Aeronautical Impact Assessment

Planning Proposal
Bankstown Central
NSW.

Client

Vicinity Centres

LB00356

Final V1

20 December 2019

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Contents

1 Introduction

1.1 The Development

Vicinity Centres has tasked Landrum & Brown Worldwide (Australia) Pty Ltd to prepare an Aeronautical Impact Assessment (AIA) to support a Planning Proposal for the Bankstown Central redevelopment project in Bankstown's CBD.

The redevelopment of the site comprises several buildings up to a maximum height of 107.08 m AHD and is located just to the north of Bankstown Railway Station. The site is bounded by North Terrace, Stacey Street, Rickard Road, Jacobs Street and The Appian Way in Bankstown.

Figure 1: Site Location (Source: Vicinity Centres)

Figure 2: Proposed development location in relation to Bankstown Airport and Sydney Airport (Google Earth)

This report considers the likely impact of the redevelopment upon aviation activities in the area, especially Bankstown Airport and outlines the steps necessary to gain approval from The Department of Infrastructure, Transport, Regional Development and Cities for any infringement of Prescribed Airspace at airports in the vicinity of the site.

2 Prescribed Airspace

2.1 Overview

The Airports (Protection of Airspace Regulations) 1996 specifies volumes of Prescribed Airspace related to Federally leased airports such as Sydney Airport and Bankstown Airport that protect them from uncontrolled obstacle growth that may have an adverse impact upon flight safety or the regularity of flight operations at those airports.

Prescribed Airspace for an airport is the airspace above any facet of the Obstacle Limitation Surfaces (OLS) or the PANS OPS (Procedures for Air Navigation Services – Aircraft Operations) surfaces for an airport, or the Radar Terrain Clearance Chart (RTCC) protection surfaces.

The OLS are conceptual surfaces associated with runways that are designed to protect aircraft operations from unrestricted obstacle growth.

The OLS comprises:

- outer horizontal surface (OHS);
- conical surface;
- inner horizontal surface (IHS);
- approach surface for each runway;
- inner approach surface for each runway;
- transitional surface for each runway;
- inner transitional surface;
- baulked landing surface; and
- take-off climb surface.

The outer segments of the OLS for airports with Type B, 3D instrument approaches, such as Sydney Airport, extend to 15 km from the airport's Aerodrome Reference Point (ARP). Airports such as Bankstown have OLS extending to 4 km from the ARP, however Bankstown has designated an OHS for future Master Planning purposes. The future surfaces must be considered.

The PANS OPS surfaces are designed beneath instrument approach and departure flight paths with a prescribed minimum obstacle clearance above the obstacles or terrain. They provide an obstacle free flight path to enable safe and efficient aircraft operations in Instrument Meteorological Conditions (IMC) during which flight crews cannot necessarily see the ground or obstacles and they must rely upon aircraft instrumentation to determine their position in relation to navigation aids and runways.

The RTCC provides Air Traffic Control (ATC) with a minimum safe altitude above terrain and obstacles, above which they can provide surveillance services to aircraft in the area around major airports. A protection surface below the useable heights restricts obstacle growth.

Infringement by a building or crane into Prescribed Airspace requires the approval of the aerodrome operator, the Civil Aviation Safety Authority (CASA), and the Department of Infrastructure, Transport, Regional Development and Cities (DITRDC) where the airport is on federally leased land.

Permanent infringement of PANS OPS or RTCC protection surfaces are not supported by the aviation authorities, however, temporary "controlled activities" up to a duration of 3 months may be able to be approved subject to support from the airport, Airservices Australia and CASA being provided to DITRDC. If the infringement is shown to impact on aviation safety or regularity of aircraft operations, it is unlikely to be approved.

2.2 PANS OPS Surfaces

Bankstown and Sydney Airports' PANS OPS surfaces were assessed in detail for this proposed redevelopment.

Other airports including RAAF Richmond and Camden Airport have PANS OPS surfaces related to a 25 nm Minimum Safe Altitude (MSA) over the redevelopment site but they are in excess of 300 m AHD so are not relevant to the content of this report.

Western Sydney Airport, which is not planned to be operational until approximately 2027 will also have 25 nm MSA PANS OPS surfaces over the redevelopment site that will be higher than 300 m AHD.

2.2.1 Bankstown Airport

The detailed assessment of Bankstown Airport's PANS OPS surfaces showed that the lowest PANS OPS surface above the building site is related to the IFR Circling Area for Category A/B aircraft, with a PANS OPS surface of 108.2 m AHD.

