WINDTECH

PEDESTRIAN WIND ENVIRONMENT STATEMENT

LADY'S LANE AND HURTS LANE, LIMERICK CITY

WL287-01F02(REV1)- WS REPORT

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Prepared for:

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EXECUTIVE SUMMARY

This report presents an opinion on the potential impact of the development works on the Ladys's Lane and Hurts Lane, located in Limerick, on the local wind environment at the critical outdoor areas within and around the subject site. The effect of wind activity has been examined for the predominant wind direction for the region, namely the west and west-south-westerly winds. Year-round wind conditions, as well as wind conditions during the summer and winter seasons, are considered in this assessment. The analysis of the wind effects relating to the proposed development has been carried out in the context of the local wind climate, building morphology and land topography.

The proposed works include the redevelopment of the existing 3-storey building and car park to an 8-story student accommodation.

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. No wind tunnel testing or Computational Fluid Dynamics (CFD) has been undertaken for the subject development, and hence this report addresses only the general wind effects and any localised effects that are identifiable by visual inspection of the architectural drawings. Any recommendations in this report are made only in-principle and are based on our extensive experience in the study of wind environment effects. This study assesses the wind conditions for the following scenario:

- Proposed development with the existing surrounding buildings.

The results of the study are summarised as follows:

- Proposed Development with Existing Surrounds:
    - With the consideration of the proposed development, the wind conditions at ground are expected to be safe for pedestrian/occupant use throughout the year.
    - In terms of pedestrian comfort, wind conditions are expected to be suitable for the existing pedestrian activities, such as strolling.
    - The wind microclimate outside the entrances of the proposed development is expected to be suitable for standing use throughout the year.
    - For the outdoor amenity areas at ground level, wind conditions in these areas are expected to be suitable for intended use.
    - The wind conditions within the various elevated terraces of the development are expected to be unsuitable for their intended use. It is expected with the recommended mitigations shown in Figure 3c that the wind conditions would become suitable.

With the retention of the proposed mitigation measures in the final design, it is expected that wind conditions for the various trafficable outdoor areas within and around the development will be suitable for their intended uses, and that the wind speeds will satisfy the applicable criteria for pedestrian wind comfort and safety.

CONTENTS

1 INTRODUCTION

An opinion on the potential 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 has been 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 or Computational Fluid Dynamics (CFD) has been undertaken for this assessment. 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 DEVELOPMENT AND SURROUNDINGS

The proposed works include the redevelopment of the existing 3-storey building and open-air car park located in Limerick, into an 8-storey student accommodation.

The site is bounded by Lady's Lane to the north and Hunts Lane to the south. Surrounding the site are predominantly low and mid-rise buildings.

A survey of the land topography indicates that no major elevation changes are present in the regions surrounding the site. An aerial image of the subject site and the local surroundings is shown in Figure 1.

Figure 1: Aerial Image of the Site Location

3 REGIONAL WIND

The characteristics of the regional winds were determined from an analysis undertaken by Windtech Consultants of recorded directional wind speeds obtained from the meteorological stations located at Shannon Airport. A total of 20 years of wind climate data has been collected from this station, and the data has been corrected so that it represents winds over standard open terrain at a height of 10m above ground. From this data, directional probabilities of exceedance and directional wind speeds for the region are determined. The results of this analysis are presented in Figures 2 for the all-year, summer and winter cases, in the form of wind roses.

The principal wind direction for the Limerick region, which can potentially affect the subject development, is from the west and west-south-west, as indicated in the following figures.

