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Date: October 11, 2019

To: Atlassian Pty Ltd

Address: Level 6, 341 George Street Sydney NSW, 2000

**RE: ATLASSIAN YHA CENTRAL STATION PROJECT
PEDESTRIAN WIND ENVIRONMENT STATEMENT - COVER LETTER**

This cover letter confirms that detailed wind tunnel testing of the Atlassian YHA Central Station redevelopment (Block A) will be undertaken at a later design stage and will provide the following information:

- A quantitative analysis of the wind conditions within and around the subject development with regards to appropriate wind comfort and safety criteria.
- Address potential wind related concerns along critical areas such as the existing Central Station platform, the future Northern Square and the OSD Link locations.
- The impact of the future Block B site redevelopment in conjunction with the proposed Atlassian development on the wind conditions within and around the subject development trafficable areas.
- Determine the requirement for wind mitigation measures, including the size and extent of treatments to ensure suitable conditions are provided for the trafficable outdoor areas throughout the development site and surrounding areas.

It should be noted that potential treatment recommendations have been provided within the wind study report prepared by ARUP for the adjacent Block B site. Based on our initial review of the findings of that report we believe that the proposed wind treatment measures would help potentially mitigate the reported wind impacts, and can confirm that Windtech will review the wind conditions and wind treatment measures through further detailed wind tunnel testing of the critical areas between Block A and Block B.

Yours faithfully,



Elias Vasilikas - Project Engineer
Windtech Consultants Pty Ltd



PEDESTRIAN WIND ENVIRONMENT STATEMENT
ATLASSIAN YHA CENTRAL STATION PROJECT
- ENVELOPE DESIGN

WE455-04F01(REV3)- WS REPORT

OCTOBER 10, 2019

Prepared for:

Atlassian Pty Ltd

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DOCUMENT CONTROL

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September 11, 2019	Updated development summary, results and reference included to WE455-02F02(rev0).	1	EV	SWR	JW/HK
September 11, 2019	Updated treatment strategies.	2	EV	SWR	JW/HK
October 10, 2019	Updated analysis.	3	EV	SWR	JW/HK

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EXECUTIVE SUMMARY

This report presents an opinion on the likely impact of the proposed Atlassian YHA Central Station development, on the local wind environment at the critical outdoor areas within and around the subject development. The effect of wind activity is examined for the three predominant wind directions for the Sydney region; namely the north-easterly, southerly and westerly winds. The analysis of the wind effects relating to the proposed development was carried out in the context of the local wind climate, building morphology and land topography. The potential impact of the redevelopment of the Dexu Frasers site on the wind conditions within and around the subject development is also discussed.

The conclusions of this report are drawn from our extensive experience in this field and are based on an examination of the latest architectural drawings. It should be noted that a wind tunnel study has been undertaken based on a previous massing design in order to assess wind speeds in relation to wind comfort and safety at selected critical outdoor trafficable areas within and around the subject development. No wind tunnel testing was undertaken for the current envelope design of the subject development, however, the current envelope design is similar to the previously tested massing. As such, the report has utilised the results of the previously tested massing to guide our expectations for the wind conditions within and around the current envelope design. This report mostly addresses the general wind effects and any localised effects that are identifiable by visual inspection in conjunction with the results determined from the previous wind tunnel study. 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 assessment indicate that the subject development is relatively exposed to the three prevailing wind directions, affecting the site. The site will benefit from some shielding provided by existing buildings in addition to the redevelopment of the Dexu Frasers site. However, there is a possible slight impact on the wind conditions along the trafficable areas throughout the site in the form of wind sidestreaming, corner acceleration and downwashing. It is expected that the wind effects identified in the report can be ameliorated with the consideration of the following treatment strategies into the design of the development:

- The inclusion of various treatments along the northern site boundary on the Upper Ground Level along the ramp landing. These treatments will be further developed and reviewed at a later design stage to be incorporated into the final design scheme.
- Provisions should be made for the installation of localised canopies or vegetation strips along the Ground Level area in between the Atlassian building and Toga site.
- Retention of existing planting and localised impermeable canopies within Henry Deane Plaza.

