

Dillworth Trust Board

# **WIND ASSESSMENT:**

## **PROJECT STELLAR, 76-80 GREAT SOUTH RD, AUCKLAND**

REPORT NO 22-529Q09.00

11 APRIL 2022






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## WIND ASSESSMENT: PROJECT STELLAR, 76-80 GREAT SOUTH RD, AUCKLAND

Dillworth Trust Board

WSP  
Petone  
33 The Esplanade  
Petone  
Lower Hutt 5012, New Zealand  
+64 4 587 0600  
wsp.com/nz

REV	DATE	DETAILS
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	NAME	DATE	SIGNATURE
Prepared by:	Neil Jamieson	11/4/22	
Reviewed by:	Nick Locke	12/4/22	
Approved by:	Peter Cenek	12/4/22	

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WSP  
Petone  
33 The Esplanade  
Petone  
Lower Hutt 5012, New Zealand  
+64 4 587 0600  
[wsp.com/nz](http://wsp.com/nz)





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# 1 INTRODUCTION

This desktop wind assessment considers the expected effects of the Project Stellar development proposed for a site at 76-80 Great South Road in the Epsom area of Auckland on pedestrian level wind conditions in the surrounding area. It considers these potential effects with reference to the requirements of the Auckland Unitary Plan (Operative in Part November 2016) regarding wind effects for consent purposes.

The assessment of the existing wind conditions is based on the anticipated effects of existing buildings on wind flows and on the consideration of the effects of buildings under construction as though they are completed. It also comments, where appropriate, on the anticipated effects of proposed buildings in the immediate vicinity that have resource or building consent, that are expected to proceed, but where construction has not yet commenced.

Assessment of the expected wind effects of the proposed development is based on (1) our experience in assessing wind conditions for new buildings and additions in urban areas and (2) the results of wind tunnel model studies carried out in situations with similar sizes and heights of buildings. No wind tunnel testing has been performed on the proposal for this assessment. All comments refer to plans and drawings prepared by Jasmax Architects, referenced as 20220401\_Stellar\_50% Preliminary Design - Drawings.

# 2 DESCRIPTION

## 2.1 DEVELOPMENT SITE

The Project Stellar site located at 76-80 Great South Road extends between Great South Road and Mauranui Avenue in the Auckland suburb of Epsom. This irregular shaped area, which is shown in Figure 1, is currently occupied by two two-storey pitched-roof motel buildings. The remainder of the site comprises carparking for the motel, as well as planted areas and lawns. Also shown on Figure 1 are (1) the direction sectors for the prevailing winds over Auckland City and (2) the approximate site outline, and (3) the site plan showing the locations and outlines of the two proposed buildings. The topography in the area is gently sloping. Under the Auckland Unitary Plan, the site is in the Business - Mixed Use Zone.

