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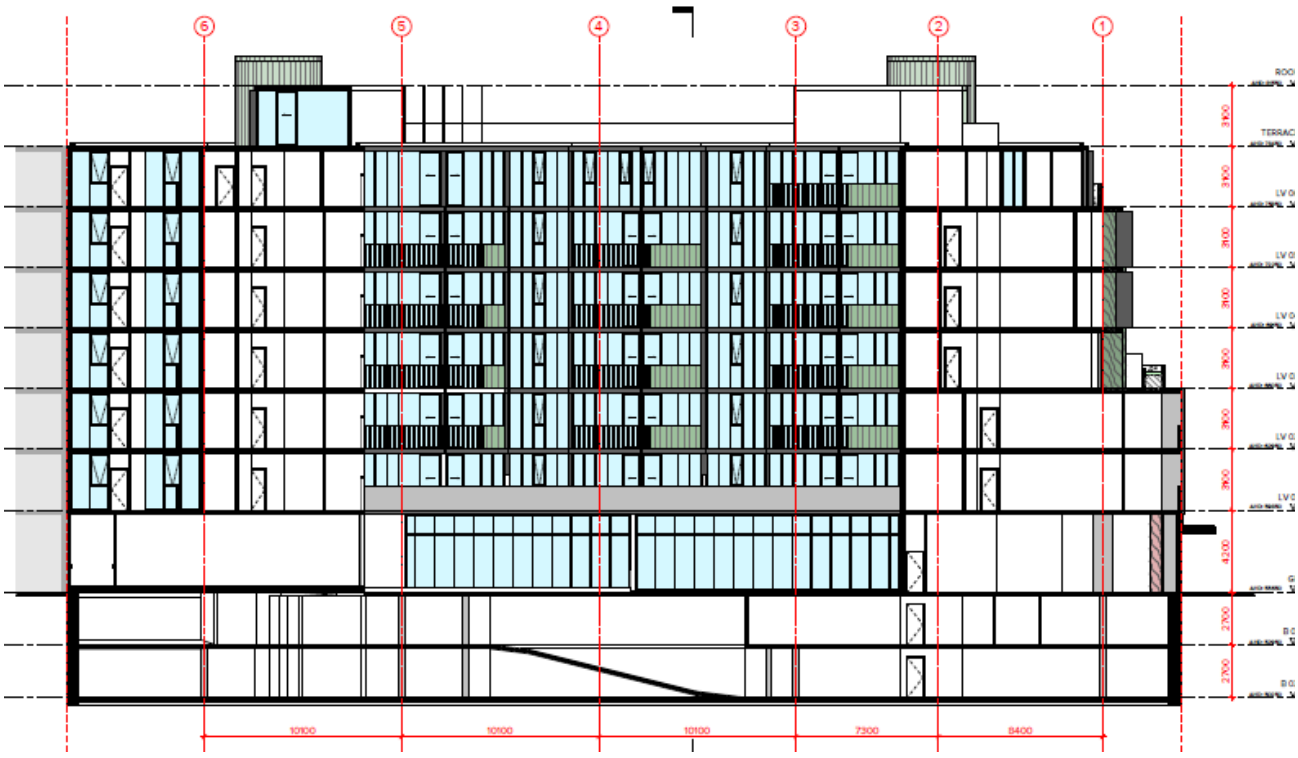
Goldman Johnson Pty Ltd

12-14 Johnson St && 1 Mills Road, Oakleigh

Wind Impact Assessment



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Prepared For:	**Prepared By:**
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Executive Summary

Goldman Johnson Pty Ltd commissioned Vipac Engineers and Scientists Ltd to prepare a statement of wind effects for the ground level areas adjacent to the proposed development at **12-14 Johnson St &**& 1 **Mills Road, Oakleigh.** This appraisal is based on Vipac's experience as a wind-engineering consultancy.

Drawings of the proposed development were provided by **Bruce Henderson Architects** in **April 2022.**

The findings of this study can be summarized as follows:

With proposed design:

- Wind conditions in the ground level footpath areas and access ways would be expected to be within the **walking** comfort criterion.
- **With recommendations,** all entrances would be expected to be within the **standing** comfort criterion;
- The private balconies would be expected to be within the recommended **walking** comfort criterion.
- **With recommendations,** the rooftop terrace/garden is expected to have wind conditions within the recommended **standing** comfort criterion.

As a general statement, educating occupants about wind conditions at open terrace/balcony areas during high-wind events and fixing loose, lightweight furniture on the terrace are highly recommended.

The assessments provided in this report have been made based on experience of similar situations in Melbourne and around the world. As with any opinion, it is possible that an assessment of wind effects based on experience and without experimental validation may not account for all complex flow scenarios in the vicinity.

Table of Contents

1 Introduction

Vipac Engineers and Scientists has been commissioned by **Goldman Johnson Pty Ltd** to carry out an appraisal of the pedestrian wind effects at the ground level of the proposed development at **12-14 Johnson St &**& 1 **Mills Road, Oakleigh.**

Strong winds in pedestrian areas are frequently encountered in central business districts of cities around the world; including Sydney, Melbourne and Brisbane. Wind characteristics such as the mean speed, turbulence and ambient temperature determine the extent of disturbance to users of pedestrian areas. These disturbances can cause both comfort and safety problems and require careful consideration to mitigate successfully.

The proposed development is a 7-storey residential building with a roof height of 25.9 m from Street level. The site is bounded by Johnson Street to the west, Mill Rd to the south, the existing developments and car park to the north as well east. A satellite image of the proposed development site and the northern elevation of the building are shown in Figure 1 and Figure 2, respectively.

This report details the opinion of Vipac as an experienced wind engineering consultancy regarding the wind effects in ground level footpath areas adjacent to the development as proposed. No wind tunnel testing has been carried out for this development at this stage. Vipac has carried out wind tunnel studies on a large number of developments of similar shape and having similar exposure to that of the proposed development. These serve as a valid reference for the prediction of wind effects. Empirical data for typical buildings in boundary layer flows has also been used to estimate the likely wind conditions on the ground level areas of the proposed development [2] & [3].

