CHAPTER SIXTEEN MICROCLIMATE – PEDESTRIAN WIND COMFORT AND DISTRESS

16.1 INTRODUCTION

IES Consulting have undertaken an analysis to assess the potential impact of wind having regard to the proposed development as described in Chapter 2.0.

An understanding of the suitability of external comfort is necessary to ensure amenity spaces are optimally designed and located to maximise their function throughout the year, which includes alleviating the effects of flow around nearby high-rise buildings.

There are two typical cases of air acceleration as it moves through a built environment. First, when the wind impinges on the face of the building, it slows down and the pressure increases. This high-pressure air will tend to move towards low-pressure areas, which exist at the base and top of the building. This sudden acceleration of air produces downwash and upwash, which can lead to uncomfortable conditions for pedestrians near the foot of the building, as well as occupants on high-level balconies and terraces.

Further, the effect can be compounded by the second effect, which is the acceleration in the space between the buildings. When air moves from an open environment into a built area, the area available for flow decreases. Consequently, the air speed increases to compensate. This can also lead to gusts, which are primarily experienced by pedestrians walking between the buildings.

16.2 ASSESSMENT METHODOLOGY

16.2.1 Lawson Pedestrian Comfort/Safety Criteria

An assessment has been carried out in accordance with Lawson's Pedestrian Comfort and Safety Criterion[1]. This is the most widely used reference for assessing pedestrian comfort, and is considered a best practice. It considers the air speed at the location as well as the frequency of the occurrence of this air speed. It consists of two assessment criteria:

- The first criteria assess whether the air movement will be comfortable for the pedestrian for different types of activities (Table 16.1).
- The second criteria assess the feeling of safety or distress by the pedestrian at higher air speeds (Table 16.2).

The following table gives the values for Lawson's pedestrian comfort assessment criteria for various activities.

Table 16. 1: Lawson's Pedestrian Comfort Assessment Criteria

Category	Pedestrian Activity	Threshold mean hourly wind speed not to be exceeded for more than 5% of the year (m/s)
C1	Business Walking	10
C2	Leisurely Walking	8
C3	Standing	6
C4	Sitting	4

The following table gives the values for Lawson's Pedestrian Safety Assessment criteria.

Table 16.2: Lawson's Pedestrian Safety Assessment Criteria

Category	Pedestrian Type	Threshold mean hourly wind speed not to be exceeded more than once per annum[2](m/s)
S1	Typical Pedestrian	20
S2	Sensitive Pedestrian	15

[1]T. V. Lawson (2001) *Building Aerodynamics*, Imperial College Press, London.
[2]Once per annum means the safety threshold is not exceeded 0.01% of the year.

16.2.2 Simulation Methodology

The methodology for the analysis was as follows:

1) The annual mean wind speed was determined from the 'IRL_ST_Shannon.AP.039620_TMYx.2009-2023' (epw)[3] weather file.

2) The site is 18.8km away from the Casement weather station.

3) 8 steady state Computational Fluid Dynamics (CFD) simulations were performed corresponding to the 8 directions – SW, W, NW, N, NE, E, SE and S, respectively.

4) The local air speed at various designated locations selected based on review of landscape and overall design, around the site, was recorded for each of the simulations.

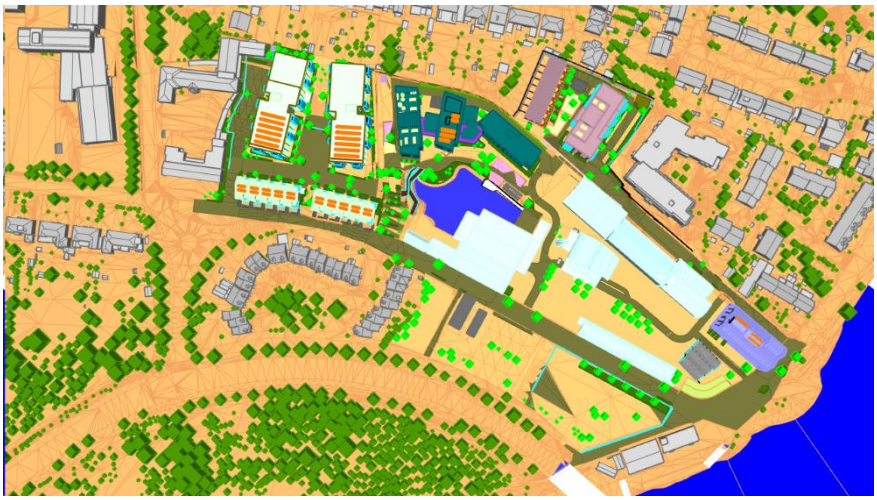
5) This local air speed was compared to the meteorological wind speed used, and the magnification factor at that location for the corresponding wind direction was determined.

6) The magnification factor was used to determine the air speed at the designated locations for the various recorded values of the wind speed and direction in the weather file, thus generating the local air speeds at designated locations for a year.

7) These recorded values were compared to the Lawson Pedestrian Comfort/Safety Criteria.

16.2.3 Orientation

The model orientation has been taken from drawings provided by the Architect, with the resulting angle shown below used in the analysis.

Orientation	
	
	

16.2.4 Model Geometry

Figures 16.1 to 16.14 show the geometry as modelled.

