10. WIND MICROCLIMATE

Introduction

10.1 This Wind Microclimate chapter has been prepared by SRE Ltd to assess the likely significant effects of the Development on the environment in respect of Wind Microclimate.

10.2 This chapter describes the relevant policy context, the methods used to assess the potential impacts, and the likely significant effects during demolition, construction and once the Development is complete and operational. Where applicable, mitigation measures are identified to prevent, reduce or offset the effects and the nature and significance of the residual effects is assessed.

10.3 This chapter draws on the technical assessment findings in 'SRE Microclimate Report' which is included within Appendix 10.1. Through undertaking a Computational Fluid Dynamic (CFD) wind study for the Site, a robust study of the microclimate conditions generated by the Development has been provided.

Legislation, Policy and Guidance Context

10.4 The wind microclimate assessment has been undertaken within the context of relevant legislation, planning policies and guidance documents. These are summarised below:

National Planning Policy

National Planning Policy Framework[i]

10.5 In February 2019, the Government published an updated version of the National Planning Policy Framework (NPPF). There are no policies or statements that are directly related to the wind microclimate. However, the benefits of a high-quality built environment are emphasised in the NPPF. For example:

> *"Planning policies and decisions should ensure that developments: […]*
> *a) will function well and add to the overall quality of the area, not just for the short term but over the lifetime of the development; […]*
> *f) create places that are safe, inclusive and accessible and which promote health and well-being, with a high standard of amenity for existing and future users…"*

National planning Practice Guidance[ii]

10.6 The National Planning Practice Guidance (NPPG) was updated in 2019 and there is no guidance related to tall buildings and wind microclimate issues.

UK Climate Projections (UKCP18) (2019)[iii]

10.7 The Met office's UK Climate Projections (UKCP18) presents a number of different predicted climate scenarios. The 'Climate Projects Report' published by UKCP18 presents the probable changes in wind speed for 2070 - 2099 in both the summer and winter seasons.

10.8 Based on these predictions, the current trends in the climate change are not likely to have any significant effects on the predicted wind microclimate conditions in and around the Development. It is therefore not necessary to provide any quantitative analysis of the increase in storm frequency and its associated implication on the effect on the wind microclimate for the Development.

Regional Planning Policy

The London Plan Spatial Development Strategy for London - Consolidated with Alterations (2016)[iv]

10.9 The London Plan places great importance on the creation and maintenance of a high-quality environment for London. The following policies apply 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: […] d) Not cause unacceptable harm to the amenity of surrounding land and buildings, particularly residential buildings, in relation to privacy, overshadowing, wind and microclimate. This is 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 [Local Development Framework].

Tall buildings: a) Should not affect their surroundings adversely in terms of microclimate, wind turbulence, overshadowing, noise, reflected glare, aviation and telecommunication interference."

The London Plan Intend to Publish - Spatial Development Strategy for Greater London (2019)[v]

10.10 The 'new' London Plan refines the above policies that apply in relation to wind microclimate:

Policy D8 Public Realm:

"Development Plans and development proposals should: […] G ensure buildings are of a design that activates and defines the public realm, and provides natural surveillance. Consideration should also be given to the local microclimate created by buildings, and the impact of service entrances and facades on the public realm."

Policy D9 Tall Buildings

"C Development proposals should address the following impacts: […] 3) environmental impact a) wind, daylight, sunlight penetration and temperature conditions 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.

[…] 4) cumulative impacts a) 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 Planning Guidance (2014)[vi]

10.1 The GLA has previously provided additional planning guidance around Micro-Climate and large buildings (as per The London Plan Policy 7.6: Architecture), and recommended the methodology for assessing local wind speed in Para 2.3.6 – which is being undertaken for the Development:

"Large buildings have the ability to alter their local environment and affect the micro-climate. For example, […] they can influence how wind travels across a site, potentially making it unpleasant at ground level or limiting the potential to naturally ventilate buildings. One way

> *to assess the impact of a large building on the comfort of the street environment is the Lawson Comfort Criteria. […]*
>
> *Where a proposed development is significantly taller that it's 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 uses."*

Local Planning Policy

Royal Borough of Kingston upon Thames – Core Strategy (2012)[vii]

10.2 Although the Royal Borough of Kingston upon Thames (RBKuT) Local Development Framework: Core Strategy (2012) does not reference wind microclimate directly, it does consider in Policy CS8 that tall buildings '*may be appropriate in the Borough's town centres*' and refers any assessment back to the London Plan policies.

