PEDESTRIAN WIND ENVIRONMENT STATEMENT

NEPEAN GREEN, PENRITH

WB389-01F02(REV3)- WS REPORT

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Prepared for:

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DOCUMENT CONTROL

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EXECUTIVE SUMMARY

This report is in relation to the proposed development known as Nepean Green, located in Penrith, 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 site.

The effect of wind activity within and around the proposed development is examined for the three prevailing winds for the Penrith region; north to north-easterly, south to south-easterly 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 Turner Associates, received July 12th, 2012. 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 the wind conditions the various central landscaped communal areas within the site are expected to be suitable for its intended uses due to the shielding provided by the surrounding proposed buildings. However, the remaining outdoor trafficable areas, within and around the subject site, are potentially exposed to the prevailing wind directions due to the alignment of the roads and proposed buildings that provides minimal wind interference. The following recommendations have been made to help mitigate against potential adverse wind conditions and are as follows:

- The inclusion of proposed densely foliating trees along Station Street, Jamison Road, Woodriff Street and the proposed roads within the development site as indicated in the landscape drawing of the site. These trees should be capable of growing to a height of at least 5m with a 4m wide canopy. They should also be of an evergreen variety to ensure their effectiveness in wind mitigation during the winter period.

- The inclusion of the proposed densely foliating trees and vegetation within the outdoor public plaza, the various central landscape communal areas and retail car-parking site as indicated in the landscape drawing of the site. To be effective in wind mitigation during the winter period, these trees should be of an evergreen variety.

- The inclusion of impermeable balustrades along the perimeter of the corner balconies within the site.

- The inclusion of full-height impermeable end screens on one end of the corner balconies, preferably those that face the north to north-easterly, western or south to south-easterly directions.

Note that the wind conditions within the remaining balconies would be further enhanced with the inclusion of impermeable balustrades along the perimeter.

With these recommended treatments included in the final design, it is expected that wind conditions within and around the subject development will be acceptable for their intended uses. Furthermore, the proposed development is not expected to cause any adverse wind effects to the local surrounding areas.

CONTENTS

List of Tables

1 REGIONAL WIND CLIMATE FOR PENRITH

The Penrith region is governed by three principle wind directions, and these can potentially affect the subject development. These winds prevail from the north to north-easterly, south to south-easterly and west directions. A summary of the principal time of occurrence of these winds throughout the year is presented in Table 1. This summary is based on an analysis of wind rose data obtained by the Bureau of Meteorology from Penrith lakes AWS between 1995 and 2010. The wind roses are attached in the appendix of this report.

For the Penrith region, the north to 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 south to south-easterly winds are by far the most frequent wind for the Penrith region, and are also the strongest. Westerly winds occur most frequently during the winter season for the Penrith region. These are usually a cold wind since they occur during the winter, and hence can be a cause for discomfort for outdoor areas.

Table 1: Principal Time of Occurrence of Winds for Penrith

Month	Wind Direction		
	North to North-Easterly	South to South-Easterly	Westerly
January		X	
February		X	
March	X	X	
April	X	X	
May	X		
June		X	X
July			X
August	X		X
September	X		X
October	X	X	
November	X	X	
December	X	X	

2 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 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	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.

3 DESCRIPTION OF THE SITE AND SURROUNDS

The proposed development site is located at 164 Station Street, Penrith. The proposed development site is bounded by the Station Street to the north and west, Jamison Road to the south, Woodriff Street to the east and the Centro Nepean Shopping Complex to the north-east. An aerial image of the site and the surroundings is shown in Figure 1.

To the north-east to south-west of the site are several sporting complexes including the Penrith Showground, Penrith Stadium and Howell Oval. To the east and south are low-rise residential developments and to the south-east is Jamison Park consisting of large areas of relatively flat terrain. The land topography is relatively flat with no major geological features close to the site.

Figure 1: Aerial Image of the Proposed Development Site

4 DESCRIPTION OF THE PROPOSED DEVELOPMENT

The concept plan of the proposed development consists of a Masters Home Improvement Store with its associated ground level car parking and twelve residential complexes with approximately 570 residential units with some retail/commercial areas and a 2 storey tavern. The residential building heights vary from between 4 to 8 storeys in height and basement car parking are proposed under the residential complexes and tavern. An image of the proposed development site is illustrated in Figure 2 below.

