WIND ENVIRONMENT STATEMENT
WEST MELBOURNE WATERFRONT PRECINCT

WC721-01F02(REV2)- WS REPORT
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Prepared for:
WMW Developments Pty Ltd
C/- Perri Projects
Level 10, 60 Albert Road
South Melbourne VIC 3205

Attention: Ms Lucy Simms
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EXECUTIVE SUMMARY

This report is in relation to the proposed development known as the West Melbourne Waterfront precinct on Kensington Road in West Melbourne, 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 subject site. The effect of wind activity is examined for the predominant wind directions for the Melbourne region. The analysis of the wind effects relating to the subject site has been 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 Draft Development Plan which has been prepared by the project architect Woods Bagot, received August, 2015. This report addresses only the general wind effects and any localised effects that are identifiable by visual inspection.

The results on the assessment have noted that the subject site is currently exposed to the prevailing winds for Melbourne due to the site being located within an undeveloped precinct with minimal existing structures on the site. Furthermore, the development of any large building form on the site will potentially result in the prevailing winds potentially causing adverse wind conditions on the ground level areas and would need to be considered in the design process. The design should therefore take into account the potential for adverse wind conditions for the key outdoor use areas and provide consideration for ways to reduce these effects.

The recommended wind comfort criteria for the precinct presented in this report has been developed with consideration for the exposure of the site along the Maribyrnong River. The minimal opportunity to reduce the westerly and northerly winds due to the exposure along the waterfront has been taken into consideration during this development. The existing conditions for these areas are expected to be between the comfort criterion and the waterfront criterion. Therefore the design has been considered to ensure that these conditions are not adversely impacted, and where possible enhanced to improve conditions.

The design has incorporated a number of key features during the design process to reduce the potential impact of winds to the pedestrian footpath around the site. This has included the development of the building form to minimise the potential for downwash of the prevailing winds, through building setbacks, inclusion of low-rise podium components and relatively low height of the various building designs. By incorporating these elements during the design process this has helped to reduce the potential for large scale changes to the built form during the detailed design stage to mitigate wind impacts.
1 DESCRIPTION OF THE DEVELOPMENT AND SURROUNDINGS

The development site is located approximately 3.5km west of the Melbourne CBD, towards the western end of the Dynon Urban Renewal Area. The subject site is bound by Kensington Road along the south-eastern aspect, the Werribee/Williamstown train line along the northern boundary, the Maribyrnong River along the western boundary and existing industrial buildings to the south-west. The north of the site is Kensington Banks, consisting of low-rise residential buildings. The east and south of the site are 1 and 2 storey commercial and industrial buildings, with the Dyon Freight Terminal rail yards further beyond this. To the south-west of the site is the City of Melbourne Waste & Recycling Centre, with Port of Melbourne further beyond this. To the west of the site is the Heavenly Queen Temple with low-rise commercial and residential buildings associated with Footscray further beyond this. Flemington Racecourse is located to the north-west.

A number of future development precincts are located in nearby areas including Joseph Road (to the west) and Hobsons Road Precinct (to the north) with proposed heights of up to 32 and 7 storeys respectively. The establish community of Kensington Banks and Kensington Estate is located north of the rail line with proposed heights between 2 and 13 storeys respectively. The future Dynon Urban Renewal Area is proposed for the North Dynon Freight Terminal precinct.

The local land topography around the site is relatively flat. An aerial image of the site and the surroundings is shown in Figure 1 below.

Figure 1: Aerial Image of the Site Location
The Melbourne region is governed by three principle wind directions, and these can potentially affect the subject redevelopment. These winds prevail from the north, 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 a detailed analysis undertaken by Windtech Consultants of recorded directional wind speeds obtained at the meteorological station located at Melbourne Airport by the Bureau of Meteorology (recorded from 1970 to 2009). From this analysis, a directional plot of the annual and weekly recurrence winds for the Melbourne region is also determined, as shown in Figure 2. The frequency of occurrence of these winds is also shown in Figure 2.