Figure 16.1: Plan view of the full site

Figure 16.2: View of the full site from the south

Figure 16.3: View of the full site from the west

Figure 16.4: View of the full site from the north

Figure 16.5: View of the full site from the east

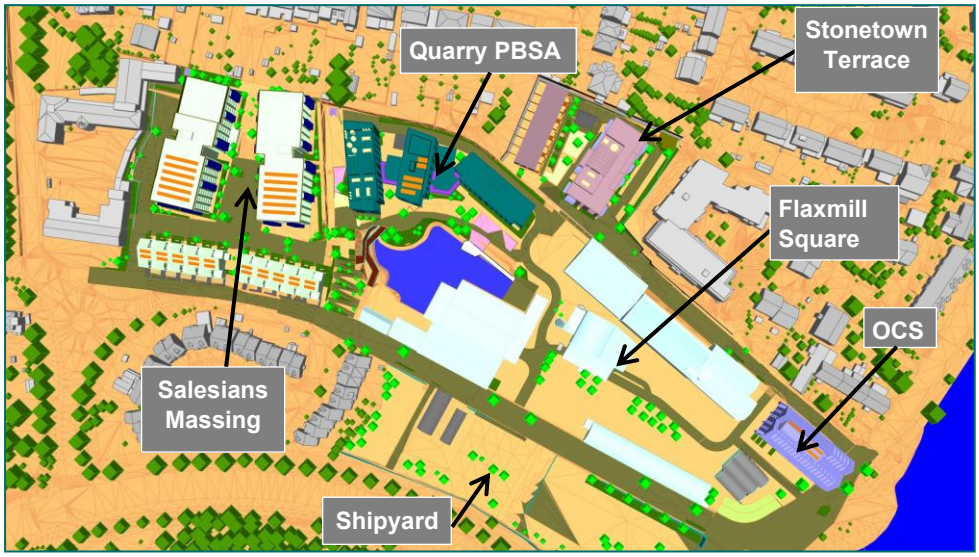


Figure 16.6: View of the Cleeves site from the top

Figure 16.7: View of the Salesians Massing and Quarry PBSA from the southwest

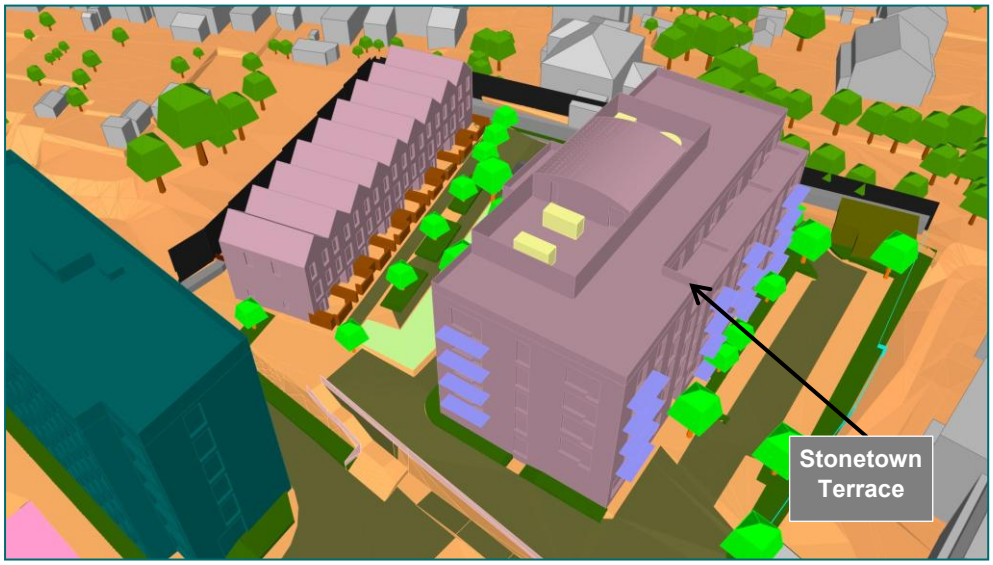


Figure 16.8: View of the Stonetown Terrace from the southeast

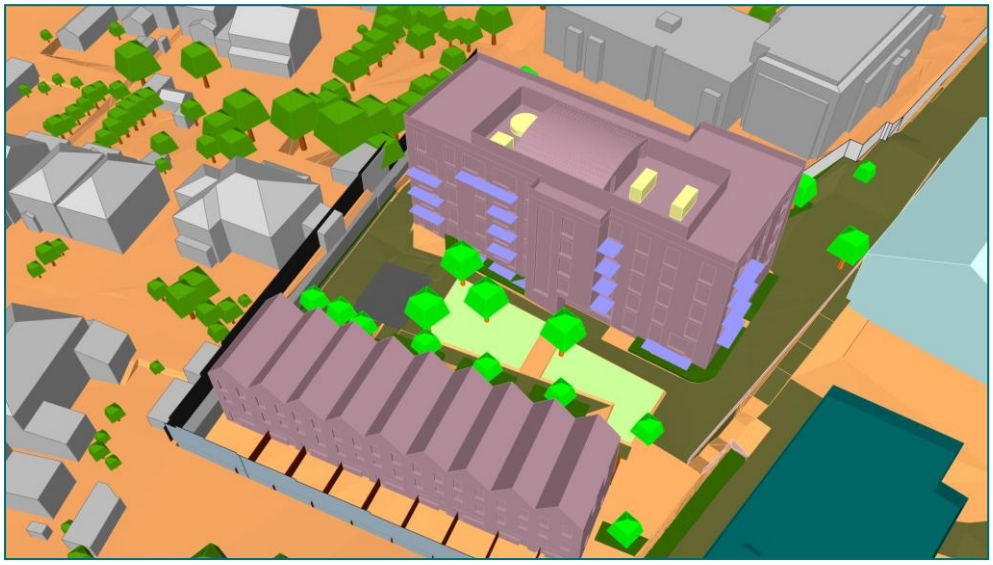


Figure 16.9: Closer view of the Stonetown Terrace block from the southwest

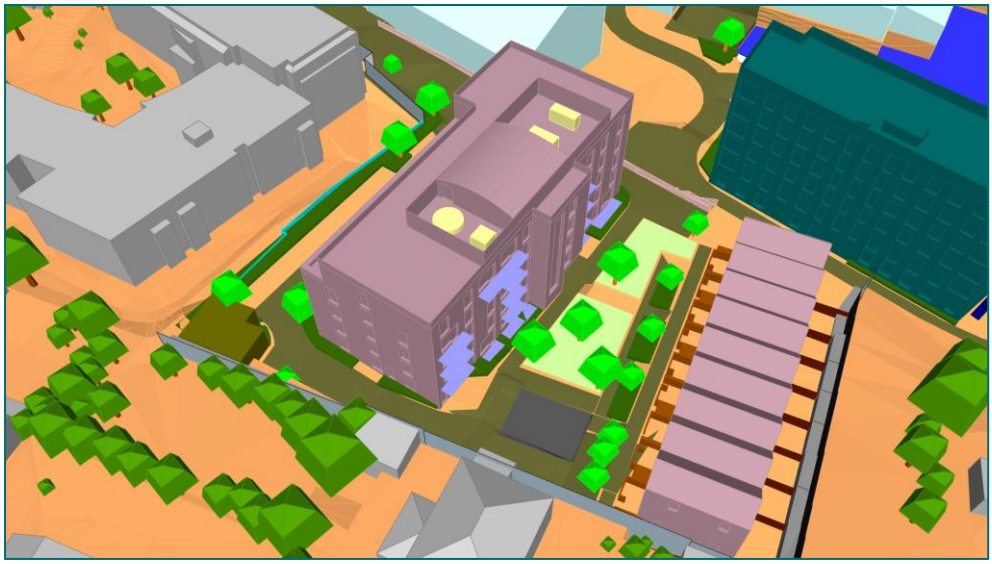


Figure 16.10: View of the Stonetown Terrace from the north

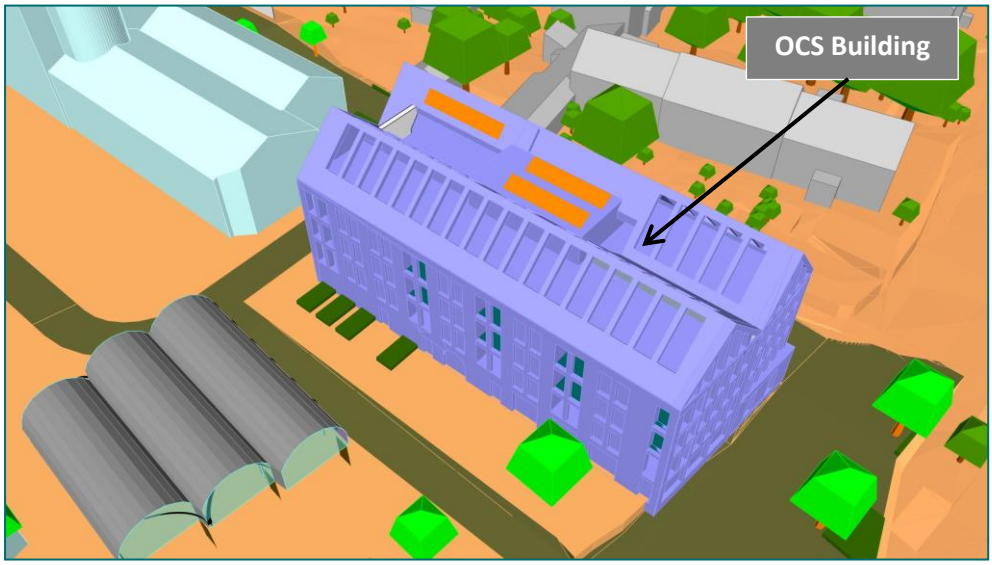


Figure 16.11: Closer view of the O'Callaghan Strand

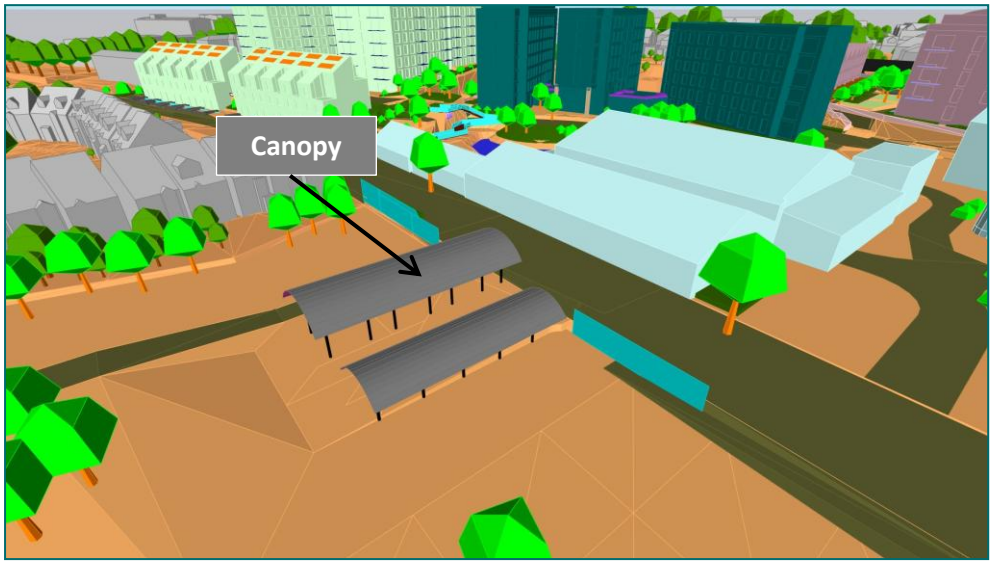


Figure 16.12: View of the Canopy on the Shipyard

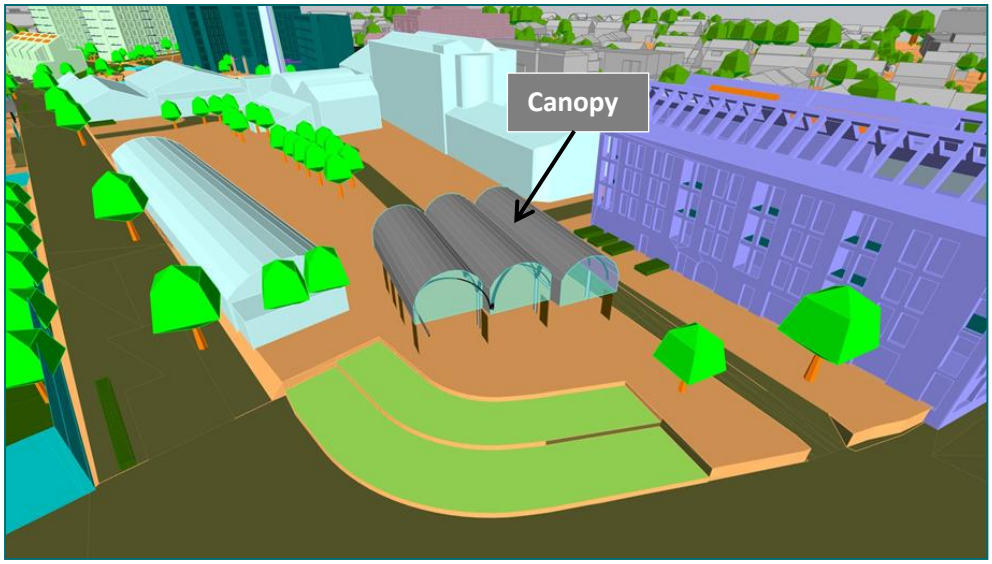


Figure 16.13: View of the Seating spaces near the Riverfront

Figure 16.14: View of the Flaxmill Square

16.3 EXISTING RECEIVING ENVIRONMENT

16.3.1 Masterplan Site

The closest weather station is located at Shannon Airport, about 20km away, situated west of the subject site. Shannon Airport weather data are used for the analysis(see Figure 16.15).

Figure 16.15: Site location from the weather station

The baseline environment is the same for both the Masterplan Site and the Application Site.

The details of the Shannon Airport weather data used for the analysis are given in the following section 16.3.2.

16.3.2 Application Site

16.3.2.1 Weather Data

The analysis is based on the 'IRL_ST_Shannon.AP.039620_TMYx.2009-2023.epw'[3] weather file. It is a weather file created from statistical analysis of weather data for the years 2009-2023 to reflect a typical year. The variation of wind speed recorded in the weather file is shown in Figure 16.16 below. Figure 16.17 shows the wind direction variation, and Figure 16.18 shows the wind rose.

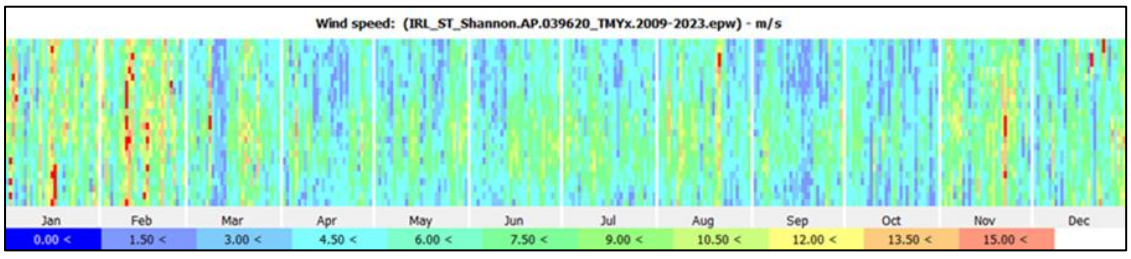


Figure 16.16: Wind speed variation

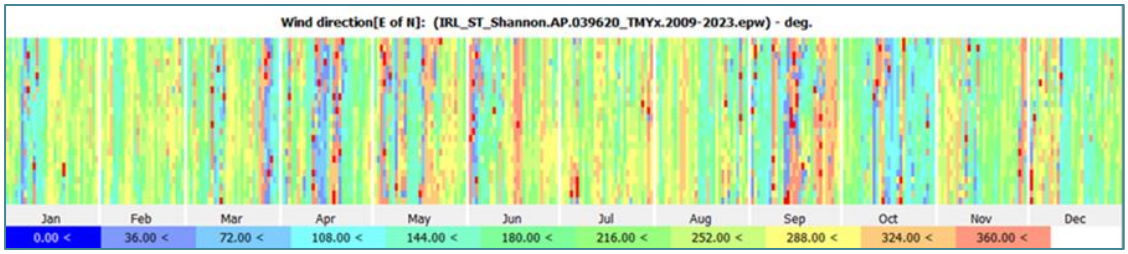


Figure 16.17: Wind direction variation

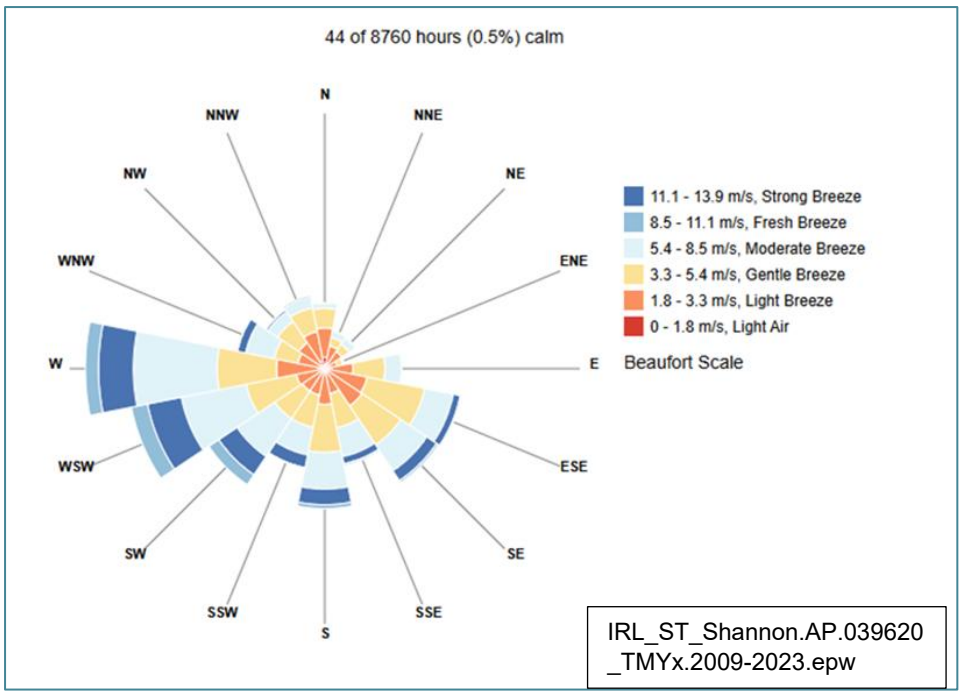


Figure 16.18: Wind rose

Based on this, the mean annual wind speed recorded was **5.3m/s** with a westerly prevailing direction.

16.3.2.2 Weather Statistics

Based on this, the mean and median wind speed recorded was 5 m/s with a westerly prevailing direction. That means, for 50% of the year, the wind speed is higher than 5 m/s. The Lawson's sitting comfort criteria, seen in Table 16.1, states that the local air speed at designated locations should not exceed 4 m/s for more than 5% of the year (equivalent to a cumulative period of 18 days). The Lawson's standing comfort criteria state that the local air speed at designated locations should not exceed 6 m/s for more than 5% of the year.

16.3.2.3 Wind Boundary Layer

In an atmospheric boundary layer, wind speed increases with height due to the influence of surface roughness, such as the presence of buildings, trees, roads, etc., on the ground (see Figure 16.19).

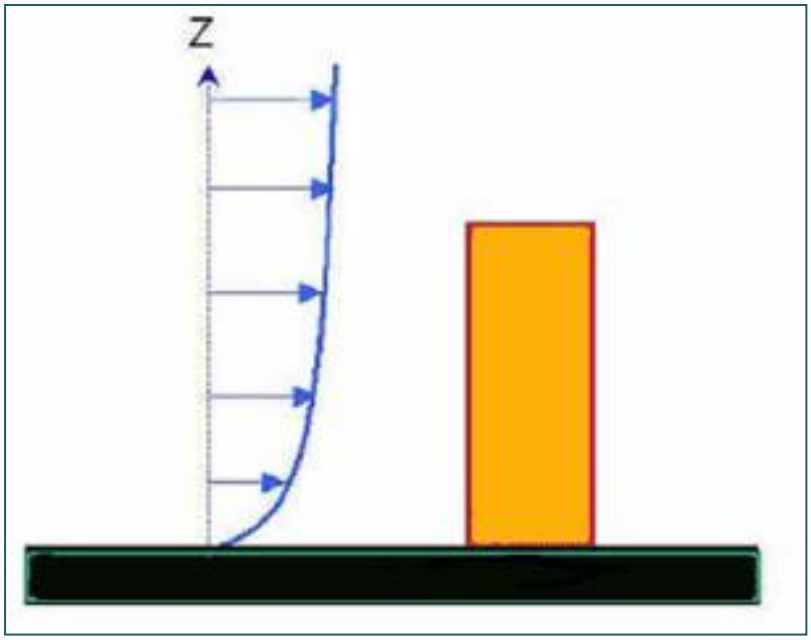


Figure 16.19: Typical velocity profile of an atmospheric boundary layer

In the current CFD modelling, the velocity profile was generated according to the parameterised ASHRAE methodology described below. This allows for different wind profiles across various terrain types, including open country, urban, and city centre.

