SITE 5, EDMONDSON PARK

EDMONDSON PARK, NSW

PEDESTRIAN WIND ASSESSMENT

PROJECT # 2205897

JULY 25, 2022

SUBMITTED TO

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1. INTRODUCTION

RWDI Australia Pty Ltd (RWDI) was retained to undertake a pedestrian wind assessment of the proposed Site 5 development located in Edmondson Park, NSW. The project site is located approximately 32 km to the southwest of Sydney CBD. The site is bound by Buchan Avenue to the north, an enclosed service lane to the east, the Rail Corridor the south, and Faulkner Way to the west. Entrance lobbies to the proposed buildings and access to the parking are located along Faulkner Way. The site location within its broader context is shown in Image 1.

Image 1: Aerial View of the Site Location within its Existing Surrounding Context
Source: Nearmap

The proposed development consists of 4 residential buildings with multiple communal open spaces between the buildings. Each pair of the buildings sits atop a common podium element that also serves as a carpark. The key outdoor pedestrian accessible areas of interest associated with the development include the pedestrian footpaths around the site, entrances to the buildings, and the various communal spaces on the ground and upper levels.

Image 2: Rendering of the Proposed Development

2. METHODOLOGY

Predicting wind speeds and occurrence frequencies around a building is a complex process and involves the combined assessment of building geometry, orientation, position and height of surrounding buildings, upstream terrain and the local wind climate. Over the years, RWDI has conducted thousands of wind-tunnel model studies and CFD assessments on pedestrian wind conditions around buildings, yielding a broad knowledge base of potential flow behaviour. In some situations, this knowledge and experience, together with literature, allows for a reliable, consistent and efficient desktop estimation of pedestrian wind conditions without wind-tunnel testing.

This qualitative approach provides a screening-level estimation of potential wind conditions and offers conceptual wind control measures to improve wind comfort, where deemed necessary. In order to quantify and confirm the predicted conditions or to refine any of the suggested conceptual wind control measures, physical scale model tests in a boundary-layer wind tunnel would be required.

RWDI's assessment is based on the following:

- A review of the regional long-term meteorological data;
- Drawings and models of the development site received by RWDI in July 2022.
- Use of RWDI's proprietary software (*WindEstimator*[1]) for providing a screening-level numerical estimation of potential wind conditions around generalised building forms;
- Wind-tunnel studies and desktop assessments undertaken by the team for projects in the region;
- Our engineering judgement, experience, and expert knowledge of wind flows around buildings[2, 3]; and,
- RWDI Criteria for pedestrian wind comfort and safety.

Note that other microclimate issues such as those relating to cladding and structural wind loads, door operability, building air quality, noise, vibration, etc. are not part of the scope of this assessment.

1. H. Wu, C.J. Williams, H.A. Baker and W.F. Waechter (2004), "Knowledge-based Desk-Top Analysis of Pedestrian Wind Conditions", ASCE Structure Congress 2004, Nashville, Tennessee.
2. H. Wu and F. Kriksic (2012). "Designing for Pedestrian Comfort in Response to Local Climate", Journal of Wind Engineering and Industrial Aerodynamics, vol.104-106, pp.397-407.
3. C.J. Williams, H. Wu, W.F. Waechter and H.A. Baker (1999), "Experience with Remedial Solutions to Control Pedestrian Wind Problems", 10th International Conference on Wind Engineering, Copenhagen, Denmark.

3. METEOROLOGICAL DATA

It is noted that the inland location of the site is less exposed to prevailing sea breezes common in most coastal areas around Sydney. Meteorological data from Bankstown Airport (rather than data from Sydney International Airport) is, therefore, considered to be more representative for the site.

Wind statistics recorded at Bankstown Airport were analysed for the period between 1999 and 2019 (inclusive) for the summer (Nov-Apr) and winter (May-Oct) seasons. Image 4 graphically depicts the directional distributions of wind frequencies and speeds. Winds from the south-east and north-east are noted to be predominant during summers with secondary winds from the south-west direction. During winters, winds from the south-west to north-north-west sectors are predominant. Strong winds of a mean speed greater than 30 km/h measured at the airport (at an anemometer height of 10 m) occur for over 2% of the time during the summer and the winter season.