As shown in Figure 2, the northerly winds are by far the most frequent wind for the Melbourne region, and are also the strongest. The southerly winds occur most frequently during the summer and shoulder months of the year. The far less frequent westerly winds are usually a cold wind since they occur during the spring and winter months and hence can be a cause for discomfort for outdoor areas. The northerly and southerly winds occur most frequently during the warmer months of the year for the Melbourne region, and hence are usually welcomed within outdoor areas.

Table 1: Principle Time of Occurrence of Winds for Melbourne

<table>
<thead>
<tr>
<th>Month</th>
<th>Northerly</th>
<th>Southerly</th>
<th>Westerly</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>February</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>March</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>April</td>
<td>X</td>
<td>X</td>
<td></td>
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<tr>
<td>May</td>
<td>X</td>
<td>X</td>
<td></td>
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<tr>
<td>June</td>
<td>X</td>
<td>X</td>
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<tr>
<td>July</td>
<td>X</td>
<td>X</td>
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<tr>
<td>August</td>
<td>X</td>
<td>X</td>
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<tr>
<td>September</td>
<td>X</td>
<td>X</td>
<td></td>
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<tr>
<td>October</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>November</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>December</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>
Figure 2a: Annual and Weekly Recurrence Mean Wind Speeds, and Frequencies of Occurrence, for the Melbourne Region (based on 10-minute mean observations from Melbourne Airport from 1970 to 2009, corrected to open terrain at 10m)
Figure 2b: Site Related Mean Wind Speeds for the Melbourne Region
3 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. Various researchers, such as Davenport, Lawson, Melbourne, Penwarden, etc, have published criteria for pedestrian comfort for pedestrians in outdoor spaces for various types of activities. Councils and Local Government Authorities have adopted elements of some of these into their planning control requirements in Australia. The following table is an example, which was developed by Penwarden in 1975, 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>
<thead>
<tr>
<th>Type of Winds</th>
<th>Gust Speed (m/s)</th>
<th>Effects</th>
<th>Applicability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calm, light air</td>
<td>0 - 1.5</td>
<td>Calm, no noticeable wind.</td>
<td>Generally acceptable for Stationary, long exposure activities such as in outdoor restaurants, landscaped gardens and open air theatres.</td>
</tr>
<tr>
<td>Light breeze</td>
<td>1.6 - 3.3</td>
<td>Wind felt on face.</td>
<td></td>
</tr>
<tr>
<td>Gentle breeze</td>
<td>3.4 - 5.4</td>
<td>Hair is disturbed, Clothing flaps.</td>
<td>Generally acceptable for walking &amp; stationary, short exposure activities such as window shopping, standing or sitting in plazas.</td>
</tr>
<tr>
<td>Moderate breeze</td>
<td>5.5 - 7.9</td>
<td>Raises dust, dry soil and loose paper. Hair disarranged.</td>
<td>Acceptable for walking &amp; stationary, short exposure activities such as window shopping, standing or sitting in plazas.</td>
</tr>
<tr>
<td>Fresh breeze</td>
<td>8.0 - 10.7</td>
<td>Force of wind felt on body.</td>
<td>Acceptable as a main pedestrian thoroughfare</td>
</tr>
<tr>
<td>Strong breeze</td>
<td>10.8 - 13.8</td>
<td>Umbrellas used with difficulty, Hair blown straight, Difficult to walk steadily, Wind noise on ears unpleasant.</td>
<td>Acceptable for areas where there is little pedestrian activity or for fast walking.</td>
</tr>
<tr>
<td>Near gale</td>
<td>13.9 - 17.1</td>
<td>Inconvenience felt when walking.</td>
<td></td>
</tr>
<tr>
<td>Gale</td>
<td>17.2 - 20.7</td>
<td>Generally impedes progress, Great difficulty with balance.</td>
<td>Unacceptable as a public accessway.</td>
</tr>
<tr>
<td>Strong gale</td>
<td>20.8 - 24.4</td>
<td>People blown over by gusts.</td>
<td>Completely unacceptable.</td>
</tr>
</tbody>
</table>

