Pedestrian Wind Environment Statement

for the proposed development known as

Norberry Terrace, North Sydney

June 16, 2010

Report Reference No. WA860-01F02(rev2)- WS Report

Sydney • Melbourne • Singapore • Dubai **www.windtech.com.au**
WINDTECH Consultants Pty Ltd: 19 Willis St, Wolli Creek NSW 2205 Australia ABN 72 050 574 037
T: (61.2) 9567 0722 **F:** (61.2) 9567 0733 **E:** reception@windtech.com.au

Document Control

Revision Number	Date	Revision History	Prepared By (initials)	Reviewed & Authorised By (initials)
0	10/05/2010	Initial	DYF	TR
1	12/05/2010	Agreed amendments	-	TR
2	16/06/2010	Updated and Revised	TH	TR

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.

1.0 Introduction

This report is in relation to the proposed development known as Norberry Terrace, located in North Sydney, and presents an opinion on the likely impact of proposed design on the local wind environment within and around the site.

The effect of wind activity within and around the proposed development is examined for the three predominant wind directions for Sydney, i.e. north-east, south and west. 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 architectural drawings prepared by Bates Smart Pty Ltd, dated May 2010. 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 Local Wind Climate

Three principal wind directions potentially affect the development. These winds prevail from the north-east, south and west; Table 1 is a summary of the principal time of occurrence of these winds. This summary is based on data obtained by the Bureau of Meteorology from Sydney Airport between 1939 and 2000. 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.

Table 1: Principal Time of Occurrence of Winds for Sydney

Month	Wind Direction		
	North-Easterly	Southerly	Westerly
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	

