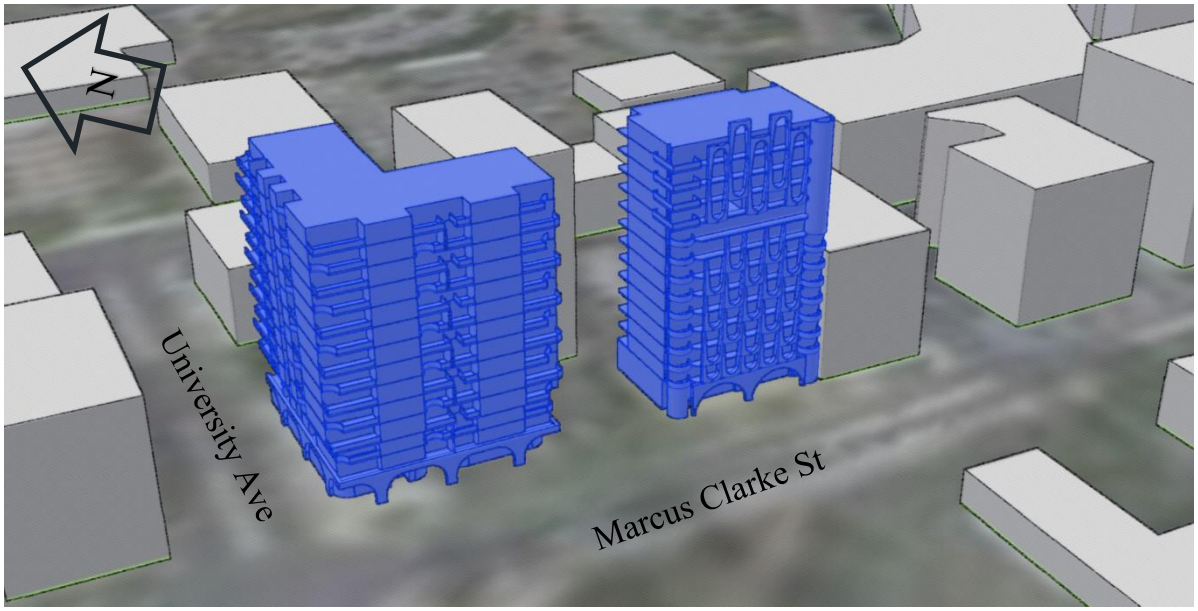
BULUM GROUP

WIND ASSESSMENT FOR DA

17-21 UNIVERSITY AVENUE

OCTOBER 2023



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Wind Assessment for DA
17-21 University Avenue

Bulum Group

WSP
Level 1, 121 Marcus Clarke Street
Canberra ACT 2601
PO Box 1551
Canberra ACT 2600

Tel: +61 2 6201 9600
Fax: +61 2 6201 9666
wsp.com

REV	DATE	DETAILS
1	12/12/2022	For DA Submission, updated to reflect revised footprint and plans
2	18/08/2023	For DA Submission, updated to reflect revised scheme and facade
3	18/10/2023	For DA Submission, updated ground floor building A

	NAME	DATE	SIGNATURE
Prepared by:	Christian Espiritu	13/10/2023	
Reviewed by:	Paolo Nicolas	18/10/2023	
Approved by:	Paolo Nicolas	18/10/2023	

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EXECUTIVE SUMMARY

WSP was engaged by Bulum Group to undertake a high-level wind assessment in support of the development application for the proposed new building at 17-21 University Ave, which is a CZ1 core zone designation. This wind assessment addresses the wind effects caused by the implementation of the building within proposed development with respect to the Commercial Zone Precinct Code and National Capital Plan, provides mitigation options (where required) to address potentially adverse conditions, and assesses compliance with Australian Standards.

This wind assessment addresses the wind effects caused by the implementation of the proposed development with respect to the safety and comfort of people in the public realm or other open spaces associated with the development. This assessment focuses on the wind effects experienced by pedestrians within the subject points A to E (Figure A).

The building is to comply with Commercial Zone Precinct Code Element 3.6 Wind, which outlines specific requirements for buildings which are greater than 28m (Rule 10). Using computational fluid dynamic (CFD) modelling and simulation, the likely outcomes were analysed using a wind speed of 40km/h, as these were the prevailing winds in the central Canberra region, taken from the Canberra Airport Comparison weather station.

FINDINGS

Overall, the proposed development (as it is currently designed) does not unreasonably impact the safety and comfort of people in the public realm or any other open spaces associated within points A, B, C, D and E of the development. However, Points B, C and E have demonstrated the potential to experience light to moderate winds, and it is recommended the project incorporates wind speed mitigation measures around these areas.

These observations are demonstrated by the two prevailing wind scenarios and summarised in Table 1.1 below. Refer to Figures A for the location of subject points.

The following features may assist in mitigating the expected wind speeds along the public realm at pedestrian level around Points B, C and E:

- Dense vegetated landscaping such as static planters and trees
- Hard landscaping, such as artwork / large sculptures; or structures such as balustrades or screens
- A combination of hard structures permeated by vegetation e.g. green wall barriers

Table 1.1 Overview of observations at each subject point under each simulated scenario.

SUBJECT POINT	SCENARIO 1: NORTH-WESTERLY AT 40KM/H	SCENARIO 2: WESTERLY AT 40KM/H
Point A – University Ave Walkway	Light winds of 2-3m/s	Light winds of 3-4m/s
Point B – Marcus Clarke Street Internal Walkway Building A	Light winds of 3-4m/s	Light to moderate winds of 5-6m/s
Point C – Landscape Area Between Building A and Building B	Light to moderate winds of 5-6m/s	Light to moderate winds of 5-6m/s
Point D – Marcus Clarke Street Internal Walkway Building B	Calm to light winds of 0-1m/s	Light winds of 2-3m/s
Point E – Landscape Area near Darwin Place	Light winds of 4-5m/s	Moderate winds of 6-7m/s

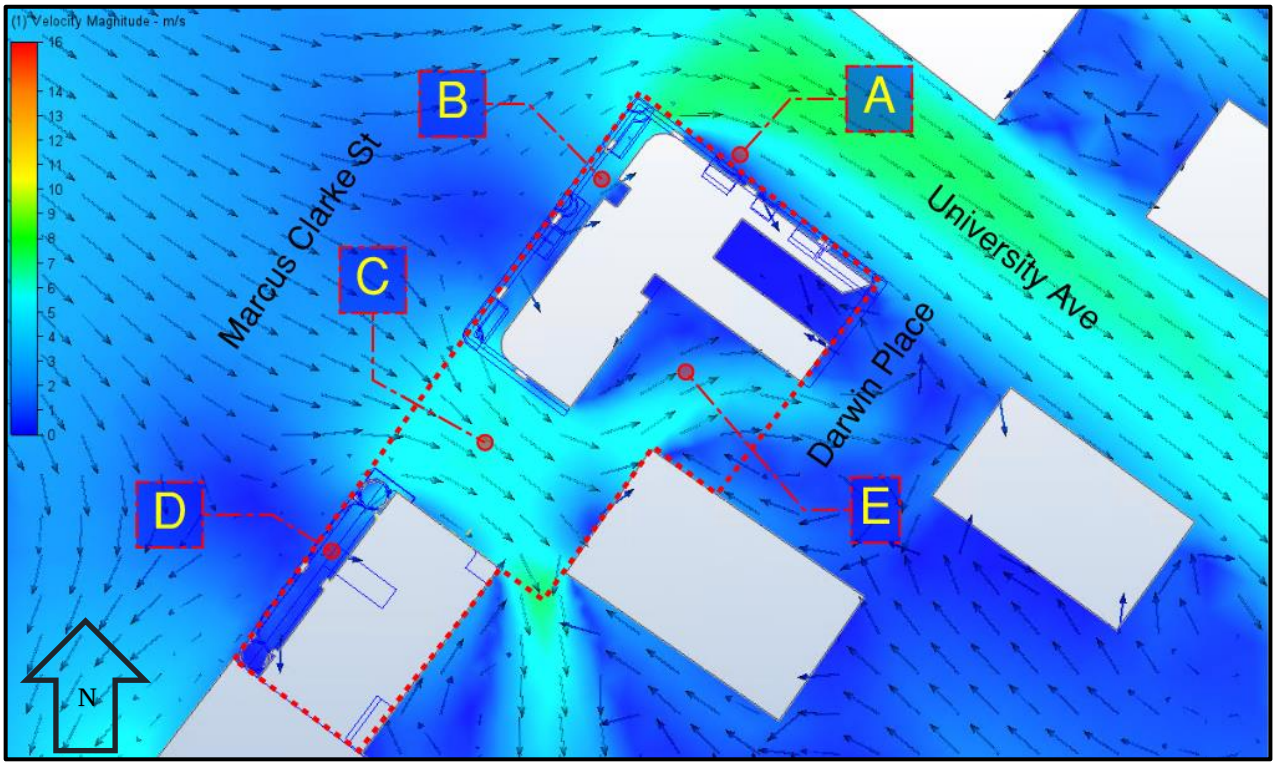


Figure A: Sample image of wind analysis modelling results of 40km/h NW winds at approx. 1m above Ground Level.

1 INTRODUCTION

1.1 PROJECT BACKGROUND

WSP was engaged by Bulum Group to undertake a high-level wind assessment in support of the development application for the proposed new building at 17-21 University Ave, which is a CZ1 core zone designation. This wind assessment addresses the wind effects caused by the implementation of the building within proposed development with respect to the Commercial Zone Precinct Code and National Capital Plan, provides mitigation options (where required) to address potentially adverse conditions, and assesses compliance with Australian Standards.

