PEDESTRIAN WIND ENVIRONMENT STATEMENT

TALLAWONG STATION PRECINCT SOUTH, ROUSE HILL

WD965-02F02(REV3)- WS REPORT

APRIL 16, 2020

Prepared for:

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DOCUMENT CONTROL

Date	Revision History	Issued Revision	Prepared By (initials)	Instructed By (initials)	Reviewed & Authorised by (initials)
February 26, 2020	Initial.	0	KH	SWR	JG
March 12, 2020	Include treatment figure and elevated comments	1	KH	SWR	JG
March 16, 2020	Revised treatment figure	2	KH	SWR	JG
April 16, 2020	Revised treatment figure	3	JG	SWR	TH

EXECUTIVE SUMMARY

This report is in relation to the Tallawong Station Precinct South concept proposal located in Rouse Hill, and presents an opinion on the likely wind conditions affecting various trafficable outdoor areas within and around the subject development. The effect of wind activity is examined for the three predominant wind directions for the North-Western Sydney region; namely the westerly, south-easterly and north-easterly winds. The analysis of the wind effects relating to the proposed development was 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 GA Plans prepared by Turner, received February 2020. No wind tunnel testing was 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. 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 subject development will be exposed to the prevailing winds from all directions due to the low-rise surrounding structures. However, certain buildings and areas are expected to be shielded by the development itself for specific wind directions. Certain regions of the development may be prone to adverse wind effects due to the interaction of the prevailing winds with the built form. These potentially adverse wind effects include the direct impact of the prevailing winds, funnelling winds between the various podia and towers due to the alignment of the buildings with respect to the prevailing winds, the side-streaming and acceleration of winds around the various corners of the development and downwash caused by the prevailing winds impacting the building and redirecting winds downwards.

To address the potential for adverse wind effects impacting the comfort of pedestrians within and around the development, generalised wind mitigation treatments that should be considered are discussed within this report, and are summarised as follows:

- Inclusion of proposed planting and vegetation throughout the site. Undergrowth such as shrubs or hedges are expected to further improve wind conditions.
- Inclusion of continuous awnings over trafficable areas below towers or podia of a significant height which are exposed to the prevailing winds.
- Inclusion of localised screening where longer duration activities are expected.
- Inclusion of operable screening to be utilised by the various retail tenancy owners for patron flexibility.
- Inclusion of wind screens or planting within through site links, and at corners of buildings.

- Recommended standard height impermeable balustrades on all Private Balconies.
- Recommended perimeter screens on elevated areas that are proposed for communal seating/recreation areas.
- Recommended planting and vegetation on elevated areas that are proposed for communal seating/recreation areas. The trees and planting should be of a dense evergreen species.

Note that for tree planting/landscaping to be effective as a wind mitigation device, the species should be of a densely foliating evergreen variety to ensure year-round effectiveness. Trees should also be planted in clusters with interlocking canopies to effectively absorb incident winds. Validation of the size and extent of the treatments can be further investigated at a later stage.

With the inclusion of these considerations in the detailed design of the development, wind conditions within outdoor trafficable areas of the development are expected to be suitable for their intended uses.

CONTENTS

1 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 was 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 was 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 THE DEVELOPMENT AND SURROUNDINGS

The development site is bounded by Cudgegong Road to the east, Schofields Road to the south, Themeda Avenue and Tallawong Metro Station to the north and parking lots to the west. The site is currently not in use and consists of a flat grass plain.

The development precinct will be primarily comprised of mixed-use developments ranging from approximately three to eight storeys high over Lot 294 and Super Lot 293 shown in Figure 2 (Lot 294 comprise of Site 1A and 1B to the north, and Super Lot 293 comprise of Site 2A, 2B, 2C, 2D, 2E to the south) with active street frontages and commercial areas proposed primarily on the ground floor close to the station entrance.

