

B&Q Cricklewood ES Volume I

Chapter 16: Wind Microclimate

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16. Wind Microclimate

16.1 Introduction

- 16.1.1 This chapter of the Environmental Statement (ES) reports the findings of an assessment of the likely significant effects on wind microclimate as a result of the proposed 'B&Q Cricklewood' development (hereafter referred to as the 'Proposed Development') in the London Borough of Barnet (LBB).
- 16.1.2 This chapter considers the potential impacts of the massing of the Proposed Development on the ground level wind speed and direction at the Site, which could affect the associated relative comfort and safety of pedestrians using the Proposed Development. This chapter also summarises the findings of wind tunnel tests completed in January 2020. Wind conditions not suitable for the intended pedestrian use of the Proposed Development and occurrences of strong winds are highlighted. The use of agreed wind mitigation measures detailed in this document improves conditions at the Site to be suitable for the intended pedestrian uses (with reassessment required at the future Reserved Matters Application (RMA) stage).
- 16.1.3 The potential for effect interactions on a single receptor (Type 1 effects) are discussed in *Chapter 17: Effect Interactions*. Combined cumulative wind microclimate effects (Type 2 effects) of the Proposed Development with other development schemes are discussed at the end of this chapter.
- 16.1.4 This assessment and ES chapter has been produced by RWDI, a specialist wind consultancy with more than 40 years' experience in the assessment of the urban wind microclimate. RWDI has state of the art simulation technology including a modelling workshop, computational software and wind tunnels to simulate the microclimate in the built environment.
- 16.1.5 This chapter is supported by the following technical appendices:
- *ES Volume III: Appendix 16.1: Pedestrian Level Wind Microclimate Assessment (February 2020).*

16.2 Legislation and Planning Policy Context

National Legislation

- 16.2.1 There is no legislation direction relating to wind microclimate issues relevant to the Proposed Development.

National Planning Policy and Guidance

National Planning Policy Framework (2019)¹

- 16.2.2 The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally-prepared plans for housing and other development can be produced. It states that the purpose of the planning system is to contribute to the achievement of sustainable development; and that the planning system must meet interdependent overarching objectives summarised as: an economic objective, a social objective and an environmental objective.
- 16.2.3 There are no policies or statements that are directly related to the wind microclimate, although the promotion of high-quality built environments was emphasised in the NPPF. For instance, paragraph 128 states:
- "f) Create places that are safe, inclusive and accessible and which promote health and well-being, with high standard of amenity for existing and future users"*

¹ Department of Communities and Local Government, 2012; National Planning Policy Framework (NPPF)

National Planning Practice Guidance²³

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

Regional Planning Policy

The London Plan – Spatial Development Strategy for Greater London (2016)⁴

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

- Policy 7.6 Architecture
 - *“Architecture should make a positive contribution to a coherent public realm, streetscape and wider cityscape. It should incorporate the highest quality materials and design appropriate to its context.”*
 - *“Buildings and structures should [...] not cause unacceptable harm to the amenity of surrounding land and buildings, particularly residential buildings, in relation to privacy, overshadowing, wind 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 particularly important if the site is not identified as a location for tall or large buildings in the borough’s Local Development Framework (LDF).”*
 - *“Tall buildings [...] should not affect their surroundings adversely in terms of microclimate, wind turbulence, overshadowing, noise, reflected glare, aviation and telecommunication interference.”*

The London Plan – The Spatial Development Strategy for Greater London: Intend to Publish Version to Secretary of State (December 2019)⁵

- 16.2.6 While the consolidated London Plan (2016) remains current, the Draft New London Plan (2019) updates and consolidates the existing plan to provide guidance for development and a policy framework for local plans across London. The Intend to Publish London Plan 2019 was published for consultation in 2018; the consultation has closed but the Intend to Publish London Plan has not yet been adopted. The Examination in Public (EiP) was held in January 2019; the Panel of Inspectors appointed by the Secretary of State issued their report and recommendations to the Mayor in October 2019. The Mayor considered the Inspector’s recommendations and in December 2019 issued his intention to publish the London Plan. Relevant policies within the Intend to Publish version include:

- Policy D3 Optimising site capacity through the design-led approach (Para 3.1B.8), states that:
 - *“Buildings [...] massing, scale and layout [...] should complement the existing streetscape and surrounding area. Particular attention should be paid to the design of the parts of a building or public realm that people most frequently see or interact with in terms of its legibility, use, detailing, materials and location of entrances. Creating a comfortable pedestrian environment with regard to levels of [...] wind”.*
- Policy D8 Public realm, Development Plans and development proposals should, states that:

² DCLG, 2016; National Planning Practice Guidance

³ DCLG, 2019; National Planning Practice Guidance

⁴ Greater London Authority (GLA), 2016; The London Plan – The Spatial Development Strategy for London Consolidated with Alterations Since 2011

⁵ Greater London Authority, 2019. Intend to Publish London Plan (clean version) – December 2019. London. GLA

- *“Consideration should also be given to the local microclimate created by buildings, and the impact of service entrances and facades on the public realm.”*
- *“Ensure that appropriate shade, shelter, seating [...] with other microclimatic considerations, including temperature and wind, taken into account in order to encourage people to spend time in a place.”*
- Policy D9 Tall buildings: Environmental impact, states that:
 - *“Wind [...] around the building(s) and neighbourhood must be carefully considered and not compromise comfort and the enjoyment of open spaces, including water spaces, around the building”;*
 - *“Air movement affected by the building(s) should [...] not adversely affect street-level conditions”.*
- Policy D9 Tall buildings: Cumulative impacts, states that:
 - *“The cumulative visual, functional and environmental impacts of proposed, consented and planned tall buildings in an area must be considered when assessing tall building proposals and when developing plans for an area. Mitigation measures should be identified and designed into the building as integral features from the outset to avoid retro-fitting.”*

16.2.7 A response from the Secretary of State was issued on 13 March 2020, outlining that the New London Plan cannot yet be published until amendments and directions outlined by the Secretary of State have been incorporated into a revised document. A response was issued by the Mayor, however currently both parties are still to informally agree text on the New London Plan prior to publishing the Final New London Plan.

