



01 August 2016

CPP Project 9427

Frasers Property Australia Pty. Ltd.

Level 12, 101 Bathurst Street
Sydney
NSW 2000

Attn: Mr. Sam Petinsky

Project: Block 11, One Central Park

Dear Mr. Petinsky,

Please find herein a brief review of the wind conditions in and around Block 11, One Central Park, Sydney. Specifically, this report addresses the concerns raised in the Development Consent Report by the NSW Government Department of Planning and Environment, and the Determination Report released by the NSW Planning Assessment Commission, both released on 02 March 2016. This report follows on from a review of the wind-tunnel testing conducted in and around the site from 2009 with reference to other sites around the city.

ENVIRONMENTAL WIND CRITERIA

Over the years, a number of researchers have added to the knowledge of wind effects on pedestrians by suggesting criteria for comfort and safety. Because pedestrians will tolerate higher wind speeds for a smaller period of time than for lower wind speeds, these criteria provide a means of evaluating the overall acceptability of a pedestrian location. Also, a location can be evaluated for its intended use, such as for an outdoor café or a footpath. One of the most widely accepted set of criteria was developed by Lawson (1990), which is described in Table 1.

Comfort (maximum of mean or gust equivalent mean (GEM ¹) wind speed exceeded 5% of the time)	
< 4 m/s	Pedestrian Sitting (considered to be of long duration)
4 - 6 m/s	Pedestrian Standing (or sitting for a short time or exposure)
6 - 8 m/s	Pedestrian Walking
8 - 10 m/s	Business Walking (objective walking from A to B or for cycling)
> 10 m/s	Uncomfortable
Distress (maximum of mean or GEM wind speed exceeded 0.022% of the time)	
<15 m/s	not to be exceeded more than two times per year (or one time per season) for general access area
<20 m/s	not to be exceeded more than two times per year (or one time per season) where only able bodied people would be expected; frail or cyclists would not be expected

Table 1: Summary of Lawson criteria

Lawson’s criteria have categories for discomfort, based on wind speeds exceeded five percent of the time, allowing planners to judge the usability of locations for various intended purposes ranging from “Business Walking” to “Pedestrian sitting”. The level and severity of these comfort categories can vary based on individual preference, so calibration to the local wind environment is recommended when evaluating the Lawson ratings. The criteria also include a distress rating, for safety assessment, which is based on occasional (once or twice

per year) wind speeds. In both cases, the wind speed used is the larger of a mean or gust equivalent-mean (GEM) wind speed. The GEM is defined as the peak gust wind speed divided by 1.85; this is intended to account for locations where the gustiness is the dominant characteristic of the wind.

SYDNEY WIND CLIMATE

To enable a qualitative assessment of the wind environment, the wind frequency and direction information measured by the Bureau of Meteorology at a standard height of 10 m at Sydney Airport from 1995 to 2015 have been used in this assessment, Figure 1. The anemometer is located about 9 km to the south of the site and is considered representative of the wind conditions at the site. It is noted from Figure 1 that strong prevailing winds are organised into three main groups which centre at about north-east, south, and west. This wind assessment is focused on these prevailing strong wind directions.