Wind statistics recorded at Bankstown Airport meteorological station are generally calmer than those measured at Sydney International Airport. This is expected since the Bankstown Airport is located further away from the coast and, therefore, wind speeds are typically lower due to the sheltering provided by the upwind terrain.

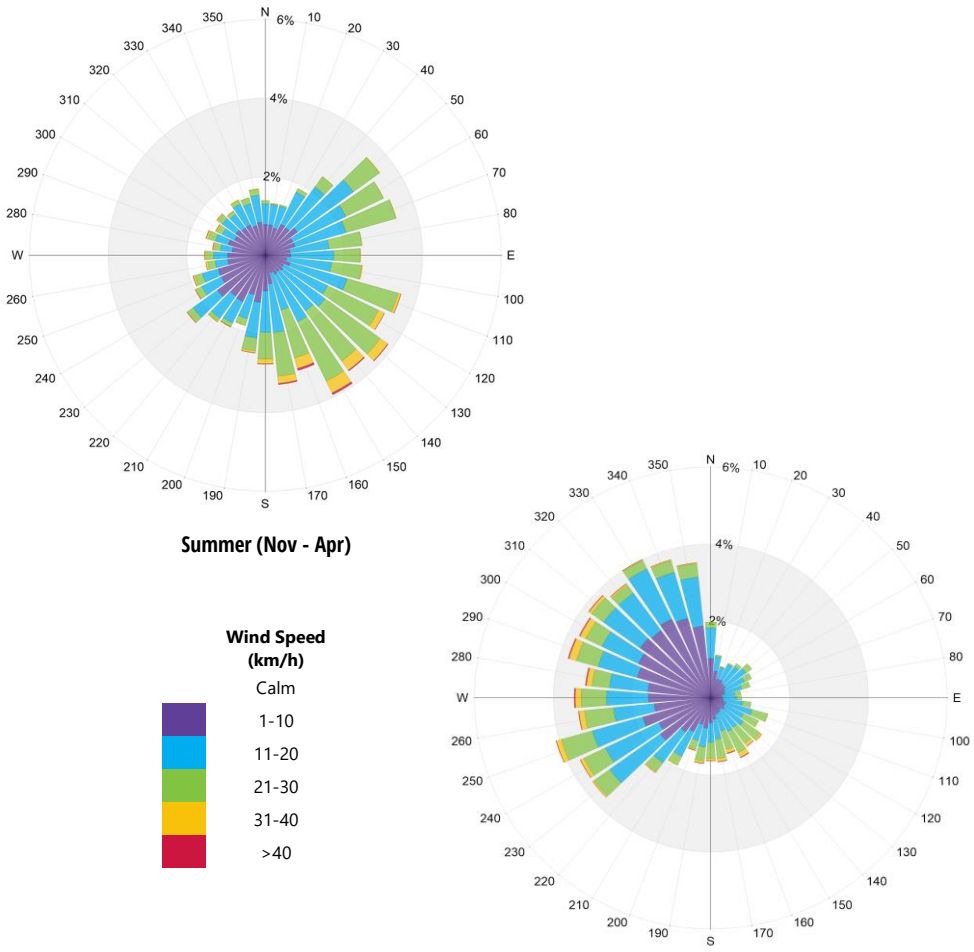


Image 3: Directional distribution of winds approaching Bankstown Airport (1999 to 2019)

4. RWDI PEDESTRIAN WIND CRITERIA

4.1 Safety Criterion

Pedestrian safety is associated with excessive gusts that can adversely affect a pedestrian's balance and footing. If strong winds that can affect a person's balance (83 km/h) occur more than 0.1% of the time or 9 hours per year, the wind conditions are considered severe. These generally coincide with areas of high wind activity noted in the report.

4.2 Pedestrian Comfort Criteria

The RWDI pedestrian wind comfort criteria, depicted in Image 4, are used in the current study. These criteria have been developed by RWDI through research and consulting practice since 1974 and have also been widely accepted by municipal authorities, building designers and the city planning community worldwide. These are categorised based on typical / intended pedestrian activities.

