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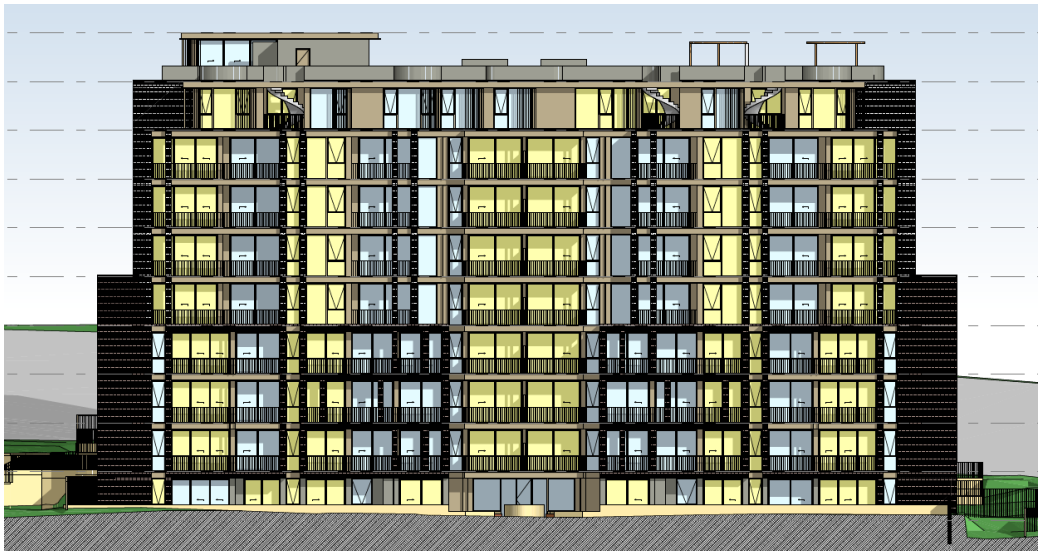

PEDESTRIAN WIND ENVIRONMENT STATEMENT

16-20 MIDDLE HARBOUR ROAD, LINDFIELD

WJ864-01F02(REV1)- WS REPORT

JUNE 13, 2025

Prepared for:

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DOCUMENT CONTROL

Date	Revision History	Issued Revision	Prepared By (initials)	Instructed By (initials)	Reviewed & Authorised by (initials)
May 27, 2025	Initial.	0	CT/AFM	MM	AFM
June13, 2025	Updated Drawings.	1	AFM	TR	AFM

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EXECUTIVE SUMMARY

This desktop pedestrian wind environment assessment report has been prepared by Windtech Consultants for Ming Yang and John Wu (the applicant) to accompany an Environmental Impact Statement (EIS)for a proposed residential flat building (RFB), including in-fill affordable housing, at 16-20 Middle Harbour Road, Lindfield, within the Ku-ring-gai Local Government Area (LGA). This report has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) issued for the project (SSD-83431958) on 5 May 2025.

This report presents an opinion on the likely impact of the 16-20 Middle Harbour Road development, located in Lindfield, on the local wind environment at the critical outdoor areas within and around the subject site. The effect of wind activity has been examined for the three predominant wind directions for the region, namely the north-easterly, southerly, and westerly winds. The analysis of the wind effects relating to the proposed development have been carried out in the context of the local wind climate, building morphology and land topography.

The conclusions of this report are drawn from our extensive experience in this field and are based on an examination of the latest architectural drawings. No wind tunnel testing has been undertaken for the subject development, and hence this report addresses only the general wind effects and any localised effects that are identifiable by visual inspection of the architectural drawings provided (received June 12, 2025). Any recommendations in this report are made only in-principle and are based on our extensive experience in the study of wind environment effects.

The results of this assessment indicate that the development has incorporated several design features and wind mitigating strategies and is expected to be suitable for the intended use for the majority of the outdoor trafficable areas. However, there are some areas that are likely to be exposed to stronger winds. It is expected that the wind effects identified in the report can be ameliorated with the consideration of the following treatment strategies into the design of the development, i.e. the proposed RFB is suitable and warrants approval subject to the implementation of the following mitigation measures:

<u>Lower Ground Level (Level 1):</u>

- Inclusion of impermeable awnings to the south and north, abutting the eastern aspect of the building envelope.
- Increasing the height of the proposed impermeable intertenancy screen along the northern perimeter of the south-eastern corner private balcony to 2m above the FFL.
- Retention of the proposed full-height porous screening along the southern aspect, adjacent to the car park entrance.
- Converting the proposed inter-tenancy screen to the north (between the two east most apartments on the northern aspect) to a full-height impermeable screen.
- Inclusion of 2m high evergreen and densely foliating hedges/shrubs within the proposed planter boxes along the eastern perimeter of the site.

<u>Upper Ground Level:</u>

- Inclusion of 2m high evergreen and densely foliating hedges/shrubs within the proposed planter boxes through the building separation zone.

