

Pedestrian Wind Environment Statement

for Stage 1A of the development located at
2 Herb Elliot Avenue, Sydney
Olympic Park

May 16, 2013

Report Reference No. WB007-03F01(rev2)- WS Report

Document Control

Revision Number	Date	Revision History	Prepared By (initials)	Reviewed & Authorised By (initials)
0	25/03/2013	Updated from Previous WS report (ref: WB007-02F01(rev0)- WS Report)	-	TH
1	27/03/2013	Updated with comments	-	TH
2	16/05/2013	Discuss the effect of staging	-	TR

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1.0 Introduction

This report is in relation to the proposed Stage 1A mixed-use development located at 6 Australia Avenue, Sydney Olympic Park, and presents an opinion on the likely impact of the proposed design on 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 architectural drawings which have been prepared by the project architect Architectus Sydney, dated 15th March, 2013. 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 Sydney

The Sydney region is governed by three principle wind directions, and these 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 2000. The wind roses are attached in the appendix of this report.

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	

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

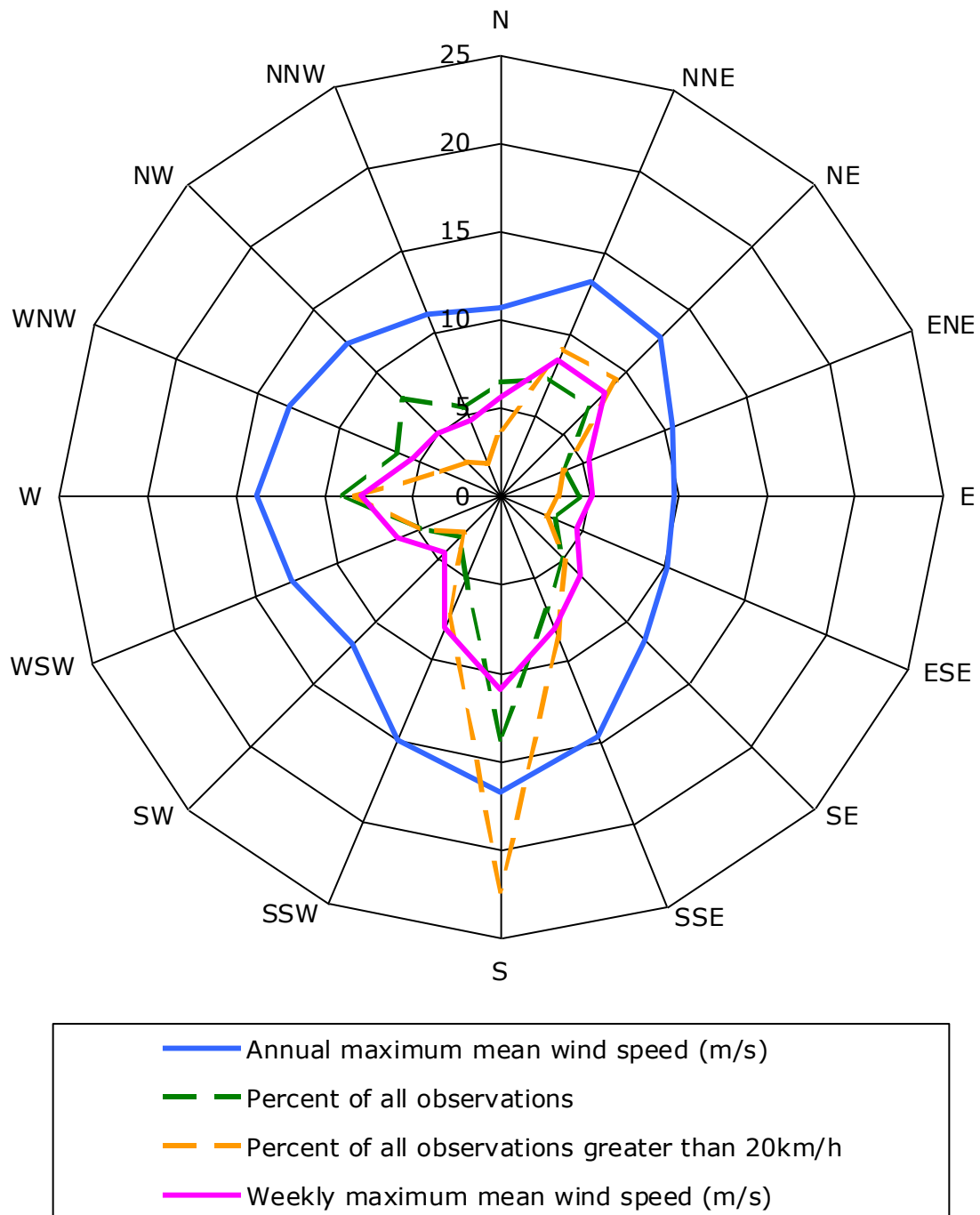


Figure 1: Annual and Weekly Recurrence Mean Wind Speeds, and Frequencies of Occurrence, for the Sydney Region (based on 10 minute mean observations from Kingsford Smith Airport from 1939 to 2008, corrected to open terrain at 10m)

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

The proposed development site is located on the south-western side of the intersection of Australia Avenue and Herb Elliott Avenue in Homebush Bay. To the far east of the site are the Australia Towers that are approximately 30-storeys above ground. To the north-east of the site is a medium-rise building of approximately 11-storey above ground. Surrounding the site to the south and west are low-rise buildings of approximately 3-storey high. The proposed development site comprises of a three stage development; Stage 1/1A located along the eastern boundary and Stage 2 located along the western boundary of the site and is indicated in Figure 2a below. The landform in the local vicinity of the site is relatively flat. An aerial image of the site is shown in Figure 2b.