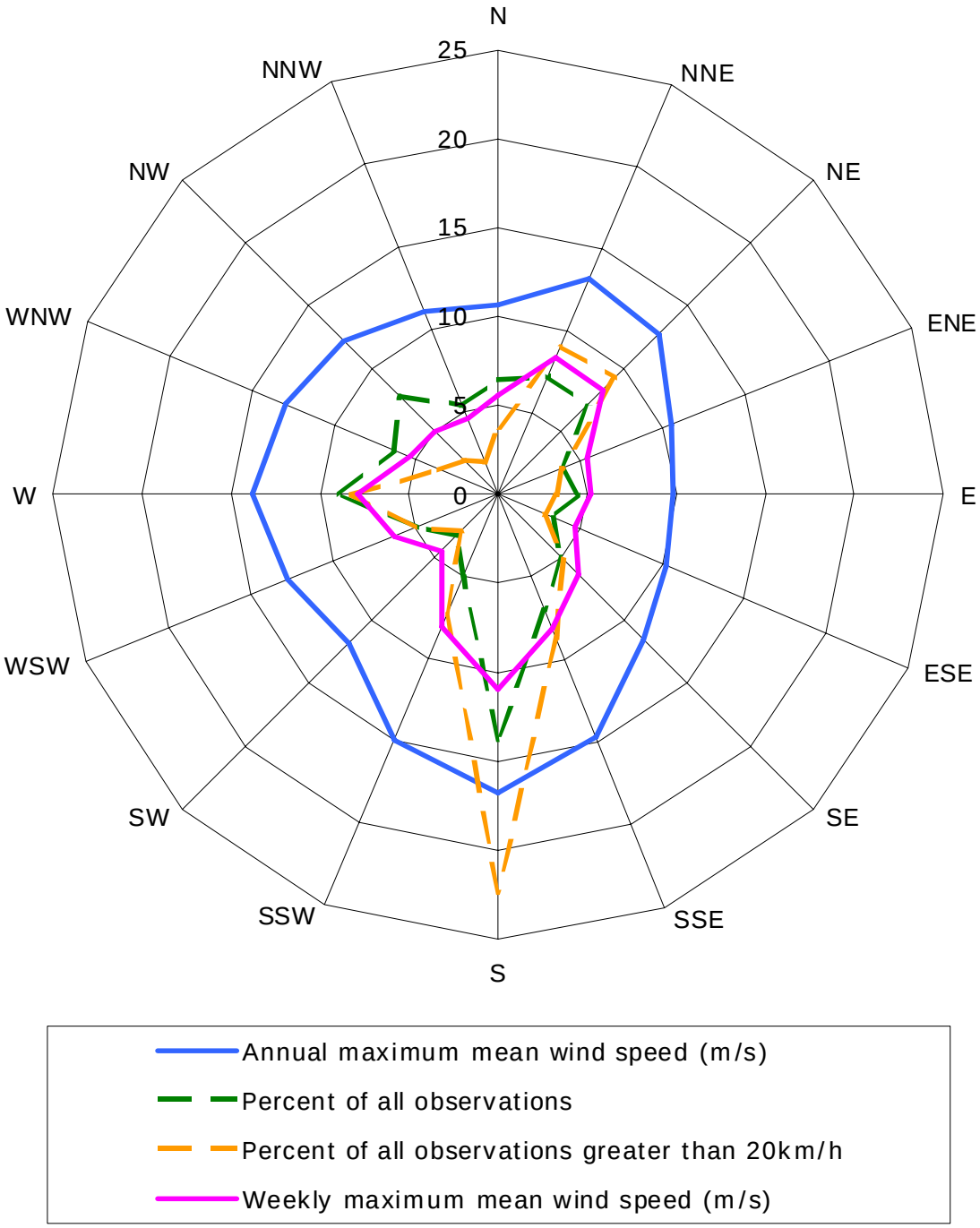


Figure 1: Annual and Weekly Recurrence Mean Wind Speeds, and Frequencies of Occurrence, for the Sydney Region (based on 10 minute mean observations from Kingsford Smith Airport from 1939 to 2008, corrected to open terrain at 10m)

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), is a modified version of the Beaufort Scale, and describes the effects of various wind intensities on people. Note that the applicability column related to 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	Beaufort Number	Gust Speed (m/s)	Effects	Applicability
Calm, light air	1	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	2	1.6 - 3.3	Wind felt on face	
Gentle breeze	3	3.4 - 5.4	Hair is disturbed, Clothing flaps	
Moderate breeze	4	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	5	8.0 - 10.7	Force of wind felt on body	Acceptable as a main pedestrian thoroughfare
Strong breeze	6	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	7	13.9 - 17.1	Inconvenience felt when walking.	
Gale	8	17.2 -20.7	Generally impedes progress, Great difficulty with balance.	Unacceptable as a public accessway.
Strong gale	9	20.8 - 24.4	People blown over by gusts.	Completely unacceptable.

4.0 Description of the Site and the Proposed Development

The site is located on the corner of Pacific Highway and Berry Street, North Sydney. Figure 2 shows an aerial image with the location of the site.

The adjacent buildings to the north and east of the site vary between 4 to 16 levels in height above ground. The adjacent buildings to the west of the site vary between 16 to 20 levels in height above ground. To the south of the site is the North Point Plaza building which is of comparable height to the proposed development. There are no large changes in the local land topography around the site.

The outdoor areas of interest analysed in this statement include all ground level pedestrian footpaths and level 12-13, 15 and 16 terraces. It is assumed that the terrace area on Plant Level 31 is accessible to maintenance personnel only and not to the general public.

