

12 WIND MICROCLIMATE

Introduction

- 12.1 This chapter of the ES presents an assessment of the potential impacts and associated likely effects of the proposed development on the local wind microclimate within and around the application site. In particular, it considers the potential effects of wind upon pedestrian comfort and safety and summarises the findings of a wind tunnel testing exercise.
- 12.2 The chapter describes the relevant policy context; the methods used to assess the potential impacts; the baseline conditions currently existing at the application site and its immediate surroundings; and the potential impacts on wind microclimate during demolition, construction and at the completed development. Where appropriate the mitigation measures required to prevent, reduce or offset the effects are identified and the chapter concludes with a summary of the expected residual effects.
- 12.3 The assessment quantifies the expected wind microclimate in pedestrian areas at ground level, podium level and terrace level. The measured wind speed statistics are benchmarked against the Lawson Comfort Criteria to determine the suitability of the application site for different pedestrian activities. Both the existing (baseline) and those for the proposed development are assessed. Strong winds are also considered. Results for the windiest season are presented, as well as results for the summer when amenity spaces are more likely to be used frequently.
- 12.4 This Chapter is accompanied by the following technical appendix:
- Technical Appendix 12.1: Pedestrian Level Wind Microclimate Assessment.

Legislation and Policy Context

National Legislation and Policy

National Planning Policy Framework, 2012

- 12.5 The UK wide National Planning Policy Framework (NPPF) came into force in March 2012¹. There are no national planning policies directly relating to wind microclimate issues; however, the benefits of a high quality built environment are emphasised in the NPPF. An example of this is presented in paragraph 58: "...using streetscapes and buildings to create attractive and comfortable places to live, work and visit..."

National Planning Practice Guidance

- 12.6 The National Planning Practice Guidance (NPPG)² was launched on the 6th March 2014 and provides a web-based resource in support of the NPPF.
- 12.7 Following its launch, a number of previously published planning guidance documents have been cancelled and are detailed within the Written Ministerial Statement titled 'Making the planning system work more efficiently and effectively', also dated 6th March 2014.
- 12.8 The NPPG identifies the potential for a building's size and shape (particularly in the case of tall and large buildings) to affect the wind microclimate. Under the section addressing 'Design: How should buildings and the spaces between them be considered?', the NPPG states in Paragraph 025 ('Consider

form') that: 'Some forms pose specific design challenges, for example how taller buildings meet the ground and how they affect local wind [...] patterns should be carefully considered.' The NPPG goes on to state in Paragraph 026 ('Consider scale') that: 'Account should be taken of local climatic condition, including [...] wind'.

Regional Policy

The London Plan Spatial Development Strategy for London Consolidated with Alterations 2016

- 12.9 The London Plan³ 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."

Local Policy

Royal Greenwich Local Plan: Core Strategy, 2014

- 12.10 Although the Royal Greenwich Local Plan: Core Strategy, 2014⁴, does not refer to wind microclimate directly, it does consider that tall buildings are "likely to have a greater environmental impact than other building types".
- 12.11 In addition it states that "Applications for tall buildings will be assessed on the basis of [...] criteria set out in policy 7.7 of the London Plan".

¹ The National Planning Policy Framework, Department for Communities and Local Government, March 2012

² UK Government, Department for Communities and Local Government.2014. *Planning Practice Guidance* [online] [Date Accessed May 2016] Available from: <http://planningguidance.planningportal.gov.uk/>

³ The London Plan July 2011. [Online] <https://www.london.gov.uk/what-we-do/planning/london-plan/current-london-plan> Mayor of London

⁴ Royal Greenwich Local Plan: Core Strategy, 2014.

Consultation Feedback

12.12 As discussed in Chapter 2: EIA Process and Methodology, consideration has been given in this assessment to the EIA Scoping feedback comments provided by the RBG and consultees in respect to the proposed development. The key considerations relating to wind microclimate are summarised in Table 12.1.

Table 12.1: Consultation feedback		
Consultee	Comment	Where in the Chapter this issue is addressed
RBG	'The proposed wind tunnel assessment should be carried out from 36 different directions.'	Method of Assessment, Potential Impacts Section and Residual Effects Section
RBG	'Computational Fluid Dynamics (CFD) wind flow modelling should also be undertaken by a separate sub consultant (also from 36 different directions). This approach will provide the most thorough assessment of potential microclimate impacts.'	An earlier response to the initial scope was made to clarify that Computational Fluid Dynamics would be of no additional benefit to the wind tunnel test, which alone provides a fully quantitative assessment. For an assessment of the site and surrounding area as a whole, the wind tunnel test will accurately capture the gusts and strong winds required for a robust assessment of wind comfort and safety, which CFD currently cannot capture. The RBG's EIA advisors agreed with this.

Assessment Methodology

12.13 The following section outlines the methodologies applied to identify and assess the range of potential wind impacts likely to result from the proposed development.

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

- To assess the suitability of the wind microclimate at residential amenity spaces within the proposed development for outdoor seating in the summer;
- To assess the wind conditions at ground level amenity spaces across the proposed development and also the off-site residential spaces at Atlas Gardens and Derrick Gardens in the summer;
- To assess the suitability of entrances of the proposed development to achieve suitable conditions throughout the year; and
- To assess the wind microclimate along the pedestrian thoroughfares within the application site and within the study area throughout the year.

12.15 The following section outlines the methodologies applied to identify and assess the wind impacts that could potentially result from the proposed development.

Baseline Characterisation

12.16 The baseline conditions at the application site were characterised by:

- review of available meteorological data to establish the prevailing wind directions and adjustment of that data for site specific application; and
- construction of a 1:300 scale model of the existing buildings at and surrounding the application site within a 360 m radius, and subsequent wind tunnel testing of the existing site conditions (the 'Existing Configuration'). 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 application site are modelled as a "generalised roughness", which modifies the behaviour of wind approaching the application site in the wind tunnel to reflect the real conditions at the site, as discussed later in this chapter in the Method of Assessment section.

12.17 A total of up to 171 test locations were included on the wind tunnel model, 125 of which represented the baseline conditions. Measurements from both on-site and off-site were taken, covering the various receptor locations identified in the study area. The study area includes:

- Offsite residential areas at Atlas Gardens and Derrick Gardens;
- Thoroughfares throughout the application site and in close proximity off-site;
- Entrances to the proposed development;
- Amenity spaces at ground level, podium level and terrace levels; and
- Proposed development balconies.

12.18 The layout and total number of receptor locations on-site for the Existing Configuration were informed by the ground floor plan of the proposed development to ensure a consistent comparison of measurement locations for the different assessment configurations. This means that some of the receptor locations present on the proposed development configuration are not present for the Existing Configuration because there is no comparable location for a receptor to be placed.

12.19 The analysis of the Existing Configuration was completed using the same testing and analysis methods used for the proposed development configuration (described later in this chapter).

Method of Assessment

12.20 The proposed development's potential impacts on wind microclimate at and surrounding the application site were assessed based on the results of wind tunnel tests. Wind tunnel testing is the most well-established and robust means of assessing the pedestrian wind environment. Wind tunnel test results are fully quantitative and enable the pedestrian level wind microclimate at the application site to be quantified and classified in accordance with the widely accepted Lawson Comfort Criteria (LCC).

12.21 Wind tunnel tests deliver a detailed assessment of the mean and gust wind conditions around the existing site and the proposed development for all wind directions in terms of pedestrian comfort and safety, and provide a basis to assess the potential impacts and likely effects of the proposed development with regards to its intended use.

12.22 The potential impacts and likely effects during demolition and construction have not been directly assessed by the wind tunnel tests, as this is a temporary condition and would be highly variable as existing buildings are demolished and new buildings constructed. However prudent professional judgement was used to consider the implications of this stage for pedestrian comfort levels surrounding the application site.