Surrounding the site are predominately low rise residential buildings to the south, west and east and parklands with low density residential buildings to the north. A survey of the land topography indicates that there the terrain gradually rises to the north-west from the south-east of the development. An aerial image of the site and the local surroundings is shown in Figure 1. The critical trafficable outdoor areas associated with the proposed development, which are the focus for pedestrian wind effects in the assessment are detailed as follows:

- Pedestrian accessible areas that are expected to experience high traffic
- The pedestrian accessible areas within the and around the site
- The proposed recreation and park areas within and around the site

Figure 1: Aerial Image of the Proposed Development Site

Figure 2: Proposed Site Plan

3 REGIONAL WIND

The Western Sydney region is governed by three principal wind directions, and these can potentially affect the subject development. These winds prevail from the north-east, south-east and west. These wind directions were determined from an analysis undertaken by Windtech Consultants of recorded directional wind speeds obtained at the meteorological station located at Bankstown Airport by the Bureau of Meteorology. The data has been collected from this station from 1993 to 2016 and corrected so that it represents winds over standard open terrain at a height of 10m above ground level. Figure 3 shows a summary of this analysis in the form of a graph, a directional plot of the annual 5% exceedance mean winds for the Western Sydney region is also determined. The frequency of occurrence of these winds is also shown in Figure 3.

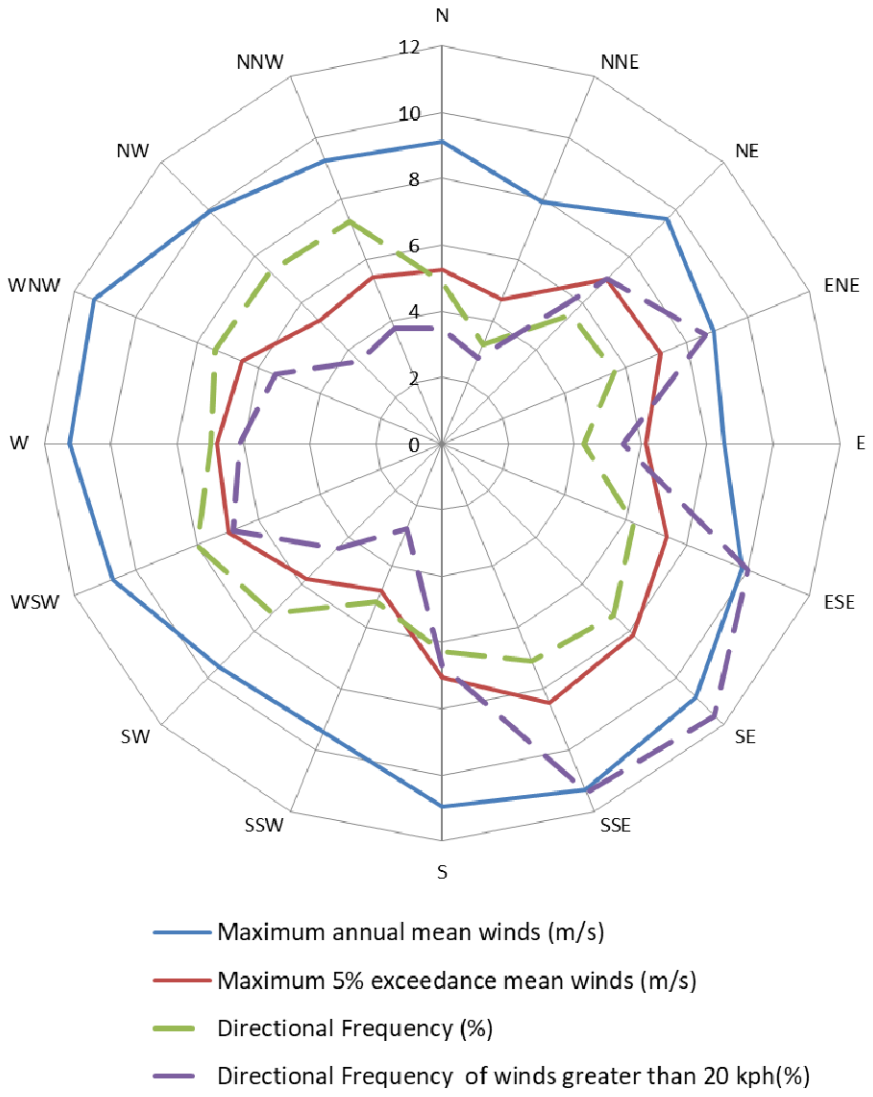

Figure 3: Annual and 5% Exceedance Hourly Mean Wind Speeds, and Frequencies of Occurrence, for the North-western Sydney Region (referenced to 10m above ground in standard open terrain)

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 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 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.