- Inclusion 3-5m high and 3-5m wide (i.e. 3-5m wide canopies) evergreen and densely foliating trees along the central strip within the building separation zone as well as to the west of the site (communal open spaces).
- Inclusion of full-height impermeable screens along the shorter aspects of the northern and eastern corner balconies.

Private Balconies and Vented Corridor Areas (Levels 2 to 8):

- Levels 2 to 7: Inclusion of full-height impermeable screens along the shorter aspects of the northern and eastern corner balconies.
- Levels 2 to 8: Increasing the height of the proposed balustrades around the southern and western corner balconies to 1.2m.
- Levels 2 to 8: Retention of the proposed full-height vertical blades along the western aspect of the vented corridors.
- Level 8: Retention of the proposed slat screening around the southern and western corner spiral staircases.

Roof-top Terraces (Level 9) (Figure 7):

- Increasing the height of the proposed balustrades around the edges of the all the individual terraces to 1.5m.

Following the implementation of the above measures in the final design, it is expected that the wind conditions for the various trafficable outdoor areas within and around the development will be suitable for their intended uses, and that the wind speeds will satisfy the applicable criteria for pedestrian comfort and safety.

In particular, with the inclusion of the recommended treatment measures, the wind conditions within the public footpaths surrounding the subject development are expected to be suitable for walking activities. With these measures in place, the wind conditions within the building entrance zones as well as the communal open spaces (including the roof-top terraces) are expected to satisfy the standing criterion. With the recommended treatments, the wind conditions within the various private balconies are expected to be suitable for standing activities.

Wind tunnel testing can be undertaken at a more detailed design stage to quantitatively assess the wind conditions and to optimise the size and extent of the treatments.

CONTENTS

1 INTRODUCTION

The State Significant Development (SSD) application seeks consent for the demolition of existing dwellings at 16-20 Middle Harbour Road, Lindfield, to facilitate a residential flat building (RFB).

Specifically, the SSD seeks consent for:

- demolition of existing structures at the site;
- construction of a 9-storey residential flat building including:
    - 98 residential units;
    - ground floor common facilities/communal open space;
- levels of basement car parking;
- associated infrastructure and services; and
- landscaping.

The proposal incorporates over 17% affordable housing and seeks to utilise the incentive controls under Chapter 2, Part 2, Division 1, Section 16 of State Environmental Planning Policy (Housing) 2021 (Housing SEPP) to achieve 30% uplift in height and floor space ratio (FSR).

This report has been prepared to address the requirements of the Secretary's Environmental Assessment Requirements (SEARs) dated 5 May 2025 (SSD-83431958).

An opinion on the likely impact of the proposed design on the local wind environment affecting pedestrians within the critical outdoor areas within and around the subject development is presented in this report. The analysis of wind effects relating to the proposed development has been carried out in the context of the predominant wind directions for the region, building morphology of the development and nearby buildings, and local land topography. The conclusions of this report are drawn from our extensive experience in the field of wind engineering and studies of wind environment effects.

No wind tunnel testing has been undertaken for this assessment. Hence this report addresses only the general wind effects and any localised effects that are identifiable by visual inspection, and any recommendations in this report are made only in-principle.

2 DESCRIPTION OF DEVELOPMENT AND SURROUNDINGS

The site is located at 16-20 Middle Harbour Road, Lindfield, within the Ku-ring-gai Local Government Area (LGA). It is legally described as 16 Middle Harbour Road (Lot 1 DO 569232) and 18 – 20 Middle Harbour Road (Lots 10 and 11 DP5374 and Lot 1 DP 983946).

The site is currently occupied by two detached dwellings, with vehicle access provided via Middle Harbour Road. An access handle forms part of 18-20 Middle Harbour Road which connects the site to Russell Avenue, however, this currently provides no vehicle access.

The site is generally rectangular in shape, with the exception of the access handle at 18-20 Middle Harbour Road.

The site is zoned R2 Low Density Residential under the Ku-ring-gai Local Environmental Plan 2015 (KLEP 2015).

The site is located within the Lindfield Transport Oriented Development (TOD) precinct and therefore permissibility and applicable development standards are provided under Chapter 5 of the Housing SEPP.

The site does not contain any local heritage items nor is it located within a Heritage Conservation Area (HCA) under the KLEP 2015. The access handle of 18-20 Middle Harbour Road does adjoin an HCA.

Biodiversity value land is present at the site, with a small portion in the centre of the site identified on the 'Biodiversity Values land' mapping, pursuant to the Biodiversity Conservation Act 2016.

The location of the site is provided at Figure 1a with TOD mapping provided at Figure 1b.

An aerial image of the subject site and the local surroundings is shown in Figure 3c, with the frequency and magnitude of the prevailing winds is superimposed for each wind direction.