The proposed development is a 2 building 13-storey mixed-use development and is 47.3m (Building A) and 50.0m (Building B) above the finished ground level (at the time of the assessment).

1.2 LOCAL PLANNING CODES

The ACT Government Territory Plan specifies wind standards for buildings at specified heights, to maintain safety and comfort in the public realm and other open spaces associated with the development. Specifically, the Commercial Zone Precinct Code Element 3.6 Wind, which outlines specific requirements for buildings which are greater than 28m (Rule 10).

1.2.1 RULE 10

This rule applies to buildings with a height of building greater than 28m. As a consequence of the proposed development wind speeds do not exceed the following:

a) adjacent main pedestrian areas and routes (as defined in the relevant precinct code) - 10m/s

b) all other adjacent streets and public places: 16 m/s.

Figure 1.1 shows the City Precinct Map in relation to the subject site. The subject points were selected on their location as the most likely areas where pedestrians will be situated around the building and defined as “public realm and open spaces” for the purposes of this assessment. Given there are no “main pedestrian areas and routes” designated around the site, the upper limit of 16m/s is applied to the analysis.

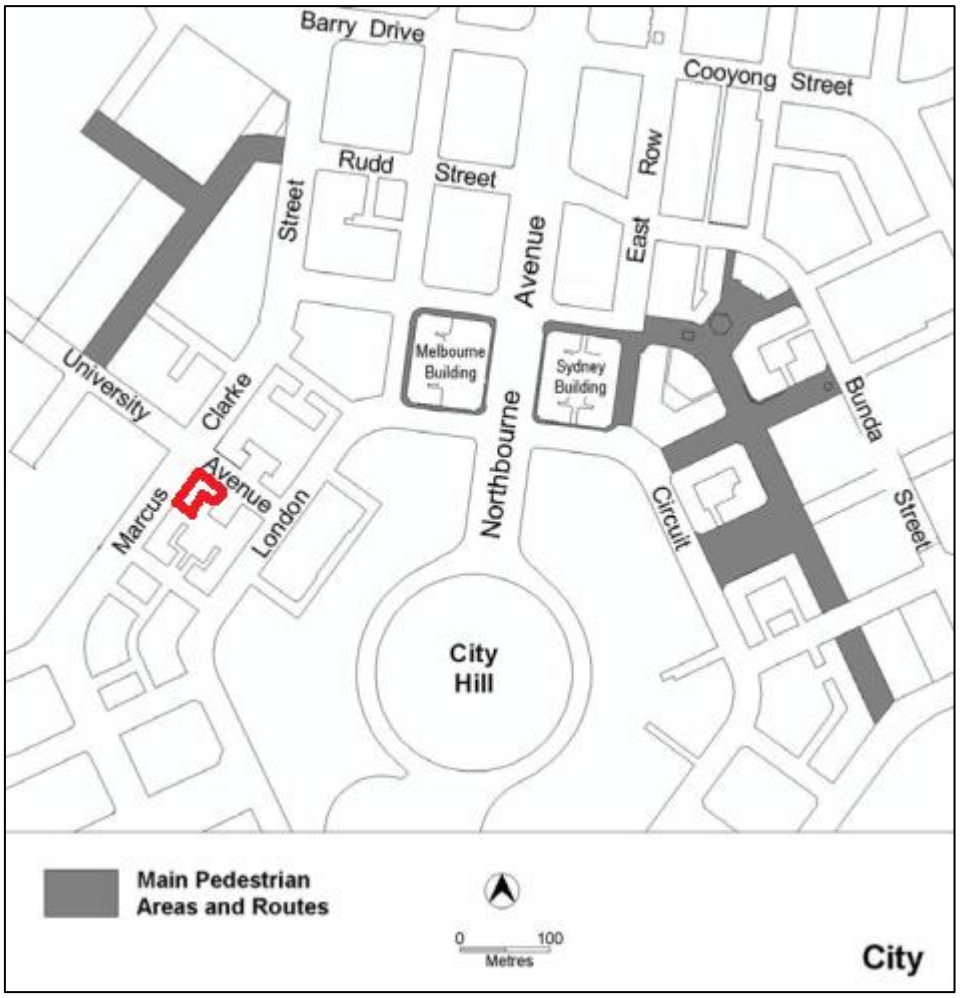


Figure 1.1 Extract from City Precinct Map showing the project site (in red). (Source: Territory Plan – City Precinct Map and Code, mark up by WSP)

1.3 SOURCES OF INFORMATION

- Preliminary DWGs by Kavellaris Urban Design received by WSP 02 August 2022 (from Bulum Group)
  - Revised ground floor plan DA03.03 received by WSP 12/10/2023
- Wind speed data from the Bureau of Meteorology website, for Canberra Airport Comparison weather station, measured from 1939-2010.
- Commercial Zones Development Code, ACT Government (effective 21 February 2020)
- City Precinct Map and Code (effective 26 July 2016)
- National Capital Plan (April 2021)

1.4 CFD MODELLING

The analysis was conducted using Autodesk CFD 2019 to produce wind assessment results to inform the DA submission. The software allows for the modelling and analysis of wind pattern and behaviour around building masses for a given wind speed and direction, whereby a simplified depiction of building massing is used for this high-level assessment. All observations and findings were taken at 1m above ground level to observe wind speeds experienced at pedestrian level for each given scenario, therefore the proposed ground floor plan is a key input for the modelling (see Figure 1.2). A snapshot of the model can be seen in Figure 1.3 and overview of the surrounding buildings on Figure 1.4.

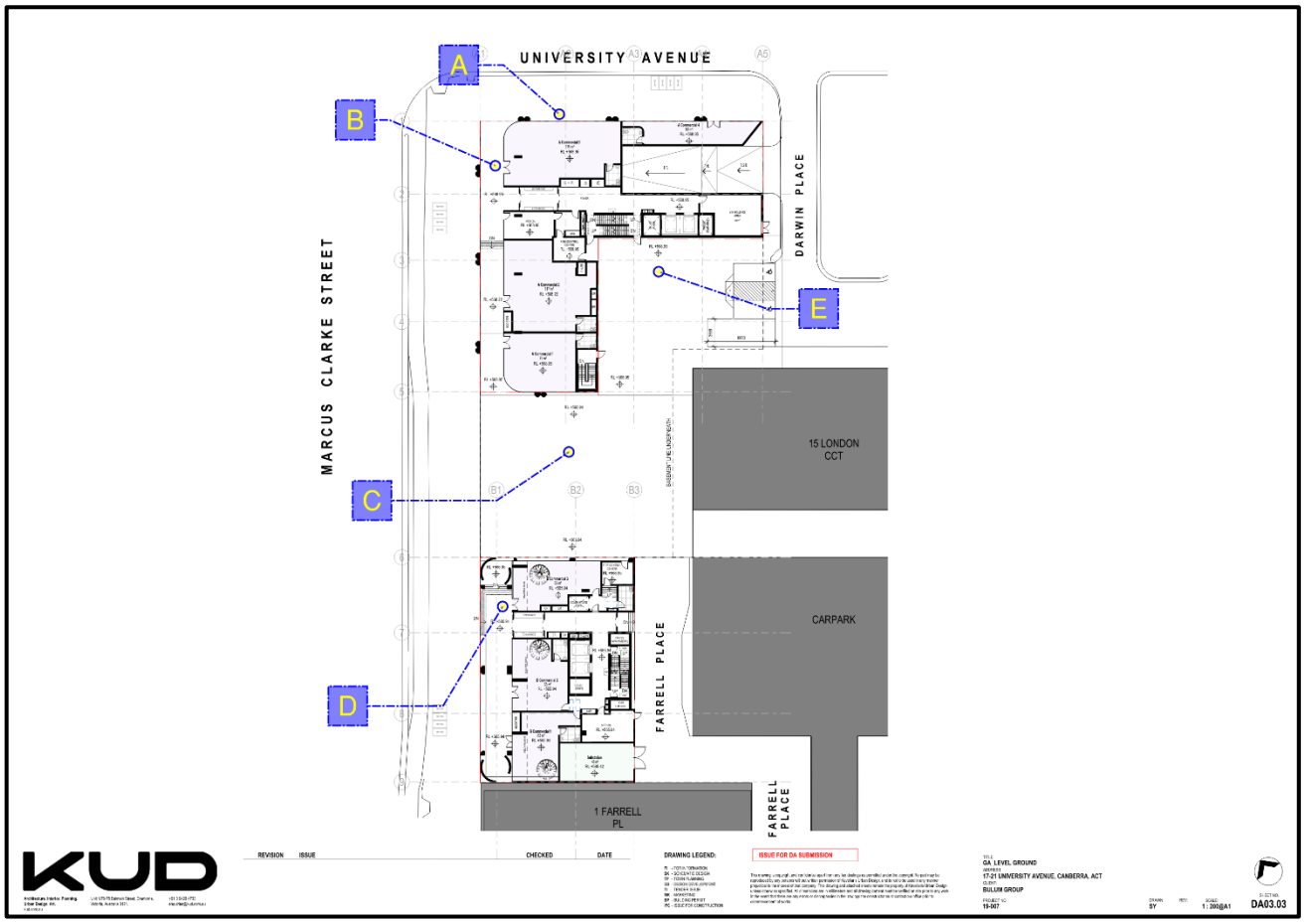


Figure 1.2 Architectural Layout – Ground floor, showing subject points A to E (Source: "GA_LEVEL GROUND sheet no. DA03.03" received by WSP 12/10/2023 from Kavellaris Urban Design, mark-up by WSP)