The wind speed UH at height H above the ground is given by:

$$U_H = U_{met}\left(\frac{\delta_{met}}{H_{met}}\right)^{a_{met}}\left(\frac{H}{\delta}\right)^{a} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (Eq.1)$$

Where,

a = Exponent in power law wind speed profile for local building terrain
δ = fully developed strong wind atmospheric boundary layer thickness (m)

$\mathbf{a_{met}}$ = Exponent for the meteorological station
$\mathbf{\delta_{met}}$ = Atmospheric boundary thickness at the meteorological station (m)
$\mathbf{H_{met}}$ = Height at which meteorological wind speed was measured (m)
$\mathbf{U_{met}}$ = Hourly meteorological wind speed, measured at height $\mathbf{H_{met}}$ (m/s)

The parameters for different types of terrain are given in Table 16.3 below.

Table 16.3: Terrain Wind Parameters

Terrain Category	Description	a	δ
1	Large city centres 50% of buildings above 21m over a distance of at least 2000m upwind.	0.33	460
2	Urban, suburban, wooded areas.	0.22	370
3	Open, with scattered objects generally less than 10m high.	0.14	270

4	Flat, unobstructed areas exposed to wind flowing over a large water body (no more than 500m inland).	0.10	210

For the current analysis, we used the atmospheric boundary layer corresponding to the terrain category 2, i.e., a suburban-type site. The met data was taken on category 3 terrain at a height of 10m.

16.4 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

16.4.1 Masterplan Site

The proposed application site (Phase II) is part of a phased development proposal for a significant city centre, regeneration area or Masterplan Site (MS). This MS is divided into four different phases of delivery as detailed in Section 1.6.3 in Chapter 1.0 Introduction. The overall MS layout, which illustrates the indicative layout of the subject site and adjoining lands in the ownership of the applicant, is displayed in Figure 1.4 in Chapter 1.0, and full details of the phases are given in Chapter 2.0, Section 2.2.4. In addition to an in-depth assessment of the Proposed Development, this assessment takes a holistic approach and examines the wider MS area, taking into account the proposed future phases of development based on the available information.

The simulations were not carried out for the entire Masterplan development. Simulations can only be carried out where detailed design of buildings and landscaping is available. Such simulations will be undertaken at each future phase of development is advanced in accordance with the principles of the Masterplan.

16.4.2 Application Site

The proposed development provides for the (A) Demolition of a number of structures to facilitate development and (B) Construction and phased delivery of (i) buildings within the site ranging in height from 3 – 7 stories (with screened plant at roof level) including (a) 234 no. residential units; (b) 270 no. student bedspaces (PBSA) with ancillary resident services at ground floor level; (c) 299sqm of commercial floorspace; and (d) a creche; (ii) extensive public realm works, riverside canopy and heritage interpretative panels (iv) 3 no. dedicated bat houses; (v) Mobility Hub with canopy; and (vi) all ancillary site development works including (a) water services, foul and surface water drainage and associated connections across the site and serving each development zone; (b) attenuation measures; (c) raising the level of North Circular Road; (d) car and bicycle parking; (e) public lighting; (f) telecommunication antennae and (g) all landscaping works. Consent is also sought for use of the PBSA accommodation, outside of student term time, for short-term letting purposes.

Within the proposed development, it is proposed to sequence the delivery of residential zones as detailed in Section 2.6.1 of Chapter 2.0.

16.5 LIKELIHOOD OF SIGNIFICANT EFFECTS

16.5.1 Construction Effects

16.5.1.1 Masterplan Site

The construction phase of the works lasts only a short time as compared to the lifetime of the development. The physical make-up of the site changes very rapidly as the construction proceeds. During the construction phases, the people on the site are well-trained to carry out tasks in a harsher environment than the likely occupants of the development post construction. The construction workers are also equipped with safety equipment to carry out such tasks. That is why the simulation for the construction phase of the development was not carried out. Typically, hoardings 2m to 3m high will be installed around the site during construction. These hoardings will obstruct the wind, protecting the workers by deflecting it away from the workers at ground level.

16.5.3 Operational Effects

Only Phase 2, as an application site within the masterplan development, was analysed for the wind Microclimate study. There are no adverse effects of wind on the site. The results are detailed in Section 16.5.3.1 and 16.5.3.2.

16.5.3.1 Sitting and Standing Comfort Results

The Lawson's Sitting Comfort Criterion states that the local air speed at designated locations should not exceed 4 m/s for more than 5% of the year. The Lawson's Standing Comfort Criterion states that the local air speed at designated locations should not exceed 6 m/s for more than 5% of the year analysed. The assessment was carried out for a typical year and is most representative of the general conditions.

Overall Site

Figure 16.21 and Figure 16.22 illustrate Lawson's Sitting and Standing Comfort Criteria results for the amenities designed at various locations throughout the site. The results meet the requirements of Lawson's Sitting and Standing Comfort Criterion for the full year. The wind speed is generally lower than 4m/s and 6m/s for more than 95% of the year as per the criteria's requirement.

Some of the locations visible in yellow and orange colour contours on the riverfront showed limited compliance with the requirements of Lawson's Sitting Comfort Criterion. The local air speed is likely to exceed 4m/s for up to 50% of the year at these locations. This space was affected due to the prevailing winds.

When comparing the results for these locations to Lawson's Standing Comfort Criterion results, they demonstrate excellent compliance, i.e., the local air speed does not exceed 6 m/s for more than 5% of the year, see Figure 16.22. Of the 20% of the year when the local air speed exceeds 4m/s, three-quarters of that collective time (i.e. 15% of the year), it does not exceed 6m/s. The local air speed in these spaces will be less than 4 m/s for 80% of the year and between 4 and 6 m/s for 15% of the year.

Any exceedance noted is considered very marginal, and it will not lead to an environment which is unpleasant to use. The local air speed is only going to be greater than a gentle breeze, but frequently less than a moderate breeze. Such conditions are unlikely to affect the usability of this space for personal recreation.
The majority of this space is designed for the standing and walking activities, for which the results fully meet the requirements of Lawson's Standing and Walking Comfort Criteria.

There are no significant adverse effects of wind on the site. No mitigation measures are recommended.

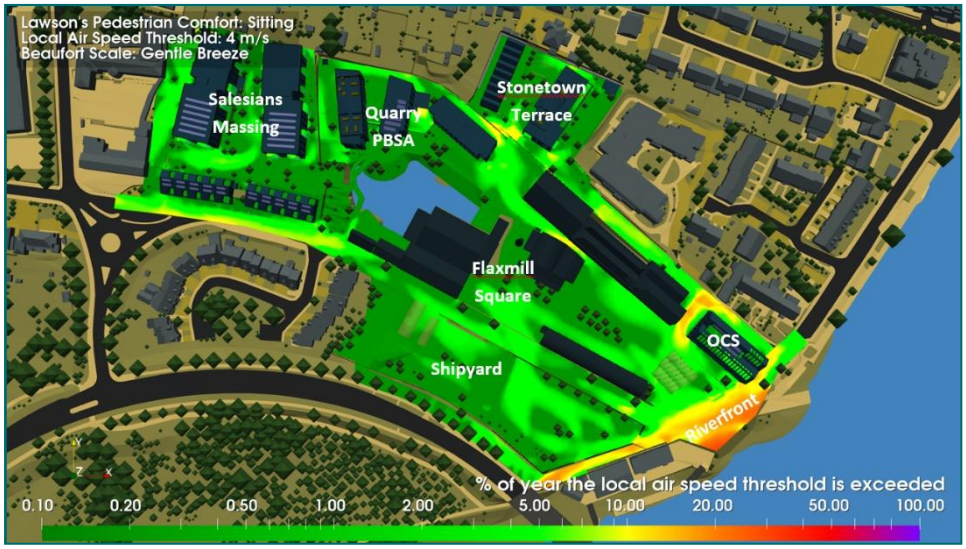


Figure 16.21: Sitting Comfort Criterion: Ground Amenities: Overall Site

Figure 16.22: Standing Comfort Criterion: Ground Amenities: Overall Site

Salesians Massing

Figures 16.23 to 16.32 illustrate Lawson's Sitting and Standing Comfort Criteria results on the following amenities within the Salesians Massing.

- All Balconies
- Communal Garden Space
- Nursery Play Space
- Play Area
- Viewing Area

The results fully meet the requirements of Lawson's Sitting and Standing Comfort Criterion for the full year. The local air speed does not exceed 4m/s and 6m/s for more than 5% of the year as per the criterion's requirement.

There are no significant adverse effects of wind on the site. No mitigation measures are recommended.

Figure 16.23: Sitting Comfort Criterion: Salesians Massing: Balconies: View from the southeast

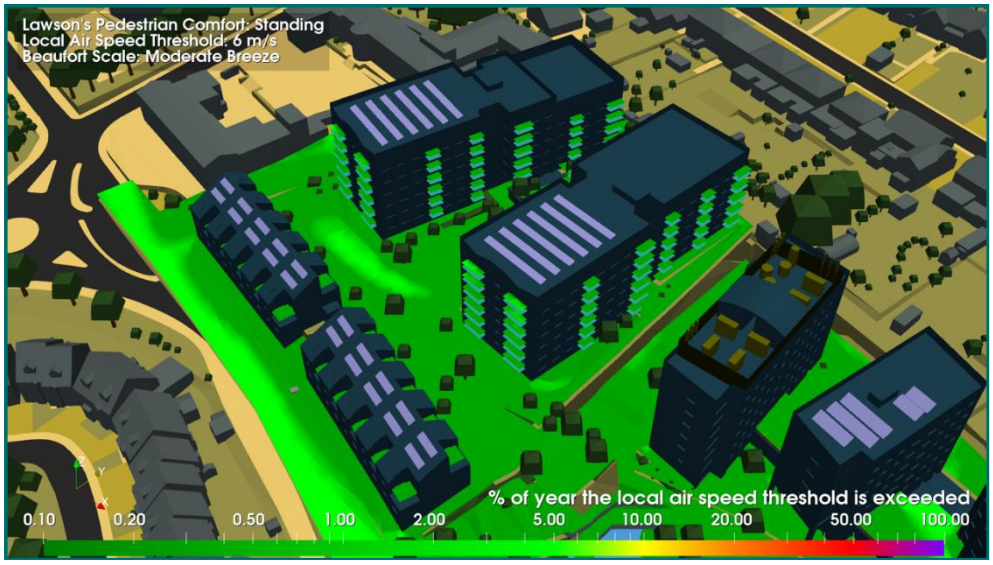


Figure 16.24: Standing Comfort Criterion: Salesians Massing: Balconies: View from the southeast

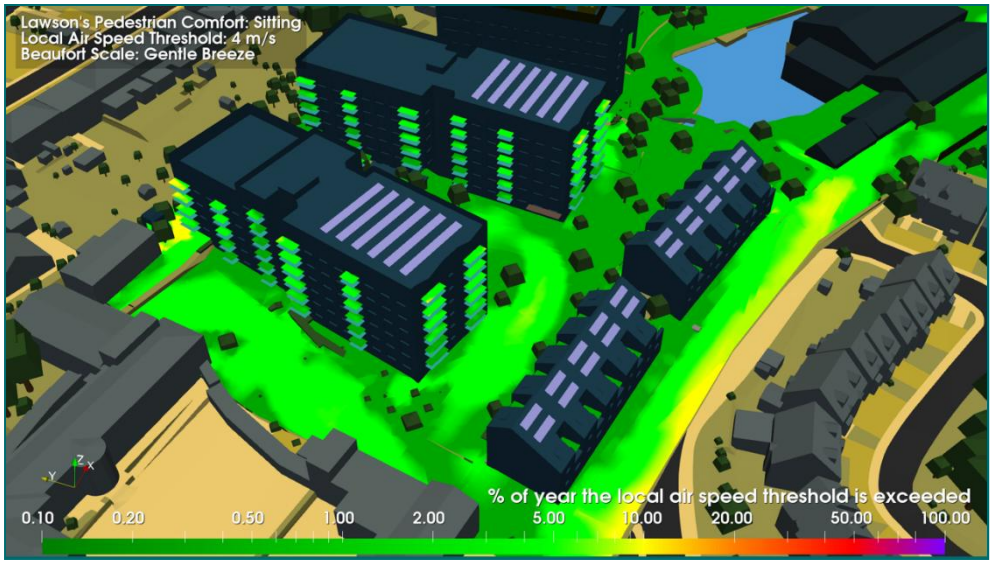


Figure 16.25: Sitting Comfort Criterion: Salesians Massing: Balconies: View from the southwest