Wind Tunnel Testing Methodology

12.23 As indicated above in the 'Baseline Characterisation' section of this chapter, a 1:300 scale model of the existing buildings at and surrounding the application site within a 360m radius of the centre of the application site was constructed and wind tunnel tested for the existing site conditions. Wind

measurements were taken at 125 locations. In addition, a model of the proposed development was built, inserted in the surround model and wind measurements taken at 171 locations. Locations for instrumentation were based on professional judgement to present a representative and worst case scenario of wind conditions. Similarly, balcony and terrace receptor locations were selected based on a selection of locations which would be considered to be most representative of conditions at these levels. There are fewer measurement locations on the baseline study because of the different building footprints of the existing site compared to the proposed development, and because of the changing use of the application site (specifically the increase in amenity space in the proposed development compared to the existing site).

12.24 The following methodology was used to quantify the pedestrian level wind environment:

- Step 1: Measure the building-induced wind speeds at pedestrian level in the wind tunnel;
- Step 2: Adjust standard meteorological data to account for conditions at the application site by using the software package BREVe3 to take into account the variation in terrain roughness approaching the application site;
- Step 3: Combine these to obtain the expected frequency and magnitude of wind speeds at pedestrian level; and
- Step 4: Compare the results with the LCC to 'grade' conditions around the application site.

12.25 Analysis was conducted on a seasonal basis however the assessment focuses on the worst case results, which typically occur during the windiest season in the winter (December, January and February), and those for the summer season (June, July and August) when the use of amenity spaces is usually most frequent.

12.26 Three configurations of the wind tunnel model were tested:

- Configuration 1: Existing Site with Existing Surrounds;
- Configuration 2: Proposed Development with Existing Surrounds; and
- Configuration 3: Proposed Development with Existing Surrounds and Landscaping.

12.27 The potential impacts during demolition and construction have been assessed using prudent professional judgement, informed by the wind tunnel test results for the configurations noted above, as the wind microclimate in these scenarios is expected to be sufficiently similar to the tested configurations that additional testing is not required. Furthermore, in the case of the demolition and construction scenarios (as noted previously), any impacts are likely to be temporary and will be highly variable as construction progresses.

12.28 A photograph of the wind tunnel model tested for Configuration 2 is shown in Figure 12.1. Additional photographs are included within ES Volume 3: Technical Appendix 12.1.

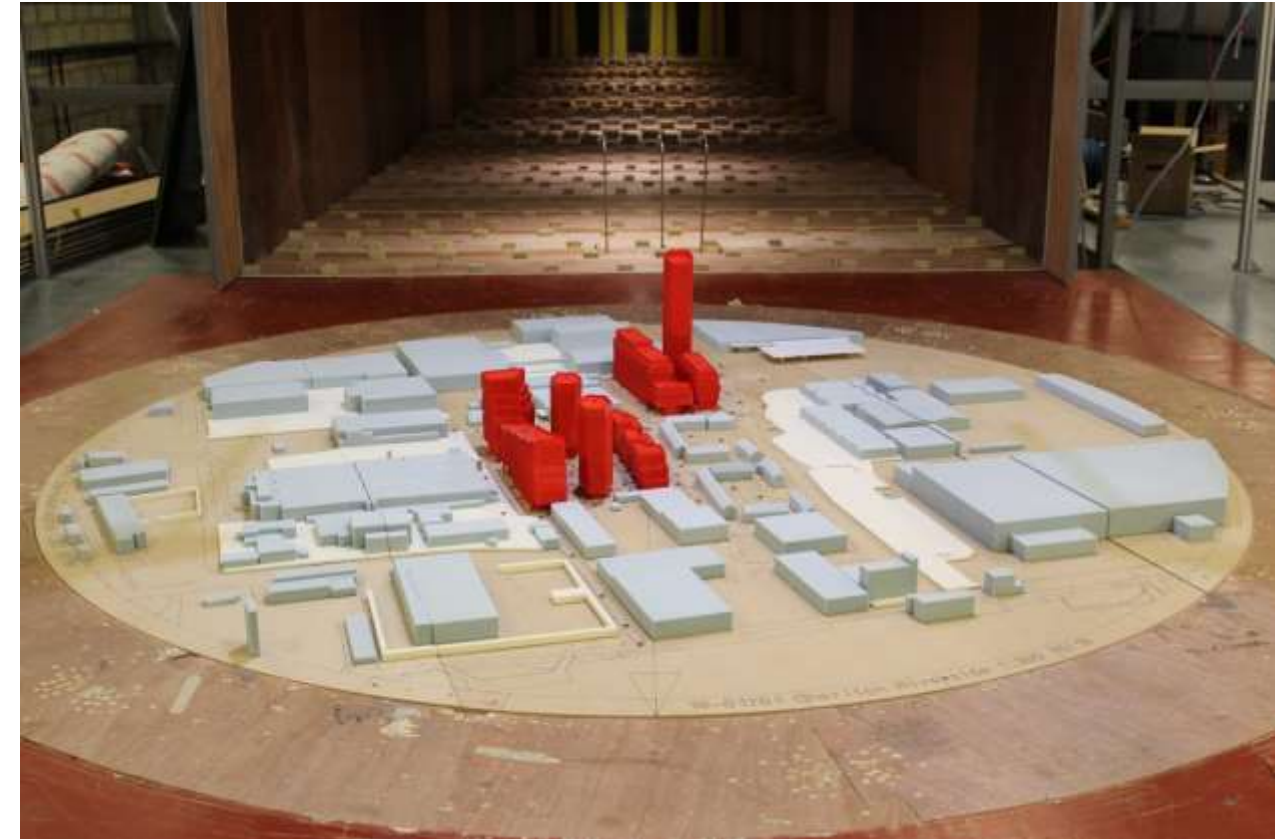


Figure 12.1: Proposed Development Model in the Wind Tunnel (view from the north)

12.29 The wind tunnel tests for Configurations 1 and 2 were conducted without any planting or landscaping detail, so that the measured conditions would be conservative (i.e. windier than would be anticipated) and therefore represent a worst-case.

12.30 The wind tunnel tests for Configuration 3 were conducted with the proposed landscaping which provides wind mitigation to some locations, as discussed later in this chapter.

12.31 Results have been presented for the windiest season and summer season. As discussed later on, this is because some pedestrian activities defined by the LCC need to be met during the windiest season whereas others, primarily external seating and amenity activities, are dependent upon the summertime conditions because they are normally most frequently used during this period.

Simulation of Atmospheric Winds

12.32 Wind is unsteady, or gusty, and this 'gustiness' or turbulence, varies depending upon the site. Modelling these effects is achieved by a series of grid, barrier and floor roughness elements to create a boundary layer that is representative of the site conditions. The detailed proximity model around the application site is used to fine-tune the flow and create conditions similar to those expected at full scale.

Measurement Technique

12.33 Wind speed measurements were taken using Irwin probes, which measure the wind speed at a scaled 1.5 metres (m) height above the ground. For pedestrian comfort studies, both the mean wind speed and peak wind speed were determined at each measurement location. The local wind speed is calculated from the pressure difference provided by the Irwin probe at a specific location (the pressure difference is taken between the tip of the probe and a cavity at its base). Irwin probes are a standard method of instrumentation for wind microclimate studies. They are well-suited to use in

multiple locations and measurements can be taken rapidly. For pedestrian comfort studies, both the mean and peak wind speeds were determined at each measurement location.

12.34 Wind speed measurements were taken at 171 locations across the application site for all wind directions in equal increments, with 0° representing wind blowing from the north and 90° wind from the east. These locations represent the areas within and around the application site where there is a potential for adverse wind microclimate effects to occur, as defined in the 'Study Area' section above in this chapter.

Meteorological Data

12.35 The Met Office supplies joint frequency tables of wind speeds divided into ranges of the Beaufort (B) scale, and direction on a monthly and annual basis for 30° sectors around the compass. Data received were corrected to standard conditions of 10 m above open flat level country terrain at sea level, in order to account for the effects of the local terrain around the anemometer sites.

12.36 Meteorological data for London (Heathrow, Gatwick and Stansted Airports), were used in this assessment. For sites in and around London, the major airports are the nearest available source of reliable, long-term meteorological records, which are representative of the wind climate for the London region.