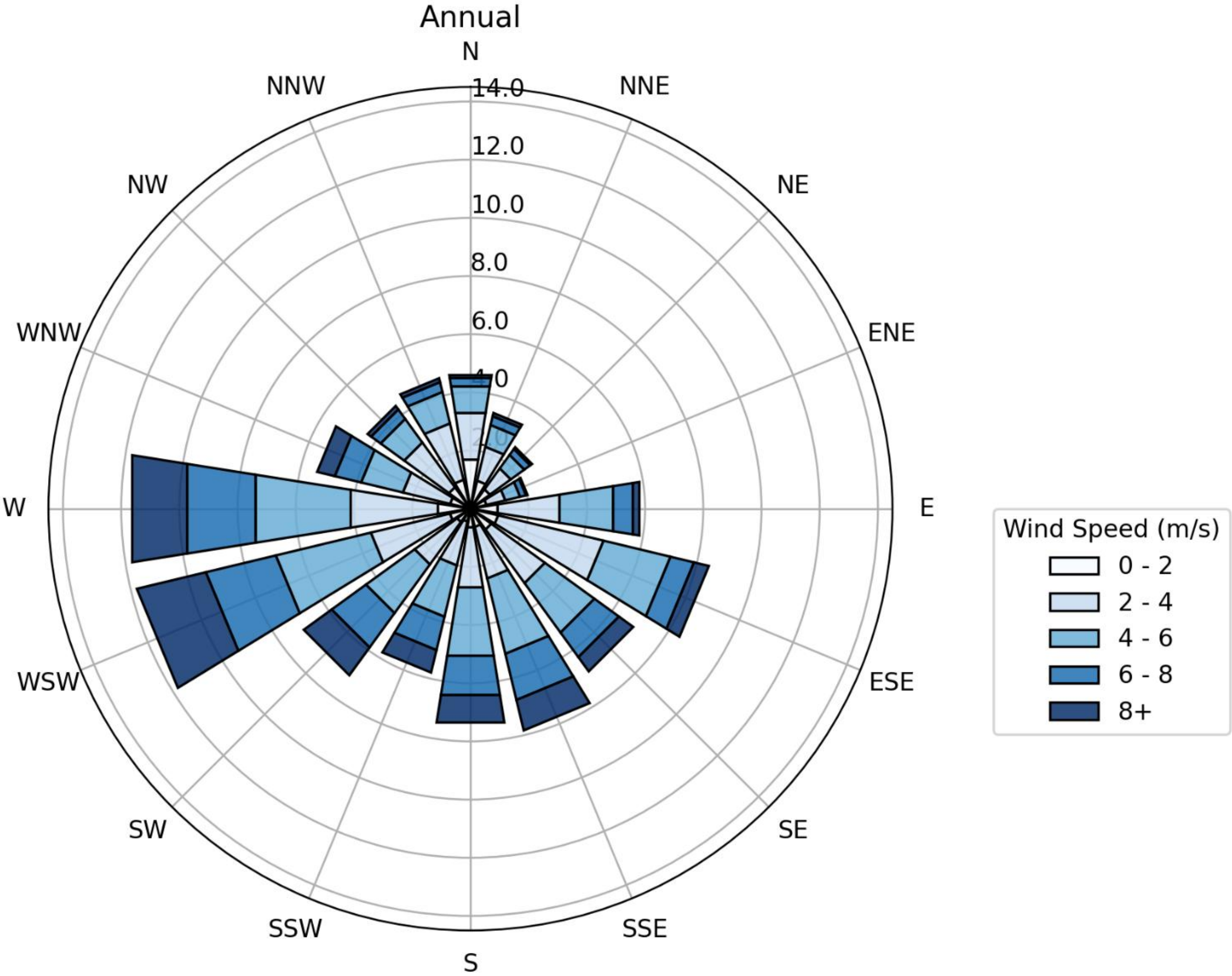
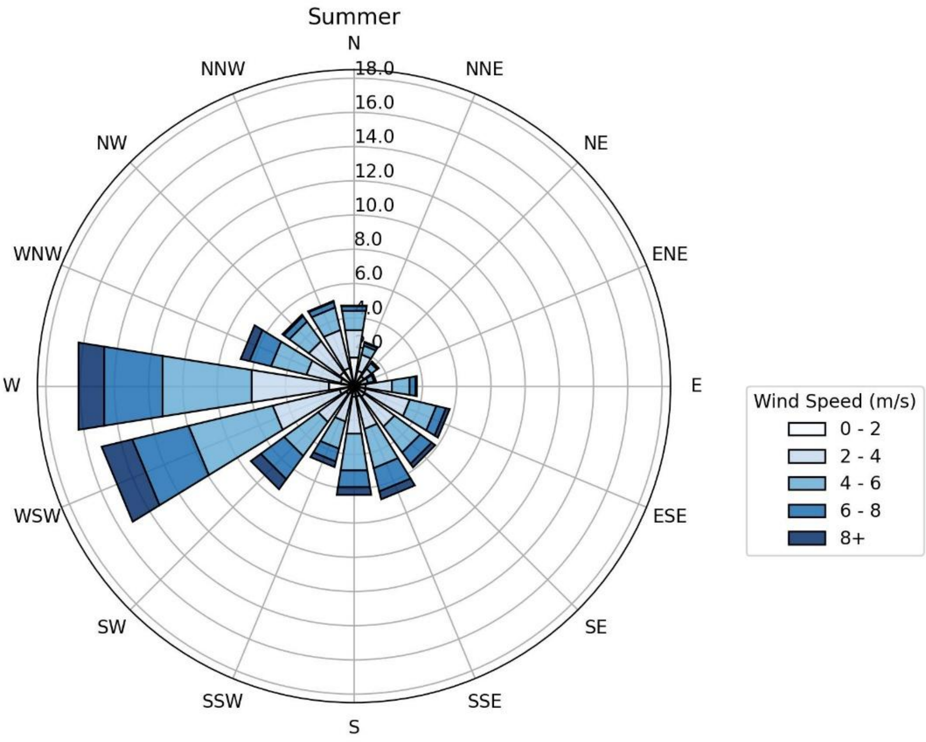


Figure 2a: Directional Annual and 5% Exceedance Hourly Mean Wind Speeds (referenced to 10m height in standard open terrain), and Frequencies of Occurrence, for Limerick Region (all-year)