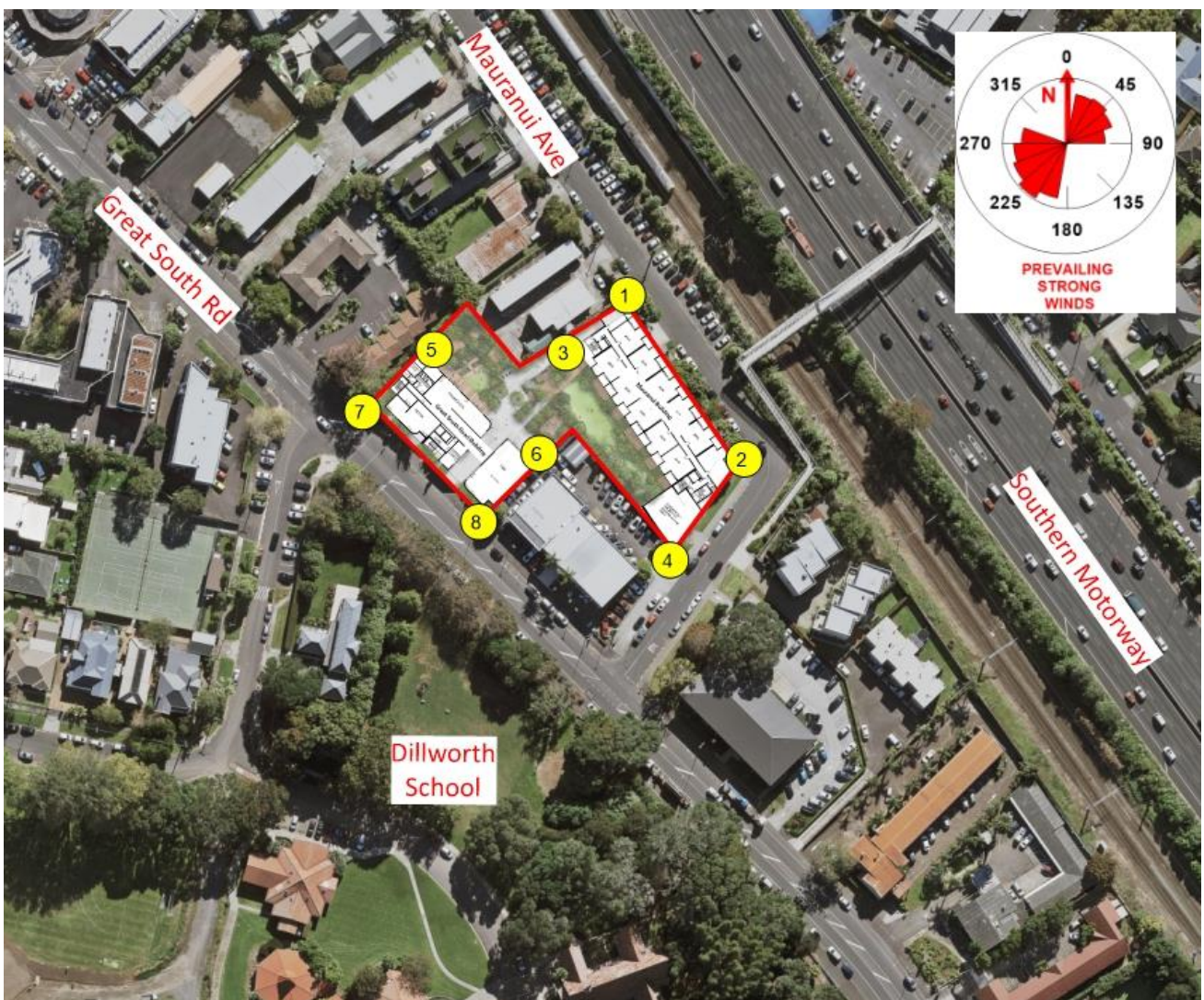


Figure 1: View of the development site and surrounding area

- Shows:
- (1) the prevailing wind directions
  - (2) No. 76-80 development site (outlined in red)
  - (3) The development building layout
  - (4) Corners 1-8 are labelled for future reference.

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## 2.2 SURROUNDING AREA

In the area around the development site there is a diverse mix of buildings and open space. Buildings include accommodation (motels), educational, retail, and commercial blocks, as well as residential buildings, ranging from single level dwellings through to multi-level apartment blocks. Most of these buildings are one or two storeys high, with a few being three or four storeys high. Apart from the streets and adjacent footpaths, there are also some other large open spaces near the site, including the grounds of Dillworth School to the south. Many of the buildings in the area have adjacent open space that is a combination of landscaped space and carparking. There are also significant number of mature trees in the area, including both evergreen and deciduous types, with most of these being in the residential areas.

Immediately to the south of the development site at 76-80 Great South Road is another potential development site at 82 Great South Road, which is also a Dillworth property, for which a five or six storey building is being envisaged at some future date.

