Hyside Projects Subtwo Pty Ltd

21 Parramatta Road Homebush

Desktop Pedestrian Level Wind Assessment

(Updated TP Drawings)

GWTS

Document No.

GWTS-PR-10630-2019-2

Client: Hyside Projects Subtwo Pty Ltd Tower 3, Level 23, 300 Barangaroo Avenue, Barangaroo NSW 2000 **Contact:** Housein Karnib ☎ 0426 262 520 ☎ (02) 9299 9900 **Email:** houseink@omaya.com.au	**Prepared By:** Global Wind Technology Services Pty Ltd 505, 434 St Kilda Road, Melbourne, VIC 3004 ☎ (03) 9939 9490 **Email:** info@gwts.com.au
Project Category: ST-CL-PD-FV	**Document No:** GWTS-PR-10630-2019-2
Prepared By: Shuang Ji	**Date:** 17th December, 2019
Released By: Seifu Bekele, Jon Becerra Booth	**Date:** 17th December, 2019
Revision History **Revision No:** 0 1 2	**Comments:** Draft Report Updated TP Drawings Second Update of TP Drawings

Contents

EXECUTIVE SUMMARY

GWTS has been commissioned by Hyside Projects Subtwo Pty Ltd to perform an assessment of pedestrian level wind effects due to the proposed 21 Parramatta Road Homebush.

This study was conducted by GWTS to help in achieving a greater understanding of the wind conditions and environment of the proposed development. GWTS investigated the wind environment around the proposed development by considering its form and exposure, the nearby existing developments, the local wind climate, the proposed use of ground level areas, in and adjacent to, the proposed development.

A summary of the study is as follows:

- Minor increases in wind speeds were predicted to occur at pedestrian level as a result of the proposed development.
- Wind speeds are predicted to approach, or marginally exceed, the limit for the recommended criteria in some locations and recommendations have been made where necessary.

The following recommendations were made:

- Minimum balustrade heights on the Level 8 open communal area
- Minimum balustrade heights on the balcony areas from Level 1 to the terraces on the roof.
- Precaution to securely fix or remove lightweight items from balconies during high wind events.

Please note that this is an opinion statement and is not based on wind tunnel testing.

1. INTRODUCTION

1.1 Geometry of Proposed Development

The proposed building is the stage 2 in the south eastern pocket of the site, comprising of 23-storeys including retail, serviced apartments, residential components and the roof. It has a shared basement with existing stage 1. The ground floor building footprint reaches 30m from north to south and 45m from east to west as illustrated in Figure 1 below. The proposed development is 78.28m in height from ground level as illustrated in the building elevations in Figure 2 and Figure 3 below.

