

# Pedestrian Wind Environment Statement

for the proposed development known as  
Precinct 2 Pemulwuy, Redfern

December 7, 2011

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## Document Control

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2	7/12/2011	Finalised	TH	

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# Table of Contents

	Page
1.0 Introduction	4
2.0 Regional Wind Climate for the Sydney Region	4
3.0 Wind Effects on People	6
4.0 Description of the Site and Surrounds	7
5.0 Description of the Proposed Development	9
6.0 Results of the Analysis	10
6.1 Pedestrian Footpaths Around The Site	10
6.2 North-Easterly Winds	10
6.3 Southerly Winds	11
6.4 Westerly Winds	12
7.0 Conclusions	14

Appendix: Wind Roses for the Sydney Region

## **1.0 Introduction**

This report is in relation to the proposed residential development known as Precinct 2 Pemulwuy, Redfern, and presents an opinion on the likely impact of the local wind environment to the critical outdoor areas within and around the development.

The effect of wind activity within and around the proposed development is examined for the three predominant wind directions for the Sydney region; north-easterly, southerly and westerly winds. The analysis of the wind effects relating to the proposal 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 Concept Plan design massing drawings which have been prepared by the project architect Nordon Jago Architects, dated 2<sup>nd</sup> December 2011. No wind tunnel tests have been undertaken for the subject development. As such, 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.

## **2.0 Regional Wind Climate for the Sydney Region**

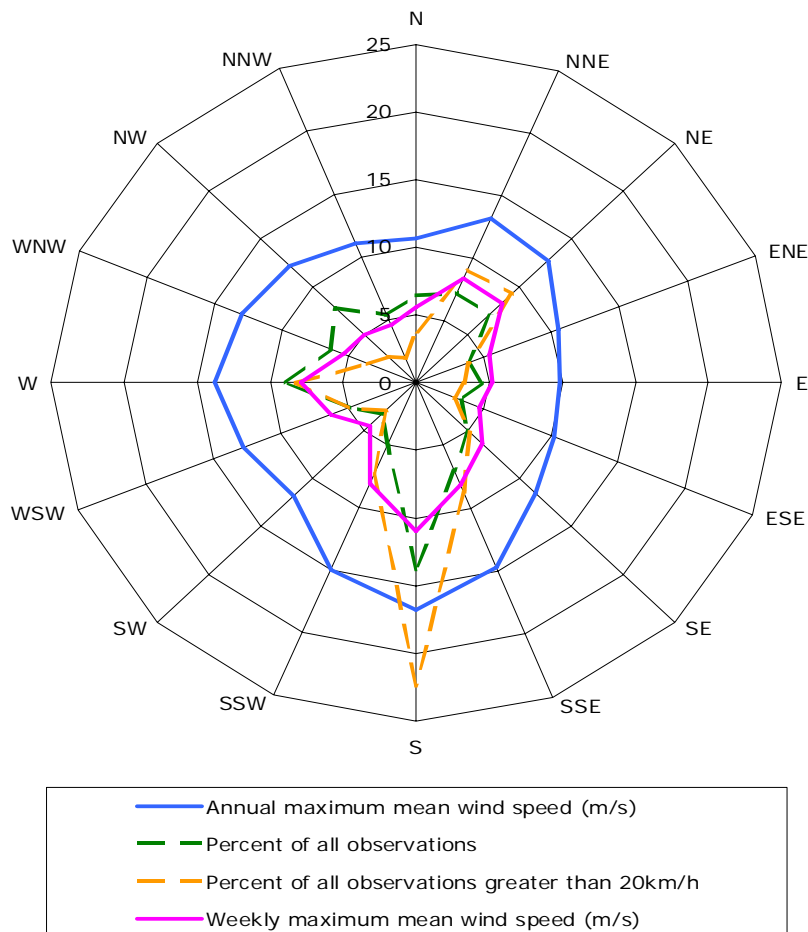
The Sydney region is governed by three principle wind directions which can potentially affect the subject development. These winds prevail from the north-east, south and west. A summary of the principal time of occurrence of these winds throughout the year is presented in Table 1 below. This summary is based on an analysis of wind rose data obtained by the Bureau of Meteorology from Kingsford Smith Airport between 1939 and 2004. The wind roses are attached in the appendix of this report.

