

# Pedestrian Wind Environment Statement

for the proposed development known as  
Precinct 1 Pemulwuy, Redfern

December 7, 2011

Report Reference No. WB028-01F02(rev2)- WS Report (P1)

## Document Control

---

Revision Number	Date	Revision History	Prepared By (initials)	Reviewed & Authorised By (initials)
0	08/09/2011	Initial	RC	TR
1	14/11/2011	Updated with comments	TH	
2	7/12/2011	Finalised	TH	

*The work presented in this document was carried out in accordance with the Windtech Consultants Pty Ltd Quality Assurance System, which is based on Australian Standard / NZS ISO 9001.*

*This document is issued subject to review and authorisation by the Team Leader noted by the initials printed in the last column above. If no initials appear, this document shall be considered as preliminary or draft only and no reliance shall be placed upon it other than for information to be verified later.*

*This document is prepared for our Client's particular requirements which are based on a specific brief with limitations as agreed to with the Client. It is not intended for and should not be relied upon by a third party and no responsibility is undertaken to any third party without prior consent provided by Windtech Consultants Pty Ltd. This report should not be reproduced, presented or reviewed except in full. Prior to passing on to a third party, the Client is to fully inform the third party of the specific brief and limitations associated with the commission.*

*The information contained herein is for the purpose of wind, thermal and or solar effects only. No claims are made and no liability is accepted in respect of design and construction issues falling outside of the scope of this report.*

# Table of Contents

	Page
Table of Contents	3
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	16

Appendix: Wind Roses for the Sydney Region

## **1.0 Introduction**

This report is in relation to the proposed residential development known as Precinct 1, 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**

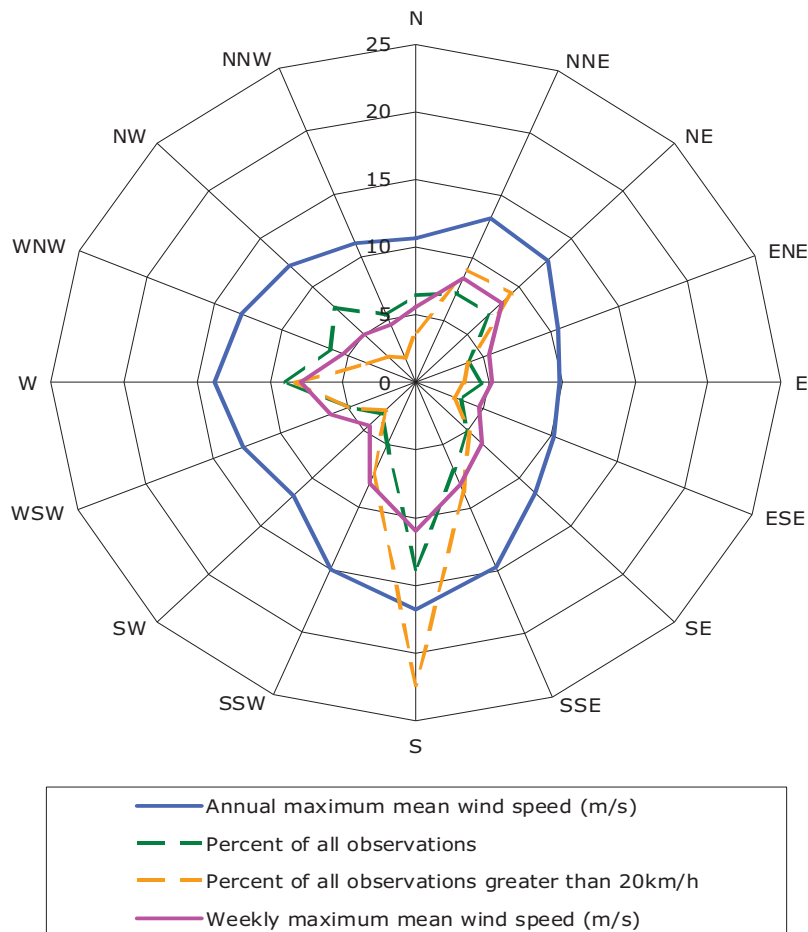
The Sydney region is governed by three principle wind directions which can potentially affect the subject development. These winds prevail from the north-east, south and west. A summary of the principal time of occurrence of these winds throughout the year is presented in Table 1 below. This summary 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 1 of the Pemulwuy development is located within Redfern, and is bounded by Vine Street to the north, Eveleigh Street to the east, Caroline Street to the south and Louis Street to the west. The Precinct 1 development is one of three development precincts, with Precinct 2 located across Caroline Street to the south and Precinct 3 located across Eveleigh Street to the east. The surrounding developments to the north, east and west are approximately 2 to 3 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**

