



PEDESTRIAN WIND ENVIRONMENT STATEMENT LIVERPOOL HEALTH & ACADEMIC PRECINCT CARPARK

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Prepared for:

Health Infrastructure

Level 14, 77 Pacific Highway,
North Sydney, NSW 2060

WINDTECH Consultants Pty Ltd

Head Office: 607 Forest Road, Bexley, NSW 2207, Australia

P +61 2 9503 0300 **E** reception@windtechglobal.com **W** www.windtechconsult.com

Sydney | Dubai | Hong Kong | London | Melbourne | Mumbai | New York | Singapore

DOCUMENT CONTROL

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March 4, 2020	Update of previous report (ref: WF151-01F02(rev1), dated January 24, 2020), for updated site location figure and treatment recommendations based off of revised drawing set.	0	ML	MV	AC
March 11, 2020	Updated recommendations.	1	ML	MV	AC

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EXECUTIVE SUMMARY

This report presents an opinion on the likely impact of the proposed development of the Liverpool Health and Academic Precinct Carpark on the local wind environment at the critical outdoor areas within and around the subject development. The effect of wind activity is examined for the three predominant wind directions for the region; namely the north-easterly, south-easterly to southerly and westerly winds. The analysis of the wind effects relating to the proposed development was carried out in the context of the local wind climate, building morphology and land topography.

The conclusions of this report are drawn from our extensive experience in this field and are based on an examination of the latest architectural drawings. No wind tunnel testing was undertaken for the subject development, and hence this report addresses only the general wind effects and any localised effects that are identifiable by visual inspection. Any recommendations in this report are made only in-principle and are based on our extensive experience in the study of wind environment effects.

The results of this assessment indicate that the subject development is somewhat exposed to the three prevailing wind directions. As a result, there is a possible slight impact on the wind comfort within certain areas such as the various pedestrian thoroughfares and walkways. It is expected that the wind effects identified in the report can be ameliorated with the consideration of the following treatment strategies into the design of the development:

The following treatments are recommended to be implemented for the proposed development so that the probability of uncomfortable conditions is minimised.

- The retention of the covered walkway awning to the north of the Don Everett Building and to the north and east of the Brain Injury Building
- The retention of all proposed landscaping, including the line of trees that wraps around the ramp, the trees to the east of the Dock B Entry, the trees to the north of the Dock B entry and the trees at the centre of the Forbes Street Entry drop-off.
- The inclusion of Callistemon planting and bamboo screening along the eastern boundary of the site, adjacent to the railway line.
- The retention of the proposed tree planting along the eastern side of the covered walkway that runs along the eastern face of the Brain Injury Building (Based on drawings prepared by Clouston Associates, received on March 11, 2020)
- The inclusion of densely foliating vegetation to be planted at the south-eastern boundary of the new carpark, adjacent to the entry/exit to P4.

It is expected that the wind effects identified in the report can be ameliorated with the consideration of the above treatment strategies into the design of the development.

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1 INTRODUCTION

An opinion on the likely impact of the proposed design on the local wind environment affecting pedestrians within the critical outdoor areas within and around the subject development is presented in this report. The analysis of wind effects relating to the proposed development was carried out in the context of the predominant wind directions for the region, building morphology of the development and nearby buildings, and local land topography. The conclusions of this report are drawn from our extensive experience in the field of wind engineering and studies of wind environment effects.

No wind tunnel testing was undertaken for this assessment. Hence this report addresses only the general wind effects and any localised effects that are identifiable by visual inspection, and any recommendations in this report are made only in-principle.

2 DESCRIPTION OF THE DEVELOPMENT AND SURROUNDINGS

The Liverpool Health and Academic Precinct Main Works is a multi-storey development that will provide parking for the Liverpool Hospital. The carpark will be erected in addition to several new building to the west of the carpark development site. Liverpool Hospital is located within the central business district of Liverpool. It sits between Warwick Farm Station to the north and Liverpool Station to the south, amongst a scatter of mid-to-low-rise business buildings, which are surrounded suburban dwellings. The site is bounded by Goulburn Street to the west, Elizabeth Street to the south-west, Burnside Drive to the north-east and a train line to the east and south-east. New roads are proposed to the north of the development to enhance commuter access. A survey of the land topography indicates no major elevation changes in the region surrounding the site. An aerial image of the subject site and the local surroundings is shown in Figure 1.

The proposed carpark will have six levels and is designed to accommodate approximately 1100 car spaces. The redevelopment of the car park will help to ease pedestrian and traffic congestion around the hospital site and at the hospital entrances by providing new entry points, while also facilitating convenient, safe and secure parking for hospital staff and visitors. This assessment covers the various outdoor trafficable areas within and around the proposed development on the Ground Level.