Note that wind conditions are assessed at a typical pedestrian chest height and are considered suitable for the intended use of the space if the associated mean winds are expected for at least 80% of the time. Wind control measures are typically required at locations where winds are rated as uncomfortable or they exceed the wind safety criterion.

Furthermore, note that these criteria for wind forces represent average wind tolerance. These are sometimes subjective with regional differences in wind climate and thermal conditions as well as variations in age, health, clothing, etc. also affecting people's perception of the wind climate. For a full assessment of comfort, it is recommended that a thermal comfort study be undertaken.

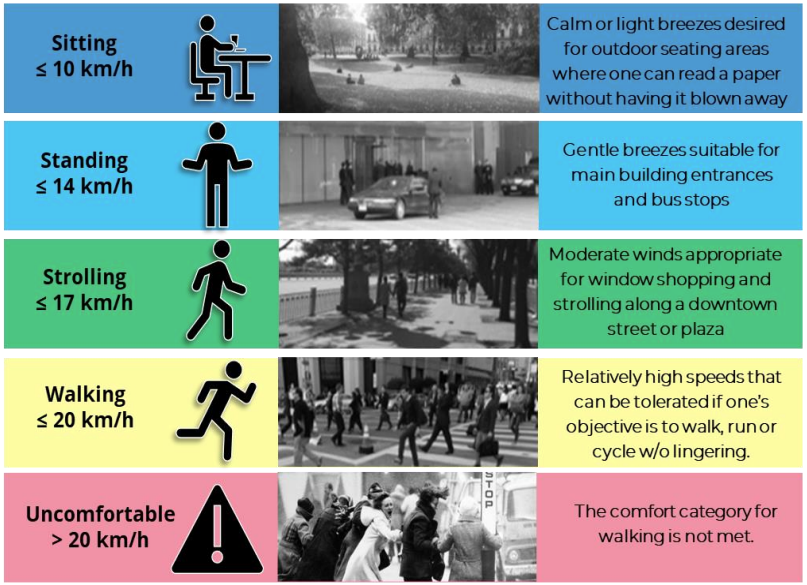
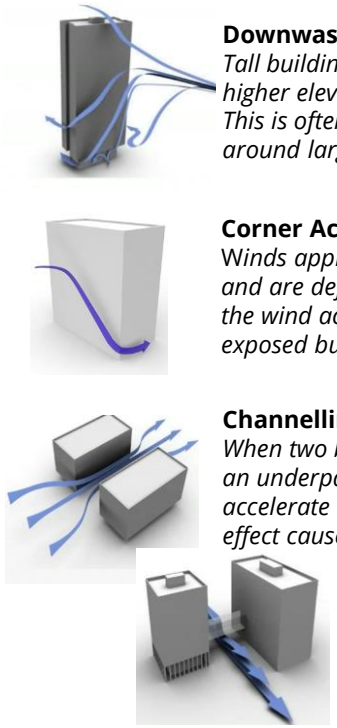


Image 4: RWDI Pedestrian Wind Comfort Criteria

5. RESULTS AND DISCUSSION

5.1 General Wind Flow around Buildings

In our discussion of wind conditions on and around the proposed development, reference may be made to the following generalised wind flows (see Image 5). If these building / wind combinations occur for prevailing winds, there is a greater potential for increased wind activity and uncomfortable or potentially unsafe conditions.



Downwashing
Tall buildings tend to intercept the stronger winds at higher elevations and redirect them to the ground level. This is often the main cause for wind accelerations around large buildings at the pedestrian level.

Corner Acceleration
Winds approach at an oblique angle to a tall façade and are deflected down causing a localised increase in the wind activity or corner acceleration around the exposed building corner(s) at pedestrian level.

Channelling
When two buildings are situated side by side or an underpass is created, wind flow tends to accelerate through the space due to channeling effect caused by the narrow gap.

Image 5: General Wind Flow around Buildings

Design details such as setting back a tower from the edges of a podium, deep canopies close to ground level, wind screens / tall trees with dense landscaping, etc. (Image 6) can help reduce high wind activity. The choice and effectiveness of these measures would depend on the exposure and orientation of the site with respect to the prevailing wind directions and the size and massing of the proposed buildings.

