PEDESTRIAN WIND ENVIRONMENT STATEMENT

STAGES 1 & 2, MORIAH COLLEGE CAMPUS, QUEENS PARK

WE954-01F02(REV2)- WS REPORT

SEPTEMBER 5, 2019

Prepared for:

Aver Pty Ltd

Level 1, 171 William Street

Darlinghurst NSW, 2010

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

DOCUMENT CONTROL

Date	Revision History	Issued Revision	Prepared By (initials)	Instructed By (initials)	Reviewed & Authorised by (initials)
August 30, 2019	Initial.	0	MV	SR	TR
September 4, 2019	Updated for comments	1	HK	SR/AB	BU
September 5, 2019	Amended plans removing north facing terrace	2	HK	SR	BU

EXECUTIVE SUMMARY

This report presents an opinion on the likely impact of the proposed partial redevelopment of Moriah College, Queens Park, 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 Sydney region; namely the north-easterly, 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 permanent openings on the north-eastern aspect of Phase 1 which connect to the North Atrium are expected to naturally ventilate the internal volume and improve occupant comfort in this area.

The results of this assessment indicate that the subject development is relatively exposed to the southerly and westerly wind directions. The areas potentially adversely affected by these winds are the pedestrian walkways following the vehicular access under Phase 2, and the various elevated terraces of both buildings. 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:

Upper Ground Level

- The inclusion of porous screens at the southern opening of the thoroughfare under Phase 2.
- The implementation of a 2 m high screen following the perimeter of the ELC outdoor area.
- The planting of densely foliating evergreen trees near the north-eastern opening of the thoroughfare under Phase 2.

Elevated terraces

- The inclusion of 2 m high impermeable and porous screens at strategic locations.

CONTENTS

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.

This Pedestrian Wind Environment Statement report accompanies an Environmental Impact Statement (EIS) in support of State Significant Development Application (SSD-10352) for new school buildings on the existing campus of Moriah College, Queens Park (the site). The site is legally described as 101 York Road, Queens Park/ Lot 22 DP 879582, 1 Queens Park Road, Queens Park/ Lot 1 DP 701512 and 3 Queens Park Road, Queens Park/ Lot 3 DP 701512.

2 DESCRIPTION OF THE DEVELOPMENT AND SURROUNDINGS

The southern segment of the college campus is proposed for redevelopment of the existing campus of Moriah College, Queens Park for new school buildings.

The proposed site area is bounded by Baronga Avenue to the south-east and York Road to the south-west. Existing low-rise school buildings are located to the north of the site. The remaining aspects of the site are bordered by parks and reserves, with Queen Park is located to east, Centennial Park to the south and Banksia Reserve to the west. A survey of the land topography indicates predominantly flat terrain surrounding the site, except for a slope up (approx. gradient of 1:12) to the site from the small creek in Centennial Park to the south. An aerial image of the subject site and the local surroundings is shown in Figure 1.

The proposed development includes two buildings joined by an elevated colonnade. The Phase 1 building follows the eastern boundary of the site and has a proposed height of 3-4 storeys. The Phase 2 building has a proposed height of 3 storeys and sits over an existing internal access road, turning it into an underpass. This assessment covers the various outdoor areas within and around the proposed development that a trafficable by pedestrians.

Figure 1: Aerial Image of the Site Location

3 REGIONAL WIND

The Sydney region is governed by three principal wind directions which can potentially affect the subject development. These winds prevail from the north-east, south and west. A summary of the principal time of occurrence of these winds throughout the year is presented in Table 1 below. This summary is based on a detailed analysis undertaken by Windtech Consultants of recorded directional wind speeds obtained at the meteorological station located at Kingsford Smith Airport by the Bureau of Meteorology (recorded from 1995 to 2016). From this analysis, directional probabilities of exceedance and directional wind speeds for the region are determined. The directional wind speeds and corresponding directional frequencies of occurrence are presented in Figure 2.

