NSW Land and Housing Corporation

600-660 Elizabeth St, Redfern — Aeronautical Assessment of Redevelopment Proposal

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Document Number: **18.035-02-001** *Version:* **2.0**

Document Title: **600-660 Elizabeth St, Redfern — Aeronautical Assessment of Redevelopment Proposal**

Purpose / Abstract: *This study has been prepared for NSW Land and Housing Corporation (LaHC).*

LaHC intends to redevelop the site at 600-660 Elizabeth Street, Redfern in order to increase social housing and make a contribution to the housing supply in Sydney.

This report assesses the regulated airspace height constraints over the site in view of existing operations and forecasted changes as included in the recently released Sydney Airport Master Plan 2039. The airspace constraints are summarised in relation to how they apply to permanent structures as well as for temporary obstacles such as cranes.

The study concludes that the proposed development would have no negative impact on aeronautical activities to and from the airport. The tallest buildings in the Reference Scheme are approximately 80m AHD and the top of the Solar Plane is approximately 90m AHD. Hence the Reference Scheme, and the cranes that will be required to construct it, is well below the most limiting restrictive airspace protection surface, the Radar Terrain Clearance Chart (RTCC) surface, with a height of 152.4m AHD above the site. The tallest building presented in the Planning Proposal will not infringe the Obstacle Limitation Surfaces (OLS), which is 90-96m AHD above the site, in which case an application for approval of the buildings by the aviation authorities will not be necessary. However, it is likely that the cranes needed to construct the buildings will require approval (as they would exceed the OLS height) under the Airports (Protection of Airspace) Regulations 1996 (APAR). For the other (less tall) buildings, it is likely that cranes required for their construction will be able to operate at maximum heights that would remain below the OLS. Only those that would infringe the OLS would require prior airspace approvals.

The evaluation contained in this report is conservative because it uses the closest point on the southern edge of the site boundary to the airport as the assessment point whereas the tallest building is in the northern part of the site. The evaluation concludes that there are no technical reasons why the required applications (for cranes) would not be approved under the Airports (Protection of Airspace) Regulations.

Contract: - *StratAir Ref:* 18.035.V2

Change History

Version	*Versn Date*	*Version By*	*QA By*	*Version / Change Description*
Prior to v2.0	Apr-2018 - Aug-2019	P. Haubourdin	J. McCarthy / C. Pak-Poy	Various versions addressing earlier planning scenarios
2.0	25-Feb-2020	C. Pak-Poy	J. McCarthy	New Reference Planning Scheme 2020

Distribution Control

Legend:	*Uncont*	Uncontrolled Document	*StratAir*	Strategic Airspace
	Client	NSW Land and Housing Corporation, DPIE	*AsA*	Airservices Australia
	APT, SACL	Sydney Airport Sydney Airport Corporation Ltd	*DPIE*	NSW Department of Planning, Industry & Environment
	CASA	Civil Aviation Safety Authority	*DITRDC*	Department of Infrastructure, Transport, Regional Development & Communications

Issue Version	*Issue Date*	*Issue Purpose / Description*	*Copy No*	*Copy Recipient*
2.0	26-Feb-2020	Distribution to Client	Uncont	StratAir, Client

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1 Executive Summary

The Aeronautical Assessment Report has been prepared on behalf of NSW Land and Housing Corporation (LaHC) to accompany a Planning Proposal to be lodged with the City of Sydney (CoS).

This Planning Proposal relates to land at 600-660 Elizabeth Street, Redfern (the Site). The Planning Proposal seeks to rezone the Site to allow redevelopment for a mix of social, affordable and private housing in an integrated residential community. The aims of the Planning Proposal are to rezone the Site to R1 General Residential..

An indicative reference scheme and urban design report has been prepared by Architectus, Silvester Fuller and Tyrell (the Project Team) to support the Planning Proposal and demonstrates how the Site may be redeveloped. The indicative reference scheme comprises:

- Approximately 327 dwellings, with building heights ranging between 6 and 14 storeys;
- A mixed-use development, with over 1,500m2 of non-residential floor space for local shops, cafes, community space and other services; and
- Three ground floor communal courtyard spaces.

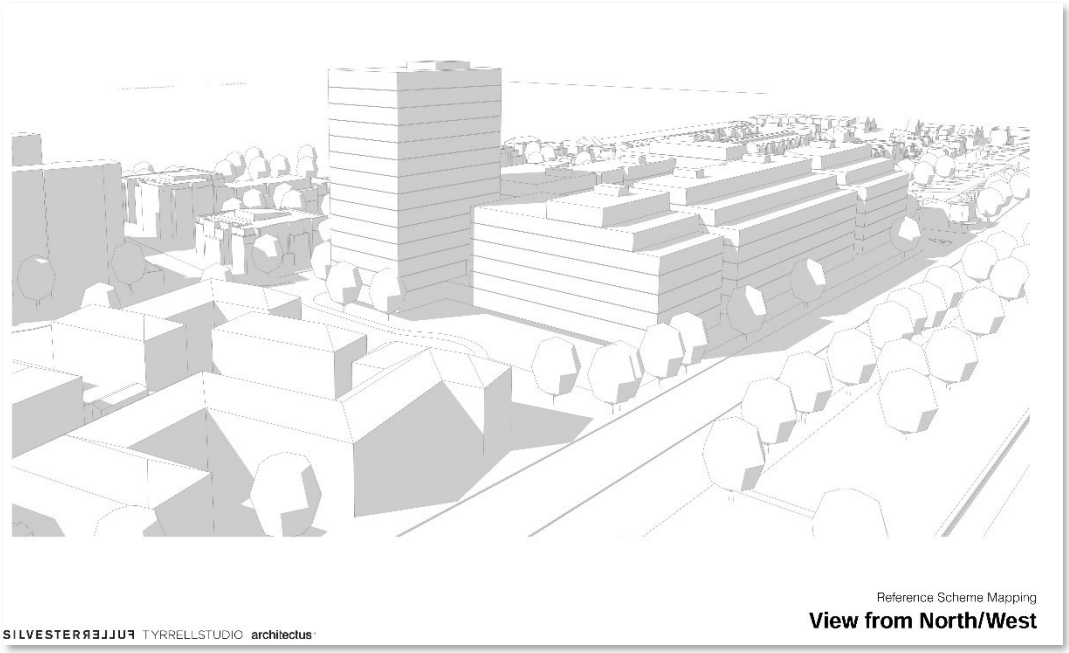
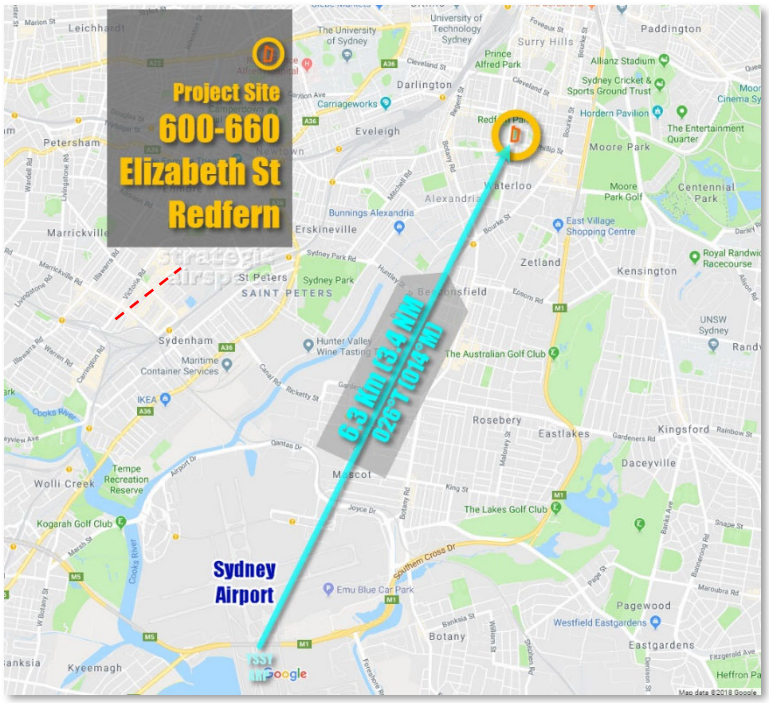


Figure 1 — Aerial View of Proposed Reference Scheme

This report assesses the regulated airspace height constraints over the site to inform the development potential and identify any constraints as a result of aeronautical activities. In this regard it also considers the solar plane overhead the site which would effectively limit the potential maximum heights of buildings in relation to planning guidelines.

The Redfern site is located approximately 6.3km (3.4 Nautical Miles (NM)) north-north-east of Sydney Airport's Aerodrome Reference Point (ARP). The site lies south of the Sydney CBD and there are no significant tall obstacles nearby: the tallest nearby buildings are several 16-storey buildings in nearby housing estates.