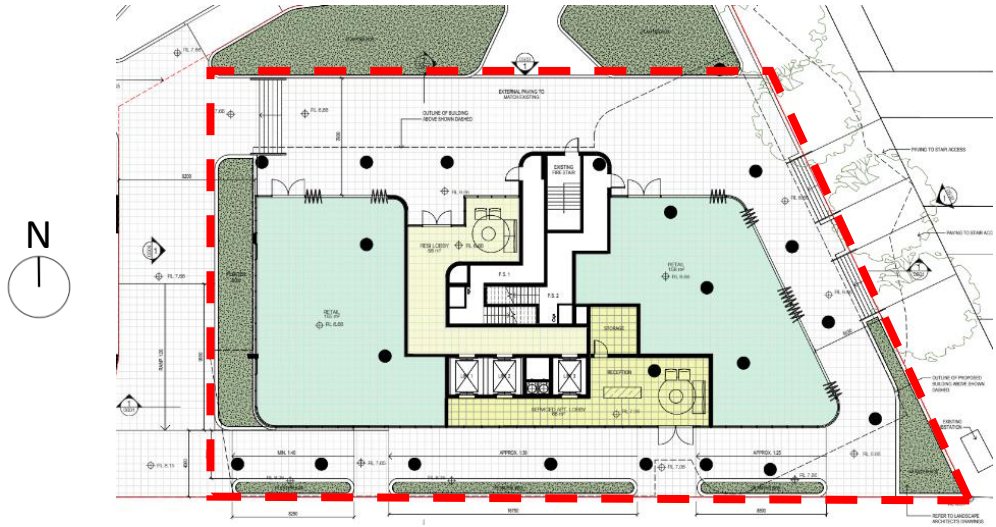


Figure 1: Plan view of the proposed development

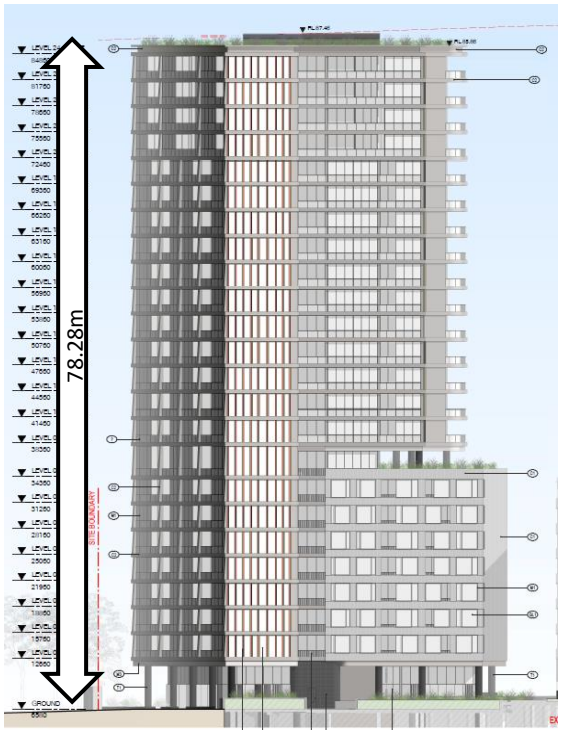


Figure 2: North elevation of the proposed developments

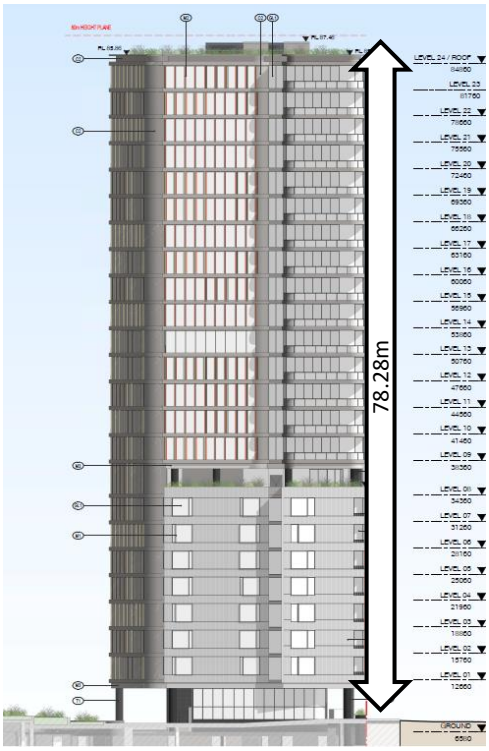


Figure 3: West elevation of the proposed developments

1.2 Building and Site Surroundings

The site is bound by Western Motorway to the north, Parramatta Road to the south, Powell Street to the west and public recreational space to east. A close-up view of the site is shown in Figure 4.

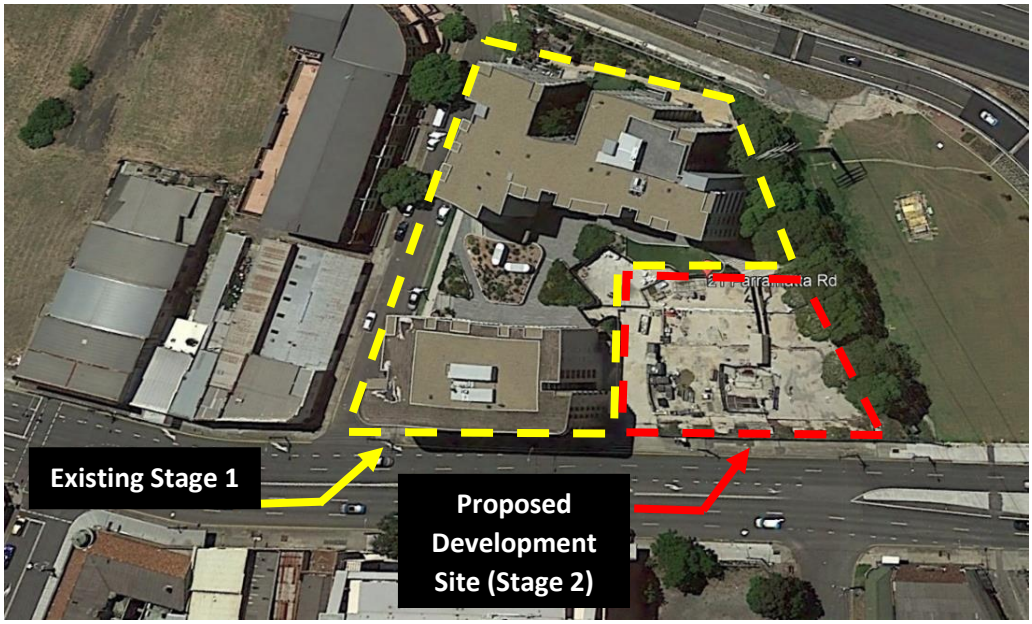


Figure 4: Location of proposed development

A satellite photograph of the project site and surrounding terrain is shown in Figure 5. The surrounding topography within a 4.7km radius, including a 1.57km lag distance from the site, consists mainly of low to mid-rise developments and open water areas. Considering the open water area to the north is narrow, the upstream terrain beyond the terrain immediately upwind of the site is modelled as an approaching wind Terrain Category 3 in accordance with AS/NZS 1170.2: 201.

