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6200 Microclimate Impact Assessment

Microclimate assessment report with focus on wind impacts

ORCHARD GATE SHD

RESIDENTIAL APARTMENT DEVELOPMENT

KENNELSFORT ROAD UPPER
PALMERSTOWN
CO DUBLIN

AAI Palmerstown Ltd

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1 Introduction

1.1 Report purpose

The aim of the assessment is to determine if there are potential microclimate effects with a particular focus on wind impacts. This report determined the existing environment using available data from the Irish Meteorological Service (MET Eireann) and considers the potential impacts of wind upon pedestrian comfort based on the local wind climate data, in combination with a desk-based analysis of the expected wind conditions at the site.

1.2 Instruction

DKPartnership (DKP) have been commissioned by AAI Palmerstown Ltd to carry out the analysis and report for the proposed Orchard Gate residential development as described below.

1.3 Development detail

The development is located at the former warehouse facility at units 54 & 65, Cherry Orchard Industrial Estate. The site presents a gateway location at the western junction of Kennelsfort Road Upper and Cherry Orchard Industrial Estate Road. This location represents the start of the lands zoned 'REGEN'continuing to the east.

The proposal is for 144 no. 'build to sell' apartments and associated facilities with a mix of 72 no. one bedroom apartments and 72 no. 2 bedroom apartments. The development is set out in 4 no. five storey buildings enclosing a raised podium courtyard with the junction corner building having a 9-storey gateway feature element. On-site parking of 65 no. resident spaces is contained within a landscaped podium element with 2 no. on street care share spaces provided.

2 Executive summary

2.1 Analysis conducted

This report undertakes an assessment with regard to microclimate effects associated with the proposed development at Palmerstown. The aim of the assessment is to determine if there are potential microclimate effects with a particular focus on wind impacts. The wind flow around buildings can have a impact on pedestrian comfort. A safe pedestrian-level wind environment is a crucial requirement of good building design. This report determined the existing environment using available data from the Irish Meteorological Service (MET Eireann) and examined the potential for wind impacts on the proposed development.

2.2 Guideline's overview

There are no national planning policies directly related to wind microclimate however the following guidance documents were followed and reviewed: BRE DG 520 Wind microclimate around buildings. Brings together the latest information on wind environment around buildings. The general principles of wind flow around buildings and techniques for mitigating unacceptable wind speeds are discussed and advice is given on the methods and criteria for assessing pedestrian wind comfort. Sustainable Design and Construction, The London Plan Supplementary Planning Guidance. Document on wind speeds and tall buildings. Building Aerodynamics, Imperial College London, Imperial College Press, 2001. shows practicing architects and engineers the information which wind engineers can present to ensure that the effects of wind are considered in building design.