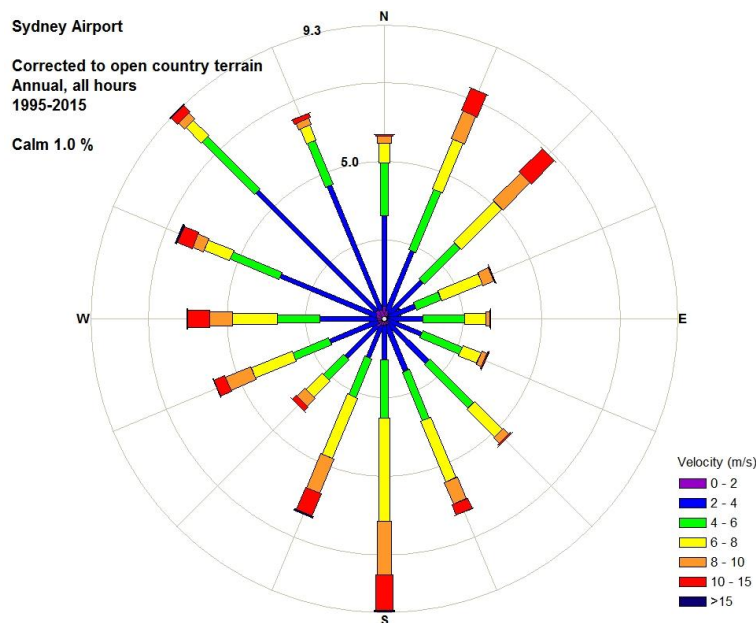


Figure 1: Wind rose of direction and speed for Sydney Airport

Strong summer winds occur mainly from the south and the north-east quadrants. Winds from the south are associated with large synoptic frontal systems and generally provide the strongest gusts during summer. Moderate intensity winds from the north-east tend to bring cooling relief on hot summer afternoons typically lasting from noon to dusk. These are small-scale temperature driven effects; the larger the temperature differential between land and sea, the stronger the breeze.

Winter and early spring winds typically occur from the south and west quadrants. West quadrant winds provide the strongest winds affecting the area throughout the year.

Sydney is a relatively windy city with the 5% of the time mean wind speed recorded at Sydney Airport about 9 m/s. Taking into account the benefits of shielding from surrounding buildings in accordance with Standards Australia (2011), the 5% of the time mean wind

speed would be about 5.4 m/s. According to the Lawson criteria, Table 1, this would result in a classification of pedestrian standing. The rating is typical of open park areas, such as Hyde Park, and the Domain, but also representative of smaller protected areas such as Wynyard Park, and Tumbalong Park. Most locations in the Sydney region would be require some level of local shielding to meet the pedestrian sitting criterion.

WIND ASSESSMENT

The three controls relating to wind in the NSW Department of Planning and Environment reports are:

- B7 Prior to the issue of **any** Construction Certificate, an updated wind assessment shall be submitted for the Secretary's approval. The wind assessment shall demonstrate what additional methods/treatments will be included so as to reduce wind impacts to ensure that the area outside the retail units fronting the O'Connor Street park would be comfortable for pedestrian sitting, and that the O'Connor Street park is comfortable for pedestrian sitting.
- B8 Prior to the issue of any Construction Certificate details are to be provided and approved by the Secretary that demonstrate the measures that have been incorporated within the design in order to reduce the impacts of wind such as;
- Additional large mature trees along O'Connor and Kensington Street;
 - External permanent or temporary fins perpendicular to the façade;
 - Planter boxes parallel to the façade; and
 - Additional trees within park areas.
- B9 Prior to the issue of **any** Construction Certificate, an updated wind assessment shall be submitted for the Secretary's approval. The wind assessment shall demonstrate what additional methods/treatments will be included to reduce wind impacts to ensure that the outdoor play area for the child care facility is classified as comfortable for pedestrian sitting.

North of the development – O'Connor Street Park

It is considered that to improve the overall wind conditions in this area to pedestrian sitting would be exceptionally difficult, as the wind conditions through this area are governed by the larger surrounding buildings, particularly Blocks 5C and 2 to the north of the site, and Blocks 1 and 4N on the north-west corner of the site, interacting with the relatively strong prevailing Sydney wind climate. The wind conditions to the north of Block 11, Figure 2, have improved compared with the original building design, Figure 4, with the area now passing the distress criterion. It is evident from Figure 3 that the strong wind directions are from the north-east and north-west. For these incident wind directions, the local wind direction in O'Connor Street Park will have both vertical and horizontal components as it accelerates around Block 5C. The wind conditions in the central green area of the development, Locations 21 to 24 in Figure 4, illustrates the benefits of a courtyard design surrounded by taller buildings creating a calmer more protected wind environment away from building corners.