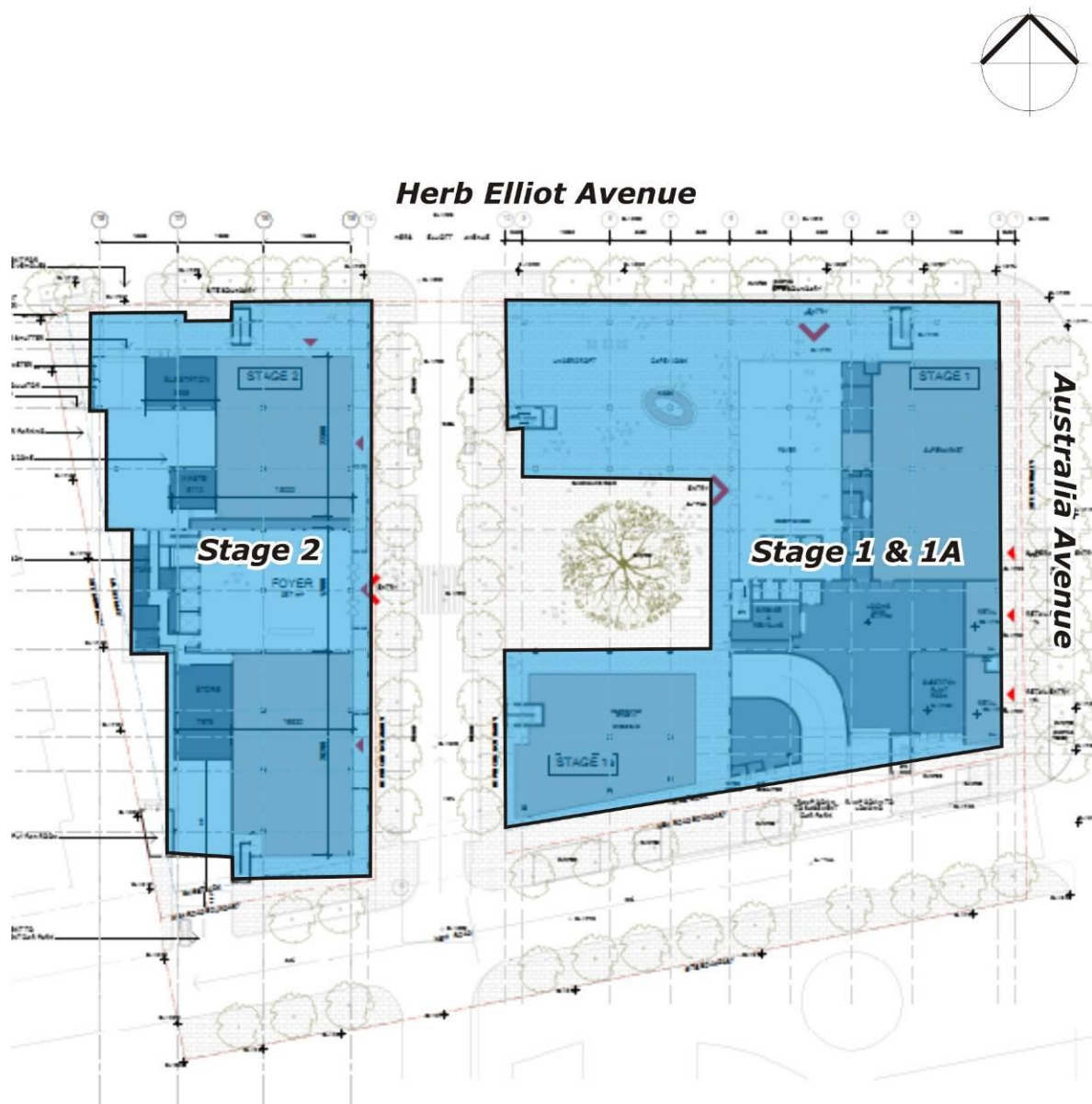


Figure 2a: Site Plan of the Subject Development



Figure 2b: Aerial Image of the Site Location

5.0 Description of the Proposed Development

The proposed development is a mixed-use building with 8 storeys consisting of office commercial space and a roof mounted plant above. Retail tenancies are proposed for the Ground Level, and commercial tenancies are proposed on the remaining levels above ground. Two basement levels are also proposed, which will be used for car parking.

The various outdoor trafficable areas of the development are summarised as follows:

- Pedestrian footpaths along Herb Elliott Avenue and Australia Avenue frontages of the site.
- Pedestrian footpaths along the proposed new roads between the Stage 1, 1A and 2 components of the development and along the southern boundary of the site.
- An undercroft is proposed at the western end of the site from Ground Level to Level 3.
- A through-site link between the Stage 1 and 1a components of the development.
- Balconies are proposed on the eastern aspect of the development, overlooking the Australia Avenue.
- Balconies are also proposed on the northern aspect of the development, overlooking of Herb Elliott Avenue.

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.

6.1 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.

Pedestrian Footpaths around the Site

The pedestrian footpath along Herb Elliott Avenue and Australia Avenue frontages of the site are exposed to the north-easterly winds. It is noted that the architectural drawings include existing trees along Herb Elliott Avenue and Australia Avenue. It is recommended that these trees be retained in the final design. These trees are effective in mitigating the north-easterly winds and providing adequate wind conditions for pedestrians on these sections of the footpath of Herb Elliott Avenue and Australia Avenue.

Trafficable Outdoor Areas within the Site