The recommended criterion for wind conditions for the circulation area is 7.5m/s with a 5% probability of exceedance, whereas short duration activities will need to satisfy a more stringent comfort criterion of 5.5m/s with a 5% probability of exceedance. Although this assessment is of a qualitative nature, the abovementioned criteria are considered when assessing the wind environment impacts.

5.1 Site Location

The wind conditions at ground level primarily depend on the orientation of the development relative to the principal wind directions and the impact of neighbouring developments. The site of the proposed development is relatively exposed to the principal wind directions as it has little-to-no shielding along the north-eastern and western sides. Shielding from low level direct winds may be provided by the low-rise residential areas to the south of the development along Schofields Road. The rise in terrain from the south-east to north-west may accelerate the south-easterly winds, however this effect is expected to be minimal. The development is expected to shield certain areas within the development from some prevailing winds.

5.2 Westerly Sector Winds

It is anticipated that certain areas of the development may be susceptible to undesirable wind effects from the prevailing westerly wind direction. The proposed car parks located west of the site exposes the developments to the direct westerly winds. These winds are expected to directly impact Site 1A, resulting in corner accelerating flow at the north-west and south-west corners. Similarly, the building height and shape may result in downwash winds along the western aspect. The communal thoroughfare that splits Site 1A is expected to experience funnelling wind effects, which can potentially spill into the communal park space, east of Site 1A.

The limited shielding is expected to result in the westerly winds funnelling along Conferta Avenue as well as the Proposed New Road, located between Sites 2A and 2D. Due to the limited shielding the direct winds are expected to result in corner accelerated flow along the western aspect corners of Sites 2A and 2D. Side streaming along Themeda Avenue has the potential to result in corner accelerated conditions at the north-east corner of Site 1B.