The critical outdoor trafficable areas associated with the proposed development, which are the focus of this assessment with regards to wind effects, are listed as follows:

- Lower Ground Level Trafficable Areas and Pedestrians Throughfares.
- Upper Ground Level Communal Open Spaces.
- Elevated Private Balconies and Roof Terraces.

The site is surrounded by built and natural environment as follows:

- North: The site is immediately bounded by low density residential development and Lindfield Tennis Club, along with higher density development further north and Cromehurst School being located to the north-east.
- East: Lower density residential uses directly adjoin the eastern boundary of the site with Roseville Park located further east on Chelmsford Avenue.
- South: Middle Harbour Road forms the site's southern boundary with low density residential dwellings along the southern side of the road.
- West: The site is bounded by low-medium residential uses, with the railway line and Pacific Highway located further to the west.

The surrounding locality is included below in Figure 1d.

Figure 1a: Site location (Source: Nearmap)

Figure 2b: TOD Map (Source: ESpatial Viewer)

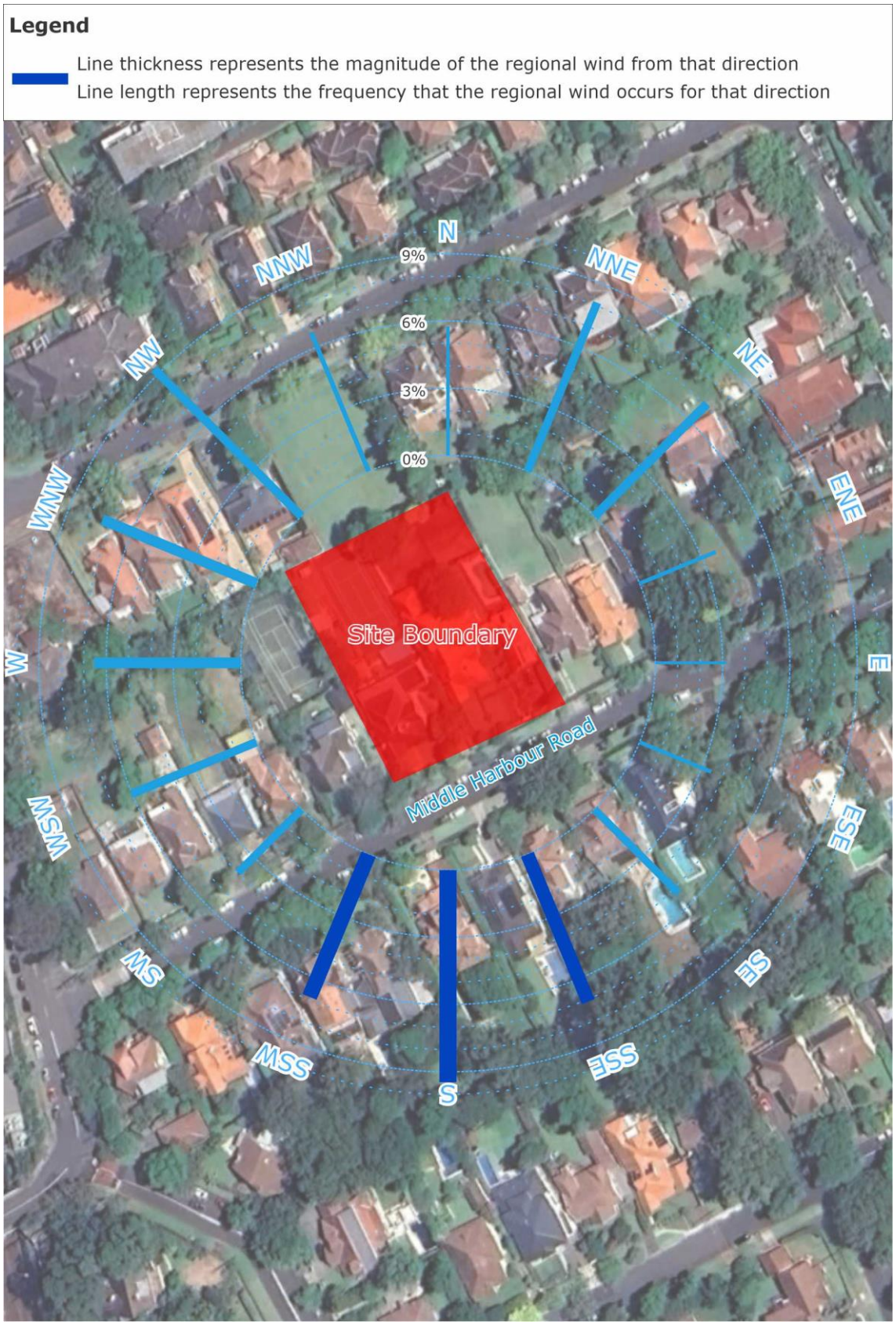

Figure 3c: Aerial Image of the Site Location and Prevailing Wind Directions

Figure 4d: Site Context (Source: Nearmap)

3 REGIONAL WIND

The subject region is governed by three principal wind directions that can potentially affect the subject development. These winds prevail from the north-east, south, and west. These wind directions were determined from an analysis undertaken by Windtech Consultants of recorded directional wind speeds obtained from the meteorological station located at Kingsford Smith Airport by the Bureau of Meteorology (recorded from 1995 to 2024). The data has been corrected to represent winds over standard open terrain at a height of 10m above ground level. The results of this analysis are presented in Figure 5 in the form of a directional plot of the annual and 5% exceedance mean winds for the region. The frequency of occurrence of these winds is also shown in Figure 5.

