NSW LaHC

Waterloo South Planning Proposal: Aeronautical Impact Assessment

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Document Title: **Waterloo South Planning Proposal: Aeronautical Impact Assessment**

Purpose / Abstract: *This report has been commissioned by the NSW Land and Housing Corporation (LaHC) to inform the Waterloo South Planning Proposal, which is part of the long-term staged planning for the Waterloo Estate — itself an important urban renewal locale which is intended to deliver social (affordable rental) and private housing in a new integrated and inclusive mixed tenure community.*

Waterloo South is the first stage identified for renewal. The adjoining and inter-related stages are Waterloo Central and Waterloo North.

The outcome of this Planning Proposal will be a revised planning framework that will enable future development applications for the redevelopment of Waterloo South.

The objective of this aeronautical impact report is to inform the strategic development of the ongoing planning process. The heights used for assessment against the aviation-related airspace height protection surfaces are based on the top RLs of the proposed building envelopes.

Buildings less than 15 stories are unlikely to infringe the prescribed airspace of Sydney Airport, and would therefore not require any specific height approvals. The taller buildings, those ranging from 15-32 stories, are likely to infringe Sydney Airport's Obstacle Limitation Surface (OLS) and would therefore need to be referred for an airspace approval under the Airports (Protection of Airspace) Regulations 1996 (APAR) prior to construction. Applications are usually submitted at the time of DA submission and are usually a condition of DA approval. Height approvals are not required for rezoning applications.

Whilst applications are submitted to Sydney Airport, the authority responsible for making final determinations of such applications is the Commonwealth Department of Infrastructure, Transport, Regional Development and Communication (DITRDC).

Based on current airspace constraints, the maximum permissible RL height for buildings across the whole of Waterloo South would be 126.4m AHD. Furthermore, it is highly likely that the same height constraint would be applicable to cranes required for the construction of buildings, except where the applicant can demonstrate that taller cranes can be operated safety and within likely operational approval conditions. The absolute maximum height up to which cranes would potentially be approved is 152.4m AHD. The potential approvability of cranes that would be required for any building is considered as part of a 'feasibility test' when assessing a building height application, when detail design drawings denoting the construction methodology can be assessed. Therefore, this must be considered an important factor as part of the ongoing planning of building heights, and the construction and delivery of the Waterloo Estate.

In summary, the maximum heights of building envelopes in the planning proposal do not exceed the PANS-OPS height limit of 126.4m AHD, the maximum permissible building height across the study area, and so are considered technically approvable under the APAR.

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Contents

Change History iv
Distribution Control iv

Executive Summary 1
1.1 Constraints Affecting the Precinct 4
1.2 Assessment Conclusions 4

1 Waterloo South Renewal 6
1.1 Introduction 6
1.2 Waterloo Estate 6
1.3 Waterloo South 7
1.4 Renewal Vision 8
1.5 Purpose of This Report 9
1.5.1 Study Requirements 9
1.6 Waterloo South Planning Proposal 10
1.7 Maximum Planned Building Envelope Heights & Assessment Elevations 12

2 Aeronautical Impact Context 14
2.1 Location of the Proposed Development 14
2.2 Methodology 16
2.2.1 Airspace Regulations 16
2.2.2 Prescribed Airspace 16
2.2.3 Note about Heights: Australian Height Datum (AHD) vs Above Ground Level (AGL) 17
2.2.4 The Application Pathway for Airspace Height Approvals 17
2.2.5 Applications for Buildings 18
2.2.6 Applications for Cranes 19
2.3 Airport Plans & Aeronautical Data References for the Study 19
2.3.1 Sydney Airport Master Plan 2039 19
2.3.2 Sydney Airport Prescribed Airspace Plans 19
2.3.3 Procedure & Airspace Charts published by Airservices Australia 19
2.3.4 Effects of Recent Changes 20
2.3.5 Trends that May Affect the Airspace over Waterloo South 20

3 Analysis 21
3.1 Analysis Summary 21
3.2 OLS Analysis 22
3.3 PANS-OPS Analysis 23
3.3.1 “Area” Procedures 25
3.3.1.1 Minimum Sector Altitudes (MSAs) 25
3.3.1.2 Circling Minima 25
3.3.2 Instrument Approaches & Missed Approaches 26
3.3.2.1 Approach Procedures to RWY 16L and RWY 25 26
3.3.2.2 Missed Approach Segments of Approach Procedures for RWY 07 and RWY 34R 26
3.3.3 Departures 26
3.4 Other Assessment Considerations 27
3.4.1 Radar Terrain Clearance Chart (RTCC) Surface / Minimum Vector Altitude (MVA) 27
3.4.2 Proximity to Emergency Helicopter Landing Site & Flight Paths 28

3.4.3 Other Approvability Measures in relation to Sydney Airport Operations 28
3.5 Renewal Proposal: Max Building Heights & Cranes 29

4 Conclusion 30

Tables

Table 1 — Study Requirements 3
Table 2 — Summary — Relevant Airspace Height Constraints 4
Table 3 — Study Requirements 10
Table 4 — Breakdown of allocation of land within the Waterloo South 11
Table 5 — Proposed Maximum Heights of the Taller Building Envelopes & Elevations used for Airspace Impact Assessment 13
Table 6 — Analysis Summary — Airspace Height Constraints 21
Table 7 — PANS-OPS Height Limit Summary 25
Table 8 — Other Assessable Height Limitations — including the RTCC MVA Limit 27
Table 9 — All PANS-OPS Instrument Flight Procedure Charts for Sydney Airport (AIP Amendment 162 – WEF 20200227 – 20200520) 2

Figures

Figure 1 — Waterloo South within the Context of the Waterloo Precinct & the Waterloo Metro Station & the Site in relation to Sydney Airport 1
Figure 2 — Waterloo Estate & Waterloo South Masterplan 2
Figure 3 — Location plan of Waterloo Estate and Waterloo South 7
Figure 4 — Waterloo Precinct 8
Figure 5 — Indicative Concept Proposal 12
Figure 6 — Waterloo South Masterplan — Maximum Heights Plan 13
Figure 7 — Waterloo Precinct in relation to Sydney Airport (Large Format) 15
Figure 8 — Waterloo South in relation to Sydney Airport's OLS 22
Figure 9 — PANS-OPS & RTCC/MVA Height Constraints across the Waterloo Precinct 24

Appendices

Appendix 1 — Abbreviations

Appendix 2 — PANS-OPS Procedures

Appendix 3 — Building Data Schedule

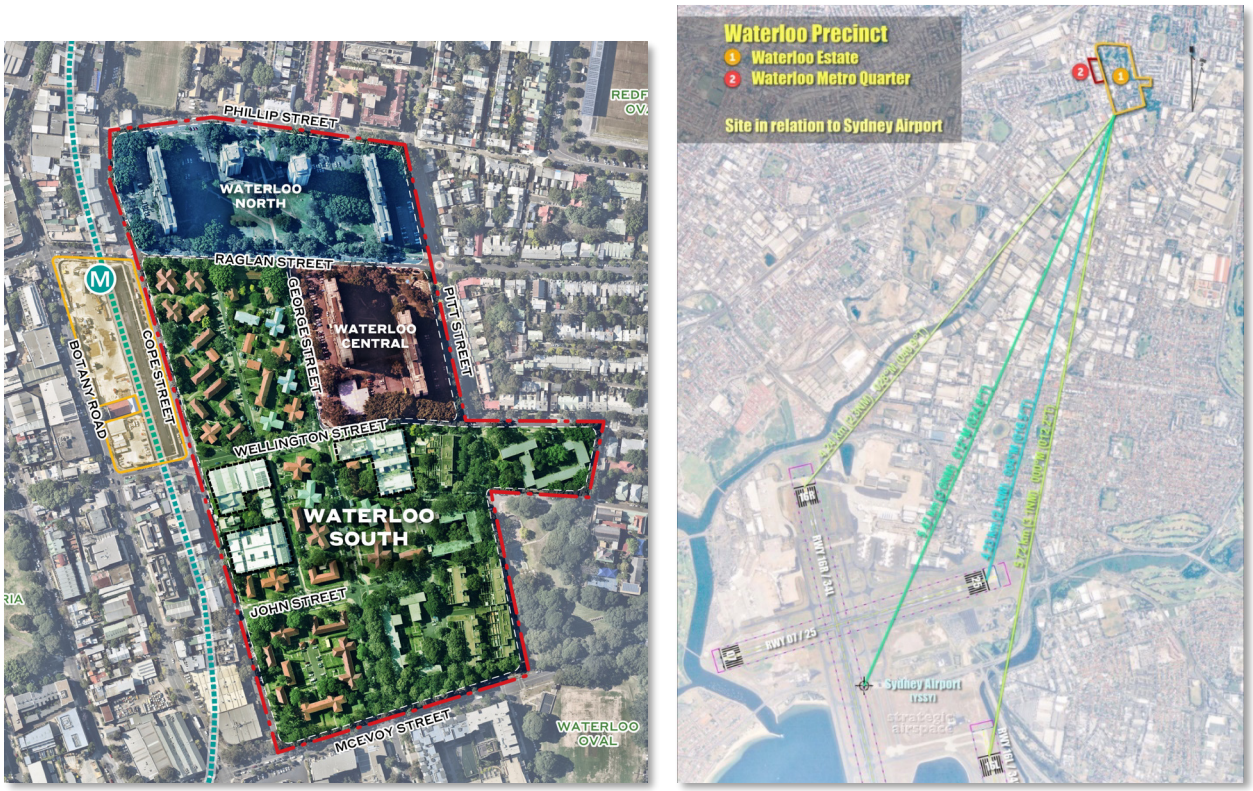
Executive Summary

This report addresses the aviation-related airspace height constraints over Waterloo South, to inform the ongoing development of the **Waterloo South Renewal** planning proposal which is being coordinated by the NSW Land and Housing Corporation (LaHC).

The Greater Sydney Region Plan and Eastern City District Plan seek to align growth with infrastructure, including transport, social and green infrastructure. With the catalyst of Waterloo Metro Station, there is an opportunity to deliver urban renewal to Waterloo Estate that will create great spaces and places for people to live, work and visit

The proposed rezoning of Waterloo Estate is to be staged over the next 20 years to enable a coordinated renewal approach that minimises disruption for existing tenants and allows for the up-front delivery of key public domain elements such as public open space. Aligned to this staged approach, Waterloo Estate comprises three separate, but adjoining and inter-related stages:

- Waterloo South
  — identified as the first stage for renewal, and the subject of this report;
- Waterloo Central; and
- Waterloo North.



Precinct graphic Source: Ethos Urban

Figure 1 — Waterloo South within the Context of the Waterloo Precinct & the Waterloo Metro Station & the Site in relation to Sydney Airport

Source: Turner Studio

Figure 2 — Waterloo Estate & Waterloo South Masterplan

The Waterloo South study area is located approximately 5.5km (3NM) from Sydney International Airport, midway between the straight-in flight paths to the closest runways, the eastern parallel runway (RWY 16L/34R) and the cross runway (RWY 07/25). In this location it is subject to various aviation-related airspace heights above which buildings would ultimately require airspace height approval for development approval, and impose maximum height constraints to help assure protection of the airspace. Evaluation of these aspects is outlined in the Study Requirements in Table 1 below.