12.37 The combined meteorological station data was adjusted from open countryside terrain to the site conditions using the BREVe3.2⁷ software package which models the wind characteristics caused by changes in the terrain roughness approaching the application site. Table 12.2 summarises the BREVe3.2 mean factors at the reference height of 120 m above ground level. This reference height is used to convert the model-scale wind tunnel data to full-scale conditions at the application site, and is sufficiently high above ground to be clear of any significant obstruction or turbulence from the modelled terrain.

Direction (°N)	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°
Mean Factors	1.40	1.44	1.51	1.44	1.37	1.37	1.43	1.41	1.38	1.35	1.38	1.35

Pedestrian Wind Comfort Criteria

12.38 The assessment of the wind conditions requires a 'standard' against which the measurements can be compared. The LCC have been established for over 30 years and have been widely used on building developments across the UK.

12.39 The LCC define six categories of pedestrian activities (set out in Table 12.3) from sitting through to more transient activities such as crossing the road, and for each activity define a threshold wind speed (in Beaufort Force as shown in Table 12.3) and frequency of occurrence beyond which the wind environment would be unsuitable for the intended activity.

Category	Ref. Colour	Threshold*	Suitable Activity
Roads and Car Parks		6% > B5	Open areas where pedestrians are not expected to linger.
Business Walking		2% > B5	'Purposeful' walking or where, in a business district, pedestrians may be more tolerant of the wind because their presence on Site is required for work.

Leisure Walking		4% > B4	Strolling
Pedestrian Standing		6% > B3	Waiting at bus-stops, window shopping etc.
Entrance Doors		6% > B3	Pedestrians entering/leaving a building.
Sitting		1% > B3	Long-term sitting, for example, sitting outside a café.

Notes: * Values refer to % of time wind speed is greater than Beaufort Scale i.e. B4 is Beaufort Force 4.

12.40 The LCC reflect the fact that less active pursuits, such as sitting, require more benign wind conditions (i.e. a low wind speed) whereas for more transient activity (such as walking) pedestrians would tolerate stronger winds.

12.41 If the wind conditions exceed the threshold, then the conditions are unsuitable for the stated activity. If the wind conditions are below the threshold, then they are described as tolerable (or suitable) for the stated activity. For example, in Table 12.4, if the wind speed exceeds Beaufort Force 4 (B4) for more than 4% of the time then the conditions would be unacceptable for leisure walking.

12.42 It is expected that tolerable conditions would not impact the amenity of a location, whereas unsuitable wind conditions could potentially lead to pedestrians not using certain areas of the application site for their intended purpose, and complaints of wind nuisance. An unsuitable result implies that remedial action should be taken to mitigate wind conditions or that the proposed pedestrian activity at that location should be redefined.

12.43 Further detailed information on the LCC is presented in Technical Appendix 12.1, ES Volume 3.

Beaufort Force	Hours Average Wind Speed (m/s)	Description of Wind	Notable Wind Effect
0	< 0.45	Calm	Smoke rises vertically.
1	0.45 - 1.55	Light Air	Direction shown by smoke drift but not by vanes.
2	1.55 - 3.35	Gentle Breeze	Wind felt on face; leaves rustle; wind vane moves.
3	3.35 - 5.60	Light Breeze	Leaves & twigs in motion; wind extends a flag.
4	5.60 - 8.25	Moderate Breeze	Raises dust and loose paper; small branches move.
5	8.25 - 10.95	Fresh Breeze	Small trees, in leaf, sway.
6	10.95 - 14.10	Strong Breeze	Large branches begin to move; telephone wires whistle.
7	14.10 - 17.20	Near Gale	Whole trees in motion.
8	17.20 - 20.80	Gale	Twigs break off; personal progress impeded.
9	20.80 - 24.35	Strong Gale	Slight structural damage; chimney pots removed.
10	24.35 - 28.40	Storm	Trees uprooted; considerable structural damage.
11	28.40 - 32.40	Violent Storm	Damage is widespread; unusual in the U.K.
12	> 32.40	Hurricane	Countryside is devastated; only occurs in tropical countries.

Target Wind Conditions

- 12.44 For a mixed-use urban site, the desired wind microclimate would typically need to have areas suitable for sitting, standing/entrance use and leisure walking. The business walking and roadway classifications may be satisfactory in isolated areas, but these classifications are also associated with occasional strong winds (which are described in the next section).
- 12.45 The target condition in seating areas, or other amenity spaces, is a wind microclimate that is suitable for sitting in the summer months, when such areas are more likely to be frequently used by pedestrians. The assessment of significance for amenity areas therefore focuses on the summer season result.
- 12.46 A wind environment suitable for standing, or calmer, is desired throughout the whole year near building entrances. Should an entrance be placed near a location where leisure or business walking conditions are predicted, this would be considered unsuitable for pedestrian egress and ingress and therefore would require mitigation. The assessment of significance for building entrances therefore focuses on the windiest season result.
- 12.47 A pedestrian thoroughfare should be suitable for leisure walking during the windiest season. The assessment of significance for a pedestrian thoroughfare therefore focuses on the windiest season result.

Strong Winds

- 12.48 This assessment also provides a notification of stronger winds which Lawson defined as wind speeds that exceed Beaufort Force 6 for more than 1 hour per year. This assessment reports on the amount of time that the wind speed exceeds Beaufort Force 6 (B6), B7 or B8 at each receptor location across the application site and within the study area. It is noted that these stronger winds tend to be associated with the business walking and roadway classifications.
- 12.49 When the wind speed exceeds B6 on a pedestrian thoroughfare for only a few hours per year this is unlikely to cause nuisance to pedestrians, whereas wind speeds in excess of B7 or B8 would impede walking. In these instances, mitigation may be necessary or a careful assessment of whether pedestrian access might be restricted on the windiest days of the year at the windy location.

Significance Criteria

- 12.50 The significance criteria used in the assessment of residual effects is based upon the relationship between the desired pedestrian use of a particular area of the proposed development (as defined by the LCC) and the wind conditions predicted at that location. This allows for an assessment to take into account any change in pedestrian activity that might arise as a result of the proposed development.
- 12.51 Table 12.5 summarises the significance criteria used within this assessment.
- 12.52 The minor, moderate and major categories indicate the severity of the difference between the desired microclimate and the actual microclimate. An adverse effect implies that a location has a wind environment that is unsuitable for its intended use and mitigation should therefore be considered. For example, if the target wind microclimate is sitting but the measured conditions are acceptable for leisure walking, two categories windier than desired, then this would be a moderate adverse effect.
- 12.53 In line with Lawson's overall methodology, strong winds are reported separately from the comfort assessment and do not form part of the impact significance criteria.

Table 12.5: Significance Criteria	
Recorded Wind Microclimate Conditions	Significance of Residual Effect
Wind Conditions are 3 categories calmer than desired	Major Beneficial

Table 12.5: Significance Criteria	
Wind Conditions are 2 categories calmer than desired	Moderate Beneficial
Wind Conditions are 1 category calmer than desired	Minor Beneficial
Wind Conditions are similar to the desired	Negligible
Wind Conditions are 1 category windier than desired	Minor Adverse
Wind Conditions are 2 categories windier than desired	Moderate Adverse
Wind Conditions are 3 categories windier than desired	Major Adverse

- 12.54 Where potentially adverse effects are identified, consideration has been given to the landscaping proposals of the proposed development to conclude how these proposals may mitigate unsuitable wind microclimate conditions.

Pedestrian Thoroughfares

- 12.55 Adverse impacts on pedestrian thoroughfares (in relation to wind comfort) would occur wherever the wind conditions exceed the 'leisure walking' classification of the LCC. In such cases, it is anticipated that pedestrians would notice (and potentially complain about) 'windy' conditions, and may choose to seek other, more comfortable walking routes. In cases of very high wind speeds, it is possible that pedestrians would have difficulty walking.

Entrances

- 12.56 Adverse impacts at entrances and drop-off areas would occur where the wind conditions exceed the 'standing/entrance use' classification of the LCC. These conditions would be noticeable while moving from a calm interior space into the relatively windy external space, and may result in complaints and/or people seeking alternative entrances/exits to and from the building.