16.2.8 The Draft London Plan is a material consideration in planning decisions.

Sustainable Design and Construction Supplementary Planning Guidance (SPG) (2014)⁶

16.2.9 The SPG states in section 2.3.7 that:

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

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

Shaping Neighbourhoods: Play and Informal Recreation SPG (2012)⁷

16.2.11 In the Shaping Neighbourhoods SPG in Section 4.48 (under Step B5: What types of play space should be provided and how should existing play provision be improved?) the following statement emphasises on wind microclimate:

⁶ GLA, 2014. Sustainable Design and Construction Supplementary Planning Guidance. London. GLA

⁷ Greater London Authority, 2012. Shaping Neighbourhoods: Play and Informal Recreation Supplementary Planning Guidance. London. GLA

- *“Playable spaces should be properly integrated into new development and the existing context [...] If [...] windy spaces are utilised, they should be made worthy through innovative design.”*

Local Planning Policy

London Borough of Barnet Draft Local Plan (Reg 18) Preferred Approach Consultation (2020)⁸

- 16.2.12 The LBB are currently in the process of reviewing and updating the borough’s adopted Local Plan documents, and recently published its Draft Local Plan (Regulation 18 document) for public consultation. The consultation period took place between 27 January – 16 March 2020, with the Regulation 19 (i.e. Publication of Local Plan for making representations on soundness issues (NPPF para 35) document scheduled for publication in Winter 2021. Adoption of the revised Draft/New Local Plan is not expected until Spring 2022.
- 16.2.13 By virtue of being at an early stage in the adoption process, the Draft Local Plan is considered to be of limited weight and is not a material consideration within this EIA.

London Borough of Barnet Local Plan

LBB’s Core Strategy Development Plan Document (DPD)(2012)⁹

- 16.2.14 There is no strategy relating to wind microclimate issues relevant to the Proposed Development.
- Barnet Sustainable Design and Construction SPD¹⁰ (2016)**
- 16.2.15 In the Barnet SPD in Section 2.5 Microclimate – Wind and Thermal Conditions under design principles Table 2.5.2 states:
- *“Developers should demonstrate that appropriate comfort levels can be achieved for all pedestrian public and communal outdoor spaces using the Lawson Criteria for Distress and Comfort as a guide to the appropriate level of amenity for the expected use of those areas.”*

LBB’s Development Management Policies DPD, 2012¹¹

- 16.2.16 The Development Management Policies DPD which sets out the policy framework for decision making on planning applications.
- 16.2.17 Section 6 Tall buildings paragraph 6.1.7, states that:
- *“The presence of an existing tall building does not necessarily mean that its replacement or another tall building in the same area will be acceptable. Redevelopment of existing tall buildings will need to consider the potential to improve on the impact of the existing building. The massing and configuration of buildings can have a significant localised effect on the climatic conditions, funnelling wind [...]. Good design can be used to minimise these effects to benefit in particular users of the public realm.”*
- 16.2.18 Policy DM05 Tall buildings, states that:
- *“Tall buildings outside the strategic locations identified in the Core Strategy will not be considered acceptable. Proposals for tall buildings will need to demonstrate: v. that the potential microclimatic effect does not adversely affect existing levels of comfort in the public realm”*

Mill Hill Area Action Plan (AAP), 2009¹²

- 16.2.19 There is no strategy relating to wind microclimate issues relevant to the Proposed Development.

⁸ LBB, 2020; Draft Local Plan for Public Consultation – Regulation 18 Document

⁹ London Borough of Barnet (LBB), 2012; Local Plan (Core Strategy)

¹⁰ LBB, 2016; Barnet Sustainable Design and Construction SPD

¹¹ LBB, 2012; Development Management Policies DPD

¹² LBB, 2009; Mill Hill Area Action Plan (AAP)

Colindale AAP, 2010¹³

16.2.20 There is no strategy relating to wind microclimate issues relevant to the Proposed Development.

Cricklewood, Brent Cross and West Hendon Regeneration Area Development Framework¹⁴

16.2.21 The Brent Cross Cricklewood Development SPG states in Chapter 4 under Building Scale and Density:

- *“Tall buildings will be acceptable providing they satisfy a series of tests including: [...] micro-climate.”*

16.2.22 In chapter 6, section Town Centre South Side under Built Form and Height:

- *“[...] Careful consideration should be given to the siting of taller buildings so as not to have an adverse impact on the micro-climate, [...] and wind exposure to Station Square.”*

Brent Cross – Cricklewood Opportunity Area¹⁵

16.2.23 There is no strategy relating to wind microclimate issues relevant to the Development.

Other Relevant Policy, Standards and guidance

Additional Policy/Standards/Guidance

16.2.24 The Historic England Advice Note 4: Tall Buildings (2015)¹⁶ states in Section 4.7:

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

16.3 Assessment Methodology

16.3.1 This section of this ES chapter presents the following:

- Information sources that have been consulted throughout the preparation of this chapter;
- Details of consultation undertaken with respect to wind microclimate;
- The methodology behind the assessment of wind microclimate effects, including the criteria for the determination of sensitivity of receptor and magnitude of change from the existing of ‘baseline’ conditions;
- An explanation as to how the identification and assessment of potential wind microclimate effects has been reached; and
- The significance criteria and terminology for the assessment of wind microclimate residual effects.