The proposed building at a maximum height of 107.08 m AHD will not infringe the PANS OPS surfaces at Bankstown Airport.

In order to improve the likelihood of gaining aviation authority approval for the redevelopment, a concise management plan for the construction cranes will be required prior to submittal of an application to Bankstown Airport. Any crane activity above 108.2 m should be limited to a maximum duration of 3 months.

2.2.2 Sydney Airport

A detailed assessment of Sydney Airport's PANS OPS surfaces showed that the lowest PANS OPS surface above the building site is related to the 25 nm MSA with a minimum altitude of 340 m AHD.

The proposed building at a maximum height of 107.08 m AHD will not infringe the PANS OPS surfaces at Sydney Airport.

2.3 Obstacle Limitation Surfaces

Obstacle limitation surfaces extend to a maximum distance of 15 km from the Aerodrome Reference Point (ARP) of relevant airports.

The redevelopment site is located within Sydney Airport's OLS and Bankstown Airport's OLS.

2.3.1 Bankstown Airport

The redevelopment site is located within the Inner Horizontal Surface (IHS) and the Conical Surface of the Bankstown Airport OLS.

The IHS is at a height of 51 m AHD.

The Conical Surface rises from 51 m at the edge of the IHS to 72 m at the intersection of Rickard Rd and Stacy St as shown on Figure 4.

The proposed building at a maximum height of 107.08 m AHD

- will infringe the OLS Inner Horizontal Surface; and
- will infringe the OLS Conical Surface.

An application to Bankstown Airport must be made in order to gain approval from DITRDC for this building project.

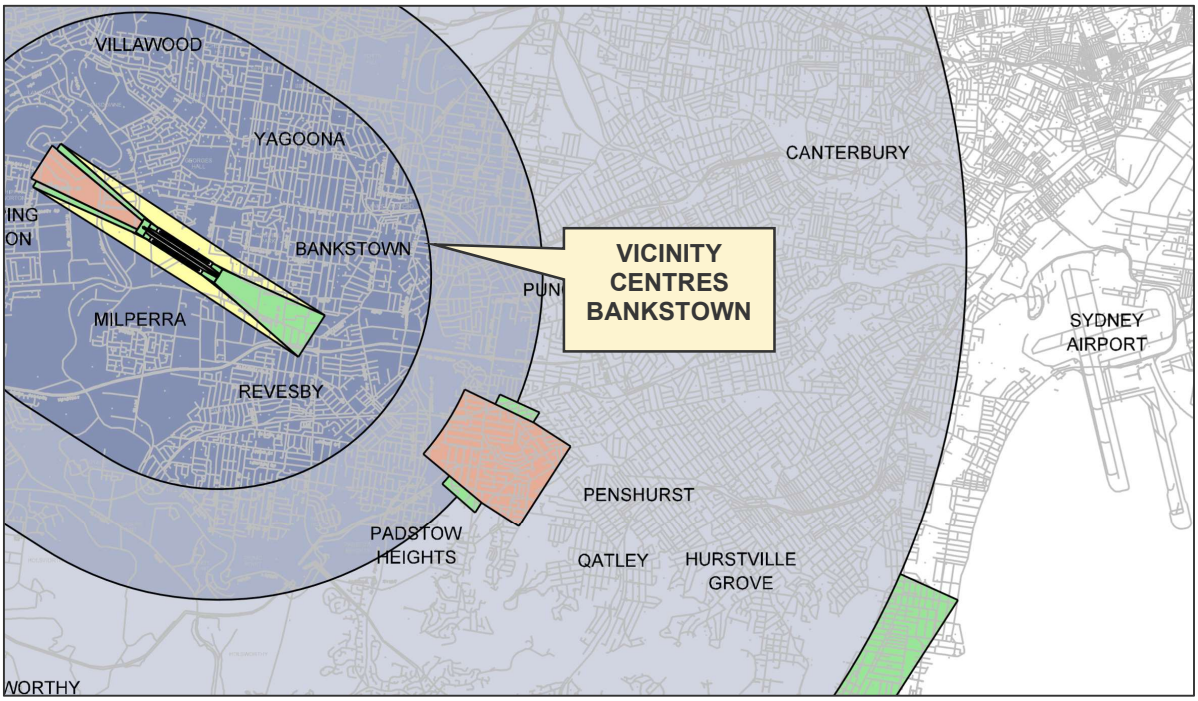

Figure 3: Development Location in relation to Bankstown Airport OLS (Sydney Metro Airports Master Plan 2014)

Figure 4: Development Location in relation to Bankstown and Sydney Airport OLS

2.3.2 Sydney Airport

The development site is located within the Outer Horizontal Surface (OHS) of the Sydney Airport OLS. The Sydney Airport OHS is at a height of 156 m AHD.