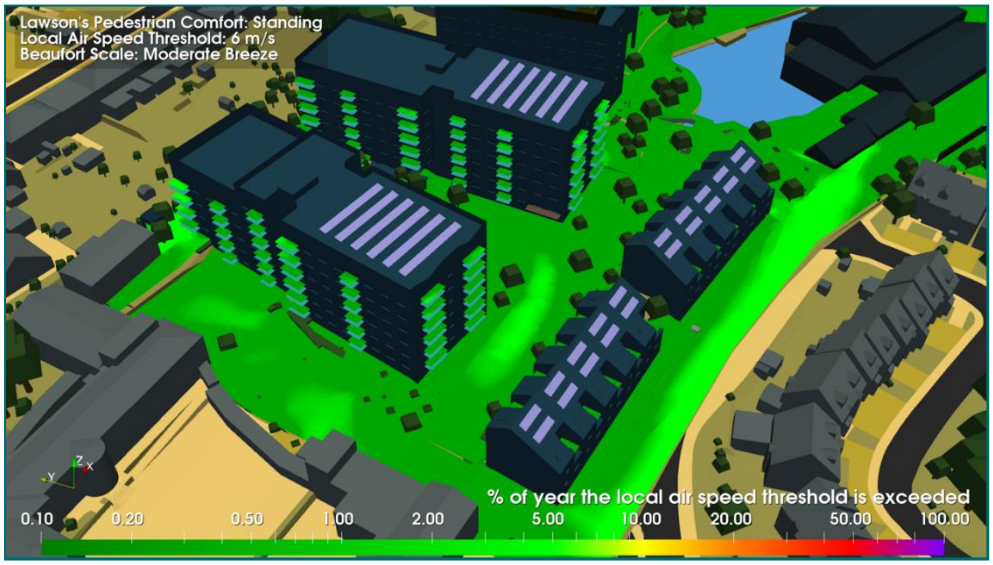


Figure 16.26: Standing Comfort Criterion: Salesians Massing: Balconies: View from the southwest

Figure 16.27: Sitting Comfort Criterion: Salesians Massing: Balconies: View from the top

Figure 16.28: Standing Comfort Criterion: Salesians Massing: Balconies: View from the top

Figure 16.29: Sitting Comfort Criterion: Salesians Massing: Ground Amenities

Figure 16.30: Standing Comfort Criterion: Salesians Massing: Ground Amenities

Figure 16.31: Sitting Comfort Criterion: Salesians Massing: Viewing Area

Figure 16.32: Standing Comfort Criterion: Salesians Massing: Viewing Area

Quarry and Reservoir

Figures 16.33 to 16.36 illustrate Lawson's Sitting and Standing Comfort Criteria results on the following amenities within the Quarry PBSA Site.

- Fitness Court
- Rock Climbing Area
- View Terrace
- Amenities in front of the Reservoir

The results meet the requirements of Lawson's Sitting and Standing Comfort Criterion for the full year. The local air speed does not exceed 4m/s and 6m/s for more than 5% of the year as per the criterion's requirement.

There are no significant adverse effects of wind on the site. No mitigation measures are recommended.

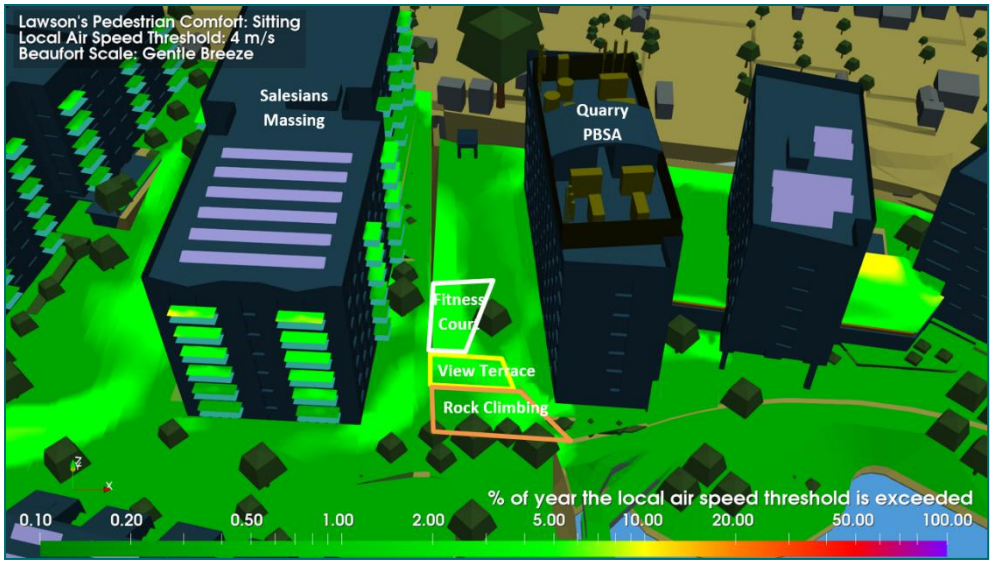


Figure 16.33: Sitting Comfort Criterion: Quarry PBSA: Ground Amenities

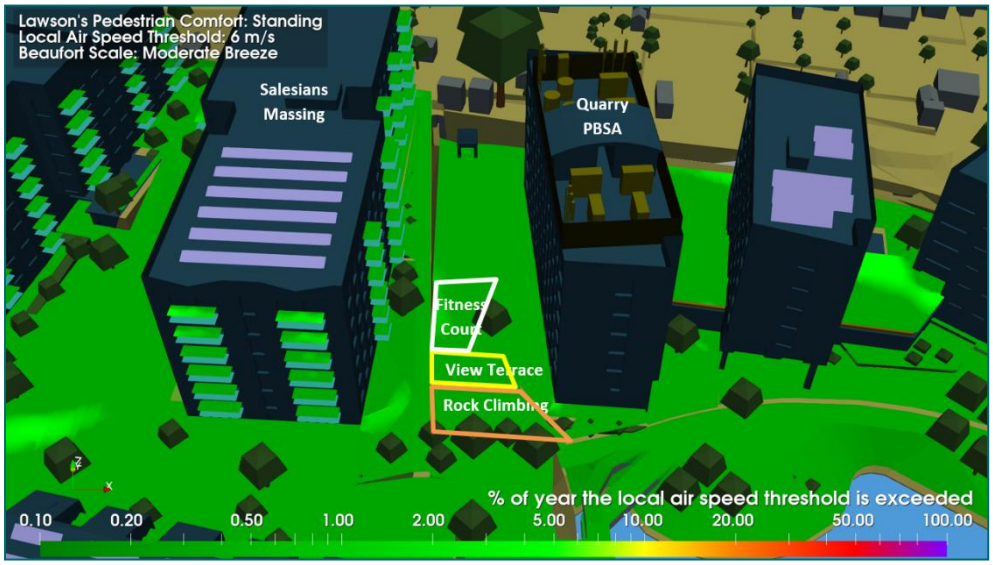


Figure 16.34: Standing Comfort Criterion: Quarry PBSA: Ground Amenities

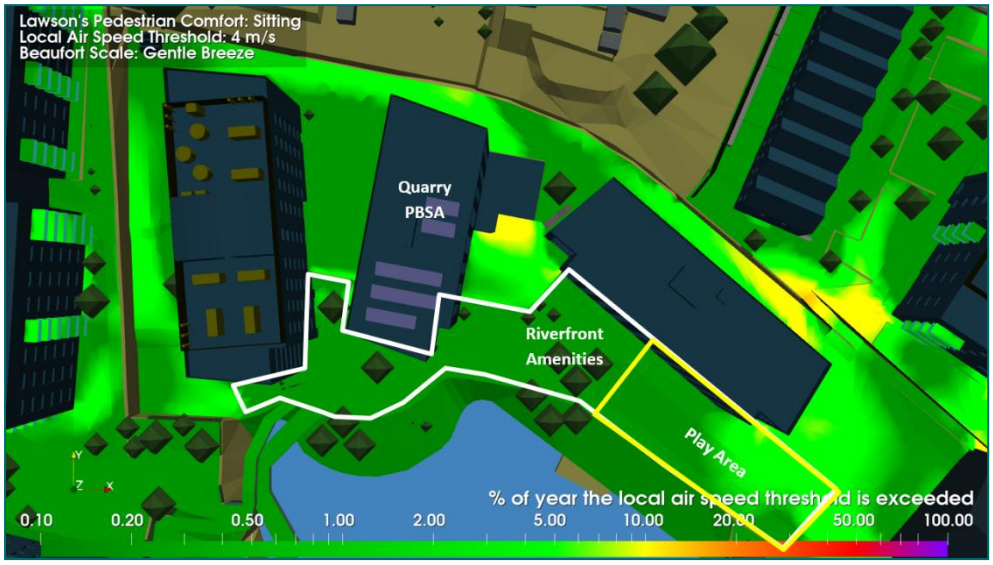


Figure 16.35: Sitting Comfort Criterion: Quarry PBSA: Amenities in front of the Reservoir

Figure 16.36: Standing Comfort Criterion: Quarry PBSA: Amenities in front of the Reservoir

A portion of the podium space, visible in yellow contouring in Figure 16.37, showed exceedance of the requirements of Lawson's Sitting Comfort Criterion. The local air speed is likely to exceed 4m/s for up to 10% of the year at these locations. This space was affected due to the prevailing southwesterly and westerly winds.

When considering the Lawson's Standing Comfort Criterion results, these locations demonstrate excellent compliance, i.e., the local air speed does not exceed 6 m/s for more than 5% of the year, see Figure 16.38. Of the 10% of the year when the local air speed exceeds 4m/s, half of that collective time (i.e. 5% of the year) does not exceed 6m/s. The local air speed on this portion will be less than 4 m/s for 90% of the year and between 4 and 6 m/s for 5% of the year. The local air speed is only going to be greater than a gentle breeze, but frequently less than a moderate breeze. Such conditions are unlikely to have any impact on the usability of this space for personal recreation.

The results visible in green colour contouring meet the requirements of Lawson's Sitting and Standing Comfort Criterion for the full year. The local air speed does not exceed 4m/s and 6m/s for more than 5% of the year as per the criterion's requirement.

There are no significant adverse effects of wind on the site. No mitigation measures are recommended.

Figure 16.37: Sitting Comfort Criterion: Quarry PBSA: Podium

Figure 16.38: Sitting Comfort Criterion: Quarry PBSA: Podium

Stonetown Terrace

Figures 16.39 to 16.44 illustrate Lawson's Sitting and Standing Comfort Criteria results on the following amenities within the Stonetown Terrace.

- All Balconies
- Communal Open Space

The results meet the requirements of Lawson's Sitting and Standing Comfort Criterion for the full year. The local air speed does not exceed 4m/s and 6m/s for more than 5% of the year as per the criterion's requirement.

There are no significant adverse effects of wind on the site. No mitigation measures are recommended.

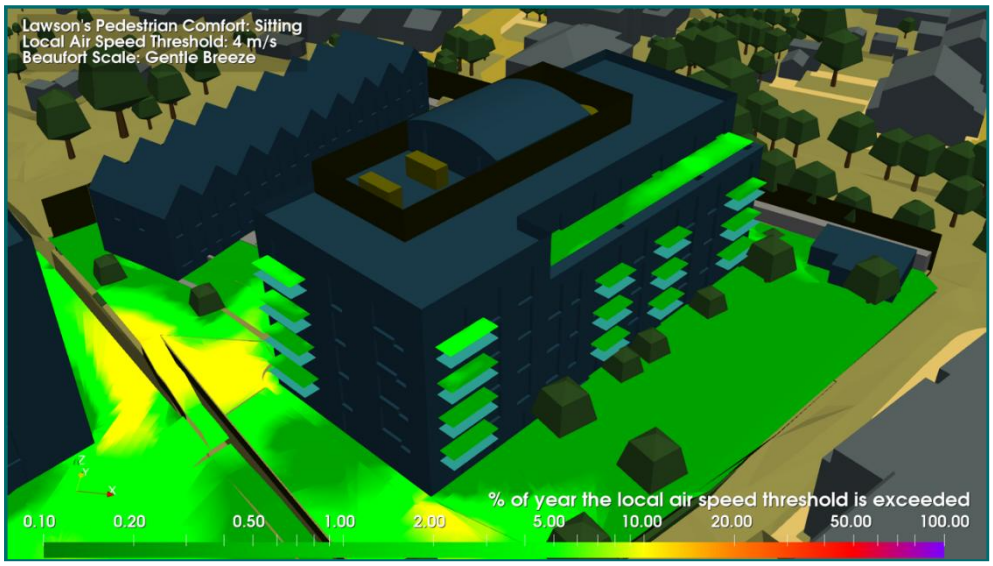


Figure 16.39: Sitting Comfort Criterion: Stonetown Terrace: Balconies: View from the southeast