As shown in Figure 2, the southerly winds are by far the most frequent wind for the Sydney region, and are also the strongest. The westerly winds occur most frequently during the winter season for the Sydney region, and although they are typically not as strong as the southerly winds, they are usually cold and cause for discomfort for outdoor areas. North-easterly winds occur most frequently during the warmer months of the year for the Sydney region, and are usually welcomed at outdoor areas since they are typically not as strong as the southerly or westerly winds.

Table 1: Principal Time of Occurrence of Winds for the Sydney Region

Month	North-Easterly Winds	Southerly Winds	Westerly Winds
January	X	X	
February	X	X	
March	X	X	
April		X	X
May			X
June			X
July			X
August			X
September		X	X
October	X	X	
November	X	X	
December	X	X	

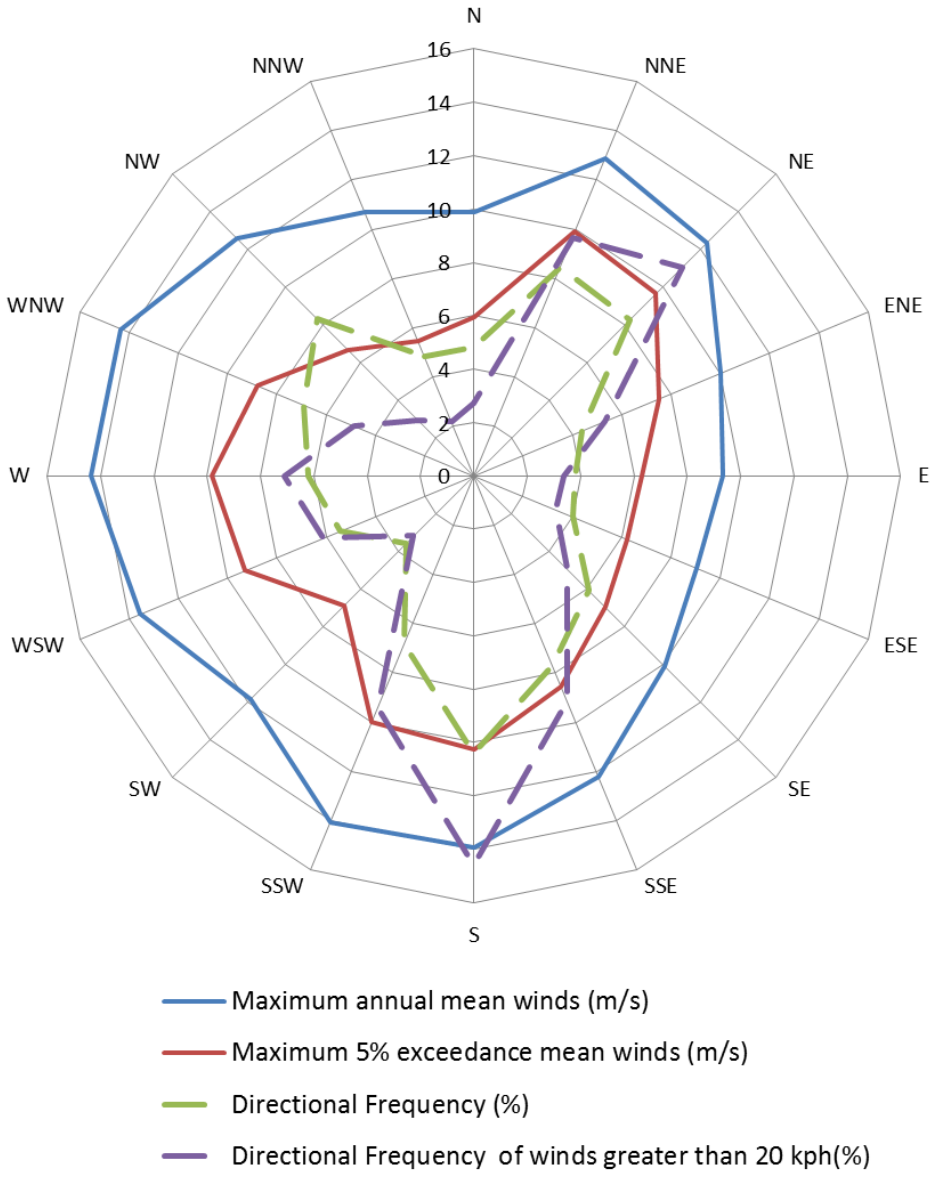

Figure 2: Annual and 5% Exceedance Hourly Mean Wind Speeds, and Frequencies of Occurrence, for the Sydney Region (referenced to 10m above ground in standard open terrain)