- Inclusion of an impermeable awning along the north-eastern aspect of the Lower Ground Level, covering the entirety of the Ambulance Avenue entrance, to replace the existing site awning. These treatments will be further developed and reviewed at a later design stage to be incorporated into the final design scheme.
- Inclusion of a 2m high impermeable screen along the entire perimeter of the terrace areas for Levels 02 to 04.
- Inclusion of a 2m high impermeable screen along the northern aspect of the connecting bridge for all levels with exposed bridges.

This assessment is based on the current envelope massing design of the proposed Atlassian YHA Central Station development, however, a wind tunnel study has been undertaken based on a previous massing design in order to assess wind speeds in relation to wind comfort and safety at selected critical outdoor trafficable areas within and around the subject development (Report Ref: WE455-02F02(rev0), dated: October 17, 2018).

The results of the detailed wind environment study of the previous massing indicate that wind conditions for the majority of trafficable outdoor locations within and around the subject development will be suitable for their intended uses. However, some areas will experience strong winds which will exceed the relevant criteria for comfort. Previously suggested treatments that are still applicable to the current envelope design are described as follows:

- Inclusion of a full height impermeable screen along the north-eastern aspect adjoining to the roof overhang of the existing building.
- Densely foliating shrubs/planter boxes capable of growing up to 1.5m in height along the north-western aspect of the Upper Ground Level outdoor spaces.
- Inclusion of a low impermeable awning extending from the tower façade along the north-western aspect, with a horizontal depth of at least 3m, above the Upper Ground Level.

Note that the detailed wind environment study does not include the effects of the Dexu Frasers site redevelopment.

It is recommended that wind tunnel testing be undertaken at a later design stage. Wind tunnel testing will be able to provide a quantitative analysis of the wind conditions and determine the requirement for wind mitigation measures, including the size and extent of treatments to ensure suitable conditions are provided for the trafficable outdoor areas throughout the development.

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1 INTRODUCTION

An opinion on the likely impact of the proposed design on the local wind environment affecting pedestrians within the critical outdoor areas within and around the subject development is presented in this report. The analysis of wind effects relating to the proposed development was carried out in the context of the predominant wind directions for the region, building morphology of the development and nearby buildings, and local land topography. The conclusions of this report are drawn from our extensive experience in the field of wind engineering and studies of wind environment effects.

No wind tunnel testing was undertaken for this envelope design. Hence this report addresses only the general wind effects and any localised effects that are identifiable by visual inspection, and any recommendations in this report are made only in-principle.

2 DESCRIPTION OF THE DEVELOPMENT AND SURROUNDINGS

The development site is bounded by Lee Street to the west, Ambulance Avenue to the north and Central Train Station to the east. Directly to the west and south of the tower lies the Toga and Dexu Frasers sites which are comprised of multiple mid-rise buildings. Surrounding the site are a mixture of mid to high-rise retail, office and residential buildings, with Central Train Station extending from the east to the south of the proposed development.

The proposed development consists of a mainly commercial-oriented tower, approximately 33 storeys tall, with a youth hostel between Levels 01 to 04. The Upper Ground Level has been designated as a lobby level. The Lower Ground Level is also a lobby level which incorporates retail elements. The tower plan form changes multiple times as it shifts from a predominantly rectangular massing to a stepped plan design along the north-western façade. The majority of the tower levels feature a centralised cavity along the northern façade aspect which is connected by a small bridge. In addition, it can be observed that the north-western aspect is stepped outwards at approximately Level 13 of the development. The existing site consists of a small 2 storey youth hostel building.

A survey of the land topography indicates that there is an incline in the direction of the landing ramp leading up to the building. The topography at the foot of the tower is generally flat with the exception of the north end of the site where a 3m step onto Ambulance Avenue can be observed. An aerial image of the subject site and the local surroundings is shown in Figure 1. A wider view of the position of the site is illustrated in Figure 2.

The critical trafficable areas associated with the proposed development, which are the focus of this assessment with regards to wind effects, are detailed as follows:

- The Ground Level pedestrian accessible areas within the site boundary.
- The Henry Deane Plaza area and the Devonshire Street Tunnel entrance.
- The pedestrian footpath area along Railway Colonnade Drive and Ambulance Avenue.
- Elevated terrace areas and connecting bridges.

In addition, these critical areas will be assessed against the following scenarios:

- The Atlassian building is developed in isolation.
- The Atlassian building and the Dexu Frasers site are both redeveloped. These are considered to be approximately the same height.