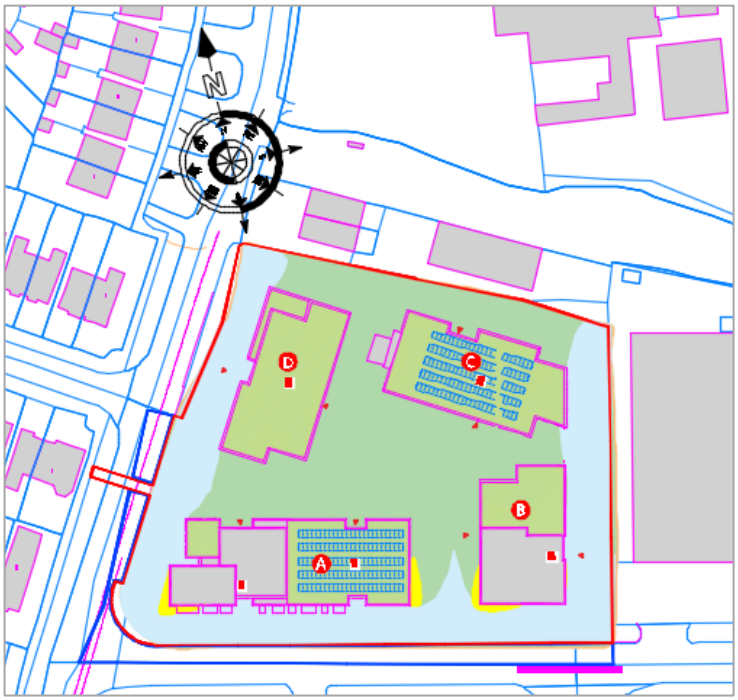
2.3 Microclimate summary

The assessment identified the existing baseline levels in the region of the proposed development by an evaluation of MET Eireann historical monitoring data. A desk-based assessment was used to determine any significant effects on the wind microclimate and compared the calculated wind speeds with appropriate comfort criteria.

- The wind profile around the proposed development used long term annual average meteorological data collected at Casement Weather Station, the dominant wind directions for the site are identified as south-west and south south-west, with an average of 19km/h wind speed.
- This corresponds to average wind speeds of Beaufort scale 3, which is described as a 'gentle breeze'. Conditions around the site during the summer season are expected to be calmer compared to the windiest season, because winds are lighter in the summer.
- The wind comfort assessment in relation to the Lawson criteria, determined that the pedestrian walkways areas and amenity areas can all be considered suitable for their intended purpose.

- Pedestrian wind comfort: Pedestrian access routes / walkways within and around the site would be suitable for their intended use, having wind conditions ranging from occasional sitting to standing (14.4 -21.6km/h) during the windiest season. Some areas along the southern façade and around building corners are expected to experience walking conditions (28.8km/h). These conditions could be considered tolerable as these areas are not located where people are expected to remain for long periods. Mitigation in the form of additional evergreen planting will improve conditions in these areas to achieve the desired standing conditions if needed. The corners of the Block A are expected to experience uncomfortable conditions during the windiest season especially when the wind is blowing from the South direction (approx. annual frequency of south winds 11.4%).

- Amenity areas: It is noted that as the national predominant wind direction are from the south and locally at the proposed site the predominant wind direction is south westerly. Given the configuration and orientation of the blocks in the proposed development, it is predicted the exposure of the amenity space to be relatively sheltered. The location of the amenity areas means there is no significant wind speed impact down to the open areas between the blocks and for the predominant time 'frequent sitting' criteria can be applied in the amenity spaces. The podium/semi private and public amenity space are shielded when the wind is blowing from the dominant south-west direction (approx. annual frequency of wind condition 18.9%). The wind very rarely blows from the NW and WNW quadrants and although more exposed in those directions, very little impact is predicted (approx. annual frequency of wind condition 3% and 4.4%). See summer wind map next page.



Frequent Sitting	9km/h	
Occasional Sitting	14.4km/h	
Standing	21.6km/h	
Walking	28.8km/h	
Uncomfortable	>28.8m/s	

Image 2.1 (see 5.6) : expected summer season wind comfort levels (during windiest scenario)

In conclusion, based on the examination conducted the proposed development would have no significant adverse impacts with regard to microclimate.

2.4 Recommendations / mitigation measures

Construction phase: No mitigation measures required however the site would be enclosed by high hoarding as part of a construction management plan which would assist in mitigating wind speeds around the perimeter.
Operational phase: it is anticipated that in general the wind speeds will be suitable for 'standing' along pedestrian routes and 'frequent sitting' for the podium amenity area. Design mitigation measures which have been incorporated include; The provision of planting of windbreaks in between each of the gaps between the blocks mitigation a lower wind speeds but will also reduce the noise levels in to the general amenity area. The mature trees around the edge of the site on the southern aspect will also be beneficial at sheltering the development from the wind and building entrances have been located well away from corners.

3 Geographical overview

3.1 Project overview

Image 3.1, the (google maps) site map below shows the approximate location of the site with proposed development approximately outlined in the area site map.