Drawings of the proposed development were supplied to Vipac by **Bruce Henderson Architects** in **April 2022.** A list of drawings supplied is provided in Appendix C of this report.

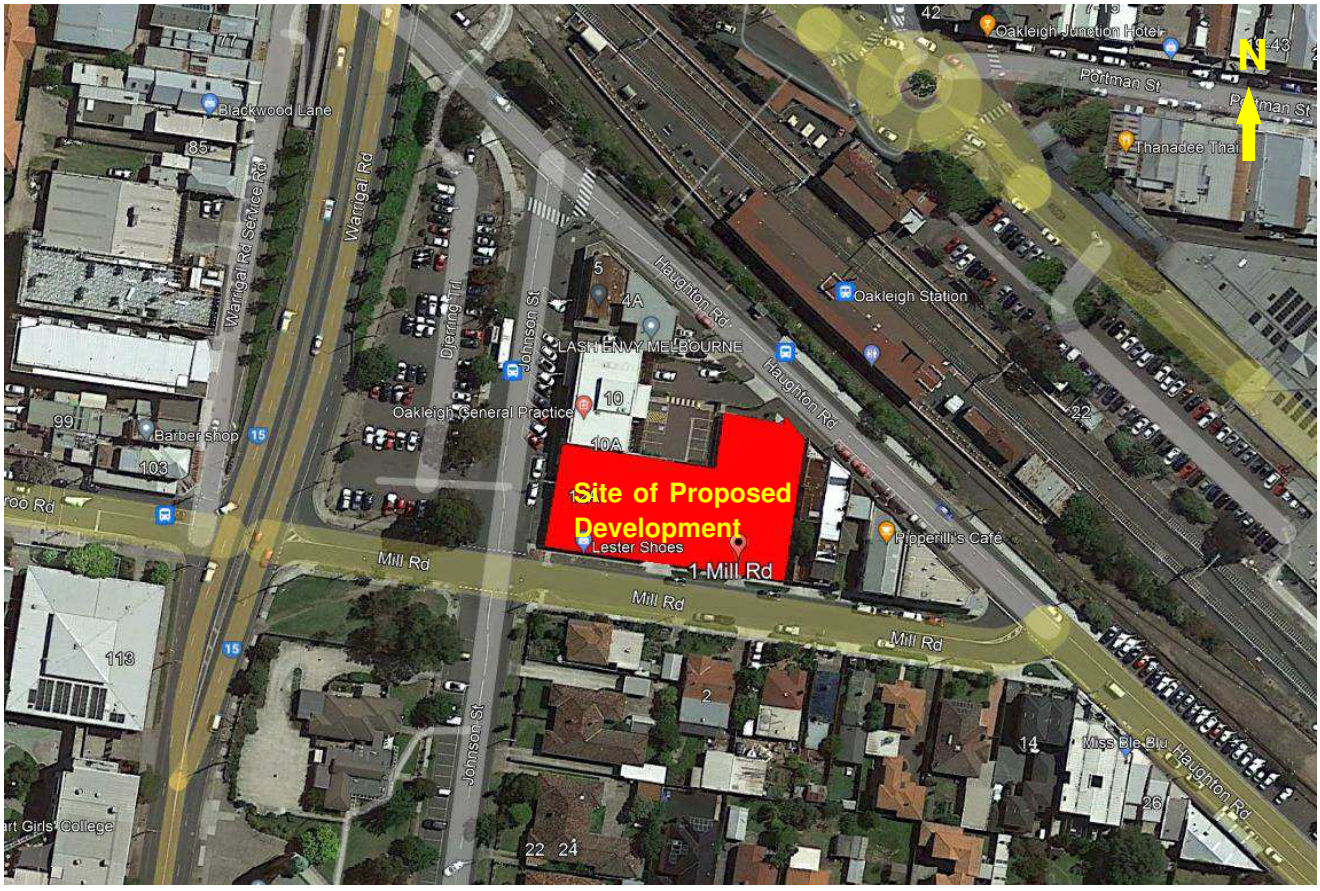


Figure 1: Aerial view of the proposed development site

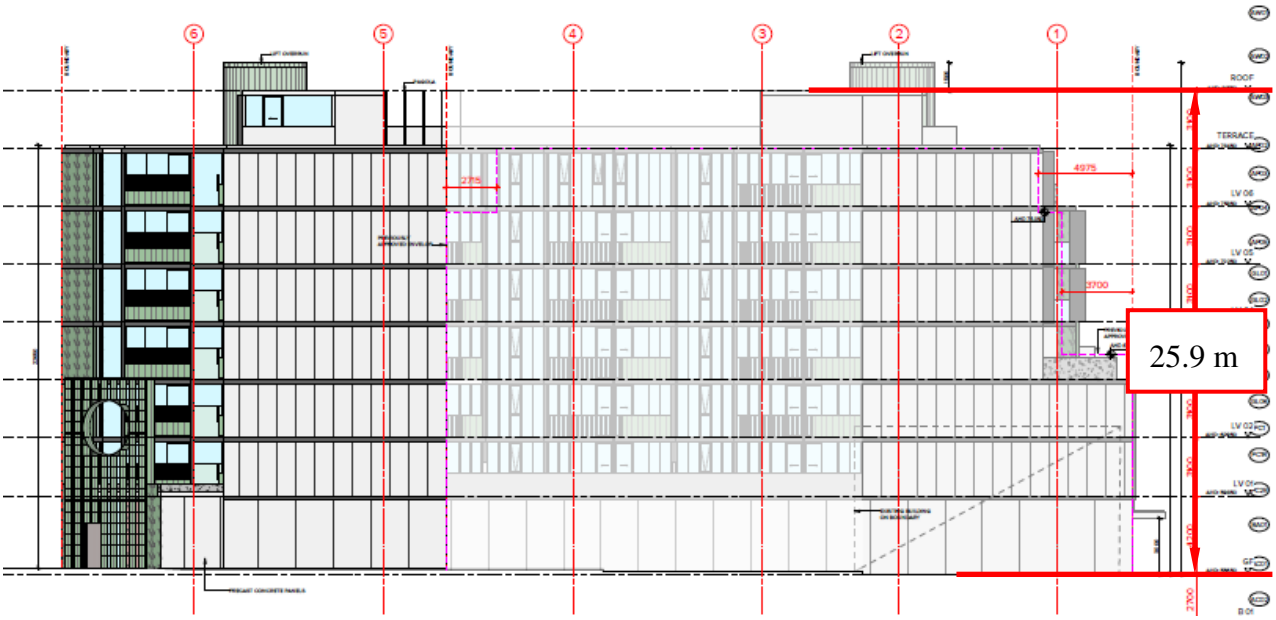


Figure 2: North Elevation of the proposed development.