External Amenity Areas

- 12.57 Adverse impacts on external amenity spaces would occur where the wind conditions exceed the 'sitting' classification during the summer season. Such an exceedance may result in complaints and/or people refusing to use the amenity space for its intended use.
- 12.58 As those using more active amenity spaces such as play areas or sport/leisure areas are expected to tolerate slightly stronger winds than seating locations, standing entrance use wind conditions is considered acceptable for these spaces.

Strong Winds

- 12.59 Occasional strong winds would potentially impede walking and result in a pedestrian losing their balance or footing during a strong gust. This is a potential safety concern (as opposed to the other effects discussed above, which are a concern for comfort only).

Assumptions and Limitations

- 12.60 The conditions for the application site during demolition and construction works have not been directly assessed by the wind tunnel tests. Instead, prudent professional judgement has been used to assess conditions during demolition and construction works. Based on experience it was assumed that the wind microclimate at ground level would develop from the existing site conditions to that of the fully proposed development as construction evolves.
- 12.61 The wind assessment is based upon meteorological data for three major London airports (Heathrow, Gatwick and Stansted) that have been adjusted to the terrain exposure of the application site. The selection of measurement locations covers areas that are accessible to either building occupants or the general public, where wind acceleration could be expected and in areas designed for more

sedentary pedestrian use. The assessment takes into account the wind conditions for all wind directions.

- 12.62 The tests for Configurations 1 and 2 were conducted with models that did not include landscape planting. Assuming that the majority of planting would be deciduous, this approach is usually representative of the winter season but tends to over-predict local wind speeds during the summer when in reality the trees would be in leaf and would provide beneficial shelter. This is a standard approach in wind microclimate studies, as it provides a conservative (i.e. worst-case) result.
- 12.63 The 1:300 model has been constructed based on the design information supplied by the Applicant's Architect Design Team, and is considered to provide an accurate basis for assessment of wind impacts.

Baseline Conditions

Current Baseline

Meteorological Data

- 12.64 The frequency of winds of various strengths for standard reference conditions (10 m height in open flat level country terrain at sea level) is shown in Figure 12.2 for spring (March, April and May), summer (June, July and August), autumn (September, October and November) and winter (December, January and February).
- 12.65 The meteorological data indicate that the prevailing wind direction throughout the year is from the south-west quadrant. There is a secondary prevailing wind direction from the north-east during the spring.

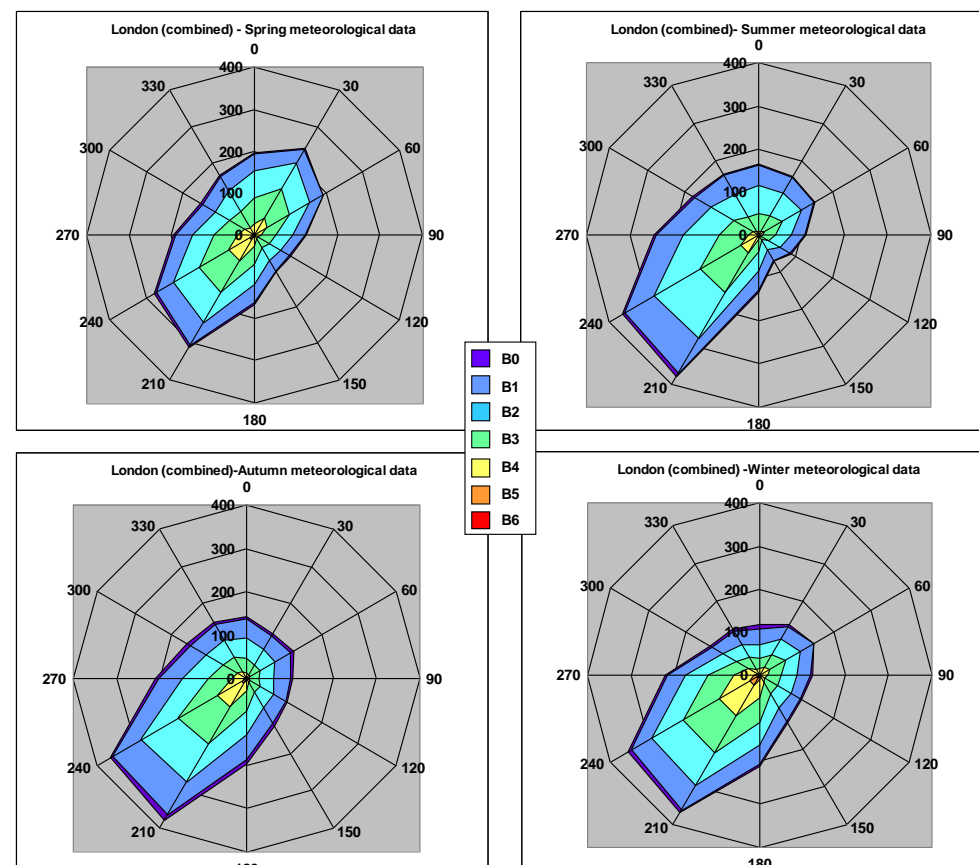


Figure 12.2: Seasonal Wind Data for London (in Beaufort Force)

Microclimate for Existing Site

- 12.66 During the windiest season conditions within and around the application site as it currently exists would predominantly be suitable for standing or sitting (as shown in Figure 12.3). However, conditions classified as acceptable for leisure walking use occur in more exposed areas at receptors 44, 102, 107, 109, 110 and 120.
- 12.67 During the summer season, all receptors would be classified as suitable for standing or sitting use, as shown in Figure 12.4.
- 12.68 The existing wind microclimate at all tested receptor locations is suitable for the current use of the application site and the surrounding areas throughout the year.

Strong Winds

Strong winds in excess of Beaufort Force 6 did not occur in the baseline scenario (Configuration 1).

Sensitive Receptors

Existing Sensitive Receptors

- 12.69 Existing sensitive receptors comprise thoroughfares and external potential amenity areas in the vicinity of the application site (i.e. within the study area, as defined previously in this chapter, but excluding the application site). The existing site itself is not considered to be an existing sensitive receptor, as the use of the area will change during construction and again when the proposed development is complete and becomes operational.
- 12.70 The existing sensitive receptors also include the existing residential gardens on Derrick Gardens and Atlas Gardens to the west of the application site, for which sitting use during the summer months would be required.

New Sensitive Receptors

- 12.71 Upon completion, the proposed development would introduce new sensitive receptors on-site, comprising all thoroughfares, entrances, play areas, terraces and balconies within the application site.



Figure 12.3: Existing building with existing surrounding buildings – windiest season



Figure 12.4: Existing building with existing surrounding buildings – summer season

Potential Effects

Demolition and Construction

- 12.72 Typically, demolition of existing buildings creates temporary open space within a site which would allow wind to blow into and across the open site. This removal of beneficial shelter would typically cause and increase in local wind speeds within and immediately around a site.
- 12.73 Temporary site hoarding would provide localised shelter around the perimeter of the application site and as construction progresses, the wind microclimate will gradually adjust from the open site conditions to the completed proposed development conditions. Impacts within the application site itself are likely to be limited, since the use of the area as an active construction site is not as sensitive to windy conditions as the operational completed development would be. However, there is the potential for uncomfortable or unsafe conditions outside the application site boundary (caused by the proposed development) that would occur before the proposed development becomes operational. These effects would be similar to the conditions assessed for the completed development (as described below), where the completed development represents the worst case.

Completed Development

- 12.74 The results for the completed development with existing surrounding buildings without the incorporation of the proposed landscaping is shown in Figures 12.5 and 12.6 for the ground/podium levels and the terraces/balconies respectively for the windiest season. For the summer season the results are shown in Figures 12.7 and 12.8 for the ground/podium levels and the terraces/balconies respectively.

Pedestrian Thoroughfares

- 12.75 The majority of receptors in Configuration 2 (proposed development with existing surrounding buildings and no landscaping) had negligible to moderately beneficial wind conditions.
- 12.76 The exception to this was at probe location 120, at the north west corner of Plot B, which had wind conditions suitable for business walking use. This is a minor adverse effect and requires wind mitigation from the landscaping scheme (as discussed below).