Wind tunnel testing was conducted without trees and landscaping as this is more appropriate for pedestrian safety, and in accordance with best practice, as they may not

survive. The proposed tree planting and associated landscaping, Figure 5, would be expected to improve the comfort classification to pedestrian standing producing a similar wind environment to Tumbalong Park. The trees would provide local shelter. To further improve the wind conditions, additional local amelioration would be required to create calmer areas. This would most effectively be the form of dense planting around the perimeter of the park, such as a hedge, or porous screens to shield against the horizontal component of the flow. It should be noted that vertical screening offers protection to an area extending below the top of the screen, to a horizontal distance at ground level about 5 times the height of the screen downwind, and about half the height of the screen upwind. Additional mature trees would provide local protection in this area, but only from the vertical component of the flow. To meet the sitting criterion, it would be expected that mature trees would need to essentially cover the extent of O'Connor Street Park.

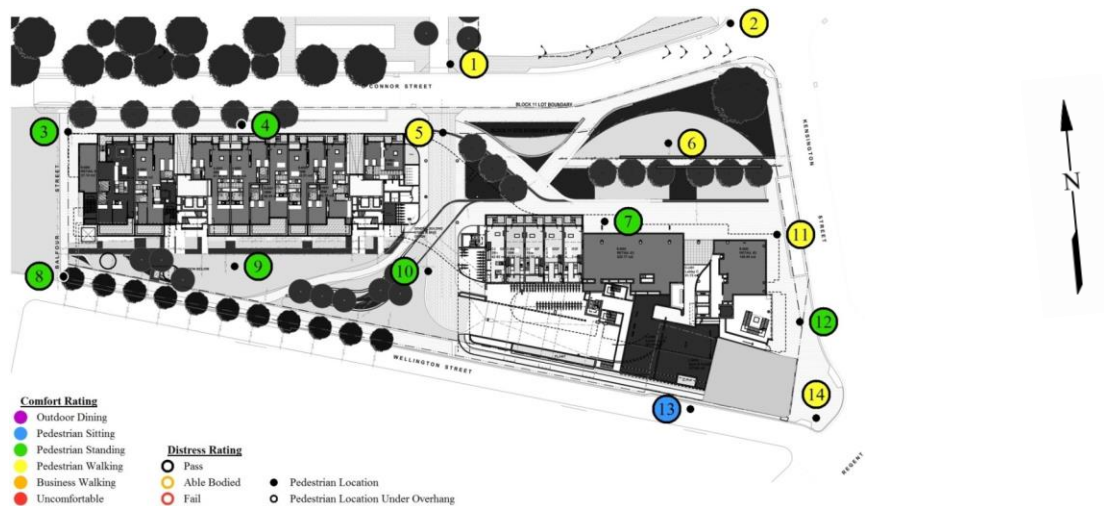


Figure 2: Pedestrian wind speed measurements locations at ground level around Block 11

