WAVERLEY COLLEGE

131 BIRRELL STREET, WAVERLEY, NSW

PEDESTRIAN WIND ASSESSMENT

PROJECT # 2405611

JUNE 14, 2024

SUBMITTED TO

M3 Architecture
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SUBMITTED BY

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DOCUMENT CONTROL

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C	Commentary included for updated courtyard	14/06/2024	AMC	JG

RWDI

RWDI is a team of highly specialised consulting engineers and scientists working to improve the built environment through three core areas of practice: building performance, climate engineering and environmental engineering. More information is available at www.rwdi.com.

QUALITY ASSURANCE

RWDI Australia Pty Ltd operates a Quality Management System which complies with the requirements of AS/NZS ISO 9001:2015. This management system has been externally certified by SAI Global and Licence No. QEC 13457 has been issued for the following scope: The provision of consultancy services in acoustic engineering, air quality and wind engineering; and the sale, service, support and installation of acoustic monitoring and related systems and technologies.

1. INTRODUCTION

RWDI Australia Pty Ltd (RWDI) was retained to undertake a pedestrian wind assessment of the subject State Significant Development Application (SSD-42425537) that involves alterations and additions to the existing Waverley College at 131 Birrell Street, Waverley (Image 1).

The proposed development involves works across the site in two parts, referred to as the east and west precincts (Images 2a and 2b). The works are proposed to be undertaken over four (4) stages as well as a range of refurbishment miscellaneous works that will be undertaken over a 15–20-year period.

The west precinct proposal involves alterations and additions to existing structures, refurbishment of existing components of the site and landscape works. The west precinct scope of works involves the following buildings/areas:

- Refurbishment of the Centenary Quad
- Refurbishment of the Centenary building
- Library extension
- Extension to Chapel entry

Landscape and external works include:

- New covered link between Centenary building and Conlon building
- New covered link along the South of the Centenary building
- Refurbishment of Kenny Building landscaping
- Extension of existing pool to enable accessible access.
- Demolition of 10, 10a and 8 Carrington Road, and
- Provision of temporary car parking during construction and new sports courts.

The east precinct proposal involves the demolition of existing structures including the residential dwellings and the construction of a new six storey building and an adjacent car park and tennis courts. The proposal also involves general landscape works. The east precinct scope of works involves the following buildings/areas:

- Demolition of 5-7, 9-11 and 17-19 Henrietta Street
- Construction of 6 storey new Building 1 for school purposes, undertaken over 2 stages
- Construction of new car parking
- New tennis court facilities, and
- Re-landscaping throughout the proposal precinct.

This desk-based report provides a review of the potential wind conditions around the subject site and offers conceptual wind control measures and design advice, if required, that is suitable for early design of the development. The key outdoor pedestrian accessible areas of interest associated with the development include the amenity areas on the ground and upper levels, pedestrian footpaths around the site, and the entrances to the buildings.

1. INTRODUCTION

Image 1: Project Location and Surroundings Context

1. INTRODUCTION

Masterplan Carparking Total = 79

Legend

FUTURE STAGING AND INCREMENTAL WORKS

West Precinct - Main

- W1 Centenary Main - West & North
- W2 Centenary Main - East

West Precinct - Small Projects

- W3 Library/Chapel Extension (Yr 12 Space)
- W4 Covered Library Area/Rooftop Deck
- W5 Conlon Link
- W6 Kenny Link & Landscaping
- W7 Airmount Courtyard
- W8 Conlon Building Level 3 & Balconies Refurbishment
- W10 Pool Ramp
- W11 Temporary Carpark
- W12 Outdoor Active Space

STAGES 1 AND 2

East Precinct

- E1 New Building 1 Phase 1 & Carpark
- E2 New Building 1 Phase 2 & Tennis (carpark converted to tennis court)
- E3 Braidwood Court