Entrances

- 12.77 Most entrance probe locations had wind conditions of negligible to minor beneficial significance.
- 12.78 Probe locations 21 at the southern entrance of Building 1, and 88 at the northern entrance of Building 2 (both in Plot A) had wind conditions suitable for leisure walking use. This is a minor adverse effect and requires wind mitigation provided by the landscaping scheme and mitigation by design as discussed below.

Ground Floor Amenity Areas

- 12.79 Plot A probe locations 13 had standing/entrance use wind conditions during the summer season and the intended use is for an amenity area (seating space), therefore the effect is of minor adverse significance. This location would require mitigation measures from the landscaping scheme/mitigation by design, as discussed below.
- 12.80 Probe location 78 also had standing/entrance use conditions during the summer season, however as this area is not to be used as a seating area, this wind condition represents a negligible effect.
- 12.81 Probe location 81 had standing/entrance use conditions during the summer season. Whilst this area forms part of the public realm, its intended use is a sports area, therefore, these conditions represent a negligible effect.

- 12.82 Plot B probe locations 117 and 119 in the outdoor café area also had wind conditions suitable for standing/entrance use during the summer season, representing a minor adverse effect. Therefore, mitigation measures discussed below would also be required at these locations.
- 12.83 Other ground floor amenity areas on site recorded wind conditions of negligible significance.
- 12.84 Offsite, the public gardens situated in Atlas Gardens and Derrick Gardens had wind conditions suitable for sitting use, which represents a negligible effect.

Podium Terrace

- 12.85 During the summer season probe locations 130, 131, 133 and 134 had wind conditions suitable for standing/entrance use, and probe locations 132 had leisure walking. As probe locations 132 to 134 are not to be used as seating locations, standing/entrance use would be suitable for this area. Therefore, the wind conditions at probes 131, 133 and 134 are of negligible significance. The wind conditions at probes 130 and 132 represent wind effects of minor adverse and moderate adverse significance respectively. Mitigation measures as described below would be required.
- 12.86 Probe location 129, which is to be used as a seating area, recorded sitting use wind conditions during the summer season, which is a negligible wind effect.

Rooftop Terraces

- 12.87 Plot A rooftop terraces generally recorded sitting use wind conditions during the summer season representing a negligible wind effect.
- 12.88 The exception to this was at probe location 166 in the southern section of the Building B2 rooftop terrace, which had wind conditions suitable for standing/entrance use during the summer season. On larger public terraces a mixture of sitting and standing conditions would be acceptable should seating locations be restricted to the calmer sitting use locations (in this case the northern section of the terrace). As location 166 would be used for planter space and soft landscaping, this represents a negligible wind condition.
- 12.89 Plot B rooftop terraces mostly saw wind conditions suitable for standing/entrance use at probe locations 135-138, 141 and 142 during the summer season. This represents a minor adverse effect and would require mitigation measures.

Balconies

- 12.90 Plot A balcony probe locations 156 and 157 had wind conditions suitable for standing/entrance use which represents a minor adverse effect and mitigation measures would be required.
- 12.91 Balcony locations 152-155, also on Plot A, recorded sitting use conditions during the summer season and would therefore be suitable for the intended use, representing a negligible wind effect.

Strong Winds

- 12.92 Strong winds in excess of Beaufort Force 7 occurred at receptors 88, 120 and 132 for up to 2.5 hours per annum. Strong winds of this magnitude would be a safety concern and therefore would require mitigation measures as described below.
- 12.93 Strong winds in excess of Beaufort Force 6 occurred at receptors 13, 21, 57, 69, 71, 81, 89, 97, 121, 122, 133, 134 and 136, for up to 5.0 hours per annum. As receptors 57, 69, 89, 97, 121, 122, are situated on thoroughfares, the exceedance of Beaufort Force 6 would be unlikely to cause nuisance. Receptors 13, 81, 133, 134, 136 are located in amenity areas, where strong winds are more likely to occur during the windiest season (winter) in which the areas are less frequently used, and is therefore unlikely to cause a nuisance.

12.94 As receptors 21 and 71 are situated at building entrances, the occurrence of strong winds in excess of Beaufort Force 6 at these locations would be a safety issue. These receptors have already been identified as requiring mitigation measures for pedestrian comfort and these measures would also be expected to reduce the frequency of these strong winds.



Figure 12.5: Proposed Development with existing surrounding buildings –Ground/Podium level - winter season

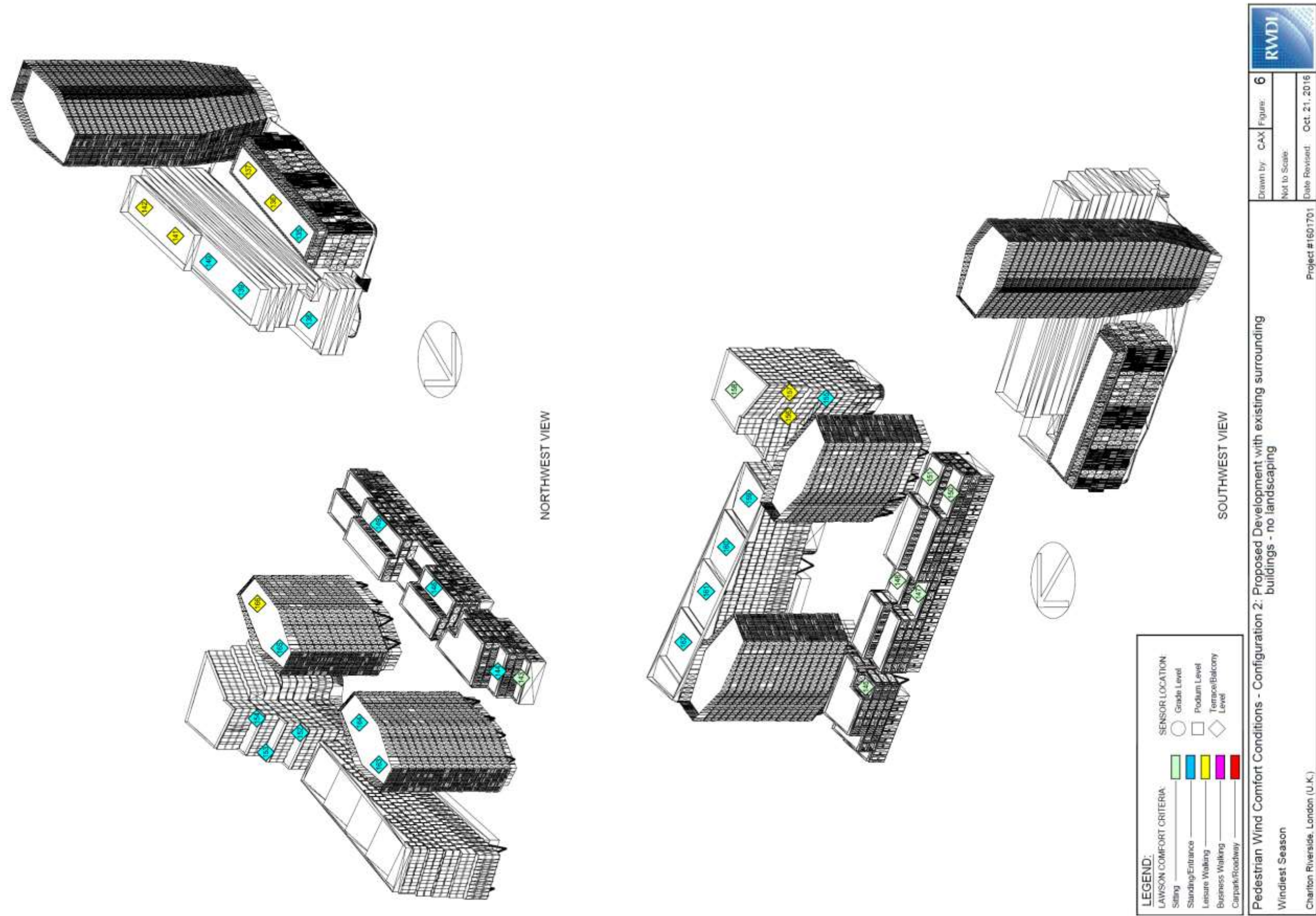


Figure 12.6: Proposed Development with existing surrounding buildings – Terrace/Balcony level - winter season