The various outdoor trafficable area of the development subject to analysis in this report are summarised as follows:

- The trafficable areas on Ground Floor including the pedestrian footpaths within and around the site.
- Central landscape communal areas within and around the site.
- Public Plaza located at the northern corner of the site.
- The various private terraces and balcony areas associated with the residential apartments on the northern, southern and western aspects of the development.

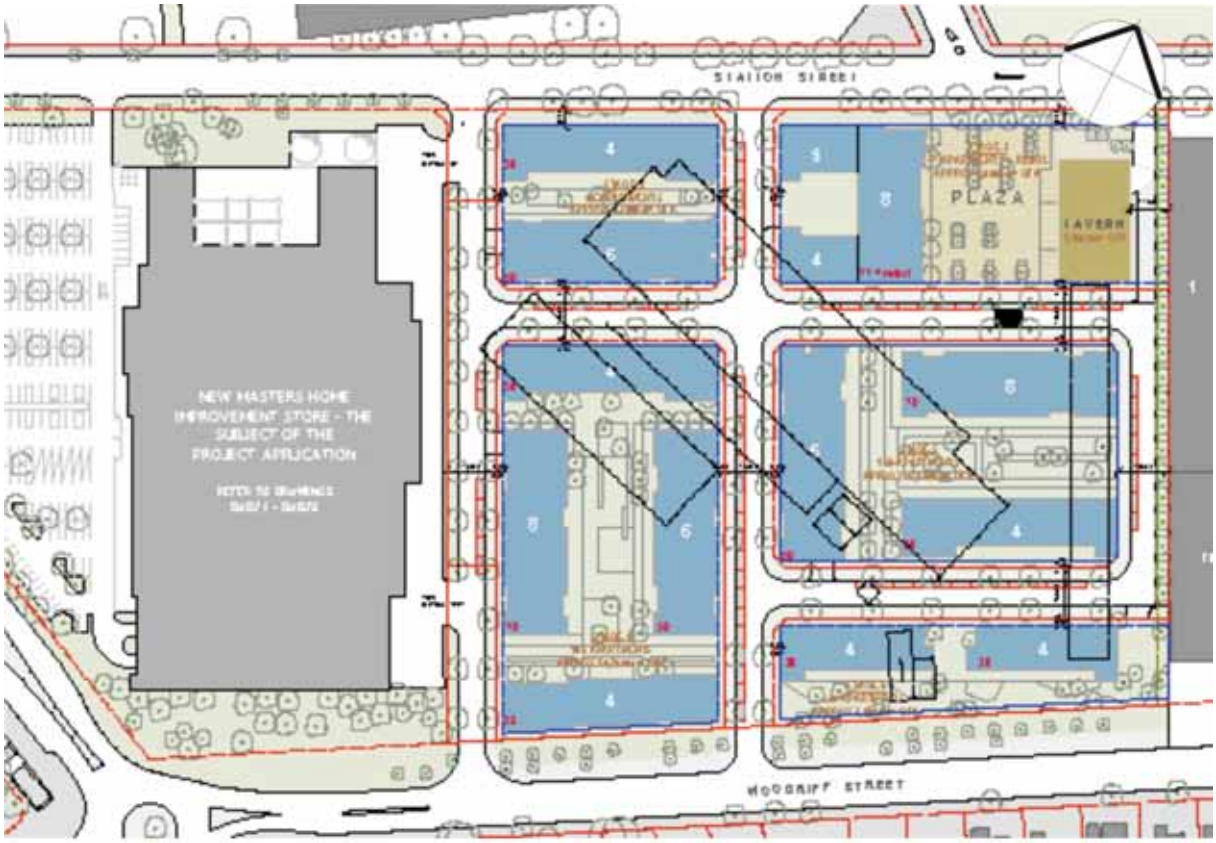

Figure 2: Site Plan of the Proposed Development Site

5 RESULTS OF THE ANALYSIS

For each of the three predominant wind directions for the Penrith 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 Pedestrian Footpaths around the Site

The pedestrian footpath along Station Street is exposed to all three prevailing wind directions due to the north-east to south-west alignment of the street and exposure to the open areas of Howell Oval west of the site. The existing wind conditions along this street will not be exacerbated by the proposed development.

Similarly, the pedestrian footpath along Woodriff Street is aligned in a north-east to south-west orientation, fortunately it benefits from being shielded from the westerly winds by the proposed development, potentially improving the wind conditions during the winter months.