10.3 However, the principles of good design are stated throughout the Core Strategy, including:

Policy DM10 Design Requirements for New Developments (including House Extensions):

> *"Development proposals will be required to incorporate principles of good design. The most essential elements identified as contributing to the character and local distinctiveness of a street or area which should be respected, maintained or enhanced […] Development proposals should also:*
> *K. have regard to the amenities of occupants and neighbours, including in terms of privacy, outlook, sunlight/daylight, avoidance of visual intrusion and noise and disturbance,*
> *q. have regard to the public realm and to ways in which it can be enhanced as an integral part of the design of the development."*

Guidance Documents

Guidance on tall buildings (2007)[viii]

10.11 English Heritage and the 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 the section Criteria for evaluation, it states 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 (2015)[ix]

10.12 The Historic England Advice Note 4: Tall Buildings 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,"*

Assessment Methodology

10.13 The following section outlines the methodologies applied to identify and assess the likely significant wind effects resulting from the Development.

10.14 The aims of the wind microclimate assessment are as follows:

- To assess the suitability of the wind microclimate at residential amenity spaces within the Development, for outdoor seating in the summer;
- To assess the wind conditions at ground level amenity spaces across the Development and also the off-site adjacent residential spaces in the summer;
- To assess the suitability of entrances of the Development to achieve suitable conditions throughout the year; and
- To assess the wind microclimate along the pedestrian thoroughfares within the Site and adjacent areas throughout the year.

Consultation

10.15 The proposed approach to assessment of the effects in relation to Wind Microclimate was set out in the submitted EIA Scoping Report (April 2020) (Appendix 2.1 of the ES). The Scoping Opinion received from RBKuT (June 2020) (Appendix 2.2 of the ES) agreed with the proposed approach to assessment.

10.16 No further consultation has been undertaken specifically with regard to Wind Microclimate.

Baseline Characterisation

10.17 The baseline conditions at the Site are characterised by:

- Review of available meteorological data to establish the prevailing wind directions and (if

applicable) any adjustment of that data for the Site-specific application in the modelling;

- Establishing a 3D model of the existing buildings in, and surrounding, the Site within a >400m radius and subsequent transient CFD simulation of the existing Site conditions. This radius is sufficient to capture the localised, building-specific wind effects on the local wind microclimate. Buildings and terrain located further away from the Site are modelled in form and mass in order to modify the behaviour of the wind to reflect the real conditions on-site;
- Overall measurement and results have been shown within the modelled area covering the 4 aims of the microclimate assessment (listed above); and
- The analysis of the Existing Condition scenario was undertaken using the same modelling and analysis methods used for the Development scenarios (as detailed later in the chapter).

Impact Assessment Methodology

Construction Phase

10.18 The potential microclimate impacts and likely significant effects during construction (including demolition) have not been directly assessed within the transient CFD modelling. This is because construction is a temporary condition and would be highly variable as the Development is built out in phases with specific existing buildings being demolished, and new buildings being constructed.

10.19 Construction activity is likely to be less sensitive to general wind conditions due the nature of the Site during construction (ie site hoardings, restricted site access for workers) compared to when the Development is completed (ie new pedestrian throughfares, new entrances and open space). Therefore, a qualitive assessment has been provided based on professional judgement informed by the background wind microclimate in the area and the results of the assessed scenarios for the baseline condition and completed Development.

Completed Development Phase

10.20 To predict the local wind environment associated with the completed Development, and the resulting pedestrian comfort within and immediately surrounding the Site, transient CFD modelling has been undertaken covering 16 no. wind directions.

10.21 The latest transient CFD modelling is a highly accurate and effective way of assessing the pedestrian level wind microclimate at and surrounding a site allowing it to be quantified and

classified in accordance with the widely accepted Lawson Comfort Criteria (LCC), a summary of which is provided later in this chapter.

10.22 CFD modelling provides a detailed assessment of the mean and gust wind conditions around the Site and the Development for the tested wind directions, in terms of pedestrian comfort and pedestrian safety, and provides a basis to assess the potential wind microclimate impacts and likely effects of the Development with regards to its intended use. Strong winds are also reported when they occur.

Assumptions and Limitations

10.23 It is assumed that there will be restricted access to the majority of the Site during demolition and construction works, and therefore windier conditions will be tolerable in these areas which will not typically be for pedestrian use where the tolerable wind speed threshold would be lower.

10.24 It is assumed that on-site construction workers will be following all relevant health and safety protocols, and that any wind-sensitive operation would cease during high wind / storm events.

10.25 This assessment is based on the worst-case wind conditions expected to be encountered during the winter season (December, January and February) in the UK. In addition, the summer wind conditions are considered due to the presence of outdoor amenity spaces at street, podium and balcony levels (Phase 1 only) across the Site.

10.26 This study complies with the standard methodology set out by the LCC for wind microclimate assessments.

CFD Modelling Methodology

10.27 In order to assess wind conditions against the full LCC, the CFD study should determine mean and gust wind speeds for a minimum of 16 no. wind directions. It is also an essential requirement of a CFD study that it can calculate peak wind speeds with a low probability of occurrence to determine the likelihood of distress or safety thresholds being exceeded.