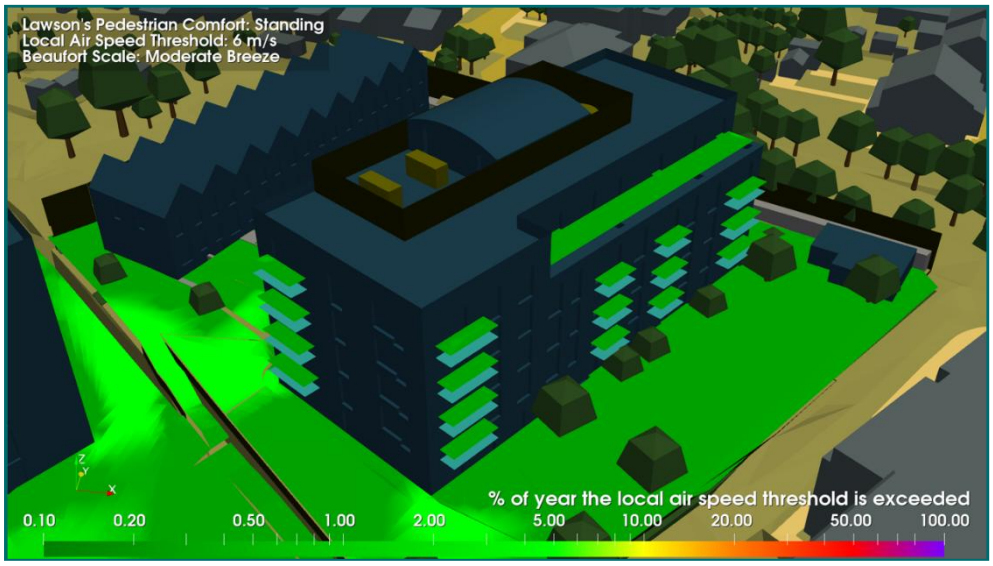


Figure 16.40: Standing Comfort Criterion: Stonetown Terrace: Balconies: View from the southeast

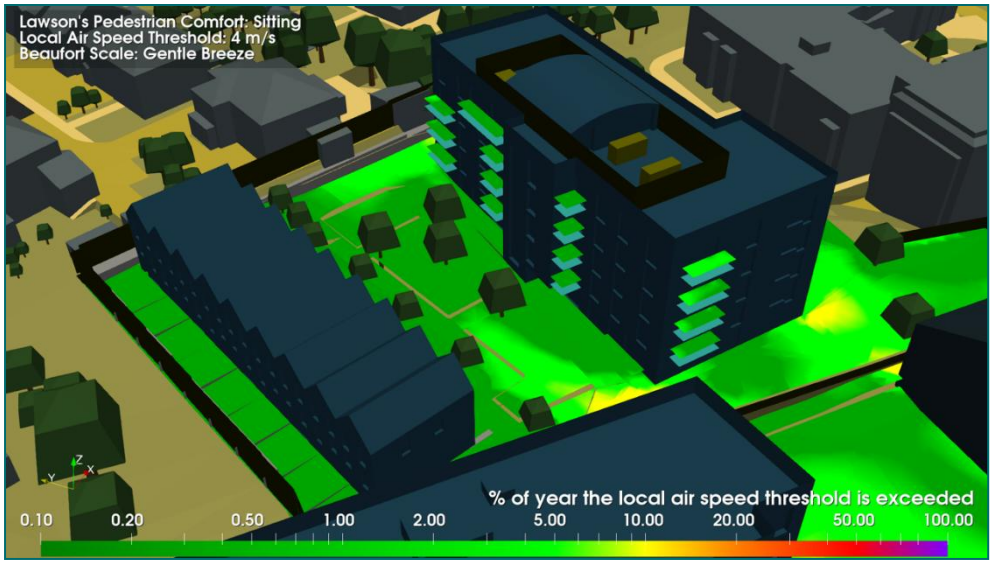


Figure 16.41: Sitting Comfort Criterion: Stonetown Terrace: Balconies: View from the southwest

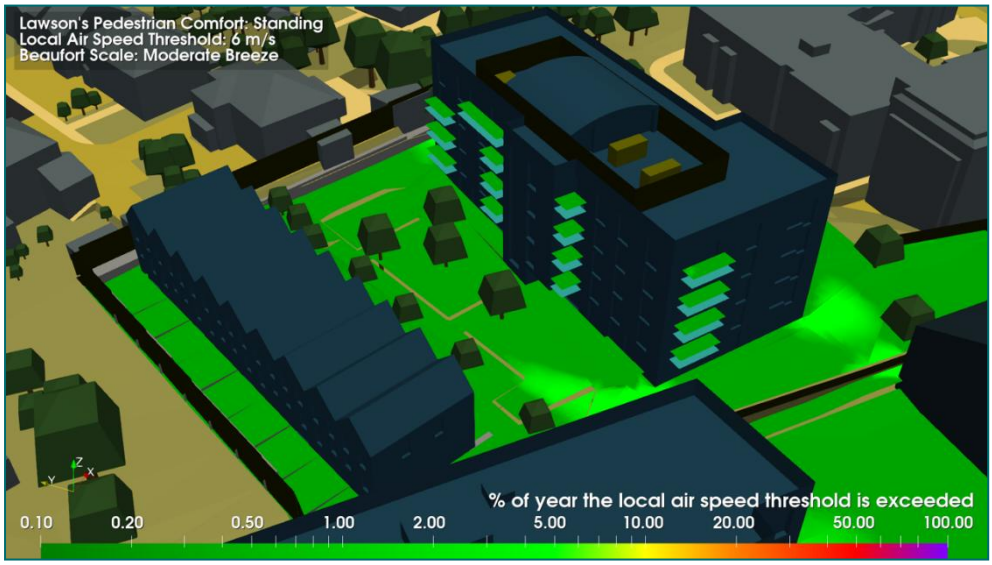


Figure 16.42: Standing Comfort Criterion: Stonetown Terrace: Balconies: View from the southwest

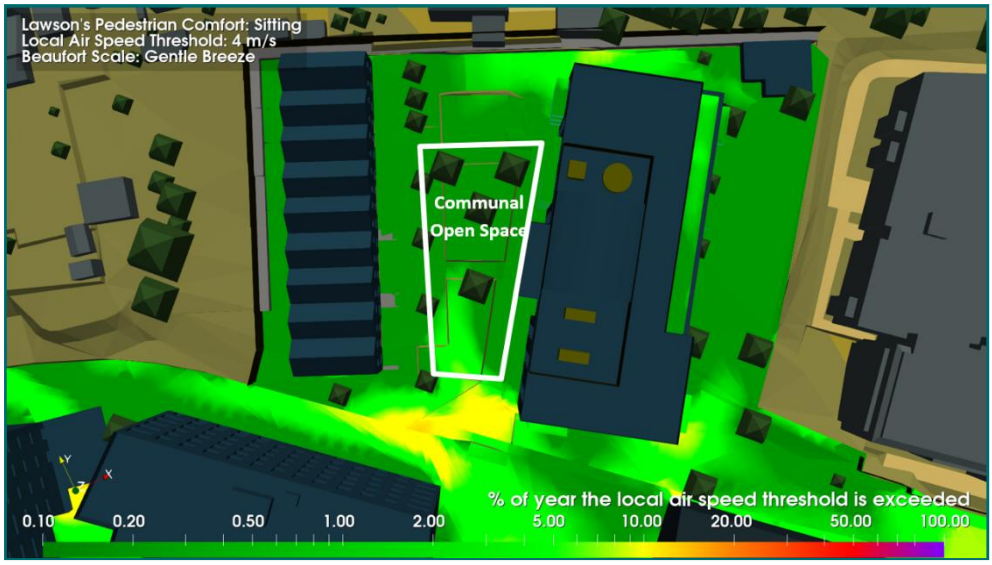


Figure 16.43: Sitting Comfort Criterion: Stonetown Terrace: Communal Open Space

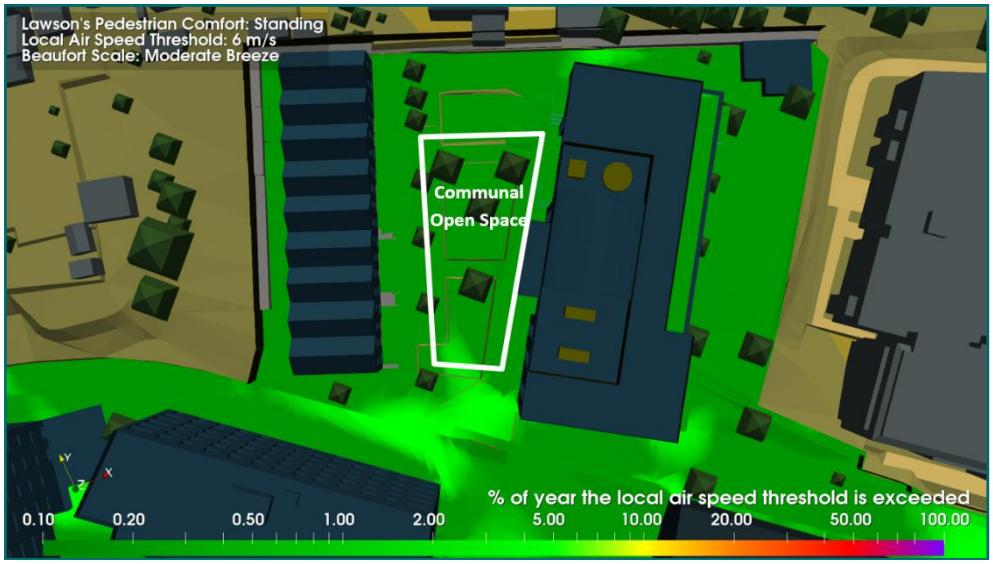


Figure 16.44: Standing Comfort Criterion: Stonetown Terrace: Communal Open Space

O'Callaghan Strand (OCS)

Figures 16.45 to 16.52 illustrate Lawson's Sitting and Standing Comfort Criteria results on the following amenities within the O'Callaghan Strand (OCS) Block.

- All Balconies
- Roof Amenities
- Outdoor Seating Spaces

The results meet the requirements of Lawson's Sitting and Standing Comfort Criterion for the full year. The local air speed does not exceed 4m/s and 6m/s for more than 5% of the year as per the criterion's requirement.

There are no significant adverse effects of wind on the site. No mitigation measures are recommended.

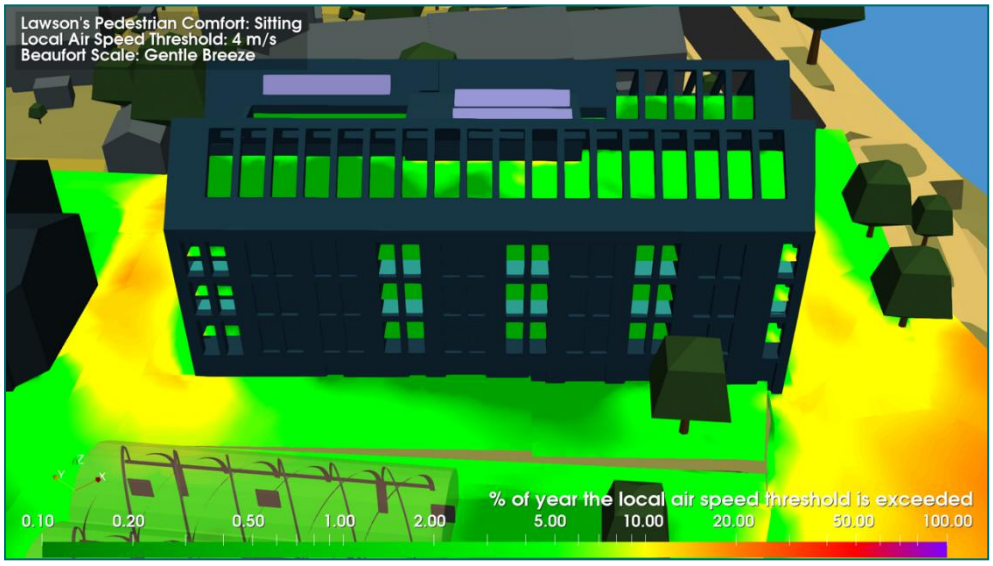


Figure 16.45: Sitting Comfort Criterion: Stonetown Terrace: Balconies: View from the southeast

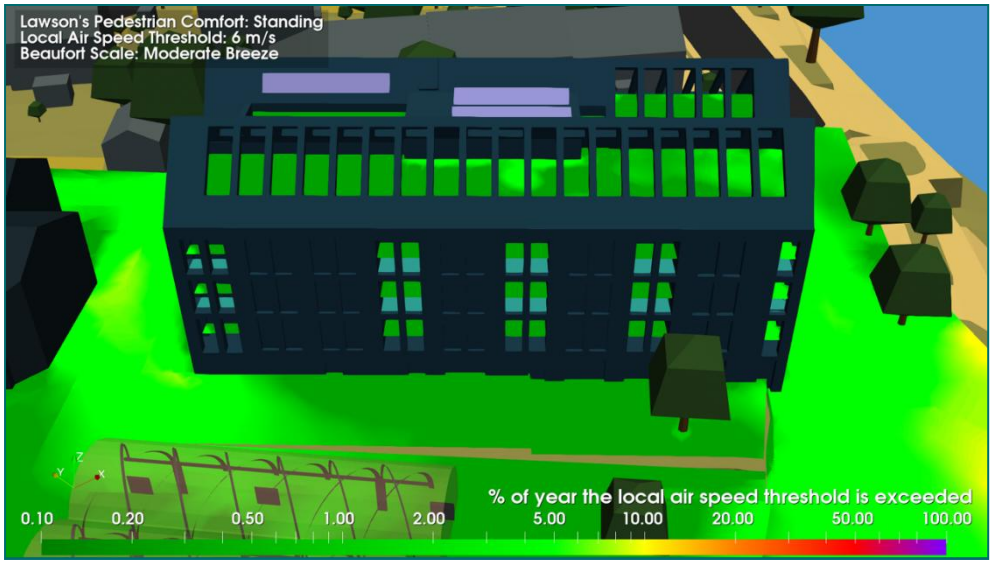


Figure 16.46: Standing Comfort Criterion: Stonetown Terrace: Balconies: View from the southeast