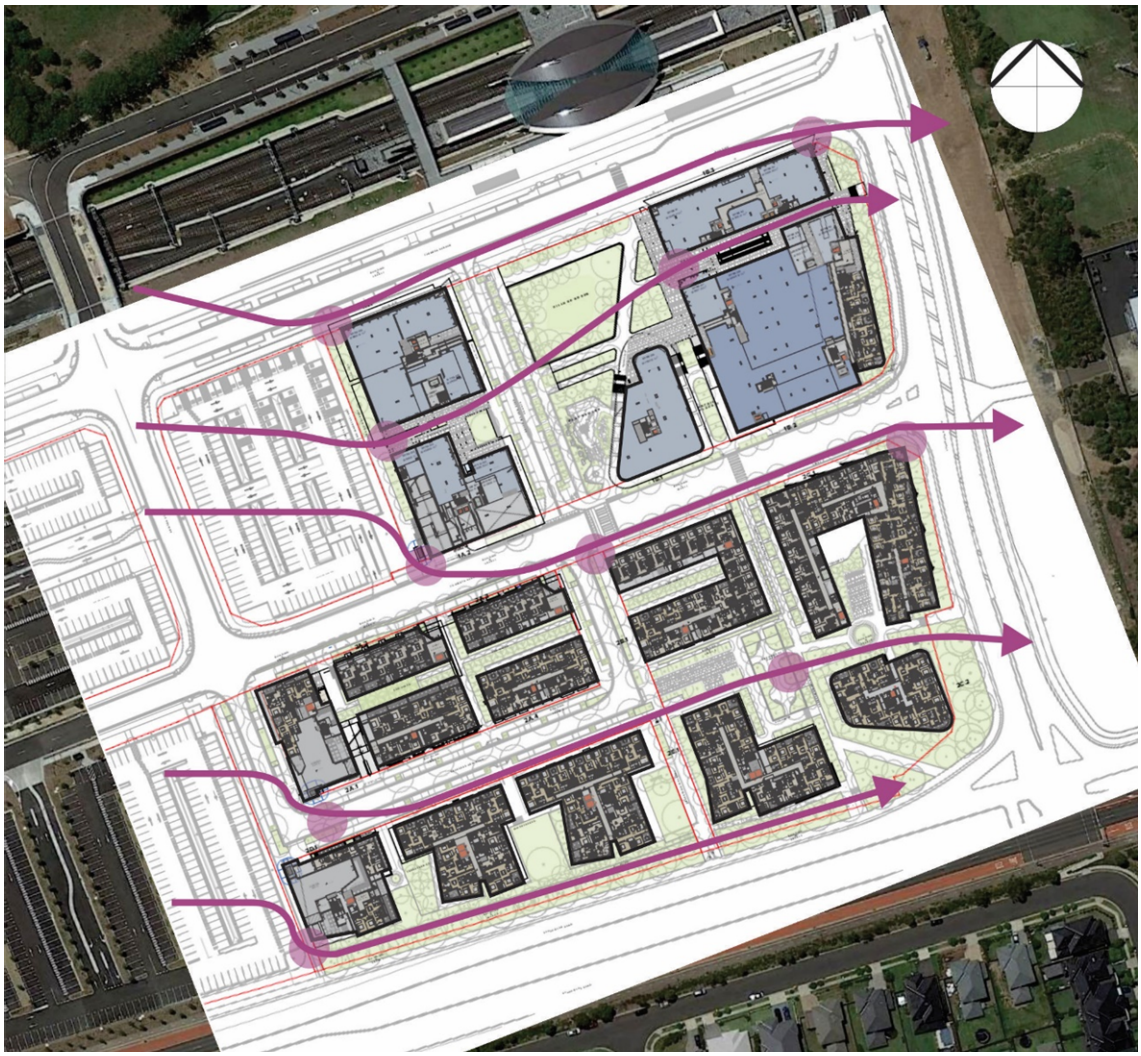

Figure 4: Westerly Wind Flow and Hotspots

5.3 Southerly Sector Winds

It is anticipated that certain areas of the development may be susceptible to undesirable wind effects from the prevailing south to south-east wind directions. Low-rise residential buildings are situated along the southern aspect of the proposed development precinct which are expected to provide minimal shielding benefits.

The non-uniform building shapes within Site 2D and 2E assist in reducing side-streaming effects along Schofields Road. However, low level side-streaming is anticipated to occur along the eastern aspect of Site 1B and 2C along Cudgegong Road. These wind conditions are expected to result in corner accelerated flow at the north-eastern corners of both sites 1B and 2C, respectively.

Due to the orientation of the developments with respect to the predominant south-easterly winds, downwash wind effects are not expected to be a major contributing factor from this wind direction. However, high level side-streaming may occur along the eastern facade aspect of Site

1B and 2C which may result in adverse wind conditions at the corner of Conferta Avenue and Cudgegong Road and Themeda Avenue and Cudgegong Road due to wrap around and wind dumping mechanisms.

The orientation of the proposed pedestrian walkways within the site generally align with the predominant southerly sector wind directions. These walkways are expected to experience funnelling wind effects which will impact the pedestrian footpath areas.

Figure 5: South-Easterly Wind Flow and Hotspots

5.4 North-Easterly Sector Winds

It is anticipated that certain areas of the development may be susceptible to undesirable wind effects from the prevailing north-east direction. The metro railway and grasslands are situated north-east of the proposed development precinct and are expected to provide minimal shielding for the prevailing north-easterly winds.

The winds are expected to sidestream along the northern façade of Sites 1A and 1B along Themeda Avenue and sidestream along the eastern façade of Sites 1B and 2C along Cudgegong Road. Similarly, due to the orientation of Conferta Avenue the predominant north-easterly winds are expected to funnel along the street and pedestrian footpaths. The north-easterly winds are also expected to wrap around Site 1B into the communal park space. Similarly, the south-east corner of the site, adjacent to Site 2C and 2E may be exposed to wrap around winds.

The eastern aspect of Site 1B and 2C are expected to experience downwash effects due to the building form and height capturing the predominant north-easterly winds.