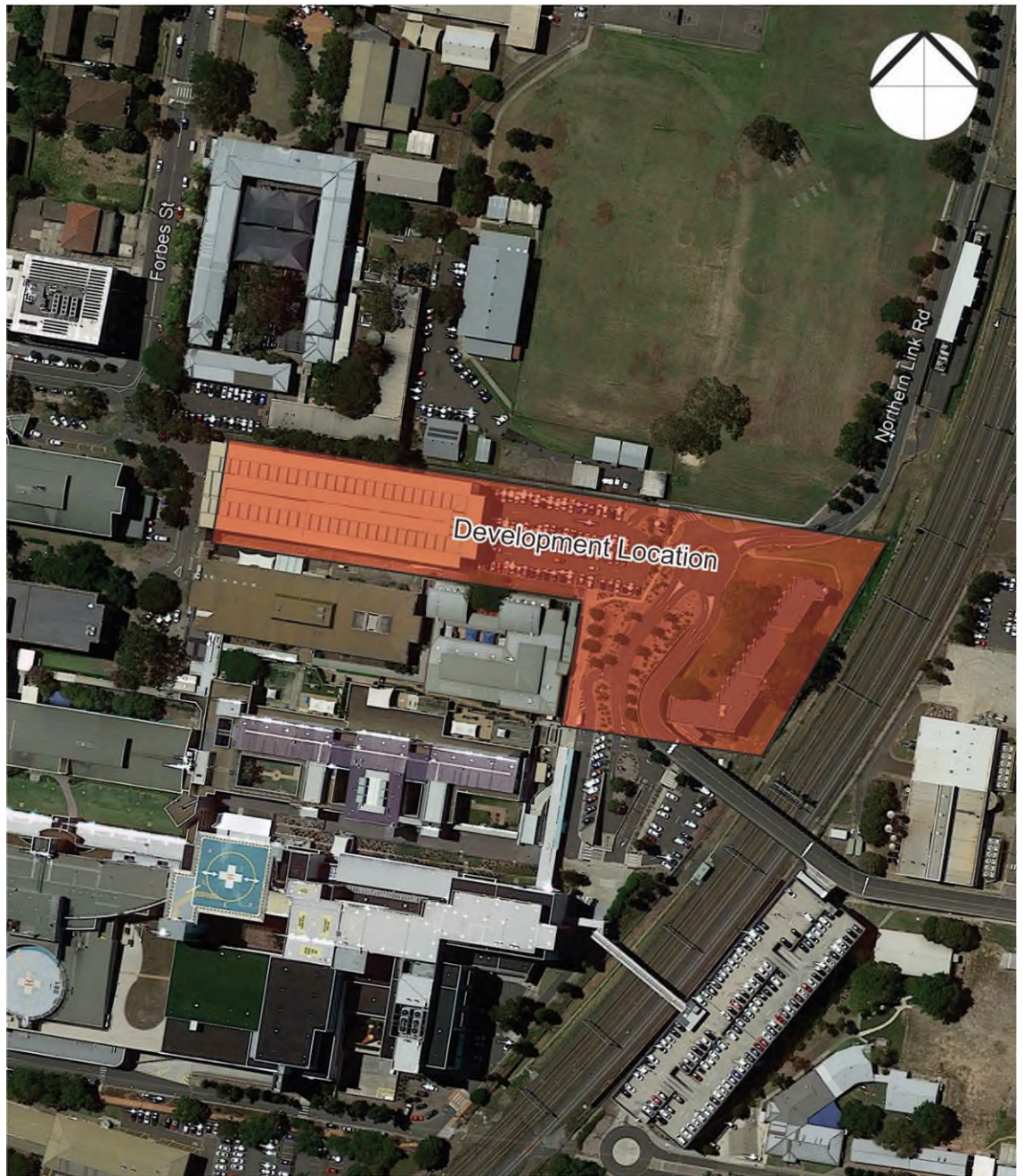


Figure 1: Aerial Image of the Site Location

3 REGIONAL WIND

The region is governed by three principal wind directions, and these can potentially affect the subject development. These winds prevail from the north-east, south-east to south, and west. These wind directions were determined from an analysis undertaken by Windtech Consultants of recorded directional wind speeds obtained at the meteorological station located at Bankstown Airport by the Bureau of Meteorology. The data has been collected from this station from 1993 to 2016 and corrected so that it represents winds over standard open terrain at a height of 10m above ground level. Figure 2 shows a summary of this analysis in the form of a directional plot of the annual and 5% exceedance mean winds for the region. The frequency of occurrence of these winds is also determined and shown in Figure 2.

