

11. WIND MICROCLIMATE

Introduction

- 11.1 This chapter of the ES assesses the likely significant effects of the Development on the environment in respect of Wind Microclimate. This chapter has been prepared by RWDI, a specialist wind engineering consultancy.
- 11.2 Wind tunnel tests were conducted on a 1:300 scale model of the Development and this chapter describes the expected conditions within and around the Site by comparing the measured wind speed and frequency of occurrence with the well-established Lawson Comfort Criteria (LDDC) version^{11.1}. The Lawson Comfort Criteria has been established for over thirty years and has been widely used on building developments across the United Kingdom.
- 11.3 The likely significant effects of the Development upon the local wind microclimate have been assessed using the following configurations:
- Configuration 1: Existing Site with existing landscaping and existing surrounding buildings (baseline);
 - Configuration 2: Development (a taller iteration of the design, referred to as "massing Option 1") with existing landscaping and existing surrounding buildings;
 - Configuration 3: Development (massing Option 1) with existing landscaping, proposed landscaping scheme, mitigation measures and existing surrounding buildings; and
 - Configuration 4: The Development (referred to as "massing Option 2" with existing landscaping, proposed landscaping scheme, mitigation measures and existing surrounding buildings.

Policy Context

National Planning Policy Framework^{11.1}

- 11.4 There are no planning policies or statements that are directly related to the wind microclimate, although the promotion of high-quality built environments is emphasised in the NPPF. For instance, paragraph 127 states the following: "[...] f) *Create places that are safe, inclusive and accessible and which promote health and well-being, with high standard of amenity for existing and future users*"

National Planning Practice Guidance^{11.2}

- 11.5 The NPPG was published in November 2016 to support the NPPF and was updated in October 2019. There is no guidance within the NPPG related to tall buildings and wind microclimate issues.

Guidance on tall Buildings^{11.3}

- 11.6 English Heritage and Commission for Architecture and the Built Environment (CABE) produced a revised and updated version of their joint guidance on tall buildings. The final version was released in July 2007 and in section Criteria for evaluation, state that:

"... planning permission for tall buildings should ensure therefore that the following criteria are fully addressed: [...] the effect on the local environment, including microclimate."

Historic England Advice Note 4: Tall Buildings^{11.4}

- 11.7 The Historic England Advice Note 4: Tall Buildings (2015) states in section 4.7:

"Planning applications for tall buildings are likely to require an environmental impact assessment (EIA), which would be expected to address matters in respect of both the proposed building and its cumulative impact, including: [...] e. Other relevant environmental issues, particularly sustainability and environmental performance, eg the street level wind environment."

The London Plan – Spatial Development Strategy for Greater London^{11.5}

- 11.8 The London Plan places great importance on the creation and maintenance of high-quality environment for London. The following policies apply specifically in relation to wind microclimate:

- Policy 7.6 Architecture
 - *"Architecture should make a positive contribution to a coherent public realm, streetscape and wider cityscape. It should incorporate the highest quality materials and design appropriate to its context."*
 - *"Buildings and structures should [...] not cause unacceptable harm to the amenity of surrounding land and buildings, particularly residential buildings, in relation to privacy, overshadowing, wind microclimate. This particularly important for tall buildings."*
- Policy 7.7 Location and Design of Tall and Large Buildings
 - *"Tall and large buildings should be part of a plan-led approach to changing or developing an area by the identification of appropriate, sensitive and inappropriate"*

- locations. Tall and large buildings should not have an unacceptably harmful impact on their surroundings."*
- *"Applications for tall or large buildings should include an urban design analysis that demonstrates the proposal is part of a strategy that will meet the criteria below. This is particularly important if the site is not identified as a location for tall or large buildings in the borough's LDF."*
 - *Tall buildings [...] should not affect their surroundings adversely in terms of microclimate, wind turbulence, overshadowing, noise, reflected glare, aviation and telecommunication interference."*

Intended to Publish London Plan^{11.6}

11.9 This is a new London Plan (also known as a Replacement Plan). This London Plan replaces all previous versions. This document provides guidance for developments and is an integrated policy framework for local plans across London.

- Policy D3 Optimising site capacity through the design-led approach (para 3.3.8), states that:
 - *"Buildings [...] massing, scale and layout [...] should complement the existing streetscape and surrounding area. Particular attention should be paid to the design of the parts of a building or public realm that people most frequently see or interact with in terms of its legibility, use, detailing, materials and location of entrances. Creating a comfortable pedestrian environment with regard to levels of [...] wind."*
- Policy D8 Public realm, states that:
 - *"Considerations should also be given to the local microclimate created by the buildings, and the impact of service entrances and facades on the public realm."*
 - *"Ensure that appropriate shade, shelter, seating [...] with other microclimate considerations, including temperature and wind, taken into account in order to encourage people to spend time in a place."*
- Policy D9 Tall buildings: Environmental impact, states that:
 - *"wind [...] around the building(s) and neighbourhood must be carefully considered and not compromise comfort and the enjoyment of open spaces, including water spaces, around the building."*
 - *"Air movement affected by the Building (s) should [...] not adversely affect street-level conditions."*
- Policy D9 Tall buildings: Cumulative impact, states that:
 - *"The cumulative visual, functional and environmental impacts of proposed, consented and planned tall buildings in an area must be considered when assessing tall building proposals and when developing plans for an area. Mitigation measures should be identified and designed into the building as integral features from the outset to avoid retro-fitting."*

Sustainable Design and Construction Supplementary Guidance^{11.7}

11.10 The SPG states in section 2.3.7 that:

Large buildings have the ability to alter their local environment and affect the microclimate. For example, [... tall buildings] can influence how wind travels across a site, potentially making it unpleasant at ground level [...] One way to assess the impact of large buildings on the comfort of the street environment is the Lawson Comfort Criteria. This tool sets out a scale for assessing the suitability of wind conditions in the urban environment based upon threshold values of wind speeds and frequency of occurrence. It sets out a range of pedestrian activities from sitting through to crossing the road and for each activity defines a wind speed and frequency of occurrence. Where a proposed development is significantly taller than its surrounding environment, developers should carry out an assessment of its potential impact on the conditions at ground level, and ensure the resulting design of the development provides suitable conditions for the intended use."