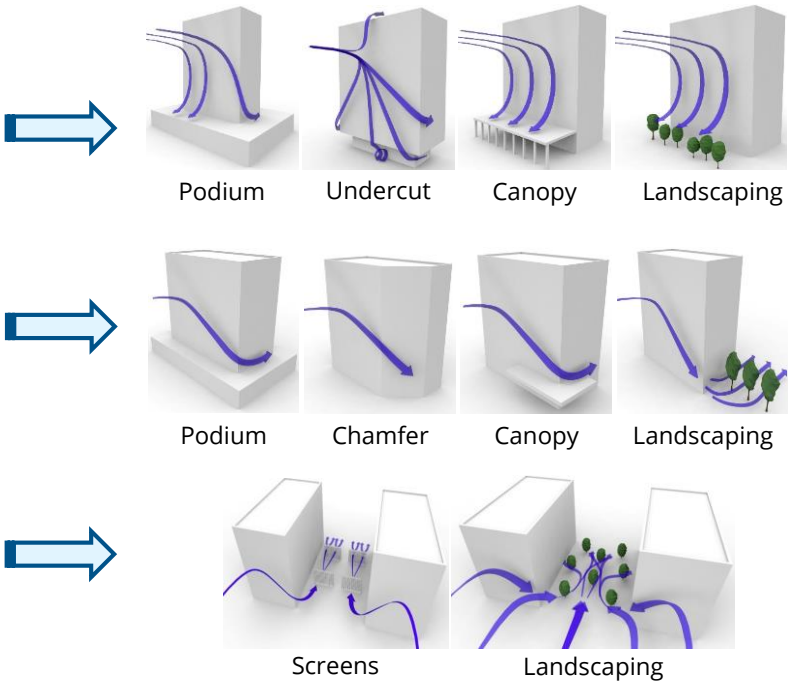


Image 6: Examples of Common Wind Control Measures

5. RESULTS AND DISCUSSION

5.2 Existing Site Conditions

The existing site is currently vacant and is shielded from the prevailing south-easterly sector winds during the summers due to the mid-rise residential buildings along Soldiers Parade. The site is, however, exposed to the regional north-easterly winds and the winter westerly and north-westerly winds that can move unimpeded across the area. The vegetation around the existing site will likely provide some buffer to the approaching winds with conditions within the site likely suitable for passive use (sitting and standing use). Wind speeds exceeding the safety margin are also not expected.

5.3 Proposed Wind Conditions

The proposed development takes advantage of several positive design features that are likely to reduce the overall wind activity around the site. These include the broad building articulations, the strategic use of landscaping around the site, single-aspect balcony design, and the use of setbacks and podia to capture higher level winds. Furthermore, similar to the existing site, the proposed buildings are generally shielded from the prevailing south-easterly sector winds during the summers. These winds are expected to present at the site with reduced intensity. Therefore, wind speeds exceeding the safety criterion are not expected around the site.