For the Sydney region, north-easterly winds occur most frequently during the warmer months of the year. They are typically not as strong as the southerly winds, and are usually welcomed within outdoor areas since they typically occur when it can be quite warm during the summer. The southerly winds are by far the most frequent wind for the Sydney region, and are also the strongest. Westerly winds occur most frequently during the winter season for the Sydney region. Although they are typically not as strong as the southerly winds, they are usually a cold wind since they occur during the winter, and hence can be a cause for discomfort for outdoor areas.

A directional plot of the annual and weekly recurrence winds for the Sydney region is shown in Figure 1. The frequency of occurrence of these winds is also shown in Figure 1. This plot has been produced based on an analysis performed by Windtech Consultants using recorded wind speed data obtained from Kingsford Smith Airport from 1939 to 2008.

**Table 1: Principal Time of Occurrence of Winds for Sydney**

Month(s)	Prevailing Wind Direction		
	North-Easterly	Southerly	Westerly
January through to March	X	X	
April		X	X
May through to August			X
September		X	X
October through to December	X	X	



**Figure 1: Annual and Weekly Recurrence Mean Wind Speeds, and Frequencies of Occurrence, for the Sydney Region (based on 10 minute mean observations from Kingsford Smith Airport from 1939 to 2008, corrected to open terrain at 10m)**

### 3.0 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.

The following table, developed by Penwarden (1975), describes the effects of various wind intensities on people. Note that the applicability column relates to the indicated wind conditions occurring frequently (exceeded approximately once per week on average). Higher ranges of wind speeds can be tolerated for rarer events.

**Table 2: Summary of Wind Effects on People (after Penwarden, 1975)**

Type of Winds	Gust Speed (m/s)	Effects	Applicability
Calm, light air	0 - 1.5	Calm, no noticeable wind.	Generally acceptable for Stationary, long exposure activities such as in outdoor restaurants, landscaped gardens and open air theatres.
Light breeze	1.6 - 3.3	Wind felt on face.	
Gentle breeze	3.4 - 5.4	Hair is disturbed, Clothing flaps.	
Moderate breeze	5.5 - 7.9	Raises dust, dry soil and loose paper. Hair disarranged.	Generally acceptable for walking & stationary, short exposure activities such as window shopping, standing or sitting in plazas.
Fresh breeze	8.0 - 10.7	Force of wind felt on body.	Acceptable as a main pedestrian thoroughfare
Strong breeze	10.8 - 13.8	Umbrellas used with difficulty, Hair blown straight, Difficult to walk steadily, Wind noise on ears unpleasant.	Acceptable for areas where there is little pedestrian activity or for fast walking.
Near gale	13.9 - 17.1	Inconvenience felt when walking.	
Gale	17.2 - 20.7	Generally impedes progress, Great difficulty with balance.	Unacceptable as a public accessway.
Strong gale	20.8 - 24.4	People blown over by gusts.	Completely unacceptable.

## 4.0 Description of the Site and Surrounds

Precinct 2 of the Pemulwuy development is located within Redfern, and is bounded by Caroline Street to the North, Eveleigh Street to the east, Lawson Street to the south and existing local surrounding buildings to the west. The Precinct 2 development is one of three development precincts, with Precinct 1 located north across Caroline Street to the north and Precinct 3 located east across Eveleigh Street.

The existing surrounding buildings to the south-west through north-west are between 2-3 levels in height above ground. The proposed Precinct 1 development to the north ranges between 2 to 5 levels in height above ground. Precinct 3 to the east of the subject development is proposed to be 7 levels in height above ground.