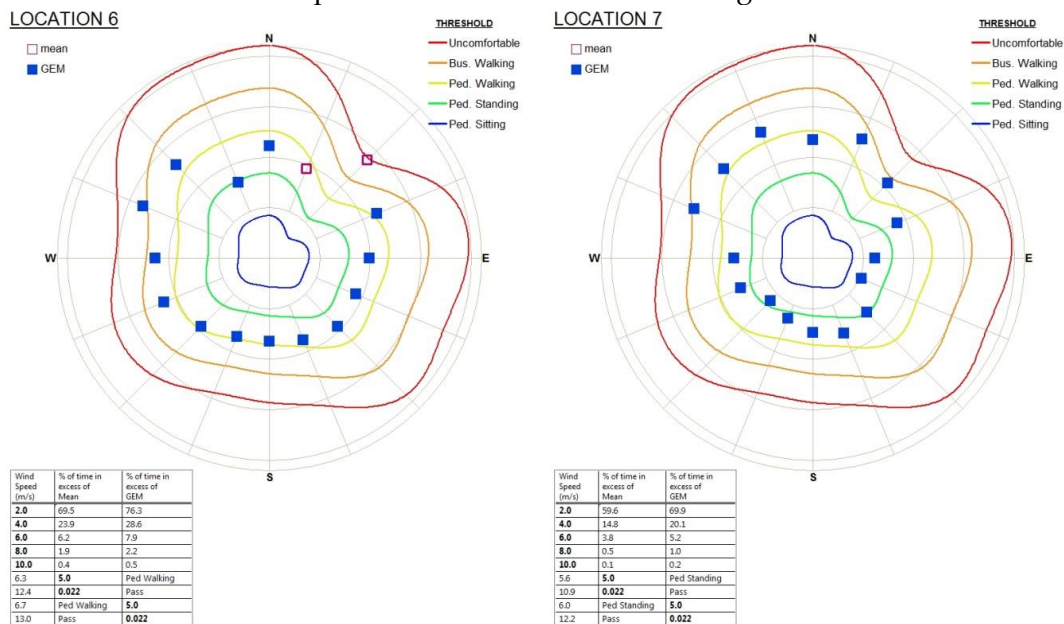


Figure 3: Results from Block 11 CPP wind report CPP 7387 dated August 2014

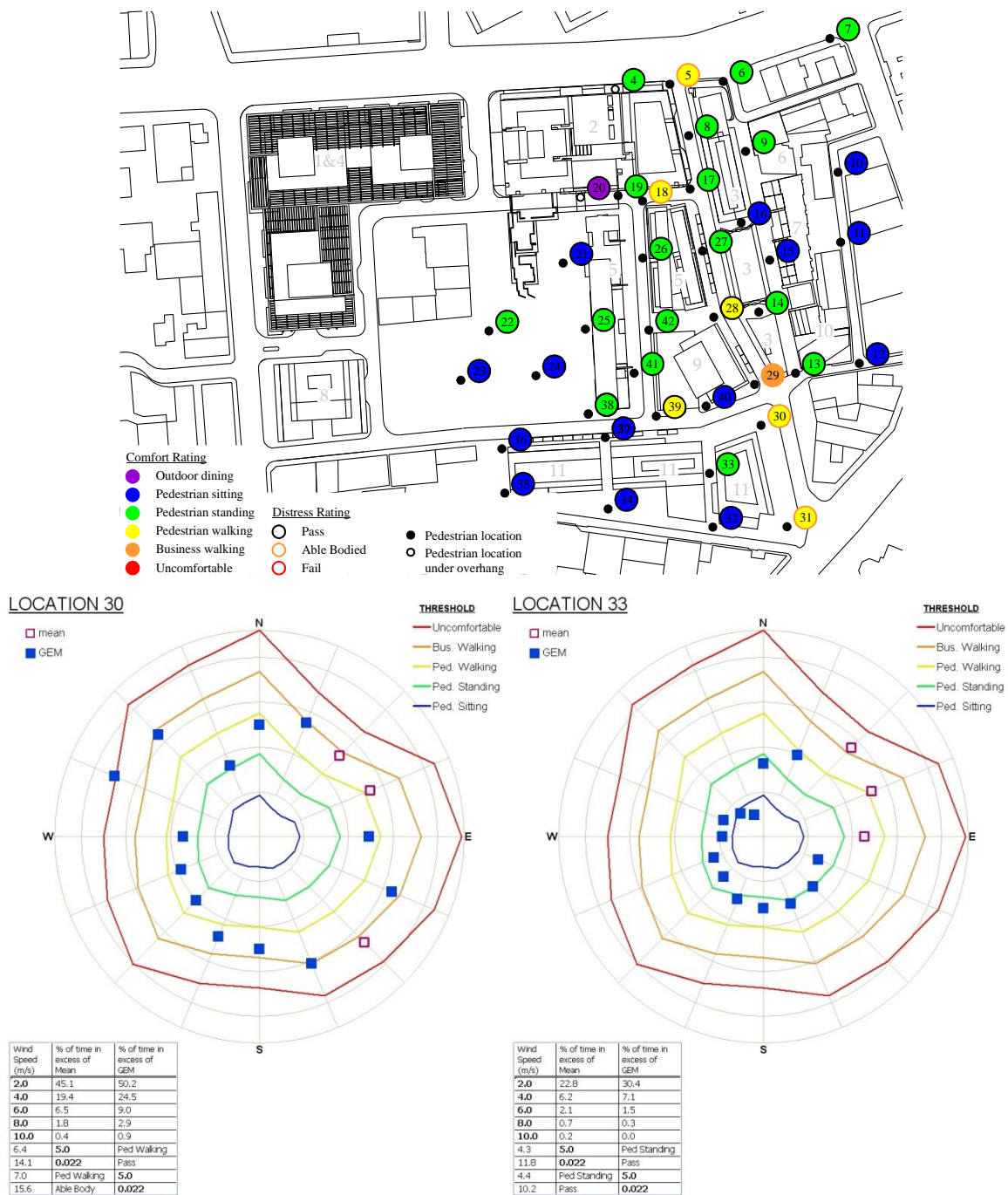


Figure 4: Wind tunnel test results from CPP wind report CPP 4946 dated April 2009
North of the development – Café outdoor seating area

The café to the north of the Building is located at Location 7 in Figure 2 and Figure 3. As with O'Connor Street Park, the strong wind directions are from the north-west and north-east. Close to the façade the local wind direction for these winds will be horizontal directed along the façade in the east-west direction. The provision of approximately 2 m high vertical porous screens extending perpendicular to the façade, Figure 6, is expected to provide local shielding for patrons sitting outside the frontage. It is recommended that the porous screens

have an open area of up to 30% to provide maximum benefit to patrons without causing a high velocity gradient at the edge of the screens.