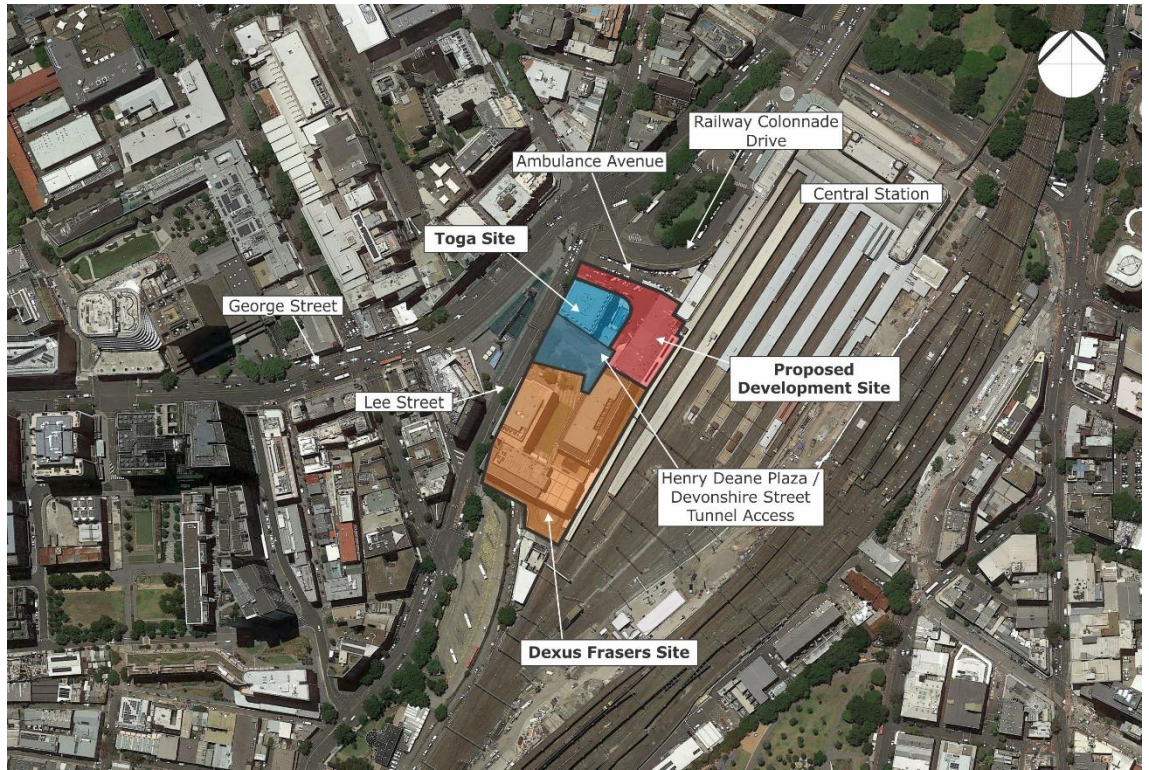


Figure 1: Aerial Image of the Site Location

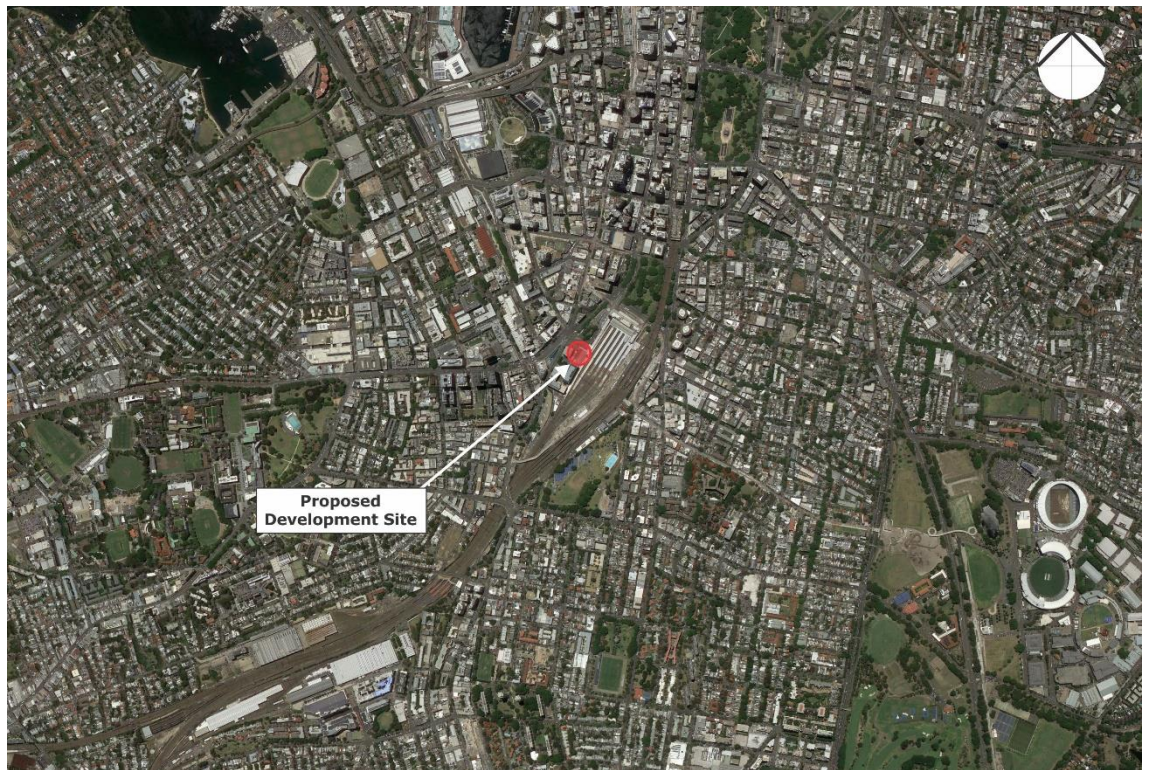


Figure 2: Wider View Aerial Image of the Site Location

3 REGIONAL WIND

The Sydney region is governed by three principal 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 a detailed analysis undertaken by Windtech Consultants of recorded directional wind speeds obtained at the meteorological station located at Kingsford Smith Airport by the Bureau of Meteorology (recorded from 1995 to 2016). From this analysis, directional probabilities of exceedance and directional wind speeds for the region are determined. The directional wind speeds and corresponding directional frequencies of occurrence are presented in Figure 3.

As shown in Figure 3, the southerly winds are by far the most frequent wind for the Sydney region, and are also the strongest. The westerly winds occur most frequently during the winter season for the Sydney region, and 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. North-easterly winds occur most frequently during the warmer months of the year for the Sydney region, and hence are usually welcomed within outdoor areas since they are typically not as strong as the southerly or westerly winds.

Table 1: Principal Time of Occurrence of Winds for the Sydney Region

Month	North-Easterly Winds	Southerly Winds	Westerly Winds
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	