Image 2a: Proposed Masterplan

Source: m3architecture Consultant Brief

1. INTRODUCTION

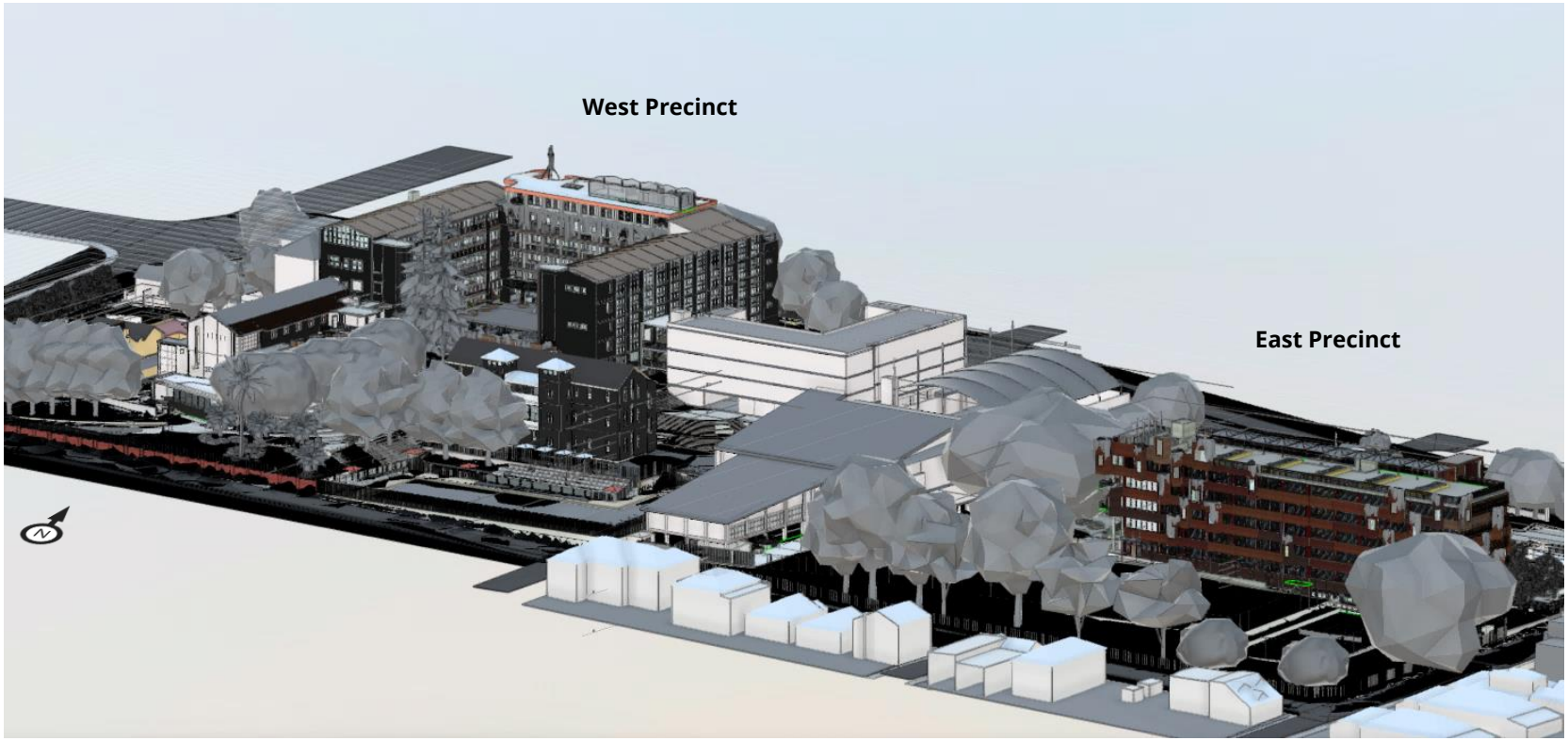


Image 2b: 3D Model of the Proposed Development Site

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. RWDI has amassed extensive expertise through conducting numerous wind-tunnel model studies and Computational Fluid Dynamics (CFD) assessments specifically focused on pedestrian wind conditions around buildings. This wealth of experience, complemented by comprehensive literature, facilitates a reliable and efficient desktop estimation of pedestrian wind conditions for concept designs without the need for wind-tunnel testing or detailed CFD studies.

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 information received by RWDI between April and June 2024;
- Wind-tunnel studies, CFD simulations, and desktop assessments undertaken by the microclimate team for projects in the region;
- Our engineering judgement, experience, and expert knowledge of wind flows around buildings[1, 2]; and,
- Pedestrian Wind Comfort Criteria as set out in Waverley Development Control Plan (2022).

In accordance with the Environmental Planning & Assessment Act 1979 (EP&A Act), Planning Secretary's Environmental Assessment Requirements (SEARs) for SSD-42425537 have been issued. This report has been prepared to respond to the issued SEARs, as set out in the table below.