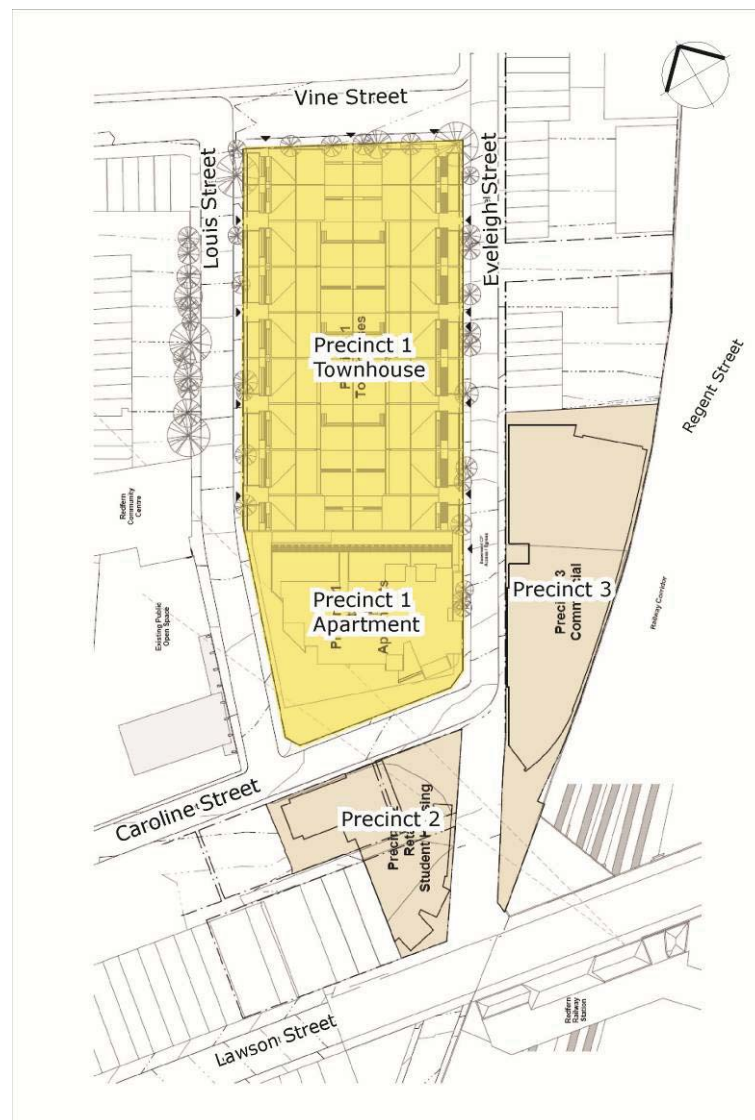
## 5.0 Description of the Proposed Development

The proposed Precinct 1 development consists of a 2-6 level mixed use tower made up of Residential Apartments, Retail and a Public Gym. The remainder of the development consists of proposed townhouses dwellings which are 2 levels in height as illustrated in Figure 3.

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

- Public Open Space on ground floor to the southwest of the site, adjacent to Caroline and Louis Street.
- Pedestrian footpath along Caroline, Eveleigh, Louis and Vine Street.
- The various balconies and terraces within the tower and townhouse component of the proposed development.

It can be assumed that the roof on level 6 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**

The pedestrian footpath along Louis, Vine, Caroline and Eveleigh Street are relatively well shielded from the prevailing wind by the proposed development itself and the existing buildings surrounding the development site. With the additional of the proposed trees along Louis, Vine, Caroline and Eveleigh Street pedestrian footpath as shown in Figure 6, wind condition along these streets are expected to be suitable for their intended uses.

### **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 Public Open Space within the Site***

The proposed Public Open Space to the south-west of the development site is relatively well shielded from the prevailing north-easterly winds by the proposed development itself. The addition of the proposed planters within the Public Open Space will provide further mitigation to the prevailing winds, hence adequate wind conditions are to be expected for these areas.

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

All the private terraces located on level one of the proposed townhouses development are relatively well shielded from the prevailing north-easterly wind by the surrounding existing buildings and the proposed development itself. The addition of the proposed trees around the perimeter of the proposed development in front of the terraces as shown in the architectural drawing will provide ideal wind condition to these terrace areas.