This report has been prepared having regard to Prescribed Airspace for Sydney Airport. **It examines the current and forecast regulated airspace height limits constraints overhead the site that are related to aviation airspace protection requirements**. Based on estimated maximum development and likely maximum crane heights required to enable such developments, the implications for airspace-related height application implications and likely approvability in relation the Commonwealth Airports (Protection of Airspace) Regulations 1996 (APAR) are also evaluated.



Source: Google Maps

Figure 2 — Site Location

The relevant airspace constraints overhead the site are summarised below.

Table 1 — Summary — Key Airspace Height Constraints

Height Limits (AHD)	*Height Limit Detail*	*Comment*
~90 - ~96m	OLS Conical Surface	THRESHOLD HEIGHT limit: Any development on the site (including temporary cranes) that would exceed the relevant OLS height (which slopes up across the site – see section 5.1 and Figure 7 below), requires a prior 'airspace height' approval from the Department of Infrastructure, Transport, Regional Development & Communications (DITRDC[1]) under the Airports (Protection of Airspace) Regulations (or APAR)[2].
152.4m	**Radar Terrain Clearance Chart (RTCC) Surface**	**The site lies within the lateral limits of the RTCC sector where the limiting height is 152.4m.** This constraint is the maximum permissible height for obstacles (buildings & cranes) at the site because it is more limiting than those of the PANS-OPS surfaces overhead the site.

1 DIRRDC, an augmented Commonwealth department formed after the 2019 federal election and later reformed in December 2019; formerly the Department of Infrastructure, Regional Development & Cities (DIRD).

2 The APAR are administered by the Airports and Aviation Division of DITRDC. Formerly part of Infrastructure, the Division now falls under the Transport ministry.

Height Limits (AHD)	*Height Limit Detail*	*Comment*
>152.4m or N/A	PANS-OPS Procedures & Other Surfaces	Height limits related to PANS-OPS Approach, Missed Approach, Departure and area manoeuvring procedures are higher than or do not overlay the site. The same applies to other surface types and other airspace and aviation operational factors.

Table 2 — Summary of Airspace Height Impact & Height Application Implications

***Feature & Proposed Max Height** (m AHD) for Assessment*	***OLS** ~90-96 m AHD Clearance / Infringement*	***PANS-OPS / RTCC** 152.4 m AHD Clearance / Infringement*	***Airspace Height Application & Approvability Evaluation Comment***
Tallest (14-Storey) Building Max Height including Rooftop Features (Conservative): **80 m AHD**	**10+**	**72.4**	**No height application would be required for the tallest building as it would be below the OLS height limit.** Similarly, no prior airspace approvals would be required for any of the other (less tall) buildings proposed.
Crane for 14-Storey Tower Max Height (Conservative): **120 m AHD**	***Estimated*** **24 - 30**	**32.4**	A crane for the tallest building is likely to exceed the OLS height and would thus require a height approval prior to the time its height would exceed the relevant OLS height limit. Because the maximum height of the crane would be below the limiting RTCC (and PANS-OPS) surface heights, it is technically approvable under the APAR, and approvable without a 3-month operating duration condition. Approval would be expected to be granted.
Top of Solar Plane Max Height (Conservative): **90 m AHD**	**0-6**	**62.4**	**No height application would be required for any building that was developed to the limit of the solar plane across the site, as they would be below the respective OLS height limits across the site.** Re Cranes — Prior approvals for cranes would only be required where the maximum crane height would exceed the relevant OLS height constraint at that location.

In summary, any permanent obstacle (such as a building) or temporary obstacle (such as cranes) erected on the site may not exceed the RTCC surface height limit of 152.4m AHD. Based on the Reference Scheme, this surface height constraint will not be challenged.

Based on the reference scheme for this Planning Proposal, all buildings will remain below the OLS height constraints and would therefore <u>not</u> require prior airspace approvals.

Further, it is anticipated that only cranes for the tallest (14-storey tower) building would require prior airspace approval. It is likely that cranes for the other buildings could operate under the OLS heights and therefore would not be subject to airspace approvals.

2 Introduction

Strategic Airspace (StratAir) has been commissioned by NSW Land and Housing Corporation (LaHC) to conduct a complete review of the existing aeronautical constraints and opportunities and the reference design scheme prepared for 600-660 Elizabeth Street, Redfern (the site).

This report has been prepared having regard to the Prescribed Airspace of Sydney Airport. It examines the current and forecast regulated airspace height constraints overhead the site that are related to aviation airspace protection requirements and summarises the maximum permissible heights in relation to the assessable airspace. Based on estimated maximum development and likely maximum crane heights required to enable such developments, the implications for airspace-related approvability in relation the Airports (Protection of Airspace) Regulations are also evaluated. The requirements for the study and references to where such requirements have been attended to in this report are documented in Table 4 (p7).

2.1 The Proposal

The Planning Proposal relates to land at 600-660 Elizabeth Street, Redfern (the Site). The Planning Proposal seeks to rezone the Site to allow redevelopment for a mix of social, affordable and private housing in an integrated residential community. The aims of the Planning Proposal are to rezone the Site to R1 General Residential.

An indicative reference scheme and urban design report has been prepared by Architectus, Silvester Fuller and Tyrell (the Project Team) to support the Planning Proposal and demonstrates how the Site may be redeveloped. The indicative reference scheme comprises:

- Approximately 327 dwellings, with building heights ranging between 6 and 14 storeys;
- A mixed-use development, with over 1,500m2 of non-residential floor space for local shops, cafes, community space and other services; and
- Three ground floor communal courtyard spaces.