10.28 The computational process involves the calculation of the equations of fluid motion. In this study a transient Computational Fluid Dynamic (CFD), based on the Lattice Boltzmann method (LBM), has been used. A computational 'mesh' was created to represent the geometry by dividing the domain into a large number of cell volumes. During the simulation, the values of each variable are determined in each cell of the mesh and a comprehensive assessment of

velocity and scalar variation within the calculation domain was obtained.

10.29 When assessing pedestrian level wind speed, the appropriate terrain roughness and wind velocity profile must be considered. The surface roughness applied to the CFD model is 0.30 which corresponds to a suburban area.

10.30 The CFD modelling has assessed the maximum parameter 3D massing for Phases 2-5 (Outline element of the Development) and the detailed 3D architectural model for Phase 1 (Detailed element of the Development).

10.31 The assessment quantifies the expected wind microclimate in pedestrian area at ground level and terrace level of the Development, and for the detailed Phase 1 element of the Development only, individual balconies & terraces. The modelled wind speed data is benchmarked against the LCC to determine the suitability of the Site for different pedestrian activities. Strong winds are considered and results for the windiest season are presented, as well as results for the summer when amenity spaces are more likely to be used frequently.

10.32 Analysis was also undertaken to assess compliance with the LCC and Lawson Distress Criteria (LDC) – Lawson 'safe criteria' by interpolating the transient CFD results of the site with hourly weather data in order to predict the frequencies of wind speeds across the course of a whole year.

10.33 Wherever possible and appropriate, the windiest (winter) season has been used to assess the likely wind conditions for the various scenarios.

Assessment Scenarios

10.34 The following three scenarios have been modelled:

- Scenario 1: Existing Site with existing surrounding buildings;
- Scenario 2: Development with existing surrounding buildings; and
- Scenario 3: Development (including mitigation measures) with existing surrounding buildings.

10.35 There are no committed developments immediately adjacent to the Site to be taken into account within a further cumulative scenario. The only proposed new residential scheme is located over 100m away at the southern end of Hampden Road which is located south east of the Site. This committed development is not relevant as this wind direction is the weakest

and least frequent wind condition for the area.

Pedestrian Wind Comfort Criteria

10.36 The assessment uses the Lawson Comfort Criteria (LCC) which sets five threshold wind speeds and then dictates the probability of wind speeds exceeding that threshold. The different threshold values, as well as the probability values, determine the likely reaction of an average pedestrian to the wind.

10.37 Each wind level corresponds to a pedestrian activity that could be achieved in an acceptable manner (sitting, standing etc) and the probability is calculated using the statistic weather data for the local area. If the measured wind conditions exceed the threshold wind speed for more than 5% of the time, then they are unacceptable for the stated pedestrian activity and the expectation is that people will not use the particular area for its intended purpose.

10.38 The LCC sets out five levels of pedestrian activities in ascending order relating to wind conditions: frequent sitting, occasional sitting, standing and walking. The fifth level is for those conditions that are uncomfortable for all pedestrian uses. This is summarised in the following table.

Table 13.1: Lawson Comfort Criteria Thresholds

Colour	Comfort Category	Wind Speed	Probability	Description
	Outdoor Dining	2	<5	Light breeze suitable for outside restaurants and seating areas where one can read a paper or comfortably sit for long periods of time
	Pedestrian Sitting	4	>5	Breeze suitable for shorter periods of sitting in parks and outdoor spaces
	Pedestrian Standing	6	>5	Gentle breeze suitable for entrances, play areas and bus stops
	Pedestrian Walking	8	>5	Moderate breeze suitable for slow paced walking with occasional stops, strolling and sightseeing, window shopping, public/private sidewalks, pathways, public spaces
	Business Walking/Cycling	10	>5	Windy conditions that are uncomfortable for all pedestrian activities
	Uncomfortable	>10	>5	Uncomfortable for all pedestrian activities

10.39 The LCC are derived for open air conditions and assume that pedestrians would be suitably dressed for the season. Thermal comfort is not evaluated as part of this microclimate assessment.

10.40 The LDC specifies two strong wind categories as part of the assessment of 'Safe Criteria', and exceeding these indicate a need for remedial measures or a careful assessment of the expected use of that location. The LDC uses a slightly different scaling than the LCC – Pedestrian Wind Comfort in order to reflect these categories.

