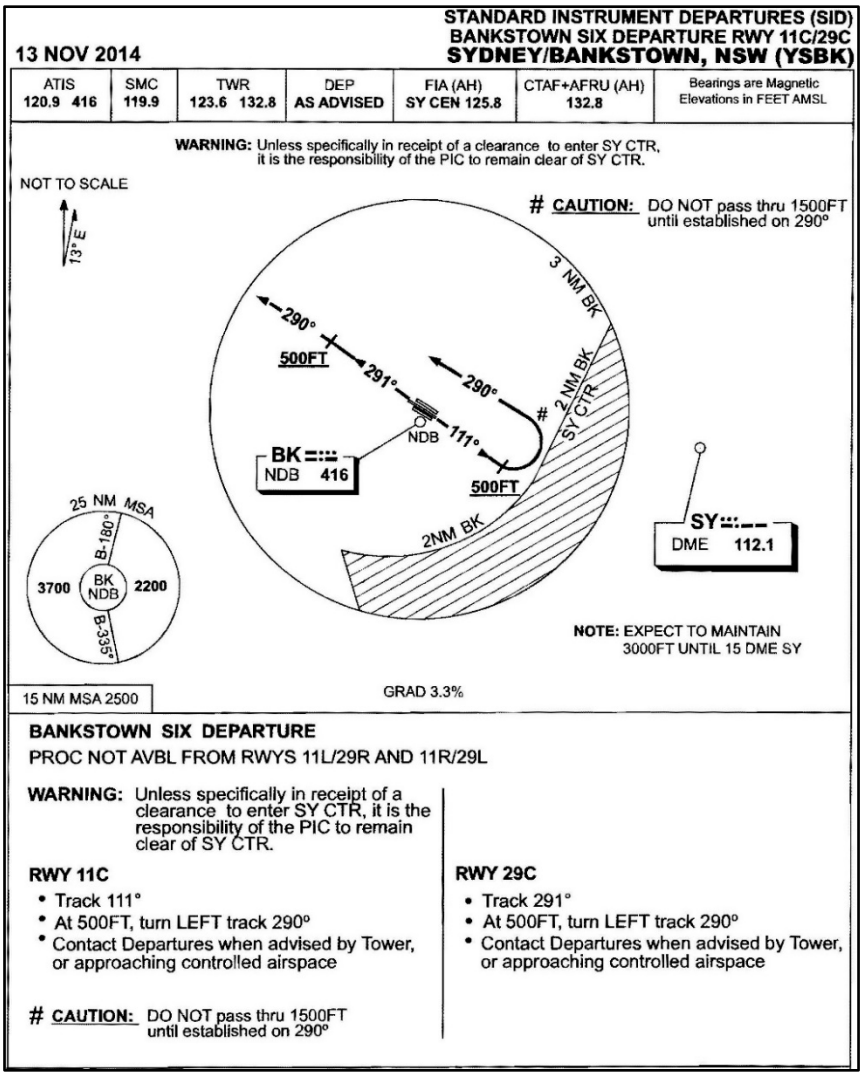

Figure A.1 Bankstown SIX Departure

As can be seen in Figure A.1, the RWY 11C procedure is to track 111°M (124°T), at 500 ft turn left and track 290°M (303°T). Climb gradient is a minimum of 3.3%.

The turn may take the aircraft over the Bankstown Compass Centre site, depending at what distance the aircraft reaches 500 ft. The PANS-OPS surfaces have been calculated for the shortest flight path distance to the Compass Centre site boundary.

ICAO DOC 8168 specifies the navigation tolerances to be applied to instrument departures. These have been plotted on Figure A.2 for the north of the RWY centerline, and are:

Semi width at the Departure End of the RWY: 150 m
Then expanding at 15°

The RWY extended centerline bearing is 124.3°T, and the northern boundary of the tolerance is therefore 109.3° T (124.3°-15°).

PANS-OPS SURFACE HEIGHT AT THE SOUTH WEST CORNER OF THE SITE

The distance from the nearest boundary of the tolerance line to the south west corner of the site is 6514 ft.

At 3.3% climb gradient, the aircraft altitude at the SW corner is 6514*0.033 = 216 ft + 500 ft turn altitude = 716 ft.

The Minimum Obstacle Clearance (MOC) is 295 ft (from the ICAO PANS-OPS document) and when this is applied to the aircraft altitude of 721 ft the result is 421 ft or 128.4 m, which is the PANS-OPS surface height at this point.

PANS-OPS SURFACE HEIGHT AT THE NORTH CORNER OF THE SITE

The distance from the nearest boundary of the tolerance to the north corner of the site is 7078 ft.