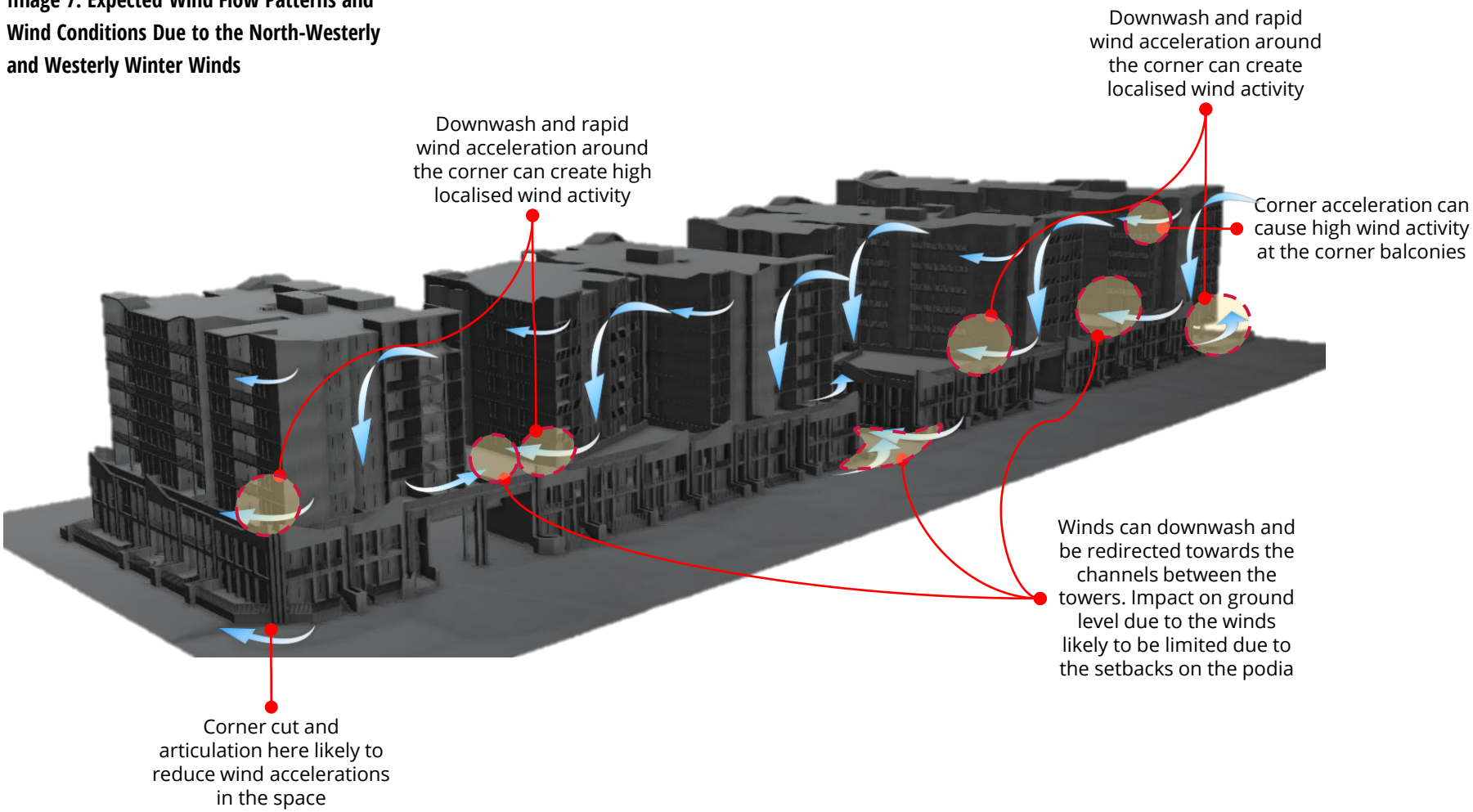
Prevailing Wind Interactions

The interaction of the prevailing regional winds with the proposed massing of the development is indicated in Images 7 and 8. The orientation of the buildings can redirect these winds towards the communal outdoor terraces atop the podia. The wind acceleration around exposed corners of the buildings and the subsequent channelling can create high wind activity within the communal terraces that will likely be unsuitable for the intended passive use of these spaces. The north-westerly and westerly winter winds are also likely to influence the outdoor thermal comfort of these spaces. The setback of the proposed buildings atop the podia is likely to protect a majority of ground level areas around the site. However, the podium elements can redirect a large volume of the regional winds around the corners creating localised spots of wind activity. In addition, the orientation and opening of the through-site link has the potential to propagate channelling effects, which can be uncomfortable for patrons during the winter season when the westerlies occur more frequently.

Extensive landscaping has been proposed around the site with trees situated strategically around exposed corners on the ground level. Clusters of trees have also been used atop the podia to mitigate the wind movement within the communal terraces. It is recommended to incorporate localised canopies / trellises above the proposed seating spaces along the eastern edge of the terraces to provide additional shelter to patrons using the spaces. The combined effect of these elements is likely to create a comfortable wind amenity for the development site.