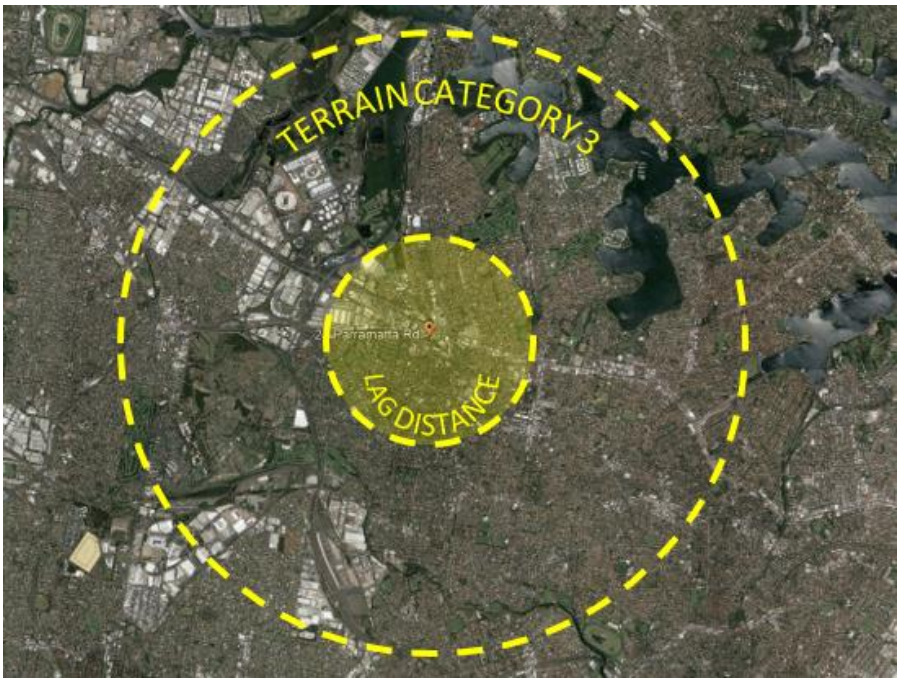


Figure 5: Satellite image of the site and surrounding terrain

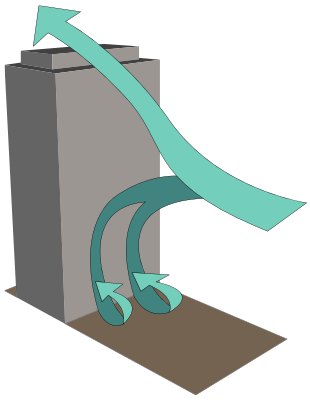
1.3 Environmental Wind Effects

1.3.1 Atmospheric Boundary Layer

As wind flows over the earth, it encounters various roughness elements and terrain such as water, forests, houses and buildings. To varying degrees, these elements reduce the mean wind speed at low elevations and increase air turbulence. The wind above these obstructions travels with un-attenuated velocity, driven by atmospheric pressure gradients. The resultant increase in wind speed with height is known as a wind velocity profile. The terminology used to describe the wind flow patterns around the proposed development is based on the aerodynamic mechanism, direction and nature of the wind flow. Typical flow patterns are defined and illustrated below.

1.3.2 Downwash

The flow of air down the exposed face of a Tower. A tall Tower can deflect a fast-moving wind at higher elevations downwards.



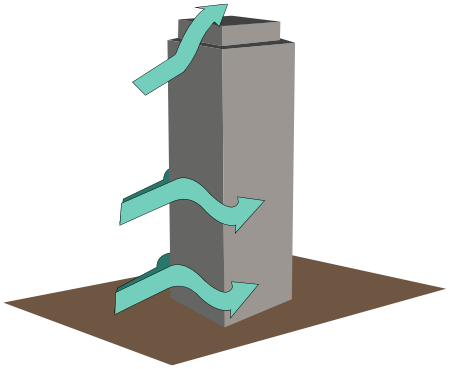
A. Downwash

1.3.3 Corner Accelerations

When wind flows around the corner of a building it tends to accelerate in a similar manner to airflow over the top of an airplane wing.

1.3.4 Flow separation

When wind flowing along a surface suddenly detaches from that surface and the resultant energy dissipation produces increased turbulence in the flow.



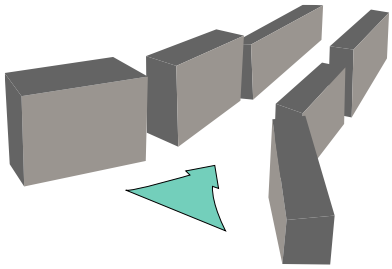
B. Corner Accelerations

1.3.5 Flow Channeling

The well-known “street canyon” effect occurs when a large volume of air is funnelled through a constricted pathway. To maintain flow continuity the wind must speed up as it passes through the constriction.

1.3.6 Direct Exposure

A location with little upstream shielding for a wind direction of interest. The location will be exposed to the unabated mean wind and gust velocity. Piers and open water frontage may have such exposure.



C. Channel Flow

2. WIND CLIMATE

The Sydney region mean and gust wind speeds have been recorded at the Sydney airport for over 66 years. This data has been analysed and the directional probability distribution of wind speeds has been determined. The directional distribution of hourly mean wind speeds at the gradient height, with a probability of occurring approximately once per year (i.e. 1 year return period, probability level 0.001) is shown in Figure 6. The distribution shows the west direction as dominant. However, the importance of the other directions changes according to the season. This difference can be exploited to design a seasonal dependent event.