Table 1 — Study Requirements

Ref No	*Study Requirement*	*Addressed at*
20.1	Review relevant background information, including the 'Sydney Airport Master Plan' to understand the current and proposed future operations of Sydney Airport, as relevant to the precinct.	Sections 2.2.2 (p16) & 2.3 (p19)
20.2	Identify and clearly map the OLS, PANS OPS and any other relevant Sydney Airport height limitation layers, including consideration of Navigation Aid Surfaces.	The whole of Section 3 (p21)
20.3	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.	*Summary*: Section 3.1 (p21) and 4 (p30) *Buildings*: Sections 2.2.5 (p18) and 3.3 (p23) *Cranes*: Sections 3.4.1 (p27) & 3.5 (p29)
20.4	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).	Sections 3.4.3 (p28)
20.5	Advise on the pathway required to secure approval from relevant bodies, e.g. Air Services Australia, as part of subsequent development application processes, including for temporary structures such as cranes.	Section 2.2.4 (p17)
20.6	Certify that subject to any recommended measures, the precinct proposal will not have an adverse impact on the operations of Sydney Airport.	Executive Summary (p4) & Section 4 (p30)

The planning proposal comprises a mix of low-rise, mid-rise and a few tall buildings, located across the site so as to satisfy planning objectives. The proposal has also been designed so that no building envelope would exceed the maximum permissible airspace height limits.

Pursuant to the Study Requirements (Table 1), this report has been prepared having regard to Prescribed Airspace for Sydney Airport. It examines the current and forecast regulated airspace height constraints overhead the site that are related to aviation airspace protection requirements which would:

a) Trigger the requirement to apply for an airspace height approval.

b) Constrain the maximum permissible building envelope heights.

c) Potentially constrain the maximum permissible heights for cranes that would be required to enable construction of the proposed development (although approvals for cranes are only necessary after DA and prior to construction).

1.1 Constraints Affecting the Precinct

The relevant airspace constraints overhead the Waterloo South study area are summarised in the following table.

Table 2 — Summary — Relevant Airspace Height Constraints

Height Limits (AHD)	*Height Limit Detail*	*Comment*
54.5m – 76m	OLS Conical Surface	Threshold Heights for Airspace Height Applications (as depicted in Figure 8, p22) Any development that would exceed the relevant limiting OLS height would require an 'airspace height' approval from the Department of Infrastructure, Transport, Regional Development and Communication under the Airports (Protection of Airspace) Regulations (or APAR) prior to construction. Applications are usually made at the time of DA; and if the airspace approval may be subject of a DA consent condition if the airspace application is still under evaluation at the time of DA approval. A height application can be made for each building separately, a block containing a number of buildings to be developed at the same time, or a single application can be made for the entire Waterloo South area. The mid-rise and tall buildings proposed would infringe the OLS and would thus require airspace approvals.
126.4m	**PANS-OPS CIRCLING Surface for Category B Aircraft** — Entirety of the Waterloo South area	**This constraint is the current maximum permissible building height that would be approved today by the aviation authorities** (see Figure 9, p24). **None of the proposed building envelopes exceed this height, and so could be considered technically approvable under the APARs**. It is likely also to be the maximum height that would be considered approvable for cranes without necessarily requiring operating duration constraints (refer also section 3.5, p29)
152.4m	**Radar Terrain Clearance Chart (RTCC) Surface** — Entirety of the Waterloo South area	**This constraint is the maximum permissible height that may potentially be considered approvable for cranes**. Where cranes are approved at heights that exceed 126.4m AHD, there would be strict operational conditions (refer also section 3.5, p29). Note that applications for cranes are only required prior to construction, typically not until after approval of DA.

1.2 Assessment Conclusions

The airspace constraints affecting Waterloo South have been examined in relation to the maximum proposed building envelope heights, which are depicted in Figure 2 above.

The site is:

- Subject to Obstacle Limitation Surface (OLS) height limits which slope up from almost 55m Australian Height Datum (AHD) at the southern-most corner to around 76m AHD at the north-east corner of Waterloo South.

  OLS heights can be considered threshold heights; any building or crane which would exceed the relevant height would need to gain airspace height approvals from the Commonwealth Department of Infrastructure, Transport, Regional Development and Communication (DITRDC), under the Airports (Protection of Airspace) Regulations (APAR) prior to construction or erection.

- The majority of buildings, including all low-rise buildings, will not require prior airspace approvals as they do not exceed the relevant OLS heights.

- Unconstrained by all PANS-OPS procedures except for the Circling Surface for Category B aircraft, which imposes a fixed height constraint of 126.4m AHD across the entirety of the site.

  PANS-OPS surface heights are based on the heights related to the protection requirements of the various PANS-OPS Instrument Flight Procedures for Sydney Airport. These define the maximum permissible heights for buildings (including all overruns) under the APAR, except where another aviation safety-related airspace constraint is lower.

  - No building envelope in the planning proposal exceeds this height, and so all could be considered technically approvable under the APAR. Cranes up to this height would be approved without operating duration constraints.

- Ultimately limited by the Radar Terrain Clearance Chart (RTCC) / Minimum Vector Altitude (MVA) surfaces, at a fixed attitude of 152.4m AHD, across the entire site. Absolute maximum potential crane height limit.

- Less than 500m to the north of the Green Square Town Centre (GSTC), which already has a number of tall tower buildings approved, the tallest approved up to a height of 125m AHD. It is highly likely that this development would provide a shielding effect to some tall buildings in Waterloo South, and therefore help justify the approvability of future airspace height applications for precinct developments that would not penetrate the current or potential future airspace constraints.

As can be seen from Table 2 above and Figure 9 (p24), the entirety of the Waterloo South Renewal study area is currently constrained by a maximum permissible building height of 126.4m AHD. Given the location of the site in relation to Sydney Airport, the nature of the PANS-OPS height constraints, and precedent considering crane approvals in the vicinity and the CBD, the RTCC may be considered as the maximum potential approvable height limit for crane operations (noting that in such cases, cranes that would exceed the PANS-OPS height limit would be subject to 3-month durations and may also be required to be lowered to the PANS-OPS heights at night). This is the general principle. Applications for buildings are usually submitted at the time of a DA, and for cranes prior to construction.

Taking these factors outlined here and below into consideration, as well as the location of the site in relation to the airport, **there is no technical impediment to approval of the development of Waterloo South** providing the maximum heights of buildings and cranes do not exceed the PANS-OPS and RTCC Height Constraints documented herein, and **we consider that future applications under the Airports (Protection of Airspace) Regulations, supported by a full aeronautical assessment and safety case would be approved by the Department of Infrastructure, Transport, Regional Development and Communication**.

1 Waterloo South Renewal

1.1 Introduction

The Greater Sydney Region Plan and Eastern City District Plan seek to align growth with infrastructure, including transport, social and green infrastructure. With the catalyst of Waterloo Metro Station, there is an opportunity to deliver urban renewal to Waterloo Estate that will create great spaces and places for people to live, work and visit.

The proposed rezoning of Waterloo Estate is to be staged over the next 20 years to enable a coordinated renewal approach that minimises disruption for existing tenants and allows for the up-front delivery of key public domain elements such as public open space. Aligned to this staged approach, Waterloo Estate comprises three separate, but adjoining and inter-related stages:

- Waterloo South;
- Waterloo Central; and
- Waterloo North.

Waterloo South has been identified as the first stage for renewal. The lower number and density social housing dwellings spread over a relatively large area, makes Waterloo South ideal as a first sub-precinct, as new housing can be provided with the least disruption for existing tenants and early delivery of key public domain elements, such as public open space.

A planning proposal for Waterloo South is being led by NSW Land and Housing Corporation (LAHC). This will set out the strategic justification for the proposal and provide an assessment of the relevant strategic plans, state environmental planning policies, ministerial directions and the environmental, social and economic impacts of the proposed amendment. The outcome of this planning proposal will be a revised planning framework that will enable future development applications for the redevelopment of Waterloo South. The proposed planning framework that is subject of this planning proposal, includes:

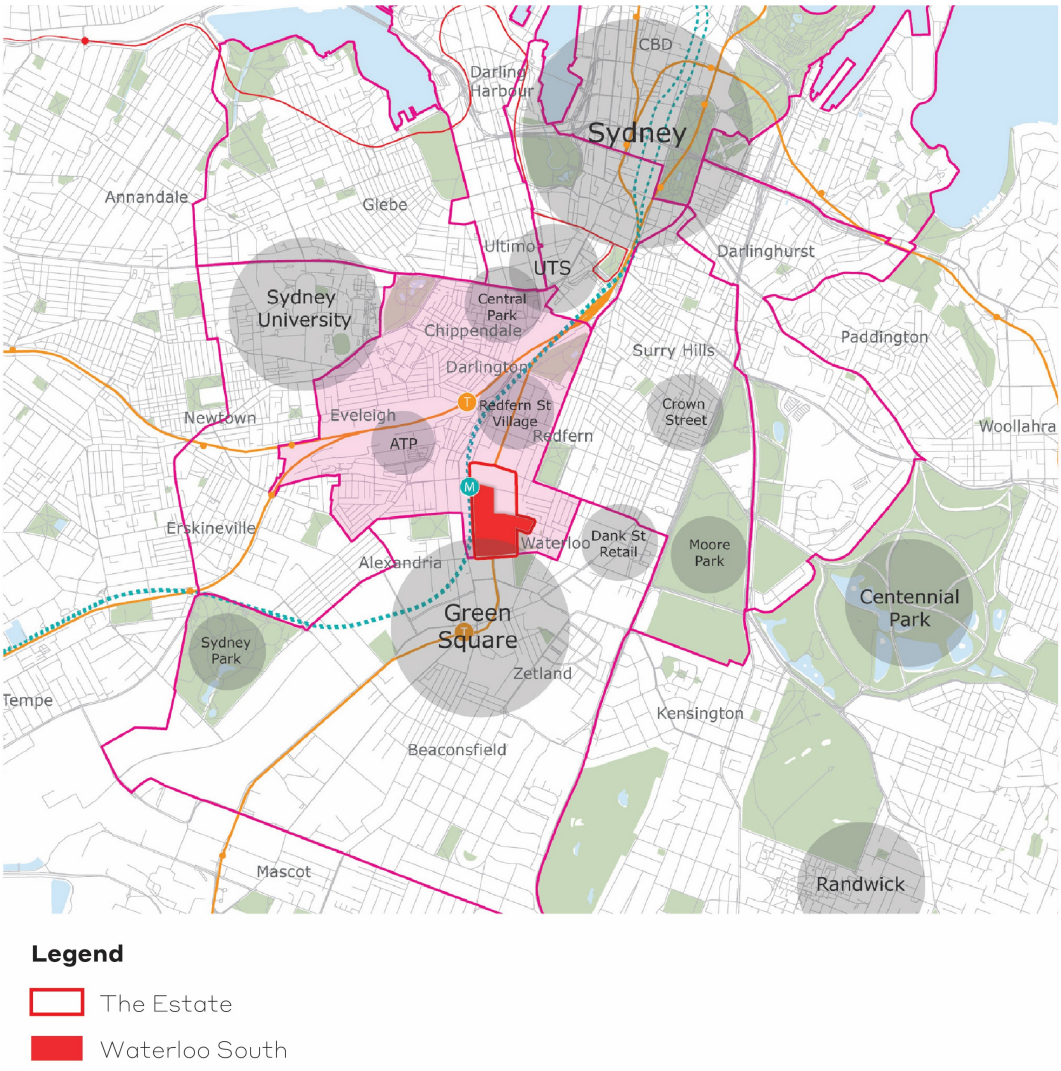
- **Amendments to the Sydney Local Environmental Plan 2012** – This will include amendments to the zoning and development standards (i.e. maximum building heights and floor space ratio) applied to Waterloo South. Precinct-specific local provisions may also be included.
- **A Development Control Plan (DCP)** – This will be a new part inserted into 'Section 5: Specific Areas' of the Sydney DCP 2012 and include detailed controls to inform future development of Waterloo South.
- **An infrastructure framework** – in depth needs analysis of the infrastructure required to service the needs of the future community including open space, community facilities and servicing infrastructure.