The majority of the private balconies, with the exception of the north-western corner balconies are relatively well shielded from the prevailing north-easterly wind due to the effective use of building setback and the

proposed development itself. It is recommended that impermeable screens as illustrated in Figure 4 and 5 are included along the north-western corner balconies to mitigate the adverse wind conditions. Hence these areas are expected to be acceptable for its intended uses.

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

With the incorporation of the above mentioned, adequate wind conditions are expected for all private balconies 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 Public Open Space within the Site***

Majority of the Public Open Space to the south-west of the site is relatively well shielded from the prevailing southerly winds by the proposed Precinct 2 developments and the existing building across Caroline Street except for a small portion at the south-east corner of the Public Open Space may be exposed to the southerly wind funneling along Eveleigh Street. It is expected the wind conditions will be similar or better than existing conditions with the inclusion of densely foliating trees along the southern boundary of the public open space and the south-east corner of the Gym as indicated in Figure 6. Hence with the inclusion of the abovementioned recommendations, it is expected the ground level wind conditions within these areas will be suitable for its intended uses.

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

All the private terraces located on level one of the proposed townhouses development are relatively well shielded from the prevailing southerly wind by the proposed apartment south-west of the site and the existing buildings south of the development site across Caroline Street. The addition of the proposed trees around the perimeter of the proposed development in front of the terraces as shown in the architectural drawing will provide ideal wind condition to these terrace areas.

The private balconies within the proposed tower component are relatively well shielded from the prevailing southerly wind due to the effective use of building setback and the proposed development itself. The impermeable balustrades which are proposed on the perimeter of the balconies will provide additional shielding from potential adverse wind condition. Hence it is recommended that these impermeable balustrades be retained in the final design of the proposed development.

## 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 Public Open Space within the Site***

The proposed Public Open Space to the south-west of the development site is exposed to the prevailing westerly winds travelling along Caroline Street and over the Community Park. It is expected the inclusion of the proposed densely foliating trees capable along the western boundary of the Public Open Space, and along Vine Street as indicated in Figure 6, will be effective in mitigating the adverse wind conditions. Hence, with the incorporation of the above mentioned, adequate wind conditions are expected at the proposed Public Open Space.

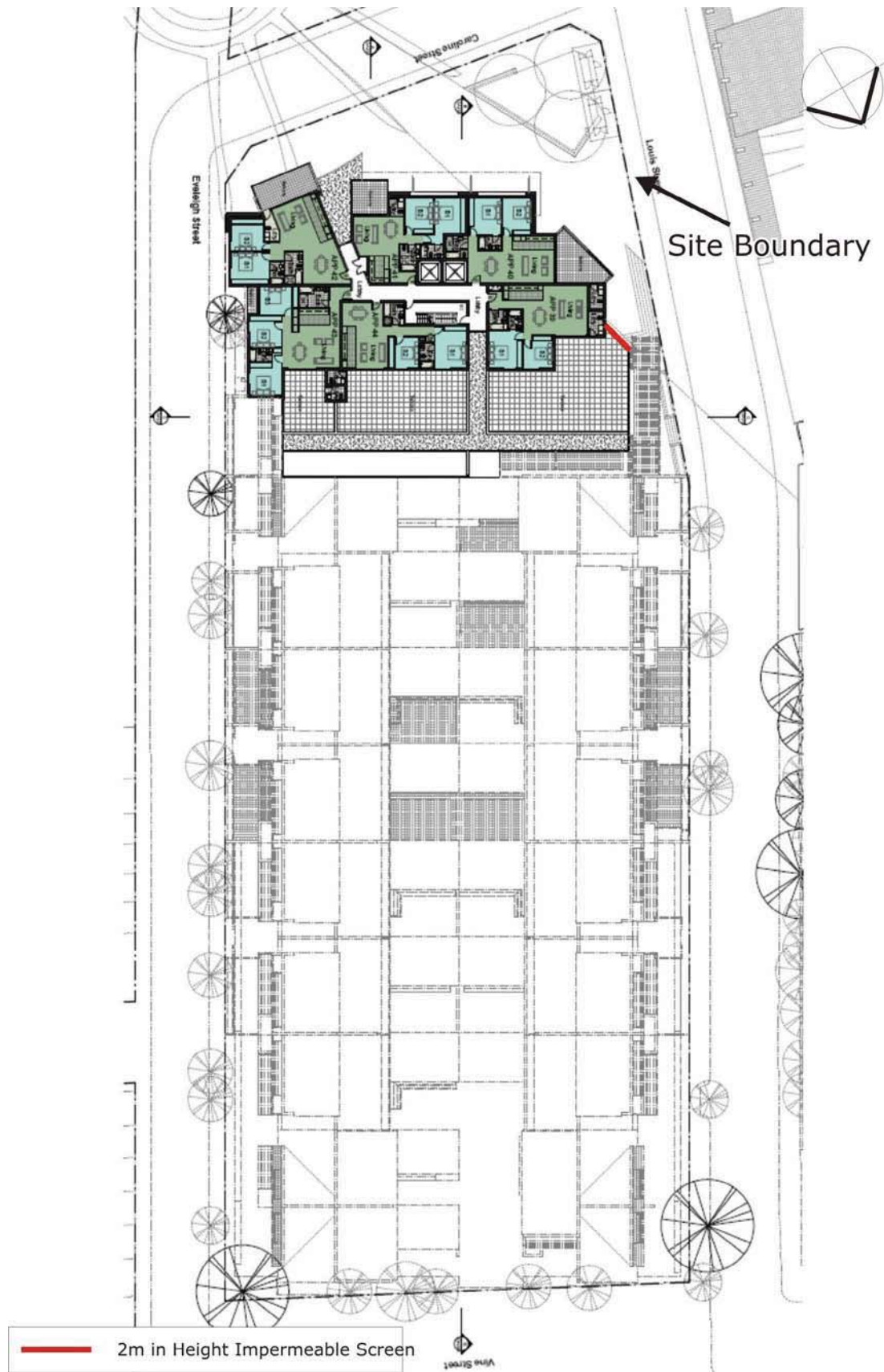
### ***Private Balconies, Terraces and Grassed Areas***