The proposed building at a maximum height of 107.8 m AHD will not infringe the OLS Outer Horizontal Surface.

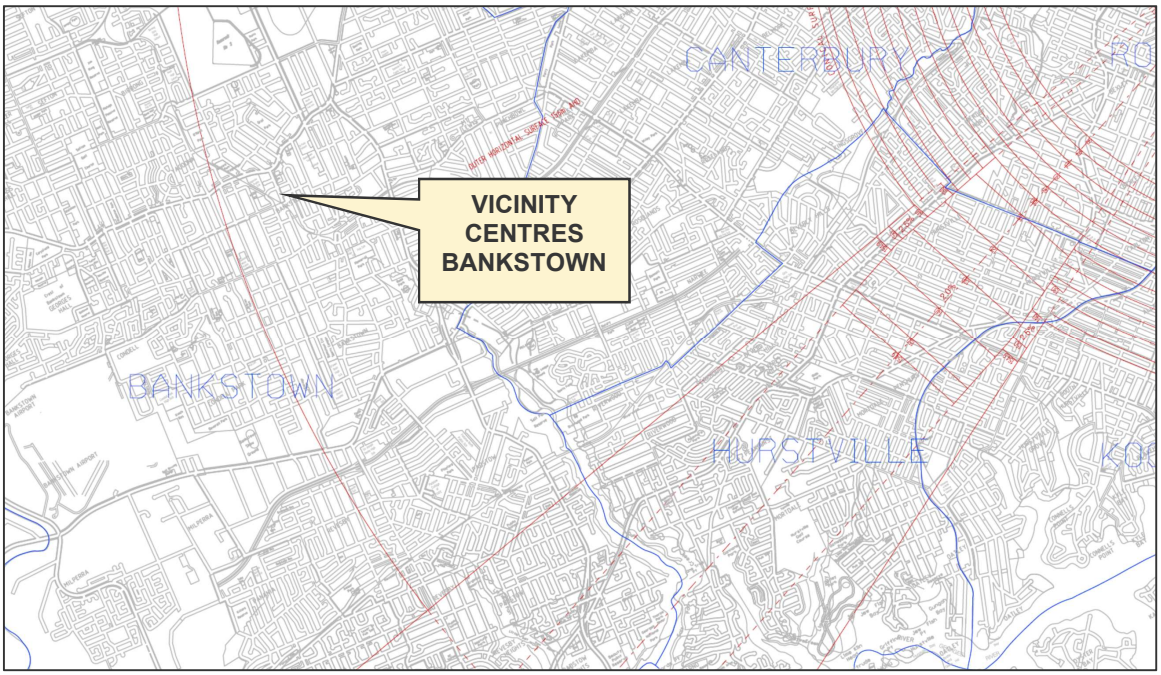

Figure 5: Development Location in relation to Sydney Airport OLS and Regional Development on 20 March 2015

2.4 Aeronautical Study and Safety Case for OLS Infringement

As part of this assessment, an aeronautical study has been conducted to demonstrate that the proposed building to a maximum height of 107.08 m AHD would not adversely affect safety or significantly affect the regularity of operations of aircraft as per ICAO Annex 14, Aerodrome Design and Operations requirements.

As noted above, the proposed building will infringe the Bankstown Airport IHS of 51 m AHD by 56.08 The purpose of the IHS, as described in ICAO standards, is to restrict obstacle growth in the vicinity of airports and to protect the obstacle clearance of aircraft circling the airport in less than visual flight conditions prior to landing.

When the OLS surfaces were initially established, instrument approaches were generally only provided to one runway at the relevant airport and aircraft were not equipped for straight-in approaches with vertical guidance other than via the Instrument Landing System (ILS). A circling approach to a runway other than to the runway to which an instrument approach was designed was usually conducted when local weather conditions, such as wind velocity or visibility, made a landing on the instrument approach runway unsuitable.