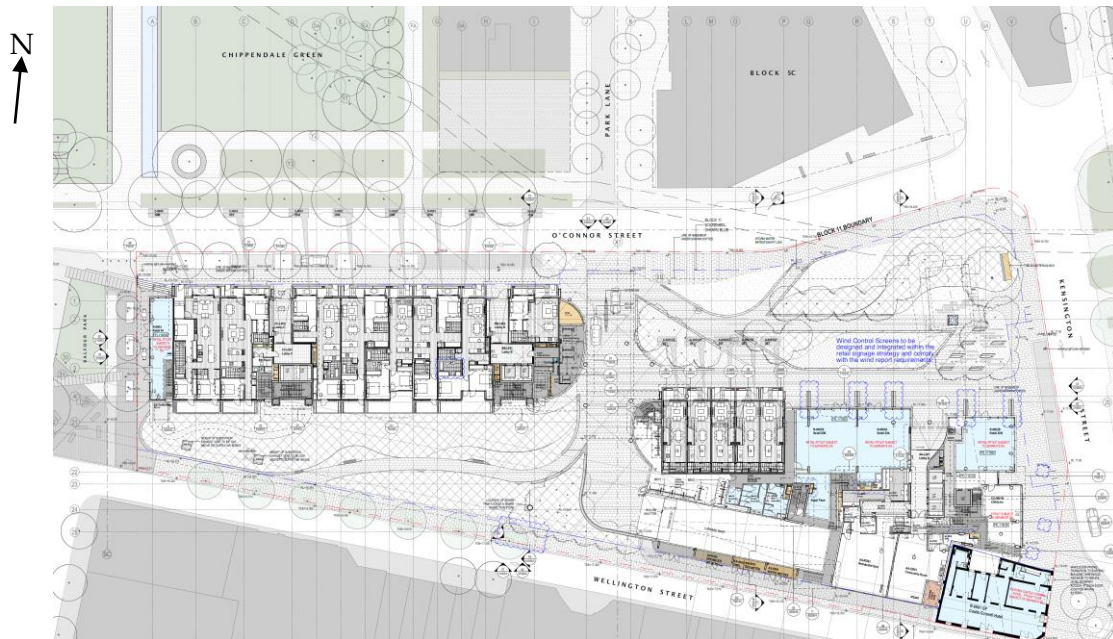


Figure 5: General arrangement plan

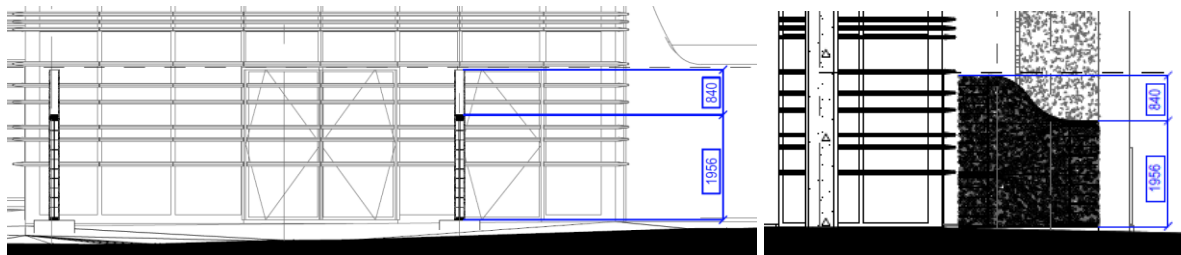


Figure 6: Proposed porous screen

Childcare Centre

The wind conditions on the childcare terrace were measured without landscaping or perimeter balustrade for modelling reasons and to provide a worst case scenario, Figure 7. The wind conditions on the terrace are classified as suitable for pedestrian standing, Figure 8. It is evident that the strong wind directions are from the south-east and west quadrants. The geometry of this level has changed slightly since the wind-tunnel testing was conducted with the inclusion of an indoor area to the south-east of the outdoor area, Figure 9. This inclusion, as well as the balustrade, and landscaping on the terrace would be expected to ameliorate the wind conditions to a level classified as suitable for pedestrian sitting over the majority of the terrace.

Summary

In summary, the proposed amelioration measures are expected to provide suitable amelioration for pedestrians to meet the NSW Department of Planning and Environment controls.