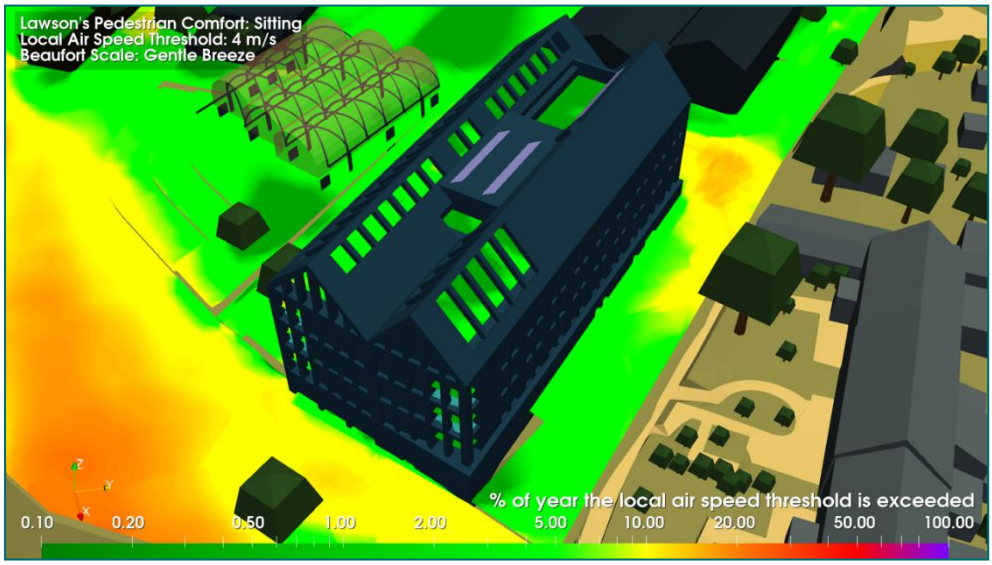


Figure 16.47: Sitting Comfort Criterion: OCS Block: Balconies: View from the southwest

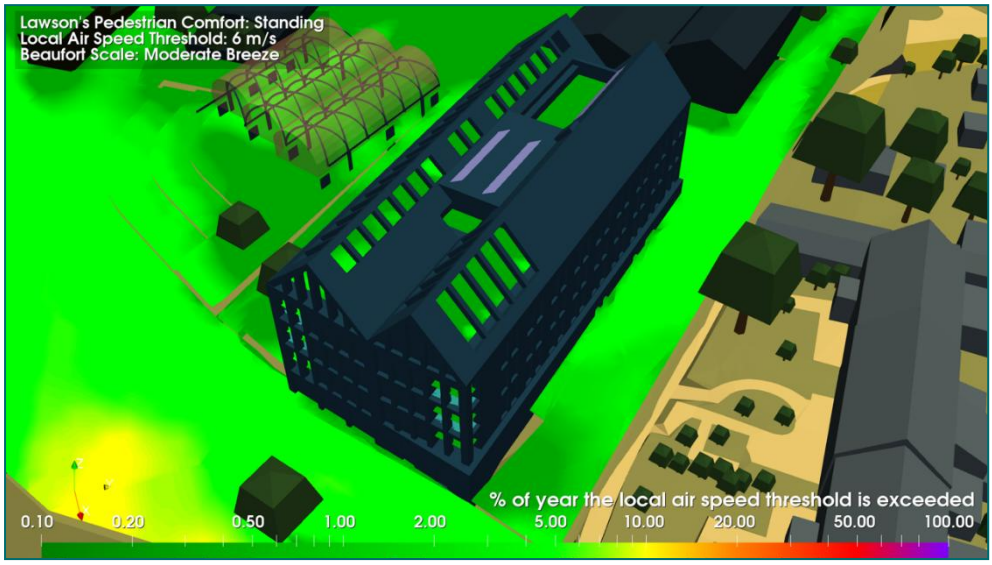


Figure 16.48: Standing Comfort Criterion: OCS Block: Balconies: View from the southwest

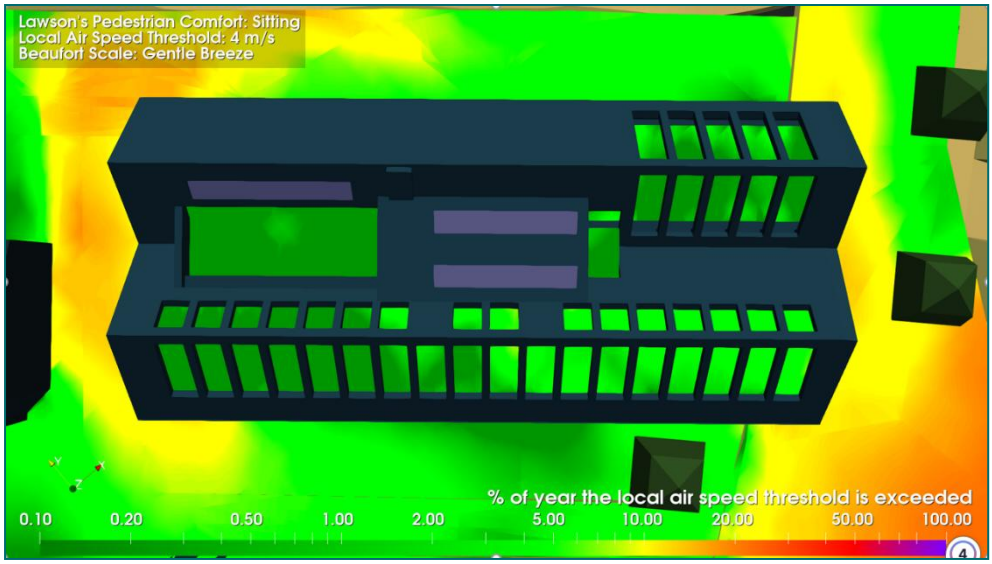


Figure 16.49: Sitting Comfort Criterion: OCS Block: Balconies: View from the southeast

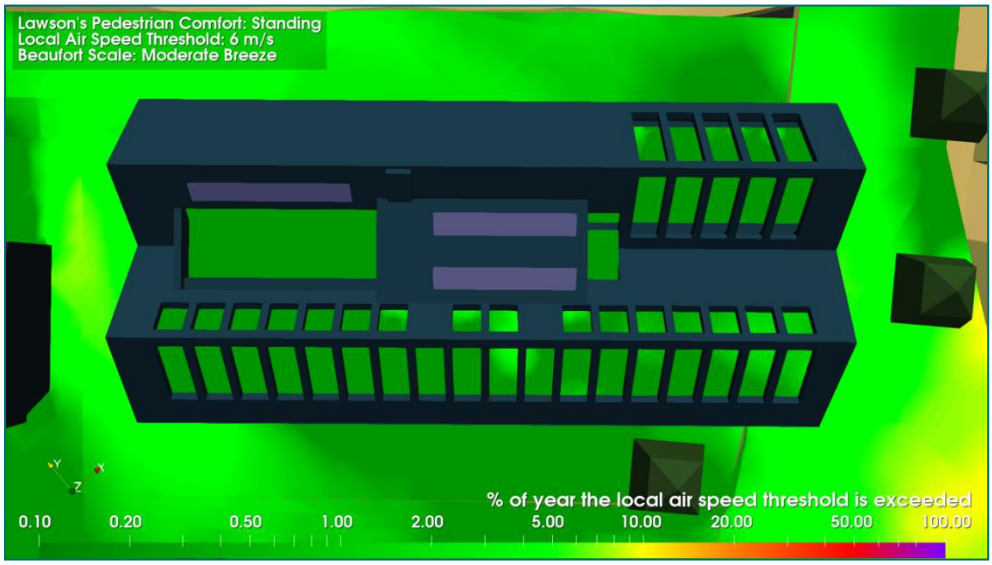


Figure 16.50: Standing Comfort Criterion: OCS Block: Balconies: View from the southeast

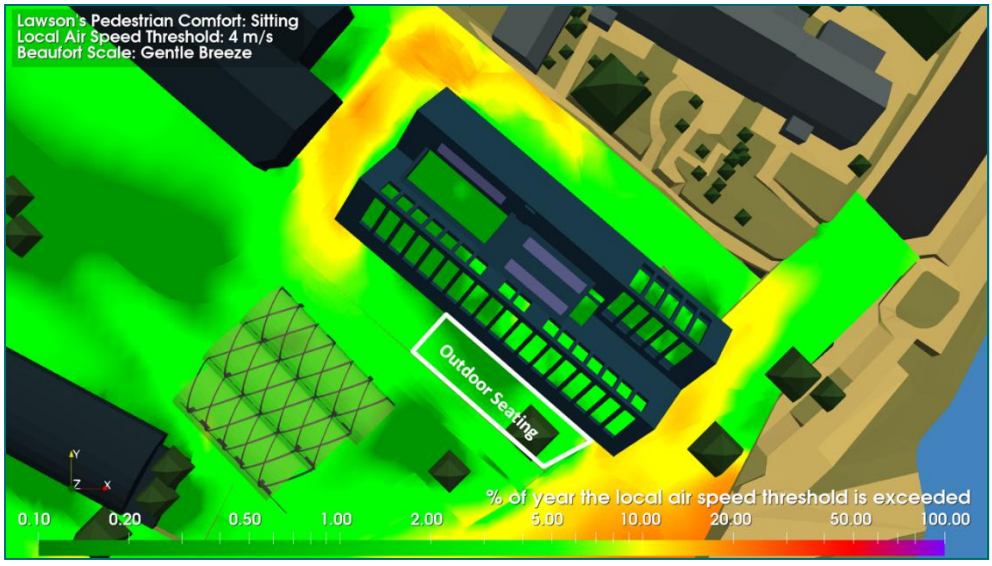


Figure 16.51: Sitting Comfort Criterion: OCS Block: Roof Amenities

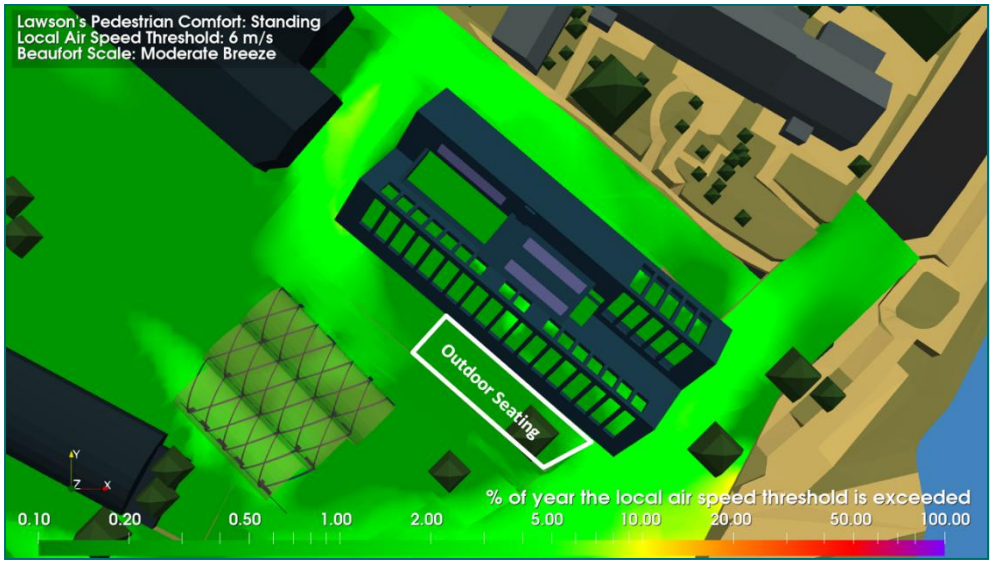


Figure 16.52: Standing Comfort Criterion: OCS Block: Roof Amenities

Riverfront

Figures 16.53 to 16.54 illustrate Lawson's Sitting and Standing Comfort Criteria results on the amenity spaces of the Riverfront located towards the southeast of the Cleeves site.

The seating spaces meet the requirements of Lawson's Sitting and Standing Comfort Criterion for the full year. The local air speed does not exceed 4m/s and 6m/s for more than 5% of the year as per the criterion's requirement.

A portion of the riverfront amenities, visible in yellow contouring in Figure 16.53, showed exceedance of the requirements of Lawson's Sitting Comfort Criterion. The local air speed is likely to exceed 4m/s for up to 20% of the year at these locations. This space was affected due to the prevailing southwesterly and westerly winds.

When considering the Lawson's Standing Comfort Criterion results, these locations demonstrate excellent compliance, i.e., the local air speed does not exceed 6 m/s for more than 5% of the year, see Figure 16.38. Of the 10% of the year when the local air speed exceeds 4m/s, half of that collective time (i.e. 5% of the year) does not exceed 6m/s. The local air speed on this portion will be less than 4 m/s for 90% of the year and between 4 and 6 m/s for 5% of the year.