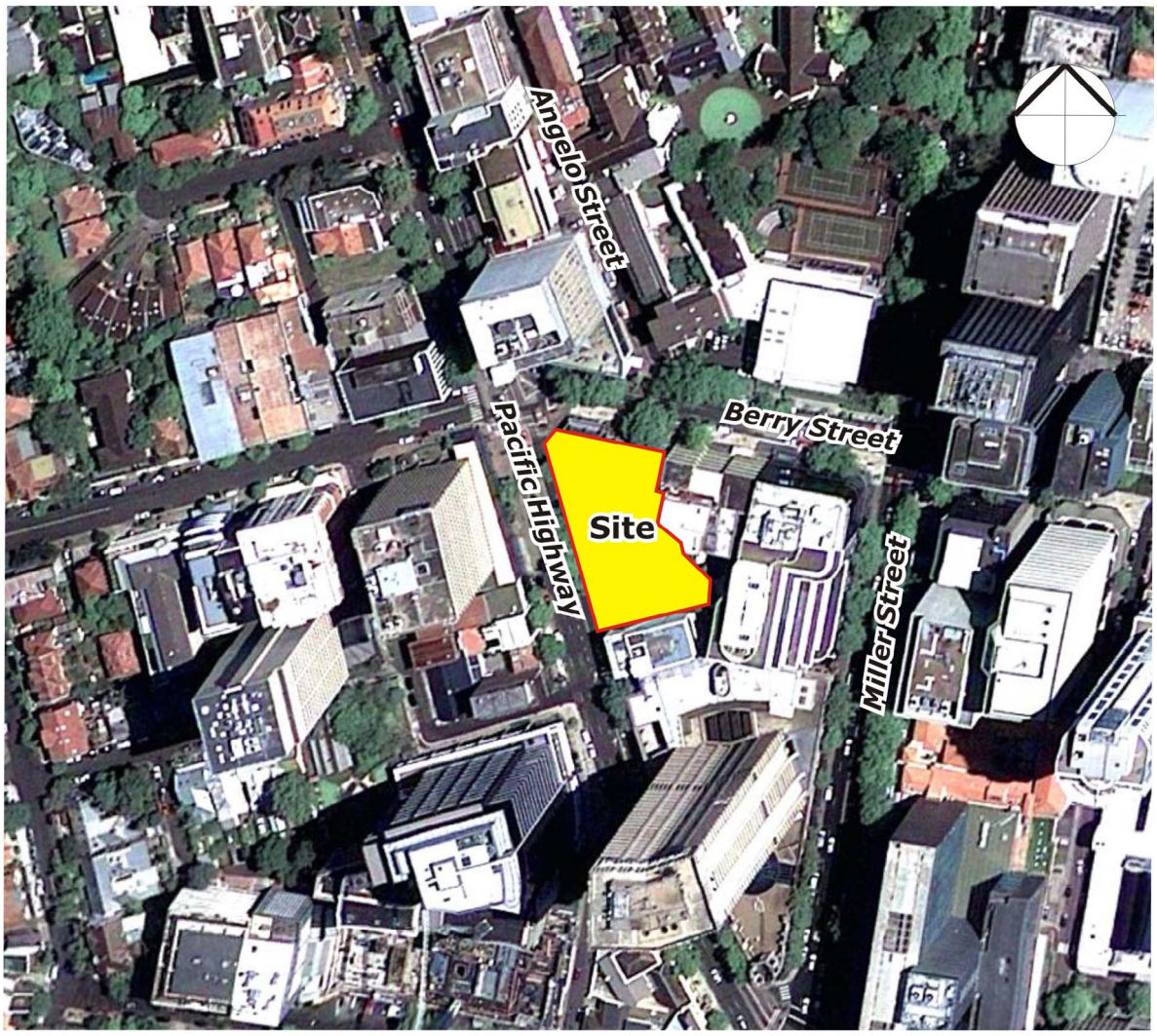


Figure 2: Aerial Image of the Site Location

5.0 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.

5.1 North-Easterly Winds

The ground level areas within or around the site are relatively well shielded by the proposed development and the local surrounding buildings to the north-east of the site. It is therefore not expected that the ground level areas including the pedestrian footpaths around the site, will be adversely affected by the north-easterly winds. It is noted that the architectural drawings include the strategic planting of trees along Berry Street at the north-western corner of the proposed development. Retaining these trees in the final landscaping plan in combination with the retention of existing trees along Pacific Highway and Berry Street pedestrian footpaths will serve to improve wind conditions at all ground level areas. Note that for trees to be effective in improving adverse wind conditions they must be of a densely foliating variety.

The south-eastern terraces on Level 12 and 13 are exposed to the direct north-easterly winds. The adjacent high-rise buildings along the north-eastern boundary will provide some shielding to the terraces. It is recommended that impermeable balustrades 1.2m in height be placed around the aforementioned terraces to mitigate the north-easterly winds and further improve wind conditions in these areas. It is also recommended that further wind tunnel study be undertaken at a more detailed design stage to confirm the effectiveness of the treatments and if necessary to investigate mitigating strategies.

Level 15 and 16 terraces are somewhat exposed to north-easterly winds; however wind conditions within these areas are expected to be suitable for their intended use due the stagnation of north-easterly winds within the terraces which are set back from the façade line of the main tower. It is recommended that impermeable balustrades 1.2m in height be placed around the aforementioned terraces to further improve wind conditions in these areas.

It is not expected that the proposed development will have any adverse impact on the wind conditions in other local surrounding streets, pedestrian footpaths and thoroughfares.

5.2 Southerly Winds

The ground level pedestrian footpath adjacent to the site along Berry Street is relatively well shielded by the proposed development. The ground level pedestrian footpath adjacent to the site along the Princes Highway is somewhat exposed to southerly winds funneling north bound

along the Princess highway, however wind conditions are expected to be suitable for its intended use due to the existing densely foliating trees located along the footpath. For this reason it is recommended that the existing trees adjacent to the site along the Pacific Highway are retained.

Level 12, 13, 15 and 16 terraces are relatively well shielded by the proposed development to southerly winds. It is therefore expected that wind conditions at Level 12, 13, 15 and 16 terraces are acceptable for their intended use. It is recommended that impermeable balustrades 1.2m in height be placed around the aforementioned terraces to further improve wind conditions is these areas.

It is not expected that the proposed development will have any adverse impact on the wind conditions in other local surrounding streets, pedestrian footpaths and thoroughfares.

5.3 Westerly Winds

The ground level pedestrian footpath adjacent to the site along the Pacific highway is relatively well shielded by the local surrounding buildings and densely foliating trees west of the site. The ground level pedestrian footpath adjacent to the site along the Berry Street is somewhat exposed to southerly winds funneling east bound along Berry Street. It is noted that the architectural drawings include the strategic planting of trees along Berry Street at the north-western corner of the proposed development. Retaining these trees in the final landscaping plan in combination with the retention of existing trees along Berry Street pedestrian footpath will aid in mitigating potential adverse wind conditions along the pedestrian footpaths.