11.11 The SPG also advises using the Lawson Comfort Criteria to assess the impact of a large building on the comfort of the street environment, which sets out a scale for assessing the suitability of wind conditions in the urban environment.

Waltham Forest Draft Local Plan (2020 – 2035)^{11.8}

11.12 The following policies within the Waltham Forest Draft Local Plan pertain to wind microclimate and high-quality building design:

- Policy 62 – Delivering High-Quality Design, states that:
 - *"To deliver high-quality design, development proposals should [...] implement design measures that increase climate change resiliency specifically in relation to [...], microclimate control."*
- Policy 63 – Tall Buildings, states that:
 - *"Taller buildings will be assessed against the following criteria: [...] inclusion of appropriate mitigation measures to adverse environmental impacts in relation to wind movement [...] [and] microclimate conditions."*
- Policy 64 – Amenity, states that:
 - *"New development should respect the amenity of existing and future occupiers, neighbours and surrounding area by: [...] avoiding adverse impacts through poor microclimate conditions."*

Legislative Context

11.13 There is no legislative framework applicable to wind microclimate.

Assessment Methodology

Methodology for Determining Baseline Conditions and Sensitive Receptors

- 11.14 The baseline conditions across the existing Site and the immediately surrounding area have been identified using wind tunnel testing to provide a detailed, quantitative assessment.
- 11.15 Mean and gust wind speeds have been measured at each location at a scaled height of 1.5m above the ground level for both the windiest season (normally winter in the UK) to show worst-case scenario, and summer season for amenity spaces (amenity spaces are assessed during the summer season as these areas are expected to be used most frequently during this period with an expectation of calmer conditions compared to other times of the year). They have also been measured at locations around the existing Site and at other surrounding buildings, paths, roads and areas of open spaces for 36 wind directions in 10⁰ increments within 360m radius of the Site which is considered a large enough scale to ensure all wind effects are captured. Developments beyond this radius would be too far away to directly affect the conditions at the Site. This has been judged considering the surrounding developments and using professional judgement. Details of the wind tunnel test methodology is presented in the section 'Wind Tunnel Testing Methodology' of this chapter.
- 11.16 The results have been combined with long-term meteorological climate data for London area (Heathrow and London City Airports). The meteorological used in this assessment is deemed to be representative of the local wind microclimate for London area. In terms of meteorological stations, combined data from meteorological stations at Heathrow and London City Airports were selected as it is the nearest suitable stations to the Site and provides most representative data for the Site. The meteorological data used is presented within Appendix 11 – 1 (Pedestrian Level Wind Microclimate Assessment), section 2.4.
- 11.17 The baseline conditions are reflected within the wind scenario 'Configuration 1: Existing Site with existing landscaping and existing surrounding buildings' (also referred as the 'Baseline Scenario'). Further details on the wind tunnel testing methodology can be found in Appendix 11 – 1.

Receptor and Receptor Sensitivity

- 11.18 The sensitivity of a given receptor at the Site in the presence of the Development is high and equal for all measurement locations. This is because the effect criteria for the wind assessment is based on whether the wind environment of the Site is acceptable for the intended use or not. As such, an equal sensitivity is assigned to each receptor within and

surrounding the Development. The geographical extent of the wind microclimate is expected to be within the Site and its immediate surroundings i.e. a local effect, for all receptors.

11.19 The following description of the receptor categories for the Site and the approach taken to the allocation of the probe location to the categories is as follows:

- On-Site locations:
 - *Pedestrian thoroughfares: includes area that are immediately adjacent to the Development (i.e. within 5m of the building line). This also includes thoroughfares within the Development;*
 - *Entrances: includes entrances at ground level; and*
 - *Amenity areas: ground floor, balcony and roof terraces.*
- Off-Site locations:
 - *All receptors falling outside the definition of the boundary of the Site, such as along roadways, surrounding building entrances, amenity areas, bus stops and pedestrian crossings.*

Methodology for Determining Demolition and Construction Effects

11.20 The potential microclimate impacts during demolition and construction works have not been directly assessed within the wind tunnel, as this is a temporary condition and would be highly variable as the existing buildings are demolished and the Development is constructed. The potential impacts are assessed using professional judgement of an experienced engineer, based on an assessment of the baseline and completed development scenarios and an understanding of the likely effects based on RWDI's experience of assessing wind in the built environment.

11.21 This approach is taken assuming that the activity on-Site during this time (i.e. construction activity) is less sensitive to wind conditions (due to protection from Site hoarding and the Site access being restricted to Site workers) than when the Development is complete and occupied. In addition, there would be appropriate health and safety measures implemented to ensure that the construction workers were adequately protected.

Methodology for Determining Operational Effects

11.22 Wind tunnel testing of the Development (once completed and operational) was undertaken in August 2020. It allows the pedestrian level wind microclimate at and surrounding the Site to be quantified and classified in accordance with the accepted criteria set out further in the 'Assessment Criteria' section of this ES chapter. It also provides a detailed assessment of the mean and gust wind conditions in and around the Site for 36 wind directions, in 10⁰ increments

in terms of pedestrian comfort and safety and provides a basis to assess the potential wind microclimate impacts and likely effects of the Development with regards to its intended use.