The local air speed is only going to be greater than a gentle breeze, but frequently less than a moderate breeze. Such conditions are unlikely to have any impact on the usability of this space for personal recreation.

The majority of this space is designed for the standing and walking activities, for which the results meet the requirements of Lawson's Standing and Walking Comfort Criteria.

There are no significant adverse effects of wind on the seating locations For the other locations of the riverfront, the wind effects are neutral and imperceptible. No mitigation measures are recommended.

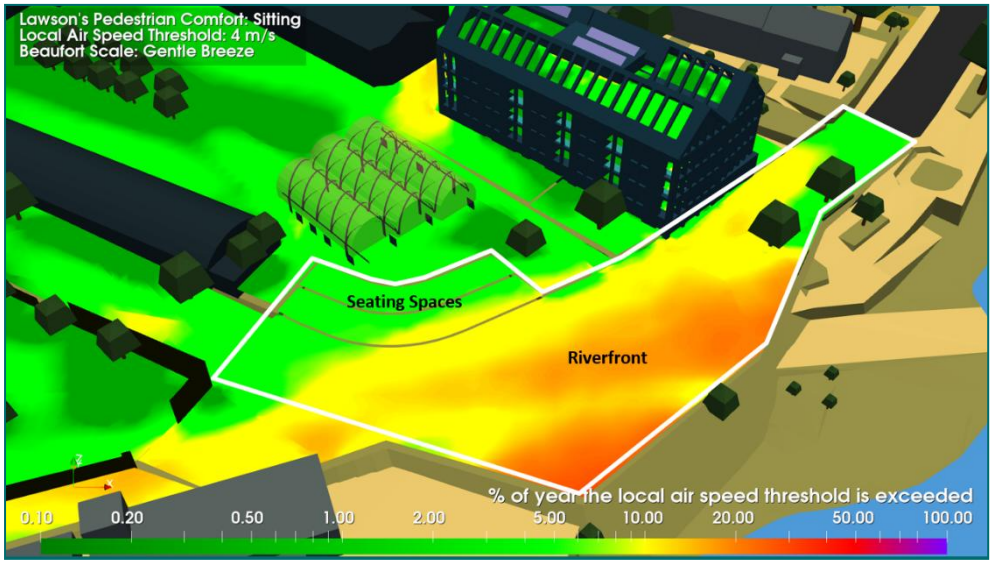


Figure 16.53: Sitting Comfort Criterion: Riverfront Amenities

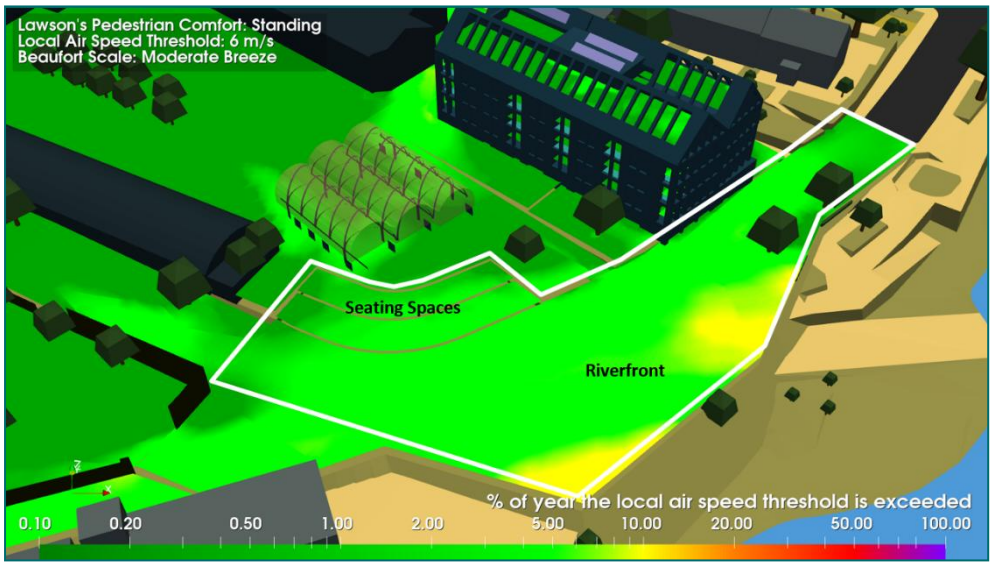


Figure 16.54: Standing Comfort Criterion: Riverfront Amenities

Flaxmill Square

Figures 16.55 to 16.56 illustrate Lawson's Sitting and Standing Comfort Criteria results on the amenities within the Flaxmill Square, located towards the southeast of the Reservoir.

The results meet the requirements of Lawson's Sitting and Standing Comfort Criterion for the full year. The local air speed does not exceed 4m/s and 6m/s for more than 5% of the year as per the criterion's requirement.

There are no significant adverse effects of wind on the site. No mitigation measures are recommended.

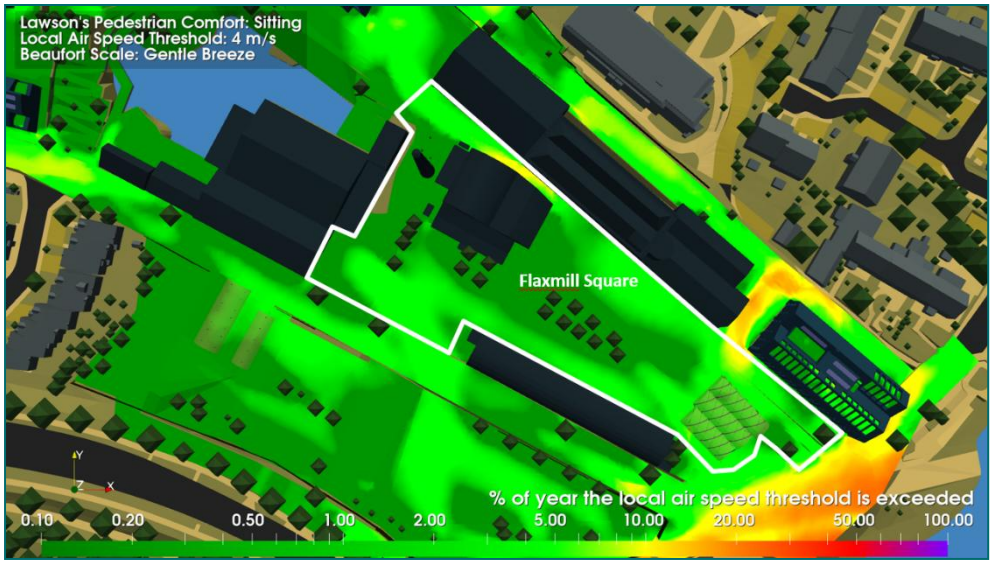


Figure 16.55: Sitting Comfort Criterion: Flaxmill Square

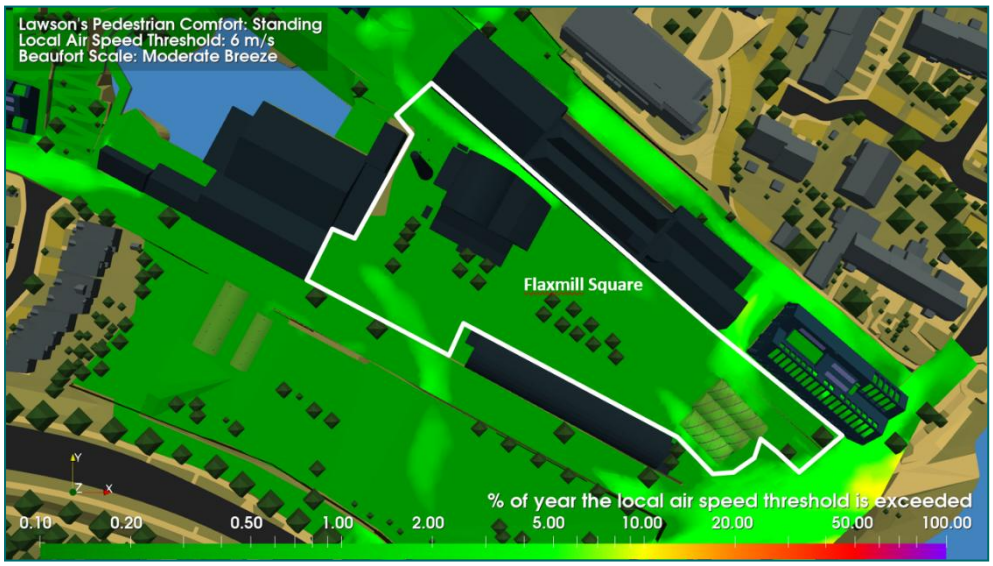


Figure 16.56: Standing Comfort Criterion: Flaxmill Square

Shipyard

Figures 16.57 to 16.58 illustrate Lawson's Sitting and Standing Comfort Criteria results on the amenities within the Shipyard located towards the south of the Cleeves site.

The results meet the requirements of Lawson's Sitting and Standing Comfort Criterion for the full year. The local air speed does not exceed 4m/s and 6m/s for more than 5% of the year as per the criterion's requirement.

There are no significant adverse effects of wind on the site. No mitigation measures are recommended.

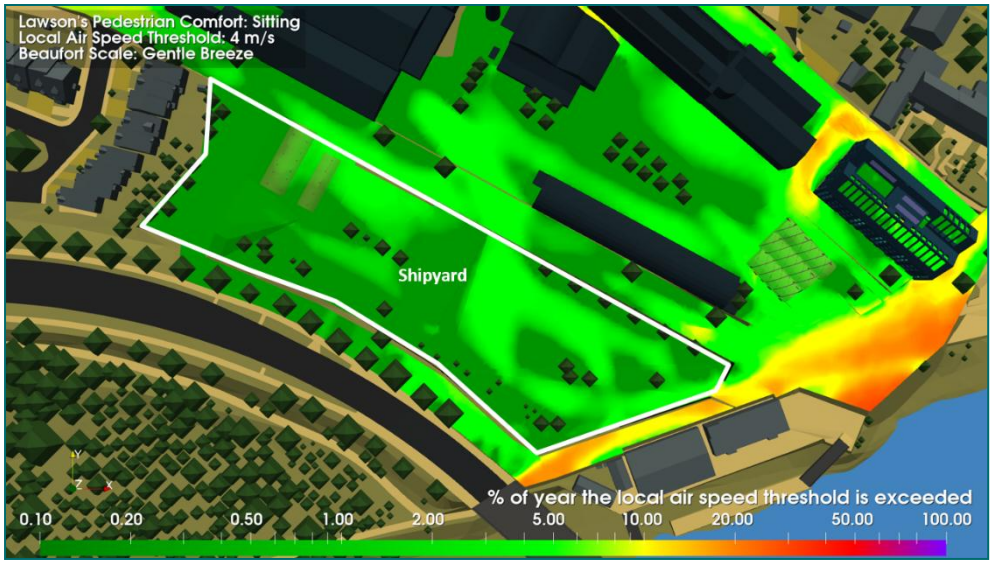


Figure 16.57: Sitting Comfort Criterion: Shipyard

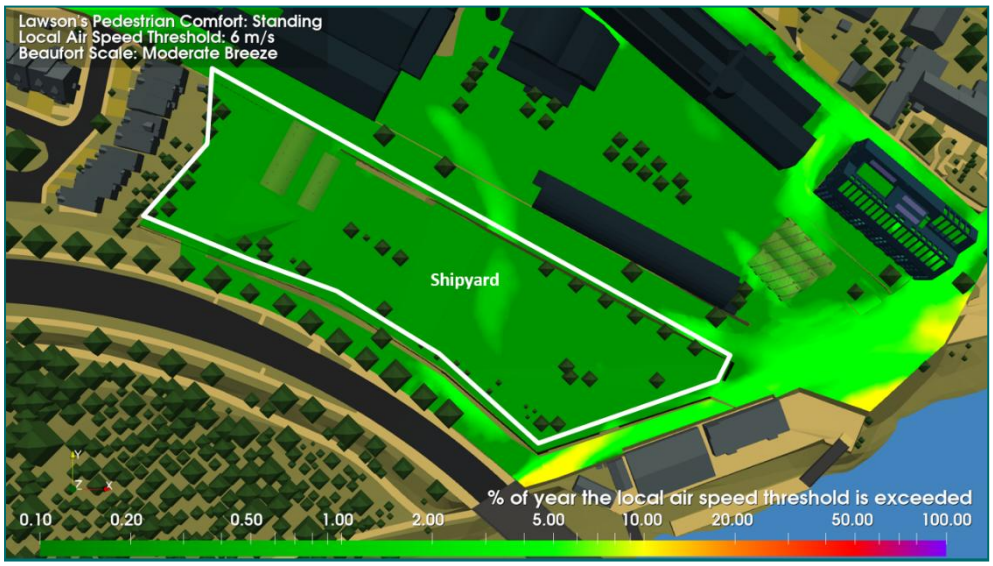


Figure 16.58: Standing Comfort Criterion: Shipyard

16.5.3.2 Walking Comfort Results

The Lawson's Leisure Walking Comfort Criterion states that the local air speed at designated locations should not exceed 8 m/s for more than 5% of the year analysed, on the various paths around the development. Additionally, the Lawson's Business Walking Comfort Criterion states the local air speed at designated locations should not exceed 10 m/s for more than 5% of the year analysed, on the various paths around the development. The assessment was carried out for a typical year and is most representative of the general conditions. The results show excellent compliance with the requirements of Lawson's Leisure Walking and Business Walking Comfort Criterion. The local air speed does not exceed 8 m/s and 10 m/s for more than 5% of the year, respectively. Figure 16.59 and Figure 16.60 below show the results of walking comfort criteria.