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## 2.3 PROPOSED DEVELOPMENT

The proposed development for 76-80 Great South Road comprises two buildings, one nine-storey building fronting onto Great South Road (GSR Building) and one ten-storey building fronting onto Mauranui Ave (Mauranui Building). The sloping terrain of the site and the surrounding area mean that both buildings are slightly over 30m in height. Separating these two buildings will be a landscaped courtyard.

The GSR building has a significant degree of vertical and horizontal articulation, with external stairs, building setbacks and recessed balconies. At ground floor level, an open laneway connects through to the internal courtyard space. The remaining levels have the same approximately rectangular planform as the ground floor, except for Level 8, the topmost level. This level includes setbacks that create an external roof terrace, shared amenity space and accommodation units.

The Mauranui building also has a significant degree of vertical and horizontal articulation, with external stairs, building setbacks and balconies. The building has what could be called a J shaped planform, extending south from the site boundary, then west to follow the dogleg of Mauranui Ave. At the northern end of the ground floor level, an open laneway connects through to the internal courtyard space, and a car entrance provides access to the subground carpark that sits below part of the central courtyard. The levels above have the same planform as the ground floor, except for Level 8, the topmost level. This level incorporates accommodation units, as well as shared amenity space and an external roof terrace at the southwest corner of the building.

Figures 2 and 3 show rendered views of the development. These illustrate (1) the building designs, (2) the relationships between the two development buildings and (3) the relationships between the scale of the development and the surrounding buildings.



Figure 2: *Rendered view of the proposed development - from the north*



Figure 3: *Rendered view of the proposed development and surroundings - from the north.*

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# 3 WIND STANDARDS

## 3.1 AUCKLAND – UNITARY PLAN

The Auckland Unitary Plan contains standards that specify the wind conditions considered appropriate for pedestrians on the footpaths, roadways, and other public areas, including parks and public squares, in various zones of the city.

As noted in Section 2.1, the site is in the Business - Mixed Use Zone. The Unitary Plan wind standards have criteria based on (1) the probability of occurrence of mean wind speeds (Category A to Category E), and (2) the maximum gust wind speed (safety criteria). The sections of the Unitary Plan relating to wind effects are reproduced in Appendix A for the Business - Mixed Use zone.

The performance categories describe the wind conditions which are experienced at a location during the year taking all the different wind directions that occur into account. Locations with Category A wind conditions have the lowest wind speeds. Locations with Category E wind conditions have the highest wind speeds, which the wind rules describe as dangerous and unacceptable. Category C wind conditions are the highest considered acceptable for pedestrian footpaths and other pedestrian linkages under the Unitary Plan.

The wind performance categories, as they relate to the measured mean wind speeds presented later in the report, are listed in Table 1, together with descriptions of their application to public space in the Unitary Plan.

**Table 1: Overall Mean Wind Speeds and Corresponding Wind Performance Categories**

Category	Description
A	Areas of pedestrian use or adjacent dwellings containing significant formal elements and features intended to encourage longer term recreational or relaxation use i.e. public open space and adjacent outdoor living space.
B	Areas of pedestrian use or adjacent dwellings containing minor elements and features intended to encourage short term recreation or relaxation, including adjacent private residential properties
C	Areas of formed footpath or open space pedestrian linkages, used primarily for pedestrian transit and devoid of significant or repeated recreational or relaxational features, such as footpaths not covered in categories A or B above
D	Areas of road, carriage way, or vehicular routes, used primarily for vehicular transit and open storage, such as roads generally where devoid of any features or form which would include the spaces in categories A - C above.
E	Category E represents conditions which are dangerous to the elderly and infants and of considerable cumulative discomfort to others, including residents in adjacent sites. Category E conditions are unacceptable and are not allocated to any physically defined areas of the city

The safety criterion requires that a proposed development must not cause the maximum annual 3-second gust speed to exceed a value of 25m/s, which is the threshold considered to be dangerous under the Unitary Plan rules.