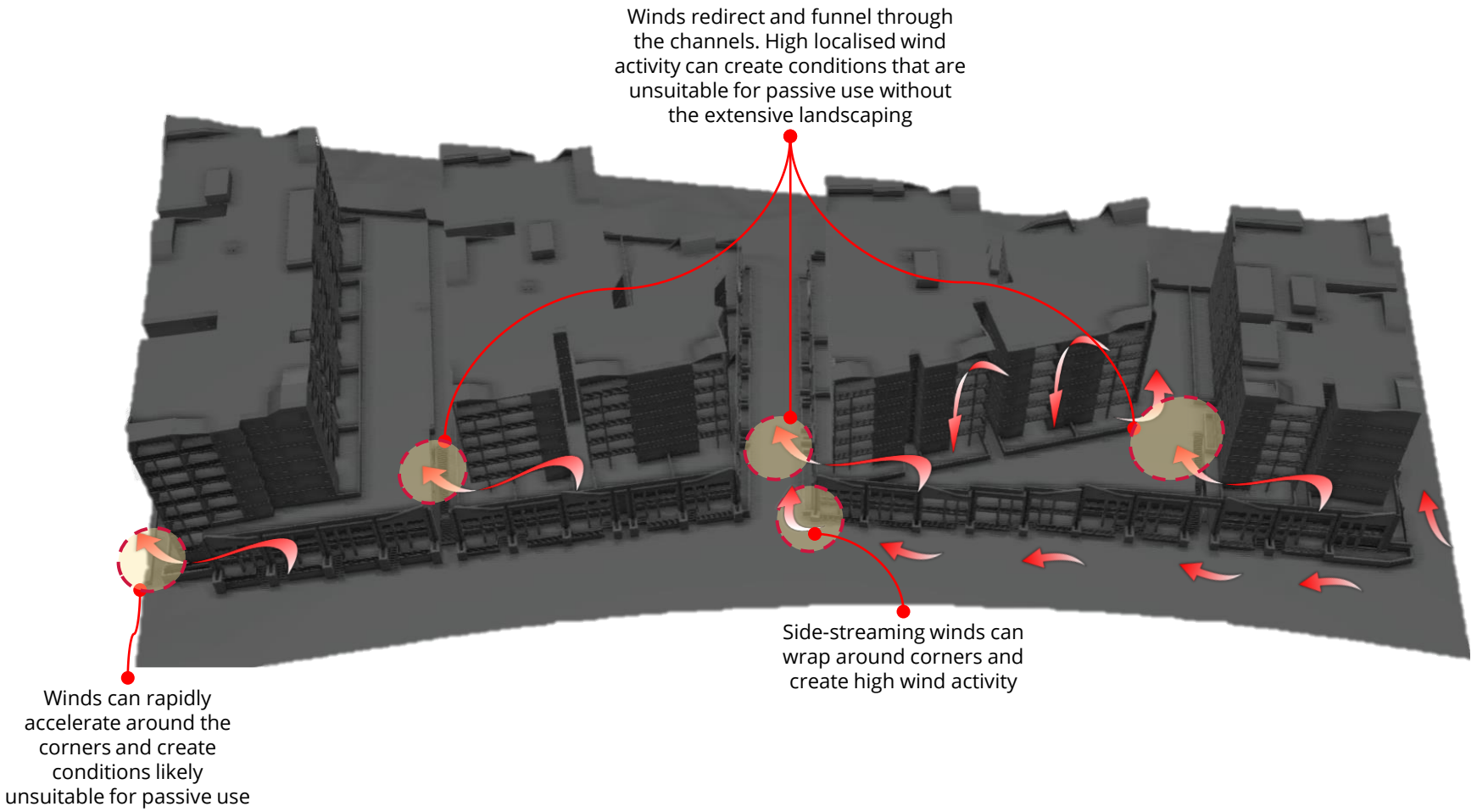
5. RESULTS AND DISCUSSION

Image 7: Expected Wind Flow Patterns and Wind Conditions Due to the North-Westerly and Westerly Winter Winds



5. RESULTS AND DISCUSSION

Image 8: Expected Wind Flow Patterns and Wind Conditions Due to the North-Easterly Summer Winds



5. RESULTS AND DISCUSSION

Private Balconies

Most of the private balconies are inset within the planform of the proposed buildings or incorporate screening along one of the aspects along the corner - creating a single aspect design. However, the northwestern corner balconies of Building D can be exposed to localised high wind activity due to winds accelerating around the corner. Balcony designs which are not single aspect should consider the inclusion of screening (similar to other balconies within the development) or impermeable balustrades around the perimeter of the balconies. This can be investigated further during the Detail Design Stage of the development.

