



# PEDESTRIAN WIND ENVIRONMENT STATEMENT

40 MEMORIAL AVENUE, BELLA VISTA

WH088-03F02(REV0)- WS REPORT

JULY 15, 2025

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**AT THE LEADING EDGE**

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# EXECUTIVE SUMMARY

This report presents an opinion on the likely impact of the proposed 40 Memorial Avenue development, located in Bella Vista, 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, south to south-easterly, 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 14 July 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:

- Retain the proposed densely foliating vegetation/tree plantings within the proposed landscape areas along the pedestrian footpaths and through-site link as indicated in the architectural drawings. In particular around the corners of the buildings, along the through-site link. Densely foliating vegetation is to be of an evergreen species to ensure their effectiveness in wind mitigation throughout the year and the vegetation should be spaced such that the foliage is able to interlock between plants (where possible).
- Retain the proposed densely foliating vegetation/tree plantings within the communal podium areas, as indicated in the architectural drawings. Densely foliating vegetation is to be of an evergreen species to ensure their effectiveness in wind mitigation throughout the year and the vegetation should be spaced such that the foliage is able to interlock between plants (where possible).
- Retain proposed perimeter planting around all communal terraces, ensuring a total height of 1.5m.
- Introduce 2m high impermeable wind screens to the western aspect of the communal terrace on Level 8, Building A, to the north and south of the plant rooms.
- Retain proposed perimeter planting around balconies/terraces, ensuring a total height of 1.5m.

Treatment to be applied to:

- Building A, all balconies on Level 3.
- Buildings B and C, penthouse terraces on eastern aspect of Level 14.
- Building D, southern aspect of south-western corner balcony on Level 4.

- Retain proposed screen, ensuring minimum height of 1.8m from slab level and a maximum porosity of 40%. Treatment to be applied to:
  - Building B, eastern aspect of north-eastern and south-eastern corner balconies on Level 3.
  - Building D, northern aspect of south-eastern corner balcony on Levels 3 and 7.
- Full-height impermeable end screen. Screen to have a depth of at least 75% of the length of the balcony edge. Treatment to be applied to:
  - Building B, northern edge of the north-western corner balcony on Levels 1-14.
  - Building B, southern edge of the south-western corner balcony on Levels 1-14.
  - Building C, northern edge of the north-western corner balcony on Levels 1-4.
  - Building C, western edge of the north-western corner balcony on Levels 5-14.
  - Building C, western edge of the south-western corner balcony on Levels 1-3.
  - Building C, southern edge of the south-western corner balcony on Levels 4-14.
  - Building D, western edge of the north-western corner balcony on Levels 1-3, 5-14.
  - Building D, northern edge of the north-western corner balcony on Level 4.
  - Building D, western edge of the south-western corner balcony on Levels 1-3, 5-14.
- 1.5m high impermeable wind screen. Treatment to be applied to:
  - Building A, southern edge of the south-eastern and south-western corner balcony on Levels 1-2.
  - Building A, northern edge of the north-eastern corner balcony on Levels 4-7.
  - Building A, western edge of the north-western and south-western corner balcony on Levels 4-7.
  - Building B, northern edge of the north-eastern balcony on Levels 1-2, 4-13.
  - Building B, southern edge of the south-eastern balcony on Levels 1-2.
  - Building C, northern edge of the north-eastern balcony on Ground Level and Levels 1-13.
  - Building C, southern edge of the south-eastern balcony on Ground Level and Levels 1-13.
  - Building D, northern edge of the north-eastern balcony on Ground Level and Levels 1-2, 4-13.
  - Building D, southern edge of the south-eastern balcony on Ground Level and Levels 1-2, 8-13.
  - Building D, western edge of the south-eastern balcony on Level 3.
  - Building D, eastern edge of the south-eastern balcony on Level 4-6.

With the inclusion of the abovementioned recommendations in the final design, it is expected that 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. Nonetheless, wind tunnel testing is recommended to be undertaken at a more detailed design to quantitatively assess the wind conditions and to optimise the size and extent of the treatments required.

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# INTRODUCTION

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.

## DESCRIPTION OF DEVELOPMENT AND SURROUNDINGS

The site is located at 40 Memorial Avenue, Bella Vista and is bounded by Memorial Avenue to the north-west and open parkland to the north-east, south-east and south-west. Surrounding the site is predominantly open parkland with low to mid-rise residential buildings towards the east along Free Settlers Drive. Further away from the site is predominantly low-rise residential housing.

A survey of the land topography indicates a gradual incline towards the south and the east, however, there are no major elevation changes in the area immediately surrounding the site.

An aerial image of the subject site and the local surroundings is shown in Figure 1, with the frequency and magnitude of the prevailing winds is superimposed for each wind direction.

The existing site consists of an empty lot. The subject development comprises of 4 residential apartment buildings: Buildings A, B, C and D, aligned in an east to west direction. Building A is 9 storeys in height, whereas Buildings B, C and D are 14 storeys in height. There are shared podiums between Buildings A/B and between Buildings C/D, and the centre of the development consists of a through-site link between Buildings B and C.

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:

- Ground Level pedestrian footpaths and through-site link.
- Communal Podiums between Buildings A/B, and Buildings C/D.
- Communal terraces on Levels 3, 8 and 14
- Private balconies and terraces.