Image 3.1 Approximate proposed development site

4 Approach and methodology

4.1 Assessment approach

Adverse wind effects can reduce the quality and usability of outdoor areas. A desk-based assessment was used to determine any significant effects on the wind microclimate. The assessment includes establishing the existing baseline microclimate, evaluating the potential for the proposed development to lead to amplified wind speed impacts and comparing the calculated wind speeds with appropriate comfort criteria. wind comfort criteria published by the City of London Wind Microclimate guidelines referred to as the City Lawson Criteria, are shown in table 4.1 below. The desired wind microclimate would typically need to have areas suitable for sitting, standing, strolling or walking.

Category	Mean and GEM wind speed (5% exceedance)	Description
Frequent Sitting	9km/h	Acceptable for frequent outdoor sitting use, e.g. restaurant, café.
Occasional Sitting	14.4km/h	Acceptable for occasional outdoor seating, e.g. general public outdoor spaces, balconies and terraces intended for occasional use, etc.
Standing	21.6km/h	Acceptable for entrances, bus stops, covered walkways or passageways beneath buildings.
Walking	28.8km/h	Acceptable for external pavements, walkways.
Uncomfortable	>28.8km/h	Not comfortable for regular pedestrian access.

Table 4.1: City Lawson Criteria

Note: Gust Equivalent Mean (GEM) speed = max(mean speed, gust speed/1.85)

4.2 Ireland's wind climate

In Ireland the prevailing wind direction is between south and west. Wind blows most frequently from the south and west for open sites while winds from the northeast or north occur least often. In January the southerly and south-easterly winds are more prominent than in July, which has a high frequency of westerly winds. Easterly winds occur most often between February and May and are commonly accompanied by dry weather. Average annual wind speeds range from 10.8km/h to 28.8km/h. The wind at a particular location can be influenced by a number of factors such as obstruction by buildings or trees, the nature of the terrain and deflection by nearby mountains or hills. A series of monitoring stations are located across the country, these stations collect wind data for public information.

4.3 Beaufort scale

The Beaufort scale is a way of estimating the wind strength according to the appearance of the sea (or on land).

		wind speed		
Scale	*Description*	*km/h*	*knots*	*Effects*
0	Calm	<1	<1	No noticeable wind, smoke rises vertically
1	Light air	1-5	1-3	Direction of wind shown by smoke drift but not wind vanes
2	Light breeze	6-11	4-6	Wind felt on face, leaves rustle
3	Gentle breeze	12-19	7-10	Wind extends light flag, leaves in constant motion
4	Moderate breeze	20-28	11-16	Raises dust and loose paper; hair disarranged, clothing flaps
5	Fresh breeze	29-38	17-21	Small trees in leaf begin to sway; limit of agreeable wind on land
6	Strong breeze	39-49	22-27	Umbrellas used with difficulty; force of the wind felt on the body; wind noisy, frequent blinking
7	Near gale	50-61	28-33	Inconvenience felt when walking; difficult to walk steadily; hair blown straight
8	Gale	62-74	34-40	Generally impedes progress; walking difficult to control; great difficulty with balance in gusts
9	Strong gale	75-88	41-47	People blown over by gusts; slight structural damage
10	Storm	89-102	48-55	Seldom experienced inland; trees uprooted, significant structural damage
11	Violent storm	103-117	56-63	Very rarely experienced; accompanied by widespread structural damage
12	Hurricane	>117	>64	Countryside devastated; winds of this force only occur in hurricanes and tornadoes

Table 4.2: Beaufort scale and wind speed

4.4 Receiving environment at Palmerstown

The nearest weather station to Palmerstown collecting detailed weather records is Casement, Co. Dublin which is located approximately 5km away. The meteorological data has been examined to identify the prevailing wind direction and average wind speeds. Table 4.3 – 4.5 shows the averages over 30 year periods and Image 4.6 illustrates the prevailing wind direction data.

wind (knots)	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
Mean monthly speed	13.6	12.9	12.4	9.8	9.1	8.6	8.8	9.0	9.6	11.1	11.6	12.3
Max gust	80	78	71	59	63	51	58	55	59	65	66	82
Max mean 10-minute speed	57	54	47	43	43	36	39	36	38	44	46	57
Mean no. of days with gales	4.5	3.2	2.1	0.6	0.4	0.1	0.1	0.2	0.3	1.2	1.9	3.5