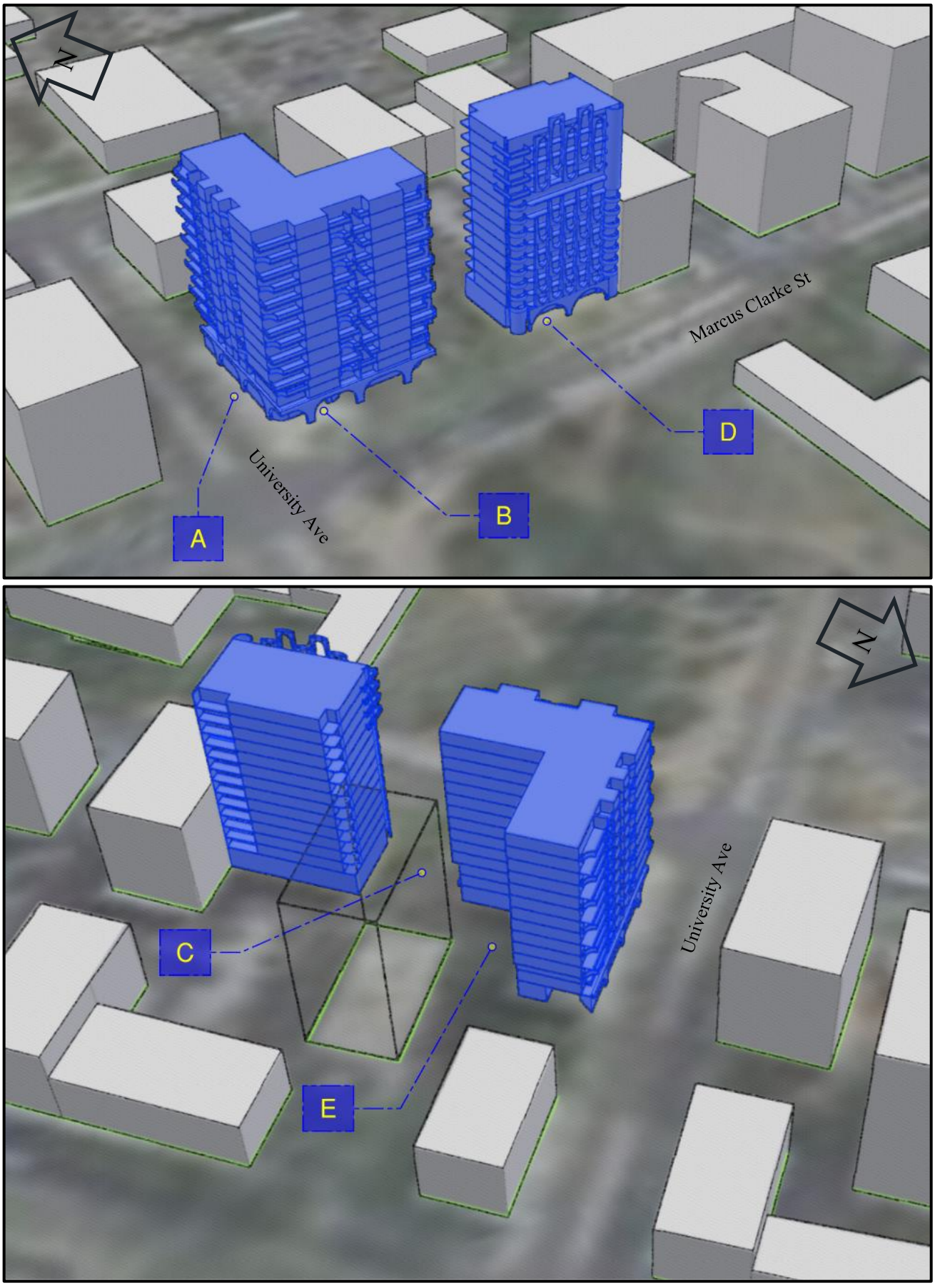


Figure 1.3 3D images of the site geometry showing the subject points on the proposed development.

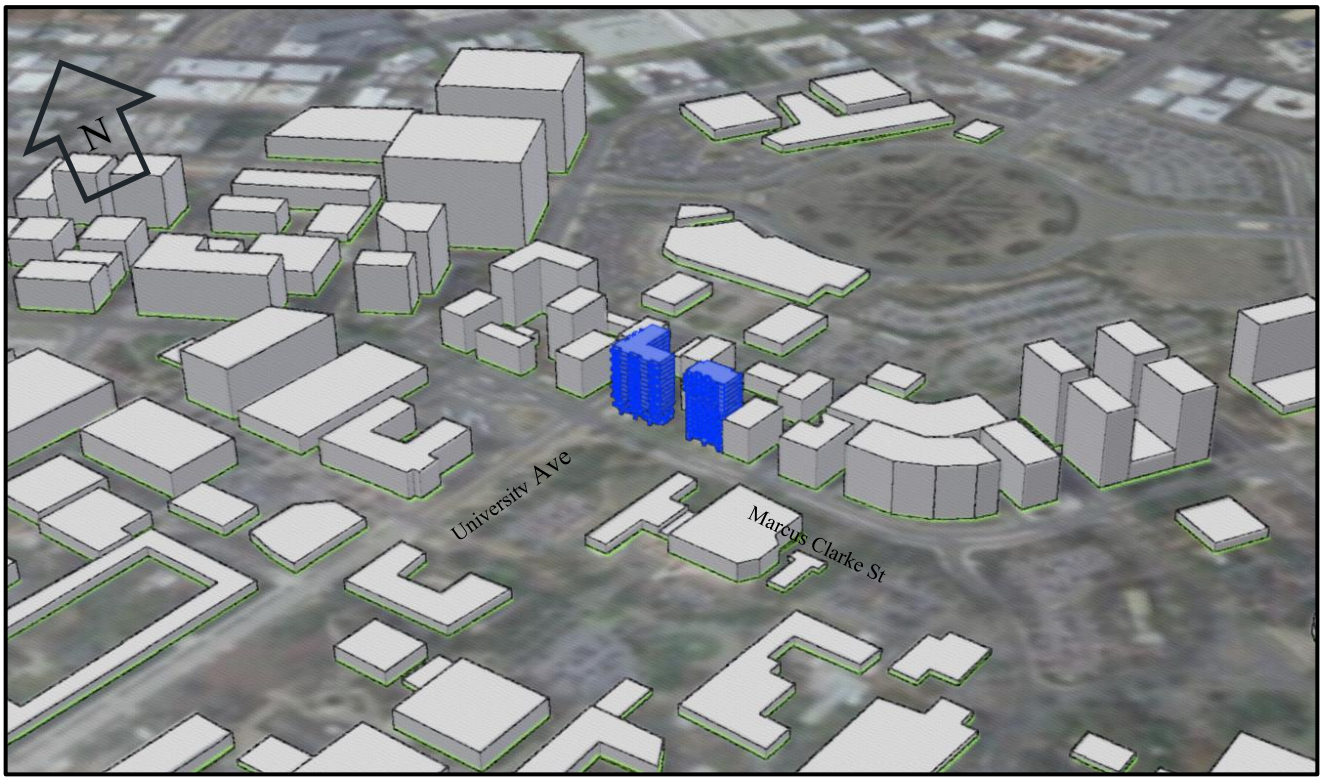


Figure 1.4 3D image of the site geometry and the modelled surrounding buildings.

1.5 LIMITATIONS

CFD simulation provides an estimate of resultant wind speeds around buildings. This estimate is based on a necessarily simplified and idealised version of the building that does not and cannot fully represent all the intricacies of the building form and landscaping once built. Thus, simulation results only represent an interpretation of the potential resultant speeds. No guarantee or warrantee of building influence on resultant wind speed in practice can be based on simulation results alone. The results detailed in this report are valid only under the modelling conditions stated in this document. Any variations to the design will render the conclusions of the report invalid.

2 WIND CLIMATE DATA

2.1 NORTHERN CANBERRA WIND DATA

In the wind assessment, known characteristics of mean and gust speeds on both an annual and seasonal basis associated with the northern Canberra wind climate are addressed using long-term Bureau of Meteorology (BoM) data, recorded at the Canberra Airport Comparison (070014) weather station from 1939-2010, taking into consideration, the strength characteristics of prevailing Canberra wind directions.

2.2 SITE-SPECIFIC WIND CHARACTERISTICS

Wind patterns are impacted by site specific wind characteristics related to terrain and topography, including:

- The proposed development site is subject to north-westerly and westerly winds, with Marcus Clarke St providing the main open-air thoroughfare for wind to the site.
- The project site is also situated on the western end of Canberra's central business district, where the majority of buildings are at least 4 storeys tall and are expected to assist in mitigating wind speed.
- The immediate neighbourhood also includes mainly flat terrain with shallow slopes.

2.3 ANNUAL SEASONAL WINDS

The characteristics of mean wind speeds on both an annual and seasonal basis associated with the Canberra wind climate based on data obtained from the Bureau of Meteorology are addressed in this report.

Figure 2.1 illustrates the annual 9am and 3pm wind roses for the northern Canberra region where there is a prevailing north-westerly and westerly wind throughout the year. North-west and westerly winds appear to be between 10 to 30km/h for most the day, whilst reaching 30 to 40km/h for short periods – particularly in the late afternoon. Gusts greater than 40km/h occur for short periods during the typical day.