16.3.2 The following sources of information that define the Proposed Development have been reviewed and form the basis of the assessment of likely significant effects on wind microclimate:

- Maximum Parameter Model: Document 10965-EPR-Maximum Parameters Massing Rev3 (Dated January 20, 2020); and
- Existing Site (Baseline): Document 109.65-EPR-XX-XX-DR-A-SD-0102 (Dated December 17, 2019)

¹³ LBB, 2010, Colindale AAP

¹⁴ LBB, 2005; Cricklewood, Brent Cross and West Hendon Regeneration Area Development Framework Supplementary Planning Guidance

¹⁵ GLA, 2014; Brent Cross – Cricklewood Opportunity Area Framework

¹⁶ Tall Buildings: Historic England Advice Note 4, 2015. London. CABE and English Heritage

Study Area and Scope

- 16.3.3 The main interactions of wind with a building occurs relatively close to the building, particularly when there are neighbouring buildings and streets along which the wind can be channelled. This means that the focus of the assessment will be within the Site boundary and the immediate surrounding streets and public realm. Conditions will be assessed on the relative comfort and safety of Site residents, visitors and users of the public, communal and private open spaces, as well as pedestrians utilising other public realm areas such as pedestrian routes within and bordering the Site.
- 16.3.4 Due to the scale of the Proposed Development, a comprehensive assessment of baseline (existing) and likely pedestrian level wind conditions upon completion of the Proposed Development has been undertaken, based on wind tunnel testing of a physical scale model and the industry standard Lawson Comfort Criteria.
- 16.3.5 The wind tunnel model of the Proposed Development is built at a scale of 1:300 and includes the surrounding area within a 360m radius of the centre of the Site (hereafter referred as the 'surrounding area'). The immediate surrounding area consists of a mixture of midrise urban residential and low-rise commercial developments and as such a 360m radius is considered a robust study area for the wind assessment. The area within the 360m radius will hereafter be referred to as the 'Study Area'.
- 16.3.6 The cumulative assessment is based on the updated cumulative scheme list as defined within *ES Chapter 7: EIA Methodology*. Cumulative developments outside of the 360m radius are not modelled but are taken account of in the terrain analysis.
- 16.3.7 The assessment undertaken focusses on the windiest season (in northern Europe, generally winter; specifically, December, January and February), to represent a 'worst case' scenario, and the summer season (June, July and August) for amenity spaces, when they are expected to be most frequently used.
- 16.3.8 In the wind tunnel assessment, the following configurations were assessed:
- Configuration 1: The Existing Site with Existing Surrounding Buildings (the Baseline Condition);
 - Configuration 2: The Proposed Development with Existing Surrounding Buildings; and
 - Configuration 3: The Proposed Development with Cumulative Surrounding Buildings.
- 16.3.9 All configurations were devoid of any landscaping in order to ensure that the assessment is based upon a conservative (i.e. worst case) scenario.
- 16.3.10 Wind is unsteady, or gusty, and this 'gustiness' or turbulence, varies depending upon the site. Modelling these effects is achieved by a series of spires and floor roughness elements to create a 'boundary layer' that is representative of the site conditions. The detailed proximity model around the Site is used to fine-tune the flow and create conditions similar to those expected at full scale.
- 16.3.11 The meteorological data obtained for London indicates that the prevailing wind throughout the year is from the south west (i.e. 210 to 240 degrees on the compass). This is typical for many areas of southern England. There is a secondary peak from the north east during the late spring and early summer. The winds from the north east are not as strong as the prevailing winds from the south west.
- 16.3.12 The meteorological station data is then adjusted to the Site conditions using the methodology set out in ESDU 01008¹⁷. Low to medium rise inner city environments increase the turbulence within the atmospheric boundary layer which reduces the mean wind speed, requiring terrain roughness factors to be specified and applied to the meteorological data to account for the variations in terrain surrounding the Site. The meteorological data indicates prevailing winds from the west throughout the year. There is a secondary peak from the south east during the autumn and winter seasons.
- 16.3.13 The combination of meteorological data, Site altitude and velocity ratios permits the percentage of time that wind speeds are exceeded at ground level on the Site to be evaluated. The locations can then be assessed using the Lawson Comfort Criteria, as described below.
- 16.3.14 To account for the difference in height and terrain roughness between meteorological conditions at the airports and the Site, it is necessary to apply adjustment factors to the wind tunnel velocity ratios. Adjustment factors (mean factors) were computed for wind directions from 00 through to 360o. The reference height in the wind tunnel was at the equivalent full-scale height of 120 metres. The seasonal

¹⁷ ESDU International, Computer program for wind speeds and turbulence properties: flat or hilly sites in terrain with roughness changes, ESDU 01008, 2001 01008

wind roses and associated mean factors are shown in *Appendix 16.1*, Figure 16.2 and Table 16.1 respectively.

Methodology for Determining Baseline Conditions and Sensitive Receptors

Current Baseline Conditions

- 16.3.15 The baseline conditions across the Site and the surrounding area have been defined using wind tunnel testing to provide a detailed, quantitative assessment.
- 16.3.16 Mean and peak wind speeds have been measured (for both the windiest season (normally winter) to show the worst case scenario, and summer season for amenity spaces (amenity spaces are assessed during the summer season as these areas are expected to be used most frequently during this period with an expectation of calmer conditions compared to other times of the year)) at locations across the Site and at other surrounding buildings, paths, roads and areas of open spaces for 36 wind directions in 10° increments within a 360m radius of the Site which is considered a large enough scale to ensure all wind effects are captured.
- 16.3.17 The results have been combined with long-term meteorological climate data for the London area (Heathrow and City Airports). The meteorological data used in this assessment is deemed to be representative of the local wind microclimate for the London area. The meteorological data used is presented in the technical *Appendix 16.1* in Figure 16.2.
- 16.3.18 The baseline conditions are reflected within the wind scenario – ‘Configuration 1: Existing Site with Existing Surrounding Buildings’ (also referred as the ‘Baseline Scenario’). Further detail on the wind tunnel testing methodology can be found in *Appendix 16.1*.

Future Baseline Conditions

- 16.3.19 The evolution of the Baseline Condition (in the event that the Proposed Development does not come forward) has been considered using professional judgement informed by the results of the Baseline Scenario (Configuration 1) and the wind tunnel results undertaken as part of the cumulative effects assessment (Configuration 3), see paragraph 16.3.26 for further details on configurations tested.