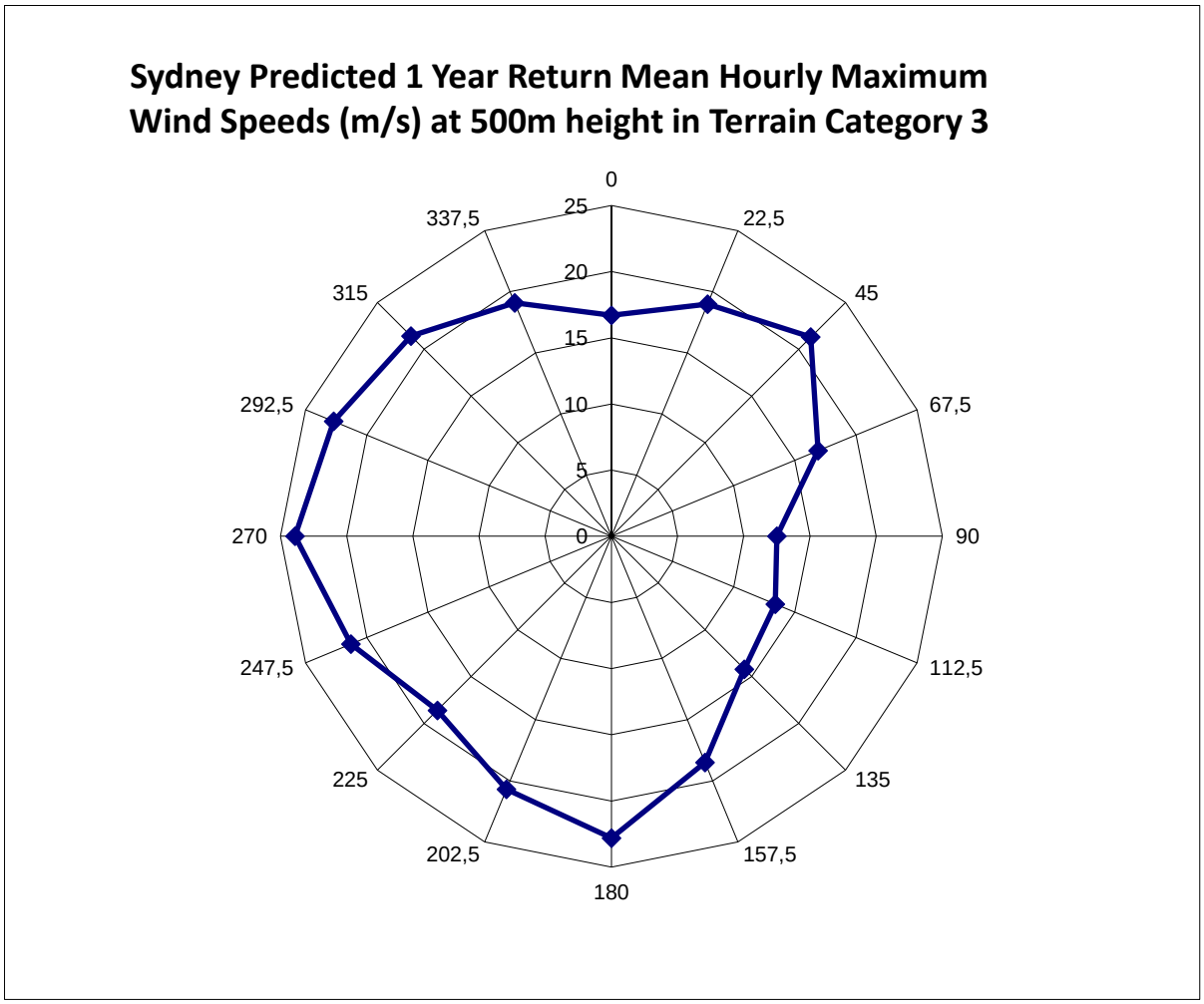


Figure 6: Directional distribution of mean hourly wind velocities for different return periods (m/s) at gradient height for Sydney.

3. ASSESSMENT CRITERIA

To assess pedestrian wind safety and comfort, a 3 second gust criteria is used as detailed in. The Australasian Wind Engineering Society's Guidelines for Pedestrian Wind Effects Criteria for safety [5]. A set of annual maximum peak 3-second gust velocities is derived from meteorological data for the geographical location under consideration, for all wind directions to be assessed. For all of these possible wind directions and speeds, the regions where each of the wind speed criteria may be exceeded are then considered.

From a wind perspective most people will consider a site unacceptable for a given activity if the gust velocities in that area during the average annual maximum synoptic wind event exceed the annual maximum wind speed criterion for that activity. The site would also be likely to be considered excessively windy for that activity during more moderate winds.

The threshold gust velocity criteria [2] are:

Table 1: Wind Comfort and Safety Gust Criteria for Homebush Area	
Annual Maximum 3 second Gust Speed	**Result on Perceived Pedestrian Comfort**
>23m/s	Unsafe (frail pedestrians knocked over)
<16 m/s	Acceptable for Walking (steady steps for most pedestrians)
<13 m/s	Acceptable for Short Standing (window shopping, vehicle drop off, queuing)
<10 m/s	Acceptable for Long Standing, Sitting (outdoor cafés, pool area, gardens)

3.1 Recommended Comfort Criteria

Table 2 lists the specific areas adjacent to the development and the corresponding recommended criteria. The assessment areas are also shown from **Error! Reference source not found.** Figure 7 to Figure 12 with the recommended criteria overlaid.