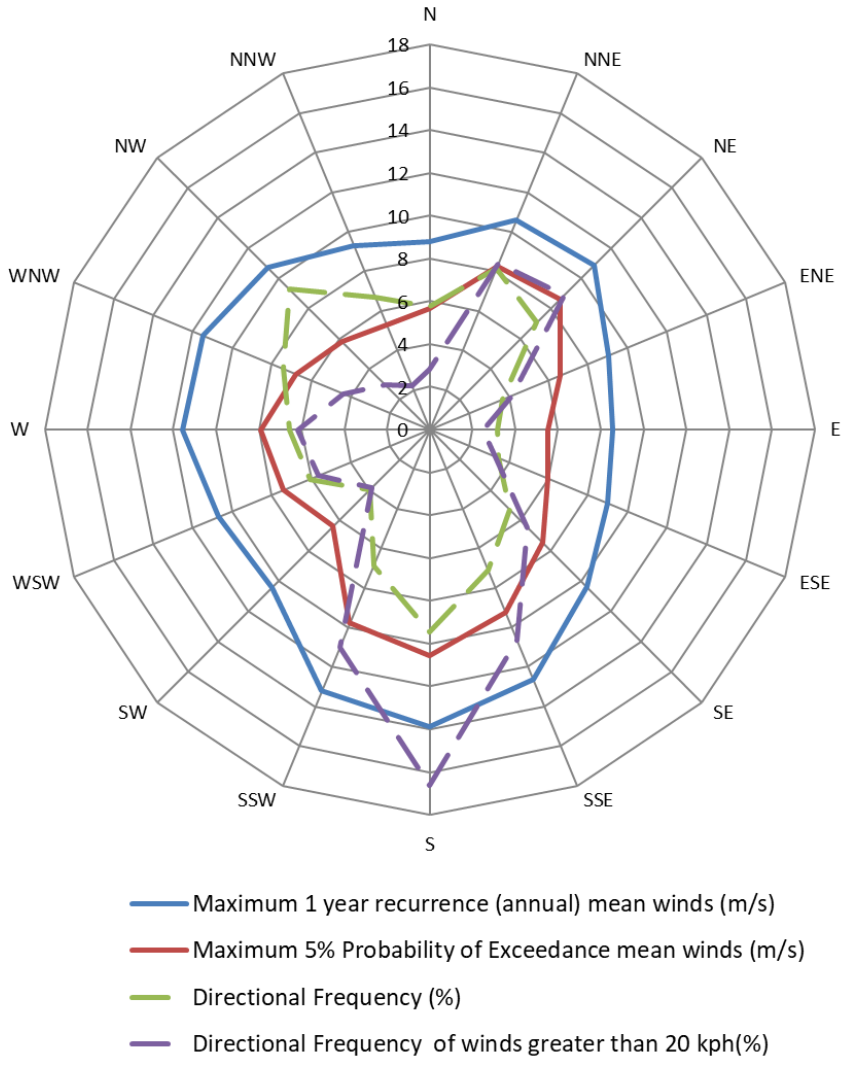

Figure 5: Directional Annual and 5% Exceedance Hourly Mean Wind Speeds (referenced to 10m height in standard open terrain), and Frequencies of Occurrence, for the Lindfield Region

4 WIND EFFECTS ON PEOPLE

The acceptability of wind in any area is dependent upon its use. For example, people walking, or window-shopping will tolerate higher wind speeds than those seated at an outdoor restaurant. Various other researchers, such as A.G. Davenport, T.V. Lawson, W.H. Melbourne, and A.D. Penwarden, have published criteria for pedestrian comfort for pedestrians in outdoor spaces for various types of activities. Some Councils and Local Government Authorities have adopted elements of some of these into their planning control requirements.

For example, A.D. Penwarden (1973) developed a modified version of the Beaufort scale which describes the effects of various wind intensities on people. Table 1 presents the modified Beaufort scale. Note that the effects listed in this table refers to wind conditions occurring frequently over the averaging time (a probability of occurrence exceeding 5%). Higher ranges of wind speeds can be tolerated for rarer events.