Methodology for Determining Demolition and Construction Effects

- 16.3.20 The potential microclimate impacts during demolition and construction works have not been directly assessed within the wind tunnel, as this is a temporary condition and would be highly variable due to the progressive nature of this phase, as the remaining buildings on-site are demolished and the Proposed Development is constructed. Therefore, the potential impacts during the demolition and construction phase are assessed using the professional judgement of an experienced wind engineer, based on an assessment of the background wind climate at the Site (the results of the tested configurations for the Baseline (Configuration 1) and completed Proposed Development (Configuration 2) Scenarios) and an understanding of the likely effects based on RWDI’s experience of assessing wind in the built environment.
- 16.3.21 This approach is taken assuming that the activity on-site during this time (i.e. construction activity) is less sensitive to wind conditions (due to protection from Site hoarding, and Site access being restricted to Site workers) than when the Proposed Development is complete and operational (which would include new building entrances and outdoor seating with amenity spaces, for example). In addition, there would be appropriate health and safety measures implemented to ensure that the construction workers were adequately protected.
- 16.3.22 Windier conditions (in terms of pedestrian comfort) will be tolerable across the active demolition and construction Site as this area is not for typical pedestrian use.

Methodology for Determining Complete and Operational Effects

- 16.3.23 To predict the local wind environment associated with the completed Proposed Development, and the resulting pedestrian comfort within and in the area surrounding the Site, wind tunnel testing of the Proposed Development has been undertaken.

- 16.3.24 Wind tunnel testing is a well-established and robust means of assessing the pedestrian wind microclimate effects developments which incorporate tall buildings. It enables the wind conditions at the Site to be quantified and classified in accordance with the widely-accepted Lawson Comfort Criteria.
- 16.3.25 It is acknowledged that a direct comparison with the baseline conditions would be useful to understand changes from the existing (baseline) wind conditions across the Site due to the presence and operation of the Proposed Development. However, a comparison of the measured wind environment for the Proposed Development with the existing conditions does not take into account any change in pedestrian activity that would usually accompany development. Comparisons between the Baseline Scenario and completed Proposed Development scenario have therefore been made where relevant.
- 16.3.26 The methodology for quantifying the pedestrian level wind environment is outlined below within four steps. Further details of the assessment methodology are contained within *Appendix 16.1*.
- Step 1: The Site's induced wind speeds are measured for the appropriate configuration(s) at the appropriate pedestrian level(s) in the wind tunnel;
 - Step 2: Standard meteorological data is adjusted to account for conditions at a Site (for this assessment, meteorological data has been derived from the meteorological stations at two London airports (Heathrow and City combined));
 - Step 3: Data from Step 1 and Step 2 is combined to obtain the expected frequency and magnitude of wind speed for the appropriate configuration(s) and at the appropriate pedestrian level(s); and
 - Step 4: The results of Step 3 are compared with the Lawson Comfort Criteria (and where relevant, the change in the wind microclimate conditions between appropriate test configuration(s)) to 'grade / score' the conditions within and around the Site.

Methodology for Determining Cumulative Effects

- 16.3.27 The following cumulative schemes as identified within *Chapter 7: EIA Methodology* are situated within the Study area and have been considered in the cumulative assessment:
- Co-op Site 1-13 Cricklewood Lane (Ref. No. 18/6353/FUL); and
 - 194-196 Cricklewood Broadway London (Ref. No. 17/0233/FUL).
- 16.3.28 The remaining schemes within the cumulative schemes list are not situated within the study area or do not involve any buildings of amassing that make them relevant for incorporation and are therefore not considered within the cumulative assessment.

Determining Significance Effect






Lawson Comfort Criteria

- 16.3.29 Wind microclimate is assessed using the Lawson Comfort Criteria ('the Lawson Criteria') (LDDC version), which have been established for over thirty years and have been widely used on building developments across the United Kingdom. The Lawson Criteria, which seeks to define the reaction of an average pedestrian to the wind microclimate which they are experiencing, are described in Table 16.3-1. 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 there may be complaints of nuisance or people will not use the area for its intended purpose.
- 16.3.30 The Lawson Criteria set out five pedestrian activities (comfort categories) and reflect the fact that less active pursuits require more benign wind conditions. The four categories are: 'Sitting', 'Standing', 'Strolling' and 'Walking', in ascending order of activity level, with a fifth category for conditions that are 'Uncomfortable' for all uses. In other words, the wind conditions in an area required for 'Sitting' need to be calmer than a location that people merely walk past.
- 16.3.31 The distinction between 'Strolling' and 'Walking' is that in the 'Strolling' scenario pedestrians are more likely to take on a leisurely pace, with the intention of taking time to move through the area, whereas in

the 'Walking' scenario pedestrians are intending to move through the area quickly and are therefore expected to be more tolerant of stronger winds. For a mixed-use development site, such as the Proposed Development (and surrounding area), the desired wind microclimate would typically need to have areas suitable for 'Sitting', 'Standing/Entrance' use and 'Strolling'.

- 16.3.32 The Lawson Criteria are derived for open air conditions and assume that pedestrians will be suitably dressed for the season. Thermal comfort is not evaluated as part of the assessment.
- 16.3.33 The assessment undertaken also provide a notification of stronger winds, which are defined as wind speeds in excess of 15 metres per second (m/s) for more than 2.2 hours of the year. Strong winds are generally associated with areas which would be classified as acceptable for 'Walking' or as 'Uncomfortable'. In a residential-led urban development, 'Walking' and 'Uncomfortable' conditions would not usually form part of the 'target' wind environment and would usually require mitigation due to pedestrian comfort considerations. This mitigation would also reduce the frequency of, or even eliminate, any strong winds.
- 16.3.34 The coloured key in Table 16.3-1 corresponds to the presentation of wind tunnel test results described later within this chapter and within Figure 16-1 to Figure 16-13 provided at the end of this chapter.