1.2 Waterloo Estate

Waterloo Estate is located approximately 3.3km south-south-west of the Sydney CBD in the suburb of Waterloo (refer to Figure 3). It is located entirely within the City of Sydney local government area (LGA). Waterloo Estate is situated approximately 0.6km from Redfern train station and 0.5km from Australia Technology Park. The precinct adjoins the new Waterloo Metro Station, scheduled to open in 2024. The Waterloo Metro Quarter adjoins Waterloo Estate and includes the station and over station development, and was rezoned in 2019. Waterloo Estate comprises land bounded by Cope, Phillip, Pitt and McEvoy Street, including an additional area bounded by Wellington, Gibson, Kellick and Pitt Streets. It has an approximate gross site area of 18.98 hectares (14.4 hectares excluding roads). Waterloo Estate currently comprises 2,012 social housing dwellings

owned by LAHC, 125 private dwellings, a small group of shops and community uses on the corner of Wellington and George Streets, and commercial properties on the south-east corner of Cope and Wellington Streets.

A map of Waterloo Estate and relevant boundaries is illustrated in Figure 4.



Source: Turner Studio

Figure 3 — Location plan of Waterloo Estate and Waterloo South

1.3 Waterloo South

Waterloo South includes land bounded by Cope, Raglan, George, Wellington, Gibson, Kellick, Pitt and McEvoy Streets, and has an approximate gross site area of 12.32 hectares (approximately 65% of the total Estate).

Waterloo South currently comprises 749 social housing dwellings owned by LAHC, 125 private dwellings, and commercial properties on the south-east corner of Cope and Wellington Streets. Existing social housing within Waterloo South is predominantly walk up flat buildings constructed in the 1950s and '60s, and mid-rise residential flat buildings (Drysdale, Dobell & 76 Wellington Street) constructed in the 1980s. Listed Heritage Items within Waterloo South include the Duke of Wellington Hotel, Electricity Substation 174 on the corner of George and McEvoy Streets, the terrace houses at 229-231 Cope Street and the Former Waterloo Pre-School at 225-227 Cope Street. The State Heritage listed 'Potts Hill to Waterloo Pressure Tunnel and Shafts' passes underneath the precinct.

A map of Waterloo Estate and relevant boundaries is illustrated in Figure 4.

Source: Ethos Urban

Figure 4 — Waterloo Precinct

1.4 Renewal Vision

The transition of Waterloo Estate will occur over a 20-year timeframe, replacing and providing fit for purpose social (affordable rental) housing as well as private housing to create a new integrated and inclusive mixed-tenure community.

This aligns with Future Directions for Social Housing in NSW – the NSW Government's vision for social housing. It also aligns with LAHC's Communities Plus program, which is tasked with achieving three key objectives:

1. Provide more social housing
2. Provide a better social housing experience
3. Provide more opportunities and support for social housing tenants

The following is LAHC's Redevelopment Vision for Waterloo Estate, which was derived from extensive consultation and technical studies:

Source: Let's Talk Waterloo: Waterloo Redevelopment (Elton Consulting, 2019)

Culture and Heritage

- Recognise and celebrate the significance of Waterloo's Aboriginal history and heritage across the built and natural environments.
- Make Waterloo an affordable place for more Aboriginal people to live and work.
- Foster connection to culture by supporting authentic storytelling and recognition of artistic, cultural and sporting achievements.

Communal and Open Space

- Create high quality, accessible and safe open spaces that connect people to nature and cater to different needs, purposes and age groups.
- Create open spaces that bring people together and contribute to community cohesion and wellbeing.

Movement and Connectivity

- Make public transport, walking and cycling the preferred choice with accessible, reliable and safe connections and amenities.
- Make Waterloo a desired destination with the new Waterloo Station at the heart of the Precinct's transport network – serving as the gateway to a welcoming, safe and active community.

Character of Waterloo

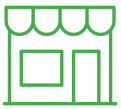
- Strengthen the diversity, inclusiveness and community spirit of Waterloo.
- Reflect the current character of Waterloo in the new built environment by mixing old and new.

Local Employment Opportunities

- Encourage a broad mix of businesses and social enterprise in the area that provides choice for residents and creates local job opportunities.

Community Services, Including Support for Those Who Are Vulnerable

- Ensure that social and human services support an increased population and meet the diverse needs of the community, including the most vulnerable residents.
- Provide flexible communal spaces to support cultural events, festivals and activities that strengthen community spirit.



Accessible Services

- Deliver improved and affordable services that support the everyday needs of the community, such as health and wellbeing, grocery and retail options.

Design Excellence

- Ensure architectural design excellence so that buildings and surrounds reflect community diversity, are environmentally sustainable & people friendly – contributing to lively, attractive and safe neighbourhoods.
- Recognise and celebrate Waterloo's history and culture in the built environment through artistic and creative expression.
- Create an integrated, inclusive community where existing residents and newcomers feel welcome, through a thoughtfully designed mix of private, and social (affordable rental) housing.

1.5 Purpose of This Report

This report relates to the Waterloo South planning proposal. While it provides comprehensive baseline investigations for Waterloo Estate, it only assesses the proposed planning framework amendments and Indicative Concept Proposal for Waterloo South.

1.5.1 Study Requirements

The key matters addressed as part of this study stem from the Study Requirements issued by the NSW Minister for Planning (on 19 May 2017) for the entire Waterloo Estate. Of relevance to this study are the following requirements:

Table 3 — Study Requirements

Ref No	*Study Requirement*	*Addressed at*
20.1	Review relevant background information, including the 'Sydney Airport Master Plan' to understand the current and proposed future operations of Sydney Airport, as relevant to the precinct.	Sections 2.2.2 (p16) & 2.3 (p19)
20.2	Identify and clearly map the OLS, PANS OPS and any other relevant Sydney Airport height limitation layers, including consideration of Navigation Aid Surfaces.	The whole of Section 3 (p21)
20.3	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.	*Summary*: Section 3.1 (p21) and 4 (p30) *Buildings*: Sections 2.2.5 (p18) and 3.3 (p23) *Cranes*: Sections 3.4.1 (p27) & 3.5 (p29)
20.1	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).	Sections 3.4.3 (p28)
20.5	Advise on the pathway required to secure approval from relevant bodies, e.g. Air Services Australia, as part of subsequent development application processes, including for temporary structures such as cranes.	Section 2.2.4 (p17)
20.6	Certify that subject to any recommended measures, the precinct proposal will not have an adverse impact on the operations of Sydney Airport.	Executive Summary (p4) & Section 4 (p30)

1.6 Waterloo South Planning Proposal

The planning proposal will establish new land use planning controls for Waterloo South, including zoning and development standards to be included in Sydney LEP 2012, a new section in Part 5 of DCP 2012, and an infrastructure framework. Turner Studio and Turf has prepared an Urban Design and Public Domain Study which establishes an Indicative Concept Proposal presenting an indicative renewal outcome for Waterloo South. The Urban Design and Public Domain Study provides a comprehensive urban design vision and strategy to guide future development of Waterloo South and has informed the proposed planning framework. The Indicative Concept Proposal has also been used as the basis for testing, understanding and communicating the potential development outcomes of the proposed planning framework.

The Indicative Concept Proposal comprises:

- Approximately 2.57 hectares of public open space representing 17.8% of the total Estate (Gross Estate area – existing roads) proposed to be dedicated to the City of Sydney Council, comprising:
  - Village Green – a 2.25 hectare park located next to the Waterloo Metro Station; and
  - Waterloo Common and adjacent – 0.32 hectares located in the heart of the Waterloo South precinct.
  - The 2.57 hectares all fall within the Waterloo South Planning Proposal representing 32.3% of public open space (Gross Waterloo South area – proposed roads)

- Retention of 52% of existing high and moderate value trees (including existing fig trees) and the planting of three trees to replace each high and moderate value tree removed.
- Coverage of 30% of Waterloo South by tree canopy.
- Approximately 257,000 sqm of GFA on the LAHC land, comprising:
  - Approximately 239,100 sqm GFA of residential accommodation, providing for approximately 3,048 dwellings comprising a mix of market and social (affordable rental) housing dwellings;
  - Approximately 11,200 sqm of GFA for commercial premises, including, but not limited to, supermarkets, shops, food & drink premises and health facilities; and
  - Approximately 6,700 sqm of community facilities and early education and child care facilities.

The key features of the Indicative Concept Proposal are:

- It is a design and open space led approach.
- Creation of two large parks of high amenity by ensuring good sunlight access.
- Creation of a pedestrian priority precinct with new open spaces and a network of roads, lanes and pedestrian links.
- Conversion of George Street into a landscaped pedestrian and cycle friendly boulevard and creation of a walkable loop designed to cater to the needs of all ages.
- A new local retail hub located centrally within Waterloo South to serve the needs of the local community.
- A target of 80% of dwellings to have local retail services and open space within 200m of their building entry.
- Achievement of a 6 Star Green Star Communities rating, with minimum 5-star Green Star – Design & As-Built (Design Review certified).
- A range of Water Sensitive Urban Design (WSUD) features.

The proposed land allocation for the Waterloo South precinct is described in Table 4 below.

Table 4 — Breakdown of allocation of land within the Waterloo South

Land allocation	Existing	Proposed
Roads	3.12ha / 25.3%	4.38ha / 35.5%
Developed area (Private sites)	0.86ha / 6.98%	0.86ha / 7%
Developed area (LAHC property)	8.28ha / 67.2%	4.26ha / 34.6%
Public open space (proposed to be dedicated to the City of Sydney)	Nil / 0%	2.57ha / 20.9% (32.3% excluding roads)
Other publicly accessible open space (Including former roads and private/LAHC land)	0.06ha / 0.5%	0.25ha / 2%
TOTAL	**12.32ha**	**12.32ha**

The Waterloo South Masterplan is illustrated in Figure 5 below.