The proposed undercroft area at the western end of the site is not directly aligned to the direction of the north-easterly winds and is thus partially shielded from north-easterly winds by the proposed development itself. It is noted that the architectural drawings include existing trees along Herb Elliott Avenue. Retaining these trees in the final landscaping plan will further enhance wind conditions in this area.

The covered through-site link between the Stage 1 and 1a development along the south-eastern boundary is shielded from the north-easterly winds by the tower component of the proposed development itself.

The wind conditions along the new road between the Stage 1, 1a and 2 development of the site are shielded from the north-easterly winds by the proposed development itself. The inclusion of the proposed densely foliating trees along the road is expected to further enhance the wind conditions within these areas.

The pedestrian footpath along the new road on the southern boundary of the site may be potentially exposed to the north-easterly winds due its alignment and accelerations around the corner of the development. It is recommended the proposed densely foliating trees around the south-eastern corner of the site and along the new road are included in the final design of the development to mitigate these potential adverse wind effects.

Wind conditions for the proposed balconies on the northern and eastern aspects of the development are expected to be ideal. These balconies will benefit from being recessed into the building form.

With the abovementioned recommendations incorporated into the final design, it is not expected that there will be any adverse wind effects caused by north-easterly winds to the various outdoor areas within and around the proposed development.

6.2 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.

Pedestrian Footpaths around the Site

The pedestrian footpath along Herb Elliott Avenue frontage of the site is well shielded from the southerly winds by the proposed development itself.