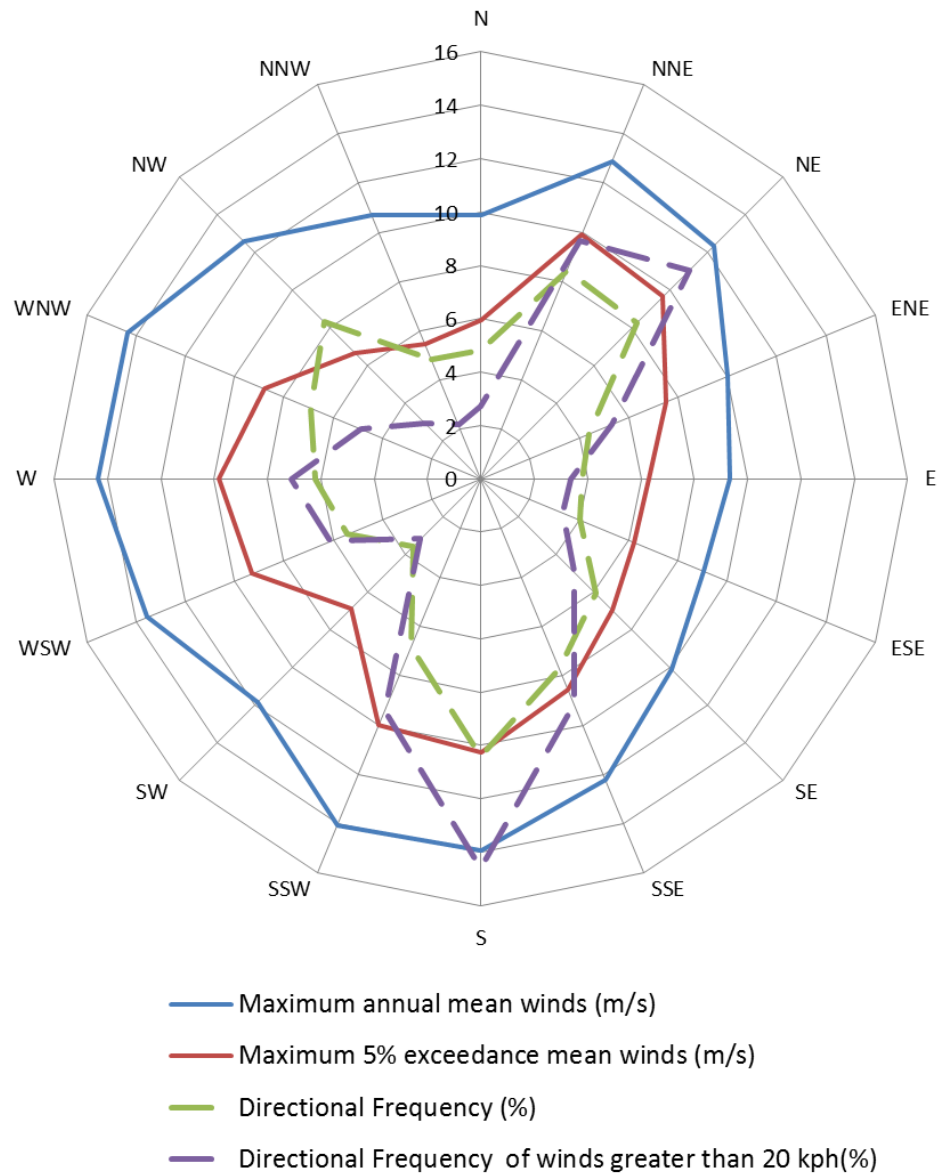


Figure 3: Annual and 5% Exceedance Hourly Mean Wind Speeds, and Frequencies of Occurrence, for the Sydney Region (referenced to 10m above ground in standard open terrain)

4 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 other researchers, such as A.G. Davenport, T.V. Lawson, W.H. Melbourne, and A.D. Penwarden, have published criteria for pedestrian comfort for pedestrians in outdoor spaces for various types of activities. Some Councils and Local Government Authorities have adopted elements of some of these into their planning control requirements.

For example, A.D. Penwarden (1973) developed a modified version of the Beaufort scale which describes the effects of various wind intensities on people. Table 2 presents the modified Beaufort scale. Note that the effects listed in this table refers to wind conditions occurring frequently over the averaging time (a probability of occurrence exceeding 5%). Higher ranges of wind speeds can be tolerated for rarer events.

Table 2: Summary of Wind Effects on People (A.D. Penwarden, 1973)

Type of Winds	Beaufort Number	Mean Wind Speed (m/s)	Effects
Calm	0	Less than 0.3	Negligible.
Calm, light air	1	0.3 – 1.6	No noticeable wind.
Light breeze	2	1.6 – 3.4	Wind felt on face.
Gentle breeze	3	3.4 – 5.5	Hair is disturbed, clothing flaps, newspapers difficult to read.
Moderate breeze	4	5.5 – 8.0	Raises dust, dry soil and loose paper, hair disarranged.
Fresh breeze	5	8.0 – 10.8	Force of wind felt on body, danger of stumbling
Strong breeze	6	10.8 – 13.9	Umbrellas used with difficulty, hair blown straight, difficult to walk steadily, wind noise on ears unpleasant.
Near gale	7	13.9 – 17.2	Inconvenience felt when walking.
Gale	8	17.2 – 20.8	Generally impedes progress, difficulty balancing in gusts.
Strong gale	9	Greater than 20.8	People blown over.

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. Any recommendations in this report are made only in-principle and are based on our extensive experience in the study of wind environment effects.

5 RESULTS AND DISCUSSION

The expected wind conditions are discussed in the following sub-sections of this report for the various outdoor areas within and around the subject development. The interaction between the wind and the building morphology in the area is considered and important features taken into account including the distances between the surrounding buildings and the proposed building form, as well as the surrounding landform. Note that only the potentially critical wind effects are discussed in this report.