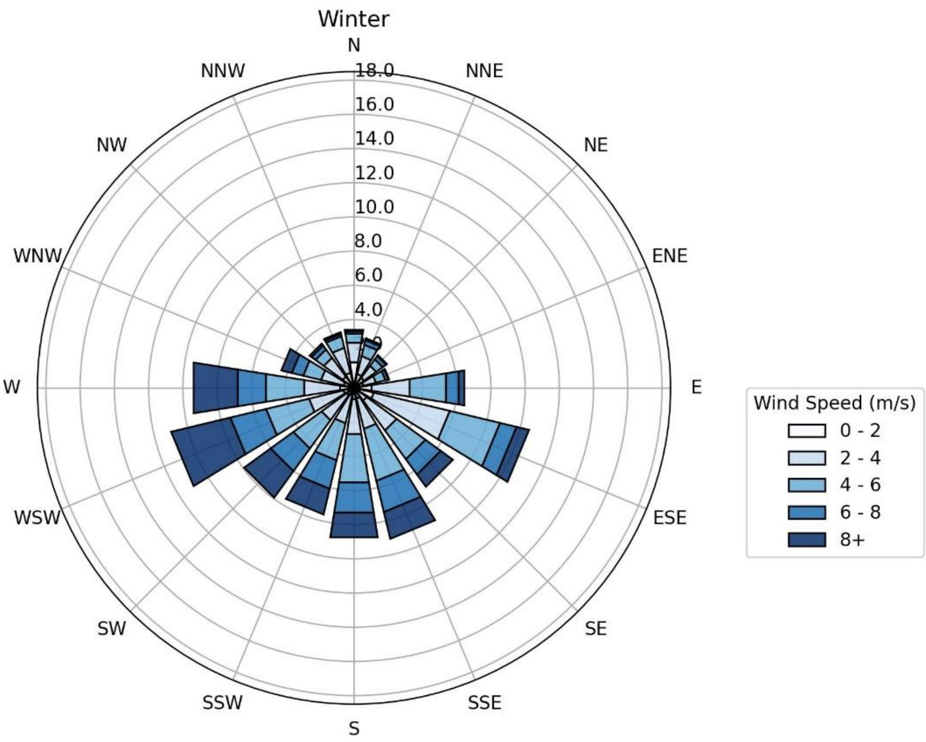


Figure 2b: Directional Annual and 5% Exceedance Hourly Mean Wind Speeds (referenced to 10m height in standard open terrain), and Frequencies of Occurrence, for the Limerick Region (summer top, winter bottom)

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. Quantifying wind comfort has been the subject of much research and many 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. This section discusses and compares the various published criteria.

It should be noted that wind speeds affecting this particular development 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.

4.1 A.D. Penwarden (1973) Criteria for Mean Wind Speeds

A.D. Penwarden (1973) developed a modified version of the Beaufort scale which describes the effects of various wind intensities on people. Table 1 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 1: 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.

4.2 A.G. Davenport (1972) Criteria for Mean Wind Speeds

A.G. Davenport (1972) also determined a set of criteria in terms of the Beaufort scale and for various return periods. Table 2 presents a summary of the criteria based on a probability of exceedance of 5%.

Table 2: Criteria by A.G. Davenport (1972)

Classification	Activities	5% exceedance Mean Wind Speed (m/s)
Walking Fast	Acceptable for walking, main public accessways.	7.5 - 10.0
Strolling, Skating	Slow walking, etc.	5.5 - 7.5
Short Exposure Activities	Generally acceptable for walking & short duration stationary activities such as window-shopping, standing or sitting in plazas.	3.5 - 5.5
Long Exposure Activities	Generally acceptable for long duration stationary activities such as in outdoor restaurants & theatres and in parks.	0 - 3.5

4.3 T.V. Lawson (1975) Criteria for Mean Wind Speeds

In 1973, T.V. Lawson, while referring to the Beaufort wind speeds of A.D. Penwarden (1973) (as listed in Table 1), quoted that a Beaufort 4 wind speed would be acceptable if it is not exceeded for more than 4% of the time, and that a Beaufort 6 wind speed would be unacceptable if it is exceeded more than 2% of the time. Later, in 1975, T.V. Lawson presented a set of criteria very similar to those presented in A.G. Davenport (1972) (as listed in Table 2). These criteria are presented in Tables 3 and 4 for safety and comfort respectively.

Table 3: Safety Criteria by T.V. Lawson (1975)

Classification	Activities	Annual Mean Wind Speed (m/s)
Safety (all weather areas)	Accessible by the general public.	0 – 15
Safety (fair weather areas)	Private areas, balconies/terraces, etc.	0 – 20

Table 4: Comfort Criteria by T.V. Lawson (1975)

Classification	Activities	5% exceedance Mean Wind Speed (m/s)
Business Walking	Objective Walking from A to B.	8 - 10
Pedestrian Walking	Slow walking, etc.	6 - 8
Short Exposure Activities	Pedestrian standing or sitting for short times.	4 – 6
Long Exposure Activities	Pedestrian sitting for a long duration.	0 - 4

4.4 W.H. Melbourne (1978) Criteria for Gust Wind Speeds

W.H. Melbourne (1978) introduced a set of criteria for the assessment of environmental wind conditions that were developed for a temperature range of 10°C to 30°C and for people suitably dressed for outdoor conditions. These criteria are presented in Table 5, and are based on maximum gust wind speeds with a probability of exceedance of once per year.