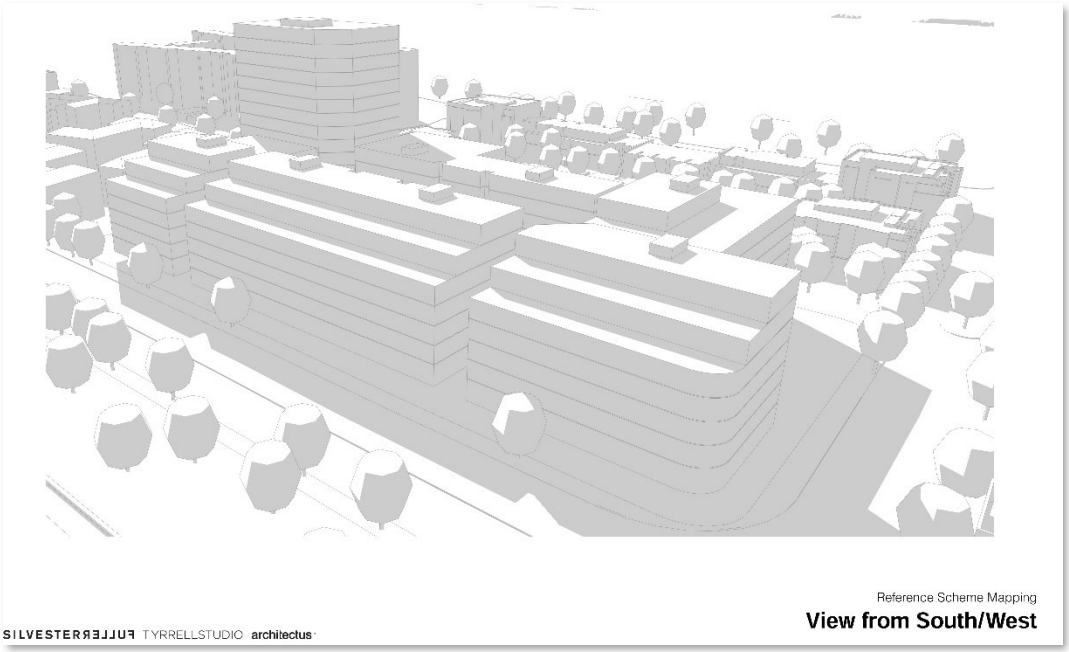


Figure 3 — 600-660 Elizabeth Street, Redfern Reference Scheme

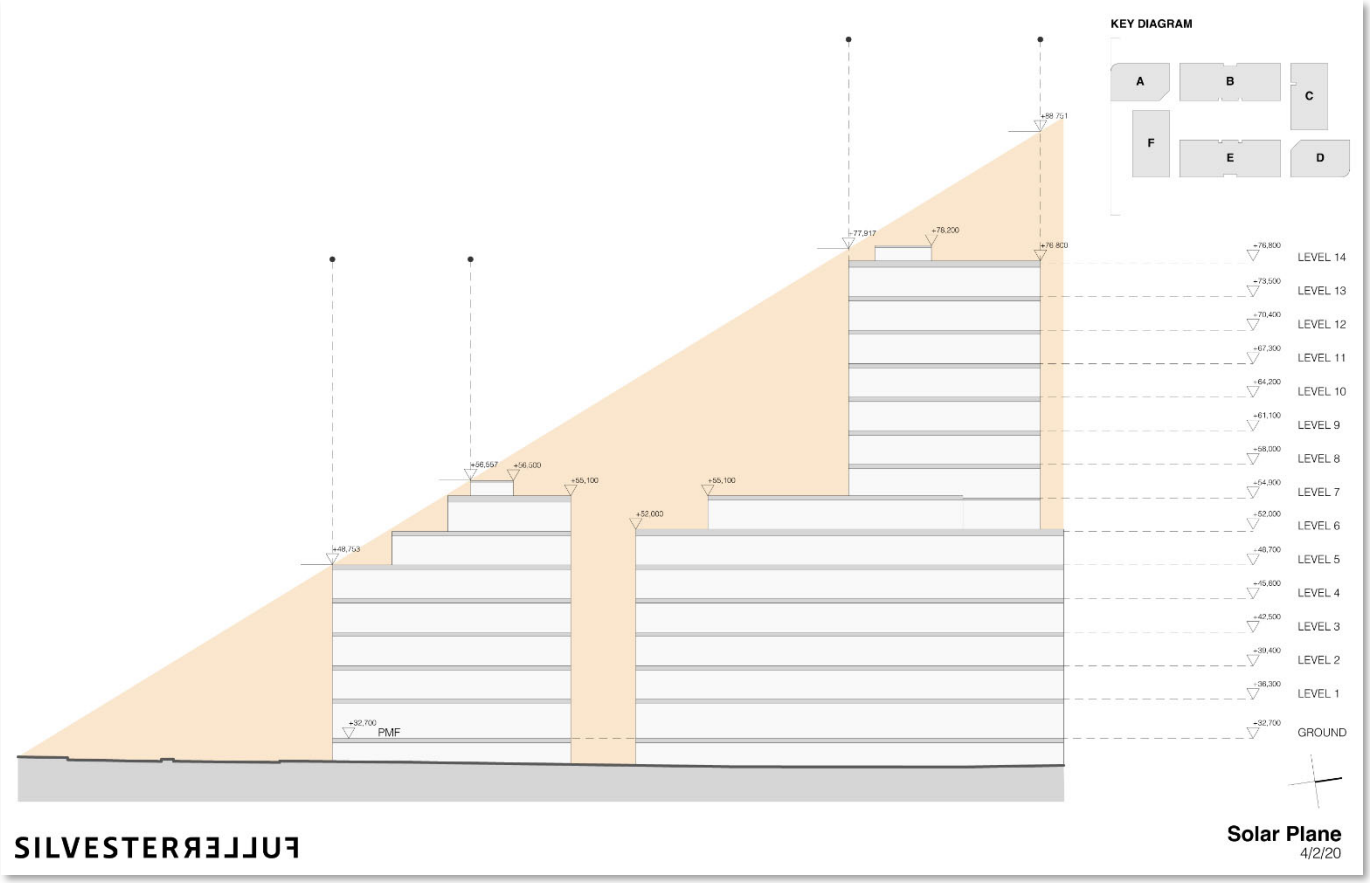


Figure 4 — Section view of the Reference Scheme in relation to the Solar Plane

2.2 Maximum Development-related Heights for Aeronautical Height Assessment

Survey plans of the site indicate that the ground height across the site is in the range of approximately 30m to 31m Australian Height Datum (AHD). The LEP height constraints typically apply to the maximum height of a building to the top of the roof level, whereas aeronautical height assessments must also take into account the any rooftop overruns for lift towers, plant rooms and any other rooftop structures.

The current reference scheme plans included in the Planning Proposal indicate building heights that include features that would account for lift towers. However, as this is only a planning-level reference scheme at this stage, we have rounded up the values from the plans provided to the nearest 2 whole meters, as documented in Table 3 below, for assessment purposes.

For assessing potential crane impact and approvability, we have assumed that a maximum crane height 40m above the roof level of the tallest building, the single 14-storey tower, which would mean a maximum height of 120m AHD. This is purely an estimated based on experience, and could in fact be conservative, depending on the type of crane used (eg, if a hammerhead crane was to be used, the maximum height could potentially be 10m lower). The same approach has been taken for a crane if the development was to go to the top of the solar plane (this number is overly conservative because any building should not exceed the solar plane.

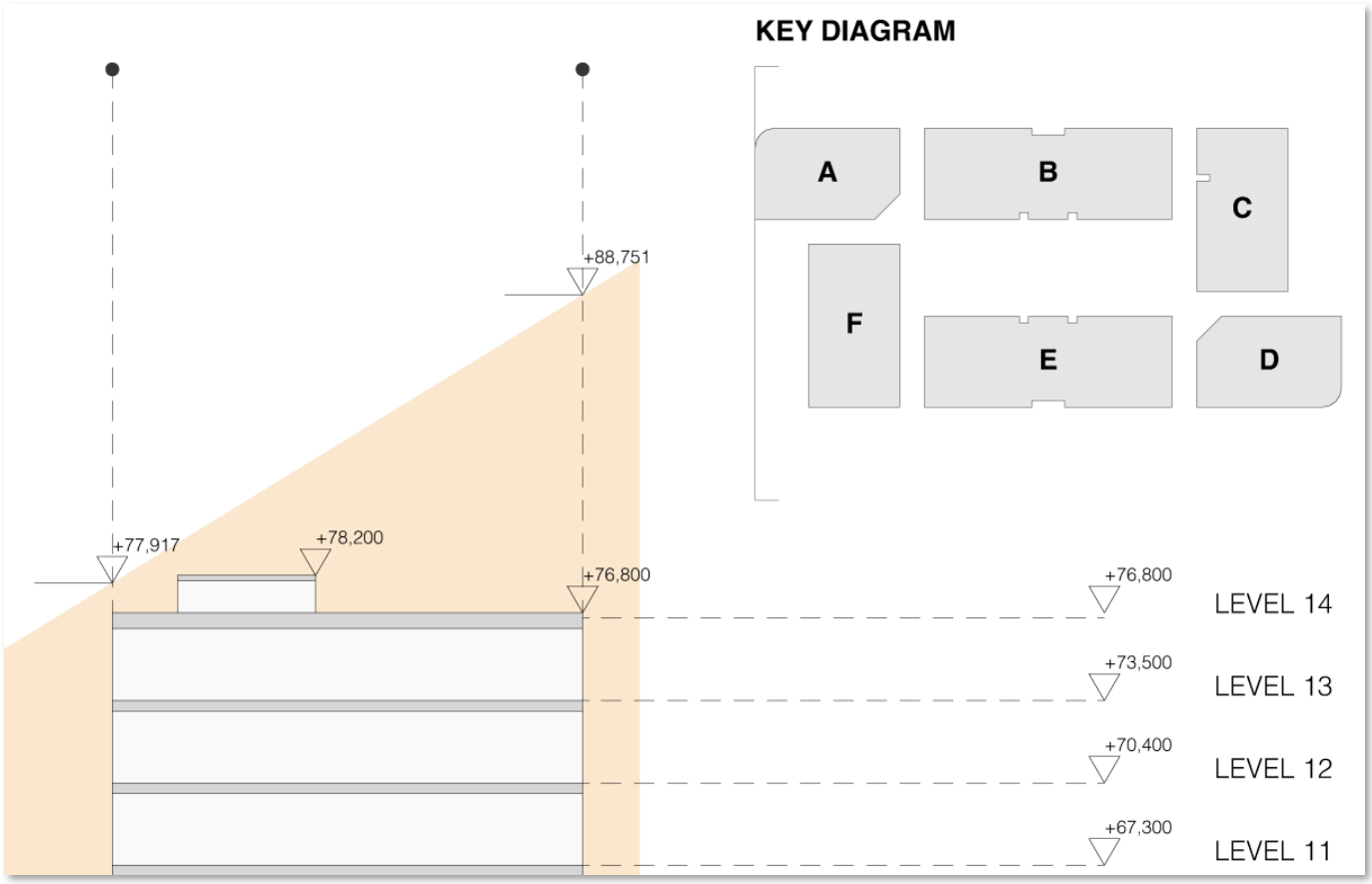


Figure 5 — Tallest building envelope (D) & Top of Solar Plane

Table 3 — Summary of Maximum Development & Crane Heights to Evaluate Aviation-related Airspace Height Approvability

Feature	*Max Heights Assumed (AHD)*	*Max Crane Height Assumed (AHD)*
Max Development Height (14-storey building, NE corner of the site)	78.2 — assume **80**	120
Max Solar Plane	88.751 — assume **90**	130

As both heights are evaluated at the corner of the site closest to the airport, but the tallest development and the highest point of the solar plane re both located at the northern edge of the site (furthest from the airport, the height assessment results will be conservative.