Monthly wind roses further demonstrate a prevailing north-westerly wind throughout the year throughout most seasons (refer to Appendix A for monthly wind roses grouped by season). The seasonal Canberra wind climate is characterised as:

- Summer | Winds typically occur from the west to north-west, increasing in intensity during the day. East and southeast winds breeze through the climate during the morning.
- Autumn | Winds occur from the north-west and southeast, with west to north-westerly winds increasing in intensity in the afternoon.
- Winter | West to north-west winds dominate in winter, again increasing in intensity during the day.
- Spring | In spring, west to north-westerly winds prevail reaching average speeds between 20 and 30 km/h with potential for 40km/h peaks.

The monthly mean wind speeds in Appendix A, demonstrate wind speeds increase during winter and peaking in spring. The seasonal wind roses indicated an increase in wind speeds and intensity in the afternoon throughout the year.

This assessment has applied the following prevailing wind speed scenarios as indicative of a typical windy day, selected based on magnitude and frequency:

- North-westerly at 40km/h (11.11m/s); and
- Westerly at 40km/h (11.11m/s).

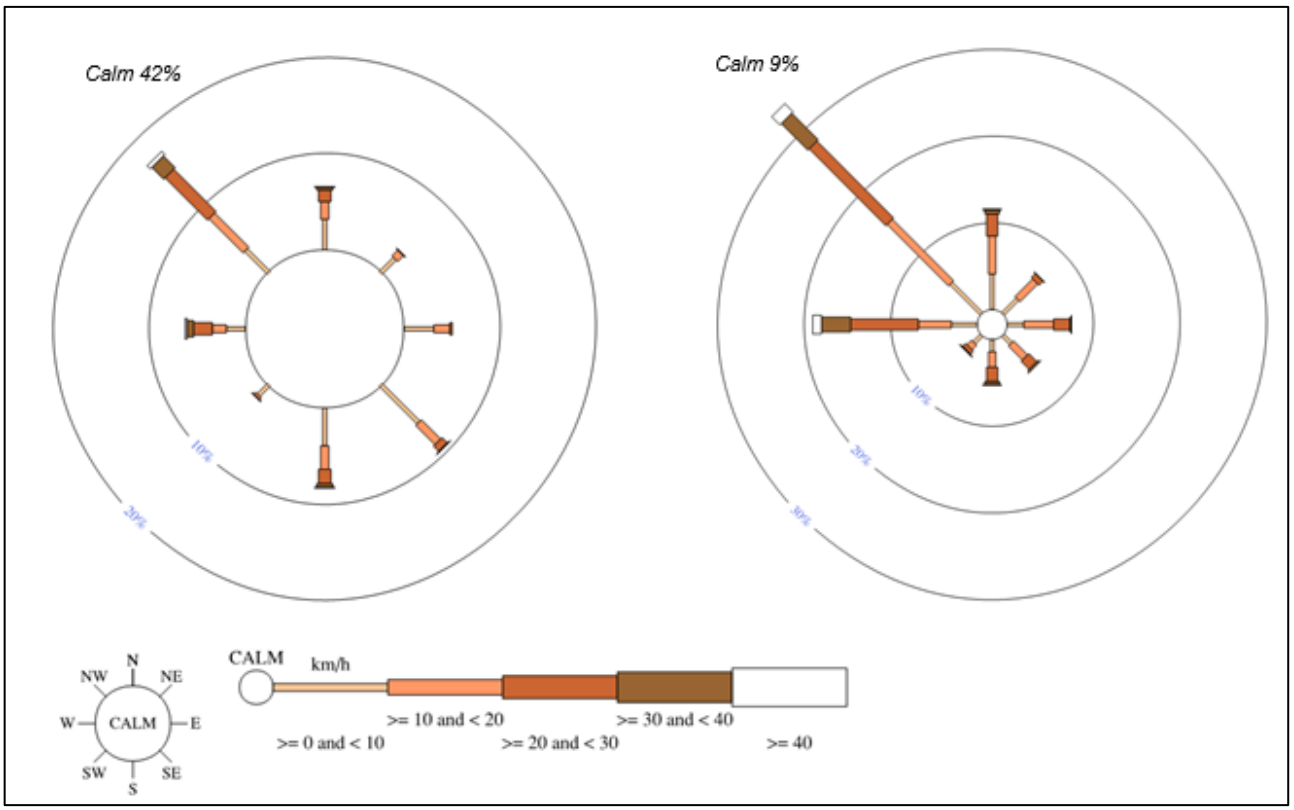


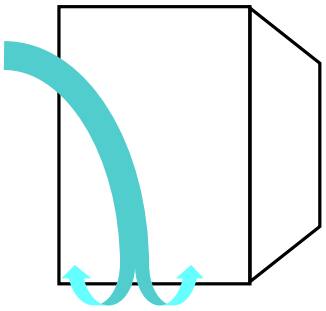
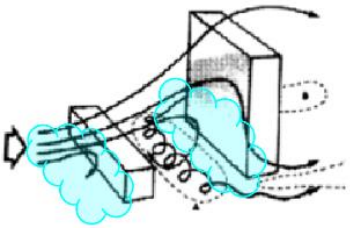
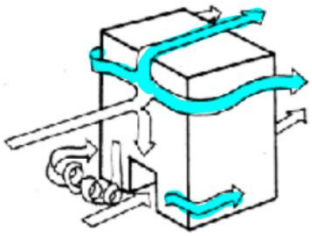
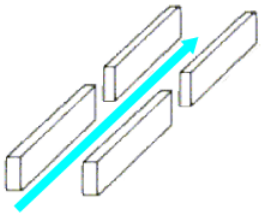
Figure 2.1 Annual wind roses at 9am [left] and 3pm [right] for Canberra Airport Comparison. (Source: BoM)

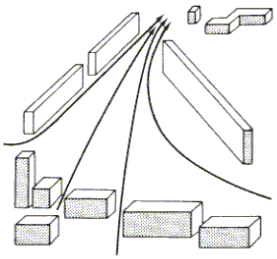
3 WIND PATTERNS AND ACCEPTABILITY

3.1 WIND PATTERN CHARACTERISTICS

Key wind characteristics in relation to buildings are shown in Table 3.1. These will inform the observations and analysis of the CFD modelling results.

Table 3.1 Wind flow pattern characteristics around buildings.

WIND CHARACTERISTIC EFFECT	DESCRIPTION	
Downwash Effect	At higher levels, greater wind speeds are seen. The downwash effect occurs when these winds are transferred down the façade of tall buildings the base, creating high wind speeds and potentially uncomfortable and dangerous conditions for pedestrians.	
	This can cause problems in groups of buildings, particularly of differing heights, the combination of downwash and low tumbling winds.	
Side-stream Effect	Winds impacting corners and edges of an exposed building.	
Urban Canyon Effect or Channelling	Where parallel buildings along streets create a wind corridor (or canyon) and winds are channelled down the corridor.	

WIND CHARACTERISTIC EFFECT	DESCRIPTION
Venturi or Funnelling Effect	Impact of winds through two or more buildings that come together to form a bottleneck and resulting in increased wind intensity through the gap between the converged buildings. 

3.2 CRITERIA FOR WIND SPEED ACCEPTABILITY

This section outlines the international criteria against which the CFD model and Canberra climatic wind data will be assessed to develop recommendations for wind speed mitigation. Potential adverse wind conditions and the likely wind intensities are compared to international standards for pedestrian and occupant safety and comfort.

The Beaufort Wind Scale also provides guidelines around the impact of different wind speeds as shown in Table 3.2. On this scale, numbers 5 and above would create uncomfortable conditions for pedestrians. Furthermore, any occurrences of numbers 7 and 8 should not occur more than two times a year.

Table 3.2 Beaufort Wind Scale and description of potential impact.

BEAUFORT SCALE NUMBER	DESCRIPTIVE TERM	UNITS IN M/S	DESCRIPTION ON LAND
0	Calm	0	Smoke rises vertically
1-3	Light winds	<5m/s	Wind felt on face; leaves rustle; ordinary vanes moved by wind.
4	Moderate winds	6 to 8m/s	Raises dust and loose paper; small branches are moved.
5	Fresh winds	8 to 11m/s	Small trees in leaf begin to sway; crested wavelets form on inland waters
6	Strong winds	11 to 14m/s	Large branches in motion; whistling heard in telephone wires; umbrellas used with difficulty.
7	Near gale	14 to 17m/s	Whole trees in motion; inconvenience felt when walking against wind.
8	Gale	18 to 21 m/s	Twigs break off trees; progress generally impeded.
9	Strong gale	21 to 24m/s	Slight structural damage occurs -roofing dislodged; larger branches break off.

BEAUFORT SCALE NUMBER	DESCRIPTIVE TERM	UNITS IN M/S	DESCRIPTION ON LAND
10	Storm	24 to 28m/s	Seldom experienced inland; trees uprooted; considerable structural damage.
11	Violent storm	29 to 33m/s	Very rarely experienced - widespread damage
12+	Hurricane	>33m/s	Very rarely experienced - widespread damage

Acceptable wind criteria to ensure pedestrian comfort and safety are defined below and are based on a range of acceptability criteria including that developed by the American Society of Civil Engineers (2003)[1], Lawson (1978)[2] and the Beaufort Wind Scale.

- SITTING <4 m/s
- STANDING 4 to 6 m/s
- WALKING 6 to 8 m/s
- FAST WALKING OR CYCLING 8-10 m/s
- UNCOMFORTABLE >10 m/s

[1] ASCE—American Society of Civil Engineers, 2003. Outdoor Human Comfort and its Assessment: State of the Art. Task Committee on Outdoor Human Comfort.