Table 5: Criteria by W.H. Melbourne (1978)

Classification	Activities	Annual Gust Wind Speed (m/s)
Limit for Safety	Completely unacceptable: people likely to get blown over.	23
Marginal	Unacceptable as main public accessways.	16 - 23
Comfortable Walking	Acceptable for walking, main public accessways	13 - 16
Short Exposure Activities	Generally acceptable for walking & short duration stationary activities such as window-shopping, standing or sitting in plazas.	10 - 13
Long Exposure Activities	Generally acceptable for long duration stationary activities such as in outdoor restaurants & theatres and in parks.	0 - 10

4.5 LDDC Criteria (2001) for Mean Wind Speeds

In 2001 the T.V. Lawson criteria described in Section 4.3 was revised by T.V. Lawson. This is often referred to as the London Docklands Development Corporation criteria (LDDC Criteria). Details of the LDDC comfort criteria are presented in Table 6 and are based on the exceedance of the threshold wind speeds, occurring less than 5% of the time. This criterion defines a reasonable allowance for extreme and relatively infrequent winds that are tolerable within each category.

Table 6: LDDC Pedestrian Comfort Criteria (T.V. Lawson, 2001)

Classification	Activities	5% exceedance Mean Wind Speed (m/s)
Uncomfortable	Winds of this magnitude are considered a nuisance for most activities, and wind mitigation is typically recommended.	>10
Walking	Relatively high speeds that can be tolerated if one's objective is to walk, run or cycle without lingering.	8-10
Strolling	Moderate breezes that would be appropriate for strolling along a city/town street, plaza or park.	6-8
Standing	Gentle breezes acceptable for main building entrances, pick-up/drop-off points and bus stops	4-6
Sitting	Light breezes desired for outdoor restaurants and seating areas where one can read a paper or comfortably sit for long periods	0-4

Details of the safety criteria are presented in Table 7 ,and are based on exceedance of 0.023% of the threshold wind speeds, occurring annually.

Table 7: LDDC Pedestrian Safety Criteria (T.V. Lawson, 2001)

Classification	Activities	Threshold Mean Wind Speed (m/s)
Unsafe for general Public & cyclists	Less able members of the public and cyclists find condition challenging	>15

5 RESULTS AND DISCUSSION

The expected wind conditions affecting the development 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 are 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. A glossary of the different wind effects described in this report is included in Appendix B.

The assessment has been carried out using the architectural drawings listed in Table 8.

Table 8: Drawings Used in this Wind Assessment

File Name	Date received
LMK-XX-00-JFA-DR-AR-P1000.pdf	19/06/2026
LMK-XX-00-JFA-DR-AR-P1003.pdf	19/06/2026
LMK-XX-00-JFA-DR-AR-P2000.pdf	19/06/2026
LMK-XX-ZZ-JFA-DR-AR-P2001.pdf	19/06/2026
LMK-XX-06-JFA-DR-AR-P2002.pdf	19/06/2026
MK-XX-07-JFA-DR-AR-P2003.pdf	19/06/2026
LMK-XX-08-JFA-DR-AR-P2004.pdf	19/06/2026
LMK-XX-ZZ-JFA-DR-AR-P4000.pdf	19/06/2026
LMK-XX-ZZ-JFA-DR-AR-P4001.pdf	19/06/2026
LMK-XX-ZZ-JFA-DR-AR-P5000.pdf	19/06/2026

The areas within and around the development site are to be mainly used as pedestrian walkways, where conditions are required to be suitable for strolling throughout the year.

For the main entrances, outdoor amenity areas and the designated terrace areas of the proposed development, the wind conditions are recommended to be suitable for standing activities throughout the year. Sitting criteria is the suitable comfort criterion for any outdoor communal seating areas, particularly during the summer season.

Although this assessment is of a qualitative nature, the abovementioned criteria are considered when assessing the wind environment impacts. This wind assessment is carried out for the following scenario:

- Proposed development with the existing surrounding buildings.

5.1 Proposed Development

The proposed development is partially exposed to the prevailing west-south-westerly winds of the region due to its height compared to the surrounding buildings, approximately 4 stories higher than surrounding buildings. Downdraughts are likely to form on the exposed side of the development. However, given that only the four topmost storeys will be exposed to the prevailing wind, this will unlikely significantly affect conditions at ground level. The buildings surrounding the site partially provide shielding at lower levels from the prevailing west-south-westerly winds as well as occasional winds from other directions that may approach the site. Wind conditions on the terraces, located on the rooftop and directly exposed to prevailing winds, are expected to have a significant impact on the usability of the space.