3 Study Requirements

The Study Requirements for the Elizabeth Street, Redfern precinct, originally issued in January 2018, were prepared with the City of Sydney Council in consultation with relevant State agencies. Of relevance to this study are the following requirements:

Table 4 — Study Requirements Index

Study Requirement	*Report Cross-Reference*
22. Aeronautical	
22.1. Review relevant background information, including the 'Sydney Airport Master Plan 2033' to understand the current and proposed future operations of Sydney Airport, as relevant to the precinct.	Section 4.2.1 (p10)
22.2. Identify and clearly map the OLS, PANS OPS and any other relevant Sydney Airport height limitation layers, including consideration of Navigation Aid Surfaces.	Sections 5 (p13)
22.3. Translate these layers into a maximum height for permanent (e.g. buildings) and temporary (e.g. cranes) structures include a building methodology specialist to translate this information into maximum building envelope height planes.	Section 5 (p13)
22.4. Advise on other measures, if necessary, to ensure the precinct does not have an adverse impact on the operations of Sydney airport, e.g. lighting, reflective surfaces etc).	Section 5.3 (p20)
22.5. Certify that subject to any recommended measures, the precinct proposal will not have an adverse impact on the operations of Sydney Airport.	Section 6, (p22)

These study requirements have been considered together with the proposed Reference Scheme and this report wholly satisfies these requirements.

4 Aeronautical Impact Context

4.1 Location of the Proposed Development

This study will focus on the South-West and South-Eastern corners of the site as they are in closest proximity to the Sydney Airport runways. The geographic coordinates of these two points have been sourced by reference to the property boundary in Google Earth.

Table 5 — Reference Assessment Coordinates

Site Corner	*Geographic Coordinates — Latitude & Longitude*	*GDA94 – MGA Coordinate Conversion Easting & Northing (Zone 56)*
SW	33° 53' 45.8" S 151° 12' 25.0" E	334,203.479 6,247,921.998
SE	33° 53' 46.2" S 151° 12' 27.5" E	334,267.914 6,247,910.797

The site at 600-660 Elizabeth Street, Redfern is located approximately 6.3 km (3.4 Nautical Miles, NM) north-east of the Aerodrome Reference Point (ARP) of Sydney Airport, as indicated in Figure 6 below.

Figure 6 — Project Site in relation to Sydney Airport

Other airports in the Sydney Basin are too distant from the site to have any impact on the airspace overhead it.

4.2 Airport Plans & Aeronautical Data References for the Study

4.2.1 Sydney Airport Master Plan 2039

Sydney Airport's Master Plan for 2039, though recently released (April 2019) is in many ways already obsolete, especially as it relates to airspace; it does not address many of the changes to operations and airspace that have taken place over the past few years.

A Effects of Recent Changes

There have been significant changes to Sydney Airport airspace in recent years. These changes have been caused by new types of operations, new navigation technology and changed ICAO safety criteria and standards used by Airservices and CASA. Most of these changes have not affected the critical airspace directly above the Redfern site.

These changes have been identified from Airservices and ICAO documents and have been taken into consideration in this report. Sydney Airport have also confirmed that the OLS is not anticipated to change during this period,

and the general pattern of the PANS-OPS instrument approach and departure procedure paths to the airport will not change (although Airservices may change the gradients and minor details of the procedures to suit air traffic operational requirements).

B Trends that May Affect the Airspace over the Redfern Site

The 2039 Master Plan does identify several trends, mostly in terms of aircraft types and number, that may affect the environmental (noise) impact and airspace limitations over the Redfern site. These trends are:

- A slowly decreasing number of General Aviation and Corporate Aviation operations: these types of airport users are the most likely to use the most restrictive PANS-OPS operation (the Category A and B Circling Area). While the Category A and B Circling area does not directly affect the Redfern site, aircraft using the Circling Area may come near the site. The number of such aircraft is already low and likely to diminish or disappear altogether.
- Increasing use of newer navigation technologies: this will decrease the need for the Category A and B Circling Area and eventually remove the current reliance on 'radar vectoring' which is the cause of the most restrictive surface above the Redfern site – the Radar Terrain Clearance Charts (RTCC). No other changes to flight paths that would impact the Redfern site are anticipated.
- The increasing number of new technology larger passenger transport aircraft, which are more efficient and have significantly lower noise emissions. This aspect is not anticipated to change the impact of flight paths in any way that will affect height constraints overhead the site.

4.3 Other Information Sources

A Sydney Airport Prescribed Airspace Plans

The currently available plans — including OLS, PANS-OPS, airspace related to the protection of radar and ground-based navigation aids, and the RTCC surfaces — were published in March 2015. These were already 'out-of-date' by the time they were declared and published because they failed to include airspace changes caused by the removal of one of the primary navigation aids at Sydney Airport. They also failed to anticipate changes that ultimately related to changes in the ICAO criteria that underly the PANS-OPS procedures and which that became effective in November 2015. They also did not anticipate the introduction of Baro-VNAV procedures that were implemented at Sydney Airport in August 2017.

The latest available Prescribed Airspace charts from Sydney Airport's Airspace Protection webpage were used for preliminary assessment.

B Procedure & Airspace Charts published by Airservices Australia

The PANS-OPS Instrument Flight Procedure (Approach and Departure) and other airspace charts maintained by Airservices Australia are regularly updated (typically every 3 months) and the updates are published on Airservices website 6 weeks prior to implementation. These charts reflect changes in ICAO criteria, changes in navigation infrastructure used and other changes implemented as a result of air traffic management demands and practices.

The PANS-OPS instrument flight procedures published in these charts are the procedures pilots are obliged to follow. Hence, they are the best source of information in deriving current airspace restrictions. The height limitations

identified in this report are based on assessment of these charts with reference to the technical calculation methods specified for such procedures.

4.4 Methodology

The report considers the existing Sydney International Airport facilities only.

In respect to the influence on the proposed development, the prescribed airspace surrounding the Airport is comprised of:

4.4.1 Obstacle Limitation Surfaces

The extent of penetration of the Obstacle Limitation Surfaces by the proposed developments was determined by plotting the site location on the prescribed airspace charts as well as by analysis of actual aeronautical activities at the airport.

4.4.2 Instrument Approach and Departure Procedures

The relevant instrument approach and departure procedures were examined to determine whether the development would impose any restriction on those procedures.

4.4.3 Other Considerations

Aside from the OLS and PANS-OPS related airspace protection, consideration is also given to the Minimum Vector Altitude (MVA) protection surfaces of Sydney Radar Terrain Clearance Chart (RTCC). Other factors which could potentially influencing the safety, efficiency or regularity of current and future air transport operations to and from Sydney Airport are also identified and evaluated as required.

5 Analysis

The impact of the various building height limitations, from lowest to highest, is summarised in the following table.

Table 6 — Summary — Airspace Height Constraints

Height Limits (AHD)	*Height Limit Detail*	*Comment*
~90 - ~96m	OLS Conical Surface	THRESHOLD HEIGHT limit: Any development on the site that would exceed the relevant OLS height (which slopes up across the site – see section 5.1 and Figure 7 below), requires a prior 'airspace height' approval from the Department of Infrastructure, Transport, Regional Development & Communications (DITRDC) under the Airports (Protection of Airspace) Regulations (or APAR).
152.4m	**Radar Terrain Clearance Chart (RTCC) Surface**	**The site lies within the lateral limits of the RTCC / Minimum Vector Altitude sector where the limiting height is 152.4m. This constraint is the maximum permissible height for obstacles at the site.**

Height Limits (AHD)	*Height Limit Detail*	*Comment*
231+m	PANS-OPS Approach & Departure Surfaces	The proposed site is outside the extent of the protection areas of most of the PANS-OPS Approach and Departure Surfaces for Sydney Airport. Some PANS-OPS Missed Approach and Departure Procedure Surfaces do overlay the site. The limiting height is that of the PANS-OPS Missed Approach surfaces for the ILS & GLS procedures for runway 34R.
335m	PANS-OPS 10NM Minimum Sector Altitude (MSA)	The site lies within the lateral limits of the 10NM Minimum Sector Altitude protection area where the limiting height is 335m.
NA	Other Surfaces	The site is outside any airspace protection requirements related to Sydney Airport's Navigation and Airport Lighting and Visual Guidance facilities, as well as those related to Airline Engine Inoperative contingency take-off procedures.