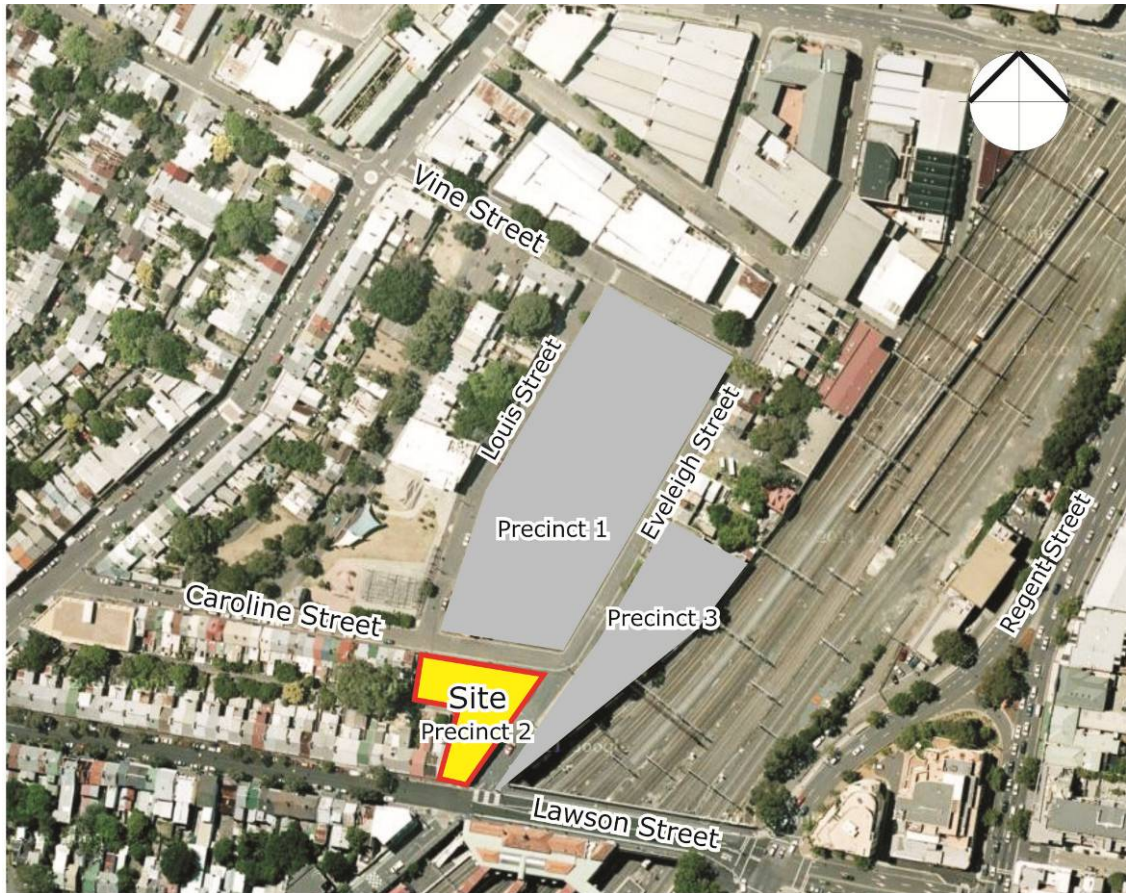
The land gradually slopes down to the north-east and there are no major topographical changes to the further away from the site. Aerial images of the site are shown in Figures 2a to 2c.



**Figure 2a: Aerial Image of the Site Location  
(view from the north, facing south)**



**Figure 2b: Aerial Image of the Site Location  
(view from the west, facing east)**



**Figure 2c: Aerial Image of the Site Location**

## 5.0 Description of the Proposed Development

The proposed Precinct 2 development is a 4 level mixed development with children's facilities on Level 1, retail on Level 2 and office space on the remaining upper levels.

The various outdoor trafficable area of the development, which are areas subject to this analysis are summarized as follows:

- Pedestrian footpath along Caroline, Eveleigh and Lawson Street
- Playground on level 1 to the northwest of the site, adjacent to Caroline Street
- Public Open Space at the junction of Caroline and Eveleigh Street, north-east corner of the proposed development site
- The balcony on level 4 of the proposed Precinct 2 development.

It can be assumed that the roof on level 4 & 5 of the proposed apartment are not accessible to the general public, hence these area will not be examine as a critical outdoor trafficable area in this assessment.