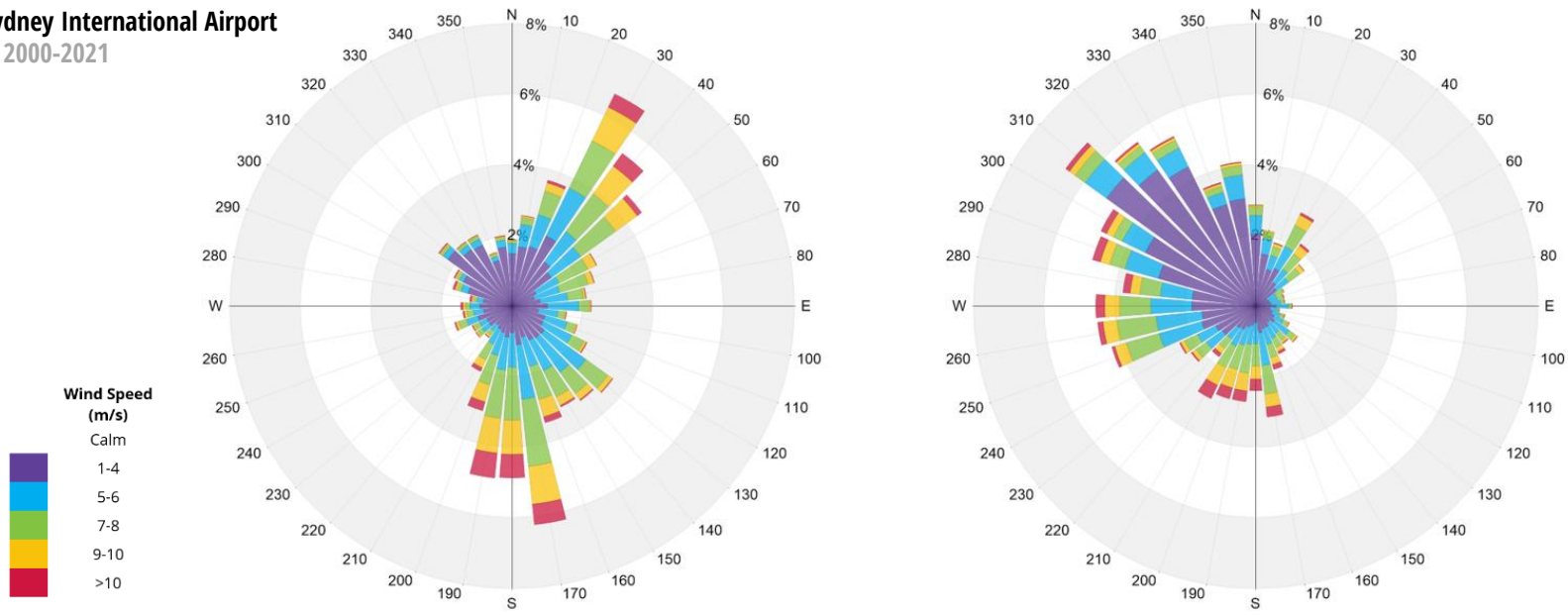
Issue and Assessment Requirement	Response
C5 Environment Amenity	
Assess amenity impacts on the surrounding locality, including lighting impacts, solar access, visual privacy, visual amenity, view loss and view sharing, overshadowing and **wind impacts** (including the preparation of a wind assessment where the development has a height above four storeys). A high level of environmental amenity for any surrounding residential or other sensitive land uses must be demonstrated.	Section 5

1. 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.
2. 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

Meteorological data recorded at Sydney International Airport from 2000 to 2021 were used as a reference for wind conditions in the area. The distributions of wind frequency and directionality for the summer (November through April) and winter (May through October) seasons are shown in Image 3. The records indicate that winds from the northeast and the southern sectors are predominant during the summer season. Wind from the west and northwest directions are predominant in the winter season and can have an impact on the perceived outdoor thermal comfort of a space. Strong winds of a mean speed greater than 8 m/s measured at the airport (at an anemometer height of 10 m) occur more often in the summers than in the winters. During both seasons, strong winds from the southerly directions are common. Winds from the northeast during summers and west to northwest during winters are also prevalent. These winds could potentially be the source of uncomfortable / unsafe wind conditions, depending on the site exposure or development design.

Image 3: Directional Distribution of Winds Approaching Sydney International Airport
Recorded from 2000-2021



Summer (November through April)

Winter (May through October)

4. 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, greater than 83 km/h (23m/s) occur more than 0.1% of the time or 9 hours per year, the wind conditions are considered severe and can impact the footing of individuals using the space. These generally coincide with areas of high wind activity noted in the report.