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 2 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 infrequent events.

Table 2: 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, 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 ground plane will be used primarily for circulation and pick-up/drop-off of students. The recommended criterion for wind conditions for the circulation area is 7.5m/s with a 5% probability of exceedance. Terrace areas may be utilised for standing or short-duration activities and will need to satisfy a more stringent comfort criterion of 5.5m/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 Ground Level Areas

Most outdoor areas around the site are expected to experience wind conditions appropriate for use. Particularly, the area between Phase 1 and Phase 2 are expected to be shielded from prevailing winds. The proposed vehicular access passing under Phase 2 is expected to create adverse wind conditions due to the alignment of openings to the south and the west – both prevailing wind directions. Pedestrian access is also required along the road, and waiting areas are proposed under the porte cochère adjacent to the canteen. This thoroughfare is expected to create an unpleasant wind tunnel. With the implementation of the following treatments, which are shown in Figure 3, potential adverse wind conditions are likely to be mitigated:

- Strategically located full-height permeable screens (30-40% porous) at the southern opening of the underpass. These screens will work together to shield and deflect southerly winds away from pedestrians and those waiting to be picked up.
- A proposed 2 m high impermeable screen following the perimeter of the Ground Level ELC outdoor area, with strategically planted densely foliating evergreen trees. The screen is expected to partially deflect westerlies away from the opening of the underpass, while wind passing over the screen will be slowed down by the trees due to the transference of the wind's kinetic energy to the tree canopies.

5.2 ELC Outdoor and Terraces

Level 1 of Phase 2 is proposed to be utilised as an ELC outdoor area and is exposed to direct winds from the south and west. It is recommended that 2 m high porous screens be implemented along the perimeter of the terrace area, as shown in Figure 4, to provide appropriate conditions for students undertaking short-duration activities such as running and playing. The screens are recommended to be porous, and not impermeable, to avoid the downward deflection of winds onto those located on the floor below.

A terrace is also proposed for Level 3 of Phase 1. The western terrace on Level 3 is exposed to direct westerly winds which will adversely impact users of the terrace, particularly during the winter. A 2 m perimeter impermeable screen, as shown in Figure 5, is expected to provide protection and ameliorate adverse wind conditions. A 2 m screen at the southern edge of the eastern terrace on Level 3 is also recommended to be implemented to provide protection from potential adverse southerly winds.