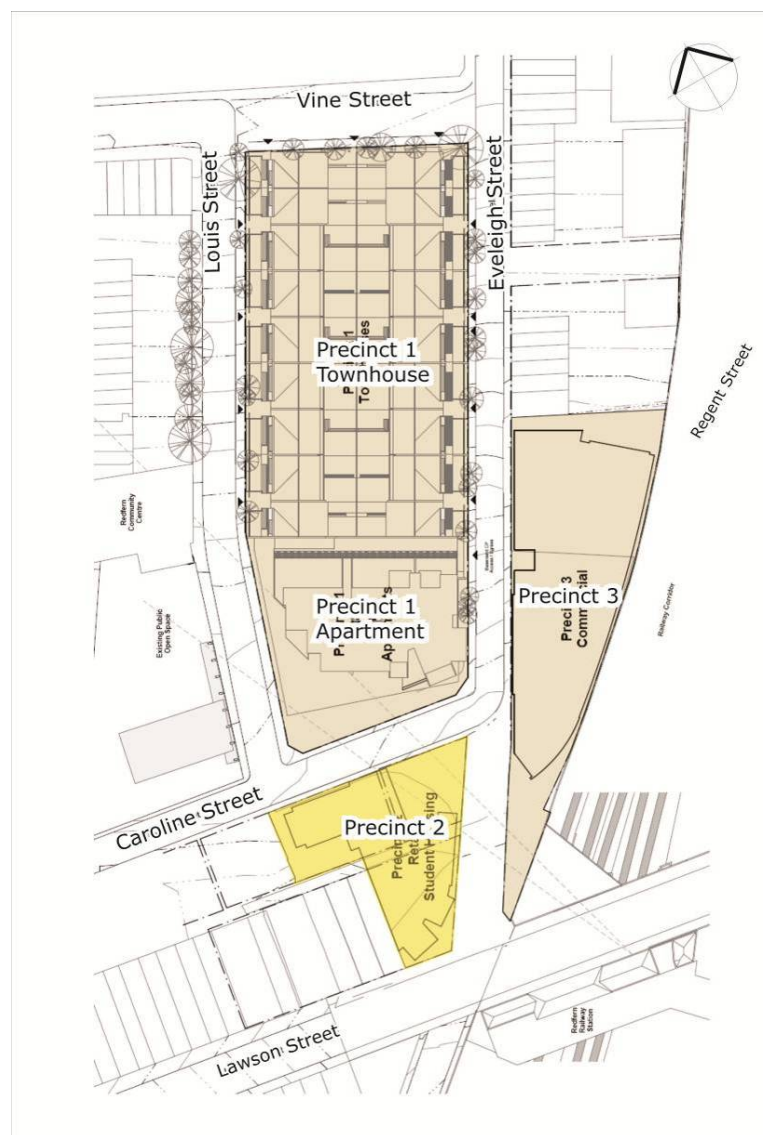


Figure 3: Site Plan Proposed Development Site

## 6.0 Results of the Analysis

For each of the three predominant wind directions for the Sydney region, the interaction between the wind and the building morphology in the area was considered. Important features taken into account include the distances between the proposed building forms, their overall heights and bulk, as well as the landform. Only the potentially critical wind effects are discussed in this report. The expected wind conditions for the various critical outdoor trafficable areas within and around the site are discussed in the following sub-sections of this report.

### 6.1 Pedestrian Footpaths Around The Site

Although Caroline and Lawson Street pedestrian footpath maybe exposed to westerly wind funneling along these two streets but it should be noted that this an existing effect and the proposed precinct 2 development is expected to have negligible impact on the wind condition on the pedestrian footpath along these two streets during strong westerly wind condition. Generally the pedestrian footpath on Caroline, Lawson and Eveleigh Street are relatively well shielded from the North-easterly and Southerly prevailing wind by the proposed precinct 1 & 3 development and the existing buildings south of the development site.

### 6.2 North-Easterly Winds

North-easterly winds occur most frequently during the warmer months of the year for the Sydney region. They are typically not as strong as the southerly winds, and are usually welcomed within outdoor areas since they typically occur when it can be quite warm during the summer.

#### ***Trafficable Ground Level Outdoor Area within the Site***

The proposed playground to the west on level 1 of the Precinct 2 development site is relatively well shielded from the prevailing north-easterly winds by the proposed precinct 1 development across Caroline Street. Hence adequate wind conditions are to be expected for these areas.

The proposed Public Open Space to the north-east corner of the development site is relatively well shielded from the prevailing north-easterly wind by the Precincts 1 & 3. Hence the wind condition within the Public Open Space is expected to be ideal for it intended use.

#### ***Private Balconies, Terraces and Grassed Areas***

The private balcony on level 4 associated with the proposed precinct 2 development is relatively well shielded from the prevailing north-easterly wind due to the effective use of building setback.