[2] Lawson TV. 1978. The wind content of the built environment. J Ind Aerodyne 3:93-105

4 ASSESSMENT FINDINGS

4.1 SCENARIO 1: NORTH-WESTERLY AT 40KM/H

SUBJECT POINT	OBSERVATION
Point A – University Ave Walkway	Displays light winds of 2-3m/s, as this point is protected from the North Westerly winds. It can be observed also on the northern edges of the development, that as the wind impacts the edges, it is diverted along the University Ave.
Point B – Marcus Clarke Street Internal Walkway Building A	Light winds of 3-4m/s is experienced on this location fronting Building A retail. Winds are seen to divert to University Ave as the wind hits the façade of the building.
Point C – Landscape Area Between Building A and Building B	This landscape area is displaying light to moderate winds of 5-6m/s. Winds pass through between the facades of Building A and B, creating a wind corridor that channels the wind towards the open parking area and to Darwin Place. Increased wind intensity is also seen creating a funnelling effect as the winds pass through the gap between the converged buildings of Building B and 15 London CCT.
Point D – Marcus Clarke Street Internal Walkway Building B	The internal walkway fronting Building B retail demonstrates calm to light winds of 0-1m/s as the incoming winds is dispersed along Marcus Clarke St and to the landscape area between Building A and B.
Point E – Landscape Area near Darwin Place	Light winds of 4-5m/s is seen on this landscape area at the back of Building A. The increased winds are coming between Building A and B and is diverted to the open parking and Darwin Place.

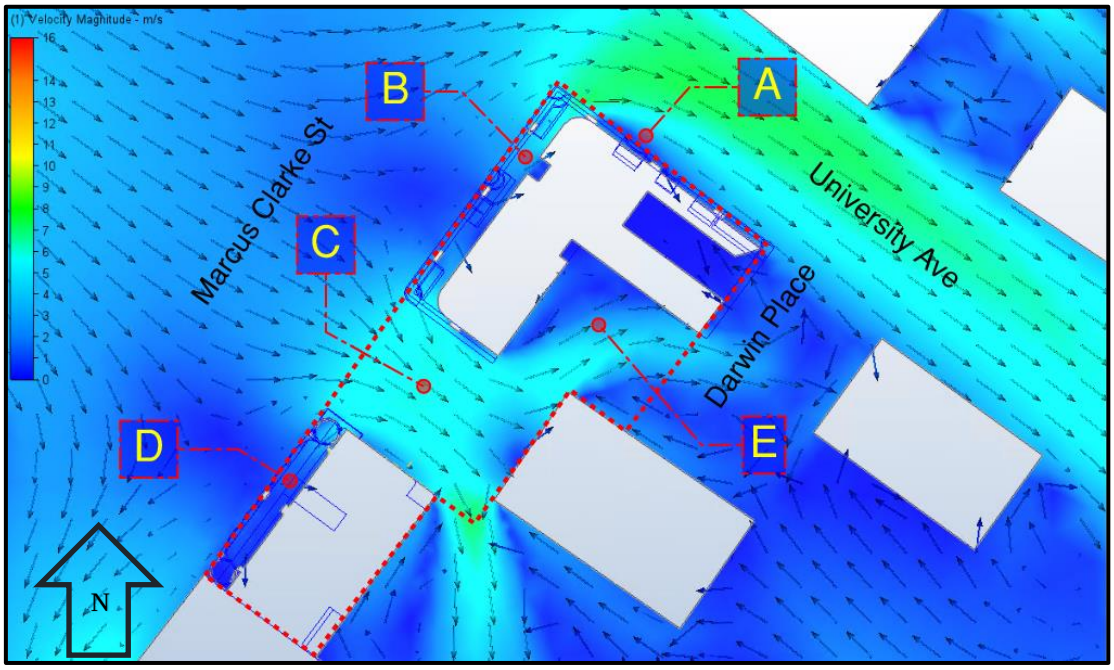


Figure 4.1 CFD modelling results for Scenario 1: north-westerly winds at 40km/h at approx. 1m above Ground Floor

4.2 NORTH-WESTERLY AT 40KM/H SECTION VIEWS

Observation: Light winds of 2-3m/s is observed in point A as shown in Figure 4.2. Light to moderate winds of 5-6m/s is shown in point C Figure 4.2 and Light winds shown in point E shown in Figure 4.4. Light winds of 3-4m/s for point B as shown in Figure 4.3. Calm to light winds of 0-1m/s is observed for point D as shown in Figure 4.3.

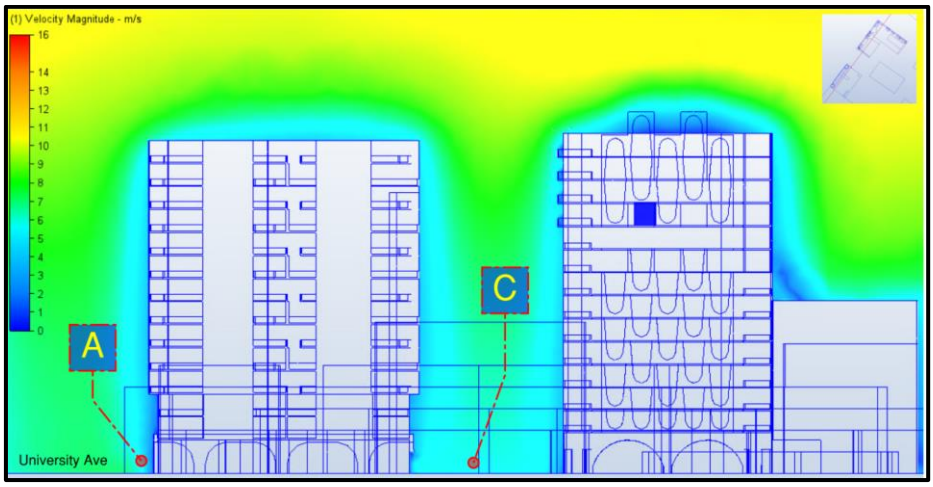


Figure 4.2 CFD modelling results for Scenario 1: north-westerly at 40km/h at section view.

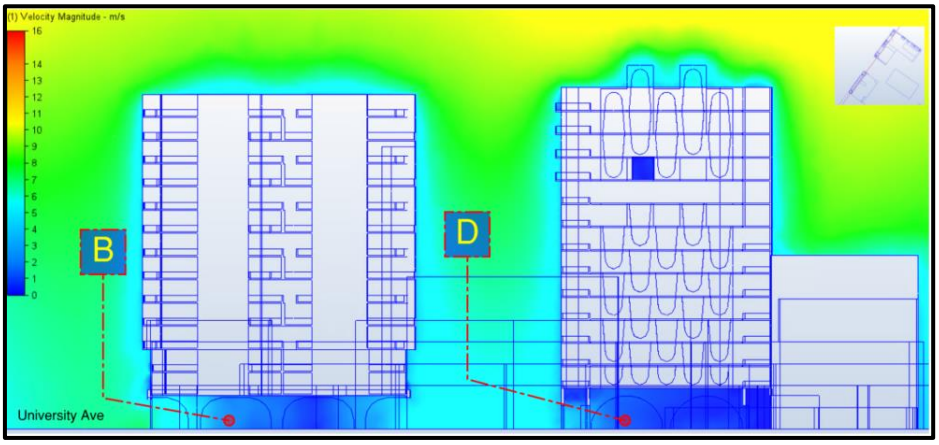


Figure 4.3 CFD modelling results for Scenario 1: north-westerly at 40km/h at section view.

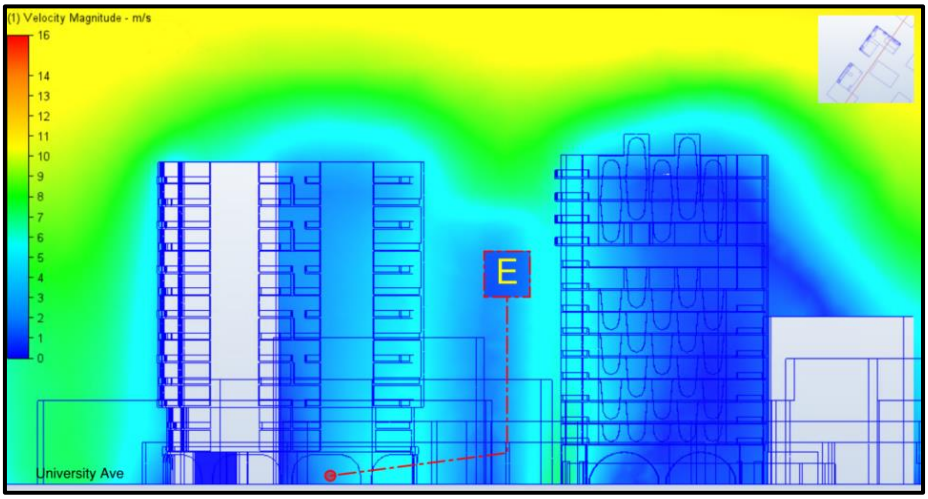


Figure 4.4 CFD modelling results for Scenario 1: north-westerly at 40km/h at section view.