Figure 12.7: Proposed Development with existing surrounding buildings – Ground/Podium level – summer season

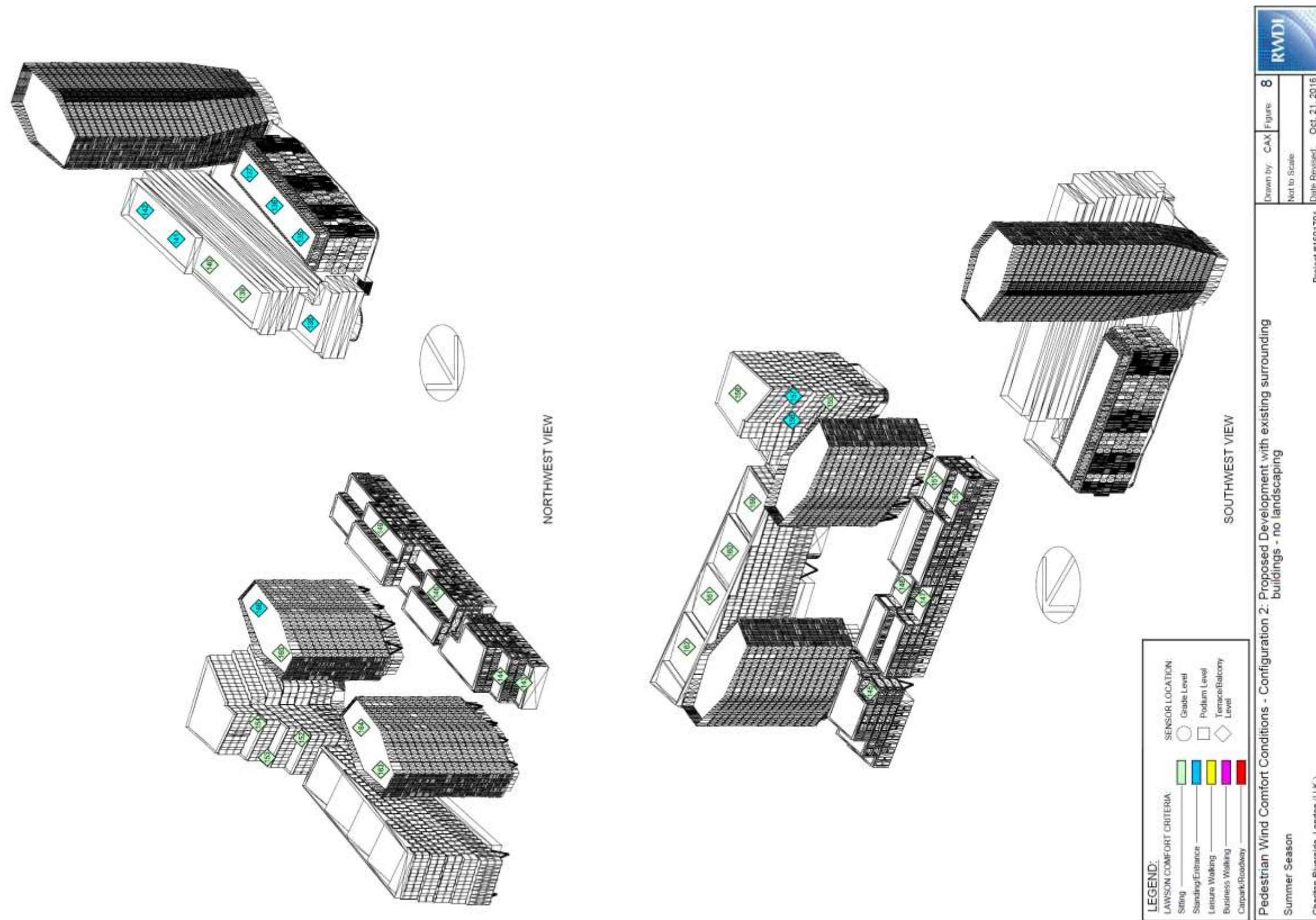


Figure 12.8: Proposed Development with existing surrounding buildings – Terrace/Balcony – summer season

Mitigation and Residual Effects

- 12.95 A landscaping scheme was developed and refined through wind tunnel testing using an iterative test process to ensure suitable mitigation measures were incorporated into the proposed development.

Demolition and Construction

- 12.96 During demolition and construction, site hoardings would be present around the perimeter of the application site and would mitigate wind speeds at ground level.

Completed Development

- 12.97 As part of the commitment to ensure a suitable wind microclimate is achieved with the Completed Development *in situ*, a number of mitigation measures have been developed to ensure that the potential for adverse effects would be avoided. These are discussed in the following paragraphs.
- 12.98 The implementation of the proposed landscape masterplan, shown in Figure 12.13 would improve conditions at ground level further, particularly during the summer season when the trees would be in full leaf.
- 12.99 In order to achieve desired wind conditions at entrance location 88 which was classified as windier than desired the entrance was recessed by 1.5 m to provide additional shelter.
- 12.100 The balustrades at the balcony locations 156-158 were also increased to 1.5m to provide additional shelter to these areas.
- 12.101 The results for the completed development within existing surrounding buildings, including mitigation and the proposed landscaping scheme is shown in Figures 12.9 and 12.10 for the ground floor/podium level and the terraces/balconies for the windiest season. For the summer season the results are shown in Figures 12.11 and 12.12 for the ground/podium levels and the terraces/balconies respectively. The results are discussed below.

Pedestrian Thoroughfares

- 12.102 Probe location 120 at the north west corner of Plot B had wind conditions suitable for business walking use when tested without landscaping (see Completed Development section), representing a minor adverse effect. This was mitigated with the inclusion of 1m shrubs and 2m-3m trees to the west of Plot B, as well as the existing 17m trees to the west of Plot B on Hope and Anchor Lane so that the location would have leisure walking conditions which represents a **negligible** effect.
- 12.103 The majority of receptors in Configuration 3 (proposed development with existing surrounding buildings and with landscaping) had conditions along pedestrian thoroughfares within and around the proposed development which would be suitable for sitting, standing/entrance use and leisure walking. These conditions are considered to be acceptable for pedestrian thoroughfare use, with no requirement for mitigation.
- 12.104 These wind conditions represent **Moderate Beneficial**, **Minor Beneficial** and **Negligible** effects for sitting, standing/entrance use and leisure walking respectively.
- 12.105 No further mitigation measures are required for thoroughfare locations.

Entrances

- 12.106 Probe location 21 had wind conditions suitable for leisure walking use when tested without landscaping (see Completed Development section), representing a minor adverse effect. With the developed landscaping, the entrance wind conditions would be suitable for sitting use representing a **minor beneficial** effect. The wind conditions were mitigated due to the additional soft landscaping

throughout the western half of Plot A, most significantly the trees to the south west of the entrance as well as the 1m high shrubs.

- 12.107 Probe location 88 was recessed by 1.5m creating a localised area of shelter, with the resulting wind conditions suitable for sitting, two categories calmer than the no landscaping scenario (as discussed in the Completed Development section) use representing a **minor beneficial** effect.
- 12.108 All other entrance probe locations had wind conditions of **negligible** to **minor beneficial** significance.
- 12.109 No further mitigation measures would be required at entrance locations.

Ground Floor Amenity Areas

- 12.110 Probe location 13 had wind conditions suitable for standing/entrance during the summer season when tested without landscaping. With the developed landscaping scheme, the wind conditions were one category calmer and suitable for sitting use during the summer season. This was due to the addition of 1m shrubs, 1m trees and 2m-3m trees to the south and south west of the area and represents a **negligible** effect.
- 12.111 Probe locations 117 and 119 have sitting use conditions during the summer season which represents a **negligible** effect. This is one category calmer than the results without the proposed landscaping (discussed in the Completed Development section) which were suitable for standing/entrance use. The wind conditions were mitigated due to the 1m shrubs and 2m-3m trees to the west of Plot B, as well as the existing 17m trees to the west of Plot B on Hope and Anchor Lane.
- 12.112 The other ground floor amenity spaces would be suitable for sitting use and therefore represent a **negligible** effect which would require no further mitigation.