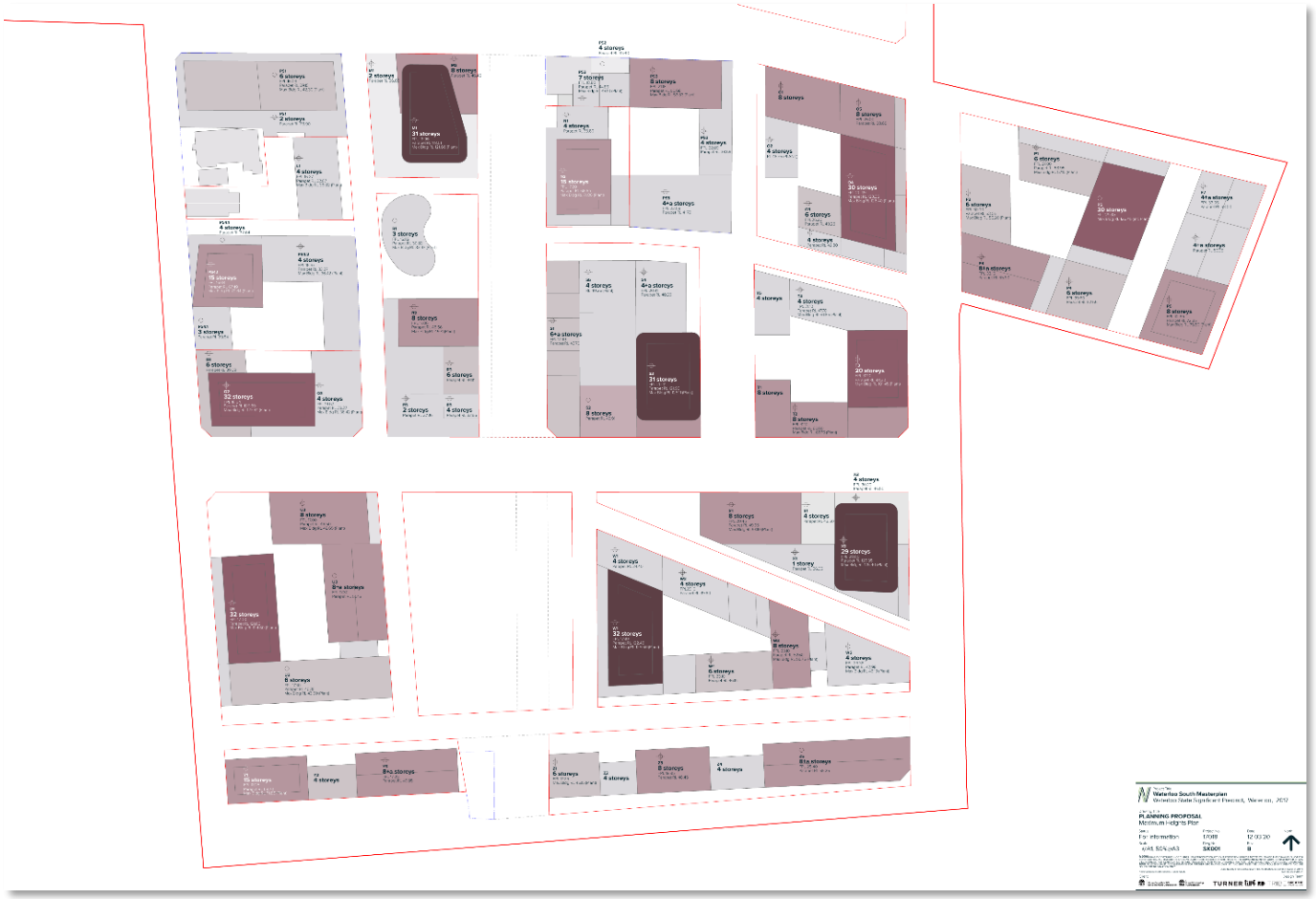
Source: Turner Studio

Figure 5 — Indicative Concept Proposal

1.7 Maximum Planned Building Envelope Heights & Assessment Elevations

The maximum heights of each building in the planning proposal are depicted in Figure 6 below (refer also to Appendix 3 — Building Data Schedule for more complete information on each building).

The relative levels (RLs) of the top of each building envelope are the equivalent of elevation in metres Australian Height Datum (AHD). The maximum RLs are based on the surveyed ground elevations, the number of storeys planned, design floor-floor heights and where relevant additional allowances for roof top features.



Source: Turner Studio — Drawing SK001 Rev B

Figure 6 — Waterloo South Masterplan — Maximum Heights Plan

Table 5 below includes the maximum envelope elevations for the taller building envelopes only — that is, it excludes the lower buildings which have already been assessed as not requiring any airspace approvals prior to construction at the proposed heights.

For the purposes of the airspace assessment at this stage of planning assessment, maximum indicative design RLs have been rounded up.

Table 5 — Proposed Maximum Heights of the Taller Building Envelopes & Elevations used for Airspace Impact Assessment

Building Block & Number	*No of Storeys*	*Max Proposed RL (m AHD)*	*Conservative Max RL Assessed for Assessment (m AHD)*
M1 / M3	31	121.66	**121.7**
N2	15	71.80	**71.8**
O4	30	126.40	**126.4**
P5	30	126.40	**126.4**
P6	8	75.50	**75.5**
PS4.1	15	70.64	**70.7**
Q1	32	123.84	**123.9**
S3	31	1.11	**125.2**
T3	20	101.45	**101.5**

Building Block & Number	*No of Storeys*	*Max Proposed RL (m AHD)*	*Conservative Max RL Assessed for Assessment (m AHD)*
U1	32	124.80	**124.8**
W1	32	125.60	**125.6**
X2	29	126.40	**126.4**
Y1 / Y2	15	71.85	**71.9**

2 Aeronautical Impact Context

2.1 Location of the Proposed Development

The site lies to the north of Sydney Airport, approximately 5.47km (3.0 Nautical Miles, NM) from the aerodrome reference point (ARP) at a bearing of 012° Magnetic (M) or 024.8° True (T) — as indicated in Figure 5 below.

The measurement point used is the southern corner of the boundary of the Waterloo South boundary, at the corner of Cope and McEvoy Streets, Waterloo. The coordinates of the measurement point are:

WGS84 Latitude & Longitude	33° 54'04.41" S	151° 12' 06.70" E
MGA94 Easting & Northing (Z56)	333743.324 E	6247340.522 N

Other key measurement references are:

- In relation to Runway (RWY) 07/25, the short cross-runway
  - ~7.96km (4.3NM) at 014°T from the threshold of RWY 25
  - ~3.58km (1.9NM) from the extended runway centreline
- In relation to Runway (RWY) 16L/34R, the eastern parallel runway
  - ~5.72km (3.1 NM) at 000°M (012.2°T) from the threshold of Runway (RWY)16L
  - ~2.36km (1.3NM) from the extended runway centreline

In addition, it is also noted that the precinct, at its southern border, is approximately 465m (0.25NM) to the north of the most significant development in the local region, the Green Square Town Centre, which is partly developed and which has buildings already approved up to a maximum height of 125m AHD. In essence, this development will have the potential to provide a 'shielding effect' to tall buildings proposed for the Waterloo Precinct, thereby possibly facilitating the airspace-related height assessment and approval path for developments in the Waterloo Precinct.

The other airports in the Sydney Basin are too distant from the study area to have any impact on the airspace above it.

Figure 7 — Waterloo Precinct in relation to Sydney Airport (Large Format)

2.2 Methodology

The methodology used to determine the maximum permissible building heights is based on an orderly assessment of the potential impact against the various elements described in this section.

2.2.1 Airspace Regulations

The proposed development site is subject to the Airports (Protection of Airspace) Regulations (APAR), under the Commonwealth's Airports Act, 1996), because of its proximity to Sydney Airport and because of its proposed height. These regulations define both: how building height limitations due to airspace safety can be determined; and the process for gaining approval of the proposed development under the regulations.

The Prescribed Airspace Regulations, and their impact upon building height limitations, are described below.

2.2.2 Prescribed Airspace

Prescribed airspace, under these regulations, includes at minimum:

- **Obstacle Limitation Surfaces (OLS)**
  - The OLS surfaces are used to identify buildings and other structures that may have an impact upon the safety or regularity of aircraft operations at an airport. This impact depends upon both the type of operations at the aerodrome and which OLS surfaces are penetrated by a (proposed) building or structure.
  - The OLS are flat and rising (invisible) surfaces around the airport. They are based on the geometry of the airport and its runways and therefore they rarely change.
  - If a permanent building development (or temporary crane) that is proposed at a height that will penetrate (exceed) the height limit of an OLS surface, then an application must be made to the Commonwealth Department of Infrastructure, Transport, Regional Development and Communication (DITRDC) — via the closest airport, and with copies to any other potentially affected airport — for an airspace height approval prior to construction of the permanent development &/or erection of the temporary crane obstacle. Such applications should demonstrate that the proposed building development does not penetrate or adversely affect surfaces protecting: instrument flight procedures (PANS-OPS surfaces); radar vectoring; navigation infrastructure; and anything else that might affect the safety, efficiency or regularity of current and future air transport operations at the airport.
- **PANS-OPS Surfaces**
  - PANS-OPS surfaces represent the protection surfaces for published instrument flight procedures to and from the airport. These surfaces comprise flat, sloping and complex surface components.
  - PANS-OPS surfaces must not be penetrated by either permanent or temporary buildings or structures. However, for a variety of reasons, PANS-OPS surfaces can and do change over time.
  - As flight procedures are changed from time to time (usually by Airservices) , the PANS-OPS Surface Plan published by an airport may not reflect the current situation — which is why we not only reference the airport's plans but also review the published charts for current (or pending) instrument flight procedures and evaluate the associated

PANS-OPS height limits. The regulations also make a provision for any factor which may be deemed to adversely affect the safety, regularity or efficiency of aircraft operations at an airport. In light of this, it is necessary to consider the following factors.

- **Other Considerations**
  - **Sydney Airport's Declared Airspace Plans** additionally include:
    - Radar Terrain Clearance Charts (RTCC), which depict the areas and height limits related to the Minimum Vector Altitudes (MVAs) used by Air Traffic Controllers when vectoring aircraft.
    - Lighting and visual guidance protection plans — used for approach guidance by aircraft, especially at night and in times of poor visibility.
    - Navaid and radar evaluation / protection surface plans.
  - **Other Factors**
    - Protection for other Instrument Flight Procedure surfaces, where the procedures are not classified as PANS-OPS and/or have been omitted from Sydney Airport's declared PANS-OPS surfaces charts. These may include a variety of Required Navigation Procedures (RNP).
    - Airline Engine-Out (Contingency) Take-Off Splays
      (as per Civil Aviation Order 20.7 1b)
      These are generally assessed independently by the airlines as part of their own evaluations of any given airspace height application, but it is prudent to evaluate any potential impact in advance.
    - Other miscellaneous factors that may be considered as potential safety issues by any of the key stakeholders, and the Civil Aviation Safety Authority (CASA) in particular. This may also include protection of critical airspace for visual flight procedures used for emergency service helicopter landing sites.