Table 4.3: Wind data at Casement 1981-2010 – 30 year average

wind (knots)	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
Mean monthly speed	14.1	13.2	12.8	10.0	9.1	8.8	8.9	8.9	10.0	11.3	12.3	13.6
Max gust	80	78	71	59	63	53	58	55	69	65	68	82
Max mean 10-minute speed	57	54	47	43	43	36	39	36	46	44	49	57
Mean no. of days with gales	5.2	3.1	2.5	0.5	0.5	0.1	0.1	0.2	0.5	1.3	2.5	4.2

Table 4.4: Wind data at Casement 1971-2000 – 30 year average

wind (knots)	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
Mean monthly speed	14.1	12.5	12.8	10.1	9.1	8.7	8.9	8.7	10.1	11.2	12.3	13.3
Max gust	80	78	71	59	63	53	58	58	69	65	68	81
Max mean 10-minute speed	57	54	47	43	43	36	39	39	46	44	49	57
Mean no. of days with gales	5.2	2.7	2.7	0.6	0.5	0.1	0.1	0.2	0.6	1.4	2.4	3.7

Table 4.5: Wind data at Casement 1961-1990 – 30 year average

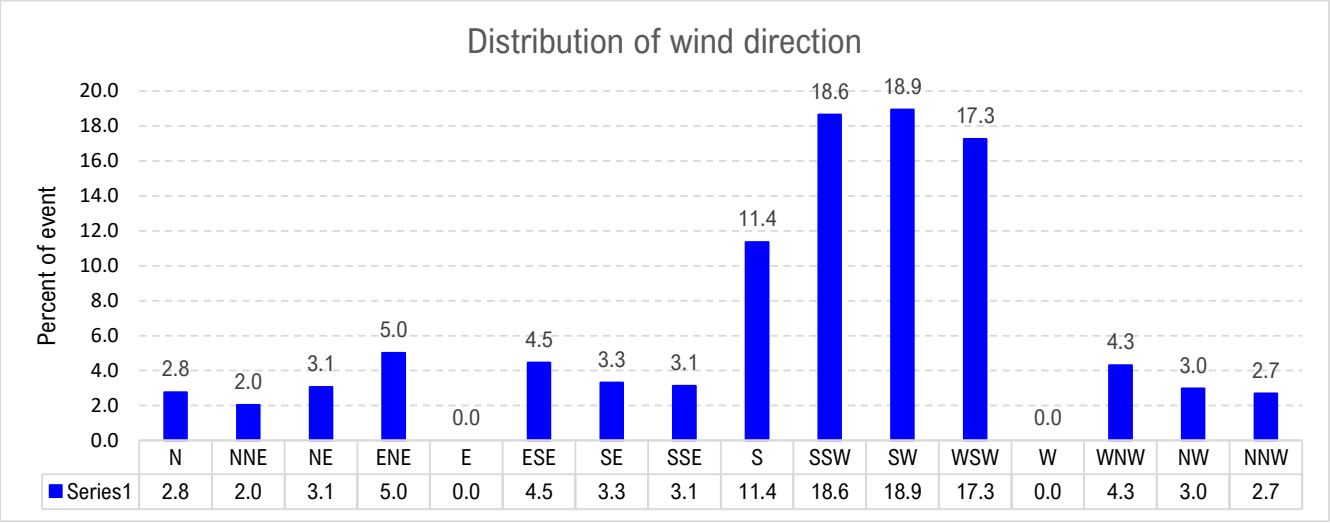


Image 4.6: Wind direction data at Casement - 54 year period (year 1967-2021)

4.5 Significance of data assessed

The data recorded from Met Eireann's historical data during the past shows the predominant wind direction is south-westerly with an average wind speed of 19km/h (calculated from averages over past 54 years, 1967-2021). there is a secondary dominant wind from the south south-west direction and west south-west, it is observed other wind directions such as northern winds are infrequent. These conditions are considered to be representative of conditions at the site given the close proximity. The site of the proposed development can be characterised as a site which experiences average wind speeds of Beaufort scale 3, which is described as a 'gentle breeze'. Conditions around the existing site during the summer season are expected to be calmer compared to the windiest season, because winds are lighter in the summer.