# 4 EXISTING WIND CONDITIONS

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## 4.1 AUCKLAND – PREVAILING WINDS

Over Auckland City strong winds blow primarily from the northerly through easterly and southwesterly through westerly sectors, as shown in Figure 1. Of these directions the strongest winds typically occur from the southwest. These are also noticed more because of the lower temperatures that can often accompany them.

Pedestrian level wind conditions in this area of Auckland are determined by a combination of factors. These factors include (1) the buildings in the area (density, location, height, area, and orientation), (2) the alignment of the streets and open spaces relative to the prevailing wind directions, (3) trees and other vegetation, and (4) the local topography.

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## 4.2 EXISTING WIND CONDITIONS - SITE

Wind conditions in the pedestrian open spaces, including streets and footpaths and adjacent/nearby properties in the vicinity of the development site are currently assessed to range from Categories A to C. They are expected to be predominantly Category A or B, with only localised areas of Category C in the more exposed open locations, such as (1) the elevated walkway over the motorway and (2) around the windward sides and corners of the taller more exposed buildings.

Wind conditions at different locations will vary significantly depending on the exposure to wind from different directions. Locations that may be well sheltered by upwind topography, buildings, or trees and planting, for some wind directions may be more exposed for other wind directions. For example, locations on the eastern sides of buildings are more exposed to the northeasterly sector winds, but more sheltered from the southwesterly sector winds.

# 5 EFFECTS ON WIND CONDITIONS

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## 5.1 BUILDINGS IN GENERAL

New buildings, as well as changes and additions to existing buildings, can have a significant impact on wind conditions in the surrounding public areas, footpaths, and pavements. They can affect the amenity of certain locations through changes in the frequently occurring wind speeds and the safety of certain locations through changes to the strongest gust speeds.

New buildings are usually either (1) taller in height or larger in bulk (or both) than the existing buildings, or (2) occupy a vacant or largely vacant site. They therefore occupy more space and will force wind that would normally flow through this space to take other paths.

Vertical wind flows, referred to as “downwash”, can be deflected down from higher levels into adjacent areas. Wind can also be channelled through gaps between buildings or accelerated around corners. Some of the worst wind conditions can occur where these vertical and horizontal wind flows combine, most often around the windward corners and sides of buildings.

New buildings, or additions, do not always cause local wind conditions to deteriorate. They can provide increased shelter to some areas, particularly those immediately downwind. They can also potentially keep wind flows away from pedestrian areas, either by deflecting them into lesser used areas, or keeping them well above ground level. Accordingly, new building developments can cause wind speeds to increase in some areas and to decrease in other areas. This will often depend significantly on the wind direction. These effects can be particularly significant when a new large building replaces a smaller existing building or occupies a largely or completely vacant site.

When building developments are found to cause wind conditions to deteriorate significantly, the effects can often be mitigated. Options for mitigation of wind effects can include design changes, such as canopies, or changes to bulk and form, or screening or planting, among others.

The following assessment has been divided into sections on the anticipated effects of the proposed development on (1) mean wind conditions covering specific wind directions and (2) the expected gust speed levels.

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## 5.2 EFFECTS IN NORTHERLY THROUGH EASTERLY WINDS

### 5.2.1 AREAS OUTSIDE THE SITE

Figures 1 through 3 show that the that proposed development is much larger, in planform and height, than the two-storey buildings that currently occupy the development site and the surrounding sites. Accordingly, the development will cause a significant redistribution of wind flows, both through the site and in areas around the perimeter of the site.

In north through easterly winds the long axes of both buildings are oriented more normal to the prevailing wind directions, thus exposing these large faces, which sit immediately adjacent to the site’s street boundaries, to direct wind flows. While the lower levels of the buildings will receive some shelter from the trees and screening associated with the railway line and southern motorway, wind flows will be deflected down and along the windward faces of the new buildings. Wind striking the east face of the Mauranui building will be deflected around the windward corners of

the building and also down this windward face. These flows will combine with existing horizontal ground level wind flows, creating windier regions in these areas.