The pedestrian footpath along Jamison Road is also exposed to all three prevailing wind directions due to its east-west alignment and the open ground level car-parking site directly north of the footpath. The existing wind conditions along this street will not be exacerbated by the proposed development.

It is expected the wind conditions along Station Street will be acceptable for its intended use with the inclusion of the proposed densely foliating street trees along Station Street, Woodriff Street and Jamison Road as indicated in the landscape drawings of the site and in Figure 3. These street trees should be capable of growing to a height of 5m, with a 4m wide canopy.

For trees to be effective in mitigating against the adverse westerly winds which predominantly occur during the winter months, they must be of a densely foliating evergreen variety.

5.2 Ground Level Trafficable Areas within and around the Site

5.2.1 Public Plaza

The Public Plaza, located at the northern corner of the site within Stage 3 is well shielded from the adverse south to south-easterly winds by the proposed residential buildings of the site. The plaza however, is exposed to the westerly and north to north-easterly winds travelling around Penrith Park and Penrith Showground respectively. It is expected the wind conditions within the public plaza will be acceptable for its intended uses with the inclusion of the proposed densely foliating trees within and around the public plaza site as indicated in landscape drawings and in Figure 3. It should be noted that for trees to be effective all year round, they should be densely foliating and of an evergreen variety.

5.2.2 Various Central Landscaped Communal Areas within the Site

The various central landscaped communal areas within the site, primarily located between the residential complexes of development site are generally well shielded from the predominant winds by the various tower developments and the acoustic wall between the Masters Home Improvement Store and the residential complexes. The landscaped drawings for the site and highlighted in Figure 3, shows there are several densely foliating trees and low lying vegetation within these landscaped communal areas. It is recommended the proposed landscape scheme is included in the final design of the development and the wind conditions within these areas are expected to be acceptable for its intended uses.

5.2.3 Car Parking Site along the South-Western Boundary

The ground level car parking site located along the south-western boundary of the site is exposed to the adverse westerly winds travelling along Jamison Road and over the relatively open areas of Howell Oval, the north-easterly winds travelling along Station Street and the southerly to south-easterly winds travelling over Jamison Park and along Jamison Road. There are several existing densely foliating trees planted within the islands of Jamison Road and within Howell Oval that will provide some shielding from the adverse winds. It is noted within the landscape drawings for the site and highlighted in Figure 3, there are numerous large densley foliating trees proposed within the car-parking site and along Station Street and Jamison Road. It is recommended these trees are included in the final design of the development and should be capable of growing to a height of at least 5m, with a 4m wide canopy and of a hardy evergreen variety. With the inclusion of the abovementioned vegetation, it is expected the wind conditions for the car parking site will be acceptable for its intended use.

5.2.4 Various pedestrian footpaths along the Proposed New Roads within the Site

The various pedestrian footpaths along the proposed new roads within the site are directly aligned with the north-easterly and south-easterly wind directions. The incident winds travel over the relatively open surrounds and funnelled into the roads by the proposed tower developments of the site. The landscape drawings for the site and indicated in Figure 3, shows avenues of large trees alongside the pedestrian footpaths throughout the site and capable of growing to a height of 5m with a 4m wide canopy. It is expected with the inclusion of the above-mentioned treatment scheme, the wind conditions along the pedestrian footpaths of the site will be acceptable for its intended uses.

5.3 Private Balconies Associated with the Various Residential Complexes

Wind conditions on the single-aspect balconies, which account for most of the balconies within the subject development site, are expected to be suitable for their intended uses due to the stagnation provided by surrounding proposed buildings, and from the effect of the various privacy screens and blade walls that protrude out from the building facades. Similarly any balconies that are recessed into the overall building form will also experience ideal wind conditions.

However, the private corner balconies located of the various residential complexes may be exposed to adverse winds being accelerated around the corners of the building. To provide adequate wind conditions within these areas, it is recommended that impermeable balustrades are used on the perimeter of the balcony area. It is also recommended to include a full-height screen along the short edge of the various corner balconies to mitigate the effect of accelerated corner winds. Hence, with the inclusion of the impermeable balustrades and end-screens on the corner balconies, the wind conditions are expected to be acceptable for its intended uses.

Note that the inclusion of impermeable balustrades along the perimeter of the remaining balconies of the development site will further enhance the wind conditions within these areas.

Figure 3: Recommended Treatments – Ground Level

6 CONCLUSION

An analysis of the wind environment impact with respect to the three principal wind directions for the Penrith region has been completed for the proposed development known as Nepean Green, located in Penrith. 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 Turner Associates, received July 12th, 2012. 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.