5.1 OLS Analysis

The height limit of Sydney Airport's OLS overhead the site is defined by the Conical Surface, which rises at a gradient of 5 per cent from the south-west to the north-east, as shown in Figure 7 below. The height limit increases across the site, from approximately 90m AHD at the southern edge to approximately 96m AHD at the northern corner.

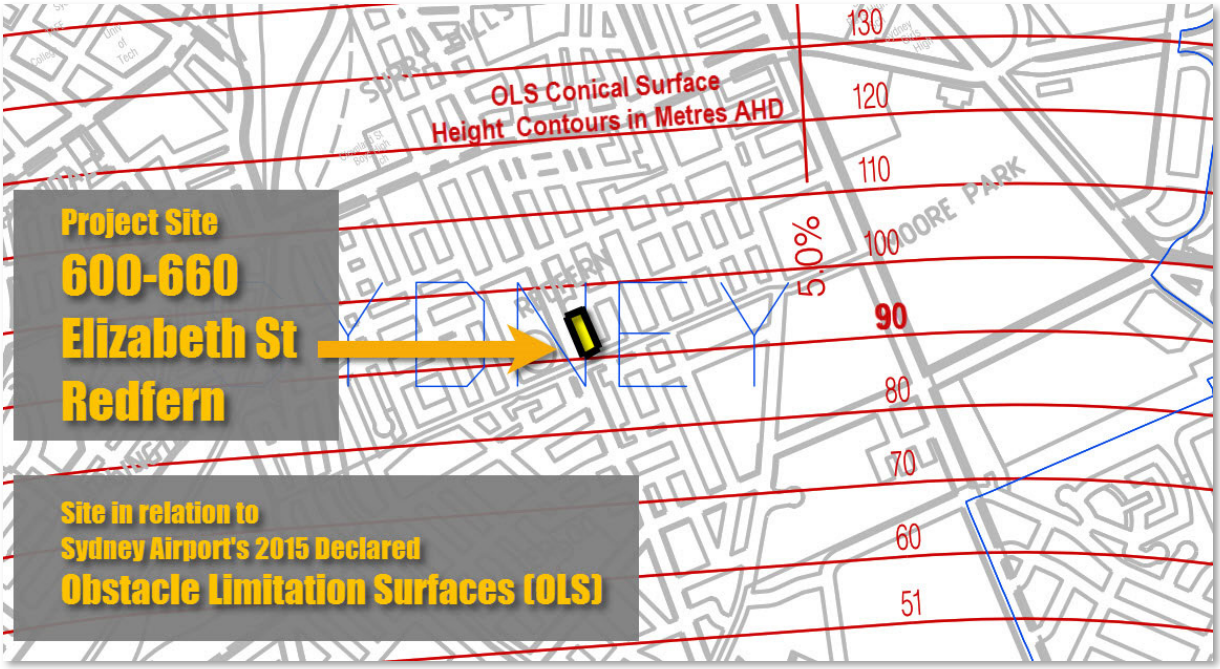


Figure 7 — Site in relation to Sydney Airport's OLS (close-up)

The OLS surface serves primarily as an assessment threshold. Buildings which at their maximum height would remain below the relevant OLS height would not require prior airspace approval.

5.2 PANS-OPS Analysis

In addition to reviewing the PANS-OPS Surfaces chart of Sydney Airport's Prescribed Airspace, assessment was conducted of the following instrument (non-visual) procedure types for Sydney Airport, as published in the Australian Aeronautical Information Publication (AIP) Departure and Approach Procedures (DAP) (for further information, refer to Appendix 2 — PANS-OPS Procedures).

- The Circling Minima and Minimum Sector Altitudes (MSAs) for existing PANS-OPS procedures
- The discrete minima for the Instrument Approach Procedures.
- Missed Approaches — as part of the evaluation of Approach Procedures
- The existing Standard Instrument Departure Procedures (SIDs)
- Minimum Sector Altitude — 10 NM Sector

Analysis of current flight procedures and procedures set to be published within the next publication cycle determined that the site is laterally outside the protection surfaces related to approach flight procedures to all runways at Sydney Airport. The site does lie under sloping restrictive surface according to the airport's latest PANS-OPS surfaces chart as illustrated in Figure 8 below, with surface height constraints across the site ranging from around 281m to 285m AHD. These height constraints, if higher than others would then be inapplicable.

Figure 8 — Sydney Airport's PANS-OPS Approach Surfaces (Wide View)

Below is an overview of the restrictions based on the different calculated assessments of published procedures.

Table 7 — PANS-OPS Height Limit Summary

Procedure	*Height Limit (m AHD)*	*Description*
Approaches and Missed Approaches to all Runways	>231	Outside the lateral protection areas of many procedures. Where protection surfaces overlay the study area, the lowest limit is 231m which is still significantly higher than the tallest crane proposed.
Departures	>250	Our analysis shows that the lowest protection area for any of the published departures is 222m AHD. The provisions of Sydney Airport's 2015 Declared Airspace chart for Omnidirectional Radar Departures stipulate a height restriction of 180m over the site, but this is disregarded as the chart has not been updated to take into account subsequent changes to the relevant procedures and protection criteria.
Minimum Sector Altitude (MSA)	335.4	The 10 NM Minimum Sector Altitude of 2100 ft results in this surface height constraint.
STARs	>335.4	Outside the lateral protection areas or too high overhead to have any impact on the proposed site.
Circling Areas	N/A	The site is lies within outside the permitted Circling Area.

Further details are provided in the following sections.

5.2.1 "Area" Procedures

A Minimum Sector Altitudes (MSAs)

The relevant sector is the inner 10 NM sector around the airport which has a 2,100ft minimum flight altitude and a 335.2m AHD protection surface.

Procedure	*Feature and / or Restriction*	*Description*
10NM MSA	Horizontal Surface: • **335.2m**	Covers the entire site

B Circling Minima

The site is located just beyond the "No Circling 3DME" boundary, in a sector of the area where circling is explicitly prohibited: beyond 3NM from the SY DME navigation aid. Therefore, circling minima are not applicable.

C STARs

The minimum segment altitude on any of the STARs surrounding Sydney Airport is 2,100ft, which would have a protection surface of 335.2m AHD. A detailed study of the extent of the protection of STARs is not included as even a finding of a protection area extending overhead the site would not result in any further restriction beyond what is already imposed by the MSA protection surface.

5.2.2 Instrument Approaches & Missed Approaches

The impact of each of the relevant PANS-OPS protection surfaces for current approach and departure procedures for Sydney Airport are detailed below:

Table 8 — PANS-OPS Approaches & Missed Approaches Assessment

Procedure	*Impact*	*Max Permissible Obstacle Elev (AHD)*	*Comment*
ILS Approaches			
RWY 07 ILS-Z & LOC-Z ILS-Y & LOC-Y	Nil – Outside lateral extent of protection surfaces	N/A	The site is located outside the lateral extent of the Basic ILS surfaces, standard OAS surfaces, OAS surfaces modified to cater for A380 and Localiser Only protection areas.
RWY 25 ILS-Z & LOC-Z	Nil – Outside lateral extent of protection surfaces	N/A	The site is located outside the lateral extent of the Basic ILS surfaces, standard OAS surfaces, OAS surfaces modified to cater for A380 and Localiser Only protection areas.
ILS 16L ILS-Z, LOC-Z & ILS-Z PRM ILS-Y, LOC-Y & ILS-Y PRM	Nil – Outside lateral extent of protection surfaces	N/A	The site is located outside the lateral extent of the Basic ILS surfaces, standard OAS surfaces, OAS surfaces modified to cater for A380 and Localiser Only protection areas.
ILS 34R ILS-Z, LOC-Z & ILS-Z PRM ILS-Y, LOC-Y & ILS-Y PRM	Site situated under missed approach surface	231m	The site is located outside the lateral extent of the Basic ILS surfaces, standard OAS surfaces, and OAS surfaces modified to cater for A380. The site is located inside the turn protection for the missed approach. Calculations used to obtain maximum permissible height are shown in the relevant section below.
ILS 16R ILS-Z, LOC-Z & ILS-Z (Cat I & II) PRM ILS-Y, LOC-Y & ILS-Y PRM	Nil – Outside lateral extent of protection surfaces	N/A	The site is located outside the lateral extent of the Basic ILS surfaces, standard OAS surfaces, OAS surfaces modified to cater for A380 and Localiser Only protection areas.
ILS 34L ILS-Z, LOC-Z & ILS-Z (Cat I & II) PRM ILS-Y, LOC-Y & ILS-Y PRM	Nil – Outside lateral extent of protection surfaces	N/A	The site is located outside the lateral extent of the Basic ILS surfaces, standard OAS surfaces, OAS surfaces modified to cater for A380 and Localiser Only protection areas.
GLS Approaches			
GLS 07	Nil – Outside lateral extent of protection surfaces	N/A	
GLS 25	Nil – Outside lateral extent of protection surfaces	N/A	
GLS 16L	Nil – Outside lateral extent of protection surfaces	N/A	