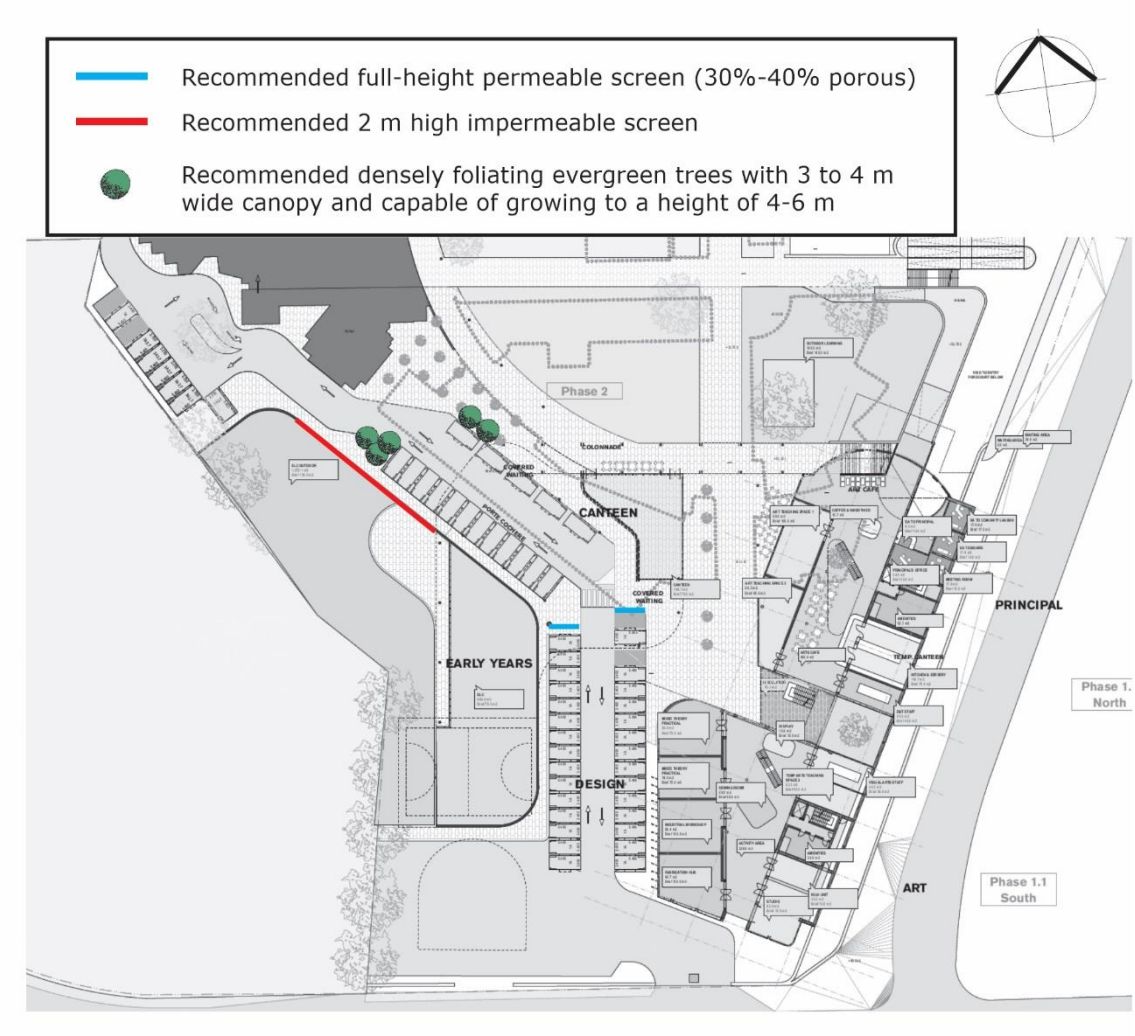

Figure 3: Recommended treatments for Ground Level of the ELC and At-Grade Carpark