4.3 SCENARIO 2: WESTERLY AT 40KM/H

SUBJECT POINT	OBSERVATION
Point A – University Ave Walkway	This point is protected from the westerly winds and displays light winds of 3-4m/s. It can be seen, that moderate to fresh winds are apparent, on the Northern external edge of the building as the wind impacts the façade and dispersed towards University Ave.
Point B – Marcus Clarke Street Internal Walkway Building A	Demonstrates light to moderate winds of 5-6m/s is experienced on this internal walkway fronting building A retails.
Point C – Landscape Area Between Building A and Building B	Displays light to moderate winds of 5-6m/s. Westerly winds impacts the façade of building B and diverts the winds to this landscape area. Winds are then transported to the open parking area and to Darwin Place. Increased wind intensity is also seen creating a funnelling effect as the winds pass through the gap between the converged buildings of Building B and 15 London CCT.
Point D – Marcus Clarke Street Internal Walkway Building B	Westerly winds impact the façade of building B and produces downward winds resulting to light winds of 2-3m/s.
Point E – Landscape Area near Darwin Place	As the westerly winds pass through the landscape area and impacts the edges of building A and B, increased wind intensity is seen and produces moderate winds of 6-7m/s and winds are diverted towards Darwin Place.

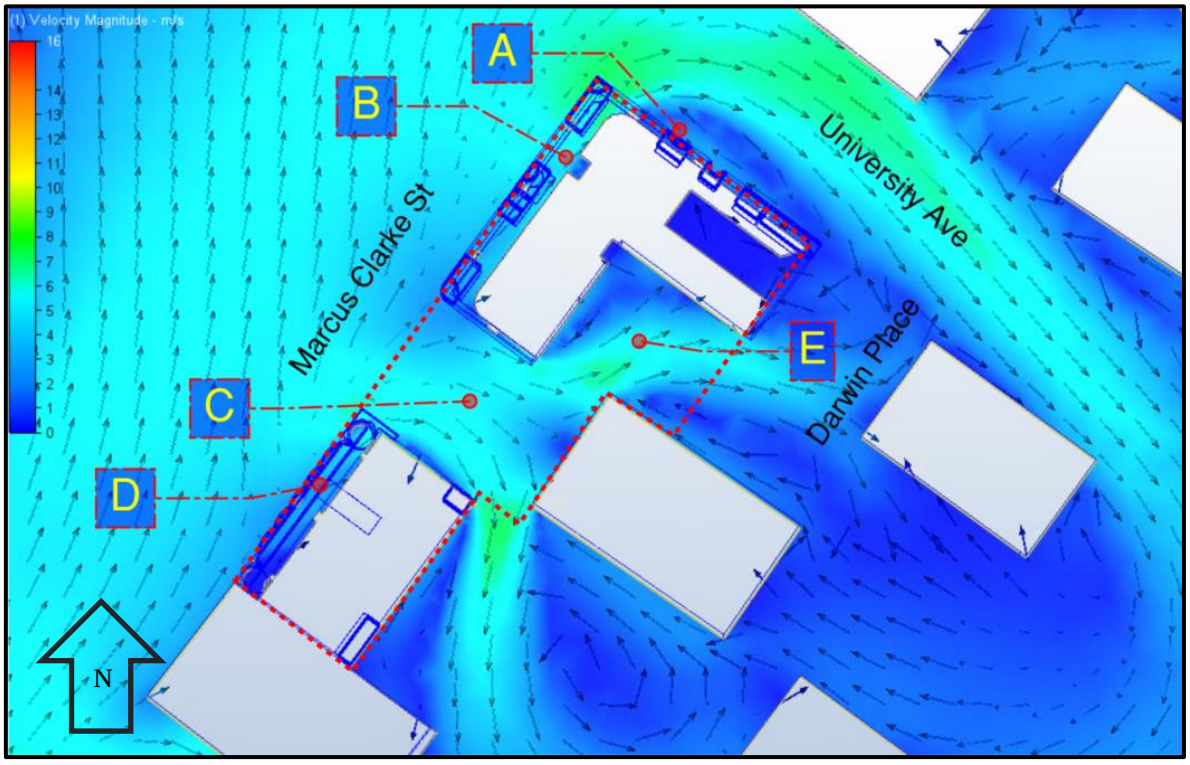


Figure 4.5 CFD modelling results for Scenario 2: westerly winds at 40km/h at approx. 1m above Ground floor.

4.4 WESTERLY AT 40KM/H SECTION VIEWS

Observation: Light winds of 3-4m/s is observed in point A as shown in Figure 4.6. For point B and C, light to moderate winds of 5-6m/s is observed as shown in Figure 4.6 Figure 4.7. Moderate winds of 6-7m/s is shown in Figure 4.8. Light winds of 2-3m/s is observed for point D as shown in Figure 4.7.

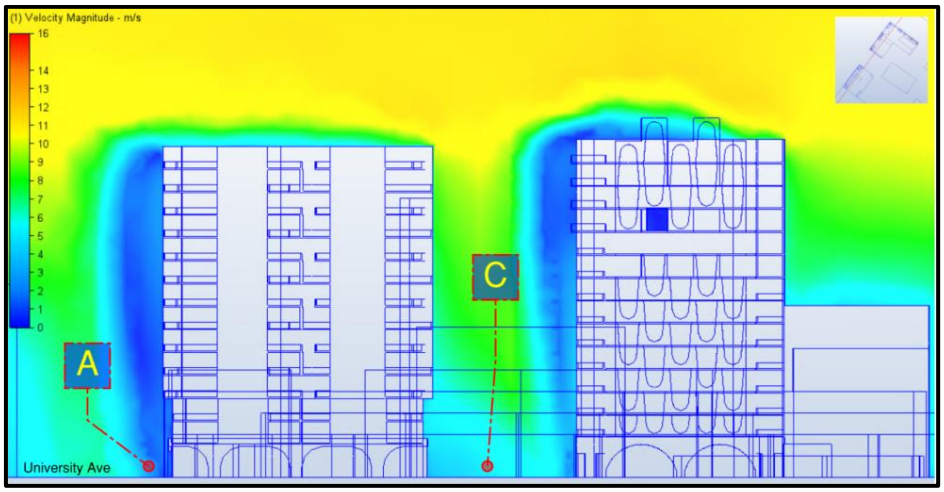


Figure 4.6 CFD modelling results for Scenario 2: westerly at 40km/h at section view

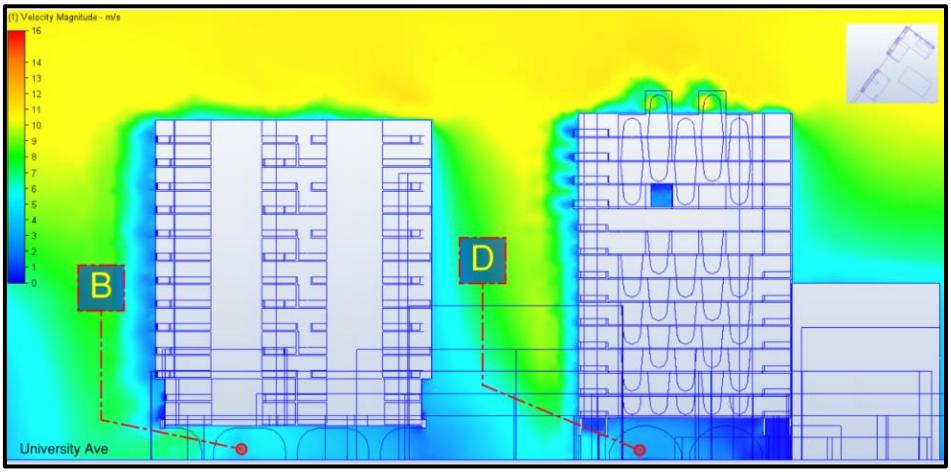


Figure 4.7 CFD modelling results for Scenario 2: westerly at 40km/h at section view

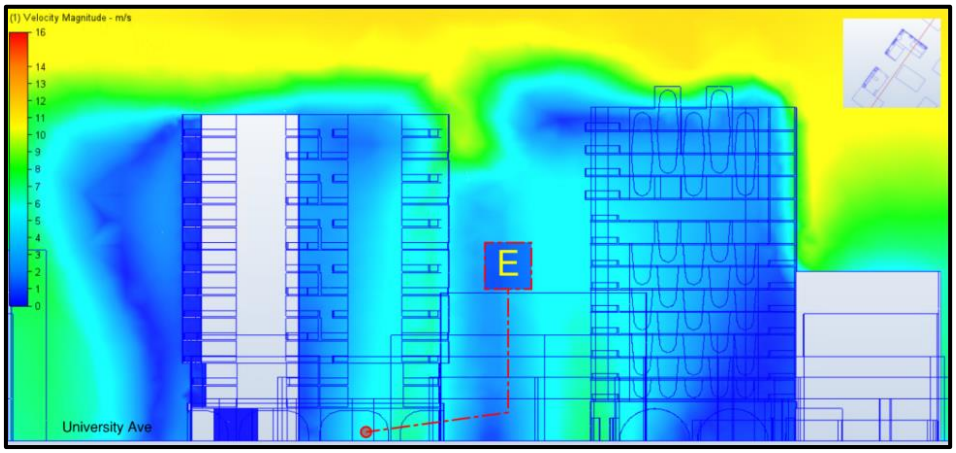


Figure 4.8 CFD modelling results for Scenario 2: westerly at 40km/h at section view

5 CONCLUSION AND RECOMMENDATIONS

The wind patterns associated with the proposed building will not unreasonably reduce the safety and comfort of people in the public realm or other open spaces associated with the development. Wind patterns and speeds observed at the subject points A, B, C, D and E (Figure 5.1) demonstrate that people present along these areas will not be subject to adverse wind conditions.