Table 2: Recommended application of criteria	
Area	**Recommended Criteria**
Public Footpaths	Recommended to fulfil criterion for walking
Building Entrances	Recommended to fulfil criterion for standing
Balconies, Podium roof, Roof Terraces	Recommended to fulfil criterion for walking (*refer to the discussion below*)

3.2 Discussion on Recommended Balconies and Terrace Areas

Balconies and terrace areas are not be intended for use all the time. People should be safe and comfortable to walk around these areas or decide whether to use the area for other recreation activities. Therefore, the walking criterion can be applied to the area since;

- The use of these areas is optional.
- The use of these areas can be avoided during a high wind events and
- These areas are not public spaces and their use is not required all the time.

It is likely to be difficult to achieve wind conditions meeting a more stringent criterion than the walking criterion on the balcony areas of the proposed development due to their exposure, the form and proximity of adjacent developments.

The walking criterion is recommended as the minimum requirement for these areas. However, it should be noted that meeting the walking criterion on elevated recreation areas may not guarantee that occupants will find wind conditions in these areas acceptable at all times.

In our experience it is preferable that outdoor recreation areas should meet the criterion for sitting comfort in order that the majority of reasonable people consider such areas acceptable for their intended use from a wind point-of-view. Wind conditions that exceed the sitting criterion will tend to result in a perceived reduction in amenity of the area. This perception may be due to:

- the cooling effect of the wind on the human body (particularly for pool deck areas),
- it being impractical to have lightweight items such as towels, serviettes, newspapers, lightweight furniture (eg. plastic banana lounges) in these areas and
- difficulty hearing others speak.

- Wind conditions meeting the criterion for walking may still result in the removal of lightweight furniture during storms whilst the balconies/terraces are unoccupied.

3.3 Intended Use of Ground Level Areas

The main building entrances of the proposed developments are highlighted in orange in Figure 7. It is recommended that the criterion for standing be satisfied for this area.

Public footpaths adjacent to or in close proximity to the proposed development are highlighted in red in Figure 7. It is recommended that the walking criterion be satisfied for these areas.

Balconies and open communal areas of the proposed development are highlighted in red from Figure 8 to Figure 14. It is recommended that the criterion for walking be satisfied for these areas (Refer to Section 3.2).

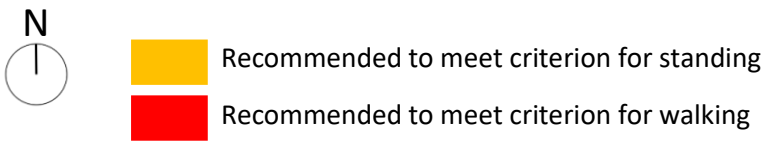


Figure 7: Schematic plan view of proposed development with recommended wind criteria overlaid on the ground floor of the proposed development

Figure 8: Schematic plan view of proposed development with recommended wind criteria overlaid on Levels 1-4 of the proposed development

Figure 9: Schematic plan view of proposed development with recommended wind criteria overlaid on Level 5 of the proposed development

Figure 10: Schematic plan view of proposed development with recommended wind criteria overlaid on Level 8 of the proposed development