Wind Tunnel Testing Methodology

- 11.23 To produce the results within the wind tunnel, a 1:300 scale model comprising the Site and the surrounding area (including relevant existing buildings and other topographical features) was constructed on a 1.2m radius disc allowing for surrounding area within a 360m radius of the centre of the Site to be modelled. This radius is considered a large enough scale to ensure all likely wind effects are captured. Other developments outside the 360m radius of the Site would not individually or cumulatively be expected to modify the wind approaching the Site and as such have not been included within the analysis of the surrounding terrain.
- 11.24 In order to model the turbulence effects of the wind, a combination of spires and floor roughness elements are used to create a naturally grown boundary layer and the detailed contoured proximity model around the Site is used to fine-tune the flow and create conditions similar to those expected at full scale.
- 11.25 Irwin probes are used to measure the wind speed at sensitive areas for 36 wind directions in 10° increments. At each location both mean and peak wind speeds are measured at scaled height of 1.5m above ground level.

Model Configurations Assessed

- 11.26 The assessment of the wind microclimate is based on the results from the test of the physical model within the wind tunnel to provide a detailed, quantitative assessment. Configuration 1 and 2 (as set out below) have been assessed with the existing landscaping to south and south-west to present a contemporary scenario. Wind conditions across the Site was tested for following configurations:
- Configuration 1: Existing Site with existing landscaping and existing surrounding buildings (results presented in Figure 11.2 – Figure 11.3);
 - Configuration 2: An earlier, taller iteration of the design (massing Option 1) with existing landscaping and existing surrounding buildings (results presented in Figure 11.4 – Figure 11.7);
 - Configuration 3: massing Option 1 with existing landscaping, proposed landscaping scheme, mitigation measures and existing surrounding buildings (results presented in Figure 11.8 – Figure 11.10); and

- Configuration 4: The Development (massing Option 2) with existing landscaping, proposed landscaping scheme, mitigation measures and existing surrounding buildings (results presented in Figure 11.11 – Figure 11.13).
- 11.27 It should be noted that Configuration 2 and 3 were tested with an earlier, taller iteration do the design (massing Option 1). As there were proposed height adjustments to Block A and Block F, themassing of the Development submitted for planning approval (Option 2) was tested in Configuration 4.
- 11.28 Effects of the Development on the wind microclimate at the Site were assessed using the massing Option 1 (Configuration 2). Based on the results of this assessment mitigation measures were developed to eliminate the windier conditions at the Site (Configuration 3).
- 11.29 However as massing option 2 is been submitted for planning approval, a simplified model (that did not include any balcony detail) of massing option 2 was constructed and tested with the proposed landscaping scheme and the developed mitigation measures due to time constraints..
- 11.30 Wind conditions at these balconies are not expected to change between the massing options and therefore results will be consistent with those presented in Configuration 3.
- 11.31 Cumulative schemes identified for the inclusion of the ES which fall outside the 360m radius and are not considered likely to materially affect the wind conditions at the Site and surrounds.



Figure 11.1: View from the south of the Development with existing landscaping and existing surrounding buildings (Configuration 2)

Assessment Methodology

Lawson Comfort Criteria

- 11.32 The assessment of the wind conditions requires a standard against which the measurements can be compared. The results presented in this ES chapter use the Lawson Comfort Criteria that has been established for over thirty years and have been widely used on building developments across the United Kingdom.
- 11.33 The Lawson Comfort Criteria (Table 11.1) sets out four pedestrian activities and reflect the fact that less active pursuits require more benign wind conditions. The coloured key in Table 11.1 corresponds to the presentation of wind tunnel test results in Figures 11.2 to 11.13.

Table 11.1 Lawson Comfort Criteria

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

Target Wind Conditions

- 11.34 For a mixed-use urban environment, such as the Site and surrounding area, the desired wind microclimate for the Development would typically need to have areas suitable for sitting, standing and strolling.
- 11.35 The walking and uncomfortable classifications are also associated with occasional strong winds (which are described below) and so the aim has been to avoid conditions falling into these categories.

Amenity Areas Balconies and Roof Terraces

- 11.36 The target for seating in amenity areas is a wind microclimate that is suitable for sitting during the summer season. This is because these areas are more likely to be frequently used during the summer when pedestrians would expect to be able to sit comfortably. If an area is classified as suitable for sitting in the summer, the windier conditions that occur during the winter season usually mean that the area would be classified as suitable for standing in the windiest season, unless additional shelter was provided.
- 11.37 Large upper level terraces and large amenity spaces are assessed on the basis that they are intended for good weather use only. A mix of sitting and standing conditions during the summer would be acceptable provided that any desired seating areas are situated in area within sitting use wind conditions
- 11.38 Wind conditions within private amenity spaces, such as balconies, would require wind conditions suitable for sitting or standing use during the summer season to be suitable for the intended use. It is expected that balconies would be used for amenity only when prevailing weather conditions would be favourable, and occupants of balconies would be more tolerant of windier standing use conditions due to the relative elevation and exposure.

Entrances

- 11.39 Areas in the proximity of building entrances require a wind environment suitable for standing or calmer, as pedestrians will transition from the calm interior to the windier exterior throughout the year. The assessment for building entrances therefore focuses on windiest season.
- 11.40 Generally, an entrance that is well recessed provides a transitional zone with calmer wind conditions for pedestrians exiting the building. If strolling conditions were observed on the pavement outside a recessed entrance, acceptable standing conditions would be expected at the recessed entrance and would therefore be suitable for an entrance use.

Thoroughfares

- 11.41 A pedestrian thoroughfare should be suitable for strolling use or calmer during the windiest season. The assessment for pedestrian thoroughfares therefore focuses on the windiest season results.
- 11.42 Localised occurrence of walking conditions may be acceptable in areas with limited footfall,

or service areas, or road crossings as long as the 'strong wind' criteria (see below) is not exceeded.