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- The inclusion of proposed densely foliating trees along Station Street, Jamison Road, Woodriff Street and the proposed roads within the development site as indicated in the landscape drawing of the site. These trees should be capable of growing to a height of at least 5m with a 4m wide canopy. They should also be of an evergreen variety to ensure their effectiveness in wind mitigation during the winter period.

- The inclusion of the proposed densely foliating trees and vegetation within the outdoor public plaza, the various central landscape communal areas and retail car-parking site as indicated in the landscape drawing of the site. To be effective in wind mitigation during the winter period, these trees should be of an evergreen variety.

- The inclusion of impermeable balustrades along the perimeter of the corner balconies within the site.

- The inclusion of full-height impermeable end screens on one end of the corner balconies, preferably those that face the north to north-easterly, western or south to south-easterly directions.

Note that the wind conditions within the remaining balconies of the site would be further enhanced with the inclusion of impermeable balustrades along the perimeter.

With these recommended treatments included in the final design, it is expected that wind conditions within and around the subject development will be acceptable for their intended uses. Furthermore, the proposed development is not expected to cause any adverse wind effects to the local surrounding areas.

APPENDIX A - WIND ROSE FOR THE PENRITH REGION

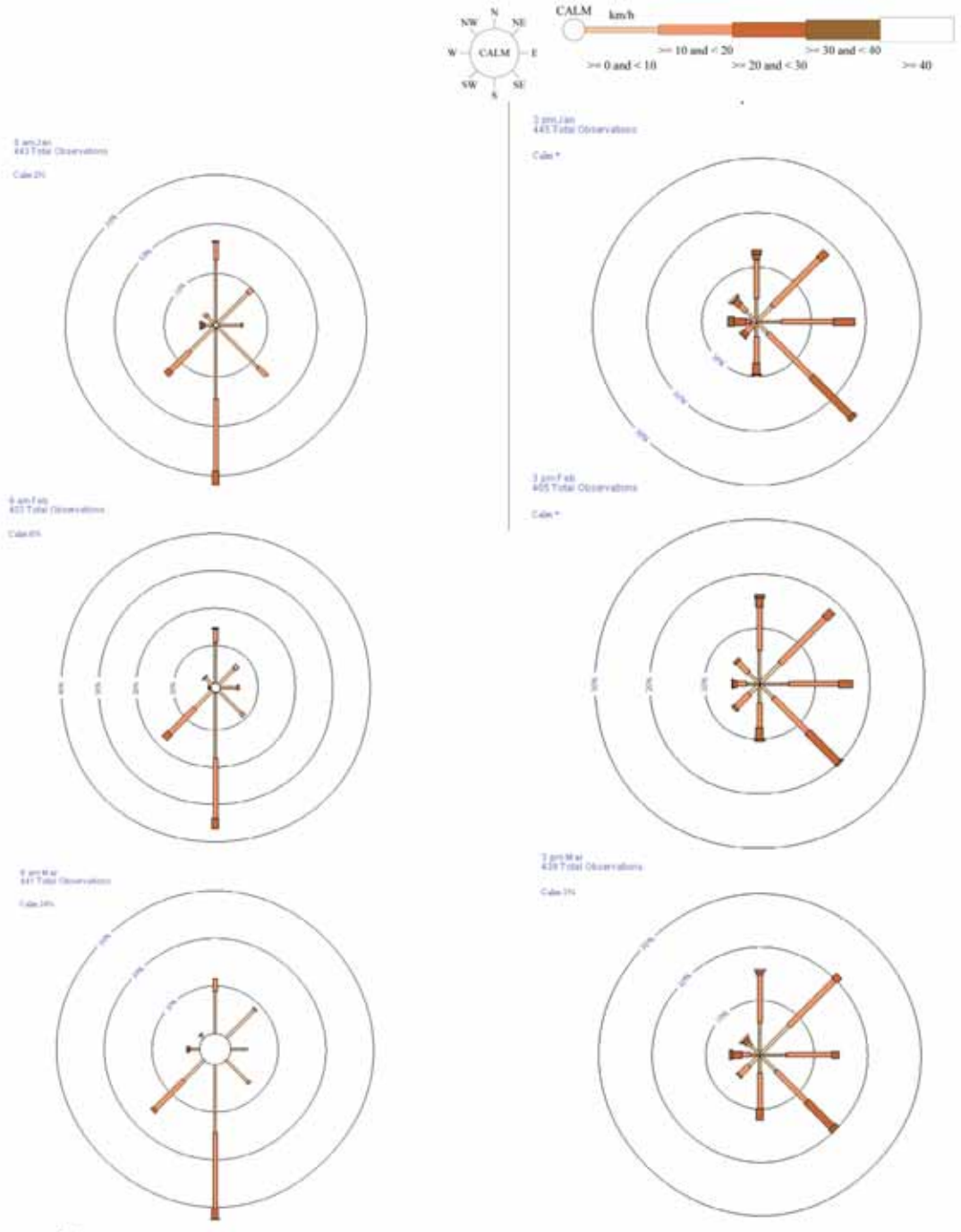
Rose of Wind direction versus Wind speed in km/h (15 Sep 1995 to 30 Sep 2010)