### Legend

- Line thickness represents the magnitude of the regional wind from that direction
- Line length represents the frequency that the regional wind occurs for that direction

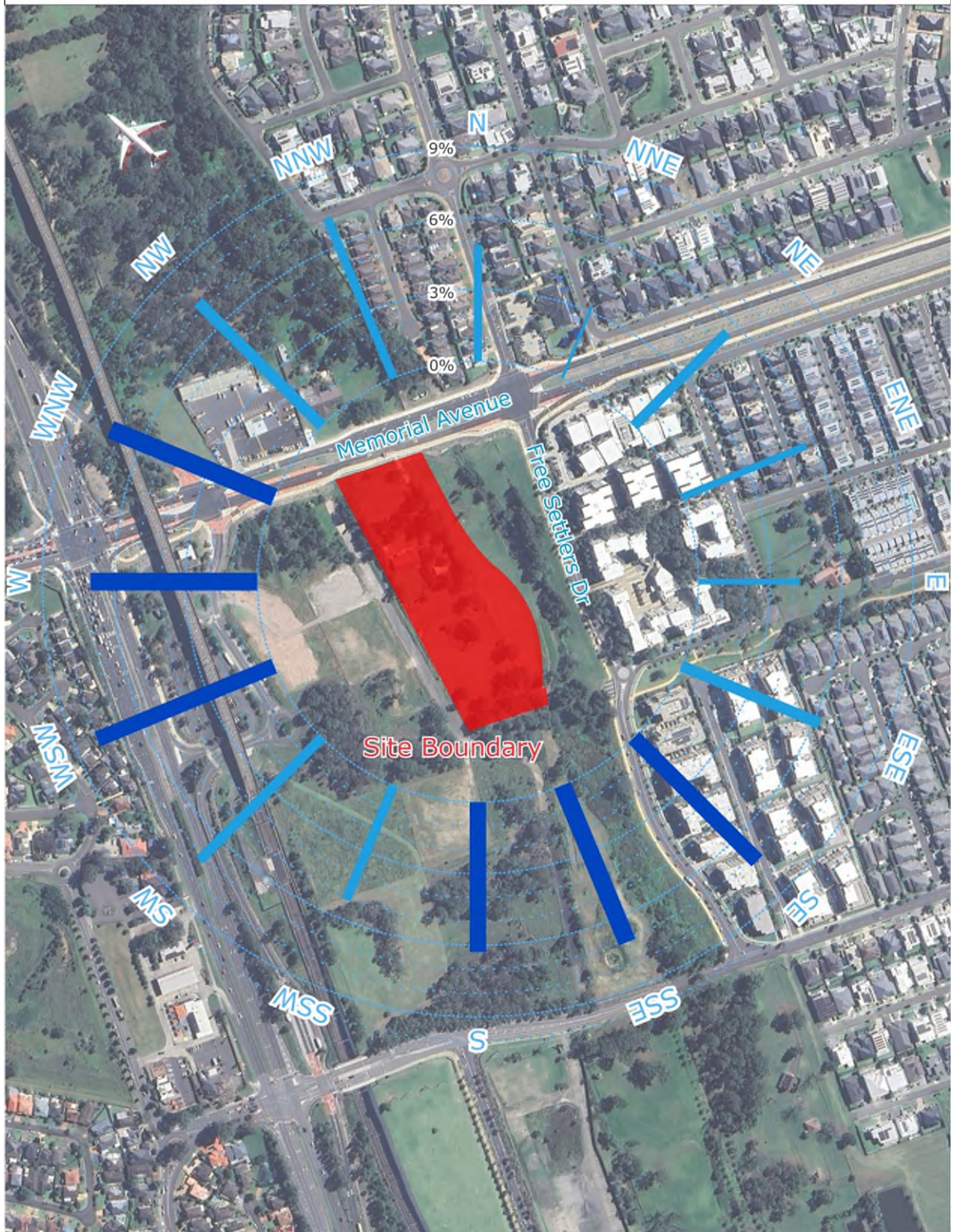


Figure 1: Aerial Image of the Site Location and Prevailing Wind Directions

### 3 REGIONAL WIND

The Bella Vista region is governed by three principal wind directions that can potentially affect the subject development. These winds prevail from the north-east, south to south-east, 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 Bankstown Airport (recorded from 1993 to 2016). 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 2 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 2.