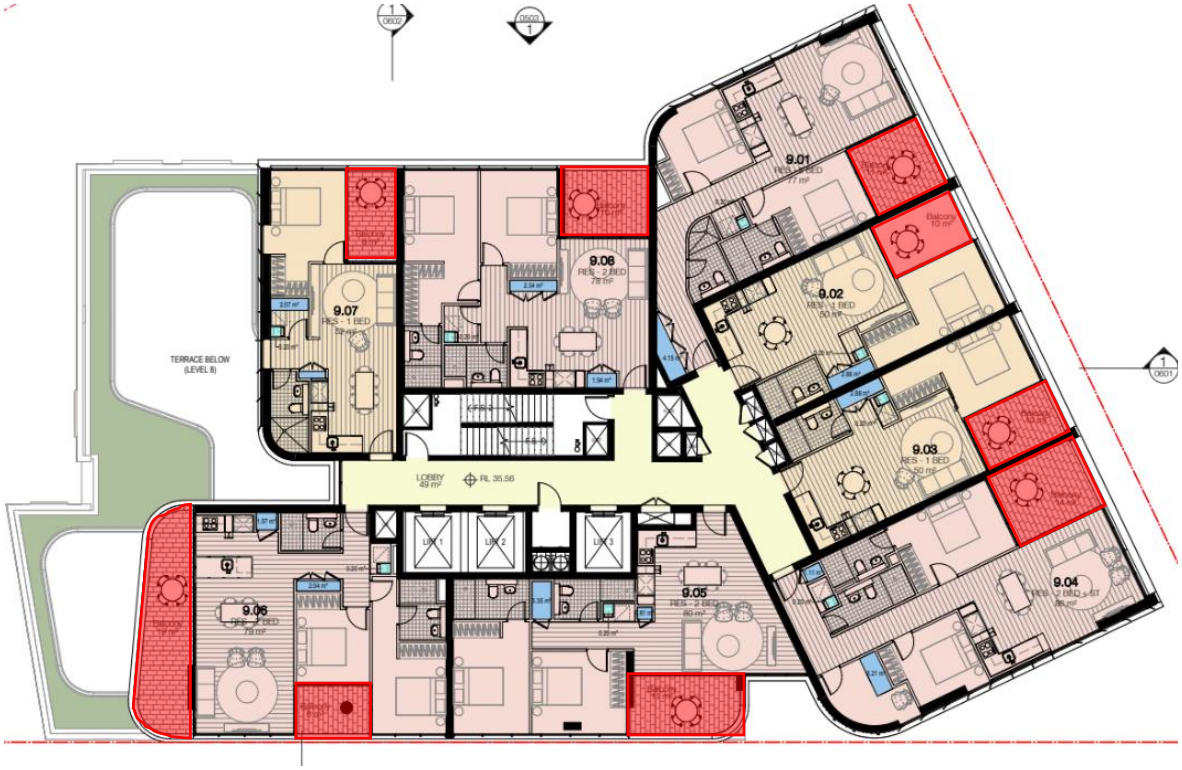


Figure 11: Schematic plan view of proposed development with recommended wind criteria overlaid on Levels 9-20 of the proposed development

Figure 12: Schematic plan view of proposed development with recommended wind criteria overlaid on Levels 21-23 of the proposed development

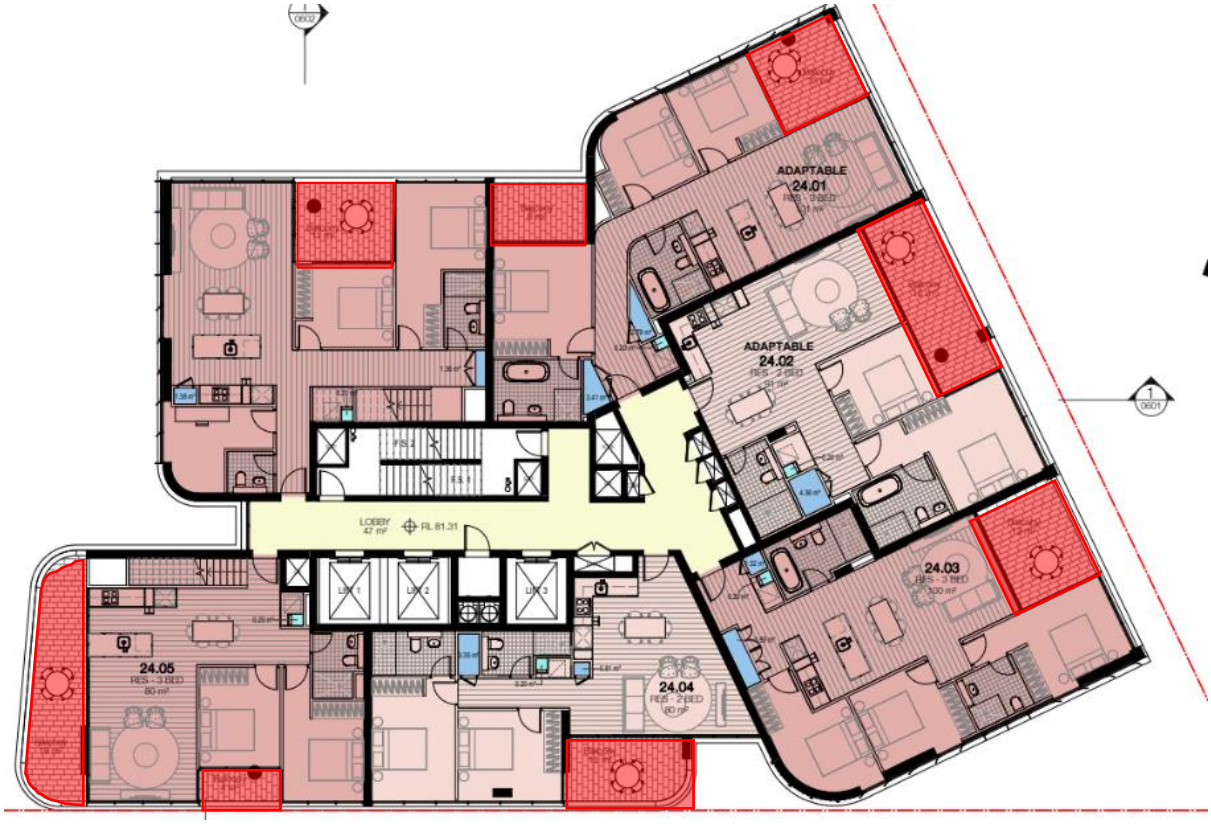


Figure 13: Schematic plan view of proposed development with recommended wind criteria overlaid on Levels 24-25 of the proposed development