It is highly recommended that wind mitigation features are in place within the areas noted at Points B, C and E, as they are likely to be subject to the highest wind speeds observed during the prevailing scenarios. As these areas form part of the precinct's main thoroughfares, the following features may assist in mitigating the expected wind speeds along the public realm at pedestrian level:

- Dense vegetated landscaping such as static planters and trees
- Hard landscaping, such as artwork / large sculptures; or structures such as balustrades or screens
- A combination of hard structures permeated by vegetation e.g. green wall barriers

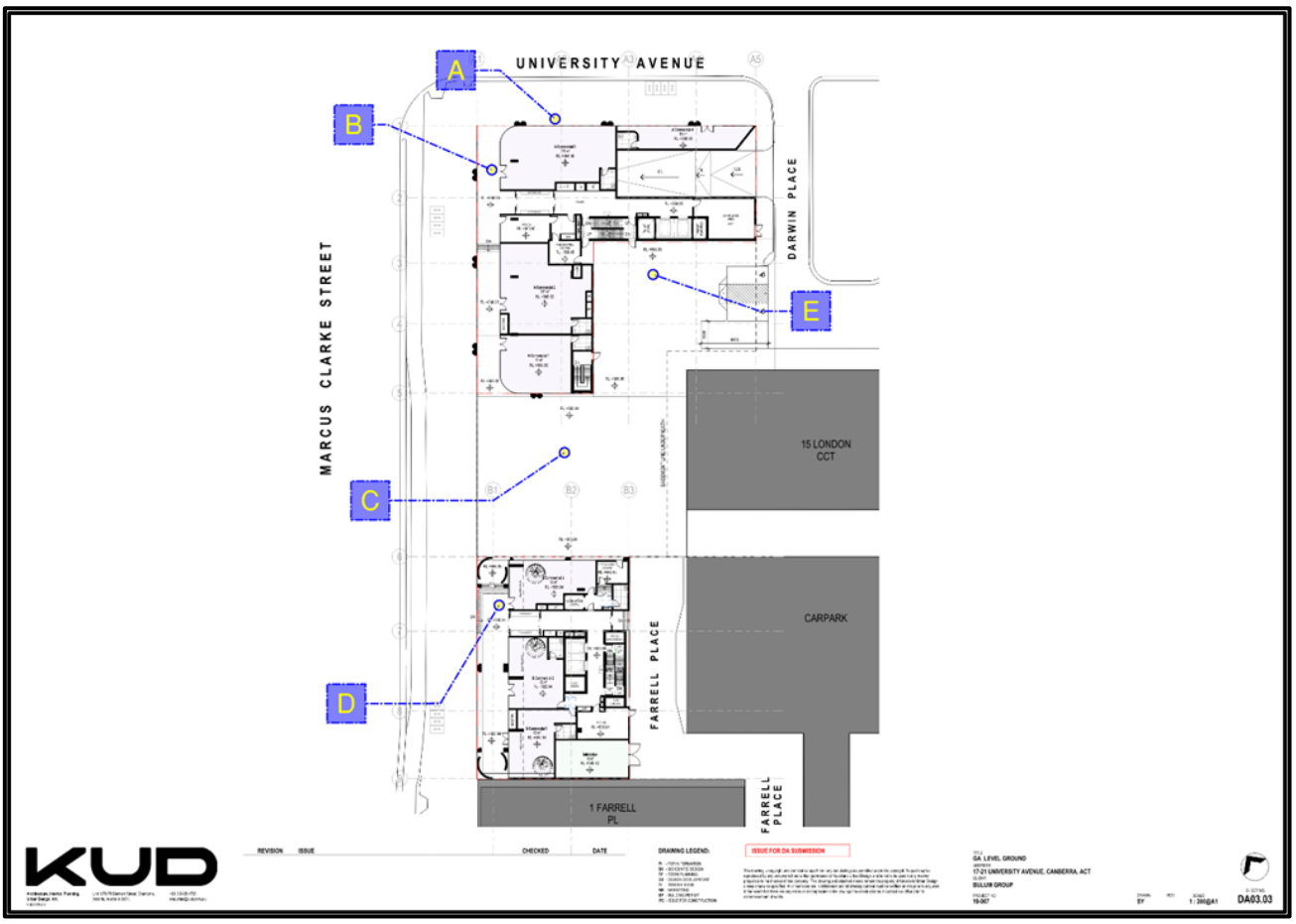


Figure 5.1 Architectural Layout – Ground floor, showing subject points A to E (Source: "GA_LEVEL GROUND sheet no. DA03.03" received by WSP 12/10/2023 from Kavellaris Urban Design, mark-up by WSP)

APPENDIX A

BUREAU OF METEOROLOGY DATA

A1 MONTHLY MEAN WIND SPEEDS

Table 5.1 Monthly mean wind speeds at recorded at the Canberra Airport Comparison weather station. (Source: BoM)

MONTH	MEAN WIND SPEED (M/S)	
	9 AM CONDITIONS	3 PM CONDITIONS
JANUARY	2.1	4.7
FEBRUARY	1.8	4.2
MARCH	1.7	4.1
APRIL	1.8	4.0
MAY	1.9	4.0
JUNE	2.2	4.3
JULY	2.4	4.8
AUGUST	2.8	5.5
SEPTEMBER	2.9	5.8
OCTOBER	3.0	5.8
NOVEMBER	2.7	5.4
DECEMBER	2.5	5.3
ANNUAL AVERAGE	**2.3**	**4.8**

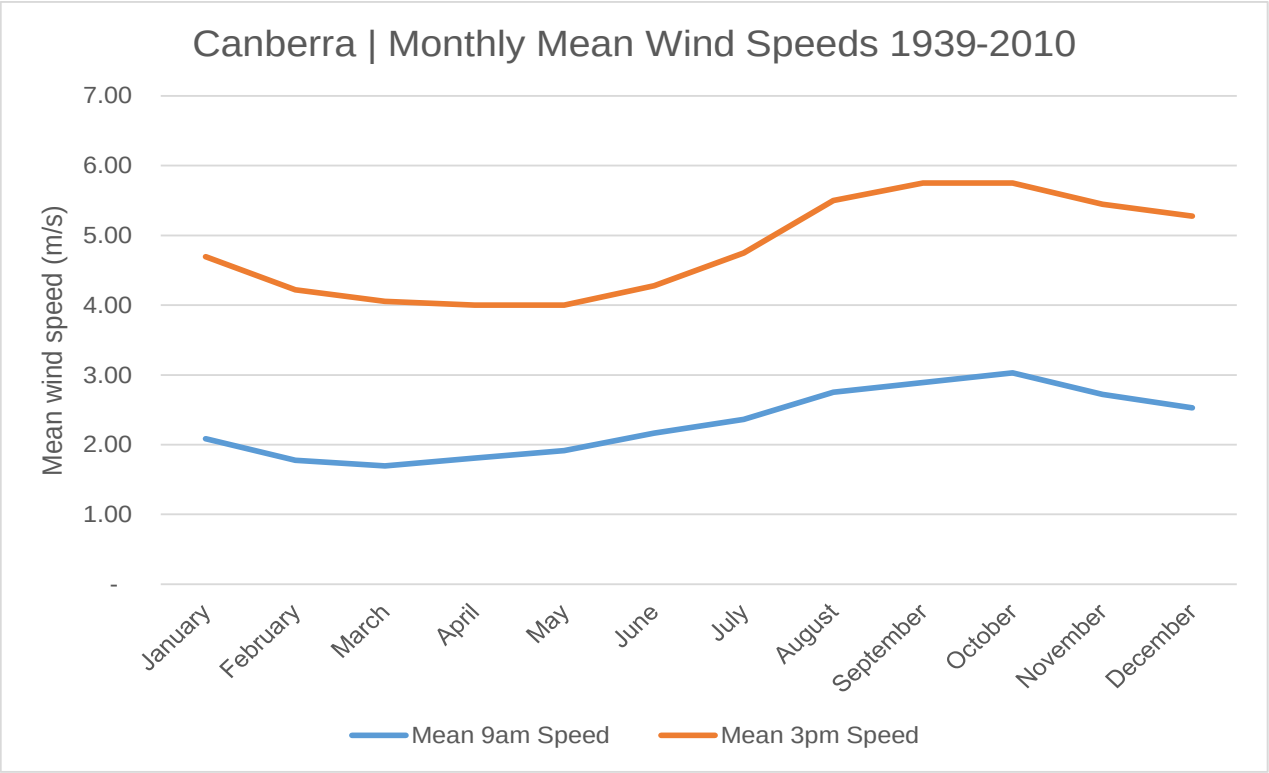
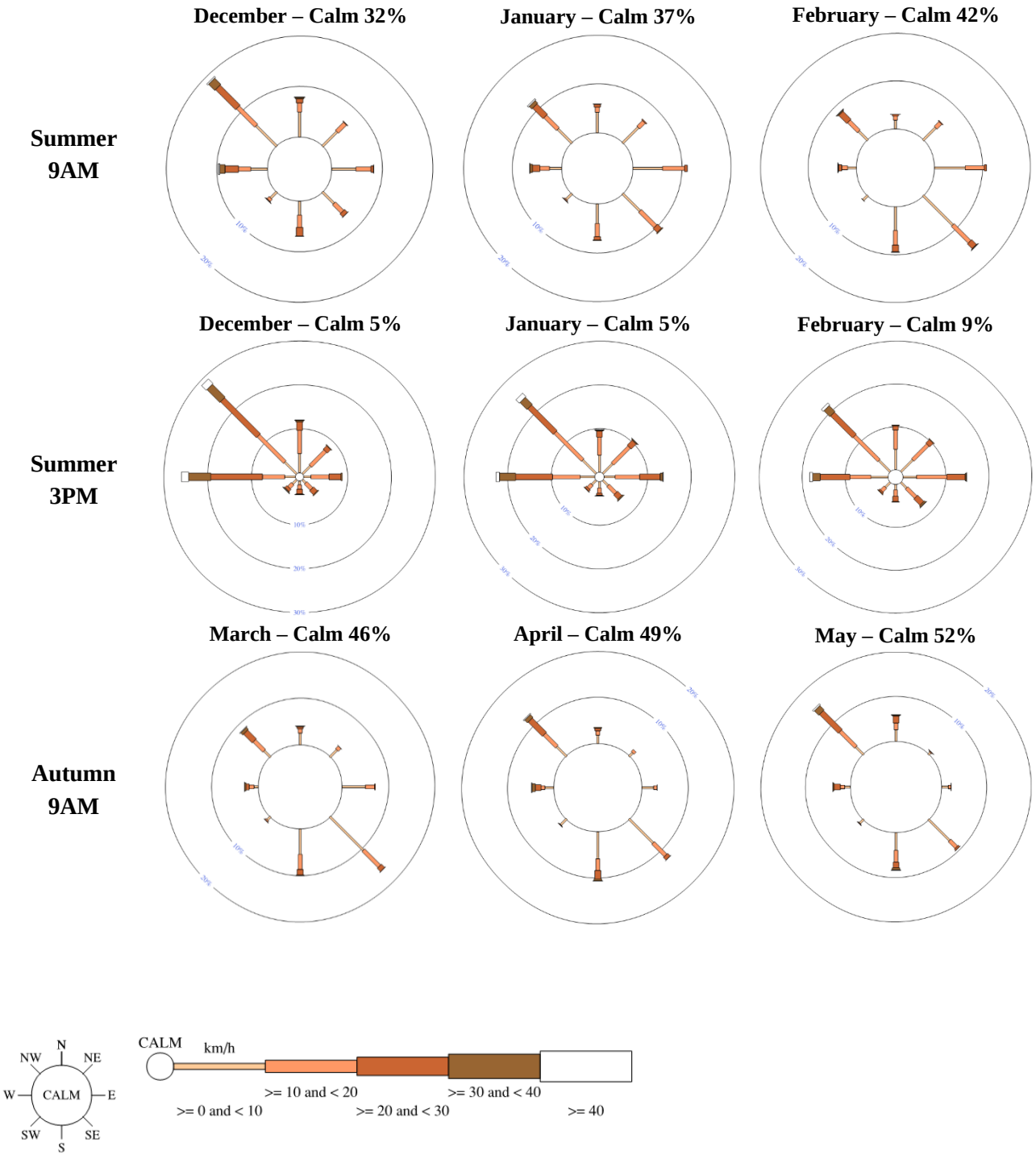