The Australian Avenue pedestrian footpath of the site is exposed to side-streaming effects of the southerly winds. However, it is noted that the architectural drawings include existing trees along Australia Avenue. It is recommended that these trees be retained in the final design. These trees are effective in mitigating the side-streaming effect of the southerly winds and provide adequate wind conditions for pedestrian on this section of the footpath of Australia Avenue.

Trafficable Outdoor Areas within the Site

The proposed undercroft area at the western end of the site is partially exposed to the southerly winds travelling along the proposed new road between the Stage 1, 1a and 2 developments. It is noted that the architectural drawings there are several proposed densely foliating trees along the southern edge of the site, the proposed road and directly south of the undercroft. It is expected these proposed densely foliating trees will be effective in mitigating the adverse southerly winds and are recommended to be retained in the final design of the development.

The covered through-site link between the Stage 1 and 1a development along the south-eastern boundary is potentially exposed to the southerly winds funneling through the link. It is expected the inclusion of the proposed densely foliating trees directly south of the through-site link will be effective in ameliorating these adverse wind effects.

The wind conditions along the new road between the Stage 1, 1a and 2 development of the site are potentially exposed to the southerly winds accelerating around the corner of the Stage 2 development. Similarly the new road along the southern boundary is exposed to the southerly winds travelling over the adjacent open car park. It is recommended the densely foliating trees along both the new road are included in the final design of the development to mitigate these potential adverse wind effects. Hence they are expected to be acceptable for its intended uses.

Wind conditions for the proposed balconies on the northern and eastern aspects of the development are expected to be ideal due to shielding by the proposed development itself.

With the abovementioned treatments incorporated and indicated in Figure 3 into the final design, it is not expected that there will be any adverse wind effects caused by southerly winds to the various outdoor areas within and around the proposed development.

6.3 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.

Pedestrian Footpaths around the Site

The pedestrian footpath along Herb Elliott Avenue frontage of the site is exposed to the westerly winds. It is noted that the architectural drawings include existing trees along Herb Elliott Avenue. It is recommended that these trees be retained in the final design. These trees are effective in mitigating the adverse westerly winds and providing adequate wind conditions for pedestrians on this section of the footpath of Herb Elliott Avenue. Note that for the densely foliating trees to be effective throughout the year, they are recommended to be of an evergreen variety.

The pedestrian footpath along Australia Avenue is well protected from direct westerly winds by the proposed development itself.

Trafficable Outdoor Areas within the Site

The proposed undercroft area at the western end of the site is not directly aligned to the direction of the westerly winds and is thus partially shielded from the westerly winds. It is noted that the architectural drawings include existing trees along Herb Elliott Avenue. Retaining these trees in the final landscaping plan will help to mitigate the adverse westerly winds.

The covered through-site link between the Stage 1 and 1a development along the south-eastern boundary is shielded from the westerly winds by the adjacent Stage 2 development. The proposed densely foliating trees along the new road and within the central courtyard are expected to further enhance the wind conditions.

The wind conditions along western corner of the new road between the Stage 1, 1a and 2 are exposed to the westerly winds accelerating around the corner of the adjacent Stage 2 development while the same building is expected to have a shielding effect on the remaining pedestrian footpath. It is recommended the proposed densely foliating trees around the western corner of the development are retained in the final design of the development to mitigate these adverse wind conditions.

The wind conditions along the new road on the southern boundary of the site of the site are shielded from the westerly winds by the proposed development and the neighboring developments. The inclusion of the proposed densely foliating trees along the road is expected to further enhance the wind conditions within these areas.

Wind conditions for the proposed balconies on the northern and eastern aspects of the development are expected to be ideal. These balconies will benefit from being recessed into the building form.

With the abovementioned recommendations incorporated and indicated in Figure 3 into the final design, it is not expected that there will be any adverse wind effects caused by westerly winds to the various outdoor areas within and around the proposed development. Note that for the densely foliating trees to be effective throughout the year, they are recommended to be of an evergreen variety.

6.4 Effect of Staging

The Stage 2 development construction may not proceed immediately after the completion of the Stage 1, 1A development. The existing 10m high building located immediately west of the site together with the proposed 1.8m high hoarding as shown in Figure 4, is expected to provide adequate amelioration of the adverse westerly winds in the proposed ground level areas within Stage 1 and 1a.