Table 1: Summary of Wind Effects on People (A.D. Penwarden, 1973)

Type of Winds	Beaufort Number	Mean Wind Speed (m/s)	Effects
Calm	0	Less than 0.3	Negligible.
Calm, light air	1	0.3 – 1.6	No noticeable wind.
Light breeze	2	1.6 – 3.4	Wind felt on face.
Gentle breeze	3	3.4 – 5.5	Hair is disturbed, clothing flaps, newspapers difficult to read.
Moderate breeze	4	5.5 – 8.0	Raises dust, dry soil and loose paper, hair disarranged.
Fresh breeze	5	8.0 – 10.8	Force of wind felt on body, danger of stumbling
Strong breeze	6	10.8 – 13.9	Umbrellas used with difficulty, hair blown straight, difficult to walk steadily, wind noise on ears unpleasant.
Near gale	7	13.9 – 17.2	Inconvenience felt when walking.
Gale	8	17.2 – 20.8	Generally impedes progress, difficulty balancing in gusts.
Strong gale	9	Greater than 20.8	People blown over.

It should be noted that wind speeds affecting this particular development can only be accurately quantified with a wind tunnel study. This assessment addresses only the general wind effects and any localised effects that are identifiable by visual inspection and the acceptability of the conditions for outdoor areas are determined based on their intended use. Any recommendations in this report are made only in-principle and are based on our extensive experience in the study of wind environment effects.

5 RESULTS AND DISCUSSION

The expected wind conditions affecting the development are discussed in the following sub-sections of this report for the various outdoor areas within and around the subject development. The interaction between the wind and the building morphology in the area is considered and important features taken into account including the distances between the surrounding buildings and the proposed building form, as well as the surrounding landform. Note that only the potentially critical wind effects are discussed in this report. A glossary of the different wind effects described in this report included in Appendix A.

For this assessment, the wind speed criteria for pedestrian comfort that are considered are listed as follows:

- Walking Criterion (8m/s with a 5% probability of exceedance)
  for general circulation and pedestrian thoroughfares, e.g. footpaths, private balconies/terraces, through-site links etc.

- Standing (Short Exposure) Criterion (6m/s with a 5% probability of exceedance)
  for stationary activities generally less than an hour, e.g. waiting areas, communal terraces, main entries, café seating etc.

- Sitting (Long Exposure) (4m/s with a 5% probability of exceedance)
  for stationary activities longer than an hour, e.g. outdoor cinemas, outdoor fine dining etc.

Note that the above wind comfort levels are derived from the Lawson (1975) criteria. Although this assessment is qualitative in nature, the abovementioned criteria for pedestrian comfort are considered when assessing the wind environment impacts. However, all areas are also assessed with consideration to a pedestrian safety criterion of 23m/s for the annual maximum gust.

5.1 Ground Level

5.1.1 Public Footpath Areas

The proposed building envelope is set-back significantly (10m) from the Middle Harbour Road (and the site boundary), and hence the inclusion of the subject development at the proposed location within the site is not expected to alter the existing wind flow patterns within and around the footpath areas along the Middle Harbour Road.

5.1.2 Lower Ground Level Trafficable Areas and Pedestrians Throughfares

The existing buildings and densely foliating evergreen trees located to the east and north of the site are expected to partially shield the proposed Ground Level areas from the prevailing north-easterly and westerly direct winds. Direct winds are however expected to impact the northern, eastern and southern Ground Level areas. These prevailing winds, as well as the southerly winds can impact the corresponding facades and downwash onto the ground plane, which can deteriorate the wind conditions within the areas immediately adjacent to the façade. These wind effects can be ameliorated via awnings, impermeable screens and vegetation.

5.1.3 Upper Ground Level (Level 1)

The Upper Ground Level areas are exposed to the prevailing southerly, westerly and north-easterly winds. Amongst these, the westerly and the southerly winds will travel through the west facing building separation (i.e. the communal open space), which will likely deteriorate the wind conditions for building patrons. The north-easterly winds will travel along the southern façade, however, given the alignment of these winds with the southern façade, the wind conditions in the vicinity are expected to be comparable to the existing conditions. Furthermore, the northern and western corner balconies are exposed to corner acceleration effects due to the prevailing westerly and southerly winds, respectively. These wind effects can be ameliorated via impermeable screens and strategic inclusion of vegetation.

5.1.4 Treatment Recommendations

The following treatment measures are recommended to be included in the design to ensure safe and comfortable wind conditions within and around the ground plane of the proposed development:

<u>Lower Ground Level (Level 1) (Figure 3):</u>

- Inclusion of impermeable awnings to the south and north, abutting the eastern aspect of the building envelope.
- Increasing the height of the proposed impermeable intertenancy screen along the northern perimeter of the south-eastern corner private balcony to 2m above the FFL.
- Retention of the proposed full-height porous screening along the southern aspect, adjacent to the car park entrance.