The resulting expected wind conditions for the critical prevailing winds are presented in Figures 3a to 3d.

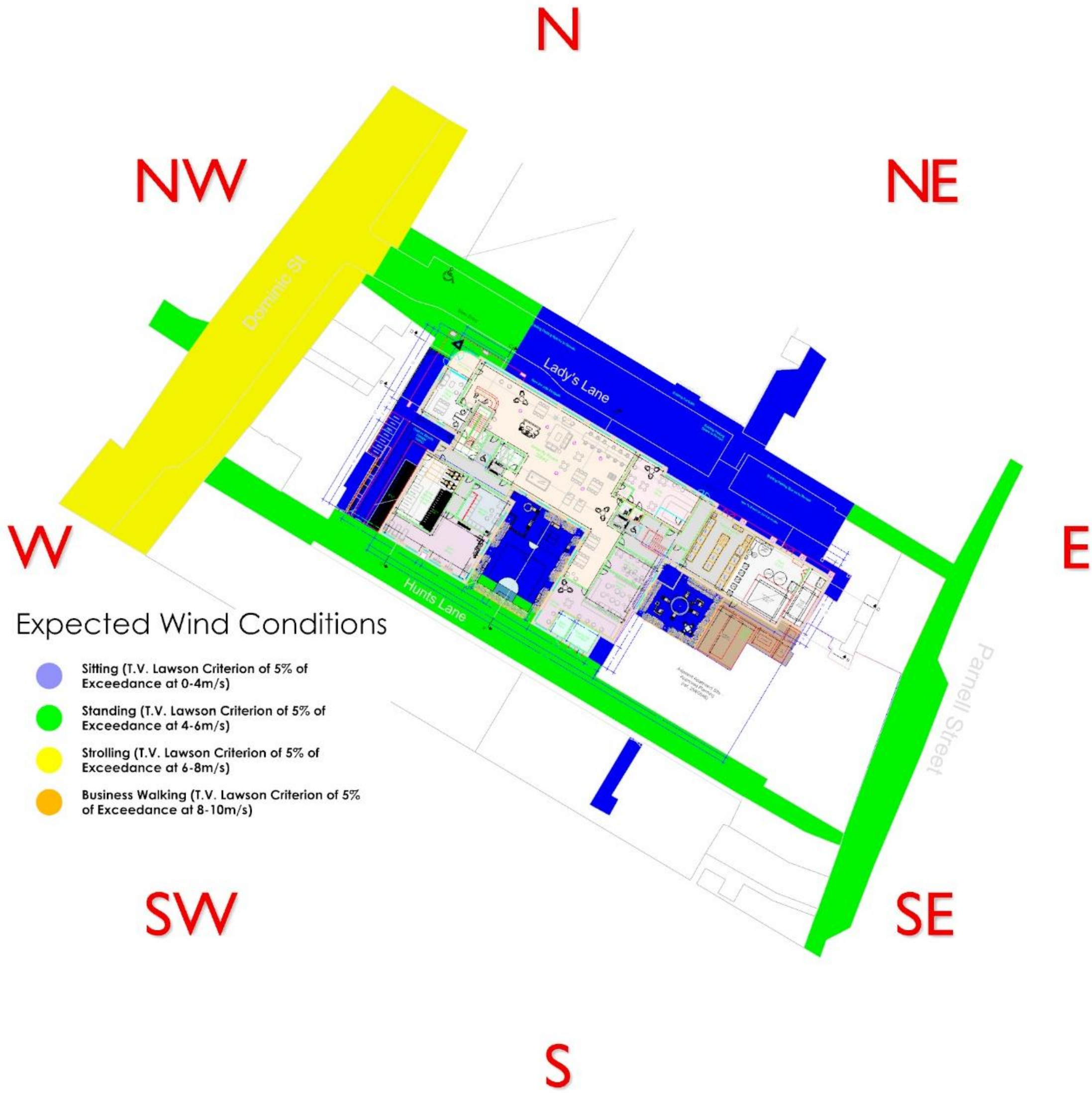


Figure 3a: Expected Wind Conditions within and around the proposed development (Winter/Worst Season) – Ground Level