Table 16.3-1: Lawson Comfort Criteria

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

Significance Criteria

Sensitivity of Receptor

- 16.3.35 The criteria used in the assessment of the potential effects is based on the relationship between the desired pedestrian uses (as defined by the Lawson Criteria) in relation to the wind conditions measured at a particular receptor location with the Proposed Development in place. This allows for the assessment to take into account any changes in pedestrian activity that might result from the Proposed Development.
- 16.3.36 The sensitivity of receptors is related to the intended pedestrian use at each location; there are no definitions for sensitivity, as the important consideration is whether the wind conditions experienced at a particular receptor location are suitable for the intended use (in terms of pedestrian comfort and strong winds) at that particular location. All receptors are considered to be highly sensitive to the local wind microclimate conditions and are given an equal weighting. The sensitivity for all receptors are defined as high.
- 16.3.37 Sensitive receptors include the following locations (where present on the Proposed Development) with the required wind conditions specified for each use:
- Thoroughfares – targeting 'Strolling' wind conditions;
 - Entrances – targeting 'Standing' wind conditions;
 - Secondary Entrances - targeting 'Strolling' wind conditions or calmer;

- Seating areas – targeting ‘Sitting’ wind conditions during the summer season; and
 - Amenity spaces – targeting ‘Sitting’ wind conditions during the summer season (with ‘Standing’ wind conditions acceptable at mixed-use amenity areas and large amenity spaces).
- 16.3.38 In addition, the wind conditions on the surrounding area will also be considered within the area that would potentially be influenced by the Proposed Development. For sensitive receptors surrounding the Site, consideration was given to the uses listed above where appropriate, as well as:
- Railway platforms – targeting ‘Standing’ wind conditions;
 - Pedestrian crossings and Roadways – targeting ‘Walking’ wind conditions; and
 - Amenity spaces – targeting ‘Sitting’ wind conditions (during summer).
- 16.3.39 The off-site locations will include a comparison with the Baseline Scenario. The significance of the effect will be defined based on whether there is a material change in the wind conditions. An example of a material change would be a location which was suitable and safe in the baseline becoming unsuitable or unsafe, or an already unsuitable/unsafe location being made worse by the Proposed Development.

Magnitude of Impact

- 16.3.40 The assessment criteria for the modelled wind microclimate, as shown in Table 16.3-2 below, comprise an increasing scale to reflect increasing wind speeds.
- 16.3.41 The low, moderate and major impact magnitude categories indicate the severity of the difference between the desired microclimate and the expected wind conditions in the presence of the Proposed Development.

Assessing Significance

- 16.3.42 The significance criteria used in the assessment of potential and residual effects at the numbered receptors are based upon the comparison of the predicated wind conditions at particular locations with the desired pedestrian use of an area as defined by the Lawson Criteria and, the predicted wind conditions at that area. This comparison takes into account any change in pedestrian activity that might arise as a result of the Proposed Development. Where the intended use for each of the modelled probe locations is not yet specified (as the Proposed Development is in Outline Stage), the potential use of the locations were considered. Further wind microclimate testing will be undertaken at the Reserved Matters stage to accurately identify locations for their intended uses.
- 16.3.43 A seven-point scale has been utilised within this assessment, as shown in Table 16.3-2. The reason for this approach is provided in the following example: once the Proposed Development has been completed, if the wind conditions at a particular location are required to be suitable for standing, but the expected wind conditions are identified as being suitable for strolling, the difference between the desired and expected wind conditions is described as being one-category windier than desired. In this case, the effect would be identified as minor adverse, and of low significance.
- 16.3.44 In terms of the nature of the effect, effects can either be Beneficial (calmer conditions than required) or Adverse (windier conditions than required). An Adverse effect implies that a location has a wind environment that is unsuitable for its intended use and mitigation would therefore be required.

Table 16.3-2: Magnitude of Impact Descriptors

Significance Criteria	Descriptor
Major adverse effect	Wind conditions are three categories windier than desired
Moderate adverse effect	Wind conditions are two categories windier than desired
Minor adverse effect	Wind conditions are one category windier than desired
Negligible	Wind conditions are similar to those desired

Significance Criteria	Descriptor
Minor beneficial effect	Wind conditions are one category calmer than desired
Moderate beneficial effect	Wind conditions are two categories calmer than desired
Major beneficial effect	Wind conditions are three categories calmer than desired

- 16.3.45 Any adverse effect is a 'significant effect' because it implies that a location, or area, has a wind microclimate that is unsuitable for the desired use of that area. On this basis, effects that are adverse need mitigating. Beneficial effects that are minor, moderate or major in scale are not considered to be significant.
- 16.3.46 An entry is included to the 'Mitigation and Monitoring Measures' section of this chapter to describe the remedial measures expected to mitigate the effect in the event of adverse effects occurrence.
- 16.3.47 The residual effects reported for the demolition/construction phases of the Proposed Development are considered to be temporary, whereas effects outlined in the assessment for the completed and operational Proposed Development are permanent.

Consultation

- 16.3.48 A summary of the comments raised in the LBB Scoping Opinion on wind microclimate assessment is provided in Table 16.3-3 below.

Table 16.3-3 Comments raised in the LBB Scoping Opinion

Comments Raised	Response Provided in the ES/Planning Application
A qualitative assessment will be undertaken to assess the wind microclimate effects during construction of the Proposed Development. The operational assessment will include wind tunnel testing of the Proposed Development.	The wind tunnel assessment conducted is in line with the scoping opinion as described in section 16.3
The Scoping Report sets out the baseline conditions at the site with prevailing wind generally from the south west, stronger in winter months and a general benign wind environment as a result of generally low-rise development. The introduction of high-rise buildings as part of the development is likely to alter the prevailing conditions and the introduction of residential uses will increase the sensitivity of the site to wind conditions, as is recognised in the Scoping Report. On this basis the LPA would agree that wind microclimate should be SCOPED IN to the ES. The assessment methodology set out within the SR is considered to be appropriate.	Noted. Wind microclimate assessment incorporated within <i>Chapter 17: Wind Microclimate</i> and <i>Appendix 16.1: Wind Microclimate Technical Report</i> .

Limitations and Assumptions

- 16.3.49 The conditions for the Site during demolition and construction works have not been assessed by the wind tunnel tests. Instead, professional judgement has been used to qualitatively assess conditions during construction phase, and experience would suggest that the wind microclimate at ground level would change from the existing Site conditions to that of the fully developed Proposed Development as demolition and construction is completed.
- 16.3.50 This wind assessment was based on the maximum parameter models for the Proposed Development and therefore entrance locations and amenity spaces are not known at this stage of the design. Entrances and amenity spaces will be assessed at the future RMA stage of the Proposed Development.