10.41 The location is 'safe' if these infrequent strong winds appear for less than 0.023% (e.g. 2 hrs) of the whole year period. Outside of these parameters the location is deemed 'unsafe'. The lower limit, 15m/s, is intended to identify wind conditions which elderly people, cyclists or children may find physically difficult. Infrequent strong wind can cause some pedestrians to have difficulties with walking, to stumble or fall. Wind speeds that exceed the upper limit, 20m/s, represent a safety risk for all members of the population. This is summarised in the following Table:

Table 13.2: Lawson Safe Criteria

Colour	Comfort Category	Wind Speed	Probability	Description
	Sitting	4	<5	Reading a newspaper and eating and drinking, sitting in outdoor cafes, patios, terraces, benches, gardens, parks
	Standing	6	<5	Appropriate for bus stops, building entrances or exits, children's play areas
	Strolling	8	<5	Gentle breeze suitable for entrances, play areas and bus stops
	Business Walking/ Cycling	10	<5	Moderate breeze suitable for slow paced walking with occasional stops, strolling and sightseeing, window shopping, public/private sidewalks, pathways, public spaces
	Uncomfortable	>10	>5	Windy conditions that are uncomfortable for all pedestrian activities
	Unsafe Frail	>15	>0.023	Safety risk for elderly people, cyclists or children, difficulties with walking, to stumble or fall
	Unsafe All	>20	>0.023	Safety risk for all members of the population

Defining Significance

10.42 The wind conditions are compared with the intended pedestrian use. With regards the Development, the following locations will be assessed with the required wind conditions specified for each use:

- Thoroughfares & Roads – targeting walking wind conditions;
- Entrances – targeting standing wind conditions; and
- Amenity Areas: ground floor, podium and balconies are targeting a mix of sitting and standing conditions during the summer season.

Scale & Significance

10.43 The criteria used in the assessment of effects is based upon the relationship between the desired pedestrian use of an area of the Development and its immediate surroundings (based on the LCC comfort categories) and, the predicted wind conditions at that area. This approach allows for the microclimate assessment to account for any change in pedestrian activity that might arise because of the Development.

10.44 The scale used within the assessment to assess the significance of an effect is:

- Negligible (no effect) – wind conditions are those required;
- Minor Adverse – wind conditions are one category windier than required;
- Moderate adverse – wind conditions are two categories windier than required; and
- Major Adverse – wind conditions are three categories windier than required.

10.45 The minor, moderate and major categories indicate the degree of the difference between the desired microclimate and the predicted (assessed) microclimate.

10.46 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. Similarly, negligible effects are not considered significant as they do not require wind mitigation measures.

10.47 Effects during the construction works are temporary: direct, local and short-term.

10.48 Effects once the Development is completed are permanent: direct, local and long-term.

10.49 Strong winds (affecting pedestrian safety) are not assigned a scale of effect and an overall significance but are reported separately. Any strong wind exceedance is significant and mitigation is required (as per adverse effects related to pedestrian comfort).

Baseline Condition – Scenario 1

10.50 The UK Meteorological Office supplies records of the number of hours that wind occurs for ranges of wind speed (using the Beaufort Scale) and by direction. Meteorological data for London Heathrow Airports, shown in the wind rose in SRE Microclimate Analysis Report (Appendix 10.1) has been used in this assessment as this is deemed to provide an accurate representation of the local wind microclimate for the Kingston on Thames area.

10.51 The meteorological data obtained for London indicates that the prevailing winds throughout the year are from the South-West through to the West (i.e. 225 to 275 degrees on the compass). This is typical for many areas of Greater London and southern England. There is a secondary peak of weaker winds from the North-East (ie 75 degrees on the compass) during the late spring and early summer.

10.52 CFD modelling results for pedestrian wind comfort for the existing site and the adjacent areas are shown in Figure 10.1 & 10.2 for the windiest (winter) and summer season. The safety exceedances due to strong winds for both seasons are presented in Figures 10.3 & 10.4.

Pedestrian Comfort

10.53 During the windiest (winter) season, wind conditions are suitable for sitting to walking use throughout the Site and the surrounding area.

10.54 During the summer season, the wind conditions are suitable for sitting to walking use throughout the Site and the surrounding area.

Thoroughfares

10.55 During the windiest (winter) season, wind conditions are suitable for sitting to walking use throughout the Site and the surrounding area.

10.56 During the summer season, the wind conditions are suitable for sitting to walking use throughout the Site and the surrounding area.

Entrances

10.57 During the windiest (winter) season, wind conditions are suitable for sitting to standing for all existing on-site and off-site entrance locations, which are acceptable conditions for the intended use.

Pedestrian Crossings

10.58 During the windiest (winter) season, wind conditions are suitable for sitting to walking use throughout the Site and the surrounding area.

Ground Level Amenity - Sitting

10.59 During the summer season, wind conditions are suitable for sitting for almost all existing ground level amenity space around the Site. The small semi-private communal garden and play area adjacent to Tower Block D (SW of Burritt Rd & Hampden Rd Junction) has wind conditions suitable for pedestrian walking, one level windier than suitable for a sitting location.

Podium Level Amenity – Seating

10.60 During the summer season, wind conditions are one level windier than suitable for a sitting location on the two main podium areas adjacent to Tower Blocks A & B. It should also be noted that the ground level area leading up to the access point for, and directly adjacent to, the Tower Block A podium has acceptable wind conditions for that area suitable for walking use.

Roads

10.61 During the windiest (winter) season, wind conditions are suitable for sitting to walking use throughout the Site and the surrounding area.