Strong Winds

- 11.43 The Lawson Criteria specifies a 'strong wind' threshold when winds exceed 15m/s for more than 0.025% of the time (approximately 2.2 hours of the year). These winds would have the potential to cause distress to pedestrians and cyclists – referred to as 'S15 Exceeded'. Exceedance of this threshold may indicate a need for remedial measures or a careful assessment of the expected use of that location; e.g. if it is reasonable to expect older adults or young children to present at the location on the windiest day of the year.
- 11.44 Wind speeds that exceed 20m/s for more than 0.025% of the time (approximately 2.2 hours of the year) represent safety issue for all members of the population, which would require mitigation to provide an appropriate wind microclimate environment.
- 11.45 Strong winds are generally associated with areas which would be classified as acceptable for walking or conditions considered uncomfortable. In a mixed-use urban development scheme, walking and uncomfortable conditions would not usually form part of the 'target' wind environment and would usually require mitigation due to pedestrian comfort considerations. This mitigation would also have the impact of reducing the frequency of, or even eliminate, any strong winds.

Significance Criteria

- 11.46 The assessment of the likely scale of effects is based on the comparison of the predicted wind conditions at a particular measurement location with the desired pedestrian use of the Site as defined in the Lawson Comfort Criteria. Where appropriate, wind conditions experienced across the Site are also compared against the baseline conditions.
- 11.47 The following terms have been used to define the significance of the effects identified and apply to both beneficial and adverse effects:
- Major effects: where wind conditions would be up to three categories calmer/winder than required;
 - Moderate effects: where the wind conditions would be up to two categories calmer/windier than required;
 - Minor effects: wind conditions would be one category calmer/windier than required; and

- Negligible: where no discernible improvement or deterioration is expected as a result of the Development and wind conditions would be suitable for the intended use.
- 11.48 Any adverse effect is a 'significant effect' because it implies that a location, or area, has a wind microclimate that is unsuitable for the desired use of that area. On this basis, effects that are adverse need mitigating. Beneficial effects that are minor, moderate or major in scale are not considered to be significant.
- 11.49 In line with Lawson's overall methodology, strong winds are reported separately from the comfort assessment and do not form part of the scale of effects criteria. This is due to the fact that any strong wind exceedance is considered to be significant regardless of its scale.
- 11.50 In terms of off-Site areas, wind conditions are compared to the baseline scenario and the intended use. If wind conditions remain consistent or calmer than the baseline scenario or remain suitable for the intended use, this would represent a negligible effect. However, if wind conditions around the Site are windier than the baseline scenario and unsuitable for the intended use, the effects would be significant. Wind conditions off-Site will only be classified as beneficial if wind conditions were not suitable for the intended use in the baseline scenario and are improved to be calmer than required for the intended use with the Development completed. If conditions are windier than the baseline, but remain suitable for the intended use, this would remain a negligible effect.

Limitations and Assumptions

- 11.51 It is assumed that there will be restricted access (i.e. not accessible to the general public) across the Site during the demolition and construction stages. As the area would not typically be for pedestrian use, windier conditions within the Site would be tolerable during the demolition and construction stage.
- 11.52 This assessment is based on worst-case wind speeds, expected to be encountered during the windiest season (December, January and February) in the UK. Additional consideration has been made for summer wind conditions due to the presence of ground floor public amenity spaces. This complies with the standard methodology set out by Lawson for wind-microclimate assessments.
- 11.53 It is expected that use of outdoor amenity spaces and rooftop terraces for sitting will be limited to the summer season. During the winter, it would be expected that these spaces would increase a criteria level to standing use.

11.54 It is expected that the ground floor amenity spaces, roof top terraces and balconies would be used primarily during the summer season for sitting and standing. During winter, it would be expected that these spaces would experience less frequent use and that occupants would be more tolerant of windier conditions.

Baseline Conditions

11.55 The UK meteorological Office supplies records of the number of hours that wind occurs for ranges of wind speed and by direction. Meteorological data for London Combined (Heathrow and London City Airports) provides a representation of the local wind microclimate for the wider London area.

11.56 Further explanation on the meteorological data is presented within Appendix 11 – 1 (Pedestrian Level Wind Microclimate Assessment), section 2.4

Configuration 1: Existing Site with Existing Landscaping and Existing Surrounding Buildings

11.57 Wind conditions for Configuration 1 are presented in Figure 11.2 for the windiest season and in Figure 11.3 for the summer season.

Pedestrian Comfort

11.58 Thoroughfare locations at and around the Site have wind conditions suitable for strolling use or calmer during the windiest season.

11.59 Wind conditions at the entrances to the existing developments in the vicinity of the Site (measurement locations 1, 25, 209, 214, 220 and 226) are suitable for sitting use during the windiest season.

11.60 Pedestrian crossings (measurement locations 28, 31 and 172) and bus stops (measurement locations 17, 40 and 41) in the vicinity of the Site have wind conditions suitable for sitting and standing use during the windiest season.

11.61 Off-Site amenity areas (measurement locations 45, 46, 164-168, 206, 210, 215, 221 and 222) have wind conditions suitable for sitting use during the summer season.

Strong Winds

11.62 There are no Strong winds exceeding 15m/s for more than 0.025% of the time (approximately

2.2 hours per year) in the baseline scenario.

Likely Significant Effects

Effects during Demolition and Construction

- 11.63 Based on the description of the Baseline environment (Configuration 1), it would be expected that conditions during the demolition and early construction stage would be suitable for a working construction site or pedestrian thoroughfares around the Site (with the hoarding in place). Therefore, the likely effect on construction workers and the existing surrounds is expected to be Negligible (not significant) and no additional design and/or management measures are considered necessary during the demolition and construction stage of the Development.
- 11.64 As construction of the Development proceeds, and massing is erected, wind conditions at the Site would gradually adjust from those of the existing site to those of the fully built Development, as described in the following section. Therefore, any mitigation measures proposed within this chapter should be incorporated to the Development before it becomes operational.