Image 4.7: Proposed development at Palmerstown. Predominant wind direction SW/SSW directional arrows.

5 Microclimate impact

5.1 Potential impact of the proposed development

Construction phase:
The effects on the wind microclimate at the site during the construction phase is difficult to qualitatively analyse however a professional judgement has been used to assess the likely conditions during this stage of development. On a cleared site, the potential impact with regard to wind would be that the oncoming wind would blow unimpeded across the empty site. Once the proposed development begins construction, localised wind conditions felt at ground level has the potential to vary on a temporary basis. However, as construction of the proposed development proceeds, the wind conditions on the site and surroundings would gradually adjust to those of the completed development. There are no construction microclimate impacts of significance.

Operational phase:
In general the construction of new buildings can lead to changes to the local wind environment around the building. Negative wind effects in the operational phase would result from wind conditions at an assessed location being winder than the established comfort threshold for the type of activity. The following effects of buildings have been analysed:

Building height: Wind speed increases with height above ground therefore the taller a building the higher the wind speeds acting on it. where tall buildings are generally taken to mean buildings more than 10 storeys high. The proposed residential development at Palmerstown is less than 10 storeys (block B, C and D) and is not classed as a high building, however a proportion of block A is 10 storeys. BRE suggest tall buildings where possible, be orientated with their narrow face into the prevailing wind. The of dominant wind direction is south-west and south south-west. The proposed blocks do not directly face the prevailing wind direction. It can be predicted that the proposed development height will not lead to a significant acceleration of wind-speeds. however, strong southerly winds may cause an increase in ground-level wind speeds. The BRE also suggest wind speed increases can be minimised using large canopies to deflect the wind away from ground level.

Using BRE guidelines a check has been carried out to determine if the buildings present a high risk due to height differential. Blocks A, B, C and D all pass this check. The height-to-width (h/w) ratio of the proposed blocks presents itself in the guideline of 'good'. Wind will go up and over the development, rather than being directed down to street level. The BRE DG 520 document notes that H to W ratio of > 0.65 should be an 'optimum' target to minimise any wind related impacts. To illustrate the height to width ratio of the proposed development blocks see images 5.1, the elevations of the proposed. Block B *h/w* =0.51, Block C *h/w* = 0.52, Block D *h/w* = 0.50 and Block A *h/w* = 0.56 (as a whole block, taking into account the differences in building height/storey).

Images 5.1:

North elevation:

East elevation:

South elevation:

West elevation:

Downwash: When the wind strikes the front face of a building, it will produce wind pressures that reach maximum speeds at a point between about two thirds and three-quarters of the building height. Below this height the wind will tend to be deflected down the front face towards the ground, called downwash, and accelerated around the corners at ground level and can produce areas of high wind speed. Above this height the wind will be deflected upwards and accelerated over the roof. Block A has a building front that could potentially present a downwash during high instances of southerly wind conditions, but generally these would occur during summer months when wind speeds are less. With regards Block A, the interaction of a lower-rise portion of the building being part of it acts like a podium and therefore the downwash effects would help to be minimised.