The impermeable balustrades which are proposed on the perimeter of the balcony will provide additional shielding from potential adverse wind condition. Hence it is recommended that this impermeable balustrade be retained in the final design of the proposed development.

With the incorporation of the above mentioned, adequate wind conditions are expected for the private balcony on level 4 of the proposed apartment.

### **6.3 Southerly Winds**

As shown in Figure 1 of this report, the southerly winds are by far the most frequent wind for the Sydney region, and are also the strongest.

#### ***Trafficable Ground Level Outdoor Area within the Site***

The proposed playground to the west on level 1 of the proposed precinct 2 development site is relatively well shielded from the prevailing southerly winds by the proposed development itself and the existing buildings south of the development site. Hence adequate wind conditions are to be expected for these areas.

The proposed Public Open Space to the north-east corner of the proposed precinct 2 development is relatively exposed to the prevailing southerly wind side-streaming along the façade of the development. The wind conditions within these areas are expected to be similar to the existing conditions. If stationary activities are anticipated, it is expected a row of densely foliating trees as indicated in Figure 4 will be effective in further enhancing the wind conditions within these areas. With the incorporation of the above mentioned, adequate wind conditions are expected to be suitable for its intended use.

#### ***Private Balconies, Terraces and Grassed Areas***

The corners of the north-facing balcony on Level 4 are exposed to the adverse southerly winds accelerating around the development. The proposed impermeable balustrades along the perimeter of the balcony are recommended to be retained in the final design of the proposed development to ameliorate the adverse wind conditions. Hence, with the incorporation of the above mentioned recommendation the wind conditions within the balcony will be acceptable for its intended uses.

## 6.4 Westerly Winds

Westerly winds occur most frequently during the winter season for the Sydney region. Although they are typically not as strong as the southerly winds, they are usually a cold wind since they occur during the winter, and hence can be a cause for discomfort for outdoor areas.

### ***Trafficable Ground Level Outdoor Area within the Site***

The proposed playground to the west on level 1 of the proposed precinct 2 development site is relatively well shielded from the prevailing westerly winds by the existing building west of the site. Hence adequate wind conditions are to be expected for these areas.

The proposed Public Open Space to the north-east corner of the site is relatively shielded from the prevailing westerly wind by the proposed precinct 2 development itself. Hence the wind condition within the Public Open Space is expected to be ideal for its intended use.