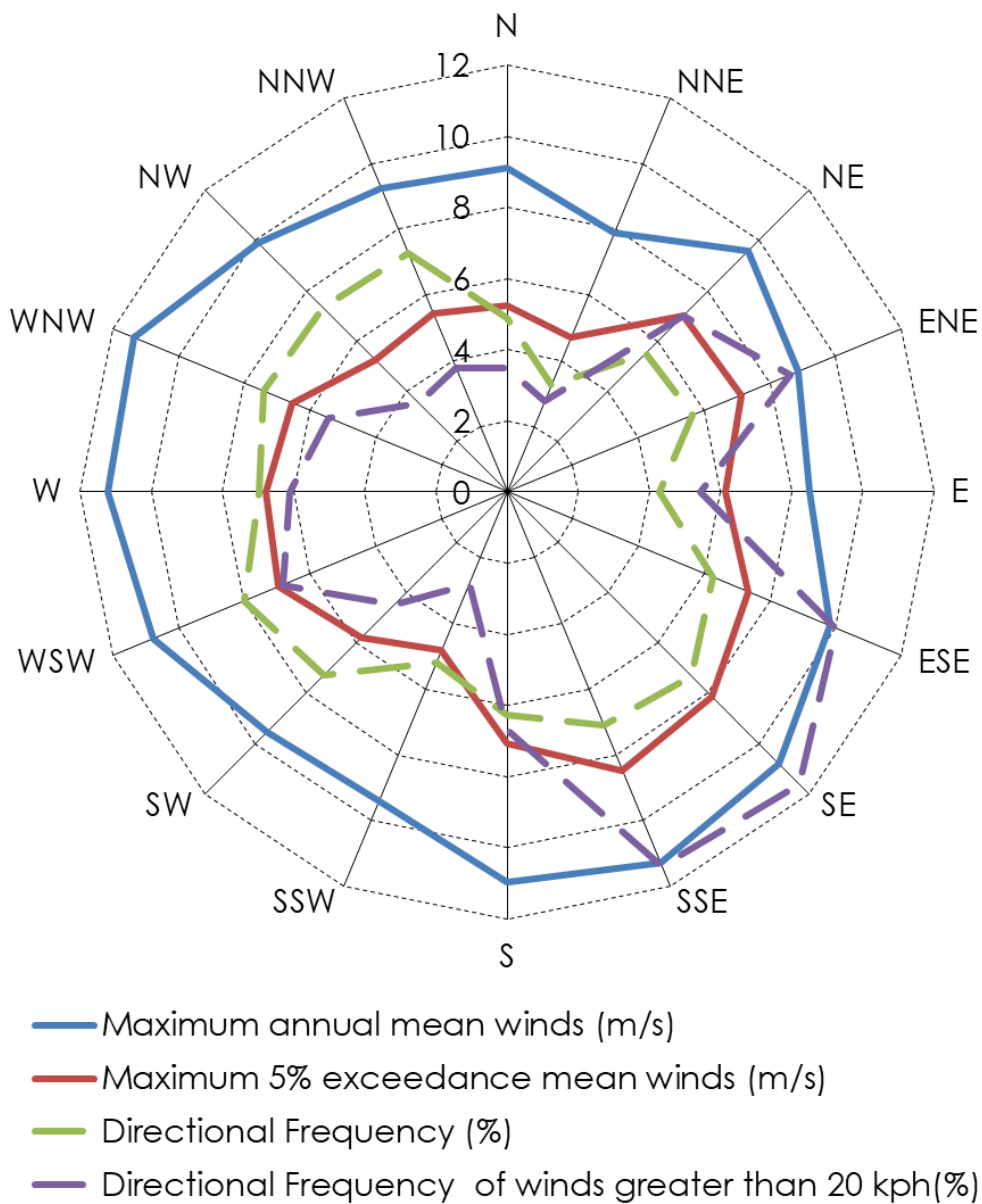


Figure 2: Directional Annual and 5% Exceedance Hourly Mean Wind Speeds (referenced to 10m height in standard open terrain), and Frequencies of Occurrence, for the Bella Vista Region

## 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.

## 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 Design Discussion and Recommendations

The expected wind conditions are discussed in the following sub-sections of this report for the various outdoor and private balcony 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.

### 5.2 Ground Level Pedestrian Footpaths and Through-Site Link

The proposed pedestrian footpaths and through-site links are expected to benefit from shielding provided by the proposed development. The existing densely foliating trees along the site boundary are also expected to provide some shielding to pedestrian footpaths when located downstream of the prevailing wind direction. Wind downwashing is unlikely to occur due to the development's alignment with the prevailing wind directions and the proposed tower setbacks.

However, the proposed pedestrian footpaths and through-site link are likely susceptible to a variety of wind effects due to the interaction of the prevailing winds with the building morphology. These wind effects are summarised below:

- The orientation and plan layout of the residential development indicates that the buildings are aligned in a manner which allows for the prevailing winds to side stream along the buildings. The prevailing westerly and north-easterly winds are expected to side stream along the north-eastern aspect whereas the prevailing south to south-easterly winds are expected to side stream along the south-eastern aspect.
- Funnelling wind effect as the prevailing winds travel between Buildings B and C along the proposed through-site link.

The following treatment strategies are expected to be effective in reducing adverse winds and hence are recommended to be considered in the final design of the development (refer to Figures 3 and 4):

- Retain the proposed densely foliating vegetation/tree planting within the proposed landscape areas along the pedestrian footpaths and through-site link as indicated in the architectural drawings. In particular around the corners of the buildings, along the through-site link. Densely foliating vegetation is to be of an evergreen species to ensure their effectiveness in wind mitigation throughout the year and the vegetation should be spaced such that the foliage is able to interlock between plants (where possible).

### 5.3 Communal Podiums between Buildings A/ B and Buildings C/ D

The proposed communal podium areas are expected to significantly benefit from the shielding provided by the proposed development. Despite the shielding, these areas are likely susceptible to a variety of wind effects due to the interaction of the prevailing winds with the building morphology. These wind effects are summarised below:

- Local wind funnelling effects from each of the prevailing wind directions at the eastern and western entrances to the communal podium areas between Buildings A/B and C/D.

The following treatment strategies are expected to be effective in reducing the wind impacts within the communal podium areas and hence are recommended to be considered in the final design of the development (refer to Figure 4):

- Retain the proposed densely foliating vegetation/tree planting within the communal podium areas, as indicated in the architectural drawings. Densely foliating vegetation is to be of an evergreen species to ensure their effectiveness in wind mitigation throughout the year and the vegetation should be spaced such that the foliage is able to interlock between plants (where possible).