There are no significant adverse effects of wind on the site. No mitigation measures are recommended.

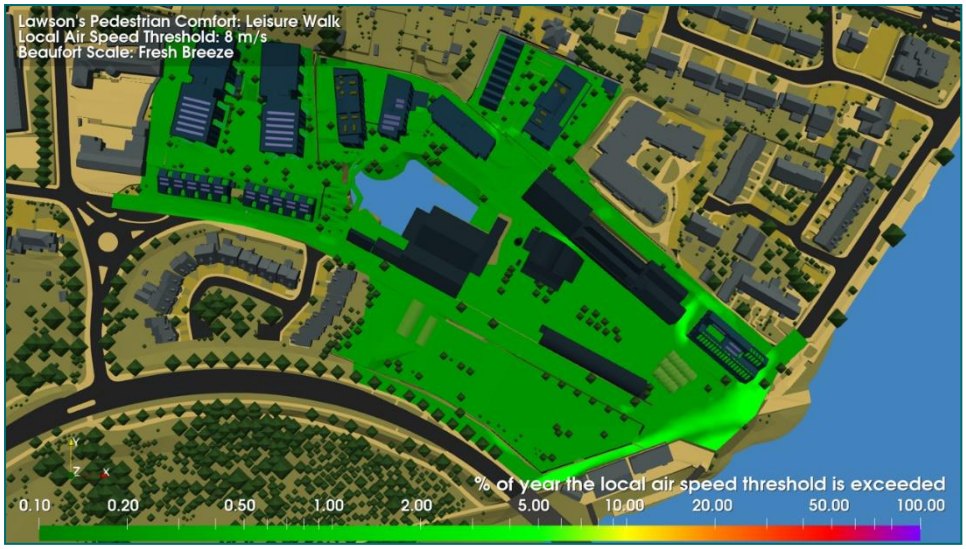


Figure 16.59: Leisure Walking Comfort Criterion: View from the top

Figure 16.60: Business Walking Comfort Criterion: view from the top

16.5.3.3 Safety Criteria

The Lawson's Normal Pedestrian Safety Criterion states that the local air speed at designated locations should not exceed 20 m/s for more than 0.01% of the year analysed. Additionally, the Lawson's Sensitive Pedestrian Safety Criterion states the local air speed at designated locations should not exceed 15 m/s for more than 0.01% of the year analysed. The Sensitive Pedestrian Safety Criterion applies to the vulnerable population, such as pensioners and children. Note the limit of the criterion is 0.01% and not 5% as with the comfort criterion.

These criteria are also intended for various paths and grounds around the development, as access is always required, irrespective of weather conditions, to enter or exit the various buildings. Figure 16.61 and Figure 16.62 show the results of the safety criteria assessment. The results of the normal and sensitive pedestrian are observed to be below 0.01% of the year.
There are no significant adverse effects of wind on the site. No mitigation measures are recommended.

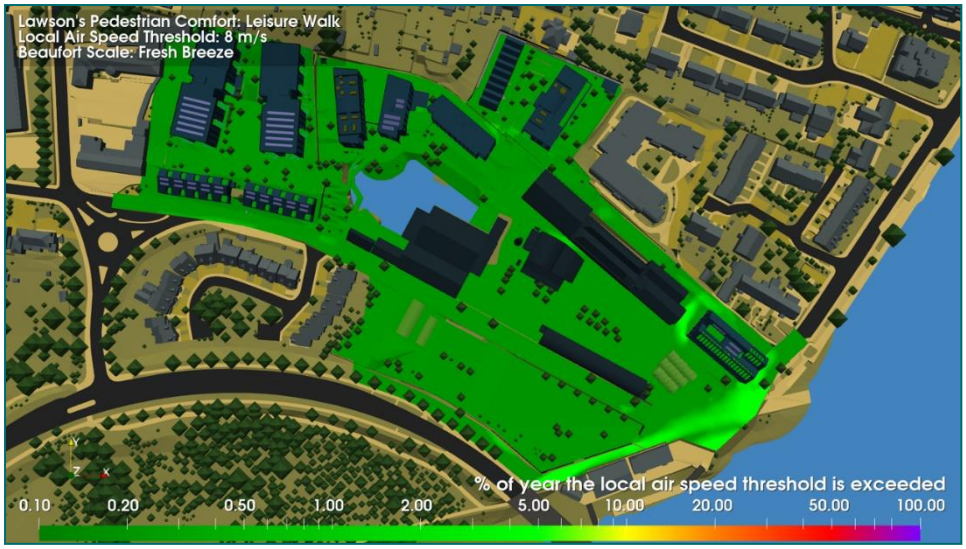


Figure 16.61: Normal Pedestrian Safety Criterion: View from the top

Figure 16.62: Sensitive Pedestrian Safety Criterion: View from the top

16.5.3.4 Conclusion

The site shows the typical behaviour of any site in Limerick with direct exposure to the southern to western arc of winds, which account for 80% of the total winds. The landscape design and site layout result in the site performing well from the wind comfort perspective.

It was observed that,

1. The following amenities showed excellent results and fully met the requirements of the Sitting and Standing Comfort criteria.
    - Salesians Massing
    - Community Garden
    - Play Area
    - Nursery Play Space
    - Viewing Area
    - Quarry PBSA

- Podium Amenities
- Fitness Court
- View Terrace
- Rock Climbing Area
- Amenities in front of the Reservoir
- Stonetown Terrace
- Communal Open Space
- O'Callaghan Strand (OCS)
- Roof Amenities
- Outdoor Seating Spaces
- Seating locations on the Riverfront
- Amenities within the Flaxmill Square
- Amenities within the Shipyaed

2. The balconies of the following blocks showed excellent results and fully met the requirements of the Sitting and Standing Comfort criteria.
    - Salesians Massing
    - Stonetown Terrace
    - O'Callaghan Strand (OCS)
3. Overall results of the walking comfort show excellent compliance with Lawson's Leisure Walking and Business Walking Comfort criteria.
4. The Lawson's Normal and Sensitive Pedestrian Safety Criteria are achieved throughout the site.

16.5.4 Do Nothing Scenario

In the absence of the proposed development, the present wind pattern is likely to continue unobstructed. The analysis was carried out only from a pure wind perspective. The assessment does not consider the correlation to the external temperature or precipitation.

16.6 CUMULATIVE DEVELOPMENT & IMPACTS

Presently, there is relatively little permitted / ongoing development in Limerick City within a 1.5km radius of the site, as per the granted planning applications closer to the proposed development listed in Table 16.4. In the analysis, the region up to 300m from the centre of the proposed development is included, and there is no other permitted development present within a 300m radius of this site. This 300m distance was considered with respect to 10-12 times of the building height.
The permitted developments closer to the site are detailed in Table 16.4 below. They are beyond the 300m zoned radius of the site.

Table 16.4: Granted planning applications closer to the proposed development

File Ref No.	Location	Distance to Site	Applicant	Description of Development
23/557	Ennis Road	1.1km north west	Tribeca Asset Management Limited	Provision of 167 no. new residential units in 5 new residential buildings ranging in height from 3 storeys to 5 storeys, a creche; the refurbishment of Ardhu House and Ardhu Bar licenced premises
178008	Rutland Street	1.13km south east	Limerick City & County Council	Part 8 - Significant mixed use development on a site of 2.35 hectares comprising 53,531.7sqm of commercial, cultural and retail floorspace
22/1186	Sexton Street	1.5km south east	Board of Management Sexton Street CBS	Redevelopment of existing school ground for educational purposes
23/60345	Upper mallow Street	950m south	Pairc na Daoine Limited	Demolition of existing building and contruction of 21 apartments in 8 storey building

The following figures 16.63 and 16.64 illustrate the location of the site.

Figure 16.63: Site location on google earth

Figure 16.64: Extents up to 300m from the centre of the proposed development

Figure 16.65 illustrates the collective results of wind comfort for the 5% threshold on the proposed development. These results were summed to calculate the total number of hours that a given pedestrian activity class exceeds the 5% yearly threshold based on the hierarchy of wind speed. The results on the proposed development are compliant with the Sitting, Standing and Walking activities.

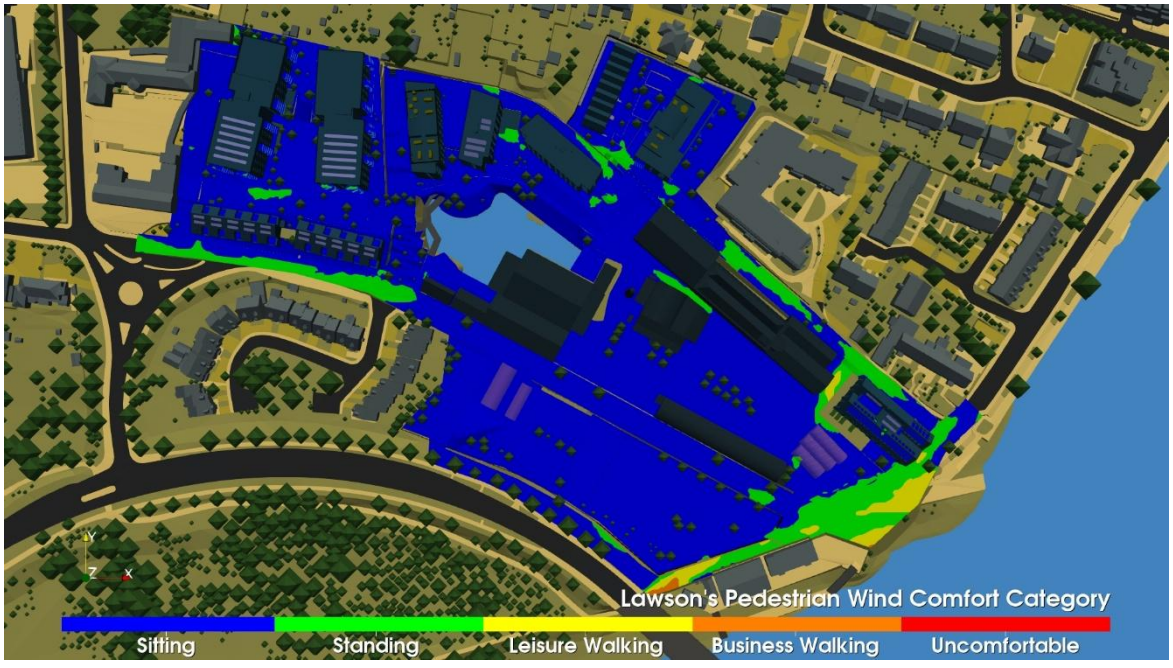


Figure 16.64: Collective Results: 5% Threshold

There are no long-term cumulative wind impacts associated with this development. The closest developments listed in Table 16.4 are not required to be included in the analysis, as they are located at a sufficient distance and are not affected by wind conditions originating from this site. This development is not expected to exert any long-term cumulative effects on the surrounding areas.

16.7 REMEDIAL & MITIGATION MEASURES

16.7.1 Incorporated Design Mitigation

The following mitigation measures have been incorporated into the design of the scheme.

- Shape, location and orientation of the Blocks in,
  - Salesians Massing
  - Quarry PBSA
  - Stonetown Terrace
  - O'Callaghan Strand (OCS)
  - Existing Structures within the Flaxmill Square
- Canopy Structures in,
  - Flaxmill Square
  - Shipyard Site
- Retaining Wall and Compound Walls around,
  - Stonetown Terrace
  - Shipyard Site
  - Flaxmill Square
- Trees and vegetation along the various paths

16.7.2 Construction Phase Mitigation

No mitigation measures are required for the construction.

16.7.3 Operation Phase Mitigation

This assessment pertains to the impacts of the operational phase. The mitigation measures such as location, orientation and shape of the amenity spaces, canopies, retaining wall, compound wall, balustrades, trees and vegetation along various paths etc. required for the operational phase have already been incorporated in the design of the scheme. No further mitigation measures are required.

16.8 RESIDUAL IMPACTS

16.8.1 Construction Phase

There are no residual impacts on the development in the construction phase.

16.8.2 Operational Phase

There are no residual impacts on the development in the operational phase.

16.9 MONITORING

No monitoring measures are required for the construction or operational phases of the proposed development with respect to the wind flow as the assessment concluded that there will not be significant adverse effects of wind on the proposed development.

16.10 REFERENCES

1. T. V. Lawson (2001) Building Aerodynamics, Imperial College Press, London.
2. ASHRAE Fundamentals Handbook (2013)
3. https://climate.onebuilding.org/WMO_Region_6_Europe/IRL_Ireland/index.html