16.4 Baseline Conditions

Configuration 1: Existing Site with Existing Surrounding Buildings

- 16.4.1 For the assessment of the Baseline Conditions, the wind tunnel model included the Existing Site with Surrounding Buildings and Landscaping.
- 16.4.2 Figure 16-1 and Figure 16-2 show the windiest season and summer season wind condition results for the Baseline Scenario at ground level respectively. Figure 16-3 presents the annual safety exceedances.

Pedestrian Comfort

- 16.4.3 During the windiest season, wind conditions on-site and off-site thoroughfares, pedestrian crossings and railway platforms of the existing Site range from suitable for sitting to standing use. Wind conditions at entrances are suitable for sitting use.
- 16.4.4 In the summer season, wind conditions are generally one category calmer. As such, the wind conditions on the existing Site and in the surrounding area range from sitting to standing use.

Strong Winds

- 16.4.5 There are no instances of strong winds exceeding the 15m/s safety threshold for more than 2.2 hours per year within the Baseline Scenario.

Figure 16-1 Baseline Conditions of Configuration 1 during the Windiest Season



Figure 16-2 Baseline Conditions of Configuration 1 during the Summer Season

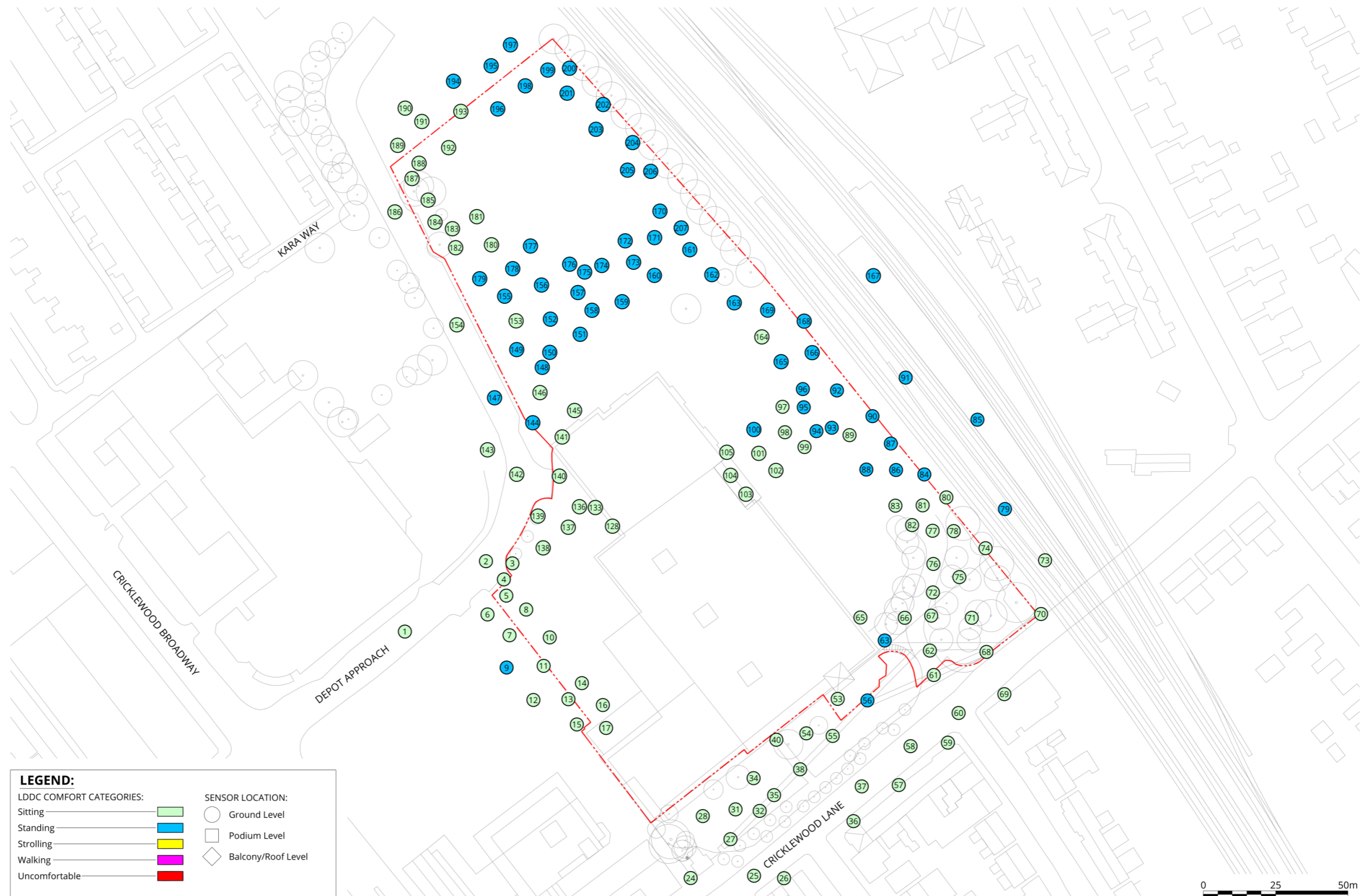


Figure 16-3 Baseline Conditions of Configuration 1 Annual Safety Exceedances.



16.5 Environmental Design and Management

- 16.5.1 Within this chapter, the maximum height and footprint parameters of the Proposed Development have been modelled and tested. The wind conditions discussed in this chapter will help to inform the future RMA stage of the Proposed Development. No design mitigation for wind microclimate has been incorporated within the outline scheme; the assessment presented within this chapter indicates what mitigation measures may need to be incorporated into the detailed design, including architectural and landscape details.
- 16.5.2 The wind microclimate effects of detailed design will need to be further assessed prior to completion, and if applicable, mitigation measures will need to be developed.
- 16.5.3 Wind mitigation measures are required to be in place before the development is complete and operational.
- 16.5.4 If the use of an area changes (after detailed design testing), the requirements to the wind climate can change. If a sensitive area, like entrances or amenity spaces, are moved, these areas need to be reassessed.