Completed Development

Configuration 2: The massing Option 1 with Existing Landscaping and Existing Surrounding Buildings

- 11.65 The discussion of the wind conditions for the Configuration 2 is based on the results presented in Figures 11.4 and 11.5 for windiest and summer season respectively for ground level, Figure 11.6 for summer season for elevated levels and Figure 11.7 for annual safety exceedances at ground level.

Pedestrian Comfort

- 11.66 Completion of the Development would create localised areas with windier conditions compared to the baseline scenario and areas with conditions windier than suitable for the intended use.
- 11.67 Prevailing winds which down-draught along the western façade of Block A and accelerate around the south-western corner would create windier conditions towards the south-west of the Site.

- 11.68 Due to the winds that would channel between Block F and Block E, wind conditions at this passage would be windier than suitable for the intended use.
- 11.69 Wind conditions at and surrounding the Development would be suitable for walking use or calmer during the windiest season.
- 11.70 Wind conditions during the summer season at the Development and surrounding area would be suitable for strolling use or calmer.

Thoroughfares

- 11.71 On-Site thoroughfares would have wind conditions suitable for sitting to walking use during the windiest season. This would represent Moderate Beneficial (not significant) to Minor Adverse (significant) effects.
- 11.72 Thoroughfares with walking conditions (measurement locations 9 and 129) would represent a Minor Adverse (significant) effect and would require mitigation.
- 11.73 Off-Site thoroughfares in the vicinity of the Development would be suitable for strolling use or calmer during the windiest season, which would represent a Negligible (not significant) effect.

Entrances

- 11.74 The majority of entrances to the Development would have wind conditions suitable for sitting and standing use during the windiest season, which would represent Minor Beneficial (not significant) and Negligible (not significant) effects.
- 11.75 Strolling conditions (measurement locations 7, 37 and 130) and walking conditions (measurement location 189) at the entrances to the Development would represent Minor Adverse (significant) and Moderate Adverse (significant) effects and would require mitigation.
- 11.76 Similar to the baseline scenario, off-Site entrances would be suitable for sitting use during the windiest season. This would represent a Negligible (not significant) effect.

Bus Stops

- 11.77 The majority of bus stops in the vicinity of the Development (measurement locations 17 and 41) would be suitable for standing use during the windiest season, which would represent a

Negligible (not significant) effect. With the inclusion of the bus stop shelter at the bus stop to the south of the Development (measurement location 40) this would be suitable for the intended use during the windiest season and would represent a Negligible (not significant) effect.

Pedestrian Crossings

11.78 Pedestrian crossings around the Development (measurement locations 28, 31 and 172) would be suitable for sitting and standing use during the windiest season and would represent a Negligible (not significant) effect.

Ground Floor Amenity spaces

11.79 The majority of the ground floor amenity spaces at the Development would be suitable for sitting use (measurement locations 74, 78, 94, 122 and 126) and standing use (measurement locations 58, 60, 61, 64, 65, 68, 69, 89, 91, 106, 112, 117, 133, 135, 138, 139, 141, 144, 147, 148 and 153). This would represent Negligible (not significant) effects provided seating is allocated in areas suitable sitting use.

11.80 Strolling conditions at the on-Site amenity area (measurement location 188) would represent Minor Adverse (significant) effects as there is no allocated seating area at this location and would require mitigation.

11.81 The majority of existing amenity spaces in the vicinity of the Development would have wind conditions suitable for sitting use similar to baseline scenario which would represent a Negligible (not significant) effect. However standing conditions at the seating area to the south-east of the Development (measurement location 167 and 168) would represent Minor Adverse (significant) effects and would require mitigation.

Elevated Level Amenity Spaces

11.82 Terrace level amenity spaces (measurement locations 233-247, 307 and 308) would be suitable for sitting use during the summer season and this would represent a Negligible (not significant) effect.

11.83 The majority of the balconies in the Development would have wind conditions suitable for standing use or calmer during the summer season, suitable for the intended. This would represent a Negligible (not significant) effect.

11.84 Strolling conditions on the uppermost balconies on the western façade of Block F (measurement locations 285 and 286) would be one category windier than suitable for the intended use. This would represent a Minor Adverse (significant) effect.

Strong Winds

11.85 There would be two instances of Strong winds (measurement locations 9 and 37) exceeding 15m/s for more than 0.025% of the time (approximately 2.2 hours per year). These would require mitigation measures.

Mitigation Measures

Mitigation Measures During Demolition and Construction

11.86 During the demolition and construction stage, the area under construction would be surrounded by hoarding until the Development is completed. No other mitigation would be required during the demolition and construction stage. However, due to the occurrence of wind conditions windier than suitable for intended use when the Development is in situ, the following mitigation measures would be implemented to the Development before it becomes operational.

Completed Development Mitigation

11.87 Due to the presence of conditions windier than suitable for the intended use and instances of strong winds within and surrounding the Development; a wind mitigation workshop was undertaken to develop mitigation measures through an iterative wind tunnel testing process with the inclusion of the proposed landscaping. As a result, the following mitigation measures will be incorporated into the proposed landscaping scheme before the Development becomes operational to achieve a suitable and safe wind microclimate at and around it:

- Recessing the entrance to Block A along the northern façade (measurement location 7) by 1.5m;
- Recessing the entrance at the south-western corner on Block A (measurement location 37) by 1.5;
- Recessing the entrance to Block E along the southern façade (measurement location 189) by 1.5m;
- Addition of eleven 4m high deciduous trees along the red line boundary to the west of Block A in the space between the existing trees to north-west and south-west of Block A;

- Addition of 1.5m high hedge on 0.5m wide, 0.5m high planter beds along the western façade of Block A;
- Addition of 1.5m high hedge on 0.5m wide, 0.5m high planter beds wrapped around the north-western corner of Block A; and
- 1.1m high 50% porous balustrade along the perimeter of the balconies on the western façade of Block F.