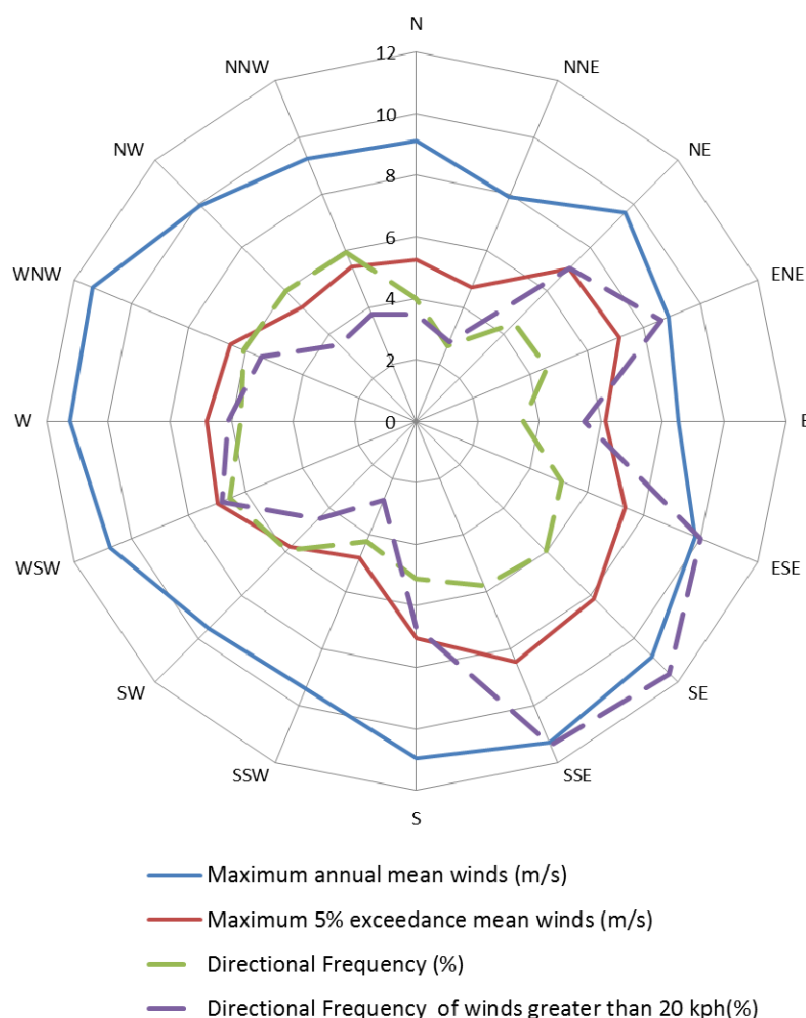


Figure 2: Annual and 5% Exceedance Hourly Mean Wind Speeds, and Frequencies of Occurrence, for the Bankstown Region (referenced to 10m above ground in standard open terrain)

4 WIND EFFECTS ON PEOPLE

The acceptability of wind in any area is dependent upon its use. For example, people walking or window-shopping will tolerate higher wind speeds than those seated at an outdoor restaurant. Various other researchers, such as A.G. Davenport, T.V. Lawson, W.H. Melbourne, and A.D. Penwarden, have published criteria for pedestrian comfort for pedestrians in outdoor spaces for various types of activities. Some Councils and Local Government Authorities have adopted elements of some of these into their planning control requirements.

For example, A.D. Penwarden (1973) developed a modified version of the Beaufort scale which describes the effects of various wind intensities on people. Table 1 presents the modified Beaufort scale. Note that the effects listed in this table refers to wind conditions occurring frequently over the averaging time (a probability of occurrence exceeding 5%). Higher ranges of wind speeds can be tolerated for rarer events.

Table 1: Summary of Wind Effects on People (A.D. Penwarden, 1973)

Type of Winds	Beaufort Number	Mean Wind Speed (m/s)	Effects
Calm	0	Less than 0.3	Negligible.
Calm, light air	1	0.3 – 1.6	No noticeable wind.
Light breeze	2	1.6 – 3.4	Wind felt on face.
Gentle breeze	3	3.4 – 5.5	Hair is disturbed, clothing flaps, newspapers difficult to read.
Moderate breeze	4	5.5 – 8.0	Raises dust, dry soil and loose paper, hair disarranged.
Fresh breeze	5	8.0 – 10.8	Force of wind felt on body, danger of stumbling
Strong breeze	6	10.8 – 13.9	Umbrellas used with difficulty, hair blown straight, difficult to walk steadily, wind noise on ears unpleasant.
Near gale	7	13.9 – 17.2	Inconvenience felt when walking.
Gale	8	17.2 – 20.8	Generally impedes progress, difficulty balancing in gusts.
Strong gale	9	Greater than 20.8	People blown over.