## 5.4 Communal Terraces

Communal terraces are located on the Level 3 eastern aspects of Buildings B and D, Level 8 of Building A and Level 14 of Building D. These terraces are exposed to the prevailing north-easterly, south to south-easterly and westerly winds. The communal terraces on Buildings A and B will benefit from shielding from the south to south-easterly winds from the upstream buildings. The north-easterly winds and south to south-easterly winds are expected to sidestream along the terraces, and the westerly winds are expected to sidestream along the northern aspect of each building and corner accelerate onto the terraces.

The following treatment strategies are expected to be effective in reducing the wind impact within each of the communal terraces, and hence are recommended to be considered in the final design of the development (refer to Figures 6, 10 and 12):

- Retain proposed perimeter planting around all communal terraces, ensuring a height of 1.5m.
- Introduce 2m high impermeable wind screens to the western aspect of the communal terrace on Level 8, Building A, to the north and south of the plant rooms.

## 5.5 Private Balconies and Terraces

The majority of the balconies of the development are expected to be suitable for their intended use due to the inclusion of various wind mitigation features such as recessing the balcony areas into the building footprint, the inclusion of inter-tenancy privacy walls and standard height balustrades along the balcony perimeter edge as indicated in the architectural drawings. These features should be retained in the final design, ensuring screens and balustrades have a maximum porosity of 40%.

Typically, corner balconies are the most susceptible to adverse wind conditions. These balconies may experience corner accelerated wind flow depending on the exposure of the balcony and proximity to the corner of the building. Architectural features such as tall impermeable screening, louvres and other large full-height elements are expected to improve wind conditions and have been included for some balconies. Other screening configurations such as half or three-quarter length full-height screening has also been included in the design of the development and may also reduce wind impact, however, this depends predominantly on the orientation of the balcony relative to the prevailing wind directions. These features should all be retained. It should be noted that Corner balconies located on the Ground Level plane are expected to be suitable for their intended uses due to the shielding provided by the dense vegetation/tree planting, which should be retained in the final design.

The following treatment strategies are expected to be effective in reducing the wind impact along corner balcony locations which are likely to experience strong winds and hence are recommended to be considered in the final design of the development (refer to Figures 4 to 12):

- Retain proposed perimeter planting around balconies/terraces, ensuring a total height of 1.5m.  
Treatment to be applied to:
  - Building A, all northern, eastern and western balconies on Level 3.
  - Buildings B and C, penthouse terraces on eastern aspect of Level 14.

- Building D, southern aspect of south-western corner balcony on Level 4.
- Retain proposed screen, ensuring minimum height of 1.8m from slab level and a maximum porosity of 40%. Treatment to be applied to:
  - Building B, eastern aspect of north-eastern and south-eastern corner balconies on Level 3.
  - Building D, northern aspect of south-eastern corner balcony on Levels 3 and 7.
- Full-height impermeable end screen. Screen to have a depth of at least 75% of the length of the balcony edge. Treatment to be applied to:
  - Building B, northern edge of the north-western corner balcony on Levels 1-14.
  - Building B, southern edge of the south-western corner balcony on Levels 1-14.
  - Building C, northern edge of the north-western corner balcony on Levels 1-4.
  - Building C, western edge of the north-western corner balcony on Levels 5-14.
  - Building C, western edge of the south-western corner balcony on Levels 1-3.
  - Building C, southern edge of the south-western corner balcony on Levels 4-14.
  - Building D, western edge of the north-western corner balcony on Levels 1-3, 5-14.
  - Building D, northern edge of the north-western corner balcony on Level 4.
  - Building D, western edge of the south-western corner balcony on Levels 1-3, 5-14.
- 1.5m high impermeable wind screen. Treatment to be applied to:
  - Building A, southern edge of the south-eastern and south-western corner balcony on Levels 1-2.
  - Building A, northern edge of the north-eastern corner balcony on Levels 4-7.
  - Building A, western edge of the north-western and south-western corner balcony on Levels 4-7.
  - Building B, northern edge of the north-eastern balcony on Levels 1-2, 4-13.
  - Building B, southern edge of the south-eastern balcony on Levels 1-2.
  - Building C, northern edge of the north-eastern balcony on Ground Level and Levels 1-13.
  - Building C, southern edge of the south-eastern balcony on Ground Level and Levels 1-13.
  - Building D, northern edge of the north-eastern balcony on Ground Level and Levels 1-2, 4-13.
  - Building D, southern edge of the south-eastern balcony on Ground Level and Levels 1-2, 8-13.
  - Building D, western edge of the south-eastern balcony on Level 3.

- o Building D, eastern edge of the south-eastern balcony on Level 4-6.

It is also recommended to retain any full height/1.8m high impermeable dividing walls or full height porous louvres across the development as these are expected to reduce any adverse wind effects from the prevailing winds sidestreaming across the building façade (refer to Figures 4 to 12).

**Treatments Legend**

-  Retain proposed landscaping and tree planting, ensuring trees are retained around building corners and lobby entrances.
-  Retain full height impermeable screen.