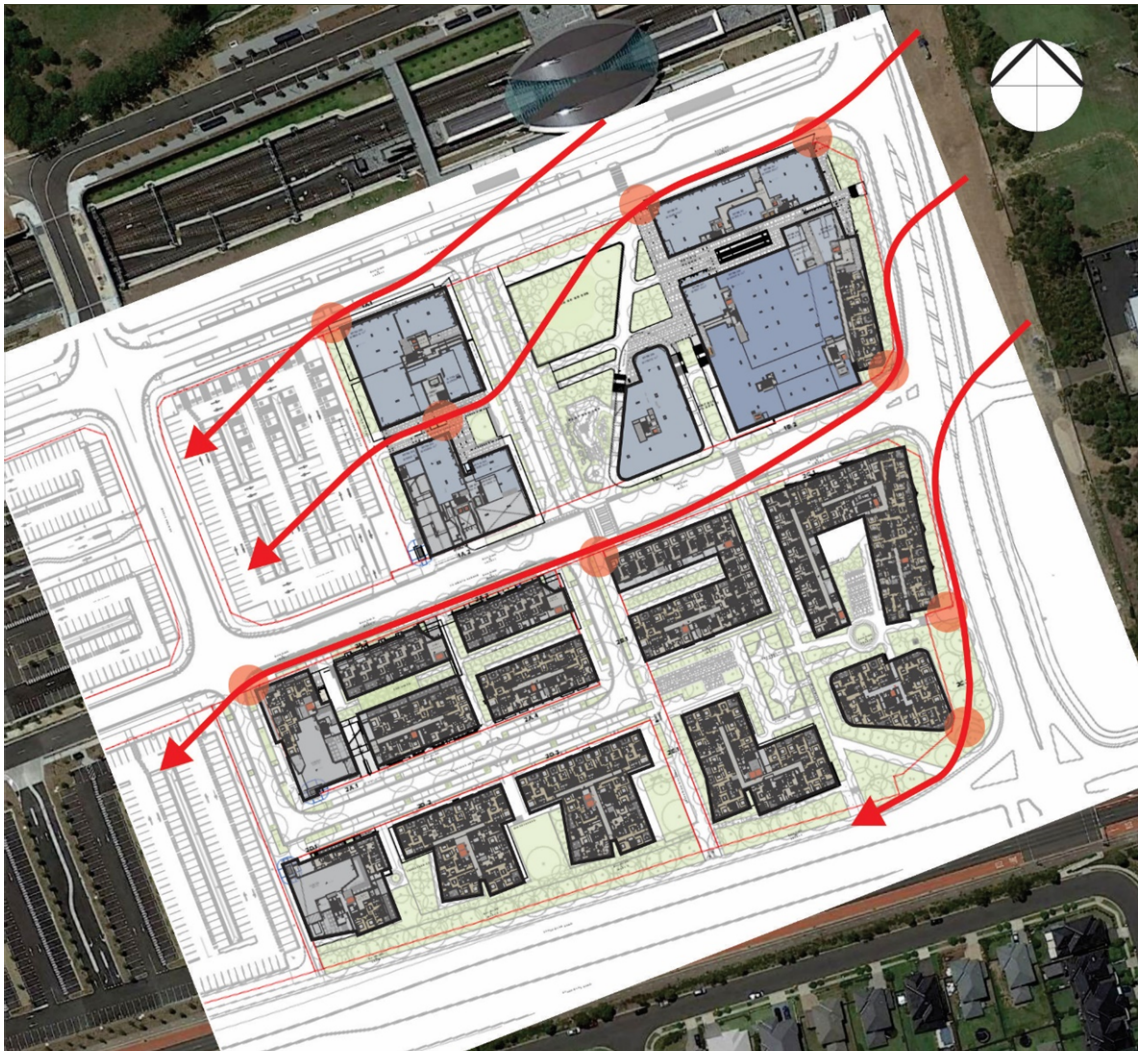

Figure 6: North-Easterly Wind Flow and Hotspots

5.5 General Recommendations

The proposed landscape plan is expected to be very effective in mitigating adverse wind conditions throughout the site. Note that for tree planting/landscaping to be effective as a wind mitigation device, the species should be of a densely foliating evergreen variety to ensure year-round effectiveness, particularly for the areas that are expected to be impacted by westerly winds, which prevail during the winter months. Trees should also be planted in clusters with interlocking canopies to effectively absorb incident winds. In sensitive areas or hotspots where strong winds are expected, mature trees should be used as immature trees may have difficulty establishing themselves in strong wind conditions. If immature trees are initially planted, the inclusion of porous screens around these tree plantings, or temporary wind screens is recommended to provide some wind mitigation while the trees develop and also provide some protection as the trees establish. Conditions can be further improved through the use of low level vegetation such as shrubs/hedges or planter boxes. When utilised below a tree canopy, they provide protection from low level winds, especially for more sensitive areas where longer duration activities are expected. In general, landscaping can help mitigate adverse wind conditions caused by winds directly impacting an area, or sidestreaming winds by slowing the winds upstream.

In areas where stronger winds are expected, wind screens may be required. These can be in the form of impermeable screens, porous screens, signage, artwork etc. which are strategically located to mitigate winds at a particular location. In areas where longer duration stay is expected, such as café, restaurant seating areas or communal recreation areas, additional localised screening, tenancy-operated screening deployable during windy conditions, or planting may be required. The location of these areas at the corners of buildings places them in an area where there is a high potential for adverse winds.

Downwash is most likely to occur at the base of tall buildings that present a flat façade to the prevailing winds, and in these areas, awnings and canopies can be used to deflect the winds away from pedestrian accessible areas. The western aspect of Site 1A and the eastern aspect of Site 1B and 2C are areas to consider awning implementation. Generally, for awnings to be effective in achieving this, an awning of at least 3m would be required. This combined with tree planting alongside for the winds to be absorbed into would be particularly effective in mitigating this wind effect. Wrap-around awnings at the corners of buildings can also prevent downwash winds from combining with winds side streaming around the corners of the development.