- Converting the proposed inter-tenancy screen to the north (between the two east most apartments on the northern aspect) to a full-height impermeable screen.

- Inclusion of 2m high evergreen and densely foliating hedges/shrubs within the proposed planter boxes along the eastern perimeter of the site.

Upper Ground Level (Figure 4):

- Inclusion of 2m high evergreen and densely foliating hedges/shrubs within the proposed planter boxes through the building separation zone.

- Inclusion 3-5m high and 3-5m wide (i.e. 3-5m wide canopies) evergreen and densely foliating trees along the central strip within the building separation zone as well as to the west of the site (communal open space).

- Inclusion of full-height impermeable screens along the shorter aspects of the northern and eastern corner balconies.

5.2 Private Balconies and Vented Corridor Areas

The private balconies of the development benefit from the inclusion of various wind mitigation features such as their overall recessed design, balustrades, and end screens. These features should be retained in the final design. However, the prevailing north-easterly, southerly and westerly winds have the potential to travel through the corner balconies without any obstructions, which can cause undesirable wind conditions. Similarly, the vented corridor areas on each typical elevated plan are exposed to the westerly prevailing winds. These wind effects can be ameliorated via strategic placement of impermeable balustrades, full height screens and louvred screens/blades.

The following treatment measures are recommended to be included in the design to ensure safe and comfortable wind conditions within the various private balconies and the vented corridors of the proposed development.

Private Balconies and Vented Corridor Areas (Levels 2 to 8):

- Levels 2 to 7: Inclusion of full-height impermeable screens along the shorter aspects of the northern and eastern corner balconies.
- Levels 2 to 8: Increasing the height of the proposed balustrades around the southern and western corner balconies to 1.2m.
- Levels 2 to 8: Retention of the proposed full-height vertical blades along the western aspect of the vented corridors.
- Level 8: Retention of the proposed slat screening around the southern and western corner spiral staircases.

5.3 Roof-top Terraces (Level 9)

The development features roof-top terrace spaces at Level 9. Given the height of the subject development in relation to the surrounding building morphology, the roof-top areas are generally exposed to the prevailing winds from all the directions. This can generate direct, side-streaming and/or corner acceleration effects (latter off the split-level penthouse enclosure) that can affect the patrons.

The following treatment is recommended to be included in the design to ameliorate these wind effects, and to ensure safe and comfortable wind conditions within the roof-top terraces:

Roof-top Terraces (Level 9):

- Increasing the height of the proposed balustrades around the edges of the all the individual terraces to 1.5m.

5.4 Concluding Remarks

Following the implementation of the above measures in the final design, it is expected that the wind conditions for the various trafficable outdoor areas within and around the development will be suitable for their intended uses, and that the wind speeds will satisfy the applicable criteria for pedestrian comfort and safety.

In particular, with the inclusion of the recommended treatment measures, the wind conditions within the public footpaths surrounding the subject development are expected to be suitable for walking activities. With these measures in place, the wind conditions within the building entrance zones as well as the communal open spaces (including the roof-top terraces) are expected to satisfy the standing criterion. With the recommended treatments, the wind conditions within the various private balconies are expected to be suitable for standing activities.

Wind tunnel testing can be undertaken at a more detailed design stage to quantitatively assess the wind conditions and to optimise the size and extent of the treatments.

