Appendix T

Pedestrian wind environment statement

Windtech

Pedestrian Wind Environment Statement

for the proposed Stage 2a City East Zone Substation and Integrated Commercial Development at

33 Bligh Street, Sydney

August 25, 2011

Report Reference No. W788-09F02(rev1)- WS Report.doc

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Document Control

Revision Number	Date	Revision History	Prepared By (initials)	Reviewed & Authorised By (initials)
0	17/08/2011	Updated with new drawings (report reference: W788-05F02(rev2))	TH	TR
1	25/8/2011	Update for Upper Sky Garden and Drawings	NT	TR

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1.0 Introduction

This report is in relation to the proposed Stage 2a City East Zone Substation and Integrated Commercial Development at 33 Bligh Street, Sydney. This report presents an opinion on the likely impact of the proposed development on the local wind environment. The effect of wind activity within and around the proposed development site 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 received August 25 2011, prepared by Kann Finch Group, dated August 19, 2010 and by Fitzpatrick and Partners, dated August 22, 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 and previous wind tunnel testing results at the site.

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	

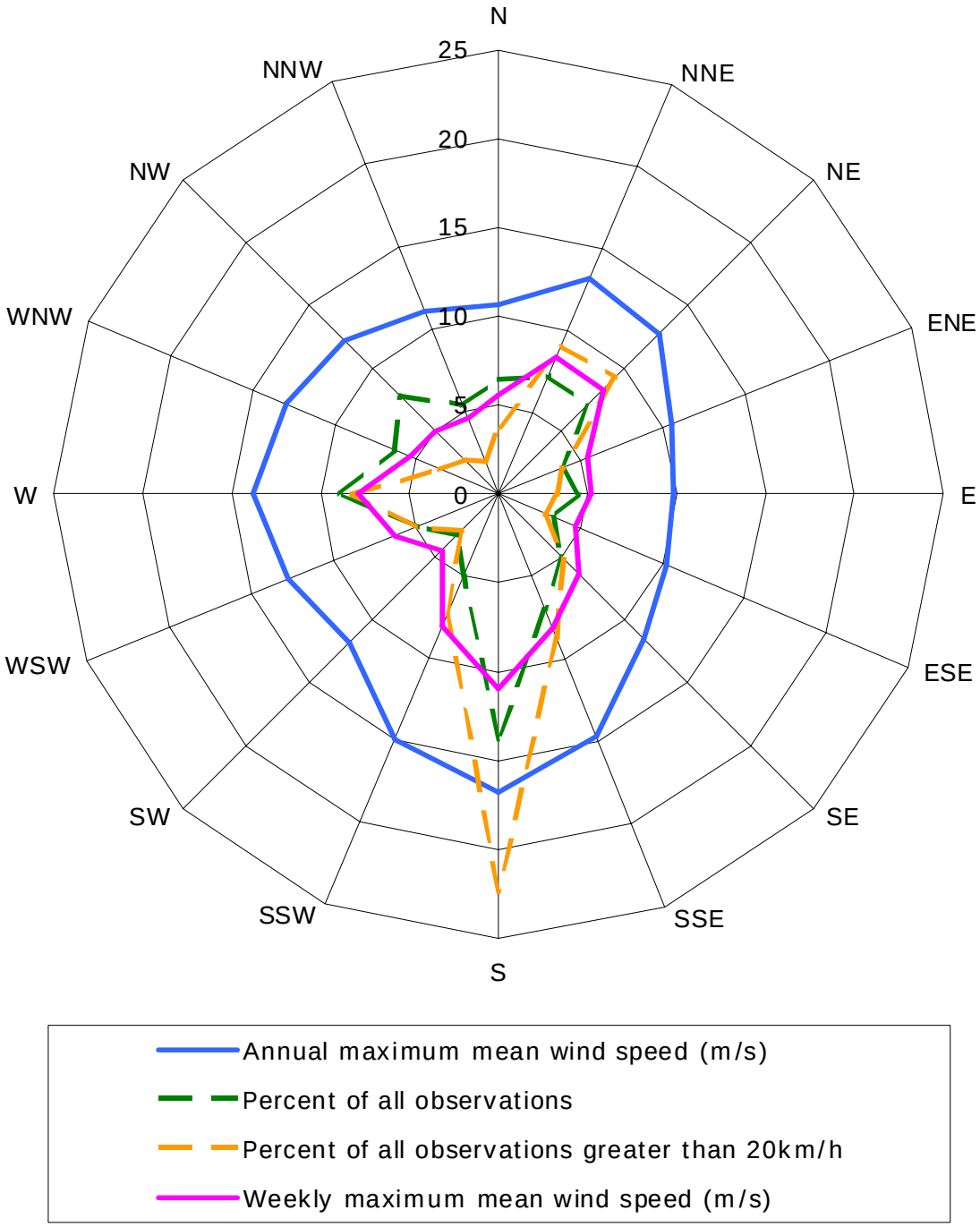


Figure 1: Annual and Weekly Recurrence Mean Wind Speeds, and Frequencies of Occurrence, for the Sydney Region (based on 10 minute mean observations from Kingsford Smith Airport from 1939 to 2008, corrected to open terrain at 10m)

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 and Location of the Proposed Development

The proposed development site is located at 20-26 O'Connell Street and 33-35 Bligh Street, within the Sydney CBD. The site is bounded by the O'Connell Street on the west and Bligh Street on the east. An aerial photograph of the local precinct is given in Figure 2. The local land topography generally rises to the east and south-east of the site. To the north the terrain falls away to Circular Quay. To the north, east and south of the proposed site are predominantly of 12 to 30 storey buildings.

The proposed development consists of an integrated Energy Australia zone substation in the basement, a podium section primarily comprised of mechanical and plant rooms, and a rectangular-plan office tower above. The proposed development is approximately 36 levels above ground. Balconies are not proposed for the office tower, and hence the façade of the office component will be flat. The various outdoor trafficable areas of the development, which are the subject of this study, are summarised as follows:

- Ground Level pedestrian footpaths within and around the site.
- Outdoor trafficable and louvered on the Sky Lobby level (on podium).
- Naturally Ventilated Sky Garden level (upper Level).