Through site links should be oriented to avoid direct alignment with the prevailing winds, incorporate bends, planting or screens in order to mitigate funnelling effects between building massing. The funnelling between buildings may be severe enough for further mitigation measures such as a baffle screen arrangement. This tends to reduce the severity of winds affecting a particular area by redirecting it around obstacles, and thus reducing the wind speed.

The wind conditions for the various private balconies are heavily dependent on their location and design. The majority of the private balconies are only exposed to winds on a single aspect

and hence are expected to be suitable for their intended use. The balconies will also benefit from the setback design. Generally, the wind speeds at the corners of the building form are expected to be the highest due to the winds accelerating around the corner of the building. Provisions should be made to limit the exposure of these balconies to a single aspect by considering a wind deflective element such as a full-height screen to be added along one of the aspects. This can be in the form of glazing, louvres, etc. (which can be operable) which are expect to mitigate this effect. It is recommended to incorporate impermeable balustrades for all balconies.

The elevated communal outdoor areas are located at various locations and heights within the development. The elevated communal spaces on Blocks 1B, 2A, 2C, 2D, and 2E, are exposed to the prevailing wind directions. The areas are expected to experience a culmination of direct winds, upwash from the building façade and corner acceleration off adjacent building forms (i.e. mechanical roof areas, lift overruns). The lower elevated communal spaces on Blocks 1A, 1B, 2B generally receives shielding from one or more prevailing wind directions from the neighbouring buildings.

Within these communal open spaces, landscaping is recommended to reduce the effect of the adverse winds. In order to be effective as a wind mitigation measure, the recommended planting should be densely foliating with interlocking canopies, rather than planted in isolation. Due to exposure to the prevailing westerly winter winds, the planting should be of an evergreen variety to ensure its effectiveness throughout the year. The perimeter of the terraces should incorporate wind screening to redirect the winds above the trafficable spaces. For the abovementioned corner accelerations, wind screens connected to the façade are expected to be required to be implemented to mitigate this effect. These screens can be supplemented with additional planting in these areas to further improve conditions.

The use of loose glass-tops, lightweight sheets or covers (including loose BBQ lids) and other lightweight furniture is not recommended on the upper level outdoor terraces and balconies unless it is securely attached to the balcony or terrace floor slab.

Figure 7: Suggested treatments (Ground Floor)

6 REFERENCES

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