It should be noted that the recommended criterion for wind conditions for circulation areas is 7.5m/s with a 5% probability of exceedance, whereas proposed seating areas will need to satisfy a more stringent comfort criterion of 5.5m/s with a 5% probability of exceedance. Although this assessment is of a qualitative nature, the abovementioned criteria are considered when assessing the wind environment impacts.

5.1 Site Location

The wind conditions at the site primarily depend on the orientation of the development relative to the principal wind directions and the impact of neighbouring developments. It is expected that the current Dexus Frasers site buildings will provide shielding from low-level direct southerly winds. Similarly the Toga site and the mid-rise buildings directly to the west of the proposed development on the opposite side of George Street, are expected to provide some shielding from low-level direct westerly winds. Although the development is within close proximity to the Sydney CBD which consists of multiple high rise towers, locally it is rather exposed, specifically from the north-east direction where north-easterly winds are expected to travel over Central Station and Belmore Park mostly unimpeded.

5.2 The Ground Level pedestrian accessible areas within the site boundary

5.2.1 The Atlassian building is developed in isolation

Ground Level pedestrian accessible areas within the proposed development site boundary will likely be affected by low-level north-easterly direct winds; the northern half of the site exposed to direct and building corner accelerated winds and the southern half exposed to wind sidestreaming and potential funnelling in between the proposed development and Toga site building.

The Lower Ground Level area, however, is likely to benefit from the shielding along the north-eastern pedestrian entrance. Wind conditions experienced on the Lower Ground Level are expected to be suitable for pedestrian activity. The site is also exposed to high-level winds. The outwards step of the proposed development is likely to redirect north-easterly winds downwards, thus exacerbating the funnelling effect mentioned previously. In addition, it is expected that westerly winds will deflect off the north-western façade and downwash onto the neighbouring Toga site pool.

5.2.2 The Atlassian building and the Dexus Frasers site are both redeveloped

It is expected that the Atlassian building and redevelopment of the Dexus Frasers site will only reduce wind impact from the south. However, as mentioned in Section 5.1, south prevailing winds are unlikely to affect Ground Level areas within the site boundary. Therefore it is expected that the redevelopment of the Dexus Frasers site is unlikely to alter the wind impact on Ground Level pedestrian accessible areas within the site boundary.

5.2.3 Recommended Treatment Strategies

The following treatment strategies are expected to be effective in mitigating the abovementioned potential wind effects, hence they are recommended to be considered in the design of the development:

- The inclusion of various treatments along the northern site boundary on the Upper Ground Level along the ramp landing. These treatments will be further developed and reviewed at a later design stage to be incorporated into the final design scheme.
- In the event that this area is intended for short duration stationary activities such as outdoor seating, provisions should be made for the installation of localised canopies or vegetation strips along the Ground Level area in between the Atlassian and Toga site.

In addition, wind tunnel testing is recommended to be undertaken. Wind tunnel testing will be able to provide a quantitative analysis of the wind conditions and determine the requirement for wind mitigation measures, including the size and extent of treatments to ensure suitable conditions are provided for the trafficable outdoor areas throughout the development.

5.3 The Henry Deane Plaza area and the Devonshire Street Tunnel entrance

5.3.1 The Atlassian building is developed in isolation

As mentioned in Section 5.1 the wind conditions at Ground Level primarily depend on the orientation of the development relative to the principal wind directions and the impact of neighbouring developments. Some shielding is provided onto the plaza and tunnel entrance from low-level direct winds from all three prevailing wind directions.

In addition, it is unlikely that high-level direct south prevailing winds will downwash onto the plaza area or tunnel entrance as the orientation of the development results in a small building aspect exposed to this wind direction. Westerly wind are likely to downwash off the north-western façade, however based on the orientation of the tower these are expected to be redirected in a north-east direction away from the plaza and tunnel entrance.

The inclusion of the Atlassian building is expected to have minimal impact upon the existing wind conditions when developed in isolation.

5.3.2 The Atlassian building and the Dexu Frasers site are both redeveloped

The redevelopment of the Dexu Frasers site is expected to further capture the west prevailing winds and downwash them onto the plaza and tunnel entrance. However, it should be noted that the plaza is covered in planting and localised canopies around seated areas. In addition the tunnel entrance is partially protected by the Atlassian building overhang. Therefore it is expected that the impact of building downwash onto these two areas will be minor.