Elements of the incident wind flow and the flows redirected by the Mauranui building will also be channelled between the Mauranui and GSR buildings. Depending on the specific wind direction, the GSR building will either be exposed to direct wind flows or sheltered to a varying degree by the Mauranui building. Some of the wind flows deflected down the windward face of the GSR building will also flow through the ground level laneway out onto Great South Road.

In contrast to the windward Mauranui Ave side of the development, wind conditions on the leeward Great South Road side of the development are generally expected to be improved because of the shelter afforded by the development.

Wind conditions on the footpaths in Mauranui Ave and in the neighbouring properties are generally expected to remain mostly Category A or B, with some localised areas of Category C wind conditions likely around the windward sides and corners of the development (corners 1 and 2 as shown in Figure 2). Category C conditions are the highest considered acceptable on footpaths and other pedestrian linkages. However, in those areas of the neighbouring properties where there are elements or features that are used for or encourage shorter-term or longer-term relaxation or recreation, the potential occurrence of Category C wind conditions will make localised areas windier than the Category A or B conditions considered appropriate under the Unitary Plan criteria. However, the wind conditions in these areas will also depend significantly on the actual fencing/screening and landscaping that is carried out on the development site adjacent to these areas, e.g. perimeter fencing or planting.

### **5.2.2 AREAS WITHIN THE SITE**

In north through easterly winds some wind flows will be deflected around the north end of the Mauranui building and channelled into the internal courtyard between the Mauranui and GSR buildings. Wind flows will also be deflected down the windward face of the GSR building into the courtyard. This will result in some swirling wind flows within the courtyard, particularly around the corners of the buildings (corners 3, 5 and 6). The high-pressure region on the windward side of the GSR building means that the wind will also seek exits around the windward corners, but also through the internal laneway.

Wind conditions within the courtyard are expected to be mostly Category B, with some Category A. However, some areas of Category C may occur around the windward corners of the GSR building. Wind conditions in these areas will depend significantly on the fencing/screening and landscaping that is carried out within the courtyard space.

### **5.2.3 ROOFTOP TERRACE AREAS**

There are two sizeable rooftop terrace areas planned in the proposed development, one on each of the buildings. The plans currently show perimeter balustrading around 1.5m high. Being rooftop areas on proposed buildings that are significantly taller than any of the surrounding buildings to the north through east, these are spaces that are likely to experience generally higher wind speeds because of their elevation.

The outdoor terrace on the Mauranui building will be reasonably sheltered in northerly through easterly winds, as it is located on the leeward side of the building. Wind conditions are expected to mostly range between Category A and B

The outdoor terrace on the GSR building is more exposed to northerly through easterly winds, as it occupies the entire northern end of the roof space. The planned 1.5m high balustrading should provide some shelter. Wind conditions are expected to be mostly Category B, with some localised areas of Category C.

Wind conditions on both rooftop terraces will depend on the final height chosen for the balustrading.

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## 5.3 EFFECTS IN SOUTHWESTERLY THROUGH WESTERLY WINDS

### 5.3.1 AREAS OUTSIDE THE SITE

As for northerly through easterly winds, in southwesterly through westerly winds the proposed development exposes a much larger area to direct wind flows than do the existing buildings on the site. Accordingly, a significant redistribution of wind flows around the development is expected. For winds more from the south and southwest, the west sides of both the GSR and Mauranui buildings will be exposed to the wind. While the lower levels will receive some shelter from the trees on the west side of Great South Road, and the Giltrap building on the corner of Mauranui Ave and Great South Road, wind flows will be deflected down and along the windward faces of the new buildings. These flows will combine with existing horizontal lower-level wind flows to make localised areas around the windward corners (corners 4, 7 and 8) windier than they are at present, with the effects being more noticeable when any deciduous trees have lost their leaves. Wind flows will also occur through the laneway in the ground floor of the GSR building, which connects high pressure on the windward side of the building to the low pressure region on the leeward side.