All the private terraces located on level one of the proposed townhouses development are relatively well shielded from the prevailing westerly wind by the existing buildings west of the development site across Louis Street and the proposed townhouse development itself. The addition of the proposed trees around the perimeter of the proposed development in front of the terraces as shown in the architectural drawing will provide ideal wind condition to these terrace areas.

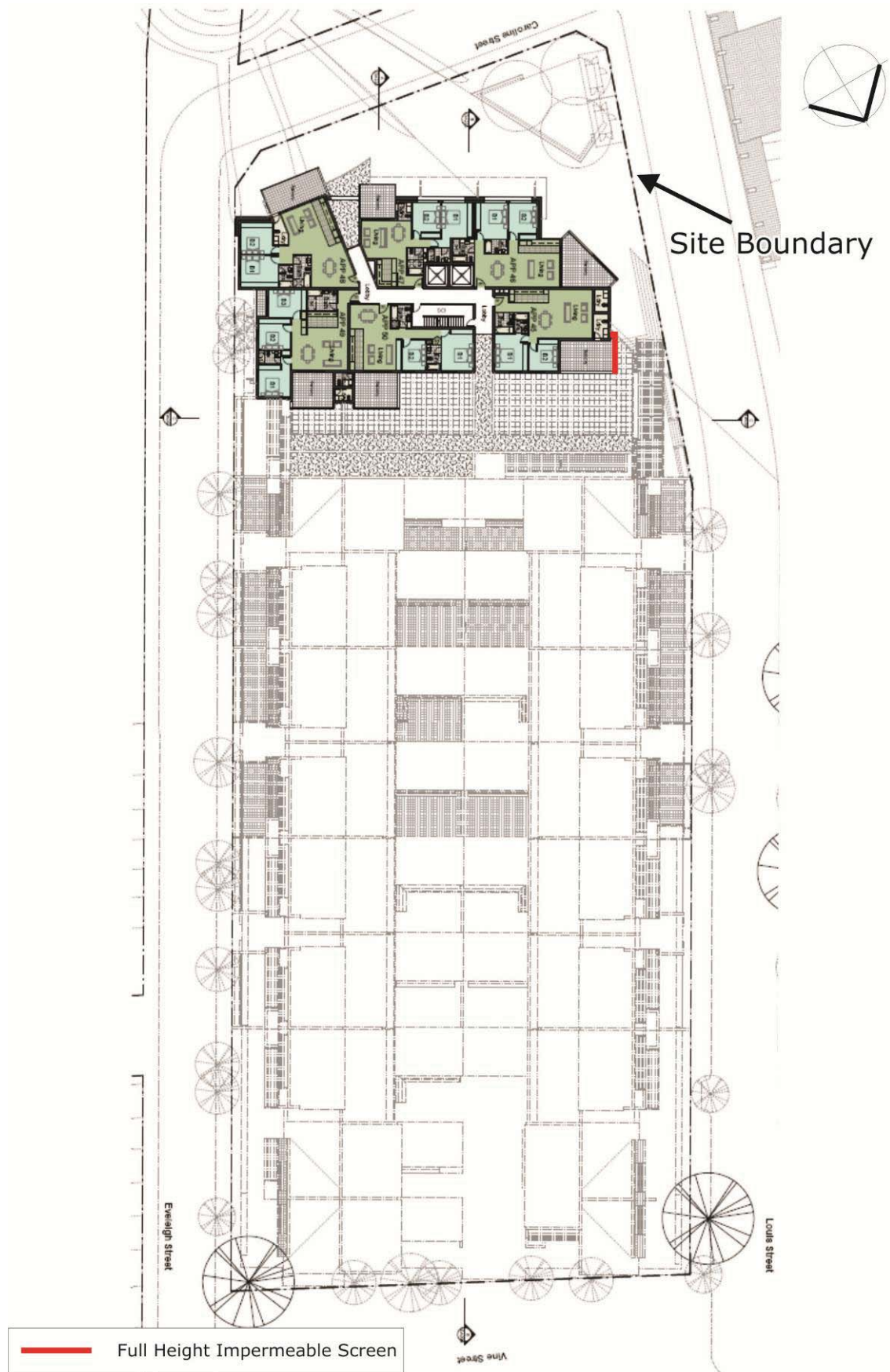
The majority of the private balconies, with the exception of the north-western corner balconies are relatively well shielded from the prevailing westerly winds due to the effective use of building setback and the proposed development itself. It is recommended that impermeable screens as illustrated in Figure 4 and 5 are included along the north-western corner balconies to mitigate the adverse wind conditions. Hence these areas are expected to be acceptable for its intended uses.