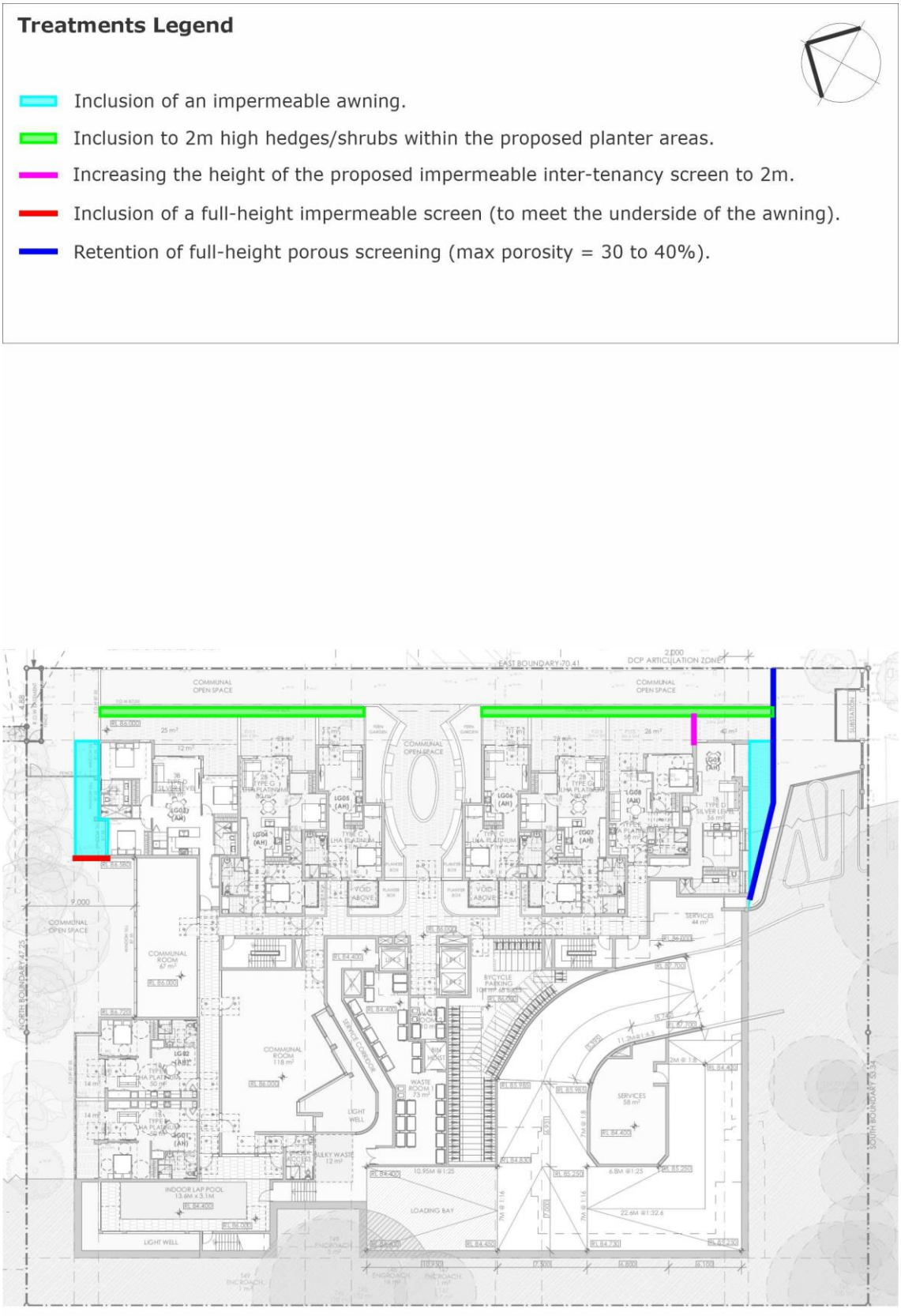

Figure 3: Recommended Treatments (Lower Ground Level)

Figure 4: Recommended Treatments (Upper Ground Level / level 01)

6 REFERENCES

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APPENDIX A WIND EFFECTS GLOSSARY

A.1 Downwash and Upwash Effects

The downwash wind effect occurs when wind is deflected down the windward face of a building, causing accelerated winds at pedestrian level. This can lead to other adverse effects as corner acceleration as the wind attempts to flow around the building, as seen in Figure A.1.

This can also lead to recirculating flow in the presence of a shorter upstream building, causing local ground level winds to move back into the prevailing wind.

The upwash effect occurs near upper level edge of a building form as the wind flows over the top of the building. This has the potential to cause acceleration of winds near the leading edge, as well as potentially reattaching onto the roof area. This effect causes wind issues particularly near the leading edges of tall building and on the rooftop areas if there is sufficient depth along the wind direction. Upwash is more apparent in taller towers and podia.

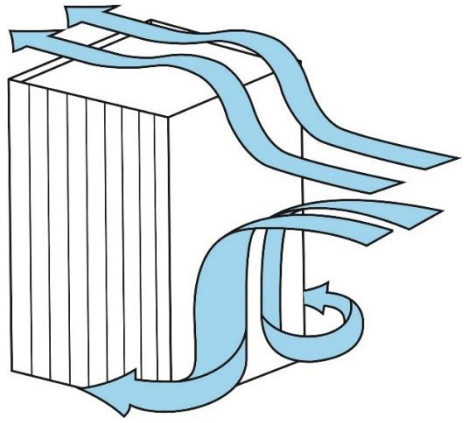

Figure A.1: Downwash Leading to Corner Wind Effect, and Upwash Effects

A.2 Funnelling/Venturi Effect

Funnelling occurs when the wind interacts with two or more buildings which are located adjacent to each other, which results in a bottleneck, as shown in Figure A.2. This causes the wind to be accelerated through the gap between the buildings, resulting in adverse wind conditions and pedestrian discomfort within the constricted space. Funnelling effects are common along pedestrian links and thoroughfares generally located between neighbouring buildings that have moderate gaps between them.