Level 12, 13, 15 and 16 terraces are relatively well shielded by the proposed development to westerly winds. It is therefore expected that wind conditions at Level 12, 13, 15 and 16 terraces are acceptable for their intended use. It is recommended that impermeable balustrades 1.2m in height be placed around the aforementioned terraces to further improve wind conditions is these areas.

It should be noted that westerly winds tend to occur during the winter months for the Sydney region, which is when a deciduous tree would provide no protection from adverse winds. Therefore, for the recommended trees to be effective in wind mitigation, they must be of an evergreen species and a densely foliating variety.

6.0 Conclusions

An analysis of the wind environment impact with respect to the principal wind directions for the Sydney region has been completed for the proposed development known as Norberry Terrace, located in North Sydney.

The conclusions of this report are drawn from our extensive experience in this field and are based on an examination of the architectural drawings which have been prepared by the project architect Bates Smart Pty Ltd, dated May 2010. 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. It is recommended that a wind tunnel testing be conducted once the design of the development is more established. This will make sure all proposed outdoor accessible areas within and around the development site are examined and the effectiveness of the recommended treatments can be confirmed.

Wind conditions for most of the various outdoor areas within and around the site are expected to be acceptable for their intended uses without the need for additional ameliorative treatments. It is recommended that the proposed trees at the north-western corner of the development be retained in the final landscape plan in combination with the retention of existing trees along Pacific Highway and Berry Street pedestrian footpaths to help improve wind conditions along the pedestrian footpaths. It is noted that the final species selection will be in accordance with North Sydney Council's requirements for street tree planting, however as westerly winds tend to occur during the winter months for the Sydney region, which is when a deciduous tree would provide little protection from adverse winds, we recommended that an evergreen species and a densely foliating variety be used.

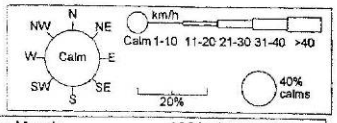
With the above recommendations taken into consideration, it is expected that the various outdoor areas within and around the site are expected to be acceptable for their intended uses.

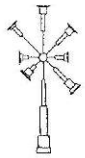
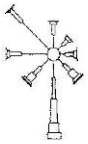
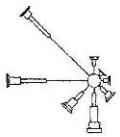
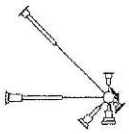
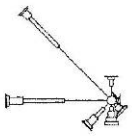
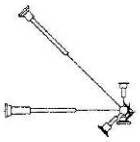
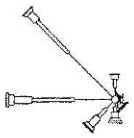
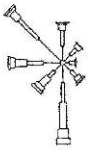
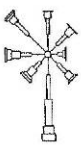
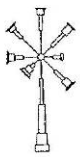
Appendix

Wind Roses for Sydney Airport
1939-2000

Wind Roses using available data between 1939 and 2000 for SYDNEY AIRPORT AMO

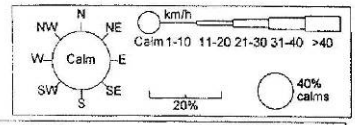
Site Number 066037 • Locality: SYDNEY AIRPORT • Opened Jan 1929 • Still Open
Latitude 33°56'28"S • Longitude 151°10'21"E • Elevation 6m

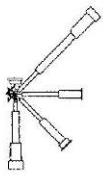
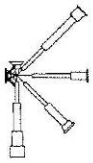
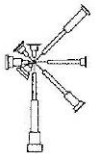
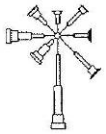
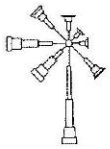
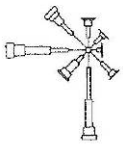
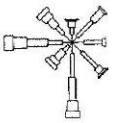
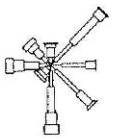


9 am January 1933 observations	9 am February 1755 observations	9 am March 1922 observations
		
9 am April 1834 observations	**9 am May 1866 observations**	**9 am June 1806 observations**
		
9 am July 1873 observations	**9 am August 1876 observations**	**9 am September 1814 observations**
		
9 am October 1901 observations	**9 am November 1835 observations**	**9 am December 1906 observations**
		

Wind Roses using available data between 1939 and 2000 for SYDNEY AIRPORT AMO

Site Number 066037 • Locality: SYDNEY AIRPORT • Opened Jan 1929 • Still Open
Latitude 33°56'28"S • Longitude 151°10'21"E • Elevation 6m



3 pm January 1939 observations	3 pm February 1771 observations	3 pm March 1925 observations
		
3 pm April 1832 observations	**3 pm May 1877 observations**	**3 pm June 1821 observations**
		
3 pm July 1882 observations	**3 pm August 1882 observations**	**3 pm September 1811 observations**
		
3 pm October 1904 observations	**3 pm November 1839 observations**	**3 pm December 1906 observations**