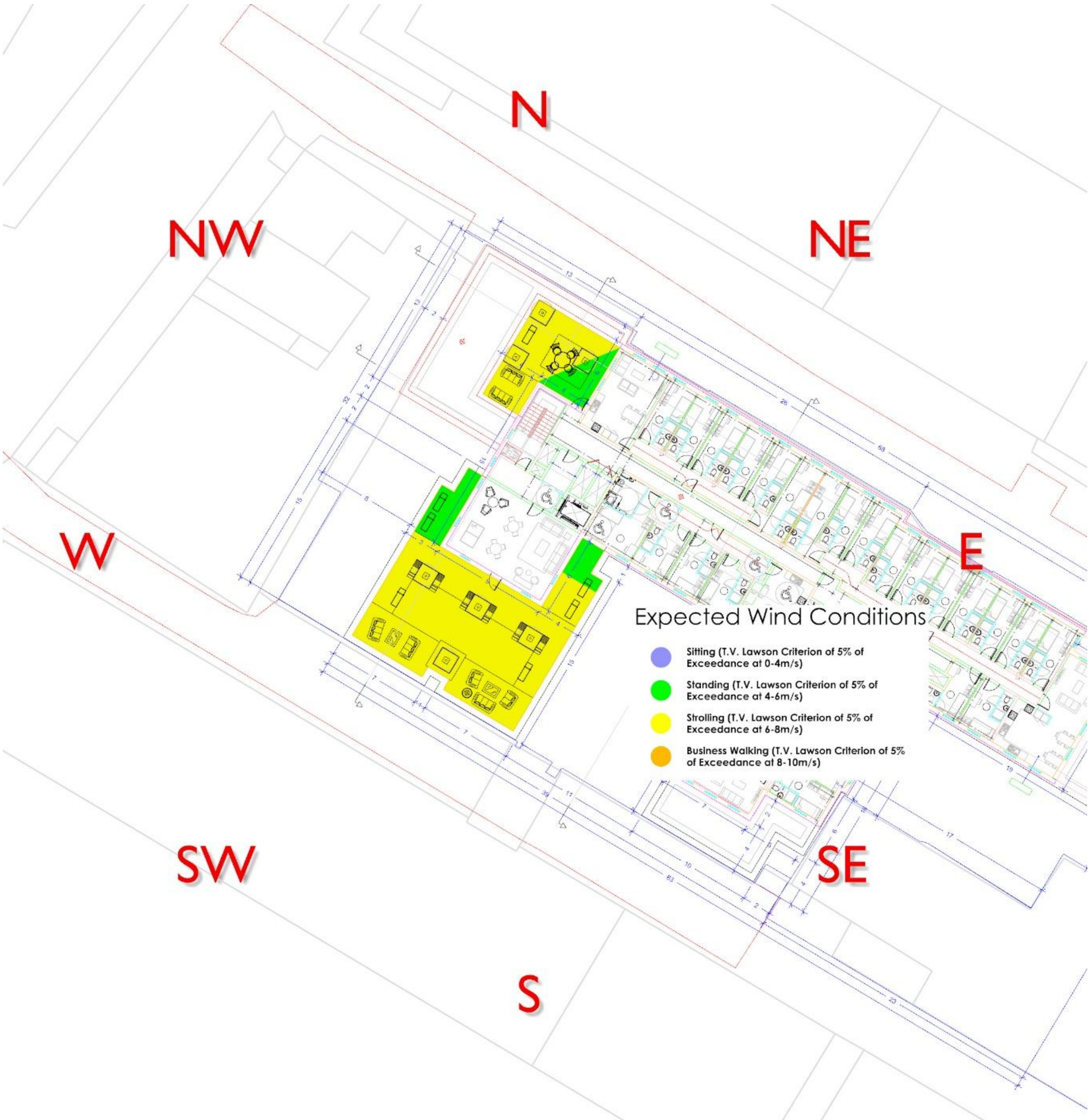


Figure 3b: Expected Wind Conditions within and around the proposed development (Summer/Best Season) – Level 7, Terraces