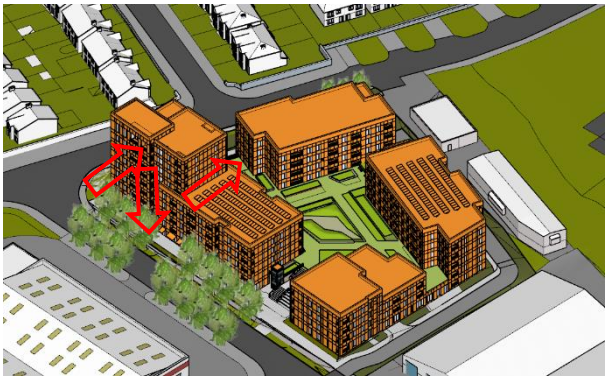


Image 5.2: Proposed Orchard Gate development

Building wake: Downwind the wind flows around the building and recombines into a region of negative pressure known as the wake. This will continue for between about six and 10 times the building height before the original flow patterns are re-established. The larger the building, the larger the volume of air that must be displaced, and the larger the potential ground-level wind speeds. Tall, isolated slab-sided buildings adjacent to large open spaces and wide streets will tend to produce high wind speeds at pedestrian level. Blocks A, B, C and D while being larger than their neighbours are not sufficiently isolated or of adverse different scale to present a high risk in terms of wake flow.

Funnelling and canyon effect: Wind funnelling can occur where there are gaps between buildings. The effect is stronger where the axes of the buildings make an angle of 90°or less. Lawson suggests that the critical gap width for funnelling is between 0.5 and 2.5 times the average building height. Elevated wind speed can also be generated where an opening runs between two tall buildings leading to a canyon effect. The optimum height-to-width ratio for ideal wind comfort is >0.65 as recommended by the BRE, see table 5.3.

		Street canyon height-to-width ratio	
Aspect of design	Optimum	Good	Undesirable
Wind comfort	>0.65	>0.4	<0.3
Sense of enclosure	0.4-0.5	0.33-0.67	<0.3->1.0
Convective cooling	0.4–0.6	< 0.65	> 0.65

Table 5.3: BRE design summary guidelines

Guidelines recommend long street canyons should not be aligned with the prevailing wind direction. For the proposed development at Palmerstown canyon C-D is facing the predominant wind however shelter is provided by Block A. As height-to-width ratio increases, the ground level wind speeds are likely to reduce. At the other extreme very wide streets with height-to-width ratio < 0.3 will not benefit from wind shelter and are likely to be quite exposed.
Canyon A-B h/w ratio 0.92=optimum, Canyon B-C h/w ratio 0.84=optimum, Canyon C-D h/w ratio 0.92=optimum
Canyon D-A h/w ratio 0.80=optimum

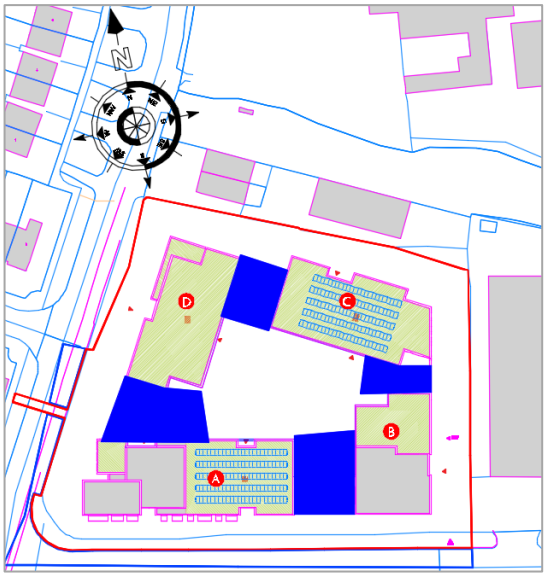


Image 5.4: potential canyon effect -

5.2 Wind comfort

The wind comfort assessment in relation to the Lawson criteria, determined that the pedestrian areas and amenity areas can all be considered suitable for their intended purpose. The windiest season wind speeds was used to examine the wind comfort. Wind comfort is in line with guidelines summarized previously in table 4.1. Image 5.5 illustrates the expected winter season wind comfort levels.