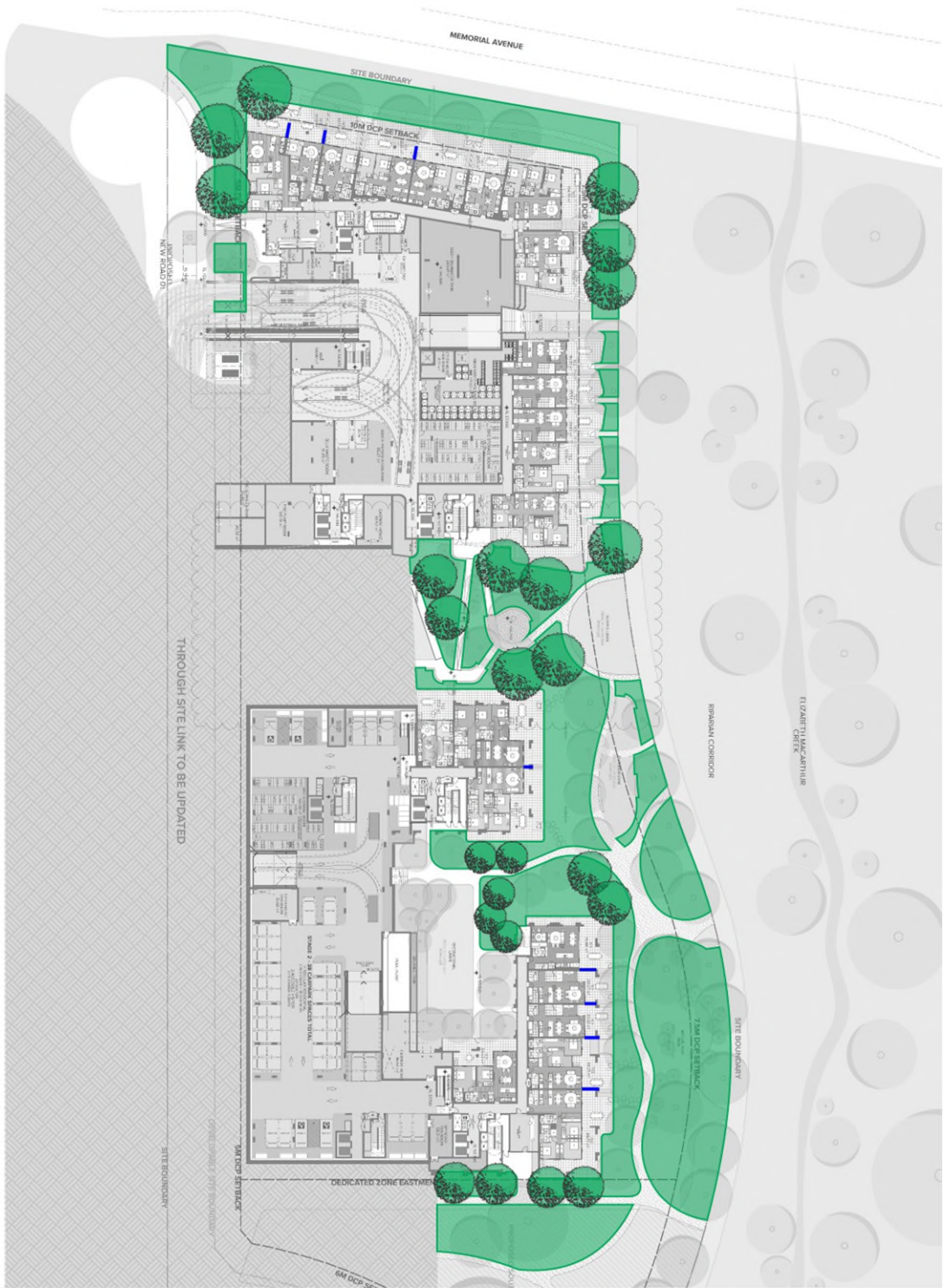






Figure 3: Recommended Treatments – Lower Ground Level

### Treatments Legend

-  Retain proposed landscaping and tree planting, ensuring trees are retained around building corners and lobby entrances.
-  Retain full height impermeable screen.
-  1.5m high impermeable wind screen.