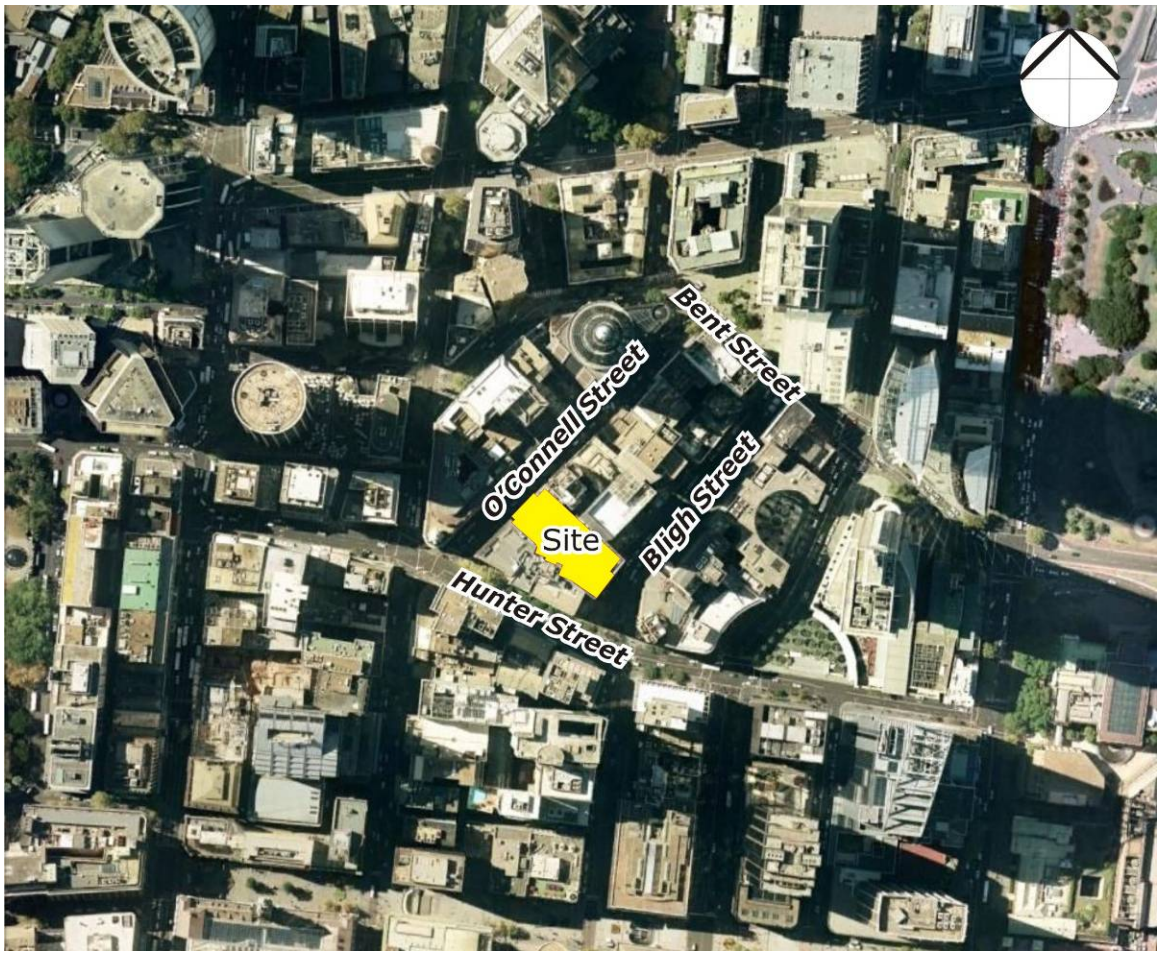


Figure 2: Aerial Image of the Site Location

5.0 Wind Conditions Within and Around the Site

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 pedestrian pathways along O'Connell Street and Bligh Street are aligned directly to the north-easterly winds. However, the upstream neighbouring buildings along the north-eastern side of Bligh Street are effective in shielding the ground level areas along O'Connell and Bligh Streets from the prevailing north-easterly winds.

Current wind conditions in the adjoining streetscapes are generally favourable. The impact of the proposed development onto the ground level wind conditions within and around the pedestrian footpaths of the site is expected to be minimal due to the significant by the neighbouring buildings. Hence the ground level wind conditions around the development site, including the adjacent Richard Johnson Square, are expected to be quite similar to the existing site conditions.

The proposed outdoor café and seating area located along the south-eastern corner of the site will need to satisfy a more stringent wind comfort criteria than the other trafficable areas around the site. Hence it is recommended the proposed canopy above is retained to mitigate the downwash effects off the tower façade, and 1.5m high impermeable portable screens be provided within and around the outdoor café area in a treatment scheme similar to that indicated in Figure 3a. The wind conditions are expected to be suitable for its intended uses with the inclusion of the abovementioned treatment scheme. It is recommended that wind tunnel testing be undertaken at a later design stage to verify the adequacy of this treatment scheme.

It is not envisaged that adverse wind conditions would occur in the open through site link. However, this will need to be confirmed by means of wind tunnel testing at a later stage in the design process.