Procedure	*Impact*	*Max Permissible Obstacle Elev (AHD)*	*Comment*
GLS 34R	Site situated under missed approach surface	231m	The site is located outside the lateral extent of the Basic ILS surfaces, standard OAS surfaces, and OAS surfaces modified to cater for A380. The site is located inside the turn protection for the missed approach. Calculations used to obtain maximum permissible height are shown in the relevant section below.
GLS 16R	Nil – Outside lateral extent of protection surfaces	N/A	
GLS 34L	Nil – Outside lateral extent of protection surfaces	N/A	
RNAV Approaches			
RNAV 07 LNAV LNAV/VNAV	Nil – Outside lateral extent of protection surfaces	N/A	
RNAV 25 LNAV LNAV/VNAV	Nil – Outside lateral extent of protection surfaces	N/A	
RNAV 16L LNAV LNAV/VNAV	Nil – Outside lateral extent of protection surfaces	N/A	
RNAV 34R LNAV LNAV/VNAV	Site situated under missed approach surface	244m	The site is located inside the turn protection for the missed approach. Calculations used to obtain maximum permissible height are shown in the relevant section below.
RNAV 16R LNAV LNAV/VNAV	Nil – Outside lateral extent of protection surfaces	N/A	
RNAV 34L LNAV LNAV/VNAV	Nil – Outside lateral extent of protection surfaces	N/A	

A ILS-Z, ILS-Y and GLS RWY 34R Missed Approach @ 2.5%

Distance from the turn initiation area to SE corner of site: 4,968.7m
Altitude reached: (4,968.7m x 2.5%) + 600ft = 307m
Height of protection surface: 307 – 50 = **257m**

B ILS-Z, ILS-Y and GLS RWY 34R Missed Approach @ 3.3%

Distance from the turn initiation area to SE corner of site: 3,001.2m
Altitude reached: (3,001.2m x 3.3%) + 600ft = 281m
Height of protection surface: 281 – 50 = **231m**

C LNAV RWY 34R Missed Approach

Distance from the turn initiation area to SE corner of site: 4,460.6m
Altitude reached: (4,460.6m x 2.5%) + 600ft = 294m
Height of protection surface: 294 – 50 = **244m**

D LNAV/VNAV RWY 34R Missed Approach

Distance from the turn initiation area to SE corner of site: 5,550.8m
Altitude reached: (5,550.8m x 2.5%) + 600ft = 321m
Height of protection surface: 321 – 50 = **271m**

5.2.3 Departures

The most restrictive of the height limits from any departure, as shown on Sydney Airport's 2015 Declared Airspace chart for Omnidirectional Radar Departures is 180m AHD. However, that particular chart (which is still the latest published on the airport's website) is not entirely correct and is obsolete due to changing of procedures since the time it was drafted and approved, and also because of a change in the PANS-OPS departure criteria at the end of 2016. Height limitations would be most restrictive in relation to departure procedures from both RWY07 and RWY34R. StratAir's independent calculations in 2019 of the current effective PANS-OPS omnidirectional departure procedures indicate that the height constraints from the current procedures are as follows:

A Departures from Runway 07

Turning altitude for the departure is 600ft with an initial climb at 4.7% to 1,500ft.

Distance from the turn initiation area to SW corner of the site: 2,632.6m
Altitude reached: (2,632.6m x 4.7%) + 600ft = 306.6m
Minimum obstacle clearance: (3657.6 + 2632.6) x 0.8% = 50.3m
Height of protection surface: 306.6 – 50.3 = **256.3m**

B Departures from Runway 34R

Turning altitude for the departure is 500ft with an initial climb at 4.8% to 1,500ft.

Distance from the turn initiation area to SW corner of the site: 3,021.8m
Altitude reached: (3,021.8m x 4.8%) + 500ft = 297.4
Minimum obstacle clearance: (2,970.8 + 3,021.8) x 0.8% = 47.9m
Height of protection surface: 297.4 - 47.9 = **249.5m**

5.3 Other Assessment Considerations

The following table provides a brief assessment of other considerations.

Table 9 — Other Assessable Height Limitations — including the RTCC MVA Limit

Procedure	*Height Limit (m AHD)*	*Description*
Radar Terrain Clearance Chart (RTCC) Surface	**152.4**	This height constraint is applicable over the entire site. This surface limit related to the Minimum Vectoring Altitude (MVA), which is used by air traffic controllers for vectoring aircraft. This information is sourced from the RTCC published as part of Sydney Airport's Prescribed Airspace Plans. An annotated extract is shown in Figure 9 below.

Procedure	*Height Limit (m AHD)*	*Description*
Navigation Infrastructure Surfaces	N/A	The proposed development is too far from the airport to affect any ground-based navigation infrastructure.
Approach Lighting & VGSI Surfaces	N/A	QQT is outside the lateral extent of published approach lighting surfaces.
Airlines Engine Out Procedures	N/A	Engine Out procedures (from RWY 34R, the most relevant take-off runway end for these procedures) are designed and maintained by each of the passenger transport aircraft operators in accordance with the relevant regulations. All such procedures necessarily take into account Sydney Tower Eye, which is closer to the airport and taller than the proposed development. As such this proposal will not adversely affect any contingency procedures.
Helicopter Emergency Management Procedures	N/A	The helicopter procedures to the closest Strategic Helicopter Landing Site (SHLS atop the Royal Prince Alfred Hospital will not be affected by developments on the site: the critical elements of the procedures close to the SHLS are laterally clear of the site.

There are no other considerations that might limit the building height at the project site.

5.3.1 Radar Terrain Clearance Chart (RTCC) Surface

The surface depicted in Sydney Airport's Radar Terrain Clearance Chart (RTCC) overhead the site protects the Minimum Vector Altitude (MVA) that can be used by air traffic controllers when vectoring aircraft in the relevant MVA sector.

The resulting RTCC limit overhead the entire study area is **152.4m AHD**. This surface is effectively the most limiting surface which constrains the maximum development height and cranes on the Redfern site. The relevant RTCC surface, depicted in relation to the site in Figure 9 below, extends from the inner-west, across the airport to the coast and up to south of the Sydney CBD and some of the eastern suburbs.

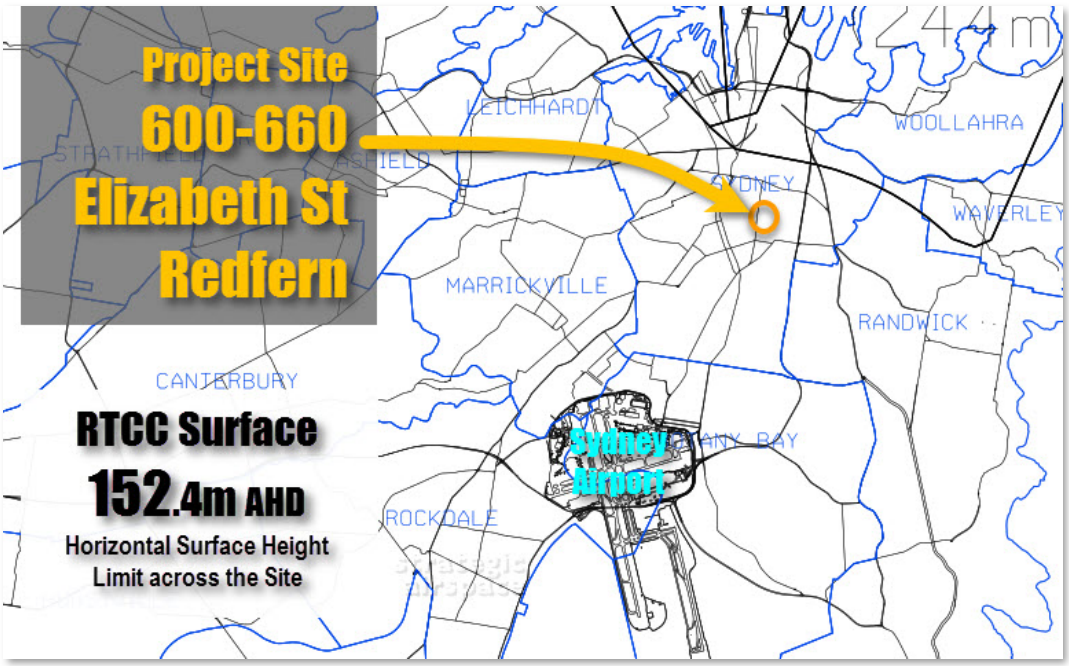


Figure 9 — Radar Terrain Clearance Chart (RTCC) Height Constraint across the Site

5.4 Other Approvability Measures in relation to Sydney Airport Operations

Other factors to consider that could potentially affect aviation operations, and therefore affect potential aviation approvability, include the nature of the materials used externally (eg, reflectivity), lighting and contribution to wind turbulence. The approvability in relation to environmental impact due to aircraft noise overhead the site is excluded from this assessment.