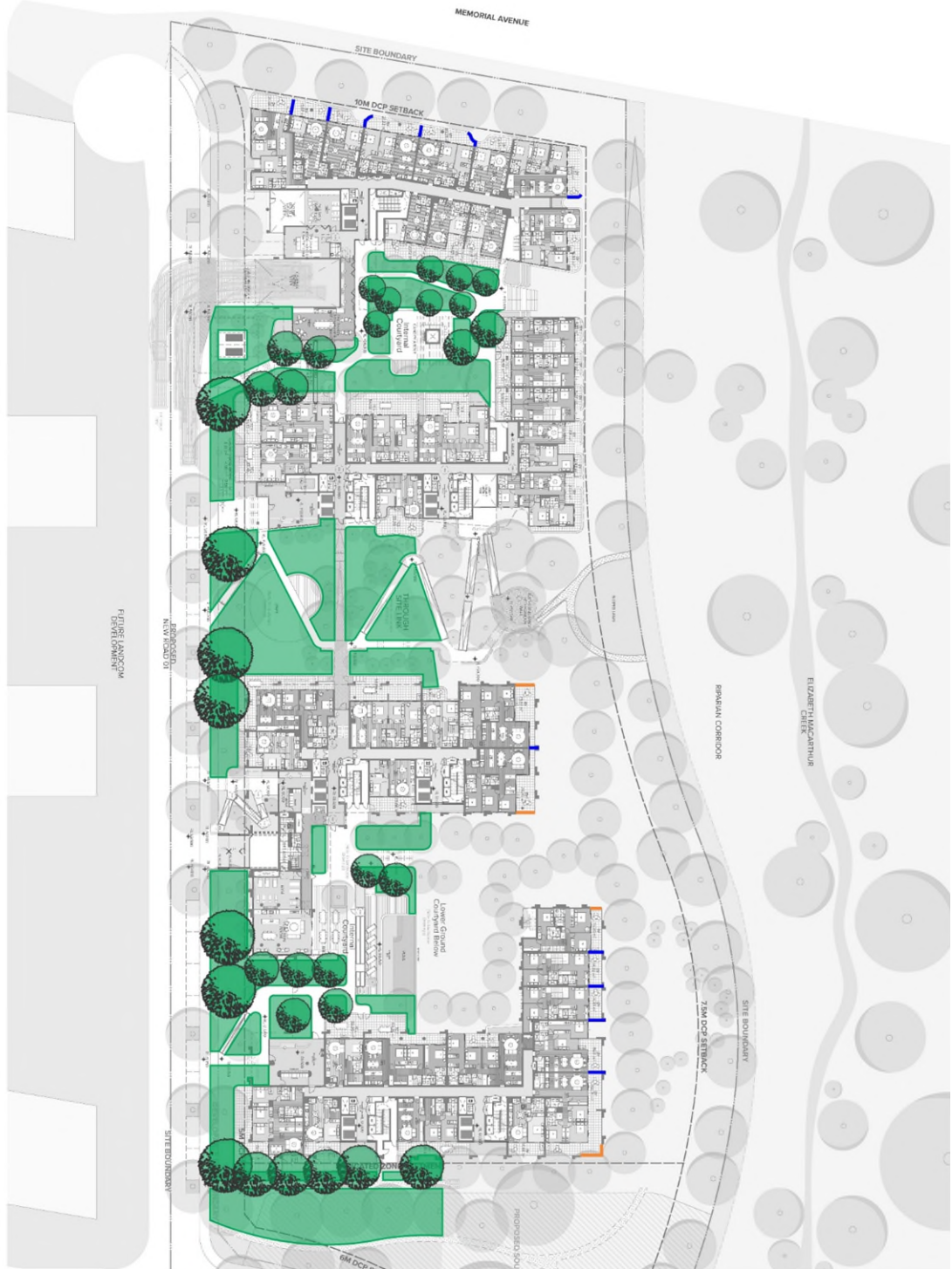


Figure 4: Recommended Treatments – Ground Level

### Treatments Legend

- Retain full height impermeable dividing walls.
- Retain 1.8m high impermeable dividing walls.
- Full height impermeable dividing walls.
- 1.5m high impermeable wind screen.