The facade surrounding the Sky Lobby area consists of glazing along the lower section with mechanically operated louvered across the top. The wind conditions within the Sky Lobby are expected to be suitable for their intended uses provided that the mechanically operated louvers can be completely shut during periods of adverse wind conditions.

The outdoor terrace areas along the south-western boundary of the Sky Lobby will be partially exposed to the north-easterly winds, particularly the section of the terrace area at the south-eastern boundary. It is recommended to retain the impermeable balustrade along the perimeter and have closely spaced densely foliating vegetation included in that area in an arrangement similar to that indicated in Figure 3b.

The facade surrounding the internal Sky Garden area comprises of a mechanically operated louver façade system. The wind conditions within these areas are expected to be suitable for their intended uses, provided that the louvered façade system can be completely shut during periods of adverse wind conditions.

5.2 Southerly Winds

The pedestrian footpath along O'Connell Street is shielded from the southerly winds by the local surrounding buildings. The pedestrian pathway along Bligh Street is aligned directly to the southerly winds coming along Castlereagh Street. However, funneled southerly winds approaching the site from Castlereagh Street are expected to be mitigated by the time they reach the subject development site due to the stagnation created by the neighbouring buildings around the site as they follow the bend around on Bligh Street.

Current wind conditions in the adjoining streetscapes are generally favourable. The impact of the proposed development onto the ground level wind conditions within and around the pedestrian footpaths of the site is expected to be minimal due to the significant by the neighbouring buildings. Hence the ground level wind conditions around the development site, including the adjacent Richard Johnson Square, are expected to be quite similar to the existing site conditions.