A study by the Flight Safety Foundation[1] Approach-and-Landing-Accident Reduction (ALAR) Taskforce found that circling approaches were a major causation factor in a majority of aircraft accidents in the vicinity of airports. The ICAO Assembly Resolution A33-16 Global Aviation Safety Plan (GASP) recognised the need to prevent Controlled Flight Into Terrain (CFIT) accidents by implementing a worldwide program whereby National Aviation Authorities provided a straight-in instrument approach with vertical guidance to each runway used by airline aircraft. In Australia, this program is almost complete with the introduction of Baro-VNAV approaches at all certified and registered airports at which regular passenger transport aircraft operate.

[1] Flight Safety Foundation ALAR Briefing Note 5.1

The promulgation of straight-in instrument approaches has reduced the requirement to restrict obstacle growth in areas where aircraft now do not operate due to the reduction in the frequency of circling approaches. ICAO has acknowledged the limitations imposed by the current OLS layout and has formed the OLS TASK FORCE[2] to review, update and align the OLS surfaces with the PANS OPS surfaces. In completing this work, ICAO recognises the economic balance required between terrestrial infrastructure requirements of growing cities and efficiency and safety of flight operations.

At Bankstown Airport, only Runway 11C is provided with a straight-in approach with vertical guidance, so in a strong north wind IFR aircraft arriving in IMC would need to conduct a circling approach to Runway 29C.

Aircraft conducting an IFR Circling approach are limited to the following minimum altitudes in the vicinity of the proposed Bankstown Central development site. See section 2.4.2 for a detailed assessment that shows that the IFR Circling areas are not infringed.

- CAT A/B – 650 ft – PANS OPS surface height 355 ft/**108.2 m** AHD
- CAT C - 840 ft – PANS OPS surface height 446 ft/135.9 m AHD.

With the building height and crane activity proposed at a maximum elevation of 107.08 m AHD, the IFR Circling areas are not infringed.

2.4.1 Infringement 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 IHS can be infringed 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.*

2.4.2 Examination of Circling Approaches

The proposed building development, at the maximum height of 107.08 m AHD, was examined to confirm that there would be no changes required to the published circling minimum altitudes.

The development site is located underneath the CAT A/B and CAT C IFR circling areas for Bankstown Airport.

The aircraft category (CAT) depends on aircraft performance parameters and is published in the ICAO PANS OPS document.

The Minimum Descent Altitudes (MDA) published for circling approaches at Bankstown Airport, when an accurate QNH is available are:

- CAT A and B aircraft: 650 feet (198.1 m) AMSL, and
- CAT C aircraft: 840 feet (256 metres) AMSL.

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

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[2] https://www.icao.int/SAM/Documents/2016-SUPLIM/RPEAGA7_NI_04_Apéndice%20B_Obstacle%20Surfaces-%20the%20Concept-%20draft-%20OLSTF-5%20Final%20with%20comments.pdf

- CAT A and B: Area radius 4.9 kilometres, MOC 295 feet (90 metres), and
- CAT C: Area radius 7.85 kilometres, MOC 394 feet (120 metres).

The MOC is the prescribed margin above obstacles or terrain in the PANS OPS segment of an instrument approach procedure that determines the Minimum Descent Altitude (MDA) for the procedure.

Note: The Aeronautical Information Publication (AIP) publishes all distances in nautical miles, and altitudes in feet for instrument flight procedures. Displays to pilots are in the same format. The MDA box is shaded which allows pilots to reduce the shown MDA by 100ft if they are in receipt of an accurate QNH, this usually occurs when ATC are on duty.

Table 2 depicts the applicable circling area protection surface height and the clearance (in green) or infringement (in red) of the building on each surface.

Aircraft Category (CAT)	Height of PANS OPS Surface	Result for building height of 107.08 m AHD
A and B	108.2 m	11 m Clearance
C	135.9 m	28.8 m Clearance

Table 1: Circling Area PANS OPS heights

2.4.3 Aeronautical Study Conclusion

The proposed development would be unlikely to have a significant impact upon flight operations at Bankstown Airport as its maximum height does not infringe the IFR Circling Area MDA.

This aeronautical study will need to be included in any application to the aviation authorities for approval of the activity.

2.5 Radar Terrain Clearance Chart

The protection surface height for the RTCC above the development site is 152 m AHD.

At a maximum height of 108.08 m the proposed building will not infringe the RTCC protection surface.