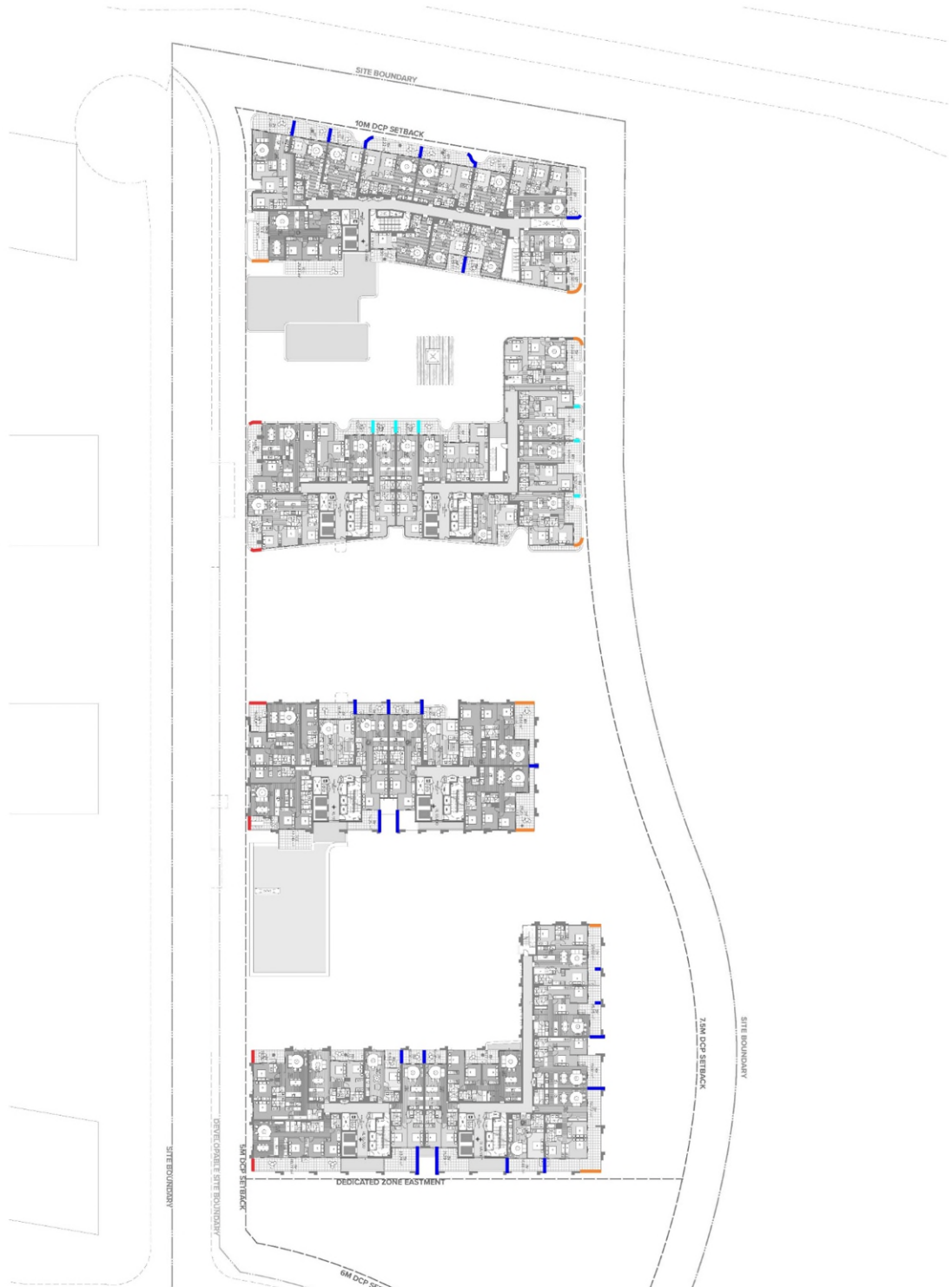


Figure 5: Recommended Treatments – Levels 1-2

**Treatments Legend**

- Retain proposed perimeter planting, ensuring a total height of 1.5m.
- Retain full height impermeable dividing walls.
- Retain 1.8m high impermeable dividing walls.
- Retain balustrade/screen, ensuring minimum height of 1.8m from slab level and a maximum porosity of 40%.
- Full height impermeable dividing walls.
- 1.5m high impermeable wind screen.






Figure 6: Recommended Treatments – Level 3

### Treatments Legend

- Retain proposed perimeter planting, ensuring a total height of 1.5m.
- Retain full height impermeable dividing walls.
- Retain balustrade/screen, ensuring minimum height of 1.8m from slab level and a maximum porosity of 40%.
- Retain full height porous louvers.
- Full height impermeable dividing walls.
- 1.5m high impermeable wind screen.



Figure 7: Recommended Treatments – Level 4

### Treatments Legend

- █ Retain full height impermeable dividing walls.
- █ Retain full height porous louvers.
- █ Full height impermeable dividing walls.
- █ 1.5m high impermeable wind screen.



Figure 8: Recommended Treatments – Level 5-6

### Treatments Legend


- █ Retain full height impermeable dividing walls.
- █ Retain full height porous louvers.
- █ Retain balustrade/screen, ensuring minimum height of 1.8m from slab level and a maximum porosity of 40%.
- █ Full height impermeable dividing walls.
- █ 1.5m high impermeable wind screen.



Figure 9: Recommended Treatments – Level 7

**Treatments Legend**

- Retain proposed planting, ensuring a height of 1.5m from slab level.
- Retain full height impermeable dividing walls.
- Retain full height porous louvers.
- 2m high impermeable wind screen.
- Full height impermeable screen.
- 1.5m high impermeable wind screen.