Strong Winds

10.62 During the windiest (winter) season, wind conditions are suitable for sitting to walking use throughout the Site and the surrounding area.

10.63 There are seven occurrences at ground level (existing Tower Blocks A, B, C & D and building E) of strong winds exceeding 15m/s for more than the safety threshold of >0.023% of time annually (e.g. 2hrs) in the baseline scenario. This equates to 'unsafe frail' wind conditions, which is two wind conditions above suitable for the use.

10.64 The wind conditions around the rest of the existing Site are suitable for sitting to strolling use during the windiest season and sitting to standing use during the summer season, with all remaining locations having acceptable wind conditions for the current use.

10.65 There are no safety exceedances due to strong winds in the baseline condition.

Likely Significant Effects

Development condition – Scenario 2

10.66 The following effects have been assessed for the Development for the construction and operational phases.

10.67 CFD modelling results for pedestrian wind comfort for the Development and the adjacent areas are shown in Figures 10.5 & 10.6 for the windiest (winter) and summer season. The safety exceedances due to strong winds for both seasons are presented in Figures 10.7 & 10.8.

Construction Phase

10.68 Wind conditions during the construction phase (including demolition) would be expected to adjust during the phased construction work from the Baseline Condition (Scenario 1) to the likely wind conditions assessed for the Development once constructed (Scenarios 2 & 3).

10.69 The wind conditions in the Baseline Condition range from suitable for sitting to walking use during the windiest season. The construction of the Development would result in conditions for pedestrian wind comfort ranging from suitable for sitting to walking use during the windiest season, but with 5 locations with instances of strong winds exceeding the safety threshold by being assessed as 'Unsafe Frail' throughout the Site. Therefore, some mitigation measures would need to be implemented prior to the completion and occupation of the Development.

10.70 Hoarding or other sheltering measures would be implemented around the construction areas to shelter pedestrian routes during the demolition and construction works of the Development. Wind conditions on-site during the construction phases of the Development would therefore represent a **negligible effect** (not significant) and is therefore suitable for construction workers.

10.71 As noted above, for the parts of the Site that will remain in use throughout the phased construction works, existing and new buildings' access and entrance points will be entirely separate to the construction works and protected via secure hoardings and covered access routes (as necessary) from the construction works and also the wind conditions. There will be no significant wind effects to existing users throughout the construction phase.

Operational Phase

Pedestrian Comfort

10.72 With the completion of the Development, the results of the wind microclimate assessment indicate wind conditions ranging from suitable for sitting to walking use during the windiest season. However, 5 no. locations with instances of strong winds assessed as 'Unsafe Frail' have been identified throughout the Site as a direct result of the Development's layout and massing. Therefore, mitigation measures would need to be implemented prior to the completion and occupation of those buildings of the Development.

10.73 The wind conditions around the Site and adjacent areas are suitable for activities from sitting to pedestrian walking during both the windiest season and the summer season.

Thoroughfares

10.74 All the on-site and off-site thoroughfares would have acceptable wind conditions ranging from suitable for sitting to walking use during both the windiest season and the summer season, acceptable conditions for the intended use. The wind conditions on these thoroughfares would represent **negligible effects** (not significant).

Entrances

10.75 In close proximity of one of the access points and entrances within the Development – west of Building M2 (outline Phase 4) would have wind conditions suitable for walking during the windiest season and the summer season, which is one category above the suitable for entrances. This represent a **minor adverse effect** (significant) and mitigation is required at this location.

10.76 All other on-site entrances within the Development would have wind conditions suitable for sitting to standing use during both the windiest season and the summer season, acceptable conditions for entrance locations, which would represent **negligible effects** (not significant).

10.77 All off-site entrance locations would have wind conditions suitable for sitting and standing use during both the windiest season and the summer season, acceptable wind conditions for entrances, representing **negligible effects** (not significant).

Pedestrian Crossings

10.78 All off-site pedestrian crossings would have wind conditions suitable for sitting and standing use during both the windiest season and the summer season, acceptable wind conditions for the intended use and representing **negligible effects** (not significant).

Ground Level Amenity – Seating

10.79 One of the ground level amenity spaces within the Development – west of Building C3 (detailed Phase 1), would experience wind conditions suitable for standing during the summer season, which is one category above the suitable for amenity. This represent a **minor adverse effect** (significant) and mitigation is required at this location.

10.80 All other on-site and off-site ground level amenity – seating areas would have wind conditions suitable for sitting use during the summer season, acceptable wind conditions for the intended use and representing **negligible effects** (not significant).

Podium Level Amenity – Seating

10.81 At the centre and west of the on-site podium level amenities areas at Block E (detailed Phase 1), this would have wind conditions suitable for standing during the summer season, which is one category above the suitable for amenity. This represents a **minor adverse effect** (significant) and mitigation is required at this location.