Podium Terrace

- 12.113 Probe location 130 had wind conditions suitable for standing/entrance use during the summer season when tested without landscaping. With the developed landscaping scheme, probe location 130 had sitting use conditions during the summer season due to the additional planters, shrubs and trees throughout the terrace space. This represents a **negligible** effect.
- 12.114 Probe locations 131, 133 and 134 had wind conditions suitable for standing/entrance use which represents a **negligible** effect as this area is not intended for sitting use. Should seating be located at these locations at a later date, a solid canopy of 2.5m height supported at all four corners would need to be used. In addition, the seating area would need to be surrounded by shrubs of 1.5m to 2m height.
- 12.115 Probe 171 was added for the testing of the proposed development with landscaping to give additional resolution to the southern section of the podium terrace.
- 12.116 Probe locations 129 and 171 had wind conditions suitable for sitting use during the summer season. This represents a **negligible** effect and the locations could be used as seating areas.

Rooftop Terraces

- 12.117 Plot B rooftop terraces without any landscaping measures had mostly wind conditions suitable for standing/entrance use at probe locations 135-138, 141 and 142 during the summer season, representing a minor adverse effect.
- 12.118 With the developed landscaping scheme Plot B, terraces recorded suitable wind conditions, with terraces either recording sitting conditions or a mixture of sitting and standing/entrance conditions during the summer season. These wind conditions represent a **negligible** wind effect, provided that seating areas at probe locations 137 and 142 which had standing/entrance use conditions were restricted.

- 12.119 Plot B wind conditions were mitigated using a 2m-3m trees throughout the terraces and between Building 3 and the building to the north, as well as 1m shrubs.
- 12.120 Plot A rooftop terraces without any landscaping measures generally had sitting conditions (with the exception of location 166 and 168 which had standing entrance use conditions, but will not be used as seating areas), which represents **negligible** effects.

Balconies

- 12.121 With the inclusion of 1.5m balustrades Plot A balcony probe locations 155-157 has wind conditions suitable for sitting. This represents a **negligible** effect and is one category calmer than recorded without mitigation measures (see Completed Development section).
- 12.122 Balcony locations 152-155 recorded sitting use conditions during the summer season and would therefore be suitable for the intended use, representing a **negligible** wind effect.

Strong Winds

- 12.123 Strong winds in excess of Beaufort Force 6 occurred at receptors 57, 89, 93, 97, 120, and 167 for up to 5.0 hours per annum.
- 12.124 Probe locations 57, 89, 93, 97 and 120 are thoroughfares, where strong winds of this magnitude would not be expected to cause a significant nuisance to pedestrians.
- 12.125 Probe locations 120, and 167 occur at amenity spaces, where the strong winds would be likely to occur during the windiest season (winter) when the spaces would not be frequently in use.
- 12.126 No strong winds in excess of Beaufort Force 7 or 8 were recorded for over one hour per annum.



Figure 12.9: Proposed Development with existing surrounding buildings and landscaping –Ground/Podium level - winter season

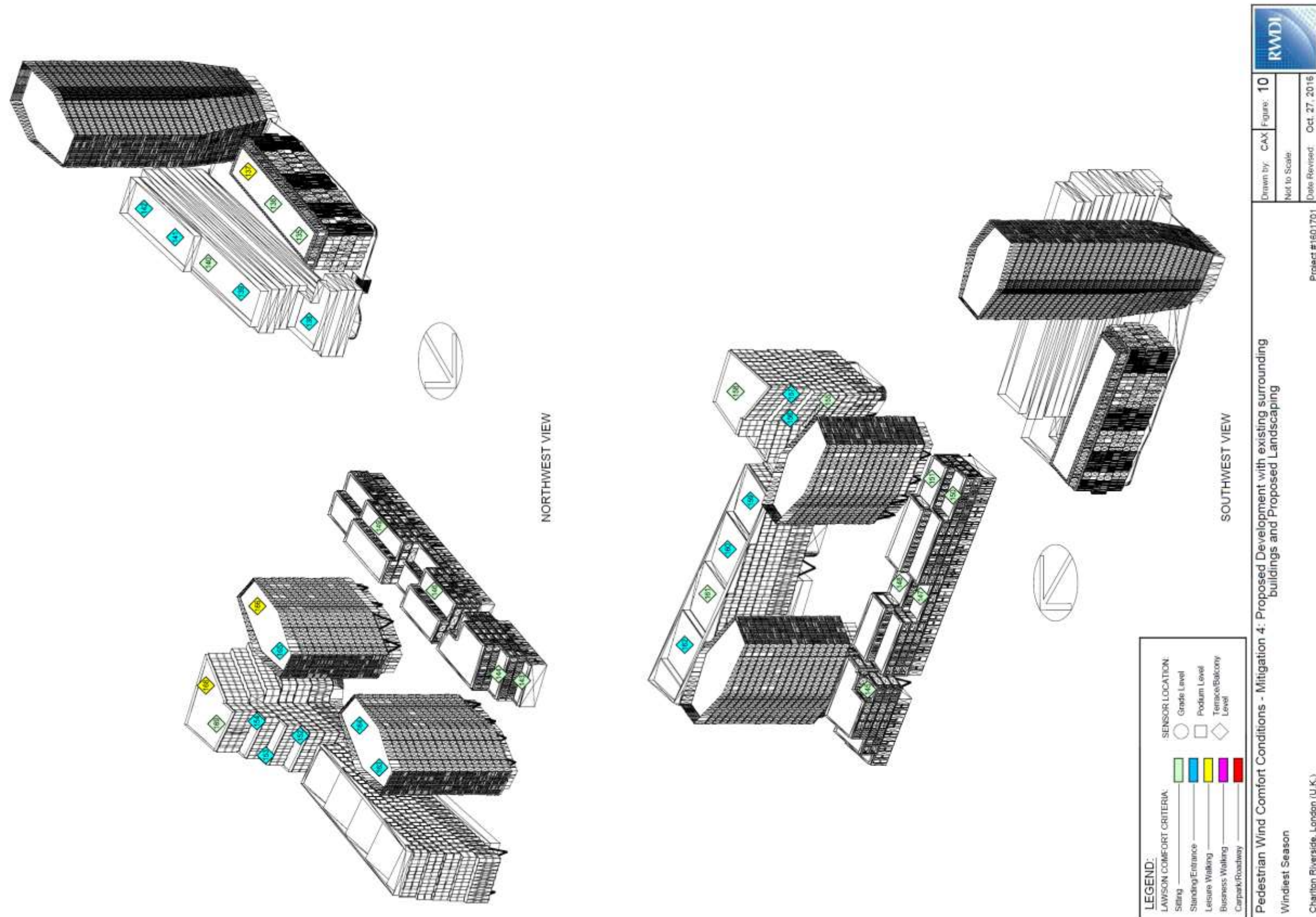


Figure 12.10: Proposed Development with existing surrounding buildings and landscaping –Terrace/Balcony level - winter season



Figure 12.11: Proposed Development with existing surrounding buildings and landscaping –Ground/Podium level –summer season