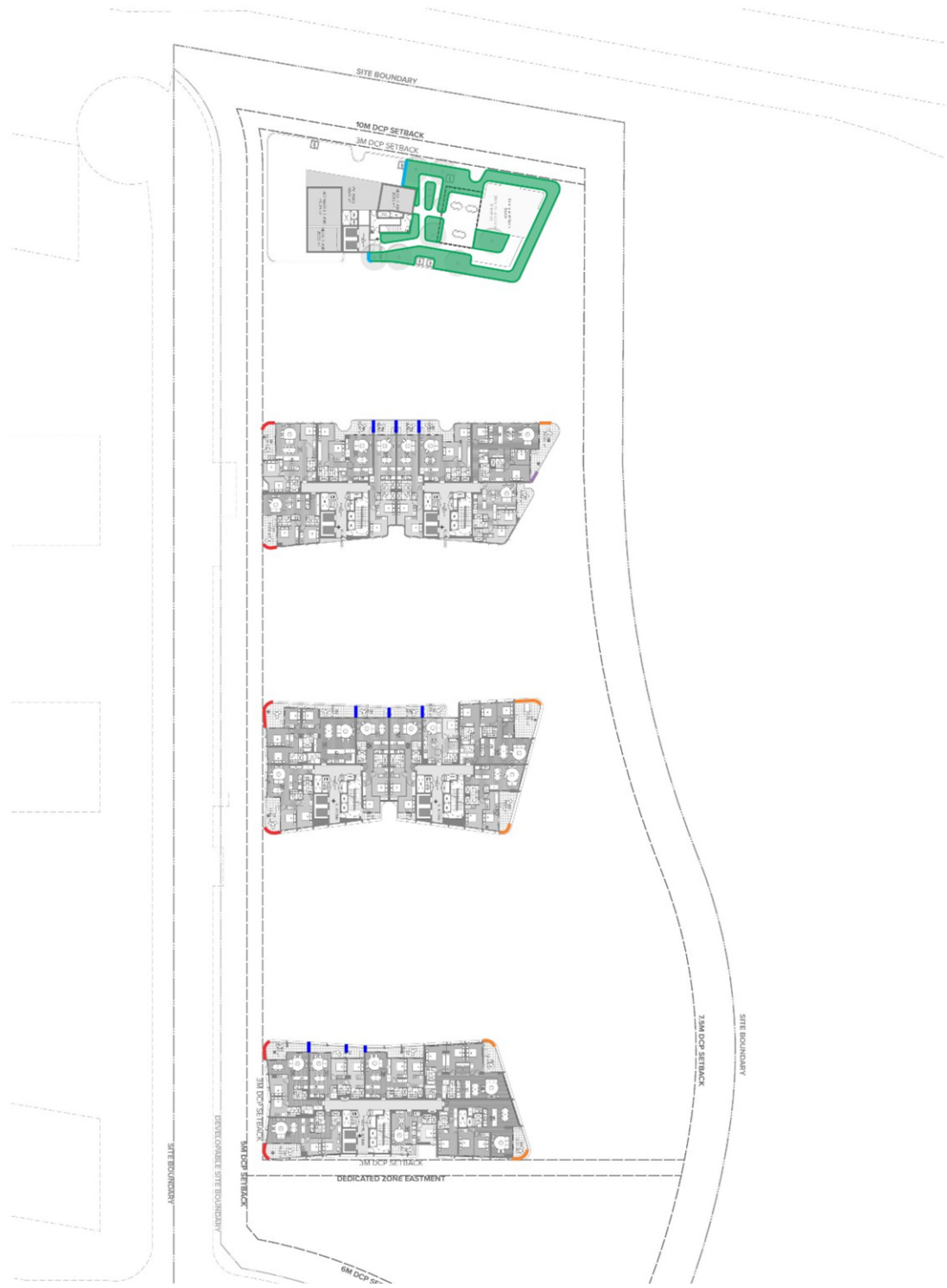


Figure 10: Recommended Treatments – Level 8

**Treatments Legend**

- Retain full height impermeable dividing walls.
- Retain full height porous louvers.
- Full height impermeable dividing walls.
- 1.5m high impermeable wind screen.





Figure 11: Recommended Treatments – Levels 9-13

**Treatments Legend**





-  Retain proposed planting, ensuring a height of 1.5m from slab level.
-  Retain proposed tree planting, ensuring a height and width of 3-5m.
-  Retain full height impermeable dividing walls.
-  Full height impermeable screen.



Figure 12: Recommended Treatments – Level 14

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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.

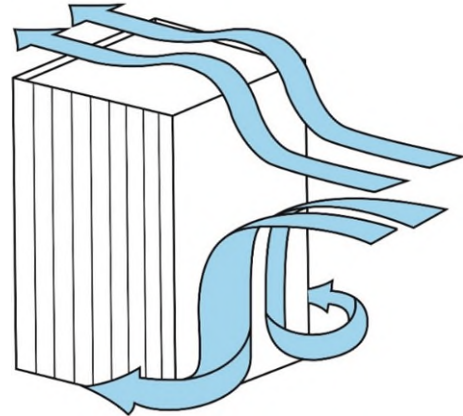


Figure A.1: Downwash Leading to Corner Wind Effect, and Upwash Effects

## 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.

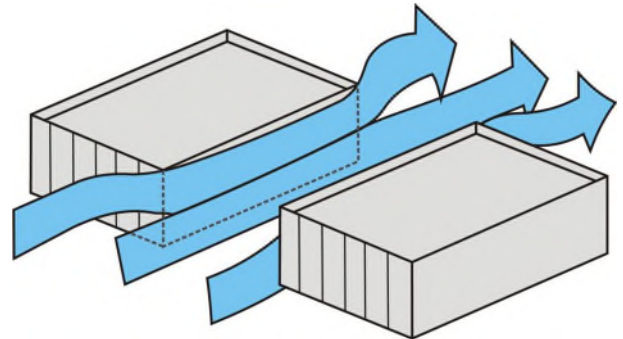


Figure A.2: Funnelling/Venturi Wind Effect

## 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.

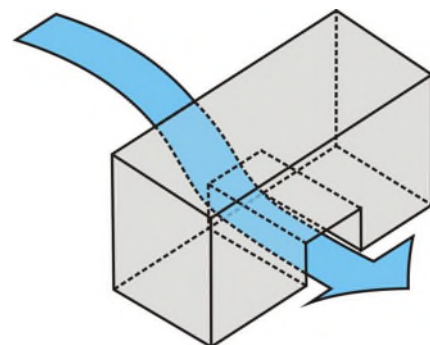


Figure A.3: Gap Wind Effect

## 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.

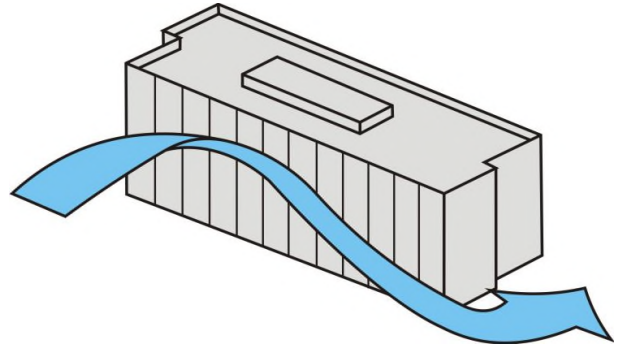


Figure A.4: Sidestream and Corner Wind Effect

## 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.