5.4 Future Wind Conditions

Note that the wind commentary provided in this report is based on the existing surrounding context of the precinct which is largely vacant. However, noting that the Edmondson Park was rezoned for urban development, a number of future developments are expected around the sites in the immediate vicinity of the proposed development (Image 9).

With the inclusion of these future buildings, the overall wind environment of the precinct will generally shift. Depending on the scale of these buildings, key wind sensitive areas can change with further development along Buchan Avenue likely to provide benefit to the proposed development site in terms of wind exposure. A precinct scale masterplan wind study is generally recommended for such areas.

Image 9: Future Development Sites

6. SUMMARY

Wind conditions on and around the proposed Site 5 development located in Edmondson Park, NSW are discussed in this report. The qualitative assessment is based on the review of local wind climate and the current design of the proposed development. The impact of the surrounding buildings (including future buildings) and the local land topography has also been considered. The assessment is based on our experience with wind tunnel testing and CFD analysis of similar developments within the region.

The proposed development includes several positive design features including building articulation, the strategic use of landscaping, and the use of setbacks and podia to mitigate ground level winds. These elements are expected to allow majority of the areas in and around the proposed development site to be suitable and safe for intended pedestrian use. However, areas that will likely be exposed to high wind activity, particularly at exposed corners on the upper-level terraces, have been identified. Wind control measures have, therefore, been discussed in the report and, with the proposed landscaping, are expected to improve the wind conditions within these areas. RWDI will further assist the design team during the Detailed Design stage of the project through wind tunnel testing to quantify and conform the predicted wind conditions discussed in the report. The conceptual wind control measures will also be further refined as part of the Detailed Design of the development.

Note that the assessed wind conditions only represent the average wind tolerance of occupants and is only one metric to understand overall comfort. Wind comfort is also sometimes subjective and regional differences in wind climate and thermal conditions as well as variations in age, health, clothing, exposure to sunlight and shading etc. can also affect a person's perception of the wind climate. Therefore, given the scale of the precinct and likely future developments, it is recommended that a thermal comfort assessment be carried out for a holistic understanding of comfort around the development site. Undertaking such an assessment can provide an exceptional level of insight into the combination of unique factors that impact a person's comfort, including temperature, humidity, wind, solar radiation, and how the space will be used. The information gained can be used to better plan the usage of outdoor spaces and can also provide additional insights into the site conditions as the precinct develops further.

7. APPLICABILITY OF ASSESSMENT

The assessment discussed in this report pertains to the proposed development in accordance with the drawings and information received in July 2022. In the event of any significant changes to the design, construction or operation of the building or addition of surroundings in the future, RWDI could provide an assessment of their impact on the wind conditions discussed in this report. It is the responsibility of others to contact RWDI to initiate this process.

Statement of Limitations

This report entitled Pedestrian Wind Assessment, dated July 25, 2022 was prepared by RWDI Australia Pty Ltd ("RWDI"). The findings and conclusions presented in this report have been prepared for the Client and are specific to the project described herein ("Project"). The conclusions and recommendations contained in this report are based on the information available to RWDI when this report was prepared. Because the contents of this report may not reflect the final design of the Project or subsequent changes made after the date of this report, RWDI recommends that it be retained by Client during the final stages of the project to verify that the results and recommendations provided in this report have been correctly interpreted in the final design of the Project.

The conclusions and recommendations contained in this report have also been made for the specific purpose(s) set out herein. Should the Client or any other third party utilize the report and/or implement the conclusions and recommendations contained therein for any other purpose or project without the involvement of RWDI, the Client or such third party assumes any and all risk of any and all consequences arising from such use and RWDI accepts no responsibility for any liability, loss, or damage of any kind suffered by Client or any other third party arising therefrom.

Finally, it is imperative that the Client and/or any party relying on the conclusions and recommendations in this report carefully review the stated assumptions contained herein and to understand the different factors which may impact the conclusions and recommendations provided.