16.6 Assessment of Effects and Significance

Effects during Demolition and Construction

- 16.6.1 As the demolition and construction phase progresses, wind conditions at the Site would be expected to gradually adjust from those at the existing Site to those of the Proposed Development in the context of the existing surrounding buildings (Configuration 2). As such, it would be expected that conditions during the demolition and construction phase would be suitable for a working construction site or pedestrian thoroughfares around the Site (with the hoarding in place), however, at one of the off-site receptors – the railway platforms (without hoarding) would be gradually windier than suitable for the intended use and would therefore require wind mitigation measures. Refer to paragraph 16.7.2 for the mitigation measures that are expected to improve the wind environment during the construction phase.
- 16.6.2 The likely wind microclimate effect on-Site during this phase is expected to be **negligible**. Therefore, no design and/or management measures are considered necessary during the demolition/construction phase of the Proposed Development. However, off-Site conditions would represent a **minor adverse** (significant) effect and would require mitigation to be implemented prior to the completion of the Proposed Development. In addition, before the Proposed Development is complete and operational, any mitigation measures required, highlighted in Configuration 2, would need to also be in place.
- 16.6.3 It is assumed that there will be restricted access (i.e. not accessible to the general public) across the Site during the demolition and construction works, and therefore windier on-Site conditions will be tolerable as the area is not for typical pedestrian use where the tolerable wind speed threshold would be lower.

Effects once Complete and Operational

Configuration 2: Proposed Development with Existing Surrounding Buildings and Existing Landscaping

- 16.6.4 The assessment presented below has been undertaken based on Configuration 2: Proposed Development with Existing Surrounding Buildings. Figure 16-4 and Figure 16-5 show the wind conditions for the windiest and summer seasons respectively, whilst Figure 16-6 shows conditions for the summer season at elevated levels. Figure 16-7 and Figure 16-8 present locations with strong winds exceedances for this configuration.

Figure 16-4 Complete and Operational Ground Floor Conditions of Configuration 2 during the Windiest Season



Figure 16-5 Complete and Operational Ground Floor Conditions of Configuration 2 during the Summer Season



Figure 16-6 Complete and Operational Rooftop Conditions of Configuration 2 during the Summer Season



Figure 16-7 Complete and Operational Ground Floor Conditions of Configuration 2 Annual Safety Exceedances

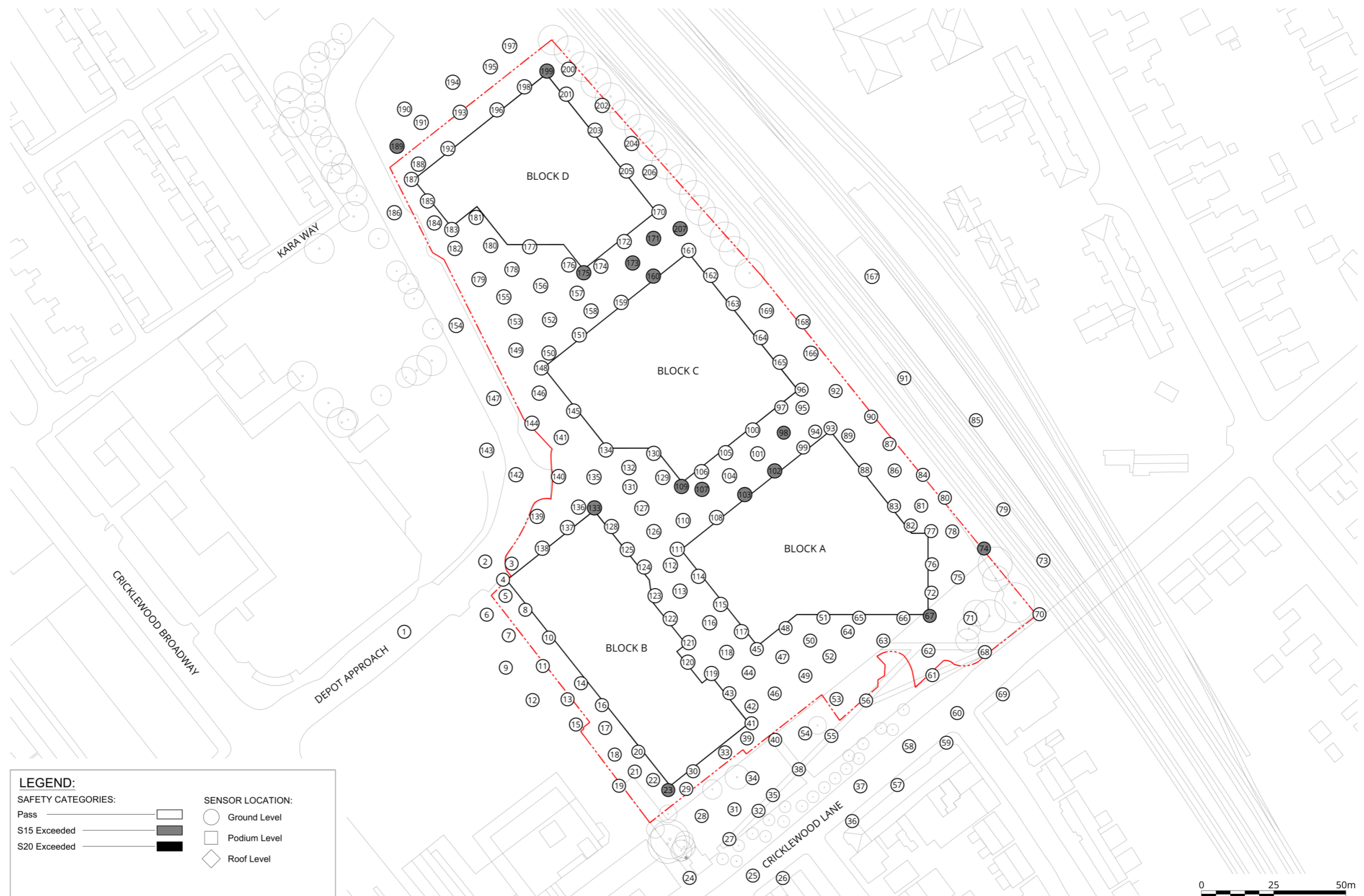
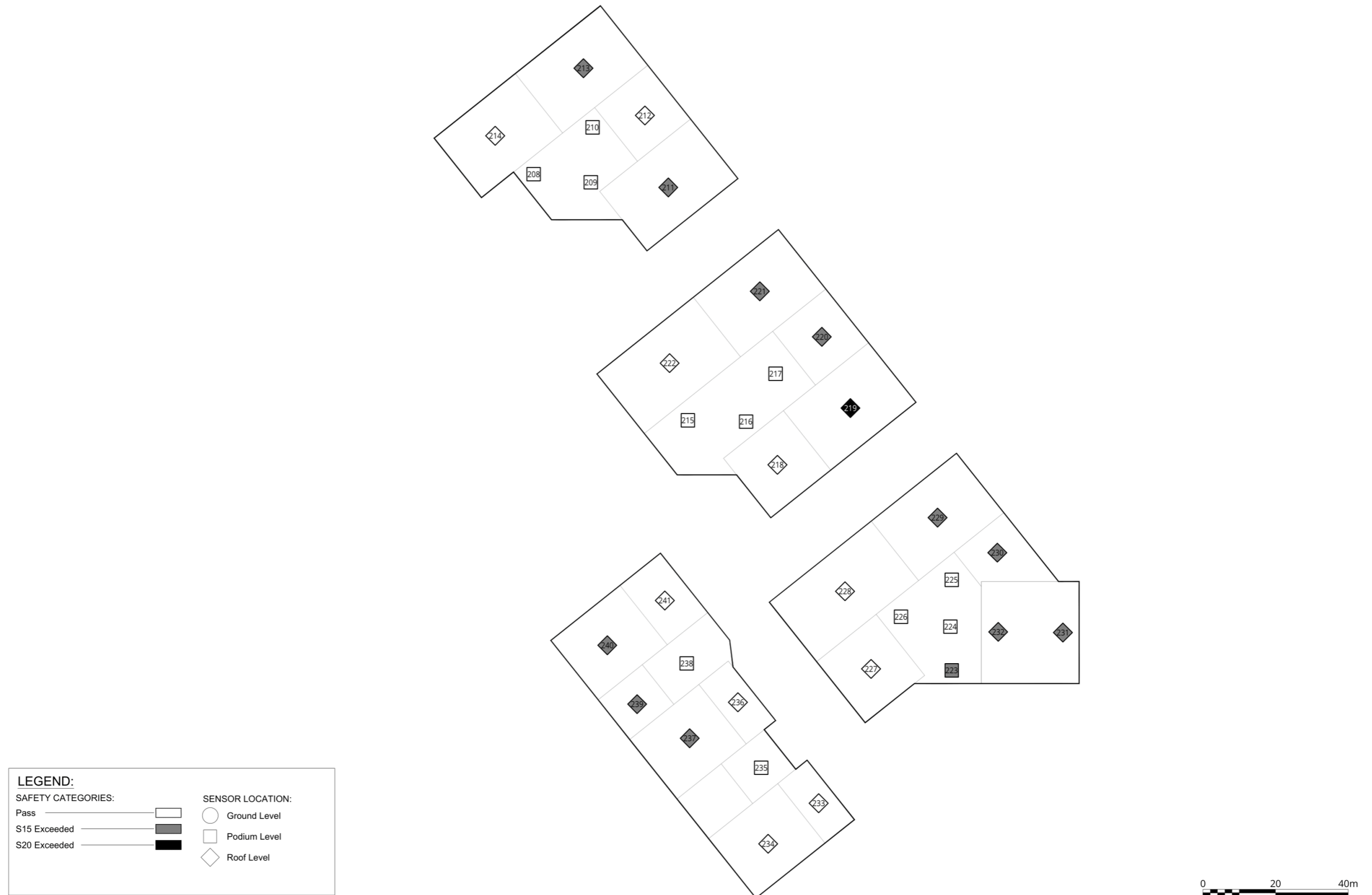