2 Analysis Approach

In assessing whether a proposed development is likely to generate adverse wind conditions in ground level footpath areas, Vipac has considered the following five main points:

- The exposure of the proposed development to wind;
- The regional wind climate;
- The geometry and orientation of the proposed development;
- The interaction of flows with adjacent developments; and
- The assessment criteria determined by the intended use of the areas affected by wind flows generated or augmented by the proposed development.

The pedestrian wind comfort at specific locations of ground level footpath areas may be assessed by predicting the gust and mean wind speeds with a probability of 0.1% and 20% expected at that location. The location may be deemed generally acceptable for its intended use while gust and mean wind speeds are within the threshold values noted in Section 2.5. Where Vipac predicts that a location would not meet its appropriate comfort criterion, the use of wind control devices and/or local building geometry modifications to achieve the desired comfort rating may be recommended. For complex flow scenarios or where predicted flow conditions are well in excess of the recommended criteria, Vipac recommends scale model wind tunnel testing to determine the type and scope of the wind control measures required to achieve acceptable wind conditions.

2.1 Site Exposure

The proposed development is located on a relatively flat terrain. The site is surrounded within an approximately 1.5 km radius predominately by suburban residential dwellings and industrial warehouses. A satellite image showing these site surroundings is shown in Figure 3.

Considering the immediate surroundings and terrain, for the purposes of this study, the site of the proposed development is assumed to be within Terrain Category 3 for all wind directions (Figure 3).

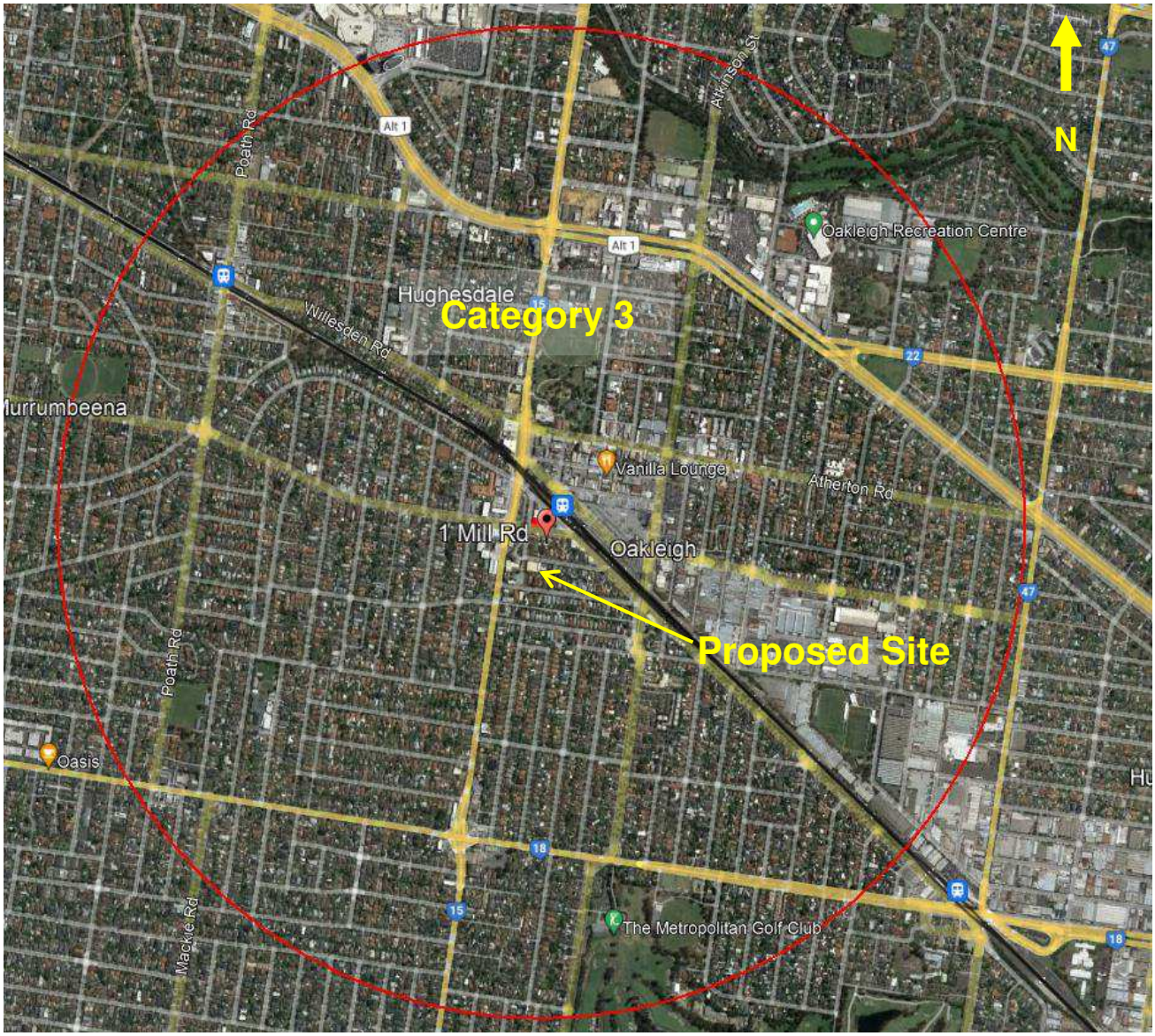


Figure 3: Assumed terrain categories for wind speed estimation.