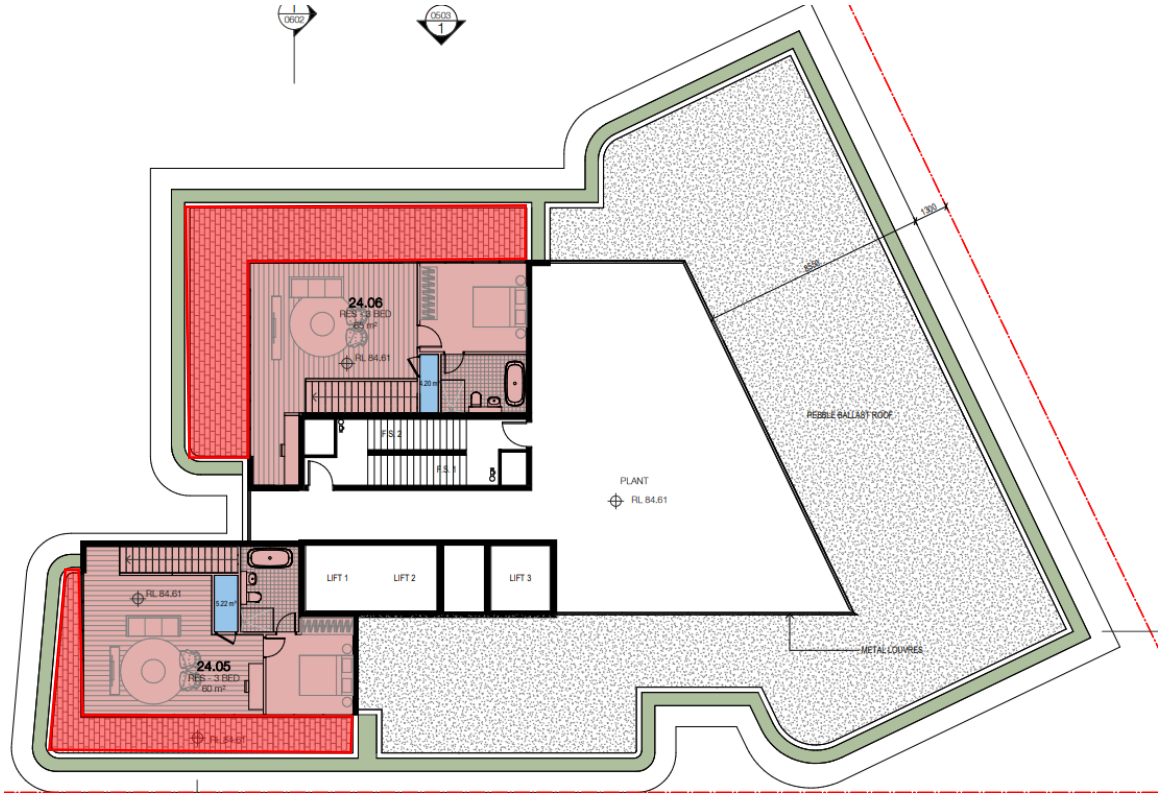


Figure 14: Schematic plan view of proposed development with recommended wind criteria overlaid on Roof of the proposed development

4. WIND ENVIRONMENT ANALYSIS

The wind profile of the site can be factored for height above ground, estimated local terrain roughness, local turbulence and the influence of buildings to produce estimated annual average maximum 3-second gust wind speeds adjacent to the proposed development. These estimates can then be compared with the selected criteria to determine whether they would be acceptable or not. Estimates of wind speeds have been made based on the Homebush region wind climate data, computational analysis, empirical aerodynamics data and upstream exposure.

Impacts on Adjoining Properties & Footpaths (no impacts)

Considering the orientation, building setbacks from the property boundary and the locations of buildings to adjoining properties and footpaths, it is predicted that the surrounding areas will not be adversely impacted by the proposed development.

Main Building Entrances

The main entrances to the proposed building are located on the southern and northern faces. The northern entrances are only exposed to the weaker northerly winds and the southern entrance are exposed to stronger southerly winds in the Homebush region. As the entrances are set back beneath the Level 1 building line above; and will therefore not be affected by downwash, it is predicted that these areas will satisfy the recommended standing criterion and no further recommendations have been made.

Level 8 Open communal area

West facing open communal area is located on Level 8 of the proposed building. Considering the elevated height and larger areas of these spaces in relation to their exposure to the stronger western and southern winds of the Homebush region, it is predicted that higher wind speeds may infrequently approach the walking criterion. Thus, recommendations on minimum balustrade heights have been made accordingly.

Balcony Areas

Due to the height and exposure of the balcony areas, it is predicted that wind speeds may exceed the recommended walking criterion during infrequent wind events, particularly on corner balconies. The phenomenon of elevated wind velocities resulting in discomfort to the users on corner balconies and terrace areas is a common occurrence for similar developments. Accelerated corner flows result in standing vortices and high exposure to corner balconies and often attract a windy environment that may impede the overall use of the recreational area. As a result, owners of corner apartments may resort to using their balcony less frequently. Thus, it is predicted that owners of corner apartments will consider the balcony areas as acceptable for their intended use the majority of the time, however, the overall use of these areas may be impeded during strong wind events. (Refer to Section 3.2). Thus, recommendations on minimum balustrade heights have been made accordingly.

5. RECOMMENDATIONS

Level 8 Open communal area

It is recommended that balustrades of minimum 1.5m height be implemented in the location highlighted in blue in Figure 15.

Figure 15: Recommended location of increased balustrade heights on the Level 8 open communal area

Balconies

It is recommended that balustrades of minimum 1.2m height be implemented on the balcony areas from Level 1 to Roof. The terraces on the roof will too be subjected to these recommendations.

It is also recommended that safety and precaution is taken by the building occupants to securely fix lightweight items in the balcony areas. During high wind events, the winter gardens are at potential risk of the removal of lightweight items from these areas of the proposed development.