Note: Airspace that is approved by the Department of Infrastructure, Transport, Regional Development and Communication (DITRDC) as Declared Airspace is considered part of an airport's Prescribed Airspace.

2.2.3 Note about Heights: Australian Height Datum (AHD) vs Above Ground Level (AGL)

All "heights" provided in this document are elevations expressed in metres in the Australian Height Datum (AHD) — and thus they are true elevations, and NOT heights above ground level (AGL).

For estimating maximum development heights AGL, the ground elevation^{AHD} should be subtracted from the airspace height limits^{AHD}.

Note also for aviation-related airspace height limits, any building height approval under the Airports (Protection of Airspace) Regulations is regarded as inclusive of the building itself plus all rooftop furniture and overruns (plant buildings, lift risers, etc).

2.2.4 The Application Pathway for Airspace Height Approvals

All applications for permanent structure (called *controlled activities*) and temporary (*short-term controlled activities*) under APAR must be submitted to DITRDC, at the appropriate time, through the closest relevant airport. At the latest, approvals for buildings must be gained prior to construction, but are usually required as a condition of approval of Development Applications by most Councils, including the City of Sydney. Note that prior airspace approval is not required for rezoning.

Applications should include aeronautical impact assessment reports that are based on the most current plans for the proposed development available at the time. For major developments, such reports should include consideration of cranes that will be required for construction: this information will be used for assessment of the feasibility of constructing the buildings if approved at the maximum heights sought. Separate applications for cranes will also be required at the appropriate times during the construction period, prior to their erection.

There are a number of factors and considerations that would influence a decision on when to make an APAR application for a building. Common decision criteria are outlined below.

- The need for early certainty of approval, versus the effort entailed in preparing documentation and supporting details required to prepare and justify an APAR application that can be approved.
- Application assessment lead time: under the APAR, the minimum processing time for evaluation is 49 days, but it may be substantially longer before a determination is made if additional information and/or clarifications are required.
- Approvals are sometimes not required prior to submitting a development application (DA) but in other cases planning assessment requires a level of certainty that an APAR application would be approved in the event that the planning proposal or DA is approved.
  - Some DAs are granted with the requirement to secure an airspace height approval as a consent condition.
  - Sydney Airport, CASA and DITRDC prefer to process applications that already have DA approval for several reasons:
    - Because applications based on advanced development plans and designs (eg, to DA level or beyond) will have enough associated information — eg, a Construction Management Plan which includes preliminary crane plans — that will help to support and justify the feasibility of construction in the event of an APAR approval; and
    - To reduce the likelihood that they will have to re-evaluate the sites for amended applications in the future due to changed designs (for example, following DA resolution).
    - That said, Sydney Airport has a formal process for applications as a result of DA referrals by councils, and applications will be accepted at any time even well before submissions of applications for DAs or similar.
  - In the event that changes to a design or construction events are likely to exceed an approval already granted for the site, an application for an amendment to the pre-existing approval would need to be made. The documentation requirements and assessment periods for amendments are usually the same as for an initial application.

2.2.5 Applications for Buildings

For proposed developments that would penetrate the OLS, Sydney Airport Corporation Limited (SACL) will seek consultation from Airservices Australia, CASA and other key stakeholders (such as major airlines), and then within 3 weeks from the date of receipt forward the application to DITRDC. Upon final receipt of technical calculations and agency and stakeholder feedback, DITRDC would make a determination and advise the SACL and the applicant. Whilst the APAR provide a 4-week response timeframe for the DITRDC response, there are provisions whereby this timeframe can be extended,

especially where DITRDC seeks clarification or further information to help in the assessment of complex cases.

A successful application would be given approval under Regulation 14 of the APAR as a controlled activity.

2.2.6 Applications for Cranes

For proposed cranes and temporary structures that would penetrate the OLS but not infringe the PANS-OPS constraint overhead, SACL may grant approval of applications under delegation. If an application seeks approval for cranes that would penetrate the PANS-OPS height constraint, permission may be granted by DITRDC subject to operational and safety assessments, as well as the agreement of SACL. In such cases, a crane which infringes the PANS-OPS would be approved for a maximum duration of 3 contiguous months as a short-term controlled activity under Regulation 14(5) of the APAR.

See also section 3.5 Renewal Proposal: Max Building Heights & Cranes (p29) regarding crane implications for the Waterloo South site and precedents related to crane heights previously approved for the nearby Green Square.

2.3 Airport Plans & Aeronautical Data References for the Study

2.3.1 Sydney Airport Master Plan 2039

The current plan in effect is the Sydney Airport Master Plan 2039, approved in 2019.

The master plan does not forecast any potential changes to the aerodrome infrastructure or flight paths which would cause any additional impact on the airspace protection constraints overhead the Waterloo South. Similarly, the master plan indicates that the whole of the precinct would remain in an area of acceptable aircraft noise (well outside the ANEF 20 noise contour)

2.3.2 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 — include a mix of plans: most were published in March 2015 as the Declared Airspace for Sydney Airport, but a more recent version of the PANS-OPS surfaces chart (drafted in 2018) was published in 2019. Like the Master Plan 2033 they no longer reflect the current airspace height constraints due to changes in on-airport navigation-related infrastructure and PANS-OPS flight procedures since that time.

2.3.3 Procedure & Airspace Charts published by Airservices Australia

These charts are regularly updated every three months and the updates are published on Airservices Australia's website six weeks prior to implementation. These charts reflect changes in the international standards for PANS-OPS procedures, changes in the navigation infrastructure used and other changes implemented as a result of air traffic management demands and practices from time to time.

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 the most recent version of these and other relevant charts published by Airservices Australia. The charts referenced are listed in Appendix 2 — PANS-OPS Procedures.

2.3.4 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 safety criteria and standards which are developed and maintained by the International Civil Aviation Organisation (ICAO) and used by Airservices and CASA. Most of these changes have not affected the critical airspace directly above the Waterloo South site.

All such changes that have been identified from Airservices and ICAO documents and have been taken into consideration in this report. These are the constraints that are relevant for the foreseeable future.

2.3.5 Trends that May Affect the Airspace over Waterloo South

The Master Plan 2039 identified several trends, mostly in terms of aircraft types and number that may affect the environmental (noise) impact and airspace limitations over the Waterloo South site. These trends were:

- 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 B Circling Area) affecting the Waterloo South site. As the number of potential users of this type of landing procedure diminishes, the relevance of this most restrictive surface diminishes. This strengthens any argument for changing or removing the restriction.
- Increasing use of newer navigation technologies: this will decrease the need for the Category A and B Circling Area and may eventually reduce the current reliance on ‘radar vectoring’ which is the cause of the second most restrictive surface (the RTCC) above the Waterloo South site. No other changes to flight paths that would impact the Waterloo 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 Waterloo South site.

Sydney Airport’s Master Plan 2039 forecasts no changes to the flight paths currently in use, which means that there are no consequential changes to airspace height limits that would further constrain the maximum building heights in Waterloo South.

3 Analysis

3.1 Analysis Summary

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

Table 6 — Analysis Summary — Airspace Height Constraints

Height Limits (AHD)	*Height Limit Detail*	*Comment*
54.5m – 76m	OLS Conical Surface	Threshold Heights for Airspace Height Applications (as depicted in Figure 8, p22) Any development that would exceed the relevant limiting OLS height would require an 'airspace height' approval from the Department of Infrastructure, Transport, Regional Development and Communication under the Airports (Protection of Airspace) Regulations (or APAR) prior to construction. Applications are usually made at the time of DA; and if the airspace approval may be subject of a DA consent condition if the airspace application is still under evaluation at the time of DA approval. A height application can be made for each building separately, a block containing a number of buildings to be developed at the same time, or a single application can be made for the entire Waterloo South area. The mid-rise and tall buildings proposed would infringe the OLS and would thus require airspace approvals.
126.4m	**PANS-OPS CIRCLING Surface for Category B Aircraft** — Entirety of the Waterloo South area	**This constraint is the current maximum permissible building height that would be approved today by the aviation authorities** (see Figure 9, p24). **None of the proposed building envelopes exceed this height, and so could be considered technically approvable under the APARs.** It is likely also to be the maximum height that would be considered approvable for cranes without necessarily requiring operating duration constraints (refer also section 3.5, p29)
152.4m	**Radar Terrain Clearance Chart (RTCC) Surface** — Entirety of the Waterloo South area	**This constraint is the maximum permissible height that may potentially be considered approvable for cranes**. Where cranes are approved at heights that exceed 126.4m AHD, there would be strict operational conditions (refer also section 3.5, p29). Note that applications for cranes are only required prior to construction, typically not until after approval of DA.
N/A or >152.4m	PANS-OPS Approaches & Departures Surfaces	The study area is outside the extent of the protection areas of PANS-OPS Approach Surfaces for Sydney Airport. Where PANS-OPS Missed Approach and Departure Procedure Surfaces do overlay the study area, the limiting heights are higher than that of the RTCC MVA constraint.
NA	Other Surfaces	The study area is outside any airspace protection requirements related to Sydney Airport's Navigation and Airport Lighting and Visual Guidance facilities. It is also clear of the primary flight paths used by emergency services helicopters to and from the nearest hospital (Royal Prince Alfred).

3.2 OLS Analysis

The height limit of Sydney Airport's OLS overhead the precinct is defined by the Conical Surface, which rises at a gradient of 5 per cent from the south-west to the north-east, as depicted in Figure 8 below. Only those building envelopes annotated with building heights in the image below, and listed in Table 5 (p13), would infringe the relevant OLS contour height limits.

Buildings and cranes may exceed the OLS height limits, but if planned as such an application for the aviation-related airspace approval for the proposed development must be submitted to Commonwealth Department of Infrastructure, Transport, Regional Development and Communication (DITRDC), via Sydney Airport. Failure to obtain such approval before construction commences can result in significant penalties under the Airports Act (1996).

Conversely, airspace height approvals are not required for any buildings or cranes that would not exceed the OLS height limits.

Figure 8 — Waterloo South in relation to Sydney Airport's OLS

Buildings that ultimately gain height approvals may be required (as part of the approval conditions) to install and operate obstacle lights on the sides and/or tops of the buildings, subject to recommendations made by CASA during their assessment of a height application and based on the specifications in the Civil Aviation Safety Regulations (CASR) Manual of Standards (MOS) Part 139.

The current Sydney Airport Master Plan to 2039 does not forecast any changes to the aerodrome that would occasion a change to the OLS. Thus, the current OLS is anticipated to remain in force for the planning horizon of the Waterloo South renewal area, as well as that of the remainder of the Waterloo Estate (Waterloo Central and Waterloo North).

All buildings of 15 or more storeys in the Proposal are anticipated to infringe the OLS to varying extents, ranging from 1.2 to 70+ metres. Buildings of less than 15 storeys will not infringe the OLS.

Note also that buildings that would not infringe the OLS will not require an airspace height approval prior to development (although the cranes required to erect any such building may require their own separate approvals at the appropriate time prior to construction).