10.82 All other on-site podium level amenity – seating areas would have wind conditions suitable for sitting use during the summer season, acceptable wind conditions for the intended use and representing **negligible effects** (not significant).

Balconies

10.83 All balconies have been modelled without any enclosure and as such the results would represent the 'worst case' scenario.

10.84 Thirty-six balconies located on buildings on Blocks B, C & E (detailed Phase 1) would have wind conditions suitable for walking use during the summer season, which is one category above that suitable for amenity. This represents a **minor adverse effect** (significant) and mitigation is required at these locations.

10.85 All other balconies would have wind conditions suitable for long term sitting to standing during

the summer season, acceptable wind conditions for the intended use, resulting in **negligible effects** (not significant).

Terraces

10.86 All the roof terraces would have a mixture of sitting and standing conditions during the summer season. This would be acceptable on the basis that no fixed seating is placed in areas suitable for standing use, otherwise mitigation measures would be required.

10.87 The south east corner of the non-accessible roof terrace level located between Buildings C1 and C3 (detailed Phase 1) would have wind conditions suitable for walking use. As this space is not accessible to building users, no mitigation would be required.

Roads

10.88 Road locations around the Site would have wind conditions ranging from suitable for sitting use to walking use during both the windiest season and the summer season, representing **negligible effects** (not significant).

Strong Winds

10.89 At ground level, there would be no expected strong winds exceeding the upper safety threshold level 'unsafe all' of 20m/s for more than 0.023% throughout the year (ie 2 hours).

10.90 However, there are five locations: NW Corners of Buildings C1 & C3 (detailed Phase 1); NW and NE Corners of Building P2 (outline Phase 2); SW Corner of Building K1 (outline Phase 3) and NW Corner of Building M1 (outline Phase 4) that would have instances of strong winds exceeding 15m/s for more than the safety threshold of 0.023% of time annually (e.g. 2hrs) – 'Unsafe Frail'. All these locations require mitigation to eliminate these safety exceedances.

10.91 In the summer season, all podium and terrace levels show no strong winds are expected.

10.92 Only one roof area on Block C (detailed Phase 1) will have wind conditions suitable for pedestrian walking. As this space is not accessible to building users, no mitigation would be required.

10.93 Twenty seven balconies across Building E1 (10 no.), Building C3 (7 no.) and Building C2 (10 no.) (all detailed Phase 1) would have instances of strong winds exceeding 15m/s for more than the safety threshold of 0.023% of time annually (e.g. 2hrs). All these locations require

mitigation to eliminate these safety exceedances.

Mitigation Measures – Scenario 3

10.94 CFD modelling results for pedestrian wind comfort for the Development are shown in Figure 10.9 for the windiest (winter) season and the safety exceedances due to strong winds for the windiest season in Figures 10.10.

Construction Phase

10.95 No mitigation measures are required during the construction phase (including demolition) of the Development.

10.96 As with all major projects there would be appropriate health and safety measures implemented (through a Construction Environment Management Plan (CEMP) secured by condition) to ensure that the construction workers, and any on-site uses that will remain in use throughout the construction, are adequately protected.

Completed Development

10.97 Mitigation measures were developed during a number of Mitigation Workshops (21.09.2020 & 02.10.2020) hosted by SRE to enhance the detailed design (Phase 1 of the Development) and the Site wide landscaping strategy. The measures were incorporated into the Development and assessed with further CFD modelling (Scenario 3).

10.98 Balustrades have now been included as porous media entities only on the balconies with minor adverse wind conditions. The porosity is based on the detailed drawings for Phase 1 of the Development (refer to Appendix 3.2) and balcony specification details with three levels being used to reflect the different designs (23%, 50% & 73%) and all set to 1.5m in height.

10.99 All trees (retained and proposed) have been included as porous media entities within the CFD model with low Leaf Area Index (LAI), in order to capture a worst case wind environment for deciduous trees. (e.g. representing average winter conditions). The heights are as per the landscape plan and the Site survey data.

10.100 Additional mitigation measures were developed during the workshops and incorporated into the Development, and consisted of:

- An additional deciduous tree (7.5m high) at NE corner of Building P2 (outline Phase 2);
- Mesh between the columns on the north elevation of the podium level terrace between Buildings C1 & C2 (detailed Phase 1)
- Suitable areas for seating (temporary or fixed) clarified on the podium level terraces of buildings on Block E and between Buildings C1 & C2 (all detailed Phase 1); and
- Included existing (retained) planting off-site to the North of Building P2 (outline Phase 2).

Residual Effects

Construction Phase

10.101 There are no residual risks associated with the construction phase.

10.102 As the wind conditions during the construction phase (including demolition) adjust from the Baseline Condition (Scenario 1) to the likely wind conditions assessed for the Development once constructed (Scenarios 2 & 3), with the implementation of previously listed measures protecting construction workers and existing users during the phased construction, the wind conditions on-site during the construction phases of the Development would therefore represent a **negligible effect** (not significant).