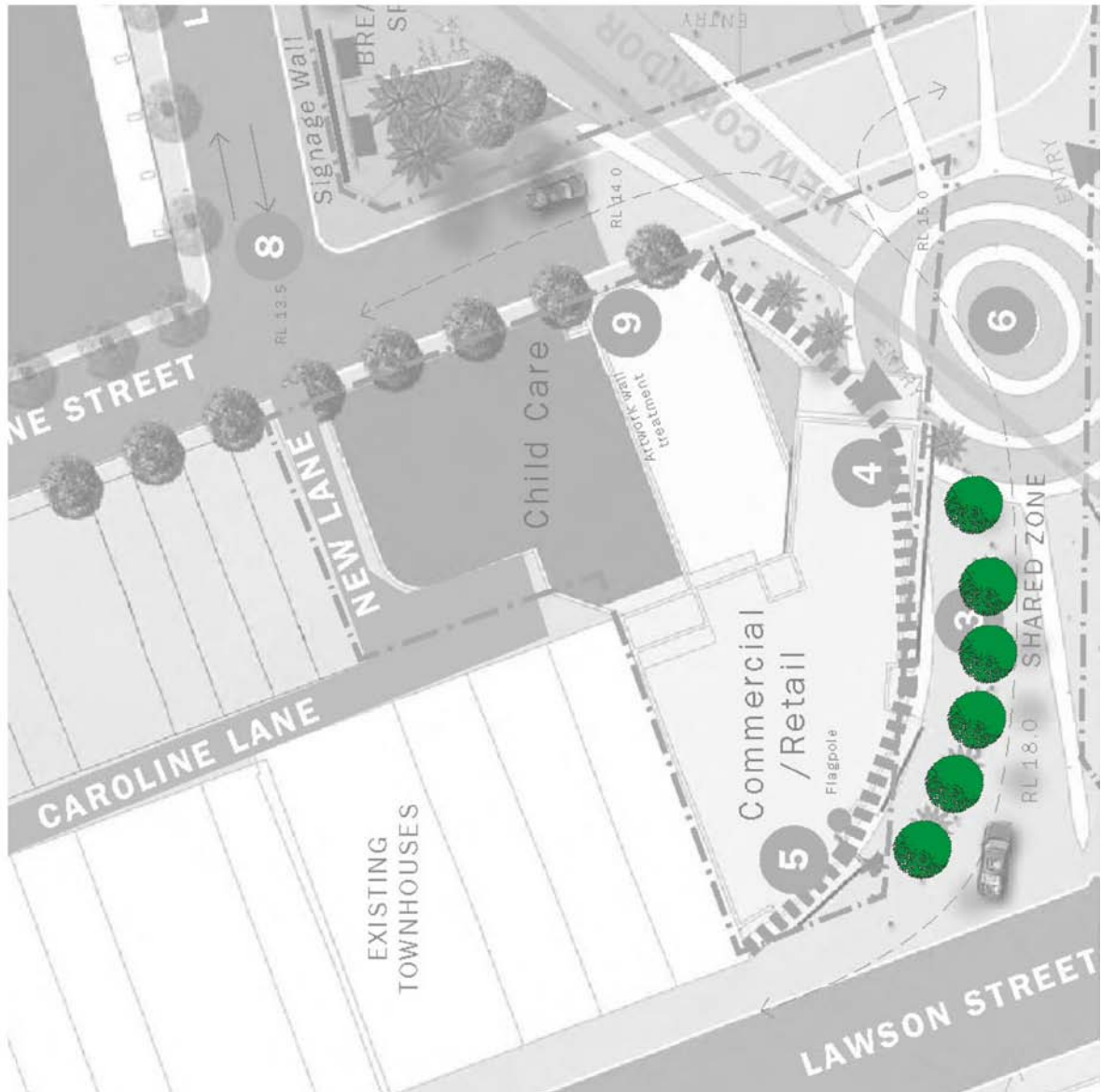
### ***Private Balconies, Terraces and Grassed Areas***

The north facing balcony on level 4 of the proposed development is relatively exposed to the westerly winds. The proposed impermeable balustrades along the perimeter of the balcony are recommended to be retained in the final design of the proposed development to ameliorate the adverse wind conditions. Hence, with the incorporation of the above mentioned recommendation the wind conditions within the balcony will be acceptable for its intended uses.

With the incorporation of the above mentioned, adequate wind conditions are expected for the private balcony of the site.



Proposed Densely foliageating trees, capable of growing to a height of 5m, with a 4m wide canopy.



**Figure 4: Optional Treatment for the Public Open Space on Ground Level**

## 7.0 Conclusions

An analysis of the wind environment impact with respect to the three principal wind directions for the Sydney region has been completed for the proposed precinct 2 development located at Pemulwuy, Redfern. The conclusions of this report are drawn from our extensive experience in this field and are based on an examination of the Concept Plan massing drawings which have been prepared by the project architect Nordon Jago Architects, dated 2<sup>nd</sup> December 2011. No wind tunnel tests have been undertaken for the subject development. As such, 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 study indicate that majority critical outdoor area and pedestrian footpaths associated with the development are suitable for their intended use due to the shielding of the prevailing wind by the surrounding buildings around the development site and the effective use of building setback. However, the following in-principle treatments are recommended to help mitigate against potential adverse winds in the following areas:

- The implementation of a strategic planting scheme similar to that presented in the report along the eastern façade of the proposed development if stationary activities are anticipated.
- Impermeable balustrades proposed along the perimeter of the level 4 balcony of the proposed precinct 2 development is recommended to be retained in the final landscape design.

With the above recommendation incorporated in the final design, wind conditions at all critical outdoor areas are expected to be suitable for their intended use.