4.2 Pedestrian Comfort Criteria

The wind standards as setout in the Waverly Development Control Plan (2022) for Site Specific Development E1 (Bondi Junction Centre) are used in the current assessment to maintain consistency with the DCP. The standards detail the requirements related to pedestrian wind comfort with the objective of mitigating adverse wind effects generated by exposed buildings. These exposed buildings are typically defined as structures with half or more of their height above the neighbouring buildings. The standard requires that any such building must not cause wind speed around it to exceed the category for the intended use of the areas, as set out in Image 4.

The criteria are similar to those proposed by Davenport (1972) and are based on Gust Equivalent Mean Wind Speeds which considered the most objective measure to assess wind comfort in built-up environments. The criteria are also equivalent to RWDI Pedestrian Wind Comfort criteria in terms of categories; however, the RWDI criteria are more stringent.

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 winds are not expected to exceed the specified criterion for more than 5% of the time. 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 the perception of the wind.

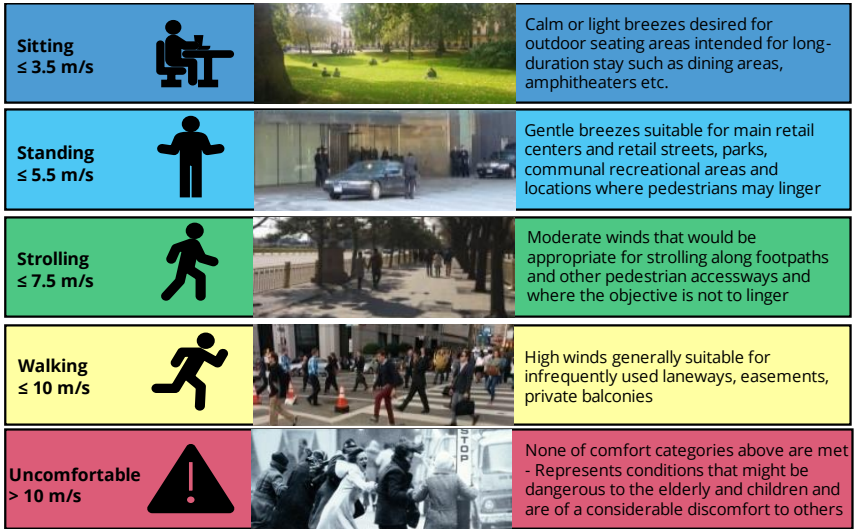


Image 4: Pedestrian Wind Comfort Criteria

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. Design details such as setting back a tower from the edges of a podium for a prevailing wind direction, deep canopies close to ground level, wind screens / tall trees with dense landscaping, etc. 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.