Figure 4: Recommended treatments for the terrace on Level 1 of Phase 2

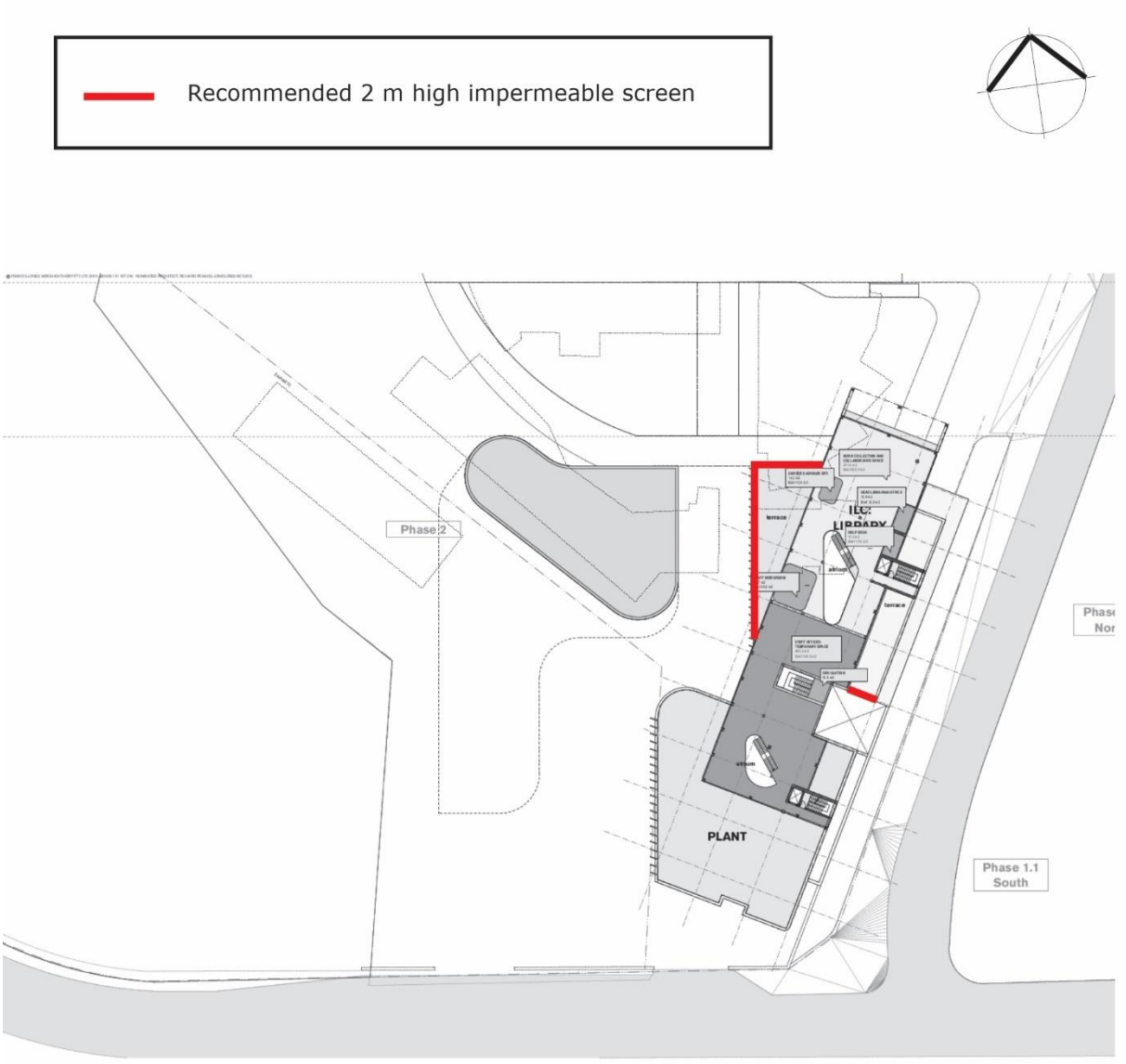

Figure 5: Recommended treatments for the terraces on Level 3 of Phase 1

6 REFERENCES

Davenport, A.G., 1972, "An approach to human comfort criteria for environmental conditions". Colloquium on Building Climatology, Stockholm.

Lawson, T.V., 1973, "The wind environment of buildings: a logical approach to the establishment of criteria". Bristol University, Department of Aeronautical Engineering.

Lawson, T.V., 1975, "The determination of the wind environment of a building complex before construction". Bristol University, Department of Aeronautical Engineering.

Lawson, T.V., 1980, "Wind Effects on Buildings - Volume 1, Design Applications". Applied Science Publishers Ltd, Ripple Road, Barking, Essex, England.

Melbourne, W.H., 1978, "Criteria for Environmental Wind Conditions". *Journal of Wind Engineering and Industrial Aerodynamics*, vol. 3, pp241-249.

Penwarden, A.D. (1973). "Acceptable Wind Speeds in Towns", Building Science, vol. 8: pp259–267.

Penwarden, A.D., Wise A.F.E., 1975, "Wind Environment Around Buildings". Building Research Establishment Report, London.