3.3 PANS-OPS Analysis

In addition to reviewing the PANS-OPS Surfaces chart of Sydney Airport's Prescribed Airspace (as declared and approved by DITRDC in 2015), assessment was conducted of the following instrument (non-visual) procedure types for Sydney Airport, as published by Airservices Australia in the Australian Aeronautical Information Publication (AIP) Departure and Approach Procedures (DAP), up to Amendment 157 (effective 08-Nov-2018 to 27-Feb-2019).

- The Circling Minima and Minimum Sector Altitudes (MSAs) for existing PANS-OPS procedures
  "Area" procedures, which provide protection for aircraft manoeuvring or circling within defined areas above the airport and surrounds
- 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)

Of the approach and departure procedures, only procedures that might be relevant to Waterloo South are included in this report. Principally these are procedures for the eastern North-South runway, RWY 16L/34R, as well as the "area" procedures.

The Sydney Airport Master Plan to 2039 was also reviewed for potential future impact. The Master Plan does not forecast any changes to procedures that would, to our best knowledge, make the airspace above Waterloo South any more constraining than that resulting from analysis of the current PANS-OPS procedures.

Analysis determined that the precinct is not constrained by protection surfaces related to approach flight procedures to runways at Sydney Airport, and although the precinct is under the protection surfaces for some missed approach and departure procedures, the effective height limit imposed on the site is by the surface related to the Circling Procedure for Category B Aircraft. See the following sections for more details.

Figure 9 — PANS-OPS & RTCC/MVA Height Constraints across the Waterloo Precinct

Table 7 — PANS-OPS Height Limit Summary

Procedure	*Height Limit (m AHD)*	*Description*
Circling — Cat B	**126.4**	**Category B Circling** — out to the extent of 3DME (a measurement from an on-aerodrome navaid, expressed in Nautical Miles; 3DME is approximately 5.6km), beyond which Circling is not permitted. This limit applies to the entirety of the Waterloo South Renewal study area. Note also that the Category A Circling area does not extend as far as the Waterloo Estate. **This height is considered the maximum permissible building height across Waterloo South.** **None of the building envelopes proposed in the Indicative Concept Proposal for Waterloo South exceed this limiting height, and so can be considered technically approvable under the APARs.**
Approaches and Missed Approaches to all Runways	N/A or >200+	Outside the lateral protection areas of many procedures. Where protection surfaces overlay the study area, the lowest limit is higher than 200m at the southern-most point of Waterloo Estate, and the height constraints across the remainder of the site are higher.
Departures	~188+	Where protection surfaces overlay the study area, the lowest limit is higher than 188m at the southern edge of Waterloo Estate, and the height constraints across the remainder of the site are higher.
Minimum Sector Altitude (MSA)	335.2	10NM Inner MSA of 2100ft.

Further details are provided in the following sections.

3.3.1 "Area" Procedures

3.3.1.1 Minimum Sector Altitudes (MSAs)

The height restrictions imposed by Minimum Sector Altitudes are higher than the limits imposed by other procedures.

3.3.1.2 Circling Minima

These are areas that define where and how low aircraft are allowed to circle the airport before landing. They are only applicable to some of the approach procedures.

The Waterloo South site is entirely covered by the circling restriction applicable to Category B aircraft. It extends from the airport, across the site, until a location 3DME (a measurement from an on-aerodrome navaid, expressed in Nautical Miles; 3DME is approximately 5.6km) from the airport, beyond which Circling is not permitted — as depicted in Figure 9 above.

Procedure	*Feature and / or Restriction*	*Description*
Cat B Circling	Horizontal Surface: • Covers the entirety of Waterloo South: **126.4m**	See Figure 9. Category B Circling — out to the extent of 3DME (a measurement from an on-aerodrome navaid, expressed in Nautical Miles; 3DME is approximately 5.6km), after which Circling is not permitted. The Cat A circling area does not extend as far as the study area.

3.3.2 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 provided in the tables below. The lateral extent of restrictions is shown in the diagrams (where appropriate).

Note also that where specific guideline height limits are provided, they are relevant only to the specific procedure. Other procedures mentioned in this report may impose more restrictive height limits over the same location.

The height restrictions due to the instrument approach procedures vary across the site, but for the most part are irrelevant because the PANS-OPS surface height of 126.4m, associated with the circling minima, is more restrictive.

3.3.2.1 Approach Procedures to RWY 16L and RWY 25

The Waterloo Precinct is laterally clear of the protection surfaces of the following procedures:

- RWY 25 RNAV(GNSS) Approach
- RWY 25 ILS and GLS Approaches
- RWY 16L RNAV(GNSS) Approach
- RWY 16L ILS and GLS Approaches

3.3.2.2 Missed Approach Segments of Approach Procedures for RWY 07 and RWY 34R

The precinct is unconstrained by the following procedures, either because the limiting heights are so high (higher than other more restrictive surfaces) or the site is laterally outside the protection surfaces. The lowest of the height limits from any of the following procedures is higher than 185m AHD at the southern-most point of Waterloo Estate. The limiting heights related to departures increase across the precinct.

- RWY 07 RNAV(GNSS) Missed Approach
- RWY 07 ILS and GLS Approaches
- RWY 34R RNAV(GNSS) Missed Approach
- RWY 34R ILS and GLS Missed Approaches

3.3.3 Departures

Height limitations may be imposed by departure procedures from both RWY34R and RWY07, but the limiting heights overhead Waterloo South are significantly higher than the Circling and other height constraints. For example, the most restrictive of the height limits from any departure is the

RWY34R departure, where the limiting height (above the southern-most point of Waterloo South) is 188.4m AHD. The limiting height of this procedure increases across the site as one moves further to the north and east.

3.4 Other Assessment Considerations

The following table provides a brief assessment of other considerations.

Table 8 — Other Assessable Height Limitations — including the RTCC MVA Limit

Procedure	*Height Limit (m AHD)*	*Description*
Radar Terrain Clearance Chart (RTCC) / Minimum Vector Altitude (MVA)	**152.4**	This height constraint is applicable over the north-eastern portion of the Waterloo Estate area, outside the area where the Circling surface constraint is more restrictive. This is the limit related to the Minimum Vectoring Altitude (MVA), which is used by air traffic controllers. This information is sourced from the RTCC published as part of Sydney Airport's Prescribed Airspace Plans.
Navigation Infrastructure	N/A	The proposed development is too far from the airport to affect any navigation infrastructure.
Airlines Engine Out Procedures	N/A	Engine Out procedures (from RWY 34R, the most relevant take-off runway end) are designed and maintained by each of the passenger transport aircraft operators in accordance with the relevant regulations. These already need to take into account the height of the tallest buildings at the Green Square Town Centre which is south of the Waterloo Precinct and closer to the airport. It is unlikely that the proposal would not adversely affect any contingency procedures. Note that these change from time to time, according to the PANS-OPS procedures, and the various aircraft types and related operating procedures employed by individual airline operators. As such they are not usually evaluated in detail until specific APAR applications are submitted.
Strategic Helicopter Landing Sites	N/A	The precinct is sufficiently distant from the nearest Strategic Helicopter Landing Site (SHLS), which is located at the Royal Prince Alfred Hospital, and is laterally clear of the preferred flight paths and their associated protection areas.

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

3.4.1 Radar Terrain Clearance Chart (RTCC) Surface / Minimum Vector Altitude (MVA)

The surface depicted in Sydney Airport's Radar Terrain Clearance Chart (RTCC) overhead Waterloo South protects the airspace used by air traffic controllers as the lowest Minimum Vector Altitude (MVA) they can use for vectoring aircraft.

The RTCC surface height overhead the entire study area is 152.4m AHD. This surface constraint becomes the effective limit where it is lower than surface heights related to PANS-OPS procedures. In this case, it comes into effect over the northern portion of the Waterloo North, outside the area where the Circling Surface limit is more constraining. This is depicted in Figure 9 above (p24).

Note also that if the current PANS-OPS Cat B Circling height restriction overhead the site was not in place, or was permitted to be infringed for a short period of time (not exceeding 3 months) for cranes, then the RTCC surface height would become the next effective height constraint.

3.4.2 Proximity to Emergency Helicopter Landing Site & Flight Paths

The Strategic Helicopter Landing Site (SHLS) at the nearby Royal Prince Alfred Hospital is approximately 1.7 kilometres from the north-east corner of the Metro Quarter site area to the west of Waterloo South.

The helicopter emergency management services (HEMS) to this facility are provided by the NSW Ambulance helicopter service. Whilst not formally part of the Prescribed Airspace of Sydney Airport, the requirement that new developments not interfere with such facilities and their associated HEMS flight paths was added, as Guideline H, to the National Airports Safeguarding Framework (NASF) in 2018. As such, the potential impact of new developments is now included as part of set of the key factors to be considered when evaluating airspace approvability under the APAR.

In this instance, the Metro Quarter is laterally clear of the HEMS flight paths to and from this SHLS and their associated flight path protection areas — and thus one can infer that the entire Waterloo South site area is also clear.

It has also been confirmed that the helicopters would not be affected by the Circling surface constraint — because even if they were to fly in instrument conditions to Sydney Airport a) they use straight-in procedures such as an precision ILS approach; and b) they do not use the Circling procedures (and even if they were to use these they fly as a Category A aircraft so the restriction is irrelevant).

Thus, the Waterloo South planning proposal would have no adverse impact in this regard.

3.4.3 Other Approvability Measures in relation to Sydney Airport Operations

Other short-term (i.e. during construction) and long-term factors to consider that could potentially impact on aviation operations, and therefore ultimately approvability from the aviation point of view, include the nature of the materials used externally (e.g. 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 taller buildings in relation to runway alignments, the maximum proposed heights, the configuration of the buildings within the site and the nature of the precinct as comprising mixed-use developments:

- It is noted that Waterloo South is outside the zones defined in the Civil Aviation Safety Regulations (CASR MOS Part 139) as requiring special external lighting constraints — thus no adverse impact from this point of view.
- The Waterloo South renewal planning proposal would not contribute any negative impact on aviation operations in terms of reflectivity.

Finally, based on the mix of heights of the proposed buildings and their configuration within the site, taken together with the location of the site in relation to the runway, no wind turbulence that is measurable to a level where it would provide an adverse impact on aviation operations is anticipated.

3.5 Renewal Proposal: Max Building Heights & Cranes

As previously noted in section 2.2.4 The Application Pathway for Airspace Height Approvals and section 2.2.6 Applications for Cranes (p19), height applications for cranes are usually made only when required, prior to construction.

All buildings in this planning proposal which have maximum RLs less than say 100m AHD (which includes some of those itemised in the Taller Building schedule in Table 5, p13) will almost certainly be able to be constructed using cranes that would not infringe the limiting PANS-OPS height of 126.4m AHD. Not only does this mean that height applications for the buildings themselves would be simpler to process, it also means that cranes for such buildings could be approved without operating duration restrictions.