2.2 Regional Wind Climate

The mean and gust wind speeds have been recorded in the Melbourne area for over 30 years. This data has been analysed and the directional probability distribution of wind speeds has been determined. The directional distribution of hourly mean wind speed at the gradient height, with a probability of 0.1% of time and 20% of time exceeded are shown in Figure 4. The wind data at this free stream height is common to all Melbourne city sites and may be used as a reference to assess ground level wind conditions at the site.

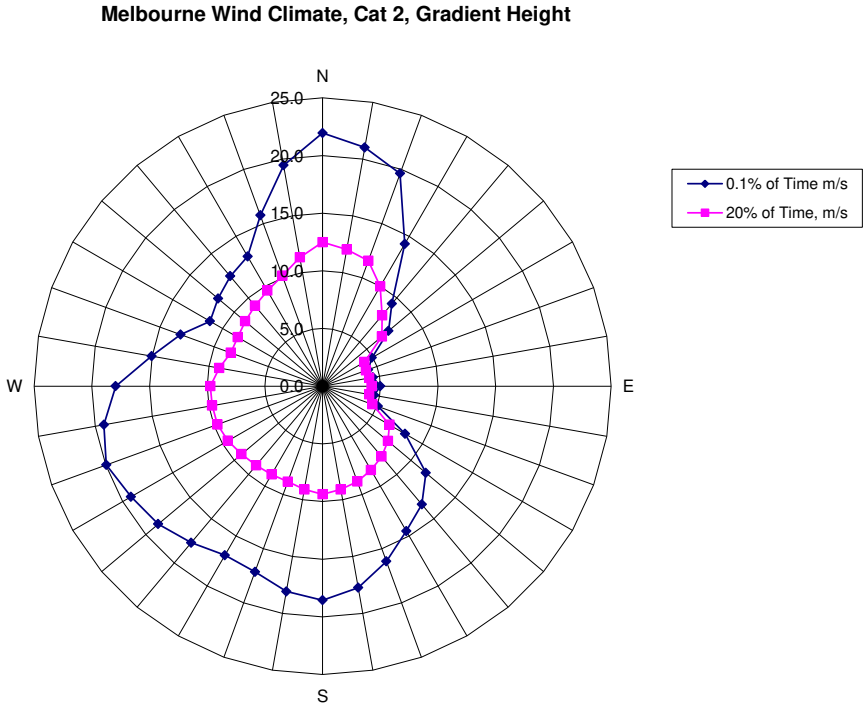


Figure 4: Directional Distribution of Mean Hourly Wind Velocities (m/s) for 0.1% and 20% exceeded at Gradient Height for Melbourne.

2.3 Building Geometry and Orientation

The proposed development is a 7-storey mixed-use building. The overall plan-form dimensions are approximately 36.58 m x 57.05 m as shown in Figure 5. The main entrances and retail entrances are located on Johnson Street and Mill Road as well as Haughton Rd at Northeast. The development incorporates canopy along Johnson Street and Mill Road. There is a courtyard proposed in north facing the car park/potential future development site.

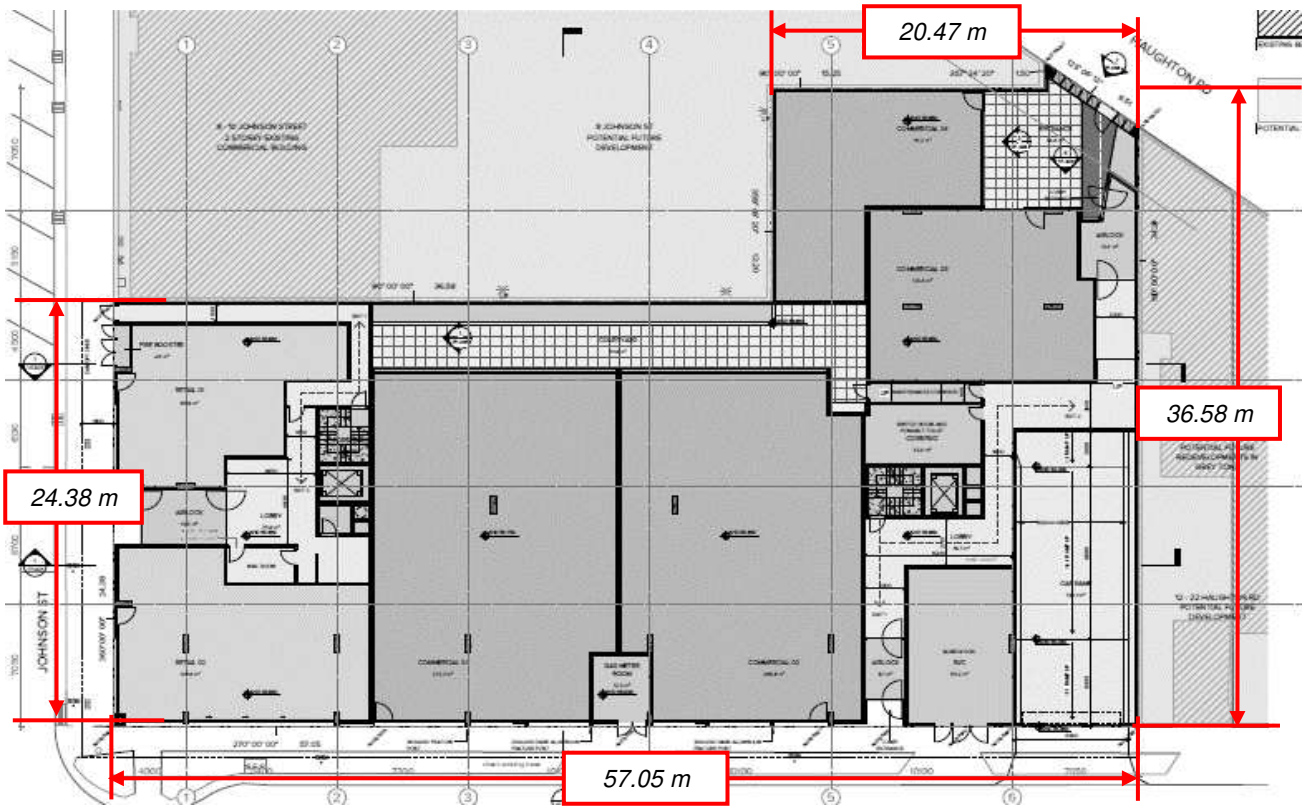


Figure 5: Ground floor plan with the plan-form dimensions overlaid.