It should be noted that wind speeds can only be accurately quantified with a wind tunnel study. This assessment addresses only the general wind effects and any localised effects that are identifiable by visual inspection and the acceptability of the conditions for outdoor areas are determined based on their intended use. Any recommendations in this report are made only in-principle and are based on our extensive experience in the study of wind environment effects.

5 RESULTS AND DISCUSSION

The expected wind conditions are discussed in the following sub-sections of this report for the various outdoor areas within and around the subject development. The interaction between the wind and the building morphology in the area is considered and important features taken into account including the distances between the surrounding buildings and the proposed building form, as well as the surrounding landform. Note that only the potentially critical wind effects are discussed in this report.

The significant pedestrian trafficable areas for this development are the various pedestrian walkways and thoroughfares located on the Ground Level, which provide access to the carpark and circulation routes around the hospital campus. The recommended criterion for wind conditions for circulation areas is 7.5m/s with a 5% probability of exceedance. Although this assessment is of a qualitative nature, the abovementioned criteria are considered when assessing the wind environment impacts.

5.1 Westerly Winds

The predominant westerly winds are not expected to create uncomfortable condition on the eastern side of the proposed carpark due to the shielding provided by the proposed carpark and the existing Don Everett and Brain Injury Unit buildings. Similarly, the pedestrian thoroughfares around the Forbes Street Entry Drop-Off are expected to be shielded from the westerly winds by the buildings to the west of the drop-off.

5.2 North-Easterly Winds

The development is relatively exposed to the predominant north-easterly winds due to the proximity of the school oval to the north of the site. These winds are expected to side stream along the eastern faces of the carpark and the ramp. There is a possibility for these wind to wrap around the curved eastern face of the proposed carpark and funnel beneath the bridge that connects the proposed carpark to the ramp. The winds are also expected to funnel and side stream westward along the proposed road that will run alongside the northern face of the carpark, although no trafficable walkways are expected to be constructed along this road. The thoroughfares around the Forbes Street Entry Drop-Off will benefit from the shielding provided by the proposed planting to the west of the proposed carpark and to the north of the Dock B Entry.

5.3 South-Easterly to Southerly Winds

The trafficable areas to the west of the proposed carpark are expected to be shielded from the predominant south-easterly and southerly winds by the proposed car park and the existing Don Everett and Brain Injury buildings. The areas on the eastern side of the proposed carpark will receive some degree of shielding from the Central Energy Building and the Multi-Story Carpark on the opposite side of the train line, to the south-east of the development. The areas that are most vulnerable to uncomfortable conditions from these winds will be the area underneath the

bridge between the proposed carpark and the ramp, the footpath to the east of the Brain Injury Building, the new covered walkway to the north of the Don Everett and Brain Injury buildings and the pedestrian thoroughfare immediately to the east of the proposed carpark.

South-easterly winds are expected to wrap around the ramp massing before funnelling westward beneath the bridge that connects the proposed carpark to the ramp. This effect leaves the covered walkway to the north of the Don Everett and Brain Injury buildings vulnerable to funnelling winds, which can become trapped beneath the awning. There is potential for south-easterly and southerly winds to side stream northward along the eastern face of the Brain Injury Building and funnel beneath the awning along the covered walkway. The pedestrian thoroughfare immediately to east of the proposed carpark is expected to experience strong south-easterly winds due to these winds accelerating around the curved eastern face of the proposed carpark. The proposed landscaping is expected decrease the effect of these strong winds. Nevertheless, some additional mitigation strategies are recommended.

5.4 Recommendations

The following treatments are recommended to be implemented for the proposed development so that the probability of uncomfortable conditions is minimised.

- The retention of the covered walkway awning to the north of the Don Everett Building and to the north and east of the Brain Injury Building
- The retention of all proposed landscaping, including the line of trees that wraps around the ramp, the trees to the east of the Dock B Entry, the trees to the north of the Dock B entry and the trees at the centre of the Forbes Street Entry drop-off.
- The inclusion of Callistemon planting and bamboo screening along the eastern boundary of the site, adjacent to the railway line.
- The retention of the proposed tree planting along the eastern side of the covered walkway that runs along the eastern face of the Brain Injury Building (Based on drawings prepared by Clouston Associates, received on March 11, 2020)
- The inclusion of densely foliating vegetation to be planted at the south-eastern boundary of the new carpark, adjacent to the entry/exit to P4.

It is expected that the wind effects identified in the report can be ameliorated with the consideration of the above treatment strategies into the design of the development.

6 REFERENCES

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