Configuration 3: massing Option 1 with existing landscaping, proposed landscaping scheme, mitigation measures and existing surrounding buildings

11.88 Figures 11.8 and 11.9 present the windiest and summer season results respectively for the completed operational Development in the context of existing landscaping, proposed landscaping scheme, mitigation measures and existing surrounding buildings for ground floor level. Figure 11.10 presents the summer results for elevated levels.

Pedestrian Comfort

11.89 With the inclusion of the proposed landscaping scheme and mitigation measures, overall wind conditions at the Development would be calmer compared to that in Configuration 2. As a result, wind conditions at and around the Site would be suitable for the intended use throughout the year.

11.90 Wind conditions at and surrounding the Development would be suitable for strolling use or calmer during both the windiest and summer season.

Thoroughfares

11.91 On-Site thoroughfares would have wind conditions suitable for sitting to strolling use during the windiest season. This would represent Moderate Beneficial (not significant) to Negligible (not significant) effects.

11.92 Existing thoroughfares in the vicinity of the Development would be suitable for strolling use or calmer during the windiest season, which would represent a Negligible (not significant) effect.

Entrances

11.93 The majority of entrances to the Development would have wind conditions suitable for sitting

and standing use during the windiest season, which would represent Minor Beneficial (not significant) and Negligible (not significant) effects.

11.94 Entrances with wind conditions suitable for strolling conditions (measurement locations 7, 37 and 189) would be recessed by 1.5m. Recessing the entrance would provide a transitional zone with calmer wind conditions for pedestrians exiting/entering the building. By recessing the entrances where strolling conditions are observed, acceptable standing conditions are expected to occur at recessed areas and would therefore be suitable for entrance use. Therefore, this would represent a Negligible (not significant) effect.

11.95 Entrances to the existing developments in the vicinity of the Development would remain suitable for the intended use during the windiest season, which would represent a Negligible (not significant) effect.

Bus Stops

11.96 Bus stops in the vicinity of the Development (measurement locations 17, 40 and 41) would be suitable for the intended use during the windiest season, which would represent a Negligible (not significant) effect.

Pedestrian Crossings

11.97 Pedestrian crossings around the Development (measurement locations 28, 31 and 172) would be suitable for sitting and standing use during the windiest season and would represent a Negligible (not significant) effect.

Ground Floor Amenity spaces

11.98 The inclusion of the landscaping scheme and wind mitigation measures would result in areas suitable for sitting use (measurement locations 61, 64, 65, 68, 69, 78, 94, 106, 122, 126, 133, 135 and 138) and standing use (measurement locations 58, 60, 74, 89, 91, 112, 117, 139, 141, 144, 147, 148, 153 and 188) during the summer season. As the seating would be allocated in areas suitable for sitting use this would represent a Negligible (not significant) effect.

11.99 With the inclusion of existing landscaping measures, the existing ground floor amenity areas in the vicinity of the Development would be suitable for sitting use during the summer season, similar to that in the baseline scenario. This would represent a Negligible (not significant) effect.

Elevated Level Amenity Spaces

- 11.100 Terrace level amenity spaces would be suitable for sitting (measurement locations 233-237, 239, 241-247, 307 and 308) and standing (measurement locations 238 and 240) use during the summer season. As seating would be allocated in areas suitable for sitting use this would represent a Negligible (not significant) effect.
- 11.101 With the inclusion of the wind mitigation measures, balcony amenity areas of the Development would be suitable for sitting and standing use during the summer season, suitable conditions for private amenity areas. This would represent a Negligible (not significant) effect.

Strong Winds

- 11.102 With the inclusion of proposed landscaping and mitigation measures there would be no instances of strong winds exceeding 15m/s for more than 0.025% pf the time (approximately 2.2 hours per year)

Configuration 4: Development (massing Option 2) with existing landscaping, proposed landscaping scheme, mitigation measures and existing surrounding buildings

- 11.103 The final massing of the Development (massing Option 2) which is to be submitted for planning included height adjustments for Block A and Block F. Therefore, it was tested to assess the effects of this massing on the wind microclimate at and around the Development.
- 11.104 The following discussion is based on the results of the additional massing option of the Development (Option 2) which was tested with the existing landscaping, proposed landscaping scheme, mitigation measures and existing surrounding buildings. This Option 2 massing option contained the following changes:
- Increasing the height of north-western development of Block A by two storeys;
 - Increasing the height of south-western development of Block A by one storey;
 - Reducing the height of southern development of Block F by one storey; and
 - Reducing the height of northern development of Block F by two storeys.
- 11.105 It should be noted that due to time constraints model of massing Option 2 of the Development was tested using the simplified model which did not include the corner balconies and protruding balconies that were modelled in massing Option 1 massing which was tested in Configurations 2 and 3.

11.106 Wind conditions at the terraces and balconies are expected to remain consistent with Configuration 2.

11.107 Figures 11.11 and 11.12 present the windiest and summer season results respectively for the completed operational Development (Option 2) in the context of existing landscaping, proposed landscaping scheme, mitigation measures and existing surrounding buildings for ground floor level. Figure 11.13 presents the occurrence of strong winds exceeding the threshold at ground level.

Pedestrian Comfort

11.108 Increasing the massing height of Block A would create windier conditions at pedestrian level as the prevailing wind would down-draught along the western façade and accelerate around north-western and south-western corner.

11.109 Reducing the height of Block F would result in calmer wind conditions at the passage between Block E and Block F as the down-draughting wind would have low speed compared to the initial massing. As a result, entrance to Block E along the southern façade (measurement location 189) would be suitable for standing use during the windiest season.

11.110 Wind conditions at and surrounding the Development would be suitable for walking use or calmer during the windiest season.