2.4 Flow interactions with Adjacent Developments

The immediately adjacent developments are shown in Figure 6. At ground level, the site is exposed to direct winds from the northerly and west directions. The building is oriented such that adverse impacts from corner acceleration at southwest corner is expected at ground level. The development is taller than the surrounding buildings and so is exposed to winds from all directions at the upper levels.

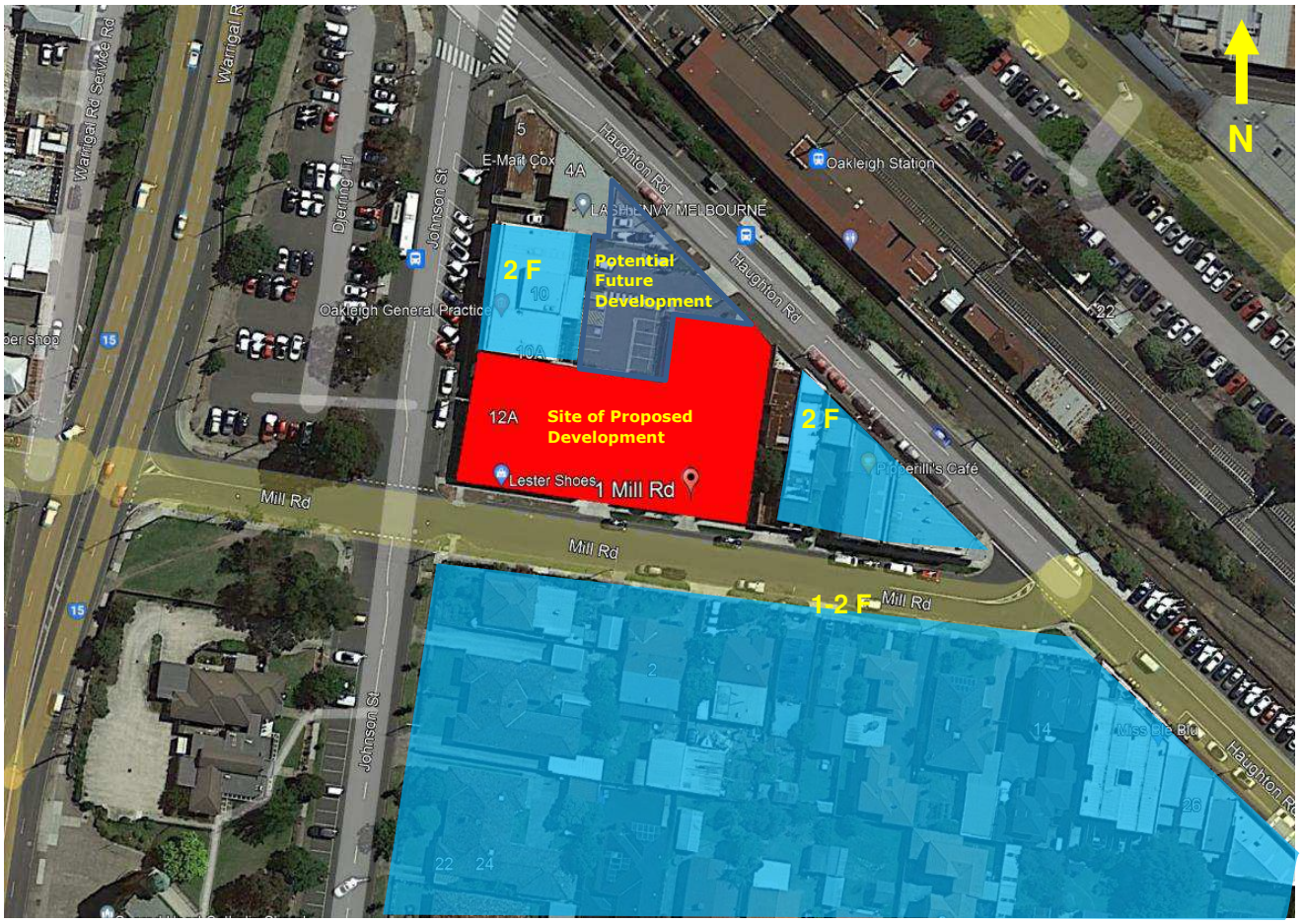


Figure 6: Immediately adjacent surroundings and their approximate number of floors (F)

2.5 Assessment Criteria

The following wind comfort criteria detailed in Table 1 were applied in this study.

Table 1: Wind Comfort Criteria as per Clause 58.04-4

Unsafe	Comfortable
Annual maximum 3 second gust wind speed exceeding **20m/sec** with a probability of exceedance of 0.1% considering at least 16 wind directions.	Hourly mean wind speed or gust equivalent mean speed from all wind directions combined with probability of exceedance less than 20% of the time, equal to or less than: **3m/sec** for sitting areas (outdoor cafés) **4m/sec** for standing areas (window shopping, queuing) **5m/sec** for walking areas (steady steps for most pedestrians)

This criterion specifically calls for the safety criterion to be used to assess infrequent winds (e.g. peak event of ≤ 0.1% of the time); and the perceived pedestrian comfort to be assessed based on frequently occurring winds (e.g. winds that occurs 80% of the time).

In Table 1, the mean wind velocity is defined as the maximum of hourly mean or gust equivalent mean (Gust/1.85).

This criteria specifies that safe and comfortable wind conditions must be achieved in publicly accessible areas within a distance equal to half the longest width of the building measured from all facades or half the overall height of the building, whichever is greater, as shown in Figure 7.