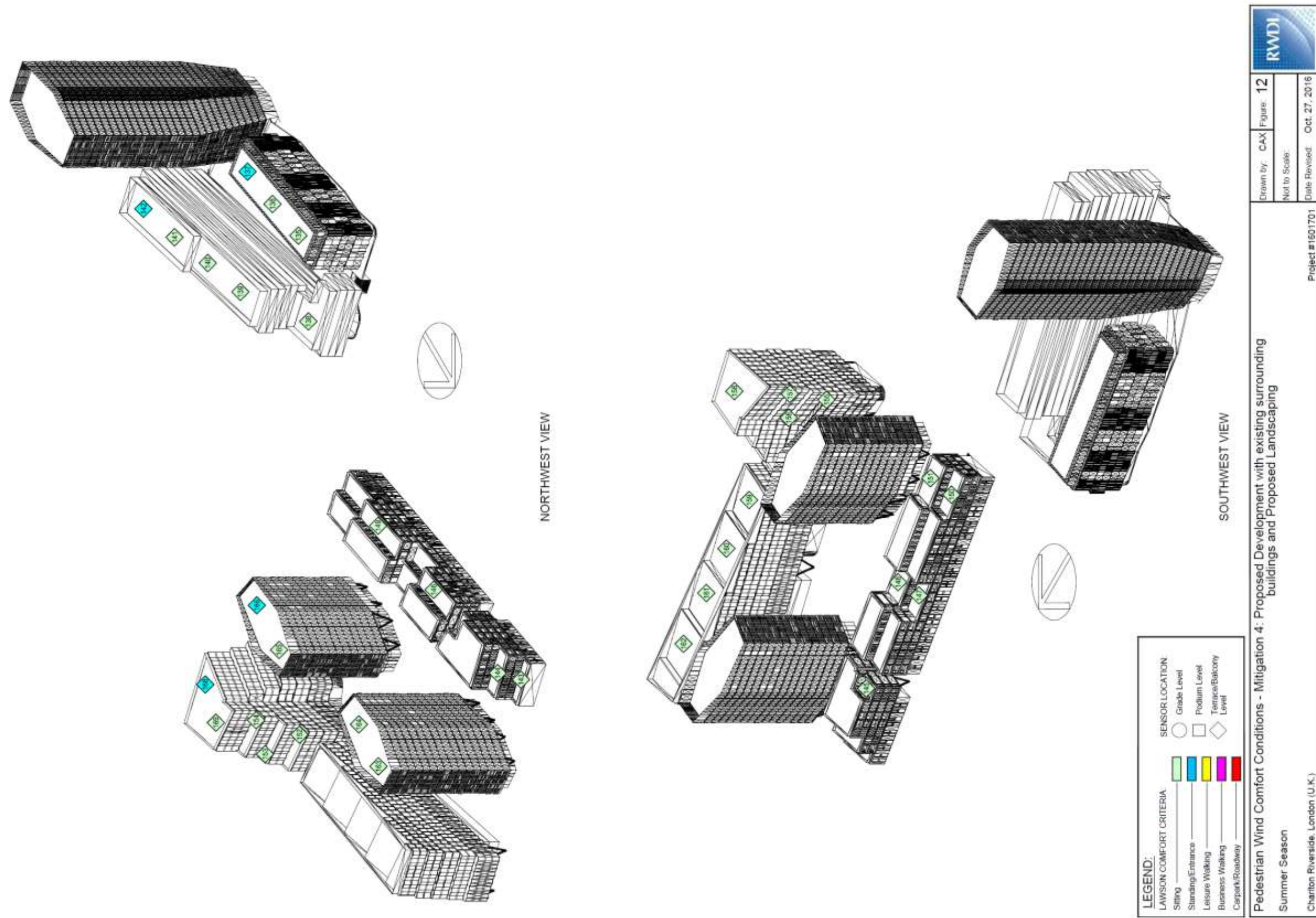


Figure 12.12: Proposed Development with existing surrounding buildings and landscaping –Terrace/Balcony level – summer season



Figure 12.13: Proposed Ground Floor Landscape Masterplan

Summary of Mitigation and Residual Effects

12.127 Table 12.6 and Table 12.7 provide a tabulated summary of the outcomes of the Wind Impact Assessment of the proposed development.

Table 12.6: Summary of Proposed Mitigation and Enhancement Measures		
Receptor	Description of Potential Effect	Proposed Mitigation & Enhancement Measures
Demolition and Construction		
Personnel on site	Increased windiness at ground level, negligible	Site hoarding
Completed Development		
Pedestrians on thoroughfares	Negligible to Moderate Beneficial effect, with the exception of the northwest corner of Plot B (location 120) which would have a Minor Adverse effect.	Retention of existing 17m trees to the west of site. 2m-3m trees and 1m shrubs on site.
Pedestrians at entrances	Minor beneficial to negligible with exception to the southern entrance of Building A1 (location 21) and the northern entrance of Building A2 (location 88) which had minor adverse effects.	Southern entrance of Building A1; 2m-3m trees to the west and south west and 1m shrubs. Northern entrance of Building A2; Recessed by 1.5m. 2m-3m trees to the west and south west and 1m shrubs.
Ground floor amenity	Negligible to minor adverse at locations 13, 78, 117, and 119.	Location 13 to have 2m-3m trees to the west and south west and 1m shrubs. Location 78 would not be used as a seating area. Locations 117 and 119, existing 17m trees to the west of site. 2m-3m trees and 1m shrubs on site.
Podium terraces	Negligible to moderately adverse	Planters, 2m-3m trees, 1m shrubs.
Rooftop terraces	Negligible to minor adverse	Planters and 2m-3m trees throughout terrace spaces.
Balconies	Negligible to minor adverse	1.5m balustrades on the balcony locations 155-157.

Table 12.7: Summary of Residual Effects								
Receptor	Description of Residual Effect	Nature of Residual Effect*						
		Significance **	+	D	P	R	St	Mt
Demolition and Construction								
None measured	Negligible	Negligible						
Completed Development								
Pedestrians on thoroughfares	Sitting use to leisure walking	Negligible to moderate	+	D	P	R	Lt	
Pedestrians at entrances	Sitting use to standing/entrance use	Negligible to Minor	+	D	P	R	Lt	
Ground floor amenity	Sitting use to standing/entrance (at active amenity spaces)	Negligible	n/a	D	P	R	Lt	
Podium terraces	Sitting use to standing/entrance use in summer	Negligible	n/a	D	P	R	Lt	
Rooftop terraces	Sitting use and standing entrance use (probe location 166) in summer	Negligible	n/a	D	P	R	Lt	
Balconies	Sitting in summer	Negligible	n/a	D	P	R	Lt	

Notes:
 * - = Adverse/ + = Beneficial; D = Direct/ I = Indirect; P = Permanent/ T = Temporary; R=Reversible/ IR= Irreversible; St- Short term/ Mt -Medium term/ Lt -Long term.
 **Negligible/Minor/Moderate/Major

Likely Significant Environmental Effects

12.128 After the implementation of the proposed landscaping and mitigation, there would be no adverse effects related to wind microclimate.

Comparison Against the Baseline

12.129 With regard to on-site wind conditions (off-site, local surrounds assessment has been presented earlier in this ES Chapter), it is recognised that the comparison with the desired pedestrian use is of most relevance in understanding whether the areas of the application site are suitable for their intended use.

12.130 However, it is acknowledged that a direct comparison with the baseline conditions (Figures 12.3 and 12.4) would also be useful to understand changes from the existing (baseline) wind conditions across the application site due to the proposed development (including the proposed landscaping scheme) (Figures 12.9 and 12.11).

12.131 Comparisons between the baseline scenario and 'with development' scenario have therefore been made where possible. However due to the existing massing on the application site there are areas within the proposed development which do not have an equivalent baseline location to be compared against.

- 12.132 In addition, as the intended use at the probe locations largely change from the baseline scenario to the 'with development' scenario, a change in wind conditions might result in the same level of significance being concluded.
- 12.133 Wind conditions at ground-level across the application site were generally similar in the baseline and expected 'with development' conditions and both scenarios had wind conditions ranging from suitable for sitting use to leisure walking use during the windiest season.
- 12.134 During the winter season fifty-one probes had the same wind conditions in both the baseline and 'with development' scenario.
- 12.135 Thirty probes became windier with the inclusion of the proposed development and landscaping by up to two comfort categories (from sitting use to leisure walking use).
- 12.136 Thirty probes became calmer with the inclusion of the proposed development and landscaping by one comfort category.

Cumulative Effects

- 12.137 At the time of testing there were no foreseeable developments of a significant size within the test radius that could interact with the proposed development from a wind microclimate perspective. Therefore, the specific wind effects in the application site would not be affected by the cumulative buildings, which would only contribute to the background terrain effects on the approaching wind speeds. As the terrain is already characterised as an urban terrain typical of London, any cumulative effects would not be significant.