Wind conditions are anticipated to be mostly Category B, with some Category A, but also with the likelihood of localised areas of Category C occurring around the windward corners.

In contrast to the effects described for the windward south and west sides of the development, wind conditions on the leeward sides of the buildings, i.e. to the east and north, and in the internal courtyard, depending on the wind direction, are generally expected to be improved because of the shelter afforded by the development.

### 5.3.2 AREAS WITHIN THE SITE

In wind flows from the southwest through west wind flows will be deflected down the windward faces of both of the development buildings. Some of this downwash will be channelled between the buildings into the internal courtyard. The flow through the laneway in the GSR building mentioned above, will also affect wind conditions in the courtyard. Wind conditions may reach Category C at some locations near the building corners, but wind conditions in the much of the courtyard itself are expected to be Category B, with areas also of Category A. As described for northerly through easterly winds, wind conditions in the courtyard space will depend significantly on the fencing/screening and landscaping that is carried out within the courtyard space.

### 5.3.3 ROOFTOP TERRACE AREAS

Compared to the situation in northerly through easterly winds, in southwesterly through westerly winds the rooftop terrace area on the GSR building has about the same exposure, while the one on the Mauranui building is more exposed, now being on the windward side of the building. The currently planned 1.5m high balustrades should provide these areas with some shelter. However,

because of their elevations, wind conditions are expected to range between Category A and C, with much of the space likely to be Category B.

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## 5.4 GUST SPEEDS

The proposed development is not expected to cause gust speeds in pedestrian areas at ground level to increase above the 25m/s threshold, which is the level above which gust speeds are considered dangerous under the Unitary Plan wind environment controls. This is because of the shelter afforded by the surrounding buildings, planting and topography.

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## 5.5 OVERALL ASSESSMENT OF BUILDING DESIGN

The development includes only limited positive wind design elements, which include the vertical and horizontal articulation described in Section 2.3 and screening of the rooftop perimeter. As the development is significantly taller than the buildings it replaces, it is inevitable that the proposed development will make some areas windier than they currently are. Nevertheless, wind conditions are not expected to be increased above Category C, which is the maximum considered acceptable for pedestrian footpaths and other pedestrian linkages devoid of recreational features under the Unitary Plan.

Wind conditions likely to occur in areas of neighbouring properties where there are elements or features that are used for or encourage shorter-term or longer-term relaxation or recreation, will depend significantly on the fencing/screening and landscaping that is included as part of the detailed design, e.g. perimeter fencing or planting.

Given the wind conditions expected around the buildings, i.e. increased or new areas of Category C conditions, particular attention should be paid to wind effects in the design and placement of fences, vertical screens and planting. Similarly, attention should also be paid to the height and design of the balustrading and landscaping for the proposed open rooftop outdoor/garden areas, if the amenity of these areas is to be maximised.

## 6 CONCLUSIONS

The following conclusions have been drawn from this assessment of pedestrian wind conditions:

1. Existing wind speeds in the immediate area around the development site are assessed to range from low to moderately high. These are primarily dictated by the degree of shelter provided by a combination of upstream buildings, screening, trees and vegetation and the nearby topography. Wind conditions are expected to be mostly within the Auckland City wind performance Categories A and B, with localised areas of Category C. Therefore, existing wind conditions are expected to fall mostly within those levels considered acceptable for shorter-term or longer-term recreation or relaxation activities. The Category C conditions are anticipated to occur in the larger open or elevated areas.
2. The development includes only limited design features for wind, in the articulation of the facades. As the proposed buildings are significantly bigger than the low-rise buildings they replace, it is inevitable that some areas will become windier than they currently are. This will occur in both northerly to easterly and southwesterly to westerly winds. In contrast, wind conditions in the lee of the proposed buildings are expected to be improved because of the increased shelter they will provide. Wind conditions in localised areas are expected to increase to Category C. Otherwise they should remain Category A or B.
3. Assuming the design and massing of the buildings in the development design remain substantially unchanged, its final effects on wind conditions will ultimately depend on the size, design and placement of the fencing/screening and landscaping incorporated in the detailed design. This is particularly important for those areas within the internal courtyard.
4. The planned rooftop terrace areas are expected to be moderately windy, because of their elevation, with wind conditions expected to be mostly Category B, but with some areas of Category C conditions also being likely. Attention will need be paid to the height and design of the screening and landscaping in these areas to maximise the amenity of these areas.
5. Gust speeds are not expected to be increased above the 25m/s danger threshold specified in the Unitary Plan standards (H8.6.28 (1)(b)).

Authored by:



Neil Jamieson  
Research Leader  
Wind Engineering

Reviewed by:



Nick Locke  
Principal Research Engineer

# 7 LIMITATIONS

This report ('Report') has been prepared by WSP exclusively for Dillworth Trust Board ('Client') in relation to the wind assessment the proposed Project Stellar development for 76-80 Great South Road in Epsom, Auckland ('Purpose') and in accordance with our offer of service dated 24<sup>th</sup> February 2022. The findings in this Report are based on and are subject to the assumptions specified in the Report. WSP accepts no liability whatsoever for any reliance on or use of this Report, in whole or in part, for any use or purpose other than the Purpose or any use or reliance on the Report by any third party.

# APPENDIX A UNITARY PLAN - WIND RULES

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## BUSINESS – MIXED USE ZONE

The Auckland Unitary Plan (Operative in part 15 November 2016) contains policies and standards relating to wind effect created by buildings in different zones of the city. According to the Auckland Council website the development site in the Mixed Use Zone. Reproduced below are the relevant sections of Chapter H13 of the Unitary Plan.

### **H13.3. Policies**

*General policies for all centres, Business – Mixed Use Zone, Business – General Business Zone and Business – Business Park Zone*

- (11) Require development to avoid, remedy or mitigate adverse wind and glare effects on public open spaces, including streets, and shading effects on open space zoned land.

### **H13.6. Standards**

All permitted and restricted discretionary activities in Table H13.4.1 Activity table must comply with the following standards.

### H13.6.8. Wind

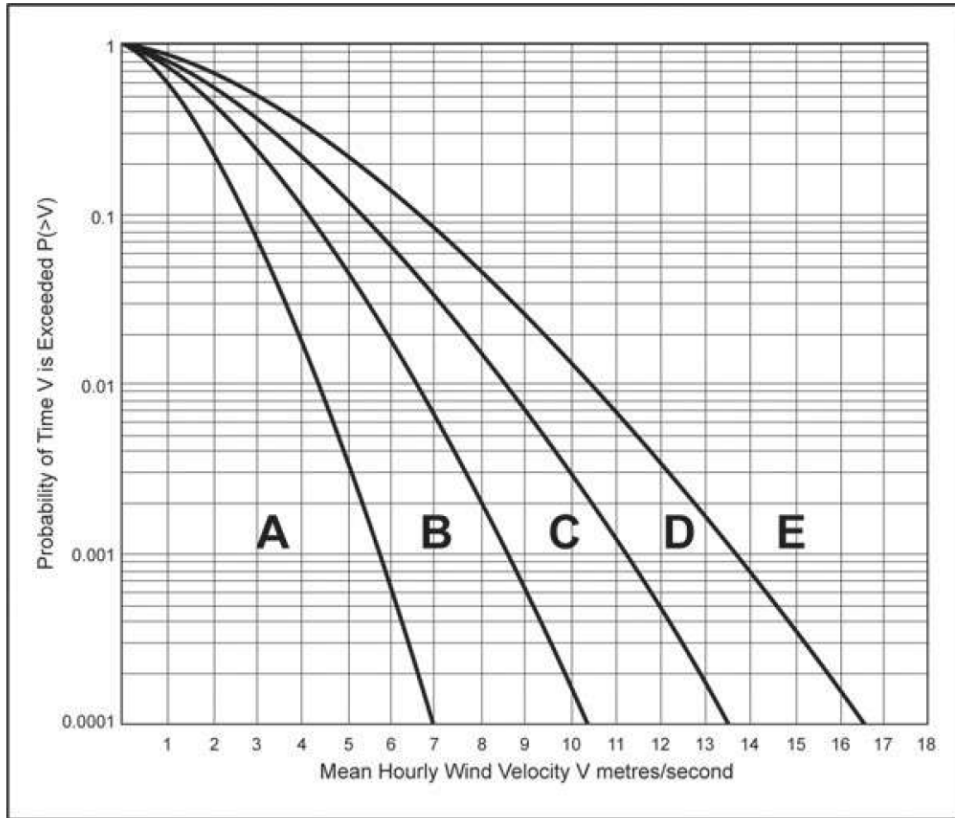
Purpose: mitigate the adverse wind effects generated by tall buildings.