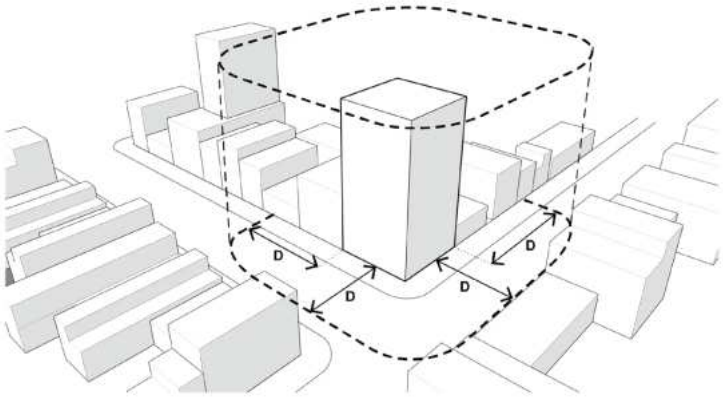


Figure 7: Assessment distance

2.5.1 Use of Adjacent Pedestrian Occupied Areas & Recommended Comfort Criteria

The following table lists the specific areas adjacent to the proposed development and the corresponding recommended criteria.

Table 2: Recommended application of criteria

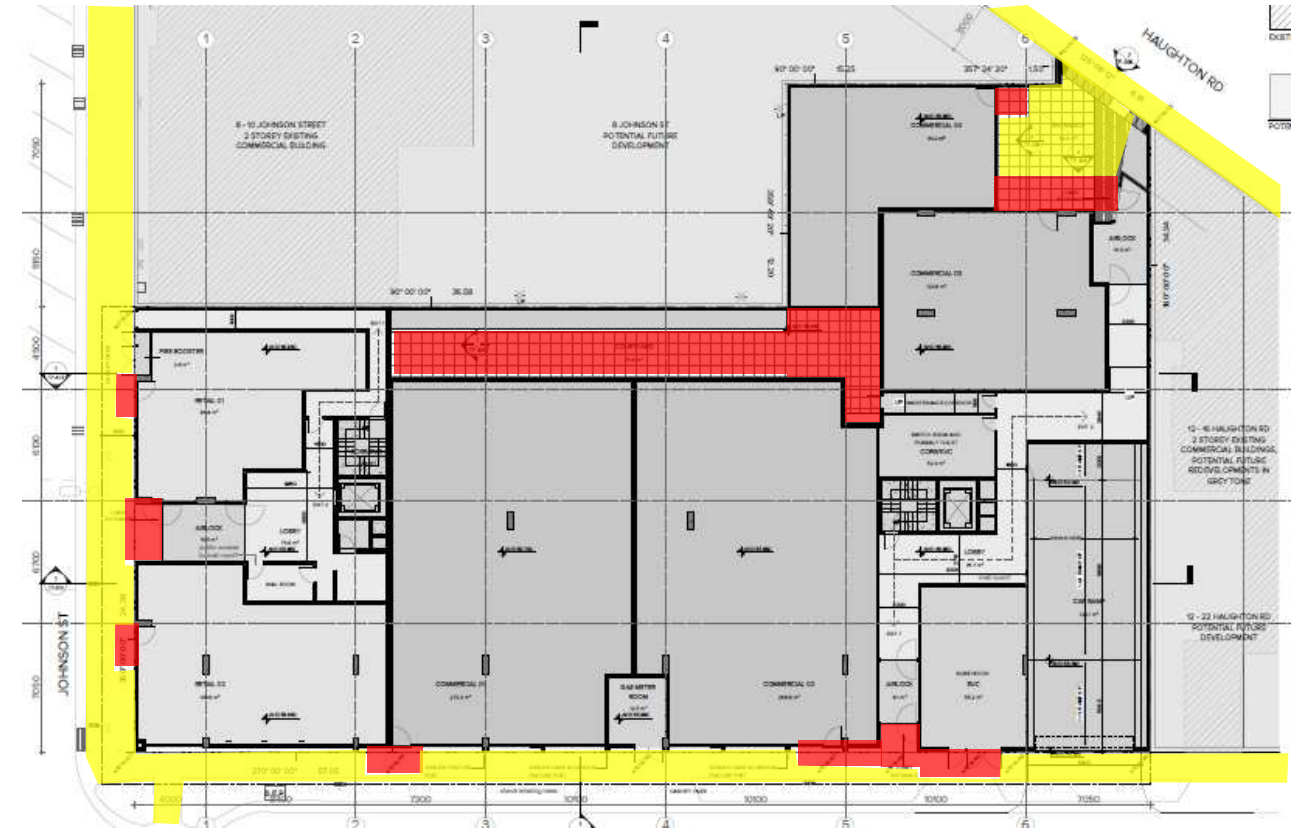
Area	Specific location	Recommended Criteria
Public Footpaths, Access ways	Along Johnson Street, Mill Road and Haughton Rd (Figure 8)	Walking
Building Entrances	Main Building Entrances Along Johnson Street, Mill Road and Haughton Rd (Figure 8)	Standing
Courtyard	North side (Figure 9)	Standing
Balcony/Terraces	Up the height of the building and residential garden on rooftop (Figure 9)	Walking (See discussion below)

2.5.2 Terrace / Balcony Recommended Criterion Discussion

There are Private Balconies and Terraces located up the height of the development. Vipac recommends as a minimum that balcony/terrace areas meet the criterion for walking since:

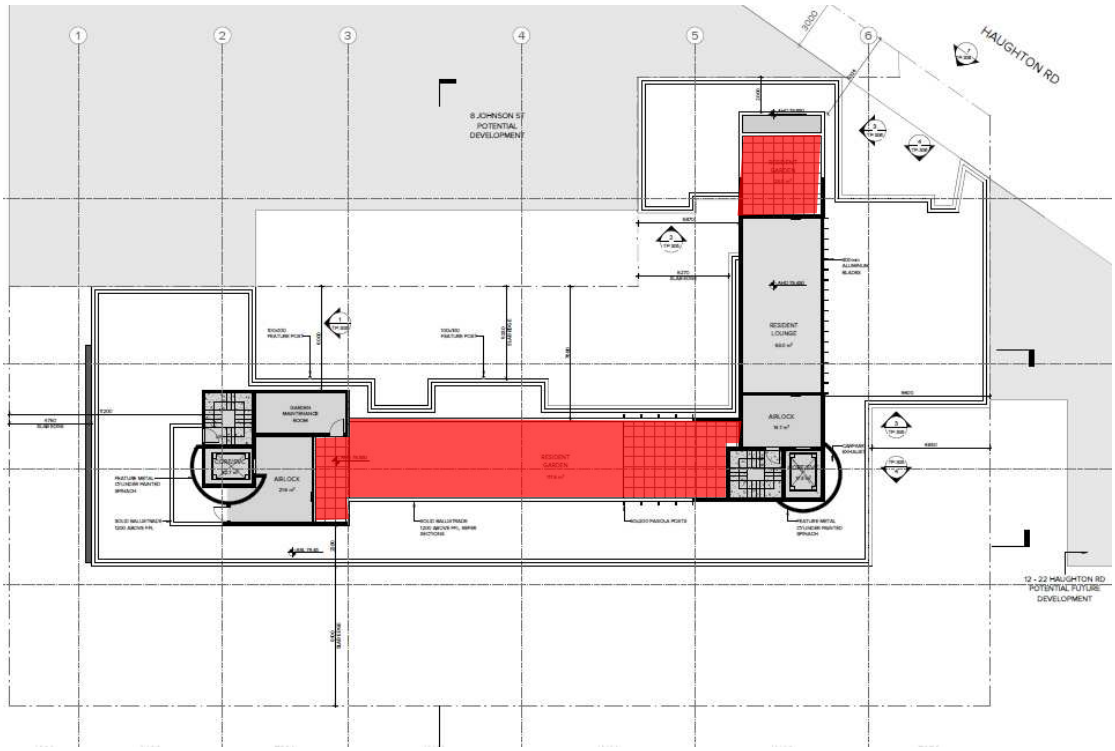
- these areas are not public spaces;
- the use of these areas is optional, and only intended to be used on fair weather days with calm winds;
- many similar developments in Melbourne and other Australian capital cities experience wind conditions on balconies and elevated deck areas in the vicinity of the criterion for walking.

In this study, apart from the balconies, the roof terrace/residential garden is assessed against Standing criterion.



Recommended to fulfil Walking *Recommended to fulfil Standing* *Recommended to fulfil Sitting*

Figure 8: Ground floor with recommended wind criteria overlaid



Recommended to fulfil Standing

Figure 9: Roof Plan with recommended wind criteria overlaid

3 Pedestrian Level Wind Effects

3.1 Discussion & Recommendations

The proposed design has a number of features that are expected to be beneficial to the pedestrian wind environment. This is inclusive but not limited to the following:

- Canopy along West and south sides;
- Residential entrance lobby setback;
- Partitions between private balconies.

Due to the massing of the proposed and canopy along west and south, pedestrian pathways around the proposed development are expected to fulfil the recommended criterion.

Main Entrances and retail entrances along west and south are expected to fulfil standing criterion. The entrances at the north east corner areas might have high wind conditions. Vipac recommends to relocate the retail entrance and add a canopy over the entrance areas (Figure 10).

The private balconies are generally expected to have wind speeds within the walking comfort criterion with the proposed design.

The rooftop terrace/garden is relatively exposed to northerly and southerly winds. With the standing comfort criterion is desired, it is recommended that the balustrades along the outer boundaries be made solid and raised to 1.8m high (Figure 11). The balustrade could be transparent for a better view at the terrace.

It should be noted that this study is based on experience only and has not utilised any experimental data for the analysis.