Based on the location of the site in relation to the airport, the aspect of the tall towers in relation to runway alignments and the maximum proposed heights it can be noted that:

- The site is outside the zones defined in the Civil Aviation Safety Regulations (CASR MOS Part 139) as requiring special external lighting constraints — thus there is no potential adverse impact;
- Any proposed development is very unlikely to contribute any negative impact on aviation operations in terms of reflectivity; and
- Any proposed development will not contribute any wind turbulence that might affect normal operations at the airport.

6 Conclusion

The lowest 'limitation' surface overhead the site is the OLS Conical Surface which has a height of approximately 90-96m AHD above the site, with the most restrictive height being at the southern border of the site. While the OLS may be penetrated, above the OLS there are a number of other protection surfaces which cannot be penetrated. The lowest of these, at 152.4m AHD, is the Radar Terrain Clearance Chart (RTCC) surface, which protects the related Minimum Vector Altitude (MVA) sector used by Air Traffic Controllers for vectoring (directing) aircraft) and therefore important for safety, efficiency and regularity of air traffic operations at Sydney Airport. Further, while the RTCC surfaces are neither OLS or PANS-OPS, they cannot be penetrated, and they are difficult to either move or alter even for temporary cranes.

Hence, any proposed building development will be limited by the 152.4m RTCC height constraint. This will also be the maximum height permitted for buildings and cranes used for construction. Therefore, development plans for proposed buildings must take into account the clearances that will be required above the top of roof height for cranes so that they too can remain below this height limit.

Based on the Reference Scheme, this surface height constraint will not be challenged — as illustrated in Table 10 below.

Table 10 — Summary of Airspace Height Impact & Height Application Implications

Feature & Proposed Max Height *(m AHD) for Assessment*	***OLS*** *~90-96 m AHD Clearance / Infringement*	***PANS-OPS / RTCC*** *152.4 m AHD Clearance / Infringement*	***Airspace Height Application & Approvability Evaluation Comment***
Tallest (14-Storey) Building Max Height including Rooftop Features (Conservative): **80 m AHD**	**10+**	**72.4**	**No height application would be required for the tallest building as it would be below the OLS height limit.** Similarly, no prior airspace approvals would be required for any of the other (less tall) buildings proposed.
Crane for 14-Storey Tower Max Height (Conservative): **120 m AHD**	***Estimated*** **24 - 30**	**32.4**	A crane for the tallest building is likely to exceed the OLS height and would thus require a height approval prior to the time its height would exceed the relevant OLS height limit. Because the maximum height of the crane would be below the limiting RTCC (and PANS-OPS) surface heights, it is technically approvable under the APAR, and approvable without a 3-month operating duration condition. Approval would be expected to be granted.
Top of Solar Plane Max Height (Conservative): **90 m AHD**	**0-6**	**62.4**	**No height application would be required for any building that was developed to the limit of the solar plane across the site, as they would be below the respective OLS height limits across the site.** Re Cranes — Prior approvals for cranes would only be required where the maximum crane height would exceed the relevant OLS height constraint at that location.

In summary, any permanent obstacle (such as a building) or temporary obstacle (such as cranes) erected on the site may not exceed the RTCC surface height limit of 152.4m AHD. Based on the Reference Scheme, this surface height constraint will not be challenged.

All buildings will remain below the OLS height constraints and would therefore <u>not</u> require prior airspace approvals.

Further, it is anticipated that only cranes for the tallest (14-storey tower) building would require prior airspace approval. It is likely that cranes for the other buildings could operate under the OLS heights and therefore would not be subject to airspace approvals.

APPENDICES

Appendix 1 — Abbreviations

Abbreviations used in this report and/or associated reference documents, and the meanings assigned to them for the purposes of this report are detailed in the following table:

Abbreviation	*Meaning*
AC	Advisory Circular (document supporting CAR 1998)
ACFT	Aircraft
AD	Aerodrome
ADS-B	Automatic Dependent Surveillance – Broadcast: an aircraft location identification and tracking service facilitated by satellite signals and ground tracking stations, similar to (but more accurate than) radar
AGL	Above Ground Level (Height)
AHD	Australian Height Datum
AHT	Aircraft Height
AIP	Aeronautical Information Publication
Airports Act	Airports Act 1996, as amended
AIS	Aeronautical Information Services
ALARP	As Low As Reasonably Practicable
ALC	Airport Lease Company
Alt	Altitude
AMAC	Australian Mayoral Aviation Council
AMSL	Above Minimum Sea Level
ANEF	Australian Noise Exposure Forecast
ANSP	Airspace and Navigation Service Provider
APACL	Australia Pacific Airports Corporation Limited, owner of Melbourne and Launceston Airports
APCH	Approach
APARs, or A(PofA)R	Airports (Protection of Airspace) Regulations, 1996 as amended
ARP	Aerodrome Reference Point
AsA	Airservices Australia
ASDA	Accelerated Stop Distance Available
ATC	Air Traffic Control(ler)
ATM	Air Traffic Management
BA (Planning)	Building Application or Building Approval (Planning)
BAC	Brisbane Airport Corporation
BCC	Brisbane City Council
CAO	Civil Aviation Order
CAR	Civil Aviation Regulation
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulation
Cat	Category
CBD	Central Business District
CG	Climb Gradient
CNS/ATM	Communications, Navigation, Surveillance / Air Traffic Management
CPA	Cairns Port Authority, Operators Of Cairns Airport
DA (Aviation)	Decision Altitude (Aviation)
DA (Planning)	Development Application or Development Approval (Planning)
DAH	Designated Airspace Handbook
DAP	Departure and Approach Procedures (published by AsA)

Abbreviation	*Meaning*
DEP	Departure
DER	Departure End (of the) Runway
DEVELMT	Development
DH	Decision Height
DITRDC / DITRDC / DIRD	Department of Infrastructure, Transport, Regional Development & Communications (since Dec-2019) Formerly the Department of Infrastructure, Regional Development (& Cities) (sometimes also abbreviated as Infrastructure)
DME	Distance Measuring Equipment
Doc nn	ICAO Document Number nn
DoD	Department of Defence
DODPROPS	Dependent Opposite Direction Parallel Runway OPerations
DPIE	NSW Department of Planning, Industry & Environment
EIS	Environmental Impact Study
ELEV	Elevation (above mean sea level)
ENE	East North East
ERSA	EnRoute Supplement Australia
ESE	East South East
FACS	NSW Family & Community Services — formerly part of LaHC, but since July 2019 part of the NSW Department of Communities & Justice (DCJ)
FAF	Final Approach Fix
FAP	Final Approach Point
Ft	Feet
GBAS	Ground-Based Augmentation System, a GNSS augmentation system to provide vertical guidance and additional precision to non-precision approaches — permits GLS Approaches
GDA94	GDA is the Geocentric Datum of Australia. It has been implemented as the standard datum since 1994.
GLS	GNSS Landing System – a precision landing system like ILS but based on augmented GNSS using ground and satellite systems.
GNSS	Global Navigation Satellite System
GP	Glide Path
HIAL	High Intensity Approach Light
HLS	Helicopter Landing Site
IAS	Indicated Air Speed
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
IHS	Inner Horizontal Surface, an Obstacle Limitation Surface
ILS	Instrument Landing System, a precision approach landing system
IMC	Instrument Meteorological Conditions
IPA	Integrated Planning Act 1997, Queensland State Government
ISA	International Standard Atmosphere
IVA	Independent Visual Approach
Km	Kilometres
Kt	Knot (one nautical mile per hour)
LaHC	NSW Land and Housing Corporation, part of the NSW DPIE
LAT	Latitude
LDA	Landing Distance Available