Custom times selected, refer to attached note for details

PENRITH LAKES AWS

Site No: 067113 • Opened Aug 1995 • Still Open • Latitude: -33.7195° • Longitude: 150.6783° • Elevation 24 m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.



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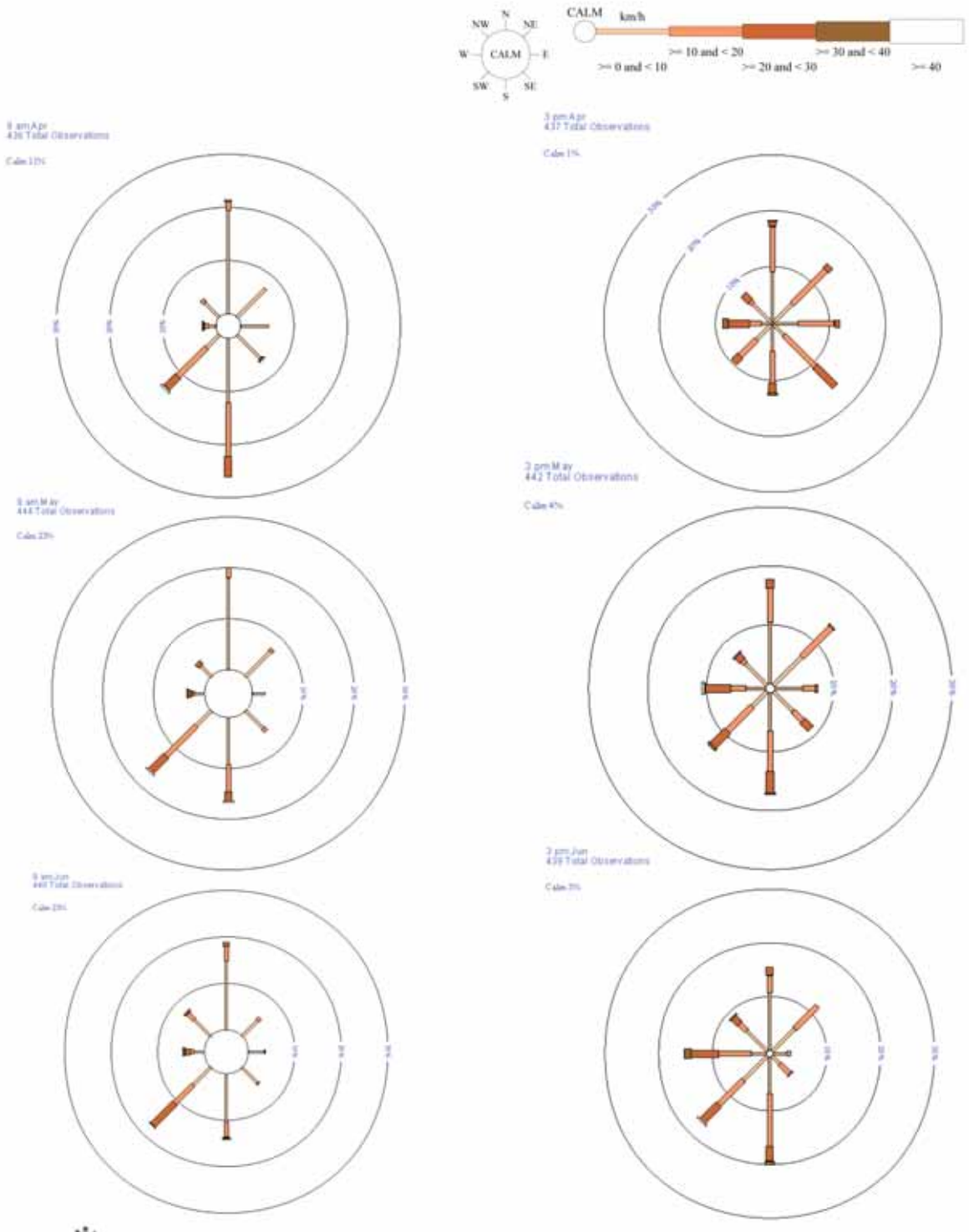