11.111 Wind conditions during the summer season at the Development and surrounding area would be suitable for strolling use or calmer.

Thoroughfares

11.112 On-Site thoroughfares would have wind conditions suitable for sitting to walking use during the windiest season. Walking conditions which would occur at measurement locations 8 and 38 are caused by the prevailing winds which would down-draught along the western and southern façades of the Block A and then accelerate around the corner.

11.113 It should be noted that the walking conditions at measurement location 8 and 38 are marginal exceedances and measurement locations 8 and 38 would be suitable for strolling and standing use respectively during the windiest season in Configuration 3. Increasing the north-west portion of Block A by 2 storeys and south-west portion by 1 storey would down-draught winds with higher mean speeds which would then accelerate around the corners causing walking conditions at measurement location 8 and 38. Therefore, even with the balconies modelled

further mitigation measures would still be required.

11.114 Wind conditions on thoroughfares at the Development when the massing Option 2 is in situ with the inclusion of corner and protruding balconies therefore would be suitable for the sitting use to walking use during the windiest season, which would represent a Moderate Beneficial (not significant) to Minor Adverse (significant) effect.

11.115 Wind conditions on thoroughfares surrounding the Development would be suitable for strolling use or calmer during the windiest season. This would represent a Negligible (not significant) effect.

Entrances

11.116 The majority of entrances to the proposed massing Option 2 would be suitable for sitting to standing use during the windiest season, which would represent Minor Beneficial (not significant) to Negligible (not significant) effects.

11.117 Entrances with strolling conditions (measurement locations 7 and 37) would be suitable for standing use as these would be recessed by 1.5m. This would represent a Negligible (not significant) effect.

11.118 Decreasing the height of Block F would result in wind conditions suitable for standing use at the entrance to Block E along the southern façade (measurement location 189) and this would represent a Negligible (not significant) effect.

11.119 Wind conditions at entrances to the surrounding developments would remain suitable for the intended use during the windiest season. This would represent a Negligible (not significant) effect.

Bus Stops

11.120 Bus stops in the vicinity of the Development would remain suitable for the intended use during the windiest season, which would represent a Negligible (not significant) effect.

Pedestrian Crossings

11.121 Pedestrian crossings around the Development would be suitable for sitting and standing use during the windiest season and would represent a Negligible (not significant) effect.

Ground Floor Amenity spaces

- 11.122 Inclusion of Proposed landscaping scheme and wind mitigation measures would result in areas suitable for sitting use (measurement locations 60, 65, 68, 69, 78, 94, 106, 117, 122, 126, 135, 138 and 139) and standing use (measurement locations 58, 61, 74, 89, 91, 112, 133, 141, 144, 147, 148, 153 and 188) during the summer season. As the seating would be allocated in areas suitable for sitting use this would represent a Negligible (not significant) effect.
- 11.123 The existing ground floor amenity areas in the vicinity of the Development would be suitable for sitting use during the summer season, similar to that in the baseline scenario. This would represent a Negligible (not significant) effect.

Elevated Level Amenity Spaces

- 11.124 Wind conditions at elevated levels in the massing Option 2 have been qualitatively assessed based on the quantitative assessment of the initial massing (Option 1) (Configuration 3). As there would not be any substantial changes to the building heights and geometry, with the proposed mitigation measures in place wind conditions at elevated levels in the secondary massing would be expected to be similar to that of the initial massing. This would represent a Negligible (not significant) effect.

Strong Winds

- 11.125 The results indicate that there would be two instances of strong winds (measurement locations 38 and 39) exceeding 15m/s for more than 0.025% of the time (approximately 2.2 hours per year).
- 11.126 In the initial massing testing (Configuration 3) strong winds exceeding 15m/s would only occur for 0.02 hours per year at probe location 38 and for 0.23 hours per year at probe location 39, well under the threshold value of 2.2 hours per year.
- 11.127 However, when the secondary massing is in place strong winds exceeding 15m/s would occur up to 5.11 hours per year at measurement location 38 and up to 2.42 hours per year at measurement location 39. Strong winds exceeding the safety threshold at the above-mentioned measurement locations are expected to be caused by the increasing the massing height of south-western and north-western portions of Block A and lack of corner balconies and protruding balconies in the simplified secondary massing model. As the height increase would cause prevailing winds with higher wind speeds to down-draught along the western

and southern façade of Block A and the lack of protruding and corner balconies would increase the wind speeds further which would accelerate through the undercut in south-western corner. Therefore, mitigation measures should be developed to eliminate the occurrence of strong winds if this massing option is to be used.

Further Mitigation

11.128 Due to the occurrence of strong winds at measurement locations 38 and 39 and conditions windier than suitable for the intended use at measurement locations 8 and 38 in Configuration 4. The following wind mitigation measures would be implemented to provide beneficial shelter:

- Increasing the height of the hedge at the north-western corner of Block A from 1.5 to 2m or increasing the planter bed height to 1m;
- Addition of 1.5m high 2m wide at least 50% porous screen at the south-western corner of Block A (north-west of measurement location 38);
- Addition of 1.5m high hedges on either side of the entrance at south-western corner (measurement location 37); and
- Addition of three 4m high deciduous tree at the south-western corner of Block A (to the north-west of measurement location 38).

Summary

11.129 A wind microclimate assessment has been undertaken using wind tunnel testing to determine the changes to the pedestrian level winds as a result of the Development.

11.130 Conditions at the Development have been assessed with reference to the Lawson Comfort Criteria which relate to the suitability of wind speeds at a given area for the intended use of that area. The Lawson Comfort Criteria also specifies a threshold for 'strong winds', which have the potential to be a safety concern for cyclists and more vulnerable pedestrians when winds exceed 15m/s for more than approximately 2.2 hours per year.