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

With the incorporation of the above mentioned, adequate wind conditions are expected for all private balconies of the proposed apartment.



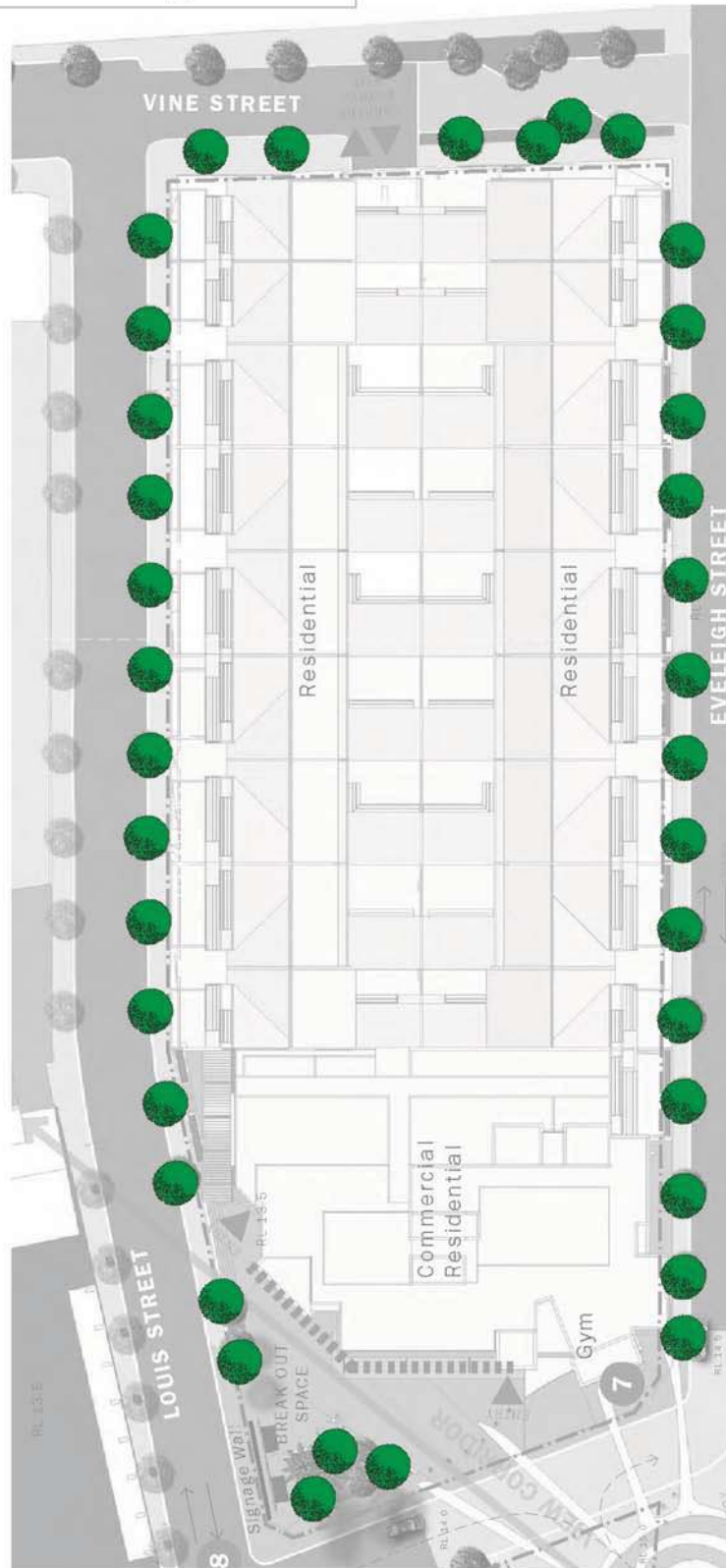
**Figure 4: Recommended Treatment Balconies on Level 2**