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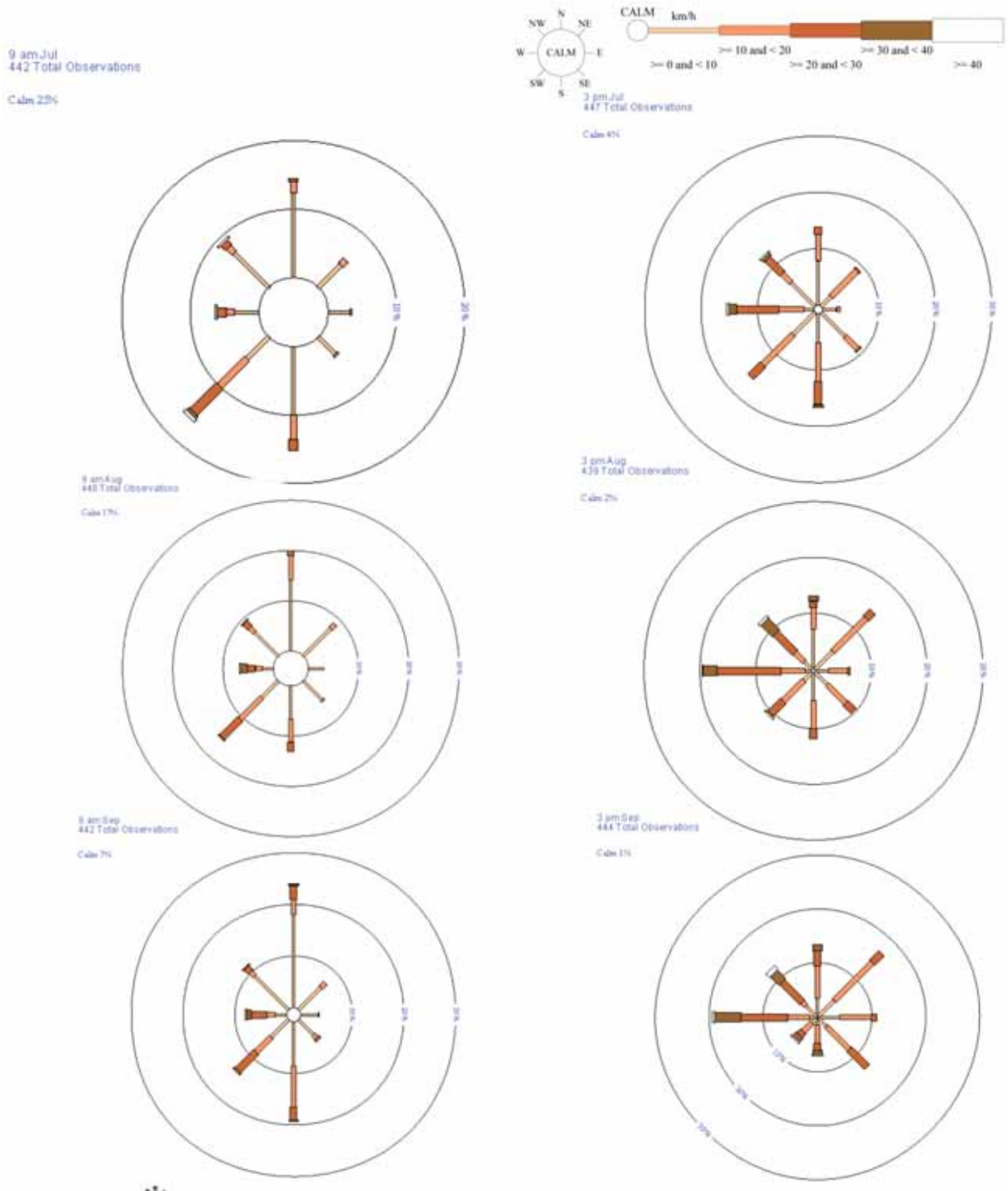

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