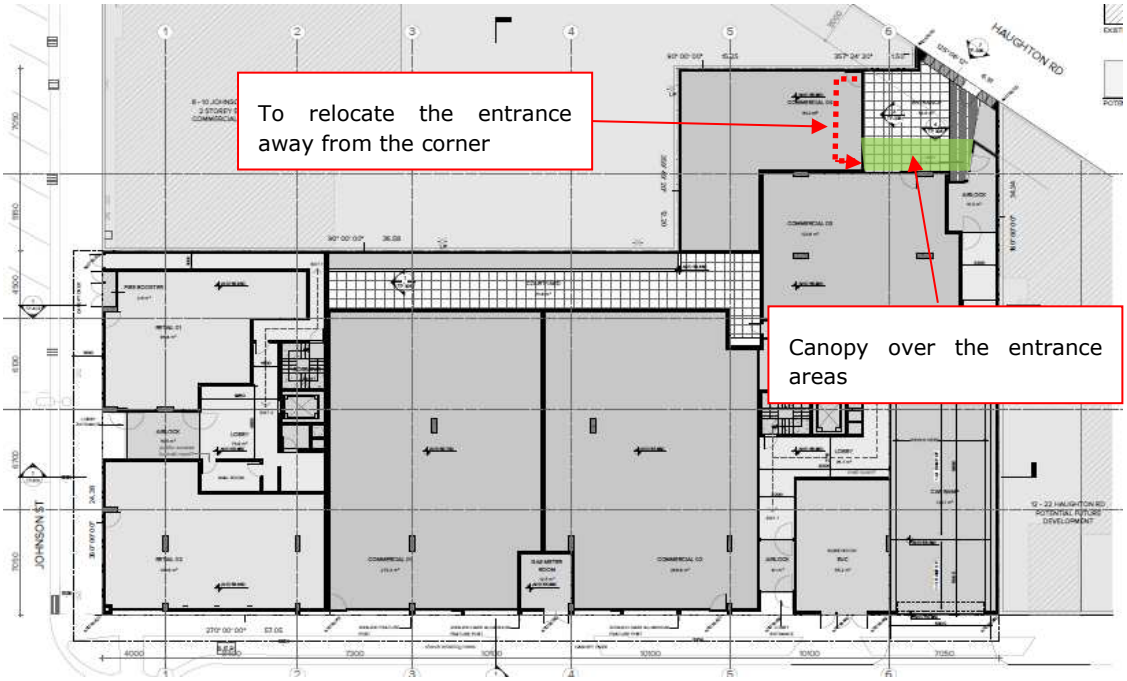


Figure 10: Ground floor plan with the recommended wind control measures overlaid

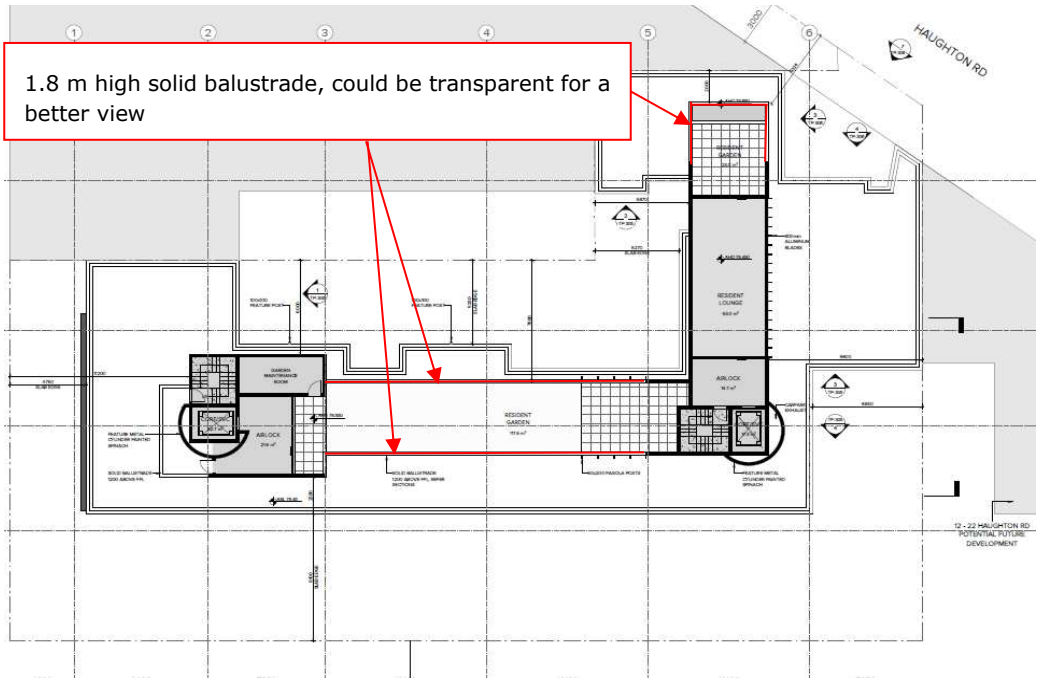


Figure 11: Roof plan with the recommended wind control measures overlaid

4 Conclusions

An appraisal of the likely wind conditions at the pedestrian ground level and balcony/terrace areas of the proposed development at **12-14 Johnson St &**& 1 **Mills Road, Oakleigh** has been made.

Vipac has carefully considered the form and exposure of the proposed development, nominated criteria for various public areas according to their function and referred to past experience to produce our opinion of likely wind conditions.

The findings of this study can be summarised as follows:

With proposed design:

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The assessments provided in this report have been made based on experience of similar situations in Melbourne and around the world. As with any opinion, it is possible that an assessment of wind effects based on experience and without experimental validation may not account for all complex flow scenarios in the vicinity.

This Report has been Prepared

For

Goldman Johnson Pty Ltd

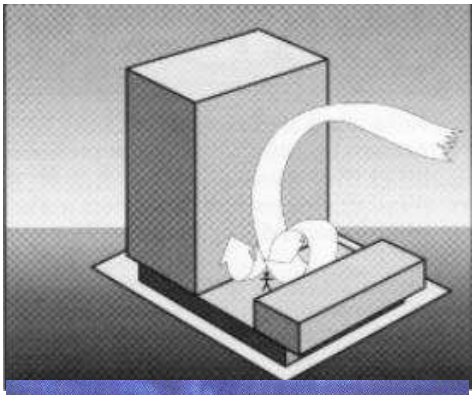
By

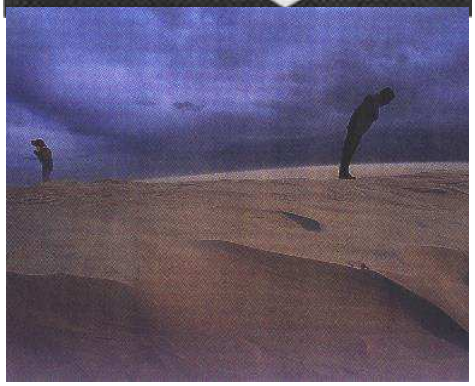
VIPAC ENGINEERS & SCIENTISTS PTY LTD.

Appendix A Environmental Wind Effects

References **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 unattenuated velocity, driven by atmospheric pressure gradients. The resultant increase in wind speed with height above ground is known as a wind velocity profile. When this wind profile encounters a tall building, some of the fast-moving wind at upper elevations is diverted down to ground level resulting in local adverse wind effects.





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.

Downwash – refers to a flow of air down the exposed face of a tower. A tall tower can deflect a fast-moving wind at higher elevations downwards.

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 aeroplane wing.

Flow separation – when wind flowing along a surface suddenly detaches from that surface and the resultant energy dissipation produces increased turbulence in the flow. Flow separation at a building corner or at a solid screen can result in gusty conditions.

Flow channelling – 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. Examples of this might occur between two towers, in a narrowing street or under a bridge.

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.

Appendix B References

[1] *Structural Design Actions, Part 2: Wind Actions*, Australian/New Zealand Standard 1170.2:2011

[2] *Wind Effects on Structures* E. Simiu, R Scanlan, Publisher: Wiley-Interscience

[3] *Architectural Aerodynamics* R. Aynsley, W. Melbourne, B. Vickery, Publisher: Applied Science Publishers

Appendix C Drawings List

Drawings Received: **April 5, 2022**

TP-205 Proposed floor plan – Ground
TP-206 Proposed floor plan – Level 1
TP-207 Proposed floor plan – Level 2
TP-208 Proposed floor plan – Level 3
TP-209 Proposed floor plan – Level 4
TP-209.5 Proposed floor plan – Level 5
TP-210 Proposed floor plan – Level 6
TP-211 Proposed floor plan - Terrace

TP-301 West Elevation
TP-302 South Elevation
TP-303 East Elevation
TP-304 North Elevation
TP-305 Partial Elevation –Sheet 01
TP-306 Partial Elevation –Sheet 02
TP-401 Section 01
TP-402 Section 02
TP-403 Section 03