Abbreviation	*Meaning*
LEP	Local Environment Plan (Planning
LLZ	Localizer
LNAV	Lateral Navigation
LONG	Longitude
LSALT	Lowest Safe ALTitude
M	Metres
MAPt	Missed Approach Point
MDA	Minimum Descent Altitude
MDH	Minimum Descent Height
MDP	Major Development Plan
MGA94	Map Grid Australia 1994
MOC	Minimum Obstacle Clearance
MOCA	Minimum Obstacle Clearance Altitude
MOS	Manual Of Standards, published by CASA
MP	Master Plan
MSA	Minimum Sector Altitude
MVA	Minimum Vector Altitude
NASF	National Airports Safeguarding Framework
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
NNW	North North West
NOTAM	NOTice to AirMen
NPR	New Parallel Runway (Project, Brisbane Airport)
OAR	Office of Airspace Regulation
OCA	Obstacle Clearance Altitude (in this case, in AMSL)
OCH	Obstacle Clearance Height
ODPROPS	Opposite Direction Parallel Runway OPerations
OHS	Outer Horizontal Surface, an Obstacle Limitation Surface
OLS	Obstacle Limitation Surface, defined by ICAO Annex 14; refer also CASA MOS Part 139
PANS-OPS	Procedures for Air Navigation – Operations, ICAO Doc 8168; refer also CASA MOS Part 173
PAPI	Precision Approach Path Indicator (a form of VGSI)
PBN	Performance Based Navigation
PRM	Precision Runway Monitor
RAAF	Royal Australian Air Force
RAPAC	Regional AirsPace users Advisory Committee
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

Abbreviation	*Meaning*
RPT	Regular Public Transport
RTCC	Radar Terrain Clearance Chart (refer also MVA)
RWY	Runway
SACL	Sydney Airport Corporation Limited
SID	Standard Instrument Departure
SODPROPS	(Independent) Simultaneous Opposite Direction Parallel Runway OPerations
SPP	State Planning Policy, Queensland (specifically SPP 1/02: Development in the Vicinity of Certain Airports and Aviation Facilities)
SSDA	State Significant Development Application
SSP	State Significant Precinct
SSR	Secondary Surveillance Radar
STAR	STandard Arrival
STODA	Supplementary Take-Off Distance Available
TAR	Terminal Approach Radar
TAS	True Airspeed
THR	THReshold (of Runway)
TMA	TerMinal Area
TNA	Turn Altitude
TODA	Take-off Distance Available
TORA	Take-Off Runway Available
VFR	Visual Flight Rules
VIS	Visual
VMC	Visual Meteorological Conditions
V_n	Aircraft critical velocity reference
VNAV	Vertical Navigation
VOR	Very high frequency Omni-directional Range
VSS	Visual Segment Surface
WAC	Westralia Airports Corporation, operators of Perth Airport
WAM	Wide-Area Multilateration
WNW	West North West
WSW	West South West
WGS84	World Geodetic System 1984
WSA	Western Sydney Airport – the proposed second international airport for the Sydney Basin

Appendix 2 — PANS-OPS Procedures

The versions of the IFPs consulted were from the published DAP Amendment 159, effective from 23-May-2019 to 14-Aug-2019 — as indicated below.
Charts and procedures updated in this amendment are highlighted in yellow.

These PANS-OPS height clearance calculations were performed prior to the generation of this version of the report, but a reference check of the procedures in the pending AIP Amendment 162, for the period effective from 27-Feb-2020, was also undertaken. No changes to the PANS-OPS procedures which would cause any more limiting height constraints overhead the site were identified.

Chart	*Effective Date (Amdt No)*
AERODROME CHART PAGE 1	8-Nov-2018 (Am 157)
AERODROME CHART PAGE 2	28-Feb-2019 (Am 158)
APRON CHART - INTERNATIONAL PAGE 1	23-May-2019 (Am 159)
APRON CHART - INTERNATIONAL PAGE 2	23-May-2019 (Am 159)
APRON CHART - DOMESTIC PAGE 1	23-May-2019 (Am 159)
APRON CHART - DOMESTIC PAGE 2	23-May-2019 (Am 159)
APRON CHART - DOMESTIC PAGE 3	23-May-2019 (Am 159)
STANDARD DOMESTIC TAXI ROUTES - ARRIVALS	21-Aug-2014 (Am 140)
STANDARD DOMESTIC TAXI ROUTES - DEPARTURES	6-Mar-2014 (Am 138)
NOISE ABATEMENT PROCEDURE PAGE 1	17-Nov-2011 (Am 129)
NOISE ABATEMENT PROCEDURE PAGE 2	17-Aug-2017 (Am 152)
NOISE ABATEMENT PROCEDURE PAGE 3	3-Mar-2016 (Am 146)
NOISE ABATEMENT PROCEDURE PAGE 4	3-Mar-2016 (Am 146)
NOISE ABATEMENT PROCEDURE PAGE 5	2-Mar-2017 (Am 150)
NOISE ABATEMENT PROCEDURE PAGE 6	24-May-2018 (Am 155)
NOISE ABATEMENT PROCEDURE PAGE 7	3-Mar-2016 (Am 146)
NOISE ABATEMENT PROCEDURE PAGE 8	3-Mar-2016 (Am 146)
NOISE ABATEMENT PROCEDURE PAGE 9	3-Mar-2016 (Am 146)
NOISE ABATEMENT PROCEDURE PAGE 10	3-Mar-2016 (Am 146)
AIRPORT EFFICIENCY PROCEDURES	1-Mar-2018 (Am 154)
IVA USER GUIDE PAGE 1	1-Mar-2018 (Am 154)
IVA USER GUIDE PAGE 2	1-Mar-2018 (Am 154)
PRM USER INSTRUCTIONS	23-May-2019 (Am 159)
SID SYDNEY ONE DEP (RADAR) - ALL RWYS	23-May-2019 (Am 159)
SID RWY 34L SOUTH WEST DEP (JET)	10-Nov-2016 (Am 149)
SID RWY 16R & 34L SOUTH DEP (NON-JET) (RNAV)	24-May-2018 (Am 155)
SID RWY 16R DEENA SEVEN (JET) (RNAV)	24-May-2018 (Am 155)
SID RWY 34R ENTRA FIVE (JET) (RNAV)	10-Nov-2016 (Am 149)
SID RWY 07 FISHA EIGHT (JET) (RNAV)	17-Aug-2017 (Am 152)
SID KAMBA DEP RWYS 07 & 16L (NON-JET) (RNAV)	1-Mar-2018 (Am 154)
SID RWY 16R KAMPI FIVE (RNAV)	24-May-2018 (Am 155)
SID RWY 16L KEVIN SIX (JET) (RNAV)	9-Nov-2017 (Am 153)
SID RWY 16L ABBEY THREE (JET) (RNAV)	24-May-2018 (Am 155)

Chart	*Effective Date (Amdt No)*
SID RWY 34R MARUB SIX (JET) (RNAV)	24-May-2018 (Am 155)
SID RWY 34L RICHMOND FIVE DEP (JET)	17-Aug-2017 (Am 152)
STAR BOREE NINE A ARRIVAL (RNAV)	23-May-2019 (Am 159)
STAR BOREE NINE P ARRIVAL (RNAV)	23-May-2019 (Am 159)
STAR MEPIL THREE ARRIVAL (RNAV)	24-May-2018 (Am 155)
STAR MARLN FOUR ARRIVAL (RNAV)	23-May-2019 (Am 159)
STAR ODALE SEVEN ARRIVAL (RNAV)	24-May-2018 (Am 155)
STAR RIVET THREE ARRIVAL (RNAV)	24-May-2018 (Am 155)
ILS OR LOC RWY 07	23-May-2019 (Am 159)
ILS OR LOC RWY 16L PAGE 1	23-May-2019 (Am 159)
ILS RWY 16L PAGE 2	23-May-2019 (Am 159)
ILS OR LOC RWY 16R PAGE 1	23-May-2019 (Am 159)
ILS RWY 16R PAGE 2	23-May-2019 (Am 159)
ILS OR LOC RWY 25	23-May-2019 (Am 159)
ILS OR LOC RWY 34L PAGE 1	23-May-2019 (Am 159)
ILS RWY 34L PAGE 2	23-May-2019 (Am 159)
ILS OR LOC RWY 34R PAGE 1	23-May-2019 (Am 159)
ILS RWY 34R PAGE 2	23-May-2019 (Am 159)
RNAV-Z (GNSS) RWY 07	23-May-2019 (Am 159)
RNAV-Z (GNSS) RWY 16L	23-May-2019 (Am 159)
RNAV-Z (GNSS) RWY 16R	8-Nov-2018 (Am 157)
RNAV-Z (GNSS) RWY 25	8-Nov-2018 (Am 157)
RNAV-Z (GNSS) RWY 34L	8-Nov-2018 (Am 157)
RNAV-Z (GNSS) RWY 34R	9-Nov-2017 (Am 153)
GLS RWY 07	23-May-2019 (Am 159)
GLS RWY 16L	23-May-2019 (Am 159)
GLS RWY 16R	23-May-2019 (Am 159)
GLS RWY 25	23-May-2019 (Am 159)
GLS RWY 34L	23-May-2019 (Am 159)
GLS RWY 34R	23-May-2019 (Am 159)

Source: http://www.airservicesaustralia.com/aip/aip.asp