For the taller buildings, airspace height applications may require supporting information to confirm that cranes which would exceed the PANS-OPS height limit could be safely operated at heights that would be below the RTCC surface height limit — which in this case is possible because there is sufficient vertical clearance between the maximum building heights proposed and the limiting RTCC height of 152.4m AHD — and that the applicant is aware that any associated cranes approvals would be to strict conditions. Such approval conditions would include a strict 3-month operating duration, and other operating conditions. This was the case for the height application of the tallest buildings for the nearby Green Square development itself, and later applications for cranes that exceeded the PANS-OPS circling height limit.

These are not conditions that are applicable to approval of a rezoning application per se, but are mentioned here as information that would pertain to developers at the time of preparation of DAs and height applications for buildings.

4 Conclusion

The OLS height limits rise across the precinct, from approximately 55m AHD at the southern point to 76m AHD at the north-eastern corner of the study area. This in effect means that the taller buildings (generally 15+ storeys) would require airspace height approvals prior to construction under the APAR. Such height applications are normally submitted at the time of the DA. Those buildings that would not penetrate the relevant OLS height restriction overhead could proceed without aviation-related airspace height approvals.

The maximum permissible heights applicable across the precinct, based on an assessment of current airspace, are:

- 126.4m AHD (Circling) — applicable across the entirety of the Waterloo South study area as the PANS-OPS height constraint, the maximum permissible building height
  - This height constraint would be the absolute cap for buildings, wherein the maximum building heights must include all rooftop furniture and overruns. The horizontal nature of this constraint affords flexibility in master planning of the buildings within the Waterloo South.
- 152.4m AHD (RTCC) — covers the entirety of Waterloo South (above the Circling height), and applicable as the absolute maximum permissible crane height (as per the precedent for crane approvals for Green Square).
  - Given the location of the precinct and the nature of the two restrictive 'maximum permissible heights', it is highly likely that these heights will also be considered by the airport, aviation stakeholders and DITRDC as the absolute maximum height applicable for cranes to be used during construction. Given the location of the precinct and the nature of the two restrictive 'maximum permissible heights', it is highly likely that the PANS-OPS height limit will also be considered by the airport, aviation stakeholders and DITRDC as the preferred maximum crane height. However, cranes may be approved up to the RTCC surface height limit but in such a case any such approvals would be subject to strict operational conditions.

Taking these factors into consideration, as well as the location of the site in relation to the airport:

- **There is no technical impediment to approval of the development of Waterloo South planning proposal** providing the maximum heights of buildings and cranes do not exceed the PANS-OPS and RTCC Height Constraints documented herein**,** and
- **It is considered that that future applications for buildings in the Indicative Concept Proposal, under the Airports (Protection of Airspace) Regulations, supported by a full aeronautical assessment and safety case would be approved by the Department of Infrastructure, Transport, Regional Development and Communications**.

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 latest versions of the IFPs consulted were from the current AIP Amendment 162 (effective from 27-Feb-2020 to 20-May-2020) — as indicated in Table 9 below.

The charts and procedures that are new or updates in the relevant amendment are highlighted in deep red text. Those that have been identified as having been updated since the last report was prepared for the Waterloo site are indicated with the ➢ symbol in the table below.

Table 9 — All PANS-OPS Instrument Flight Procedure Charts for Sydney Airport (AIP Amendment 162 – WEF 20200227 – 20200520)

SYDNEY (YSSY)

	Name of Chart	*Effective Date*	*(Amendment No)*
➢	AERODROME CHART PAGE 1	7-Nov-2019	(Am 161)
➢	AERODROME CHART PAGE 2	7-Nov-2019	(Am 161)
➢	APRON CHART - INTERNATIONAL PAGE 1	7-Nov-2019	(Am 161)
➢	APRON CHART - INTERNATIONAL PAGE 2	7-Nov-2019	(Am 161)
➢	APRON CHART - DOMESTIC PAGE 1	7-Nov-2019	(Am 161)
➢	APRON CHART - DOMESTIC PAGE 2	27-Feb-2020	(Am 162)
➢	APRON CHART - DOMESTIC PAGE 3	27-Feb-2020	(Am 162)
➢	STANDARD DOMESTIC TAXI ROUTES - ARRIVALS	7-Nov-2019	(Am 161)
➢	STANDARD DOMESTIC TAXI ROUTES - DEPARTURES	7-Nov-2019	(Am 161)
➢	NOISE ABATEMENT PROCEDURE PAGE 1	7-Nov-2019	(Am 161)
➢	NOISE ABATEMENT PROCEDURE PAGE 2	7-Nov-2019	(Am 161)
➢	NOISE ABATEMENT PROCEDURE PAGE 3	7-Nov-2019	(Am 161)
➢	NOISE ABATEMENT PROCEDURE PAGE 4	7-Nov-2019	(Am 161)
➢	NOISE ABATEMENT PROCEDURE PAGE 5	7-Nov-2019	(Am 161)
➢	NOISE ABATEMENT PROCEDURE PAGE 6	7-Nov-2019	(Am 161)
➢	NOISE ABATEMENT PROCEDURE PAGE 7	7-Nov-2019	(Am 161)
➢	NOISE ABATEMENT PROCEDURE PAGE 8	7-Nov-2019	(Am 161)
➢	NOISE ABATEMENT PROCEDURE PAGE 9	7-Nov-2019	(Am 161)
➢	NOISE ABATEMENT PROCEDURE PAGE 10	7-Nov-2019	(Am 161)
➢	AIRPORT EFFICIENCY PROCEDURES	7-Nov-2019	(Am 161)
➢	IVA USER GUIDE PAGE 1	7-Nov-2019	(Am 161)
➢	IVA USER GUIDE PAGE 2	7-Nov-2019	(Am 161)
➢	PRM USER INSTRUCTIONS	7-Nov-2019	(Am 161)
➢	SID SYDNEY ONE DEP (RADAR) - ALL RWYS	7-Nov-2019	(Am 161)
➢	SID RWY 34L SOUTH WEST DEP (JET)	7-Nov-2019	(Am 161)
➢	SID RWY 16R DEENA SEVEN (JET) (RNAV)	7-Nov-2019	(Am 161)
➢	SID RWY 34R ENTRA FIVE (JET) (RNAV)	7-Nov-2019	(Am 161)
➢	SID RWY 07 FISHA EIGHT (JET) (RNAV)	7-Nov-2019	(Am 161)
➢	SID RWY 16R KAMPI FIVE (RNAV)	7-Nov-2019	(Am 161)
➢	SID RWY 16L KEVIN SIX (JET) (RNAV)	7-Nov-2019	(Am 161)
➢	SID RWY 16L ABBEY THREE (JET) (RNAV)	7-Nov-2019	(Am 161)
➢	SID RWY 34R MARUB SIX (JET) (RNAV)	7-Nov-2019	(Am 161)
➢	SID RWY 34L RICHMOND FIVE DEP (JET)	7-Nov-2019	(Am 161)
➢	STAR BOREE ONE A ARRIVAL (RNAV)	7-Nov-2019	(Am 161)
➢	STAR BOREE ONE P ARRIVAL (RNAV)	7-Nov-2019	(Am 161)
➢	STAR MEPIL THREE ARRIVAL (RNAV)	7-Nov-2019	(Am 161)
➢	STAR MARLN FOUR ARRIVAL (RNAV)	7-Nov-2019	(Am 161)
➢	STAR ODALE SEVEN ARRIVAL (RNAV)	7-Nov-2019	(Am 161)

	Name of Chart	*Effective Date*	*(Amendment No)*
➢	STAR RIVET THREE ARRIVAL (RNAV)	7-Nov-2019	(Am 161)
➢	ILS OR LOC RWY 07	7-Nov-2019	(Am 161)
➢	ILS OR LOC RWY 16L PAGE 1	7-Nov-2019	(Am 161)
➢	ILS RWY 16L PAGE 2	7-Nov-2019	(Am 161)
➢	ILS OR LOC RWY 16R PAGE 1	7-Nov-2019	(Am 161)
➢	ILS RWY 16R PAGE 2	7-Nov-2019	(Am 161)
➢	ILS OR LOC RWY 25	7-Nov-2019	(Am 161)
➢	ILS OR LOC RWY 34L PAGE 1	7-Nov-2019	(Am 161)
➢	ILS RWY 34L PAGE 2	7-Nov-2019	(Am 161)
➢	ILS OR LOC RWY 34R PAGE 1	7-Nov-2019	(Am 161)
➢	ILS RWY 34R PAGE 2	7-Nov-2019	(Am 161)
➢	RNAV-Z (GNSS) RWY 07	7-Nov-2019	(Am 161)
➢	RNAV-Z (GNSS) RWY 16L	7-Nov-2019	(Am 161)
➢	RNAV-Z (GNSS) RWY 16R	7-Nov-2019	(Am 161)
➢	RNAV-Z (GNSS) RWY 25	7-Nov-2019	(Am 161)
➢	RNAV-Z (GNSS) RWY 34L	7-Nov-2019	(Am 161)
➢	RNAV-Z (GNSS) RWY 34R	7-Nov-2019	(Am 161)
➢	GLS RWY 07	7-Nov-2019	(Am 161)
➢	GLS RWY 16L	7-Nov-2019	(Am 161)
➢	GLS RWY 16R	7-Nov-2019	(Am 161)
➢	GLS RWY 25	7-Nov-2019	(Am 161)
➢	GLS RWY 34L	7-Nov-2019	(Am 161)
➢	GLS RWY 34R	7-Nov-2019	(Am 161)

Source: AIP Book (27-Feb-2020) via http://www.airservicesaustralia.com/aip/aip.asp?pg=10

APPENDIX 3 — BUILDING DATA SCHEDULE

TURNER

Waterloo South Individual Building Information

Project No: 17018
Project: **Waterloo Estate**
Date: 12.03.2020

Note: Heights indicative only based on:
- Freeboard Levels (Flood Planning Level (FPL)) extrapolated from advice provided by Aecom Freeboard 24.01.19
- Natural Ground Level (NGL) extrapolated from survey file SCR002_Waterloo Overall.dwg

Maximum Height (m) = Maximum Height (RL) – Natural Ground Level (RL)

Lot	Building No.	No. Storeys	Max. Height (m)	Natural Ground Level (NGL)	Freeboard Level (FPL)	Maximum Height (RL)	Retail GFA (m^2)	Community GFA (m^2)	Residential GFA (m^2)	Total Gross Floor Area (m^2)	No. of Dwellings
F/G	F	1	5.0 m	RL	FPL	RL	-	30 m^2	-	**30 m^2**	-
PS	PS1	2	10.82 m	RL 15.08	FPL 16.09	RL 25.90	-	-	-	**-**	-
		6	27.22 m	RL 15.08	FPL 16.09	RL42.30					
L	L1	4	20.31 m	RL 15.71	FPL 16.27	RL 36.02	-	-	1,280 m^2	**1,280 m^2**	15
	L2	2	EXISTING	-	-	-	-	320 m^2	-	**320 m^2**	-
M	M1	2	10.43 m	RL 16.23	FPL 16.96	RL 26.66	740 m^2	1,080 m^2	18,480 m^2	**20,300 m^2**	235
	M2 / **M3**	**31**	**105.43 m**	**RL 16.23**	**FPL 16.96**	**RL 121.66**					
		8	30.23 m	RL 16.23	FPL 16.96	RL 46.46					
N	N1/2	15	54.90 m	RL 16.90	FPL 17.20	RL 71.80	140 m^2	-	7,090 m^2	**7,230 m^2**	89
		4	16.90 m	RL 16.90	FPL 17.20	RL 33.80					
PS	PS2	4	17.02 m	RL 18.38	FPL 18.80	RL 35.40	-	-	-	**-**	-
		7	29.72 m	RL 18.38	FPL 18.80	RL 48.10					