The proposed outdoor café and seating area located along the south-eastern corner of the site will need to satisfy a more stringent wind comfort criteria than the other trafficable areas around the site. Hence it is recommended the proposed canopy above is retained to mitigate the downwash effects off the tower façade, and 1.5m high impermeable portable screens be provided within and around the outdoor café area in a treatment scheme similar to that indicated in Figure 3a. The wind conditions are expected to be suitable for its intended uses with the inclusion of the abovementioned treatment scheme. It is recommended that wind tunnel testing be undertaken at a later design stage to verify the adequacy of this treatment scheme.

It is not envisaged that adverse wind conditions would occur in the open through site link. However, this will need to be confirmed by means of wind tunnel testing at a later stage in the design process.

The facade surrounding the Sky Lobby area consists of glazing along the lower section with mechanically operated louvered across the top. The wind conditions within the Sky Lobby are expected to be suitable for their intended uses provided that the mechanically operated louvers can be completely shut during periods of adverse wind conditions.

The outdoor terrace areas are exposed to direct adverse southerly winds. The wind conditions within the outdoor terrace areas are expected to be suitable for its intended use with the retention of the impermeable balustrade along the perimeter and inclusion of closely spaced densely foliating vegetation in a treatment scheme similar to that indicated in Figure 3b. Furthermore, it is recommended that wind tunnel testing be undertaken at a later design stage to investigate the

wind conditions within these areas and verify the effective of the recommended treatment scheme.

The facade surrounding the internal Sky Garden area comprises of a mechanically operated louver façade system. The wind conditions within these areas are expected to be suitable for their intended uses, provided that the louvered façade system can be completely shut during periods of adverse wind conditions.

5.3 Westerly Winds

The pedestrian pathways along O'Connell Street and Bligh Street, and the adjacent Richard Johnson Square, are well shielded from westerly winds by the many neighbouring buildings. The impact of the proposed development onto the ground level wind conditions around the site is expected to be minimal due to the significant amount of neighbouring buildings and other obstructions for the wind. Hence the ground level wind conditions around the development site are expected to be quite similar to the existing site conditions.

It is not envisaged that adverse wind conditions would occur in the open through site link. However, this will need to be confirmed by means of wind tunnel testing at a later stage in the design process.

The facade surrounding the Sky Lobby area consists of glazing along the lower section with mechanically operated louvered across the top. The wind conditions within the Sky Lobby are expected to be suitable for their intended uses provided that the mechanically operated louvers can be completely shut during periods of adverse wind conditions.

The outdoor terrace areas along the southern boundary of the Sky Lobby will be exposed to the westerly winds, particularly the section of the terrace area at the south-western boundary. It is recommended to retain the impermeable balustrade along the perimeter and have closely spaced densely foliating vegetation of an evergreen species included in that area in an arrangement similar to that indicated in Figure 3b. It is recommended that wind tunnel testing be undertaken at a later design stage to verify the adequacy of this treatment scheme.

The facade surrounding the internal Sky Garden area comprises of a mechanically operated louver façade system. The wind conditions within these areas are expected to be suitable for their intended uses, provided that the louvered façade system can be completely shut during periods of adverse wind conditions.