Pedestrian Comfort: Pedestrian access routes / walkways within and around the site would be suitable for their intended use, having wind conditions ranging from occasional sitting to standing (14.4 -21.6km/h) during the windiest season. Some areas along the southern façade and around building corners are expected to experience walking conditions (28.8km/h). These conditions could be considered tolerable as these areas aren't on main locations where people are expected not to linger. Mitigation in the form of additional evergreen planting will improve conditions in these areas to achieve the desired standing conditions if needed. The corners of the Block A are expected to

experience uncomfortable conditions during the windiest season especially when the wind is blowing from the South direction (estimated frequency of south winds 11.4%).

Amenity areas: It is noted that as the national predominant wind direction are from the south and locally at the proposed site the predominant wind direction is south westerly. Given the configuration and orientation of the blocks in the proposed development, it is predicted the exposure of the amenity space to be relatively sheltered. The location of the amenity areas means there is no significant wind speed impact down to the open areas between the blocks.
The podium/semi private and public amenity space are well shielded when the wind is blowing from the dominant south-west direction (frequency of wind condition 18.9%). The wind very rarely blows from the NW and WNW quadrants and although more exposed in those directions, very little impact is predicted (frequency of wind condition 3% and 4.4%).

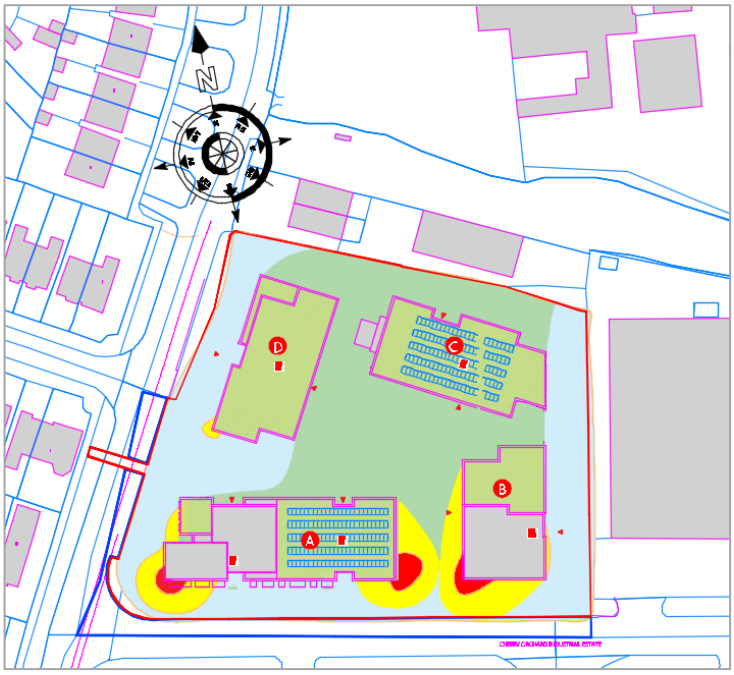


Image 5.5: expected winter season wind comfort levels (during windiest scenario)

Frequent Sitting	9km/h	
Occasional Sitting	14.4km/h	
Standing	21.6km/h	
Walking	28.8km/h	
Uncomfortable	>28.8m/s	