 **Densely Foliating Trees recommended to be retained in the final design of the development.**
The densely foliating trees are to be of an evergreen variety.

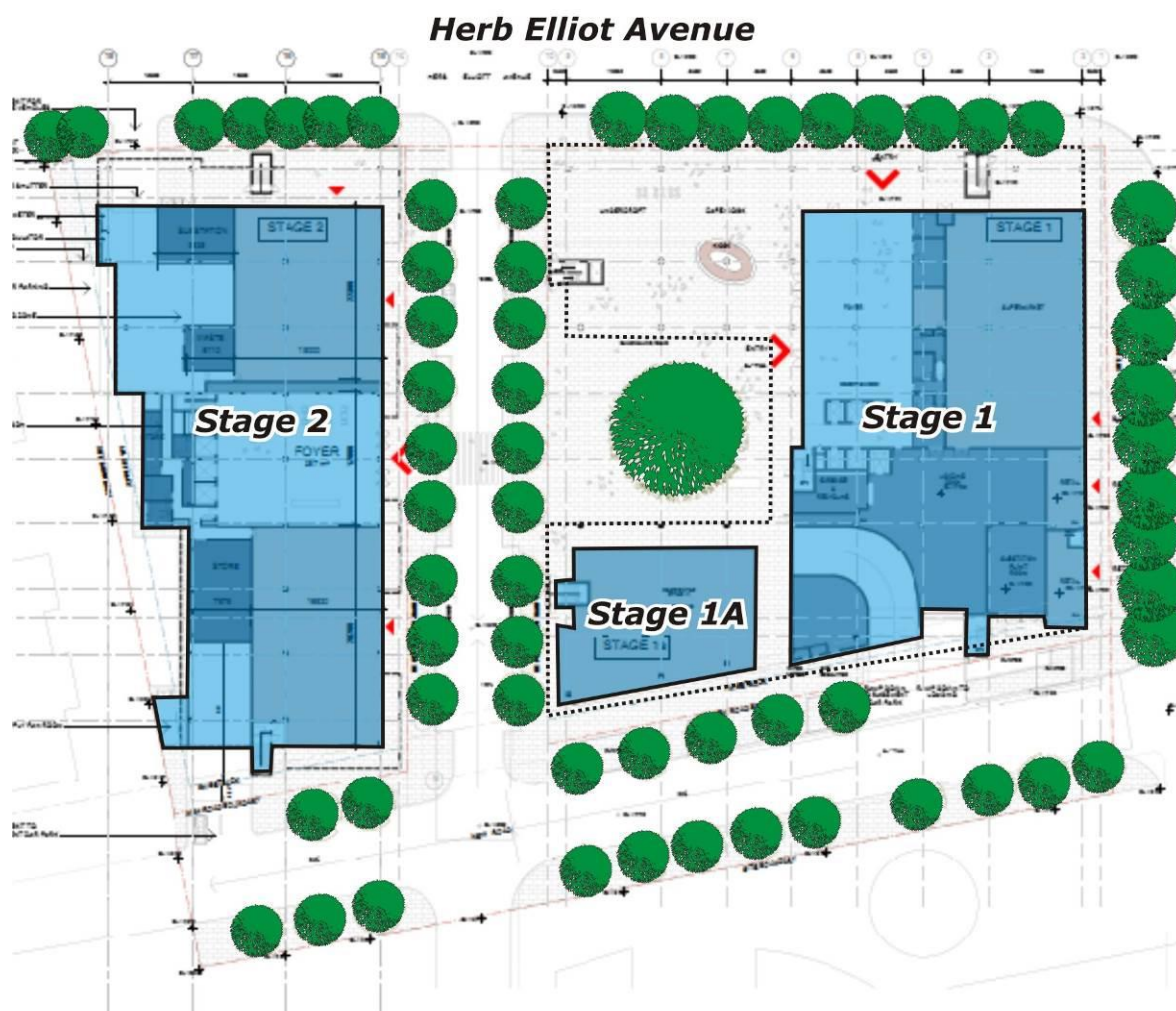
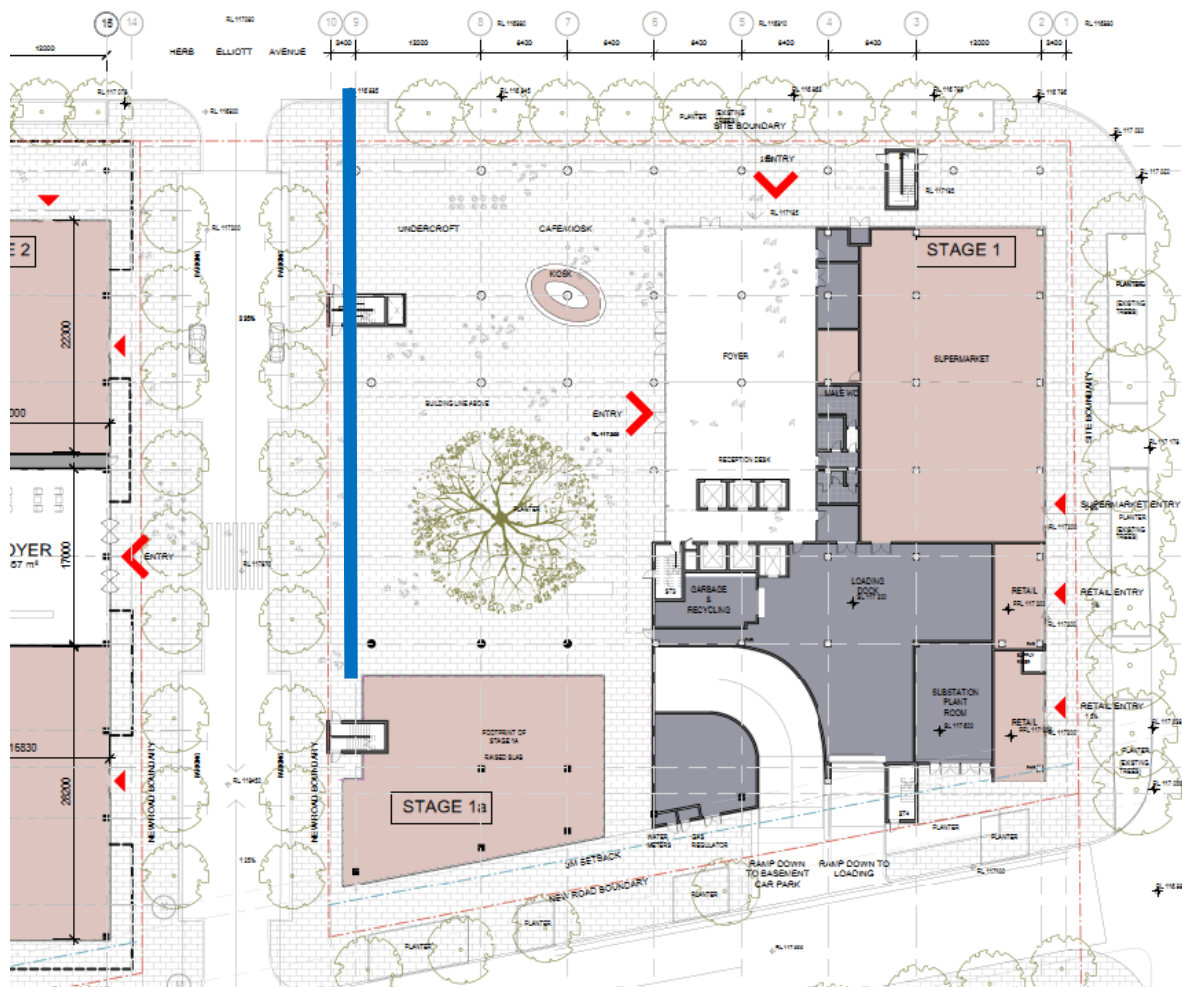