At 3.3% climb gradient, the aircraft altitude at the north corner is 7078*0.033 = 233 ft + 500 ft turn altitude = 733 ft.

The Minimum Obstacle Clearance (MOC) is 295 ft (from the ICAO PANS-OPS document) and when this is applied to the aircraft altitude of 733 ft the result is 438 ft or 133.5 m, which is the PANS-OPS surface height at this point.

AsA will use the same criteria but will use a PANS-OPS software tool to do the calculations and their distances may differ slightly.

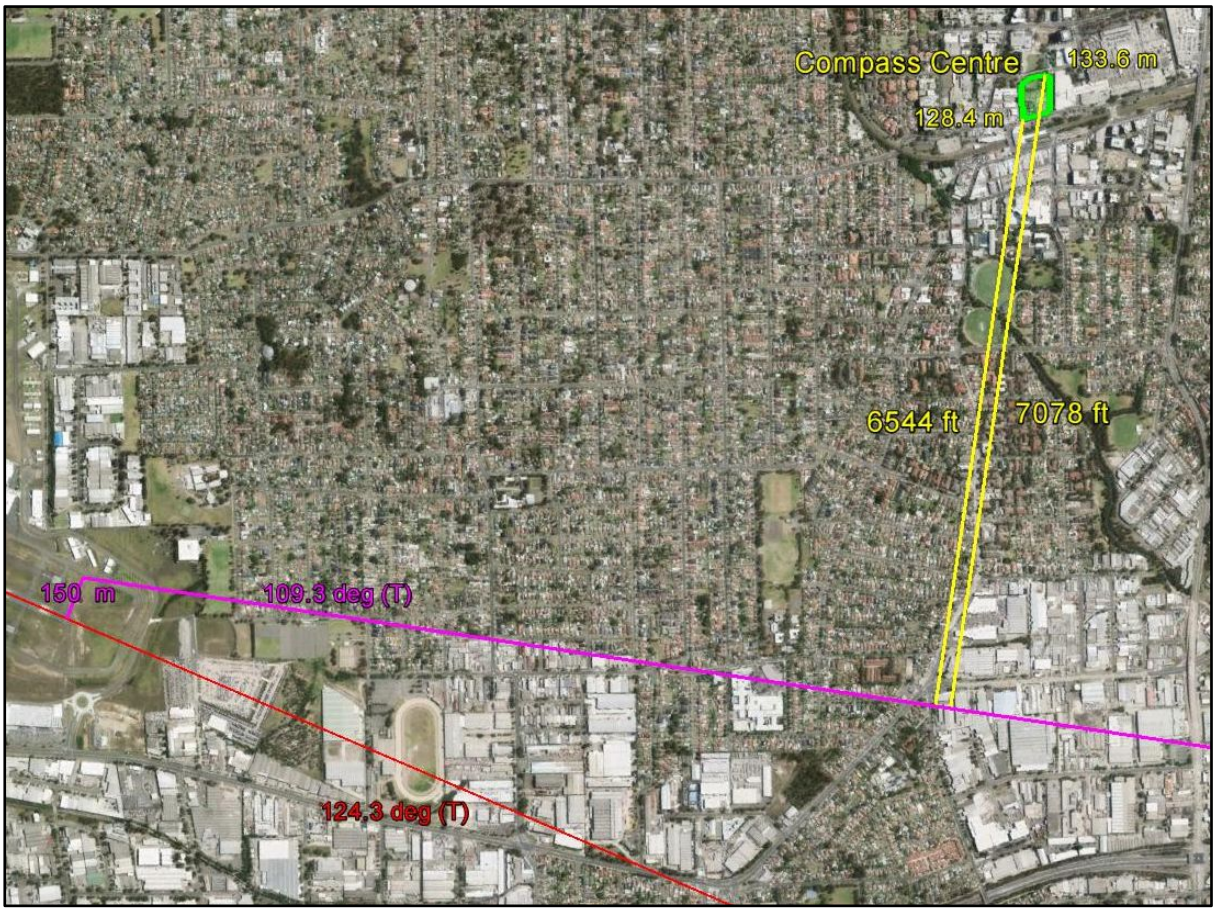

Figure A.2 RWY 11C SID PANS-OPS Navigation Tolerance and Calculation Distances

APPENDIX B

Glossary of Terms and Abbreviations

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Glossary of 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.

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
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))
DOTARS	See DIRD 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

Abbreviation	Meaning
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
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 (= 1.872.1 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

Abbreviation	Meaning
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
V_n	aircraft critical Velocity reference
VOR	Very high frequency Omni directional Range
WAC	World Aeronautical Chart