Operational Phase

Pedestrian Comfort

10.103 With the inclusion of the above completed mitigation measures for the Development, the results of the wind microclimate assessment indicate wind conditions ranging from suitable for sitting to walking use during the windiest season.

10.104 All Scenario 2 elements with adverse effects have been re-assessed for the Development against the windiest (winter) season (i.e. worst case).

Entrances

10.105 The wind conditions around Building M1 (outline Phase 4) would have wind conditions suitable for sitting and standing during the windiest season which now reflects the required wind level for this use and is therefore of **negligible effect** (not significant). No further mitigation is required.

Ground Level Amenity – Seating

10.106 The ground level amenity space west of Building C3 (detailed Phase 1), will experience wind conditions suitable for pedestrian sitting during the windiest (winter) season, which is suitable for amenity use in the summer season too. This represent a **negligible effect** (not significant) and no further mitigation is required.

Podium Level Amenity – Seating

10.107 At the centre and west of the on-site podium level amenity areas on Block E (detailed Phase 1), any proposed fixed seating/amenity have been removed from the landscaping plan and this area would be used for pedestrian access – which requires wind conditions suitable for standing during the summer season. This represents a **negligible effect** (not-significant) for the podium and no further mitigation is required.

Balconies

10.108 The thirty six failing balconies on buildings within Blocks B, C & E (detailed Phase 1) have been modelled with the porous media entities reflective of the different enclosure/balustrade designs and the 1.5m height and now have wind conditions suitable for sitting – acceptable for amenity use. This represents a **negligible effect** (not-significant) and no further mitigation is required.

Roads

10.109 Road locations around the Site would have wind conditions ranging from suitable for sitting to walking use during both the windiest season and the summer season, representing **negligible effects** (not significant) and no further mitigation is required.

Strong Winds

10.110 Of the five locations where instances of strong winds exceeding 15m/s for more than the safety threshold of 0.023% of time annually (e.g. 2hrs) – 'Unsafe Frail' (NW Corners of Buildings C1 & C3 (detailed Phase 1), NW and NE Corners of Building P2 (outline Phase 2), SW Corner of Building K1 (outline Phase 3) and NW Corner of Building M1 (outline Phase 4), the strong winds adjacent to Buildings C1 & C3 have been mitigated by the above measures.

10.111 The remaining locations have been reduced to only four localised 'spots': the NW corner of Building P2 (outline Phase 2), NE corner of Building P1 (outline Phase 2), SW Corner of

Building K1 (outline Phase 3) and NW Corner of Building M1 (outline Phase 4). These localised spots show strong winds exceeding 15m/s for more than the safety threshold of 0.023% of time in the windiest season (e.g. 2hrs) and will be resolved through further low-level planting or screening in the locality (refer to Landscape Plan 3.2). This residual risk will be mitigated and the measures will be verified through further CFD modelling at each Reserved Matters Application stage.

10.112 All twenty seven balconies across Building E1 (10 no.), Building C3 (7 no.) and Building C2 (10 no.) (all detailed Phase 1) **no longer** have any instances of strong winds exceeding 15m/s for more than the safety threshold of 0.023% of time annually (e.g. 30mins) so the adverse effects have been mitigated.

10.113 Taking into consideration all of the proposed mitigation measures, the residual effects associated with pedestrian wind comfort on the site will be **negligible**.

Cumulative Effects

10.114 There are no cumulative effects directly applicable to the Development, as there are no committed developments within the adjacent area that will have any impact on the wind conditions expected across the Site.

10.115 The only proposed new residential scheme is located over 100m away at the southern end of Hampden Road which is located south east of the Site. This committed development is not relevant as this wind direction is the weakest and least frequent wind condition for the area.

Summary

10.116 The microclimate assessment quantifies the expected wind microclimate in pedestrian areas at ground level and terrace level for the Site, and also for the detailed Phase 1 individual balconies & terraces, by interpolating the transient CFD results of the Site with hourly weather data in order to predict the frequencies of wind speeds across the course of a whole year.

10.117 The modelled wind speed data is benchmarked against the Lawson Comfort Criteria (LCC) to determine the suitability of the Site for different pedestrian activities as well as the Lawson Distress Criteria (LDC) where strong winds are considered and levels of pedestrian safety are assessed – 'Safe Conditions'.

10.118 The LCC sets five threshold wind speeds appropriate for different pedestrian uses from long term sitting to pedestrian walking.

10.119 The results for the windiest (winter) season are predominantly presented within the chapter, being the 'worst case' and naturally address the summer season when amenity spaces are more likely to be used frequently. Effects are assessed as being negligible, minor/moderate/major adverse and whether they are temporary or permanent.