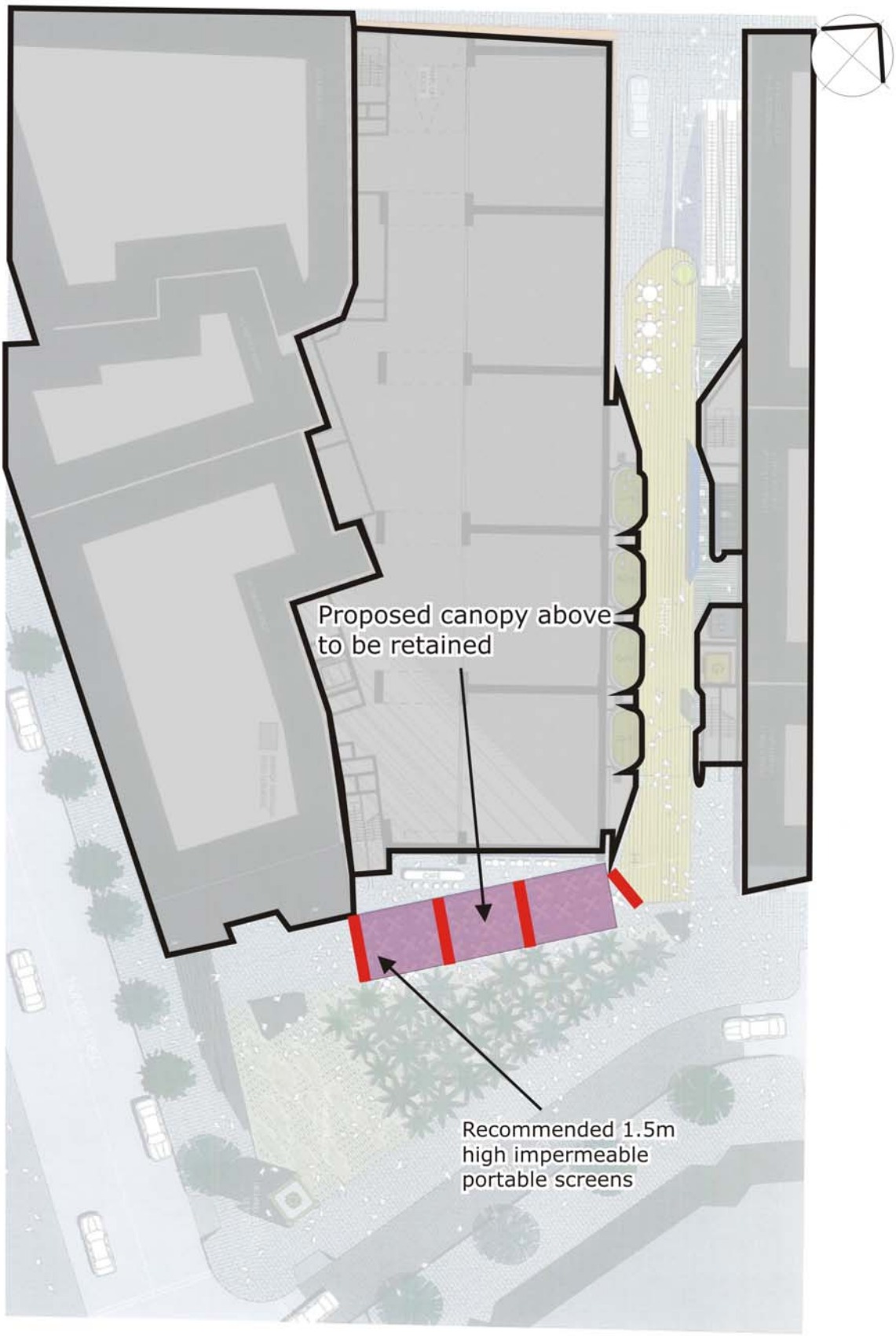


Figure 3a: Recommended Treatments – Ground Level

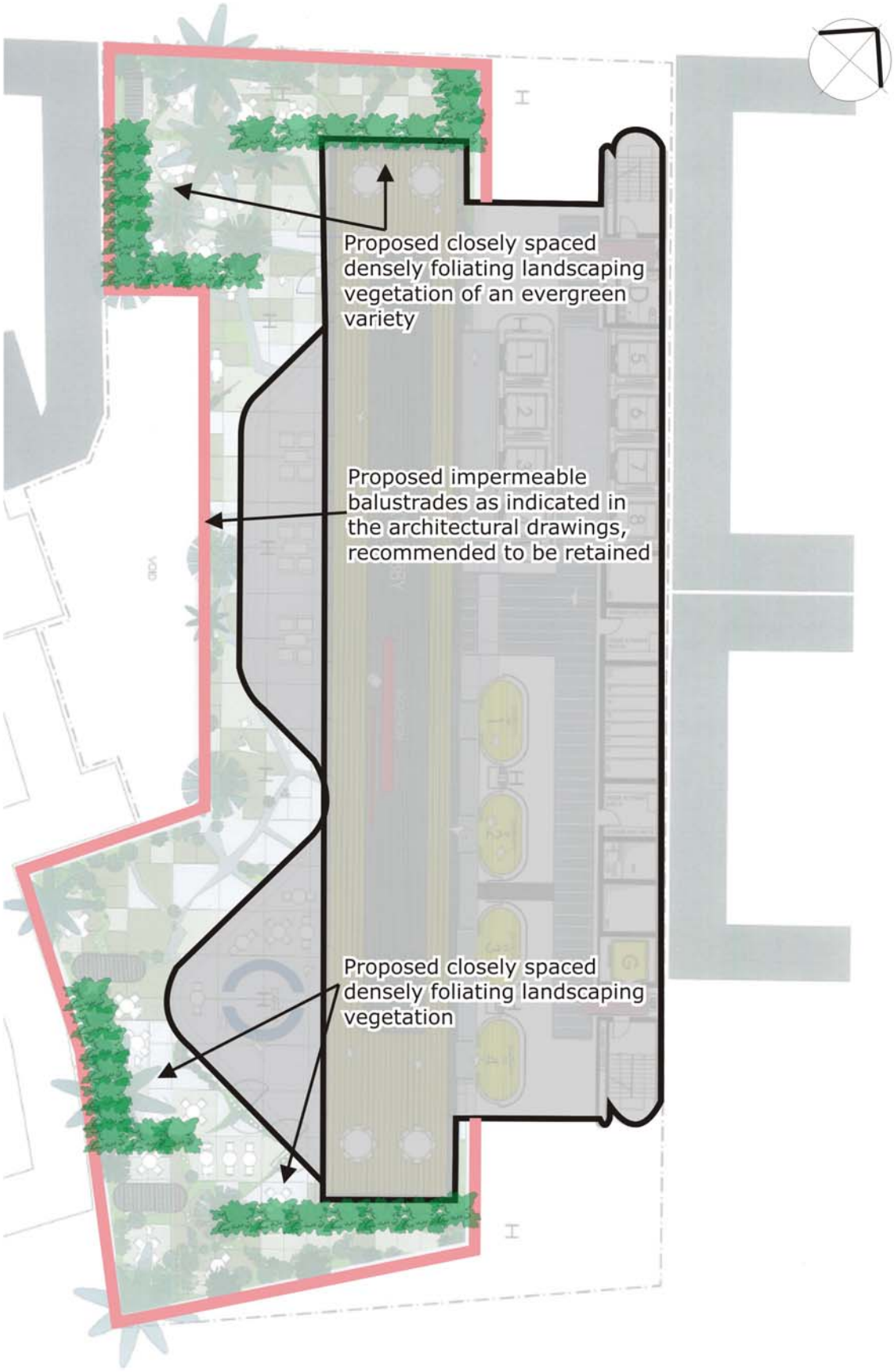


Figure 3b: Recommended Treatments – Sky Lobby Level

6.0 Conclusions

An analysis of the wind environment impact with respect to the principal wind directions for Sydney has been completed for the proposed Stage 2a City East Zone Substation and Integrated Commercial Development at 33 Bligh Street, 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 received August 25 2011, prepared by Kann Finch Group, dated August 19, 2010 and by Fitzpatrick and Partners, dated August 22, 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 the assessment indicate that wind conditions for all outdoor trafficable areas within the development are expected to be suitable for their intended uses with the inclusion of the following recommendations:

- The retention of the proposed canopy above the ground level outdoor café and seating area.
- The addition of 1.5m high impermeable portable screens within and around the ground level outdoor café and seating area.
- The retention of the proposed impermeable balustrades along the perimeter of the outdoor terrace area on the Sky Lobby Level.