Figure 3: Recommended Treatments to Ground Level



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 Stage 1A development located at 6 Australia Avenue, Sydney Olympic Park. 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 Architectus Sydney, dated 15th March, 2013. 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 wind conditions for the balconies on the subject development will be acceptable for its intended uses due to the recessed design of the balconies into the building form. There were several ground level areas within and around the site that are potentially exposed to the adverse wind conditions due to a number of factors such as the orientation/alignment of the roads and potential accelerations around the corner sites of the development. To ensure adequate wind conditions are achieved for all trafficable outdoor areas with and around the site, it is recommended the proposed vegetation scheme of densely foliating trees within and around the site is retained in the final design of the development and hence wind conditions are expected to be acceptable for its intended uses.

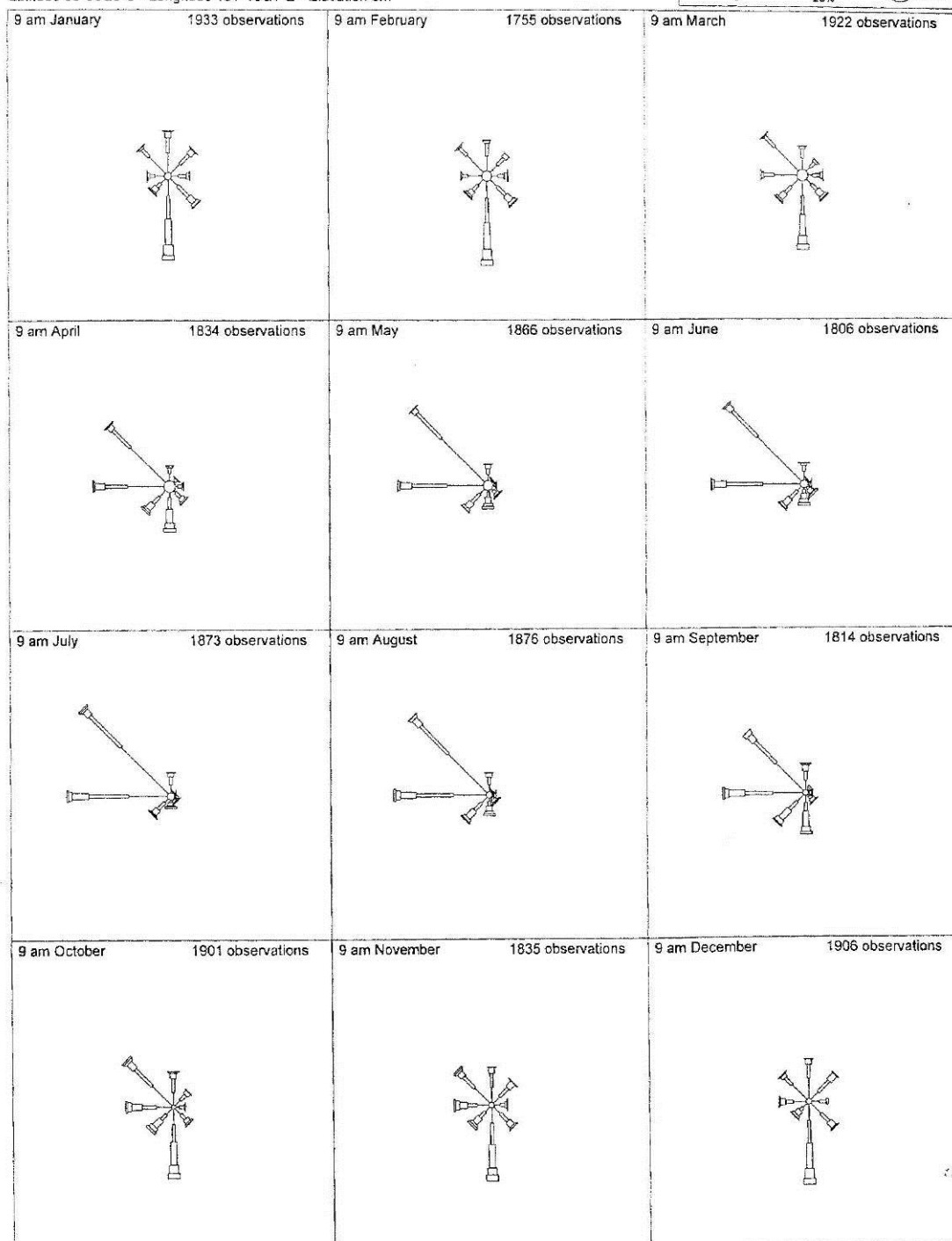
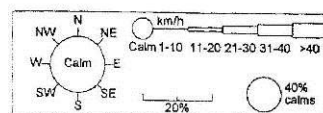
Note that to ensure the densely foliating trees are effective in wind mitigation throughout the year, they are recommended to be of an evergreen species.