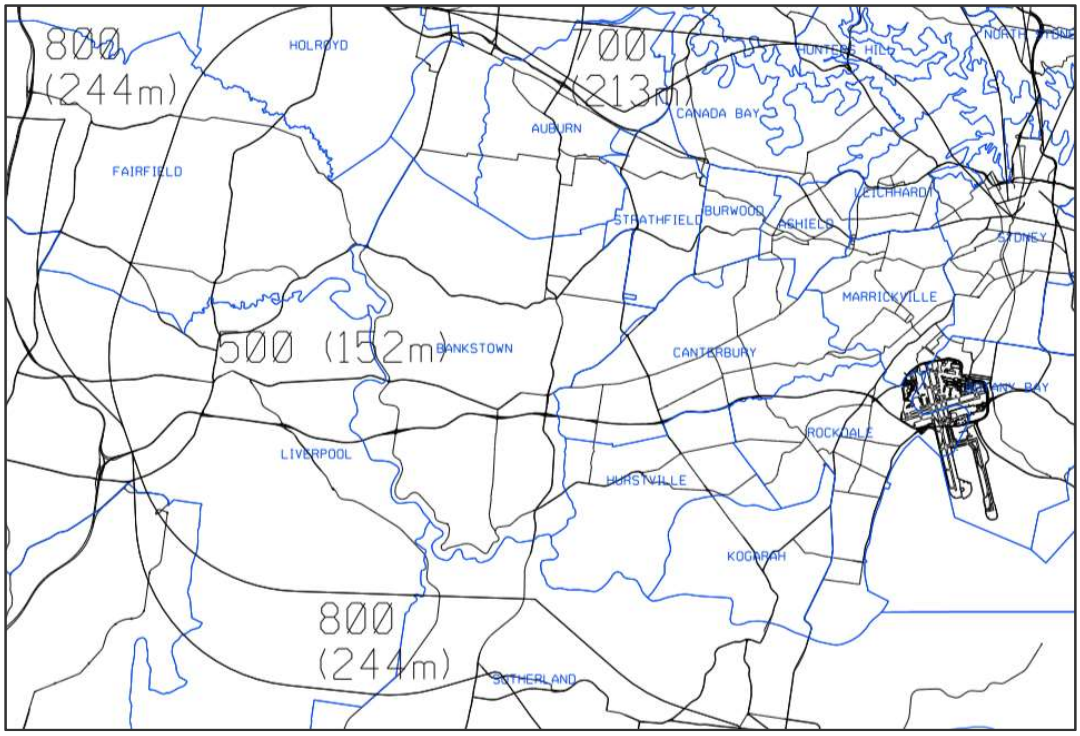


Figure 6: Sydney RTCC (SACL Airspace Protection web site)

3 ATC Surveillance System Performance

ATC rely on surveillance systems to safely and efficiently control aircraft operations in the vicinity of Sydney Airport and the other airports in the Sydney Basin.

Buildings and/or terrain that infringe radar clearance planes have the potential to cause signal shadows in areas where ATC need to provide a surveillance service or advisory service to aircraft.

This assessment identified two radars in relative proximity to the development site: the Sydney Airport Terminal Area Radar (TAR), and the Cecil Park TAR.

The presence of multiple surveillance systems that support each other will reduce the potential of shadow effects.

The proposed development, at a height of 107.08 m AHD, will not infringe the Sydney Airport TAR clearance plane or the Cecil Park TAR clearance plane.

Construction cranes are not considered to have an impact on the performance of ATC surveillance equipment.

Airservices Australia will assess any likely impact that the proposed development may have on the Sydney Airport TAR, or other surveillance systems such as ADS-B, along with any mitigating effect of the other installations.

Surveillance System	Distance from development	Antenna Elevation (AHD)	Clearance Plane Elevation at development site Distance x Tan 0.5° + TAR elevation	Result for development height of 107.08 m AHD
Sydney Airport TAR	13700 m	38.2 m	157.8 m	50.72 m Clearance
Cecil Park TAR	19090 m	200.5 m	367.1 m	260.02 m Clearance

Table 2: Impact of development on ATC Surveillance System Performance

4 Navigation Aid Performance

There are navigation aids installed at Bankstown Airport and Sydney Airport, including ILS, GBAS, NDB and DME.

The Building Restricted Areas (BRA) describes a sensitive zone that exists to a radius of 3000 m from the navigation aid antenna sites. The building development limitations within the BRA is specified in the Airservices Australia document Navigation Aid Building Restricted Areas and Siting Guidance AEI-7.1613 Issue 2.

The development site is located more than 3 km from any navigation aid and is therefore outside of all BRA for all navigation aids in the Sydney area and therefore should not have an impact upon their operation.