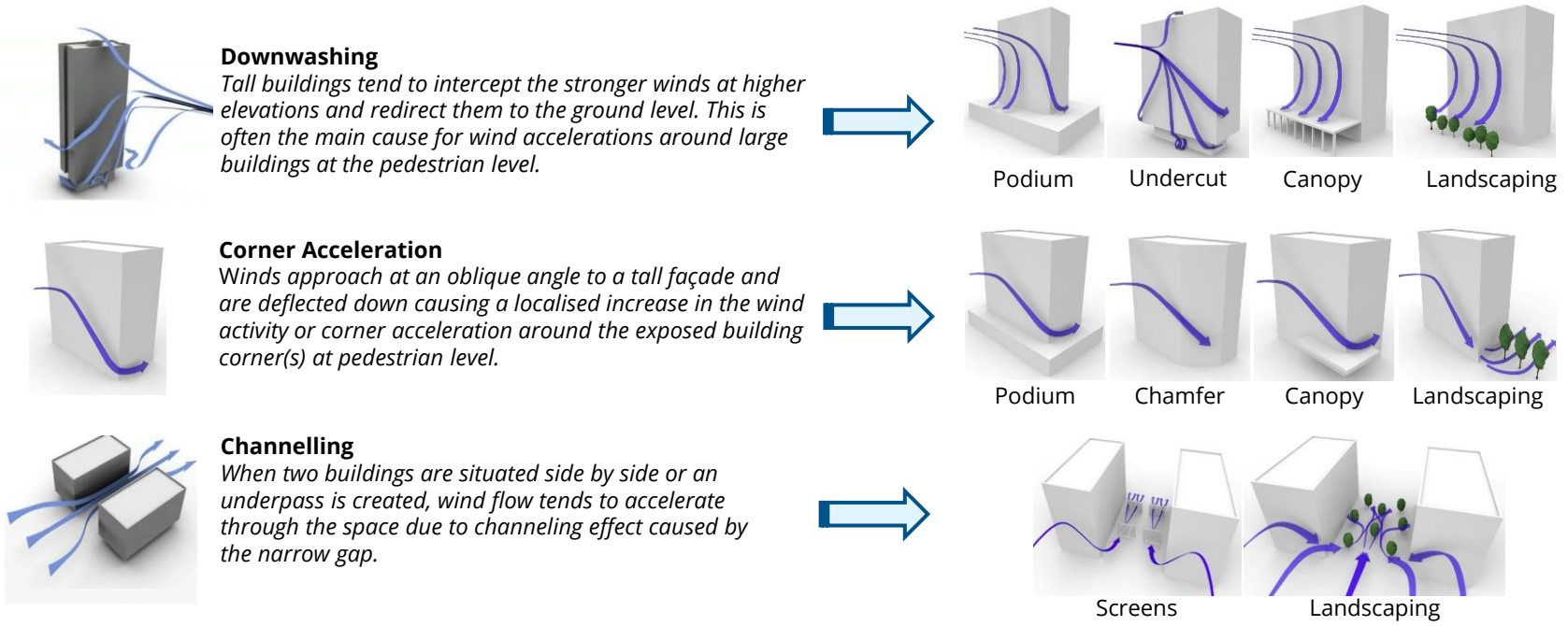


Image 5: General Wind Flow around Buildings with Examples of Common Wind Measures

5.2 Site Exposure and Existing Site Conditions

The existing campus primarily consists of low-rise buildings, with the only exposed structure being the mid-rise Centenary Building along Birrell Street. Given the height of the buildings, wind impacts are expected to be limited and predominantly influenced by the interaction with the exposed Centenary Building, local topography, and street alignment.

The exposure of the site to regional prevailing winds, as indicated in Image 6, shows that the high-rise buildings to the northwest provide a significant buffer to winds from this direction, likely diminishing overall wind impacts. Similarly, winds from the northeast are buffered by the substantial upwind landscape within Waverley Park and low exposure of the Centenary Building from winds from this direction, reducing wind speeds at the site. However, westerly winds are expected to increase due to the topographic rise from west to east towards the site and can be intercepted and redirected towards Birrell Street by the Centenary Building which is located approximately along the ridge. Consequently, wind conditions along most of Birrell Street are likely suitable for passive standing use with slightly higher winds, ranging from passive standing to active strolling use, expected near the Centenary Building. The decline in topography after the building along Birrell Street is likely to decrease wind speeds. Minor wind impacts may also occur due to the U-shaped form of the Centenary Building which can capture winds from the south and cause minor recirculation within the Quad. Overall, wind impacts are expected to be low with dense landscaping within and around the site providing a significant buffer to approaching winds.

5.3 Proposed Site Conditions

5.3.1 West Precinct

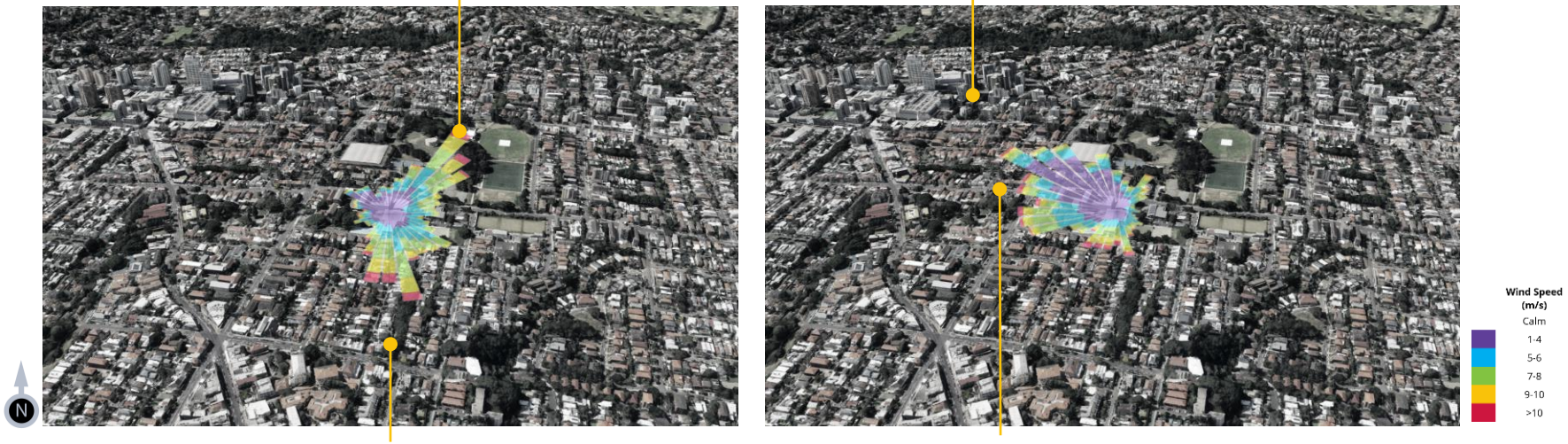
The elements introduced as part of the redevelopment of the West Precinct are generally minor and are not likely to have a significant impact on the surrounding areas. Key changes with minor localised impacts are noted below:

- The demolition of Kenny Access and replacement with an open link can be exposed to minor channelling winds. Overall conditions are likely to be comfortable for standing use during summers and sitting use during winters.
- The Centenary Quad and all existing outdoor areas (e.g., upper-level walkways and platforms, external decks on Levels 3 & 5, etc.) are expected to have similar wind conditions to the existing site.
- A semi-enclosed space has been introduced on Level 6 of the Centenary Building. This space is expected to be generally comfortable, with minor localized impacts due to the opening at the northwest corner near the existing statue. Winds from the northeast can affect this corner with a small risk of winds from the west also reattaching here, resulting in conditions that are likely suitable for passive standing use. However, most seating areas are typically sheltered and are likely to be comfortable for long-duration sitting use, as intended.

5. RESULTS AND DISCUSSION

Dense landscape within Waverley Park is similar in scale to the buildings in Waverley College - likely to provide significant buffer to winds from the northeast.

High rise cluster buffers winds from the northwest during winters.



Suburban low-rise buildings towards south likely to provide little buffer to prevailing southerly winds. However, tree cluster along Salisbury Road to the south of Centenary Building is likely to reduce impacts.

Suburban low-rise buildings towards west likely to provide little buffer to winter winds with significant rise in topography approaching the site from west likely to contribute to increased winds.

Image 6: Exposure of Site to Regional Prevailing Winds
Left: Summer | Right: Winter

5.3.2 East Precinct

The scope for the East Precinct involves the construction of a new six-storey building (E1+E2) which introduces an additional exposed building within the mix. Key wind impacts are shown in Image 7 and discussed below:

- The new E1+E2 building is likely to be sheltered from prevailing winter winds by the upwind structures within the college. Additionally, the narrow aspect of the building relative to westerly winds is expected to reduce overall impacts. Consequently, wind conditions around the site during winter are anticipated to be similar to those of the existing site.
- Winds from the northeast are likely to shear at the northeast corner of the new building (see Image 7). These winds are expected to be intercepted by the massing extensions, such as the planter pods and Staircase 3, thereby reducing overall impacts around the site. The proposed new courtyard is also expected to benefit from these extensions and the proposed landscape around it.
- Wind acceleration is likely to occur at the southern corners due to the relative orientation of the new building with the southerly winds. However, overall impacts are likely to be small due to moderate height of the building and the existing surrounding landscape which will buffer the approaching winds from this direction.
- Slight increase in wind channeling is expected between the existing gym building / the Langlee and the new proposed development. This may lead to conditions suitable for passive standing use to active strolling use between these buildings. To enhance comfort, the outdoor seating to the west of the proposed building might benefit from additional localised landscaping, such as east-west aligned planters, to reduce winds near the seating areas (examples shown in Image 8).
- The upper-level corridors (circulation areas) are only exposed to northeast winds during summers. As such, conditions are expected to be comfortable for passive sitting to standing use within these corridors. Similarly, the open space on Level 5 is recessed within the building planform and is expected to be comfortable for passive sitting to standing use.

5.3.2 East Precinct (continued)

- The roof deck on Level 6 is likely to be exposed to winds due to its height. It is understood that impermeable 1.3m tall balustrades are to be included in the design. These are expected to provide shelter from prevailing southerly winds. However, winds can upwash and reattach within the space. Hence, the proposed canopy which is situated along the northern perimeter is not likely to provide a significant benefit from a wind standpoint. Therefore, it is recommended to:

Option 1:

  - Relocate the canopy towards the center or southern side of the roof deck to reduce the risk of wind reattachment.
  - Retain north-south aligned planters with the inclusion of dense vegetation capable of growing 0.5-1m above the planter box.

Option 2:

  - Retain canopy along northern aspect.
  - Change the alignment of the planters to be east-west aligned so to offer protection from the reattached southerly winds. Recommended to include dense vegetation capable of growing 0.5-1m above the planter box.