**Figure 5: Recommended Treatment  
Balconies on Levels 3-5**



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



**Figure 6: Recommended Treatment Ground Level Trafficable Areas**

## 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 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, the effective use of building setback and the proposed trees along the perimeter of the subject development. However, the following in-principle treatments are recommended to help mitigate against potential adverse wind conditions in the following areas:

- The implementation of a strategic planting scheme similar to that presented in the report within and around the Public Open Space along Caroline Street and the pedestrian thoroughfare at the south-eastern corner of the Public Open Space.
- Proposed trees along the perimeter of the development site are recommended to be retained in the final landscape design.
- The addition of the 2m high impermeable screens along the north-western perimeter of the north-western corner balcony on Level 2.
- The addition of the full-height impermeable screens along the north-western perimeter of the north-western corner balcony on Levels 3 to 5.
- Impermeable balustrades proposed along the perimeter of the balconies for the proposed apartment are recommended to be retained in the final landscape design.

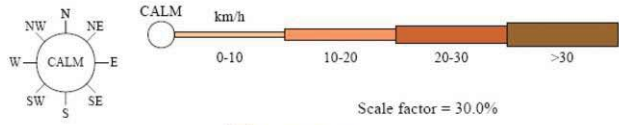
With the above recommendation incorporated in the final design, wind conditions at all critical outdoor areas are expected to be suitable for their intended use.

For trees and vegetation to be effective in mitigating potential adverse winds during the winter months, they must be densely foliageating and of an evergreen variety.

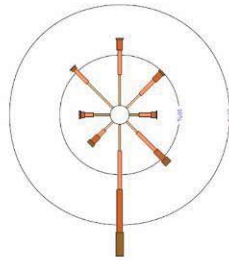
# **Appendix**

## Wind Roses for the Sydney Region

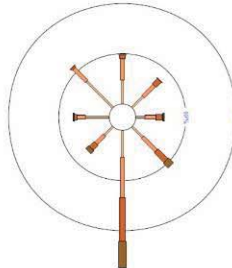
**WIND FREQUENCY ANALYSIS (in km/h)**  
**SYDNEY AIRPORT AMO STATION NUMBER 066037**  
**Latitude: -33.94 ° Longitude: 151.17 °**



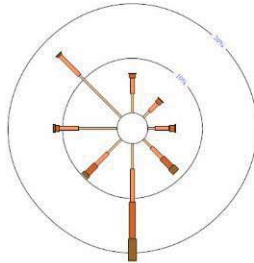
9 am Jan  
1933 Total Observations (1939 to 2004)  
Calm 9%



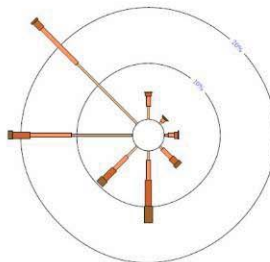
9 am Feb  
1760 Total Observations (1939 to 2004)  
Calm 13%



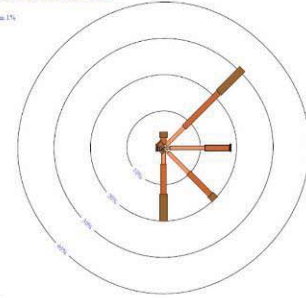
9 am Mar  
1968 Total Observations (1939 to 2004)  
Calm 14%