It should be noted that wind speeds can only be accurately quantified with a wind tunnel study. This assessment addresses only the general wind effects and any localised effects that are identifiable by visual inspection, and the acceptability of the conditions for outdoor areas are determined based on their intended use (rather than referencing specific wind speeds). Any recommendations in this report are made only in-principle and are based on our extensive experience in the study of wind environment effects.
4 RESULTS AND DISCUSSION

4.1 Proposed Development Site

An initial assessment has been undertaken with regards to the context of the subject development site and the prevailing winds for Melbourne as outlined in Section 2. It is initially noted from the location of the subject site in West Melbourne that the site is exposed to the prevailing winds for the Melbourne region. Minimal upstream shielding is provided in all directions due to the sites surrounding context of the Maribyrnong River, the Dynon Freight Terminal train yards, Newell’s Paddock, Flemington Racecourse, the City of Melbourne Waste & Recycling Centre and the Port of Melbourne. Some localised shielding is noted to be provided for the prevailing northerly winds by the raised Werribee/Williamstown train line.

The main prevailing winds for Melbourne and as such the site are the northerly, southerly and westerly winds. It is noted that the development of any proposed building form over the entire site greater that the existing 2 storey dwellings will have some impact on the prevailing winds. Some of the key aspects to consider include:

- Any building form included on the site will potentially cause the prevailing winds to downwash to the ground plane. Consideration should be made in the design to account for this effect.
- The areas along the banks of the Maribyrnong River will be exposed to the prevailing northerly and westerly winds. Development of the form of the southern buildings on the site could help mitigate the existing impact of the southerly winds.
- Wind conditions along Kensington Street are expected to be reduced with the inclusion of a development at the subject site due to additional shielding provided from the northerly and westerly winds.

4.2 Wind Comfort Criteria for the Proposed Development

For the purpose of the Development Plan Overlay schedule it is recommended that the outdoor areas within and around the West Melbourne Waterfront precinct be assessed to ensure that wind conditions are suitable for the relevant intended uses. These conditions include the following:

- Accessible areas for either public or private use should satisfy the comfortable walking criterion of 7.5m/s for the Weekly Gust Equivalent Mean Wind speeds, which corresponds to 16m/s for the annual maximum gust wind speeds. This includes walkways, private balconies, footpaths outside the waterfront zone.
- All outdoor seating areas such as café seating and short duration stays, including building entries, should satisfy the short exposure criterion of 5.5m/s for the Weekly Gust Equivalent Mean Wind speeds, which corresponds to 13m/s for the annual maximum gust wind speeds.
- All areas to be used for long duration stay activities, such as restaurant use, should satisfy the long exposure criterion of 3.5m/s for the Weekly Gust Equivalent Mean Wind speeds, which corresponds to 10m/s for the annual maximum gust wind speeds.

- All areas will also need to satisfy the Safety Limit Criterion of 23m/s for the annual maximum gust wind speeds.

Note that the Weekly Gust Equivalent Mean wind speed corresponds to a 5% probability of exceedance by a wind event in any given week. The annual maximum gust wind speeds correspond to a probability of exceedance of 0.1% during daylight hours which 1 storm will exceed the criteria per annum.

The ground level areas and corresponding relevant comfort criteria have been outlined in Figure 3 below. It should be noted that due to the current exposure to the prevailing winds along the waterbank, conditions are expected to currently exceed the comfortable walking criteria. For these areas where built form or landscaping cannot be developed upstream of the area, the development will ensure that conditions do not exceed these existing conditions.