5 Roof Top Exhaust Plumes

Exhaust plumes in excess of 4.3 m/s which exist in either OLS or PANS OPS surfaces can create sufficient turbulence to upset the stability of aircraft during take-off and landing operations.

Part 139 of the Civil Aviation Safety Regulations 1988 (CASR 1988) provides that CASA may determine that a gaseous efflux having a velocity in excess of 4.3 m/s is, or will be, a hazard to aircraft operations because of the velocity of the efflux.

Should any roof top exhaust plume rise in excess of 4.3 m/s infringe any of the above mentioned OLS or PANS OPS surfaces, they must be referred to CASA for their assessment of risk to aircraft operations.

6 Cranes

Should any construction cranes be required above the lowest PANS OPS height of 108.2 m AHD and therefore infringe any Prescribed Airspace, an application to Bankstown Airport will need to be made.

Cranes that infringe Prescribed Airspace may only be able to be approved up to a maximum duration of 3 months if in the opinion of the aviation authorities, safety standards are not affected.

7 Conclusion

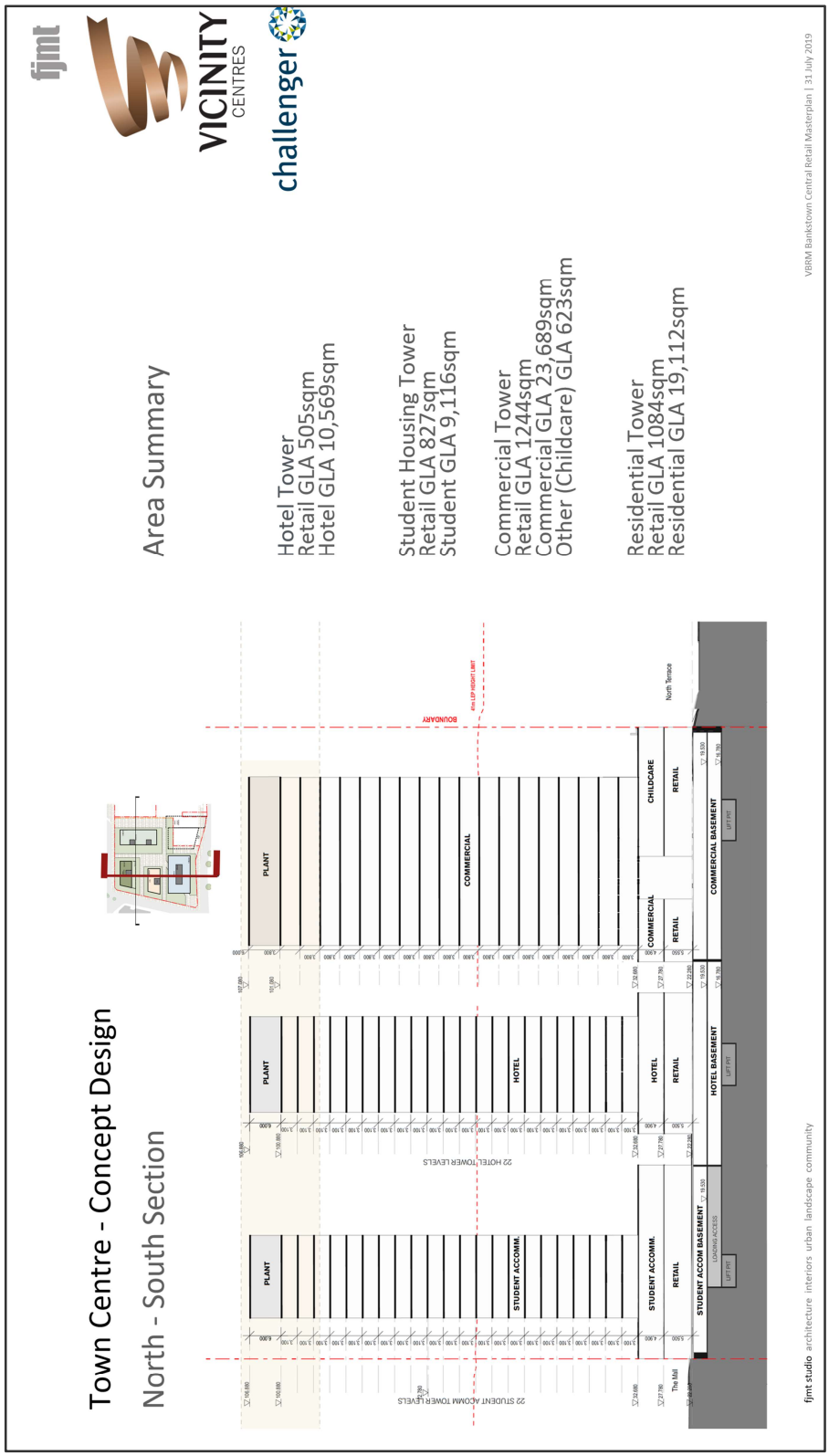
The Bankstown Central planning redevelopment proposal, with a building to a maximum height of 107.08 m AHD:

- will infringe the Inner Horizontal Surface of the OLS for Bankstown Airport;
- will not infringe the PANS OPS surfaces for Bankstown Airport;
- will not infringe Sydney Airport's OLS or PANS OPS surfaces;
- will not infringe the PANS OPS surfaces for any other airport in the vicinity;
- will not infringe any BRA for navigation aids at Sydney Airport;
- will not infringe the Sydney TAR or the Cecil Park TAR clearance plane; and
- will not infringe the RTCC protection surface above the site.

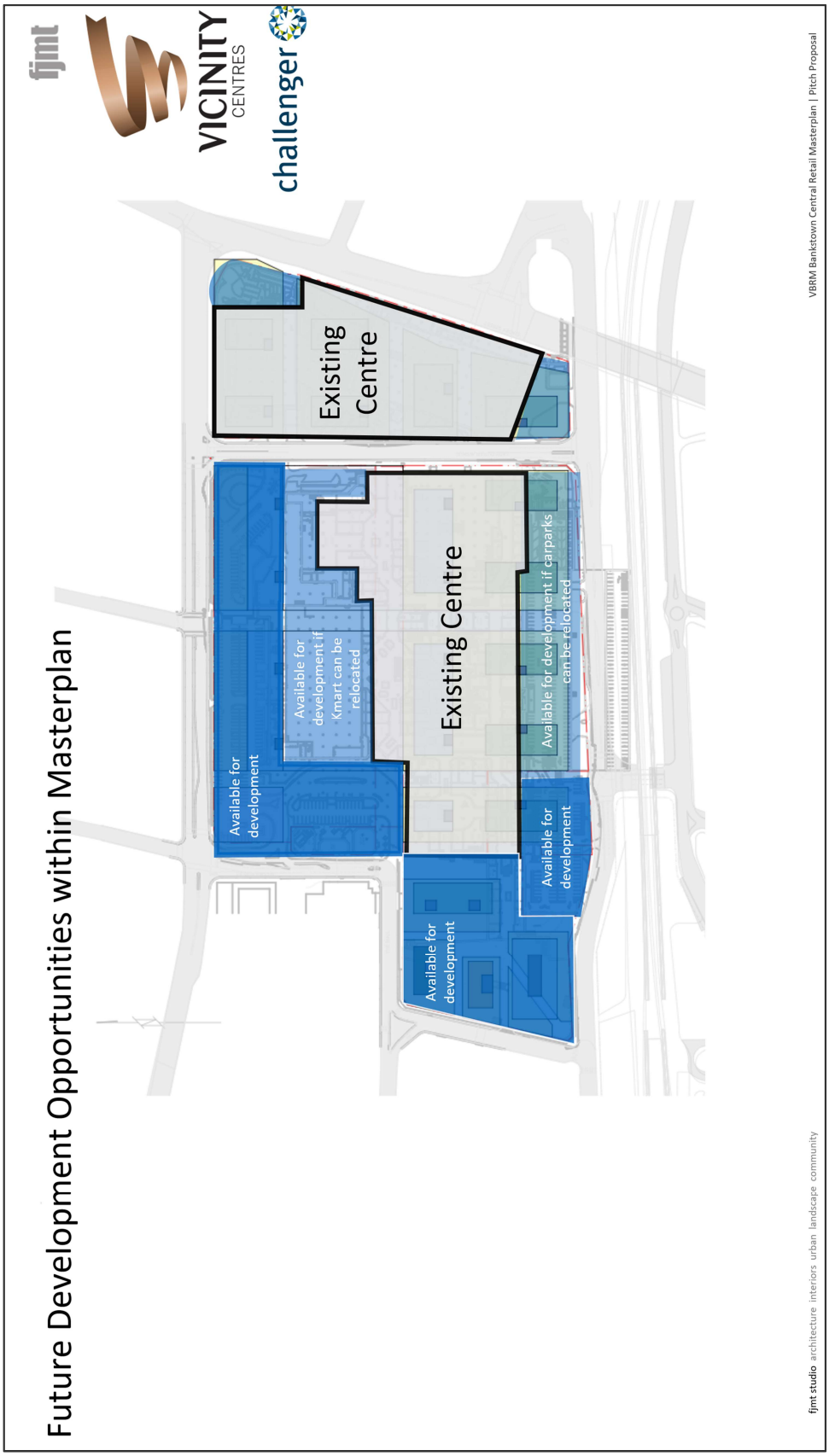
Based on the information provided throughout this report, the infringements to the Bankstown Airport OLS is unlikely to be considered to adversely affect aviation safety or regularity of flight operations and approval for the building is likely to be achieved.