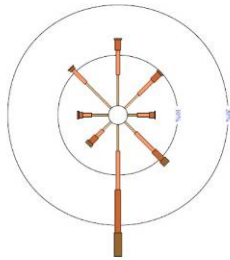
# **Appendix**

## Wind Roses for the Sydney Region

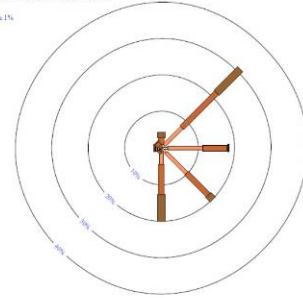
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**SYDNEY AIRPORT AMO STATION NUMBER 066037**  
**Latitude: -33.94 ° Longitude: 151.17 °**



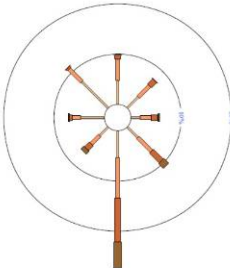
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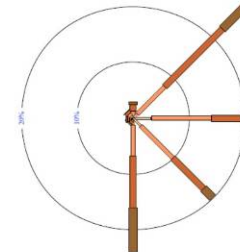
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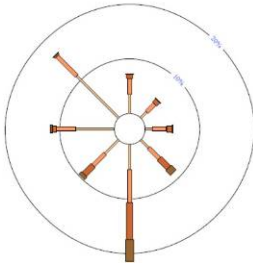
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Calm 13%



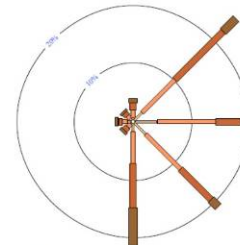
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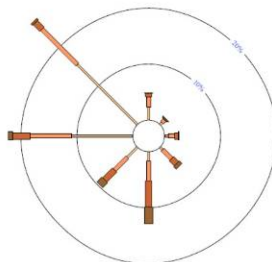
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Calm 14%



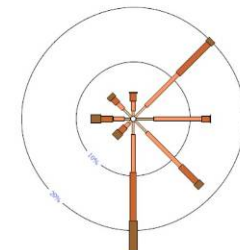
3 pm Mar  
1975 Total Observations (1939 to 2004)  
Calm 2%



9 am Apr  
1963 Total Observations (1939 to 2004)  
Calm 14%



3 pm Apr  
1963 Total Observations (1939 to 2004)  
Calm 2%

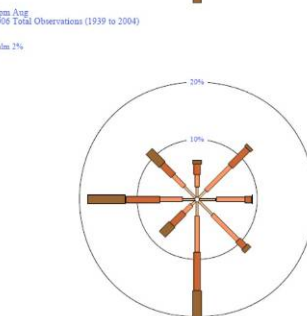
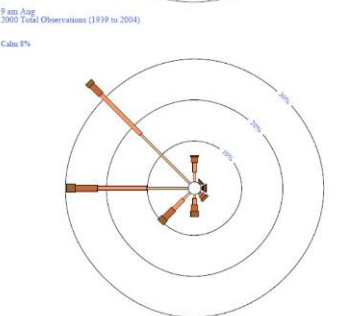
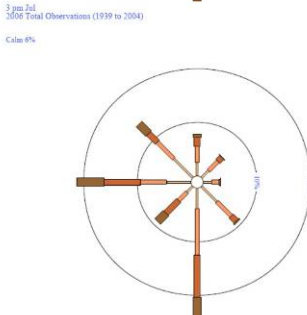
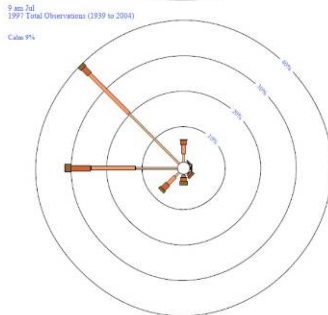
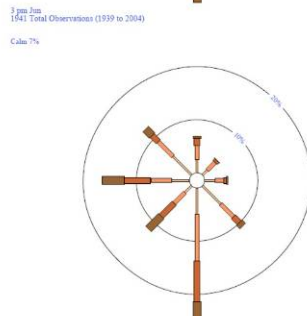
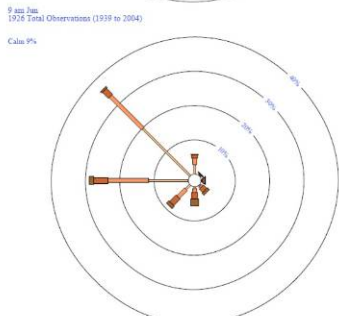
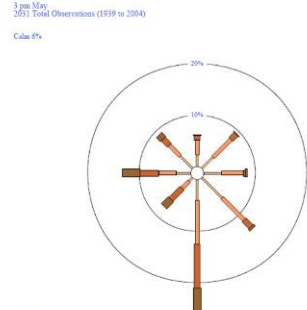
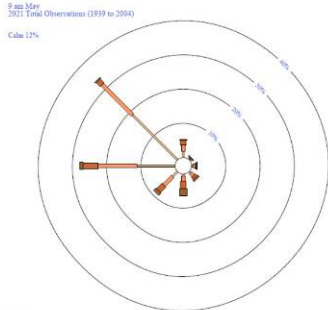
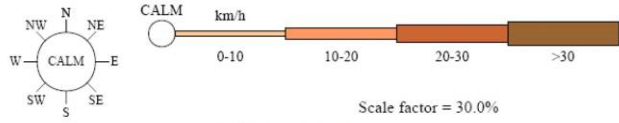