5. RESULTS AND DISCUSSION

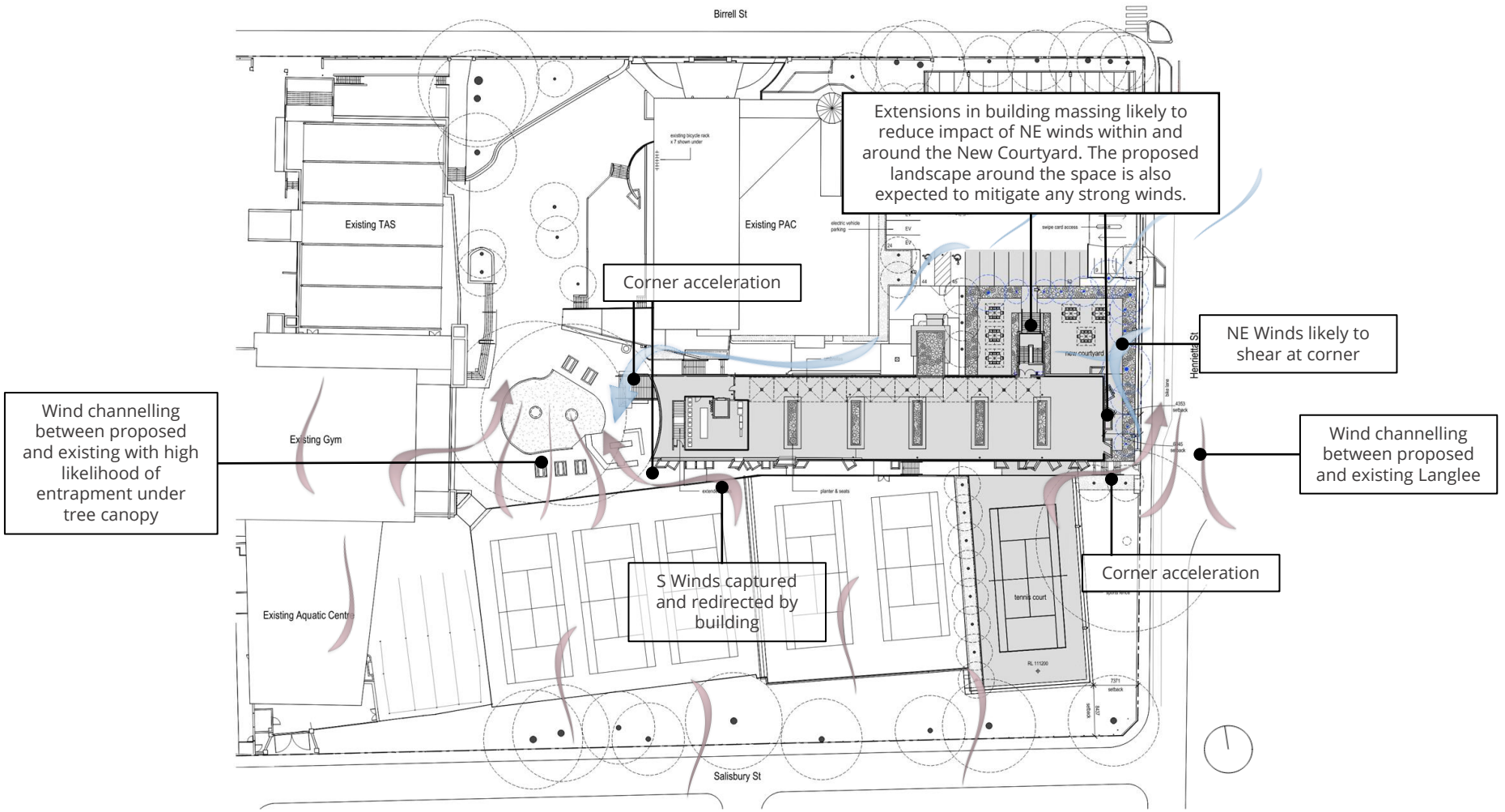


Image 7: Expected Wind Flows and Conditions / Risk on Ground Level

Blue: NE Winds| Red: S Winds

5. RESULTS AND DISCUSSION

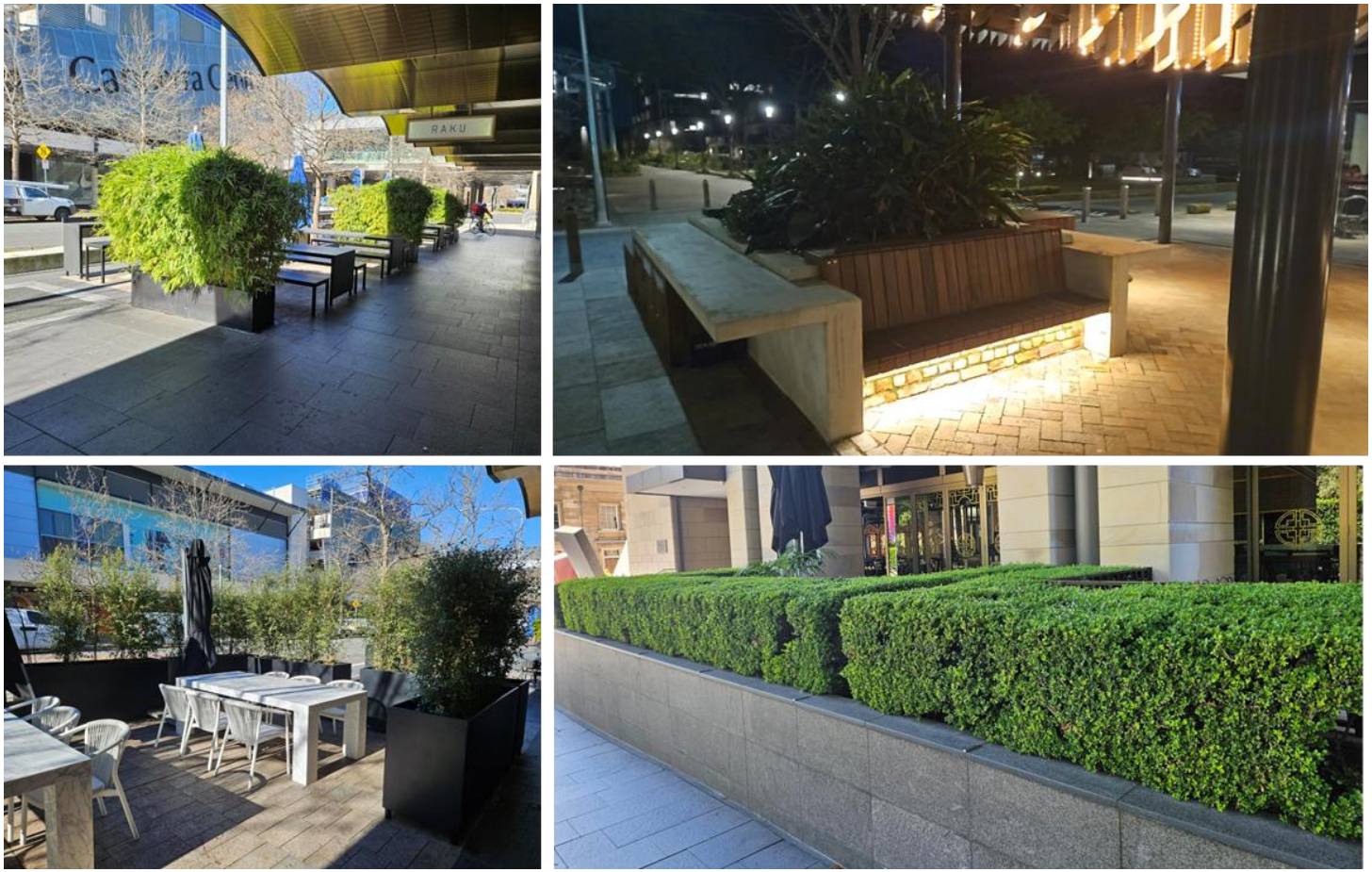


Image 8: Examples of Wind Control Measures – Seating Areas

6. SUMMARY

Wind conditions on and around the proposed Waverley College Senior Campus at 131 Birrell Street, Waverley 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 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 buildings within the region.

Conceptual wind flows around the proposed precinct are discussed in the report for the prevailing wind directions to identify key wind sensitive areas. Noting the relative height of the building and exposure, wind speeds exceeding the wind comfort and safety criteria are not likely around the site. However, slightly windier conditions are anticipated due to increased channelling between existing buildings and the new E1+E2 building. Design advice in the form of conceptual mitigation measures and built-form response are noted for the ground level sitting area to the west of the new E1+E2 building and for the roof deck of the building.

Note that the mitigation options discussed in this report are based on the assumptions and flow activity noted here. These can be refined further through wind tunnel testing or CFD studies.

7. APPLICABILITY OF ASSESSMENT

The assessment discussed in this report pertains to the proposed development in accordance with the drawings and information received between April & June 2024. 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 '*Waverley College Pedestrian Wind Assessment*', dated 14 June 2024, 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.