It will be necessary to gain approval for the infringement of the Bankstown OLS via an application to Bankstown Airport.

Appendix A – Building Height and Site Layout Diagrams



North- South Section Elevation
Source: Vicinity Centre/ FJMT Studio



Site Layout
Source: Vicinity Centres/FJMT Studio

Appendix B – Assessment Methodology

In preparing aeronautical impact assessments associated with airport safeguarding and protection, it is necessary to observe the requirements of the relevant aviation authorities including:

- The Department of Infrastructure, Regional Development and Cities (DIRDC);
- The Civil Aviation Safety Authority of Australia (CASA);
- Airservices Australia (ASA);
- Airport Operators; and
- Department of Defence where appropriate.

The *Airports Act 1996* and *Airports (Protection of Airspace) Regulations 1996* prescribes the volumes of airspace surrounding Federally Leased Airports that protect aircraft operations into those airports, in order to ensure the safety and regularity of airline and other flight operations.

Sydney Airport's Prescribed Airspace comprises:

- Obstacle Limitation Surfaces (OLS) that restrict obstacle growth in the vicinity of takeoff and landing paths; and
- PANS OPS surfaces that provide a buffer between flight paths and terrain or obstacles.

Relevant Acts and Regulations applicable to developments near airports and air traffic routes were referenced during this assessment.

The major relevant documents include:

- The Airports Act 1996, Airports (Protection of Airspace) Regulations 1996;
- Civil Aviation Safety Regulation (CASR) Part 139 Manual of Standards – Aerodromes;
- Aeronautical Information Publication (AIP);
- Airservices Australia's Airways Engineering Instruction – Navigation Aid Building Restricted Areas and Siting Guidance (BRA);
- International Civil Aviation Organisation (ICAO) DOC 8168 Procedures for Air Navigation – Aircraft Operations (PANS OPS).

A Glossary of Aeronautical Terms and Abbreviations is shown at Appendix C.

Appendix C – 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, AIP is issued by Airservices Australia on behalf of CASA.

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. Pilots must hold IFR qualifications and aircraft must be suitably equipped with appropriate instruments and navigation aids to enable flight in IMC.

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.

MDA (Minimum Descent Altitude) is the lowest altitude that can be used during a non-precision approach in IMC. Flight below the MDA reduces the clearance above obstacles and is not permitted in IMC.

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 infringe the OLS, they cannot be permitted to infringe 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.

Radar Terrain Clearance Chart (RTCC) is a chart that provides air traffic controllers with the lowest usable altitude that they can vector an aircraft using prescribed surveillance procedures within controlled airspace. There is a protection surface below this usable altitude which is shown in airport master plans.

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. Pilots must be specifically qualified and aircraft specifically equipped to enable flight in IMC,

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 (documents that support CAR 1998)
ACFT	Aircraft
AD	Aerodrome
ADS-B	Automatic Dependent Surveillance - Broadcast
AHD	Australian Height Datum
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
BARO-VNAV	Barometric Vertical Navigation
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
DME	Distance Measuring Equipment
Doc nn	ICAO Document Number nn
DITRDC	Department of Infrastructure, Transport, Regional Development and Cities
ELEV	Elevation (above mean sea level)
ENE	East North East
ERSA	Enroute Supplement Australia
FAF	Final Approach Fix
FAP	Final Approach Point
FAS	Final Approach Surface of a BARO-VNAV approach

Abbreviation	Meaning
ft	feet
GBAS	Ground Based Augmentation System (satellite precision landing system)
GNSS	Global Navigation Satellite System
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
LNAV	Lateral Navigation criteria
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 – Aircraft Operations, ICAO Doc 8168

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