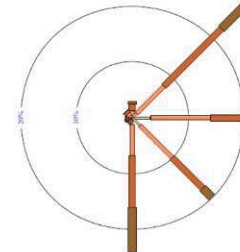
9 am Apr  
1963 Total Observations (1939 to 2004)  
Calm 14%



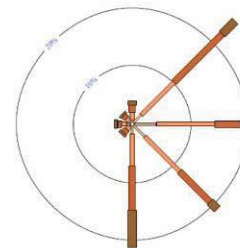
3 pm Jan  
1641 Total Observations (1939 to 2004)  
Calm 1%



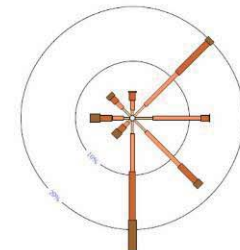
3 pm Feb  
1776 Total Observations (1939 to 2004)  
Calm 1%



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



3 pm Apr  
2063 Total Observations (1939 to 2004)  
Calm 2%

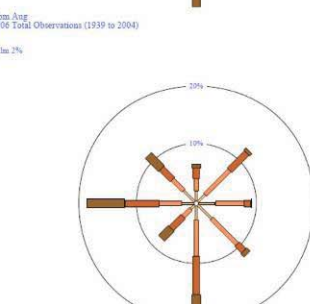
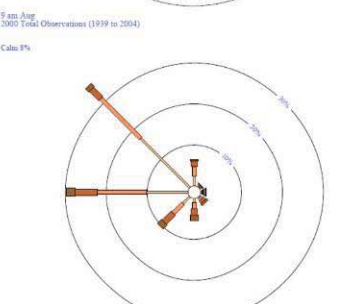
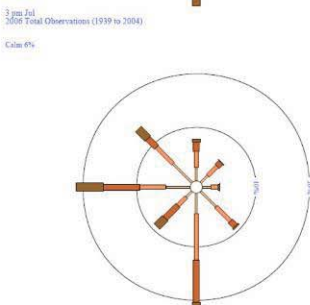
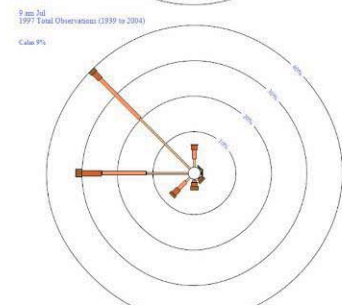
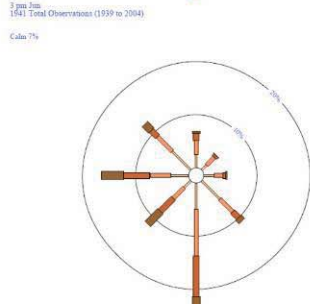
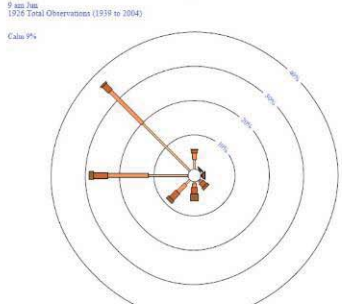
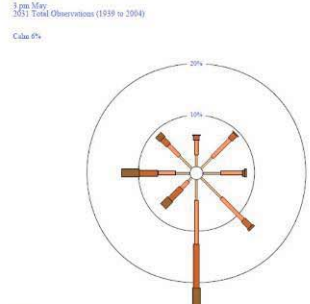
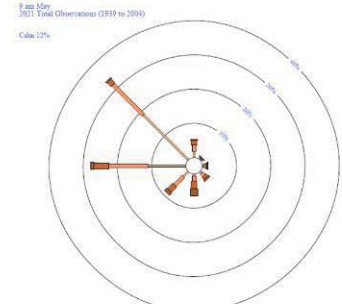
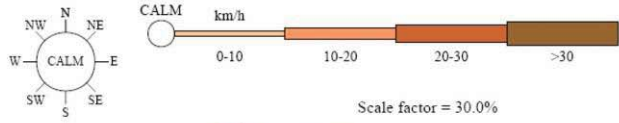


Wind directions are divided into eight compass directions. Calm has no direction.  
 An asterisk (\*) indicates that calm is less than 1%.  
 An observed wind speed which falls precisely on the boundary between two divisions (eg 10km/h) will be included in the lower range (eg 1-10 km/h). Only quality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



Copyright © Commonwealth of Australia 2004  
 Prepared by the National Climate Centre of the Bureau of Meteorology.  
 Contact us by phone on (03) 9669 4082, by fax on (03) 9669 4515, or by email at webclim@bom.gov.au . We have taken all due care but cannot provide any warranty nor accept any liability for this information.