10.120 The meteorological data for London Heathrow has informed the Baseline Conditions, with the prevailing winds being from the SW & W. The existing Site has suitable conditions for sitting to walking use in both the windiest (winter) and summer seasons. Localised areas of amenity space around existing Tower Blocks A, B, C & D and building E show wind conditions suitable for walking use – one level windier than suitable for a sitting location – as well as 'uncomfortable' strong winds.

10.121 The construction of the Development will result in wind conditions suitable for sitting to walking for ground level pedestrian use during the windiest season. There will be negligible effects during the construction phase. During the operation phase, within the detailed Phase 1 element there are 37 no. balconies that have wind conditions suitable for standing – one level above the amenity use – that provide a minor adverse effect and are to be mitigated. There are five locations across the Site with instances of strong winds exceeding the safety threshold that require mitigation.

10.122 Assessment scenario 3 adopted a range of mitigation measures identified and agreed during a number of mitigation workshops, and through changes to the detailed design of the buildings (detailed Phase 1 balconies and terraces) and proposed landscaping plan (retained and new trees) all minor adverse effects have been reduced to negligible in relation to pedestrian wind comfort.

10.123 The only residual effects relate to four spots where 'unsafe frail' strong winds are identified (Adjacent to Buildings P1, P2, K1 and M1 (outline element of the Development). These locations are very localised and would be mitigated through the use of additional localised planting and screens to reduce the strong wind level to walking. This is shown in the landscaping plan for the Site (Figure 3.2) and verified through further CFD simulations at each reserved matters application stage.

10.124 There are no cumulative effects due to the existing adjacent sites and only committed development is to the SE of the Site – which is the least significant wind condition for the area – impacting the Development.

10.125 Table 10.3 contains a summary of the likely significant effects of the Development.

Table 10.3: Table of Significance – Wind Microclimate

Potential Effect	**Nature of Effect** (Permanent/ Temporary)	**Significance** (Major/Moderate/Minor) (Adverse/Negligible)	**Mitigation / Enhancement Measures**	**Geographical Importance***							**Residual Effects** (Major/Moderate/Minor) (Adverse/Negligible)
				I	UK	E	R	C	B	L	
Construction											
Wind Impacts during Construction	Temporary	Negligible	N/A							X	Negligible
Completed Development											
Thoroughfares	Permanent	Negligible	Retained and new trees and planting within the landscaping along with the overall building layouts throughout the Site.							X	Negligible
Entrance – Building M2	Permanent	Negligible to Minor Adverse	Implementing landscaping within the vicinity of Building M2 such as trees (>5m in height) and shrubs (min 1.5m in height).							X	Negligible
Entrances – other	Permanent	Negligible	N/A							X	Negligible
Entrances – off site	Permanent	Negligible								X	Negligible
Pedestrian Crossing	Permanent	Negligible								X	Negligible
Ground Level Amenity – Sitting	Permanent	Negligible to Minor Adverse	Implementing additional landscaping such as specific new trees (>7.5m in height) and shrubs (min 1.5m in height).							X	Negligible
Podium Level Amenity – Sitting	Permanent	Negligible to Minor Adverse	Centre and west area of Podium level amenity on Building plot E to be used for access only. All fixed seating/amenity has been removed from this location in building plot E. Utilise permanent semi-porous (50%) screen between the columns on the north elevation on building plot C. Implementing landscaping elements such as trees (>3m in height), shrubs in planters (min 1.5m in height).							X	Negligible

Balconies (Phase 1)	Permanent	Negligible to Minor Adverse	37 no. balconies across Phase 1 have balustrades set to min 1.5m in height. Porosity of these balustrades increased (23%, 50% & 73%) and reflect the different designs.							X	Negligible
Strong Winds	Permanent	Significant	Implementing additional landscaping such as trees (>5m in height) and shrubs (min 1.5m in height) in localised areas. Implementing balustrades set to min 1.5m high (Phase 1).							X	Not Significant
Cumulative Effects											
Wind Impacts during Construction	Temporary	Negligible	N/A							X	Negligible
Operational Phase	Permanent	Negligible	N/A							X	Negligible

*** Geographical Level of Importance**

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

REFERENCES

[i] MHCLG (February 2019) *National Planning Policy Framework*
[ii] MHCLG (2014) *National Planning Practice Guidance.*
[iii] Met Office (January 2019) *UKCP18 Science Overview Executive Summary*
[iv] GLA (March 2016) *The London Plan Spatial Development Strategy for London - Consolidated with Alterations (2016)*
[v] GLA (December 2019) *The London Plan Intend to Publish (clean version) - Spatial Development Strategy for Greater London (2019)*
[vi] GLA (April 2014) *Sustainable Design and Construction Supplementary Planning Guidance (2014)*
[vii] Royal Borough of Kingston upon Thames (April 2012) *Core Strategy Local Development Framework (2012)*
[viii] English Heritage & Commission for Architecture and the Built Environment (July 2007) *Guidance on Tall Buildings*
[ix] Historic England (December 2015) *Tall Buildings Historic England Advice Note 4*