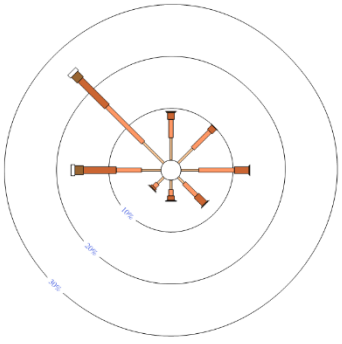
Figure 5.2 Monthly mean wind speeds (m/s) at recorded at the Canberra Airport Comparison weather station. (Source: BoM)

A2 CANBERRA AIRPORT COMPARISON AWS SEASONAL WIND ROSES

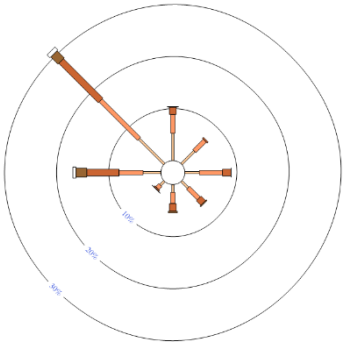


Autumn 3PM

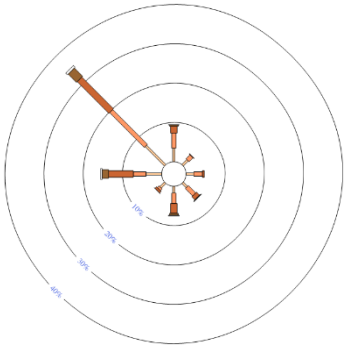
March – Calm 10%



April – Calm 12%

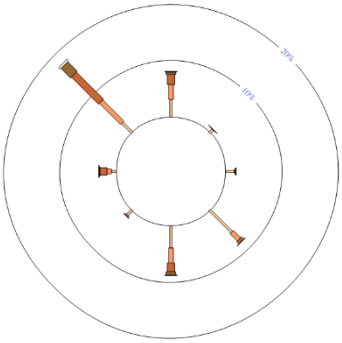


May – Calm 16%

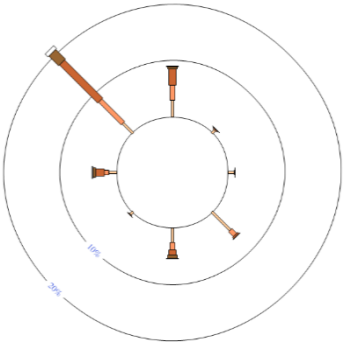


Winter 9AM

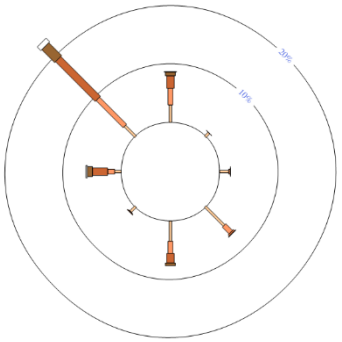
June – Calm 49%



July – Calm 50%

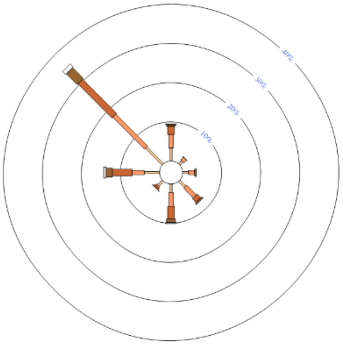


August – Calm 43%

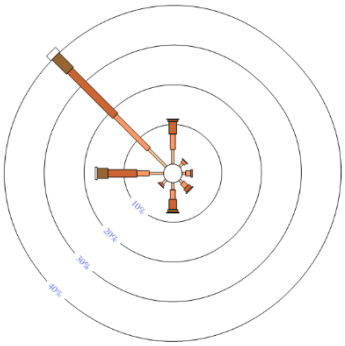


Winter 3PM

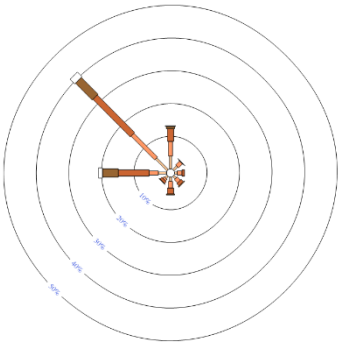
June – Calm 15%

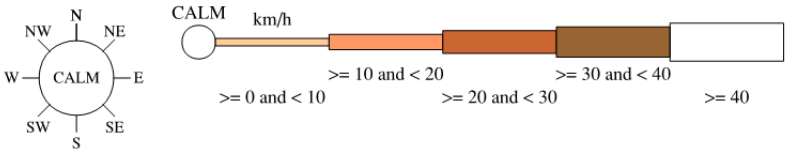


July – Calm 12%



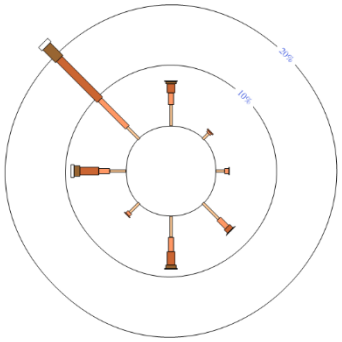
August – Calm 6%



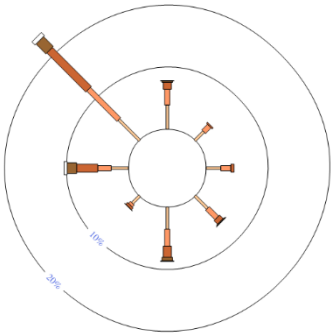


Spring 9AM

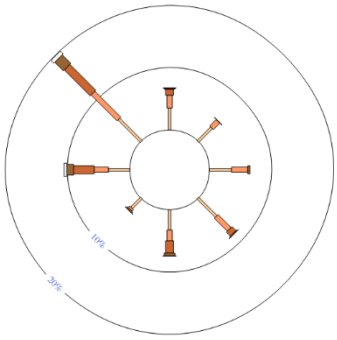
September – Calm 38%



October – Calm 32%

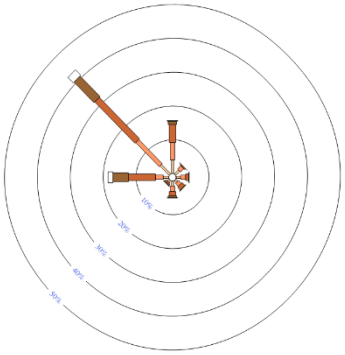


November – Calm 33%

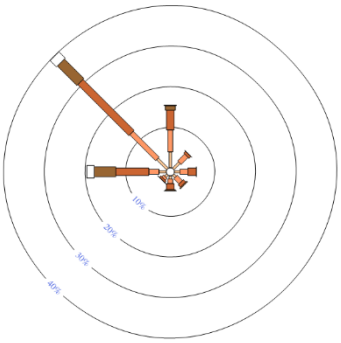


Spring 3PM

September – Calm 6%



October – Calm 5%



November – Calm 5%