Appendix

Wind Roses for the Sydney Region

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

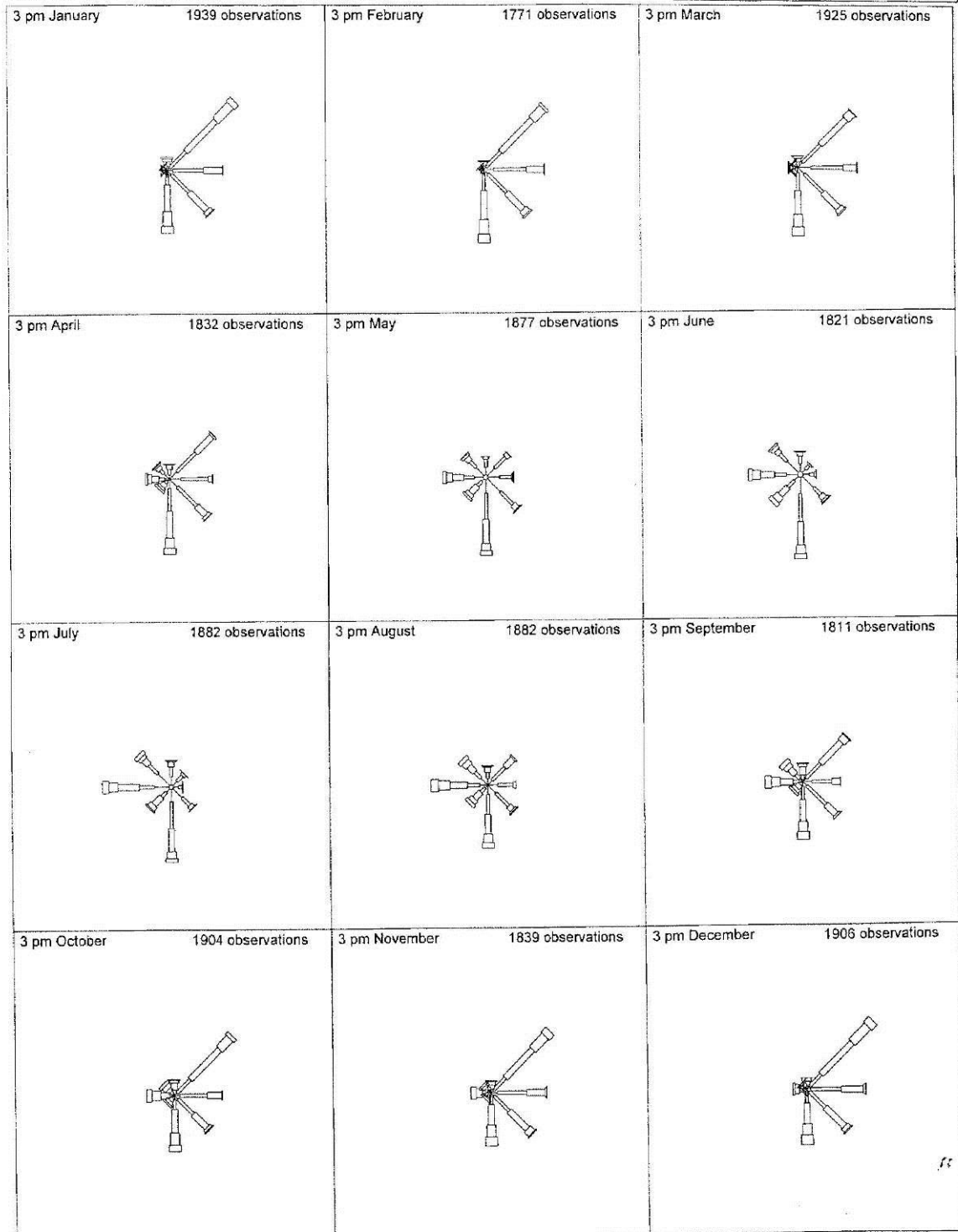
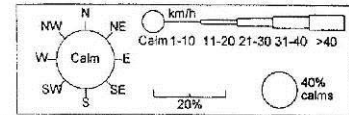


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Wind Roses using available data between 1939 and 2000 for SYDNEY AIRPORT AMO

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