Wind directions are divided into eight compass directions. Calm has no direction.  
 An asterisk (\*) indicates that calm is less than 1%.  
 An observed wind speed which falls precisely on the boundary between two divisions (eg 10km/h) will be included in the lower range (eg 1-10 km/h). Only quality controlled data have been used.



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**SYDNEY AIRPORT AMO STATION NUMBER 066037**  
**Latitude: -33.94 ° Longitude: 151.17 °**

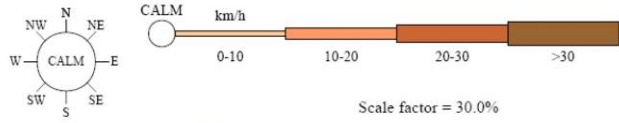


Wind directions are divided into eight compass directions. Calm has no direction.  
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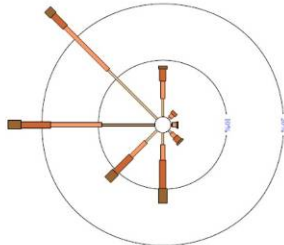


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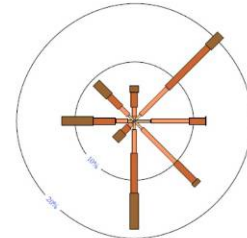
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**SYDNEY AIRPORT AMO STATION NUMBER 066037**  
**Latitude: -33.94 ° Longitude: 151.17 °**



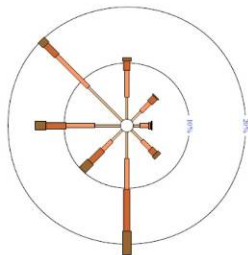
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Calm 7%



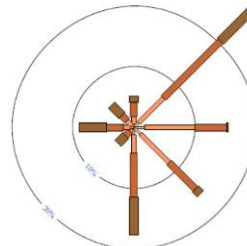
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1931 Total Observations (1939 to 2004)  
Calm 1%



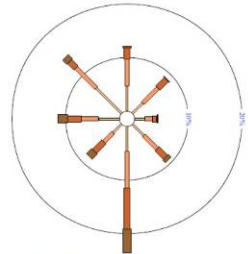
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1993 Total Observations (1939 to 2004)  
Calm 6%



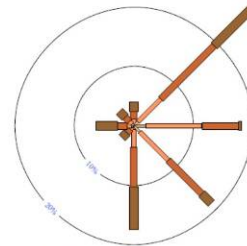
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1997 Total Observations (1939 to 2004)  
Calm 1%



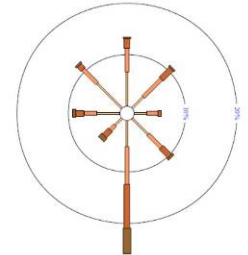
9 am Nov  
1897 Total Observations (1939 to 2004)  
Calm 7%



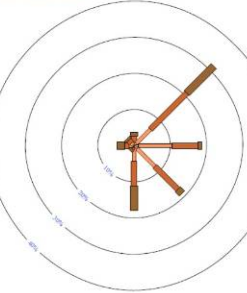
3 pm Nov  
1901 Total Observations (1939 to 2004)  
Calm 1%



9 am Dec  
1937 Total Observations (1939 to 2004)  
Calm 7%



3 pm Dec  
1939 Total Observations (1939 to 2004)  
Calm 9%



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