6. CONCLUSION

GWTS has carefully evaluated the wind environment around the proposed building by considering the form and exposure of the proposed development, the nearby existing developments, the local wind climate and the proposed use of ground level areas and elevated recreational areas, in and adjacent to, the proposed development. Based on our experience and empirical relations for wind speeds at pedestrian/recreational areas, and the above consideration, the expected wind speeds around the proposed building have been predicted and assessed against the widely accepted and used criteria for comfort and safety.

A summary of the study is as follows:

- Minor increases in wind speeds were predicted to occur at pedestrian level as a result of the proposed development.
- Wind speeds are predicted to approach or marginally exceed the limit for the recommended criteria in some locations and recommendations have been made where necessary.

The following recommendations were made:

- Minimum balustrade heights on the Level 8 open communal area
- Minimum balustrade heights on the balcony areas from Level 1 to the terraces on the roof.
- Precaution to securely fix or remove lightweight items from balconies during high wind events.

Please note that this is an opinion statement and is not based on wind tunnel testing.

7. References

[1] “Australian Standard 1170.2:1989, Wind actions”.

[2] W.H., “Criteria for Environmental Wind Conditions,” *Jour. Industrial Aerodynamics,* vol. 3, pp. 241-249, 1978.

[3] Australian Wind Engineering Society, “Cladding Pressure and Environmental Wind Studies,” Quality Assurance Manual, 2001.

[4] “AS/NZS 1170.2 Supplement 1:2011”.

[5] Australasian Wind Engineering Society, “Guidelines for Pedestrian Wind Effects Criteria,” September 2014.

[6] Developmentactivity.melbourne.vic.gov.au. (2018), “Development Activity Model,” [Online]. Available: https://developmentactivity.melbourne.vic.gov.au/ . [Accessed 16 Oct 2018].

APPENDIX A – DRAWING FILES

DA-0001 - Cover	PDF File	290 KB	No	290 KB	0%	09/12/2019 21:57
DA-0101-03- Site Location	PDF File	4.271 KB	No	4.271 KB	0%	09/12/2019 21:57
DA-0102-04-Site Plan and Analy...	PDF File	1.598 KB	No	1.598 KB	0%	09/12/2019 21:57
DA-0103-02-Survey Plan	PDF File	270 KB	No	270 KB	0%	09/12/2019 21:57
DA-0201-05.-Basement 4	PDF File	804 KB	No	804 KB	0%	16/12/2019 23:39
DA-0202.-05-Basement 3	PDF File	898 KB	No	898 KB	0%	16/12/2019 23:39
DA-0203.-05-Basement 2	PDF File	1.178 KB	No	1.178 KB	0%	16/12/2019 23:39
DA-0204.-05-Basement 1	PDF File	771 KB	No	771 KB	0%	16/12/2019 23:39
DA-0205.-07-Ground	PDF File	1.259 KB	No	1.259 KB	0%	16/12/2019 23:39
DA-0206.-07-Level 1 - Level 4	PDF File	1.585 KB	No	1.585 KB	0%	16/12/2019 23:39
DA-0207-03.-Level 5 - Level 7	PDF File	790 KB	No	790 KB	0%	16/12/2019 23:39
DA-0208-08-Level 8	PDF File	950 KB	No	950 KB	0%	16/12/2019 23:39
DA-0209-07-Level 9 - Level 20	PDF File	852 KB	No	852 KB	0%	16/12/2019 23:39
DA-0210-07-Level 21 - Level 23	PDF File	701 KB	No	701 KB	0%	16/12/2019 23:39
DA-0211-01.-Level 24	PDF File	703 KB	No	703 KB	0%	16/12/2019 23:39
DA-0212-05-Roof	PDF File	575 KB	No	575 KB	0%	16/12/2019 23:39
DA-0501-05-Elevation - South (...	PDF File	2.658 KB	No	2.658 KB	0%	09/12/2019 21:57
DA-0502-05-Elevation - East (Ar...	PDF File	2.520 KB	No	2.520 KB	0%	09/12/2019 21:57
DA-0503-05-Elevation - North	PDF File	2.794 KB	No	2.794 KB	0%	09/12/2019 21:57
DA-0504-05-Elevation - West	PDF File	2.196 KB	No	2.196 KB	0%	09/12/2019 21:57
DA-0601-06-Section A	PDF File	801 KB	No	801 KB	0%	16/12/2019 23:39
DA-0602-05-Section B	PDF File	408 KB	No	408 KB	0%	09/12/2019 21:57
DA-1401-03-Apartment Types - ...	PDF File	703 KB	No	703 KB	0%	09/12/2019 21:57
DA-2901-03-Area Calculations -...	PDF File	2.469 KB	No	2.469 KB	0%	16/12/2019 23:39
DA-3101-03-Shadow Diagrams	PDF File	951 KB	No	951 KB	0%	09/12/2019 21:57
DA-3201-04-Solar and Cross Ve...	PDF File	1.001 KB	No	1.001 KB	0%	16/12/2019 23:39
DA-3301-02-3D Views	PDF File	2.905 KB	No	2.905 KB	0%	09/12/2019 21:57
DA-3401-01-External Material a...	PDF File	2.701 KB	No	2.701 KB	0%	09/12/2019 21:57
DA-4001-02-Visualisation - Vie...	PDF File	252 KB	No	252 KB	0%	09/12/2019 21:57
DA-4002-02-Visualisation - Vie...	PDF File	289 KB	No	289 KB	0%	09/12/2019 21:57