5.3.3 Recommended Treatment Strategies

The following treatment strategies are expected to be effective in mitigating the abovementioned potential wind effects, hence they are recommended to be considered in the design of the development:

- Retention of existing planting and localised impermeable canopies within Henry Deane Plaza.

5.4 The pedestrian footpath areas along Railway Colonnade Drive and Ambulance Avenue

5.4.1 The Atlassian building is developed in isolation

Based on the positioning of the proposed development, it is unlikely that footpath areas along the northern end of the development will be affected by south or west prevailing winds. The Atlassian building is directly aligned with the prevailing north-eastern winds and therefore some downwashing may occur. However, because of the relatively small building aspect which is exposed to the north-eastern prevailing winds, it is expected that any wind downwashing onto Ambulance Avenue / Railway Colonnade Drive will be minor. Furthermore, the centralised cavity on the northern aspect is expected to further mitigate the potential for downwashing winds from the prevailing north-easterly winds.

5.4.2 The Atlassian building and the Dexu Frasers site are both redeveloped

It is expected that the redevelopment of the Dexu Frasers site will not vary the wind conditions described in Section 5.4.1 along the Railway Colonnade and Ambulance Avenue pedestrian footpath areas.

5.4.3 Recommended Treatment Strategies

The following treatment strategies are expected to be effective in mitigating the abovementioned potential wind effects, hence they are recommended to be considered in the design of the development:

- Inclusion of an impermeable awning along the north-eastern aspect of the Lower Ground Level, covering the entirety of the Ambulance Avenue entrance, to replace the existing site awning. These treatments will be further developed and reviewed at a later design stage to be incorporated into the final design scheme.
- The inclusion of various treatments along the northern site boundary on the Upper Ground Level along the ramp landing (also recommended in Section 5.2.3). These treatments will be further developed and reviewed at a later design stage to be incorporated into the final design scheme.

5.5 Elevated terrace areas and connecting bridges

5.5.1 The Atlassian building is developed in isolation

The elevated terrace areas are located along Levels 02 to 04 and therefore will benefit from the shielding provided by the existing Toga site building. However, the terrace area spans the entire length of the north-eastern tower aspect and therefore is likely to be affected by corner accelerated winds from the south and north-east prevailing winds in addition to wind sidestreaming from the north-east. The connecting bridges are expected to be affected by direct north-easterly wind impact.

5.5.2 The Atlassian building and the Dexu Frasers site are both redeveloped

It is expected that the redevelopment of the Dexu Frasers site will not vary the wind conditions described in Section 5.5.1 along the elevated terrace areas and connecting bridges.

5.5.3 Recommended Treatment Strategies

The following treatment strategies are expected to be effective in mitigating the abovementioned potential wind effects, hence they are recommended to be considered in the design of the development:

- Inclusion of a 2m high impermeable screen along the entire perimeter of the terrace areas for Levels 02 to 04.
- Inclusion of a 2m high impermeable screen along the northern aspect of the connecting bridge for all levels with exposed bridges.

5.6 Wind Tunnel Study

This assessment is based on the current envelope massing design of the proposed Atlassian YHA Central Station development, however, a wind tunnel study has been undertaken based on a previous massing design in order to assess wind speeds in relation to wind comfort and safety at selected critical outdoor trafficable areas within and around the subject development (Report Ref: WE455-02F02(rev0), dated: October 17, 2018).

It should be noted that the current envelope design is similar to the previously tested massing. As such, this report has utilised the results of the previously tested massing to guide our expectations for the wind conditions within and around the current envelope design.

The results of the detailed wind environment study of the previous massing indicate that wind conditions for the majority of trafficable outdoor locations within and around the subject development will be suitable for their intended uses. However, some areas will experience strong winds which will exceed the relevant criteria for comfort. Previously suggested treatments that are still applicable to the current envelope design are described as follows:

- Inclusion of a full height impermeable screen along the north-eastern aspect adjoining to the roof overhang of the existing building.
- Densely foliating shrubs/planter boxes capable of growing up to 1.5m in height along the north-western aspect of the Upper Ground Level outdoor spaces.
- Inclusion of a low impermeable awning extending from the tower façade along the north-western aspect, with a horizontal depth of at least 3m, above the Upper Ground Level.

Note that the detailed wind environment study does not include the effects of the Dexu Frasers site redevelopment.

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