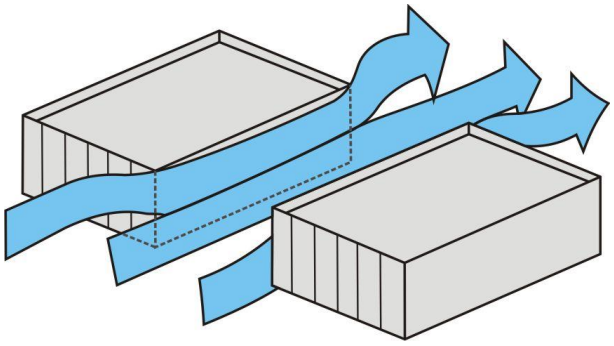

Figure A.2: Funnelling/Venturi Wind Effect

A.3 Gap Effect

The gap effect occurs in small openings in the façade that are open to wind on opposite faces, as seen in Figure A.3. This can involve a combination of funnelling and downwash effects. Presenting a small gap in the façade on the windward aspect as the easiest means through which the wind can flow through can result in wind acceleration through this gap. The pressure difference between the windward façade and the leeward façade also tends to exacerbate the wind flow through this gap.

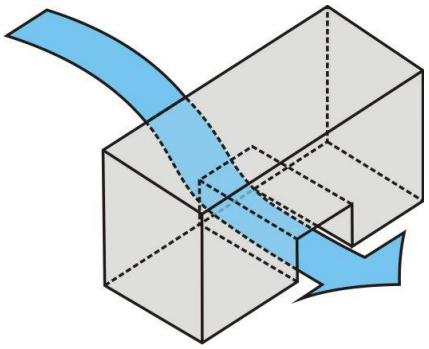

Figure A.3: Gap Wind Effect

A.4 Sidestream and Corner Effects

The sidestream effect is due to a gradual accumulation of wind shearing along the building façade that eventuates in an acceleration corner effect. The flow is parallel to the façade and can be exacerbated by downwash effects as well, or due to corner effect winds reattaching on the façade.

This is shown in Figure A.4. The corner refers to the acceleration of wind at the exterior vertical edge of a building, caused by the interaction of a large building massing with the incident wind, with the flow at the corner being accelerated due to high pressure differentials sets up between the windward façade and the orthogonal aspects. It can be further exacerbated by downwash effects that build up as the flow shears down the façade.

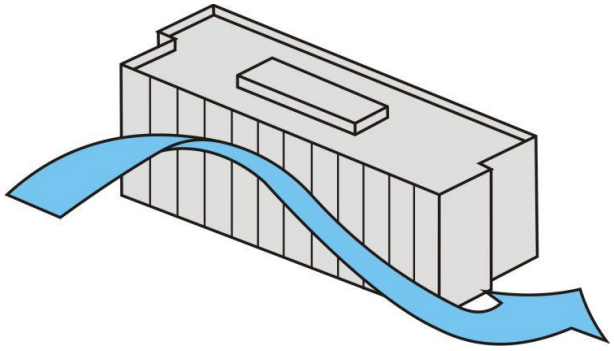

Figure A.4: Sidestream and Corner Wind Effect

A.5 Stagnation

Stagnation in a region refers to an area where the wind velocity is significantly reduced due to the effect of the flow being impeded by the bluff body. For a particular prevailing wind direction, this is typically located near the middle of the windward face of the building form or over a short distance in front of the windward face of a screen or fence. Concave building shapes tend to create an area of stagnation within the cavity, and wind speeds are generally low in these areas.

APPENDIX B LIST OF ARCHITECTURAL DRAWINGS REFERENCED

Table B1: List of Architectural Drawings Referenced (Received June 12, 2025)

DRAWING LIST	
00	COVER SHEET
01	GFA & FSR SCHEDULE
02	UNIT SCHEDULE
03	LOCATION PLAN - WIDER CONTEXT
04	LOCATION PLAN - URBAN CONTEXT
05	CONTEXT ANALYSIS - ZONING
06	CONTEXT ANALYSIS - HERITAGE & BIODIVERSITY
07	SITE ANALYSIS - DETAIL SURVEY
08	SITE ANALYSIS - EXISTING SITE PLAN
09	SITE ANALYSIS - CONCEPT BUILT FORM
10	SITE ANALYSIS - PROPOSED SITE PLAN
11	BASEMENT 3 PLAN
12	BASEMENT 2 PLAN
13	BASEMENT 1 PLAN
14	LOWER GROUND FLOOR PLAN
15	UPPER GROUND / LEVEL 1 FLOOR PLAN
16	LEVEL 2 FLOOR PLAN
17	LEVEL 3 FLOOR PLAN
18	LEVEL 4 FLOOR PLAN
19	LEVEL 5 FLOOR PLAN
20	LEVEL 6 FLOOR PLAN
21	LEVEL 7 FLOOR PLAN
22	LEVEL 8 FLOOR PLAN
23	LEVEL 9 FLOOR PLAN
24	ROOF PLAN
25	SECTIONS A & B
26	SECTIONS C & D
27	SECTIONS E & F
28	SECTIONS G & H
29	SECTIONS I & J
30	SECTION K
31	ELEVATIONS- SOUTH & EAST
32	ELEVATIONS- NORTH & WEST