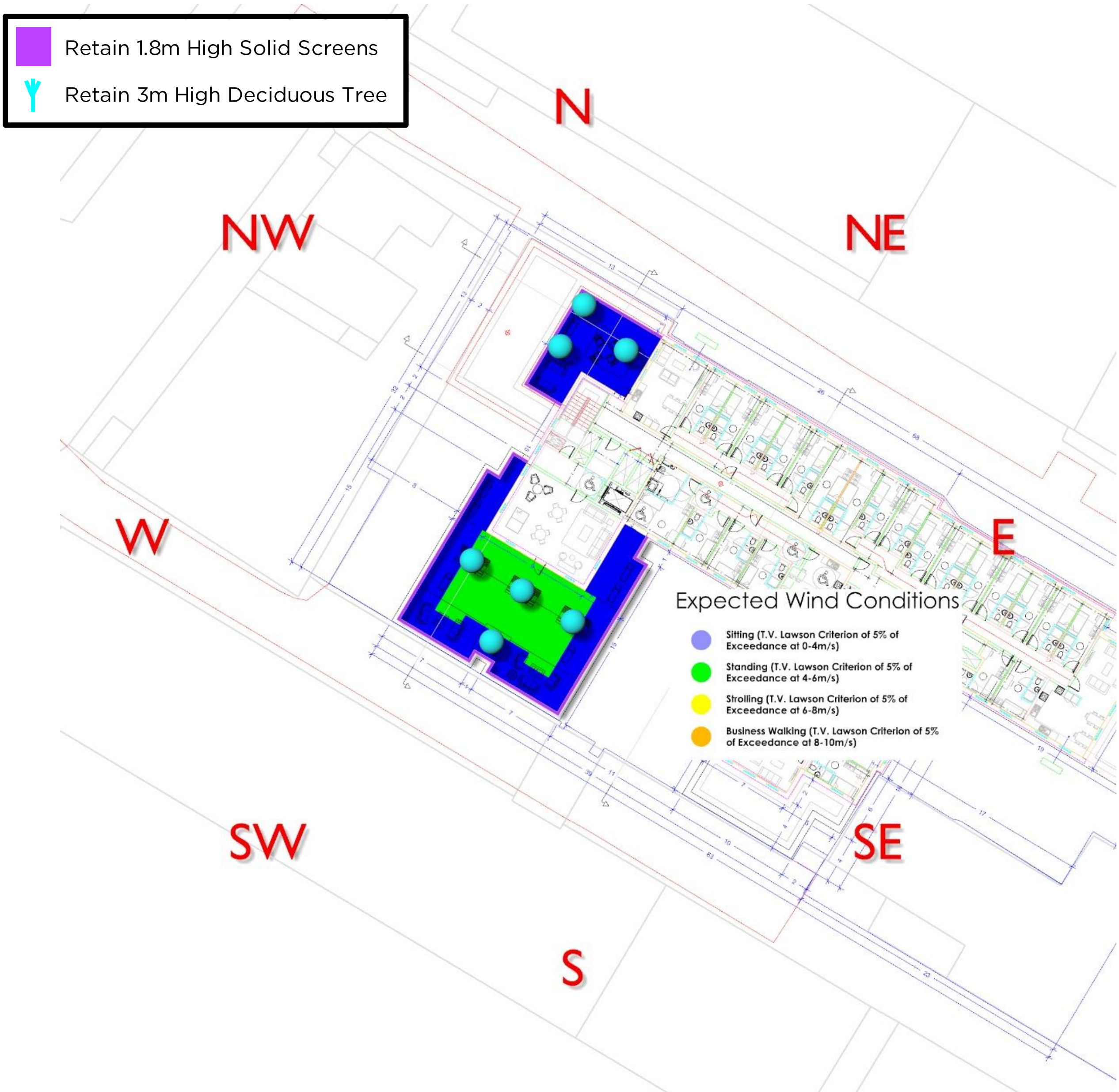


Figure 3c: Expected Wind Conditions within and around the proposed development with mitigation (Summer/Best Season) – Level 7, Terraces

5.1.1 Ground Level

Wind conditions at ground level within the proposed development site and surroundings are expected to be safe, in terms of pedestrian safety, for all users throughout the year.

At the site, wind funnelling is likely to occur along Dominic Street and downdrafts are expected to occur on the southern façade of the proposed development which could lead to funnelling along Hunts Lane. Lady's Lane is expected to be predominantly well sheltered in the wake of the proposed development for the predominant wind direction.

The wind conditions at all thoroughfares within the proposed development site are expected to be suitable for the intended pedestrian and cyclist activities throughout the entire year.

5.1.1.1 Entrances

The wind conditions outside the entrances of the proposed development are expected to be suitable for entrance use throughout the year.

5.1.1.2 Surrounds

The addition of the proposed development is expected to somewhat alter the wind conditions within the local surroundings. Nonetheless, wind conditions for all pedestrian thoroughfares around the subject development site are expected to be suitable for the intended pedestrian activities throughout the year. Furthermore, with the addition of the proposed development, wind conditions on the roads are expected to remain suitable for cyclist use throughout the year.

The wind conditions in the far-field areas of the site are mostly expected to be the same as the wind conditions that occur for the existing scenario.

5.1.1.3 Terraces and Terrace Seating areas

The wind conditions on the rooftop terraces and terrace seating areas are expected to be unsuitable for intended use in some areas during the summer season. The terraces are located at the northern and western corners of the development. Their location exposes them to the prevailing wind direction. It is anticipated that accelerations will occur at the northern and western corners.

It is expected that with the retention of the proposed 1.8m high solid screens and the retention of the proposed roof level trees the wind conditions will be suitable for the intended sitting use in proximity to the balustrade and standing anywhere beyond 2m away.

APPENDIX A REFERENCES

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Lawson, T.V., 1973, "The wind environment of buildings: a logical approach to the establishment of criteria". Bristol University, Department of Aeronautical Engineering.

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APPENDIX B WIND EFFECTS GLOSSARY

B.1 Downwash and Upwash Effects

The downwash wind effect occurs when wind is deflected down the windward face of a building, causing accelerated winds at pedestrian level. This can lead to other adverse effects as corner acceleration as the wind attempts to flow around the building, as seen in Figure B.1.

This can also lead to recirculating flow in the presence of a shorter upstream building, causing local ground level winds to move back into the prevailing wind.