11.131 Wind Conditions at and in the vicinity of the existing Site are suitable for the intended use throughout the year with no instances of strong winds exceeding 15m/s for more than approximately 2.2 hours per year.

11.132 During the construction and demolition stage, wind conditions would be expected to gradually adjust from conditions in the baseline scenario to those when the Development is operational.

Wind conditions on and surrounding the Site would therefore be suitable for the intended pedestrian uses. Conditions would therefore represent a Negligible (not significant) effect. However, the proposed landscaping scheme and wind mitigation measures should be included prior to the Development become operational.

11.133 The effects of the Development on the wind microclimate at and around the Site has been assessed using an earlier, taller iteration of the design (massing Option 1) of the Development and due to the instances of strong winds and conditions windier than suitable for intended pedestrian use, mitigation measures were developed to ensure a safe and comfortable wind microclimate at and around the Development.

11.134 The inclusion of the developed mitigation measures in combination with the proposed landscaping scheme would result in wind conditions suitable for intended pedestrian use throughout the year and there would be no instances of strong winds exceeding the safety threshold.

11.135 A lower design (Massing option 2 is submitted for planning approval). Once a wind microclimate suitable for pedestrian and occupants was achieved, massing Option 2 was tested with the inclusion of the proposed landscaping scheme and developed mitigation measures.

11.136 It should be noted that due to the time constraints, a simplified model (that did not include any balcony details) of massing Option 2 was constructed and tested. Wind conditions at the balcony levels are not expected to change between the massing options.

11.137 Overall wind conditions at and around the secondary massing option would remain similar to those in Configuration 3; suitable for intended use throughout the year. However, there would be two instances of walking (measurement locations 8 and 38) and two instances where strong winds would exceed 15m/s for more than 2.2 hours per year (measurement locations 38 and 39)

11.138 It should be noted that Block A would have protruding balconies and corner balconies at the north-western and south-western corners. These corner balconies would represent a chamfering effect and winds would flow through them and the protruding balconies would reduce the speed of any winds that down-draught along the western and southern façade of Block A. However, the simplified massing model of the Option 2 of the Development was tested without these elements and also with increased storey heights. Therefore, winds accelerating towards the ground floor would be of high speeds resulting in windier conditions at measurement locations 8 and 38. As this would be one category windier than suitable for

the intended use mitigation measures would be required.

11.139 Similarly, strong winds exceeding the 15m/s threshold at measurement location 38 and 39 are expected to be caused by combination of the increase in massing height and also due to the lack of corner and protruding balconies modelled in the second massing option. Due to the occurrence of strong winds further wind tunnel test is recommended to develop and refine the mitigation options suggested.

Table 11.2: Table of Significance – Wind Microclimate

Potential Effect	Nature of Effect (Permanent/Temporary)	Significance (Major/Moderate/Minor) (Beneficial/Adverse/Negligible)	Mitigation / Enhancement Measures	Geographical Importance*							Residual Effects (Major/Moderate/Minor) (Beneficial/Adverse/Negligible)
				I	UK	E	R	C	B	L	
Demolition and Construction (On Site)											
Wind conditions at the demolition and construction Site	Temporary	Moderate Beneficial (not significant) to Minor Beneficial (not significant)	None required							L	Moderate Beneficial (not significant) to Minor Beneficial (not significant)
Demolition and Construction (Off Site)											
Wind conditions on thoroughfares at the vicinity of the Site (windiest season)	Temporary	Negligible (not significant)	None required							L	Negligible (not significant) to Minor Beneficial (not significant)
Wind conditions at entrances to the existing developments (windiest season)	Temporary	Negligible (not significant)								L	Negligible (not significant)
Wind conditions at the existing Bus stops and pedestrian crossings in the vicinity of the Site (windiest season)	Temporary	Negligible (not significant)	None required							L	Negligible (not significant)
Existing amenity areas around the Development (summer season)	Temporary	Negligible (not significant)	None required							L	Negligible (not significant)

Completed Development (On Site) – The Development (referred to as Option 2)										
Wind conditions on thoroughfares (windiest season)	Permanent	Moderate Beneficial (not significant) to Minor Adverse (significant)	Increasing the height of the proposed hedge from 1.5m to 2m at the north-western corner and adding 1.5m high 2m wide at least 50% porous screen at the south-western corner along the southern façade (north-west of measurement location 38)						L	Moderate Beneficial (not significant) to Negligible (not significant)
Wind conditions at entrances to the Development (windiest season)	Permanent	Negligible (not significant) to Moderate Beneficial (not significant)	None required						L	Negligible (not significant) to Moderate Beneficial (not significant)
Wind conditions at ground floor amenity spaces (summer season)	Permanent	Negligible (not significant)	None required						L	Negligible (not significant)
Wind conditions at elevated levels (summer season)	Permanent	Negligible (not significant)	None required						L	Negligible (not significant)
Strong wind exceedances	Permanent	Significant	Three 4m high deciduous trees (north, north-west of measurement location 39) or 1.5m high 2m wide at least 50% porous screen at the south-western corner to reduce the corner accelerating winds						L	Significant

Completed Development (Off Site)											
Wind conditions on thoroughfares at the vicinity of the Site (windiest season)	Permanent	Negligible (not significant)	None required							L	Negligible (not significant)
Wind conditions at entrances to the existing developments (windiest season)	Permanent	Negligible (not significant)	None required							L	Negligible (not significant)
Wind conditions at the existing Bus stops and pedestrian crossings in the vicinity of the Site (windiest season)	Permanent	Negligible (not significant)	None required							L	Negligible (not significant)
Existing amenity areas around the Development (summer season)	Permanent	Negligible (not significant)	None required							L	Negligible (not significant)

*** Geographical Level of Importance**

I = International; UK = United Kingdom; E = England; R = Regional; C = County; B = Borough; L = Local

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