Legend:
OLS PANS OPS

/Volumes/Projects/00017 TURNER PROJECTS 2017/17018 Waterloo Estate/A_TURNER/A15_File Notes/17018_BUILDING DATA.docx Page 1 of 5

Nominated Architect
Nicholas Turner 6695

Note: Heights indicative only based on:

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- Natural Ground Level (NGL) extrapolated from survey file SCR002_Waterloo Overall.dwg

Maximum Height (m) = Maximum Height (RL) – Natural Ground Level (RL)

Lot	Building No.	No. Storeys	Max. Height (m)	Natural Ground Level (NGL)	Freeboard Level (FPL)	Maximum Height (RL)	Retail GFA (m^2)	Community GFA (m^2)	Residential GFA (m^2)	Total Gross Floor Area (m^2)	No. of Dwellings
PS	PS3	8	33.15 m	RL 20.68	FPL 21.18	RL 53.83	-	-	-	**-**	-
		4+a	20.00 m	RL 21.79	FPL 22.09	RL 41.79					
		4	16.90 m	RL 21.79	FPL 22.09	RL 38.69					
O	O1	8	33.15 m	RL 25.50	FPL 26.00	RL 58.65	70 m^2	-	2,720 m^2	**2,790 m^2**	35
	O2	4	20.25 m	RL 25.50	FPL 26.00	RL 45.75	-	60 m^2	745 m^2	**805 m^2**	9
	O3	4	18.45 m	RL 24.35	FPL 26.20	RL 42.80	90 m^2	-	1,150 m^2	**1,240 m^2**	15
		6	24.90 m	RL 24.35	FPL 26.20	RL 49.25					
	O4*	**30**	**105.91 m**	**RL 20.49**	**FPL 20.49**	**RL 126.40***	-	-	17,270 m^2	**17,270 m^2**	221
	O5	8	m	RL	FPL	RL 58.65	-	-	2,275 m^2	**2,275 m^2**	29
P	P1	6	29.60 m	RL 27.50	FPL 27.80	RL 57.10	240 m^2	-	2,160 m^2	**2,400 m^2**	28
	P2	6	26.70 m	RL 29.50	FPL 30.00	RL 56.20	-	60 m^2	1,755 m^2	**1,815 m^2**	22
	P3	8+a	33.90 m	RL 32.00	FPL 33.15	RL 65.90	-	-	3,935 m^2	**3,935 m^2**	50
	P4	6	33.15 m	RL 39.25	FPL 39.60	RL 62.65	-	-	2,300 m^2	**2,300 m^2**	30
	P5*	**30**	**96.90 m**	**RL 29.50**	**FPL 29.80**	**RL 126.40***	-	-	16,280 m^2	**16,280 m^2**	209
	P6	8	33.15 m	RL 42.35	FPL 42.85	RL 75.50	-	-	3,525 m^2	**3,525 m^2**	45
	P7	4+a	20.2 m	RL 39.15	FPL -	RL 59.35	-	-	2,415 m^2	**2,415 m^2**	31

Nominated Architect
Nicholas Turner 6695

Note: Heights indicative only based on:

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- Natural Ground Level (NGL) extrapolated from survey file SCR002_Waterloo Overall.dwg

Maximum Height (m) = Maximum Height (RL) – Natural Ground Level (RL)

Lot	Building No.	No. Storeys	Max. Height (m)	Natural Ground Level (NGL)	Freeboard Level (FPL)	Maximum Height (RL)	Retail GFA (m^2)	Community GFA (m^2)	Residential GFA (m^2)	Total Gross Floor Area (m^2)	No. of Dwellings
PS	PS4.1	15	55.10 m	RL 15.54	FPL 16.04	RL 70.64	-	-	-	**-**	-
		3	14.00 m	RL 15.54	FPL 16.04	RL 29.54					
	PS4.2	4	20.05 m	RL 16.37	FPL 16.67	RL 36.42					
Q	**Q1**	**32**	**108.10 m**	**RL 15.74**	**FPL 16.04**	**RL 123.84**	50 m^2	-	18,835 m^2	**18,885 m^2**	240
		6	23.35 m	RL 15.74	FPL 16.04	RL 39.09					
	Q2	4	20.05 m	RL 16.37	FPL 16.67	RL 36.42	180 m^2	-	1,285 m^2	**1,465 m^2**	16
R	R1	3	17.65 m	RL 16.32	FPL 16.82	RL 33.97		1030 m^2		**1,030 m^2**	
	R2	8	33.15 m	RL 16.56	FPL 17.06	RL 49.71	330 m^2	340 m^2	2,930 m^2	**3,600 m^2**	37
	R3	2	10.80 m	RL 16.56	FPL 17.06	RL 27.36	670 m^2	470 m^2	830 m^2	**1,970 m^2**	10
		4	17.10 m	RL 16.56	FPL 17.06	RL 33.66					
		6	23.55 m	RL 16.56	FPL 17.06	RL 40.11					
S	S1	6+a	26.60 m	RL 17.10	FPL 17.40	RL 43.70	540 m^2	-	2,965 m^2	**3,505 m^2**	38
	S2	8	32.81 m	RL 17.10	FPL 17.40	RL 49.91	90 m^2	-	1,920 m^2	**2,010 m^2**	24
	S3	**31**	**105.00 m**	**RL 20.11**	**FPL 20.41**	**RL 125.11**	2930 m^2	-	16,825 m^2	**19,755 m^2**	216
	S4	4+a	20.15 m	RL 20.11	FPL 20.41	RL 40.26	-	80 m^2	1,310 m^2	**1,390 m^2**	17
	S5	4	23.16 m	RL 17.10	FPL 17.40	RL 40.26	-	-	960 m^2	**960 m^2**	12

Note: Heights indicative only based on:

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- Natural Ground Level (NGL) extrapolated from survey file SCR002_Waterloo Overall.dwg

Maximum Height (m) = Maximum Height (RL) – Natural Ground Level (RL)

Lot	Building No.	No. Storeys	Max. Height (m)	Natural Ground Level (NGL)	Freeboard Level (FPL)	Maximum Height (RL)	Retail GFA (m^2)	Community GFA (m^2)	Residential GFA (m^2)	Total Gross Floor Area (m^2)	No. of Dwellings
T	T1	8				RL 63.75	90 m^2	-	1,405 m^2	**1,495 m^2**	18
	T2	8	32.95 m	RL 30.80	FPL 31.10	RL 63.75	-	-	2,770 m^2	**2,770 m^2**	35
	T3	20	70.65 m	RL 30.80	FPL 31.10	RL 101.45	-	-	9,430 m^2	**9,430 m^2**	120
	T4	4	20.05 m	RL 30.80	FPL 31.10	RL 50.85	90 m^2	-	1,265 m^2	**1,355 m^2**	16
	T5	4				RL 50.85	-	40 m^2	700 m^2	**740 m^2**	9
U	**U1**	**32**	**108.10 m**	**RL 16.70**	**FPL 17.00**	**RL 124.80**	-	-	17,700 m^2	**17,700 m^2**	227
	U2	6	29.50 m	RL 17.00	FPL 17.30	RL 43.50	-	60 m^2	3,800 m^2	**3,860 m^2**	48
	U3	8+a	33.35 m	RL 16.80	FPL 17.30	RL 50.15	-	-	4,420 m^2	**4,420 m^2**	57
	U4	8	33.15 m	RL 16.50	FPL 17.00	RL 49.65	340 m^2	-	3,500 m^2	**3,840 m^2**	45
W	**W1**	**32**	**108.10 m**	**RL 17.50**	**FPL 17.80**	**RL 125.60**	600 m^2	70 m^2	18,415 m^2	**19,085 m^2**	236
	W2	4	17.00 m	RL 22.60	FPL 23.10	RL 39.60	-	730 m^2	1,990 m^2	**2,720 m^2**	25
	W3	8	33.15 m	RL 22.60	FPL 23.10	RL 55.75	-	910 m^2	2,225 m^2	**3,135 m^2**	29
	W4	6	23.55 m	RL 22.60	FPL 23.10	RL 46.15	-	-	1,150 m^2	**1,150 m^2**	15
	W5	4	20.05 m	RL 26.08	FPL 26.38	RL 46.13	250 m^2	-	1,280 m^2	**1,530 m^2**	16
X	X1	8	32.95 m	RL 20.15	FPL 20.45	RL 53.10	-	1,420 m^2	4,050 m^2	**5,470 m^2**	50
	X2	**29**	**98.70 m**	**RL 27.70**	**FPL 28.00**	**RL 126.40**	600 m^2	-	16,380 m^2	**16,980 m^2**	210
Y	Y1/Y2	15	54.90 m	RL 16.95	FPL 17.25	RL 71.85	755 m^2	-	5,660 m^2	**6,415 m^2**	71
	Y3	8+a	32.90 m	RL 16.95	FPL 17.25	RL 49.85	595 m^2	-	3,130 m^2	**3,725 m^2**	40

/Volumes/Projects/00017 TURNER PROJECTS 2017/17018 Waterloo Estate/A_TURNER/A15_File Notes/17018_BUILDING DATA.docx

12.03.2020

Page 4 of 5

Nominated Architect
Nicholas Turner 6695

Note: Heights indicative only based on:
- Freeboard Levels (Flood Planning Level (FPL)) extrapolated from advice provided by Aecom Freeboard 24.01.19
- Natural Ground Level (NGL) extrapolated from survey file SCR002_Waterloo Overall.dwg

Maximum Height (m) = Maximum Height (RL) – Natural Ground Level (RL)

Lot	Building No.	No. Storeys	Max. Height (m)	Natural Ground Level (NGL)	Freeboard Level (FPL)	Maximum Height (RL)	Retail GFA (m^2)	Community GFA (m^2)	Residential GFA (m^2)	Total Gross Floor Area (m^2)	No. of Dwellings
Z	Z1/Z2	6	28.20 m	RL 16.95	FPL 17.25	RL 45.15	610 m^2	-	1,630 m^2	**2,240 m^2**	20
	Z3/Z4	8	30.00 m	RL 18.45	FPL 18.95	RL 48.45	390 m^2	-	2,585 m^2	**2,975 m^2**	32
	Z5	8+a	33.35 m	RL 24.90	FPL 25.40	RL 58.25	810 m^2	-	4,375 m^2	**5,185 m^2**	56
							11,200 m^2	**6,700 m^2**	**239,100 m^2**	**257,000 m^2**	**3,048 dw**

/Volumes/Projects/00017 TURNER PROJECTS 2017/17018 Waterloo Estate/A_TURNER/A15_File Notes/17018_BUILDING DATA.docx
12.03.2020
Page 5 of 5

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