The upwash effect occurs near upper level edge of a building form as the wind flows over the top of the building. This has the potential to cause acceleration of winds near the leading edge, as well as potentially reattaching onto the roof area. This effect causes wind issues particularly near the leading edges of tall building and on the rooftop areas if there is sufficient depth along the wind direction. Upwash is more apparent in taller towers and podia.

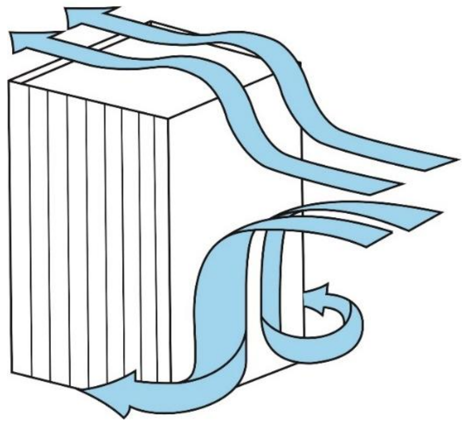

Figure B.1: Downwash Leading to Corner Wind Effect, and Upwash Effects

B.2 Funnelling/Venturi Effect

Funnelling occurs when the wind interacts with two or more buildings which are located adjacent to each other, which results in a bottleneck, as shown in Figure B.2. This causes the wind to be accelerated through the gap between the buildings, resulting in adverse wind conditions and pedestrian discomfort within the constricted space. Funnelling effects are common along pedestrian links and thoroughfares generally located between neighbouring buildings that have moderate gaps between them.

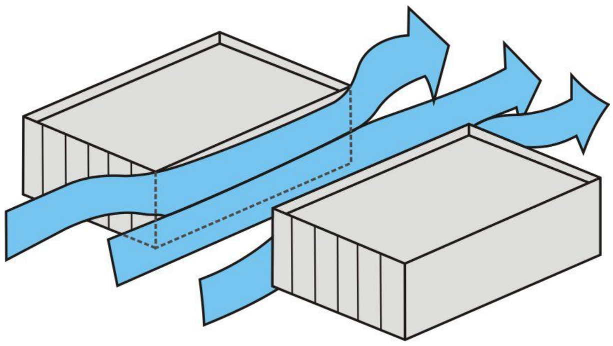

Figure B.2: Funnelling/Venturi Wind Effect

B.3 Gap Effect

The gap effect occurs in small openings in the façade that are open to wind on opposite faces, as seen in Figure B.3. This can involve a combination of funnelling and downwash effects. Presenting a small gap in the façade on the windward aspect as the easiest means through which the wind can flow through can result in wind acceleration through this gap. The pressure difference between the windward façade and the leeward façade also tends to exacerbate the wind flow through this gap.

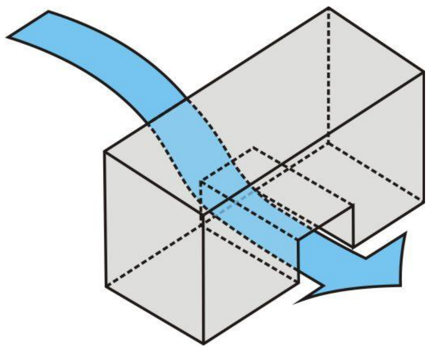

Figure B.3: Gap Wind Effect

B.4 Sidestream and Corner Effects

The sidestream effect is due to a gradual accumulation of wind shearing along the building façade that eventuates in an acceleration corner effect. The flow is parallel to the façade and can be exacerbated by downwash effects as well, or due to corner effect winds reattaching on the façade.

This is shown in Figure B.4. The corner refers to the acceleration of wind at the exterior vertical edge of a building, caused by the interaction of a large building massing with the incident wind, with the flow at the corner being accelerated due to high pressure differentials sets up between the windward façade and the orthogonal aspects. It can be further exacerbated by downwash effects that build up as the flow shears down the façade.

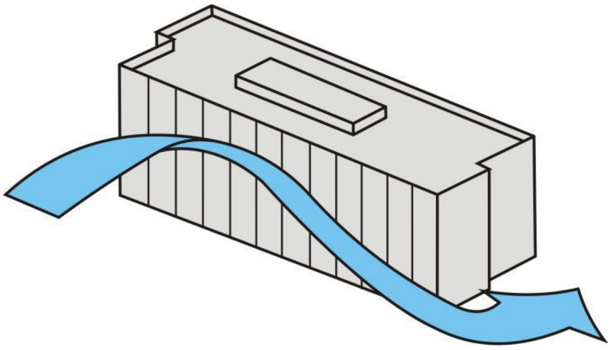

Figure B.4: Sidestream and Corner Wind Effect

B.5 Stagnation

Stagnation in a region refers to an area where the wind velocity is significantly reduced due to the effect of the flow being impeded by the bluff body. For a particular prevailing wind direction, this is typically located near the middle of the windward face of the building form or over a short distance in front of the windward face of a screen or fence. Concave building shapes tend to create an area of stagnation within the cavity, and wind speeds are generally low in these areas.