- The implementation of a strategic planting scheme similar that presented in the report for the outdoor terrace area on the Sky Lobby Level.

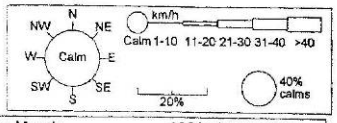
Furthermore, it is recommended that wind tunnel testing be undertaken at a later design stage to verify the effectiveness of the recommended in-principle treatments listed above.

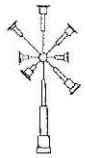
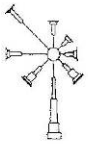
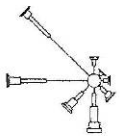
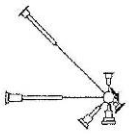
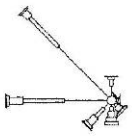
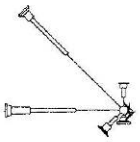
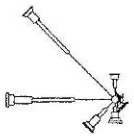
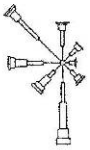
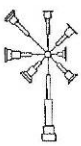
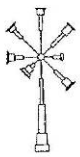
Appendix

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
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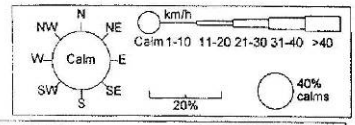

3 pm January 1939 observations	3 pm February 1771 observations	3 pm March 1925 observations
3 pm April 1832 observations	3 pm May 1877 observations	3 pm June 1821 observations
3 pm July 1882 observations	3 pm August 1882 observations	3 pm September 1811 observations
3 pm October 1904 observations	3 pm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