![Figure 3: Ground Level Desired Wind Comfort Criteria](image)

It is noted that the comfort criteria outlined in Figure 3 has been based on an assessment of the site and the prevailing wind conditions. It should be noted that the areas along the...
waterfront (outlined in red), while desired to be based on a short or long exposure criteria, is currently exposed to the prevailing northerly and westerly winds. This is due to the exposure over the water in these directions, and with no opportunity to provide upstream protection from these wind directions, little impact can be had on the existing conditions to mitigate these effects. It should be noted that the comfort criteria along the waterfront is not a result of the building massing, which is currently noted to be formed to minimise potential downwash (setbacks) but due to the exposure of the area. As the design developments, it will be ensured that the design does not impact these conditions, and acts to enhance these conditions where possible (from the easterly and southerly winds).

More stringent wind comfort criteria is proposed for the areas adjacent to the building forms on the waterfront aspect where outdoor seating is expected to be incorporated.

4.3 Wind Conditions Associated with the Proposed Development

The proposed development is to consist of four staging plots with heights setbacks from both Maribyrnong River and Kensington Road. Three internal east-west through-site links are proposed between the four staging plots connecting Kensington Road to the Maribyrnong River waterfront.

The proposed building forms are as follows:

- Stage 1 is located at the northern end of the site along the railway corridor. A 5 level podium is proposed over the site with a chevron design building form in the east/west direction, up to 9 levels above podium. The eastern and western aspects are proposed to be stepped back towards the middle of the site in line with the sites height restrictions. Outdoor terrace areas are proposed at the various building setbacks.

- Stage 2 consists of a somewhat triangular shaped site on the southern aspect of Stage 1. A 5 level podium is proposed over the site with an L-shaped building form atop of between 2-5 levels. The main building is setback from the Kensington Road podium edge and steps back on each level on the western aspect (riverbank). Outdoor terrace areas are proposed at the various building setbacks and atop the podium.

- Stage 3 consists of a rectangular plan form consisting of a 4 level podium and 5 level building above which is setback from both the eastern and western aspects.

- Stage 4 located at the southern end of the site is somewhat similar in design to Stage 3 in building form however consists of a 4 level podium with main building height up to

Ground floor areas for the various buildings are proposed to consist primarily of retail type uses, which are expected to require wind conditions within the short exposure criteria. A main Public Realm Node is to be development between the Stage 2 building and the Maribyrnong River waterfront.
4.3.1 Preliminary Assessment

The location of the proposed development precinct in an open undeveloped area means the site will be exposed to the prevailing winds for the area. The design of the proposed masterplan for the precinct however has incorporated a number of key design aspects which will assist in minimising the potential adverse wind effects, and increase the likelihood of recommended wind criterion being met. This includes:

- The incorporation of building setbacks from the podium edge. These will assist in reducing the potential for downwash effects to the ground level areas.

- Wind conditions within the through-site links will be shielded from the prevailing northerly and southerly winds due to the east-west to alignment. The through site links between Stages 2 and 3, as well as Stage 3 and 4 will also benefit from shielding from the westerly winds by their north-west to south-east alignment. The proposed inclusion of dense landscaping at the western end of the through-site links will further assist in mitigating the westerly winds from being funnelled between the buildings.

- The location of the Public Realm Node on the Maribyrnong River waterfront will mean that the area can be expected to be exposed to the prevailing winds. The northerly and southerly winds are expected to travel along the river and the westerly winds from Newell’s Paddock and the Heavenly Queen Temple. The southern components of Sites 3 and 4 are expected to provide some shielding to the southerly winds. The inclusion of the proposed dense landscaping along the waterfront areas, as well as adjacent to the Public Realm Node is expected to assist in mitigate these prevailing winds. The inclusion of porous side-walls for any proposed pavilions is recommended to assist in baffling the prevailing winds. As the westerly winds occur primarily during the winter months of the year and the northerly winds throughout the entire year, consideration for the inclusion of evergreen species of tree planting is recommended to ensure their effectiveness in wind mitigation.

- Outdoor terrace areas have been proposed for the podium roof top spaces, as well as for the various building setback levels along the western aspect for all four plots. There are a number of recommended treatment strategies such as impermeable balustrades and the inclusion of strategic landscaping, will assist in ensuring that desired wind conditions are provided for these areas.