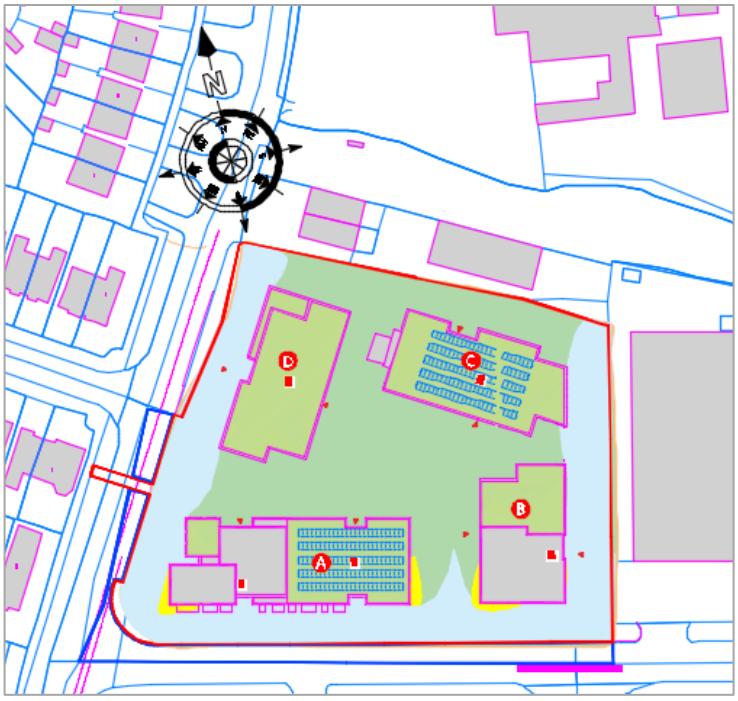


Image 5.6: expected summer season wind comfort levels (during windiest scenario)

6 Conclusion

6.1 Wind impact summary

The assessment identified the existing baseline levels in the region of the proposed development by an evaluation of MET Eireann historical monitoring data. A desk-based assessment was used to determine any significant effects on the wind microclimate and compared the calculated wind speeds with appropriate comfort criteria.

- The wind profile around the proposed development used long term annual average meteorological data collected at Casement Weather Station, the dominant wind directions for the site are identified as south-west and south south-west, with an average of 19km/h wind speed.
- This corresponds to average wind speeds of Beaufort scale 3, which is described as a 'gentle breeze'. Conditions around the site during the summer season are expected to be calmer compared to the windiest season, because winds are lighter in the summer.
- The wind comfort assessment in relation to the Lawson criteria, determined that the pedestrian walkways areas and amenity areas can all be considered suitable for their intended purpose.
- Pedestrian wind comfort: Pedestrian access routes / walkways within and around the site would be suitable for their intended use, having wind conditions ranging from occasional sitting to standing (14.4 -21.6km/h) during the windiest season. Some areas along the southern façade and around building corners are expected to experience walking conditions (28.8km/h). These conditions could be considered tolerable as these areas are not located where people are expected to remain for long periods. Mitigation in the form of additional evergreen planting will improve conditions in these areas to achieve the desired standing conditions if needed. The corners of the Block A are expected to experience uncomfortable conditions during the windiest season especially when the wind is blowing from the South direction (approx. annual frequency of south winds 11.4%).
- Amenity areas: It is noted that as the national predominant wind direction are from the south and locally at the proposed site the predominant wind direction is south westerly. Given the configuration and orientation of the blocks in the proposed development, it is predicted the exposure of the amenity space to be relatively sheltered. The location of the amenity areas means there is no significant wind speed impact down to the open areas between the blocks and for the predominant time 'frequent sitting' criteria can be applied in the amenity spaces. The podium/semi private and public amenity space are shielded when the wind is blowing from the dominant south-west direction (approx. annual frequency of wind condition 18.9%). The wind very rarely blows from the NW and WNW quadrants and although more exposed in those directions, very little impact is predicted (approx. annual frequency of wind condition 3% and 4.4%).

In conclusion, based on the examination conducted the proposed development would have no significant adverse impacts with regard to microclimate.

6.2 Remedial and reductive measures

Construction phase: No mitigation measures required however the site would be enclosed by high hoarding as part of a construction management plan which would assist in mitigating wind speeds around the perimeter.
Operational phase: it is anticipated that in general the wind speeds will be suitable for 'standing' along pedestrian routes and 'frequent sitting' for the podium amenity area. Design mitigation measures which have been incorporated include; The provision of planting of windbreaks in between each of the gaps between the blocks mitigation a lower wind speeds but will also reduce the noise levels in to the general amenity area. The mature trees around the edge of the site on the southern aspect will also be beneficial at sheltering the development from the wind and building entrances have been located well away from corners.

6.3 Monitoring

It is recommended that the local weather conditions should be reviewed routinely, particularly for construction works carried out at a height. It is not necessary to monitor any wind speed and direction monitoring on site during the construction or operational phases.