- (1) A new building exceeding 25m in height and additions to existing buildings that increase the building height above 25m must not cause:
  - a) the mean wind speed around it to exceed the category for the intended use of the area as set out in Table H13.6.8.1 and Figure H13.6.8.1 below;
  - b) the average annual maximum peak 3-second gust to exceed the dangerous level of 25m/second; and
  - c) an existing wind speed which exceeds the controls of Standard H13.6.8(1)(a) or Standard H13.6.8(1)(b) above to increase.
- (2) A report and certification from a suitably qualified and experienced person, showing that the building complies with Standard H13.6.8(1) above, will demonstrate compliance with this standard.
- (3) If the information in Standard H13.6.8(2) above is not provided, or if such information is provided but does not predict compliance with the rule, a further wind report including the results of a wind tunnel test or appropriate alternative test procedure is required to demonstrate compliance with this standard.

**Table H13.6.8.1 Categories**

Category	Description
Category A	Areas of pedestrian use or adjacent dwellings containing significant formal elements and features intended to encourage longer term recreational or relaxation use i.e. public open space and adjacent outdoor living space
Category B	Areas of pedestrian use or adjacent dwellings containing minor elements and features intended to encourage short term recreation or relaxation, including adjacent private residential properties
Category C	Areas of formed footpath or open space pedestrian linkages, used primarily for pedestrian transit and devoid of significant or repeated recreational or relaxational features, such as footpaths not covered in categories A or B above
Category D	Areas of road, carriage way, or vehicular routes, used primarily for vehicular transit and open storage, such as roads generally where devoid of any features or form which would include the spaces in categories A - C above.
Category E	Category E represents conditions which are dangerous to the elderly and infants and of considerable cumulative discomfort to others, including residents in adjacent sites. Category E conditions are unacceptable and are not allocated to any physically defined areas of the city

Figure H13.6.8.1 Wind environment control



Derivation of the wind environment control graph:

The curves on the graph delineating the boundaries between the acceptable categories (A-D) and unacceptable (E) categories of wind performance are described by the Weibull expression:

$$P(>V) = e^{-(v/c)^k}$$

where V is a selected value on the horizontal axis, and P is the corresponding value of the vertical axis:

and where:

$P(>V)$  = Probability of a wind speed V being exceeded;

e = The Napierian base 2.7182818285

v = the velocity selected;

k = the constant 1.5; and

c = a variable dependent on the boundary being defined:

A/B, c = 1.548

B/C, c = 2.322

C/D, c = 3.017

D/E, c = 3.715