Figure 7: Photograph of Block 11 wind-tunnel model

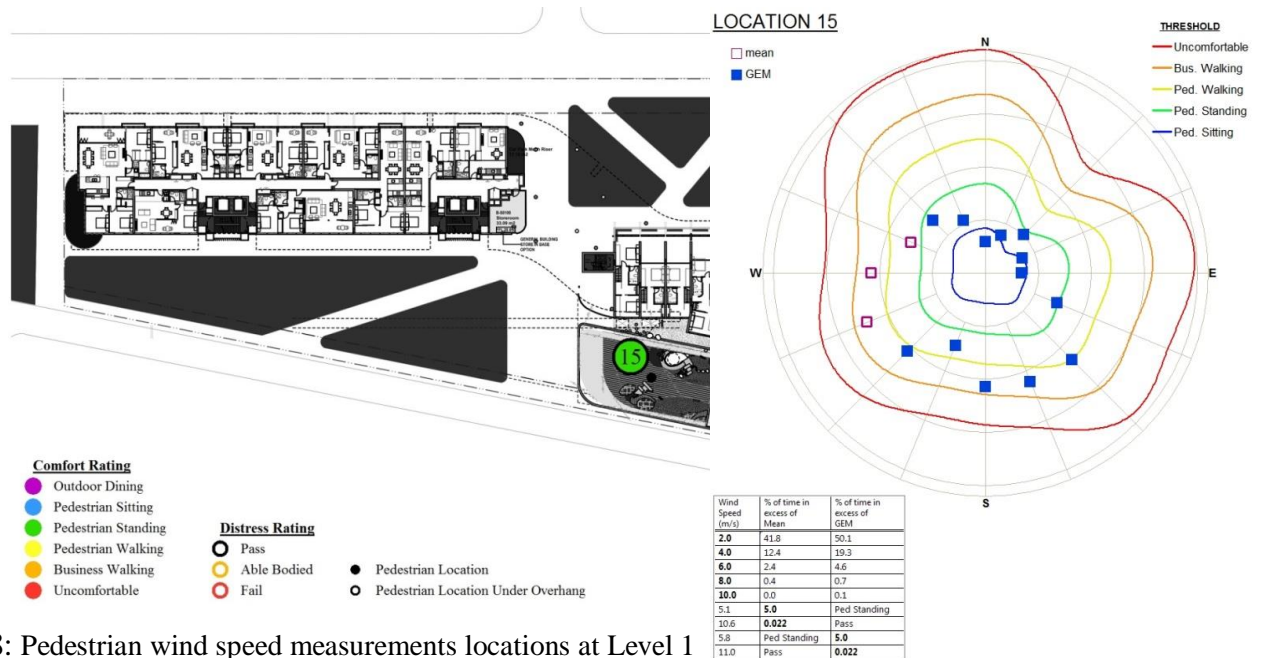


Figure 8: Pedestrian wind speed measurements locations at Level 1

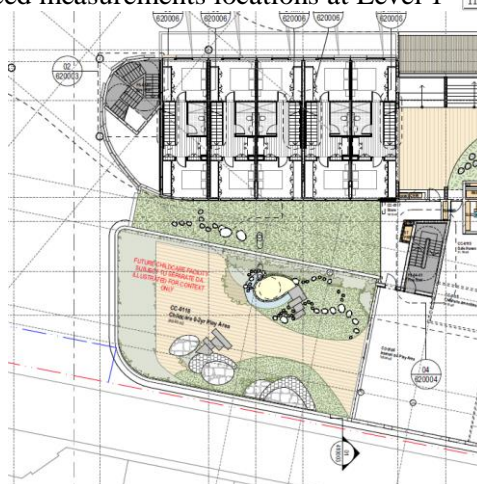


Figure 9: Current Level 1 plan

CONCLUSION

The proposed landscaping and local amelioration is expected to improve the wind conditions at areas to the north of the site. Due to the general characteristics of the Sydney wind climate, the wind conditions in the open park areas are not expected to meet the pedestrian sitting criterion, however the wind conditions are expected to be similar to those measured in Tumbalong Park.

Closer to the north face of the building where the outdoor seating areas are located, the proposed vertical porous screens are expected to improve the wind conditions to a level classified as suitable for outdoor sitting activities in accordance with control B7.

With the changed geometry around the child care centre on Level 01 and the inclusion of an appropriate solid balustrade, it is expected that the wind conditions on the outdoor terrace play area would be classified as suitable for pedestrian sitting activities in accordance with control B9.

The above addresses the concerns from the Department of Planning and Environment regarding the serviceability wind conditions around the proposed development. Please do not hesitate to contact me if you have any questions regarding any aspect of this report.

Yours sincerely,



Graeme Wood
Director

REFERENCES

Cermak Peterka Petersen, (2009) Wind Tunnel Tests for: Frasers Broadway Blocks 3, 5, 6, 7, 9 and 10, CPP4946, April 2009.

Cermak Peterka Petersen, (2014), Environmental Wind Tunnel Test Assessment: One Central Park Block 11, CPP7387, August 2014

Standards Australia (2011), Australian/New Zealand Standard, Structural design action, Part2:Wind actions, AS/NZS 1170.2:2002.