**WIND FREQUENCY ANALYSIS (in km/h)**  
**SYDNEY AIRPORT AMO STATION NUMBER 066037**  
**Latitude: -33.94 ° Longitude: 151.17 °**

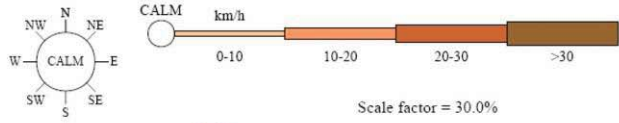


Wind directions are divided into eight compass directions. Calm has no direction.  
 An asterisk (\*) indicates that calm is less than 1% .  
 An observed wind speed which falls precisely on the boundary between two divisions (eg 10km/h) will be included in the lower range (eg 1-10 km/h). Only quality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

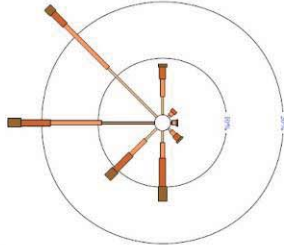


Copyright © Commonwealth of Australia 2004  
 Prepared by the National Climate Centre of the Bureau of Meteorology.  
 Contact us by phone on (03) 9669 4082, by fax on (03) 9669 4515, or by  
 email at [webclim@bom.gov.au](mailto:webclim@bom.gov.au) . We have taken all due care but cannot  
 provide any warranty nor accept any liability for this information.

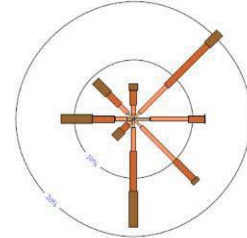
**WIND FREQUENCY ANALYSIS (in km/h)**  
**SYDNEY AIRPORT AMO STATION NUMBER 066037**  
**Latitude: -33.94 ° Longitude: 151.17 °**



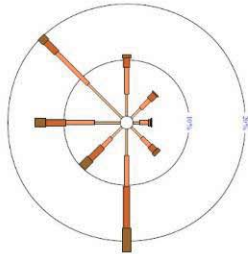
9 am Sep  
1934 Total Observations (1939 to 2004)  
Calm 7%



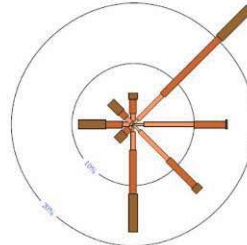
3 pm Sep  
1931 Total Observations (1939 to 2004)  
Calm 1%



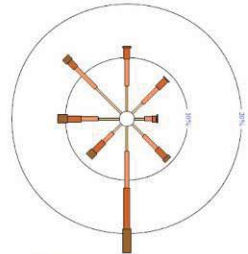
9 am Oct  
1993 Total Observations (1939 to 2004)  
Calm 6%



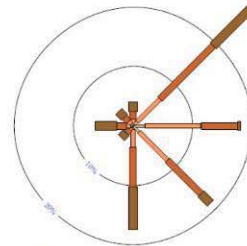
3 pm Oct  
1997 Total Observations (1939 to 2004)  
Calm 1%



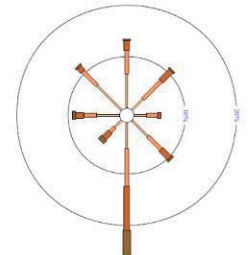
9 am Nov  
1897 Total Observations (1939 to 2004)  
Calm 7%



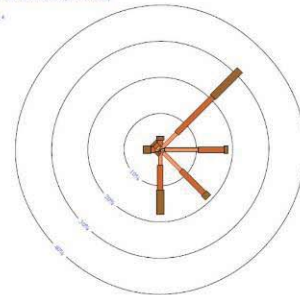
3 pm Nov  
1901 Total Observations (1939 to 2004)  
Calm 1%



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



3 pm Dec  
1939 Total Observations (1939 to 2004)  
Calm 6%



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.



Copyright © Commonwealth of Australia 2004  
 Prepared by the National Climate Centre of the Bureau of Meteorology.  
 Contact us by phone on (03) 9669 4082, by fax on (03) 9669 4515, or by  
 email at [webclim@bom.gov.au](mailto:webclim@bom.gov.au) . We have taken all due care but cannot  
 provide any warranty nor accept any liability for this information.