Figure 16-8 Complete and Operational Rooftop Conditions of Configuration 2 Annual Safety Exceedances



Pedestrian Comfort

- 16.6.5 Wind conditions in and around the Proposed Development in the context of the existing surroundings would range from suitable for sitting use to being uncomfortable for all uses during the windiest season.
- 16.6.6 During the summer season, wind conditions are consistent or one category calmer than those during the windiest season and would range from suitable for sitting to walking use.

Thoroughfares

On-Site

- 16.6.7 Wind conditions on thoroughfares within the Proposed Development would range from suitable for sitting to being uncomfortable for all uses during the windiest season.
- 16.6.8 Probe locations 65, 66, 72, 82, 83, 114, 115, 117, 120, 123, 128, 130, 138, 145, 181 and 185 would be suitable for sitting use and thus corresponds to a **moderate beneficial** effect.
- 16.6.9 Probe locations 3, 5, 8, 10, 14, 16-18, 20, 22, 29, 30, 33, 39, 41-53, 56, 63, 64, 76, 81, 84, 86-90, 97, 106, 108, 110, 113, 116, 118, 119, 121, 122, 124-126, 129, 132, 134, 136, 137, 139, 140, 141, 144, 146, 148-153, 155, 156, 162-166, 168, 169, 176-180, 182-184, 187, 188, 192, 193, 196, 198 and 201-206 would be suitable for standing use and would represent a **minor beneficial** effect.
- 16.6.10 Probe locations 4, 11, 13, 21, 23, 61, 62, 68, 70, 71, 75, 77, 78, 80, 92, 94-96, 99, 100, 101, 104, 105, 111, 112, 127, 131, 133, 135, 157-159, 161, 170, 172, 174 and 200 would be suitable for strolling use. This would represent a **negligible** effect.
- 16.6.11 Probe locations 67, 74, 93, 98, 102, 103, 107, 109, 160, 171, 199 and 207 would be suitable for walking use (one category windier than suitable for the intended use) and would thus correspond to a **minor adverse** (significant) effect, and would require mitigation, as discussed in Section 16.7.3.
- 16.6.12 Probe locations 173 and 175 would be uncomfortable (two categories windier than suitable for the intended use) and would represent a **moderate adverse** (significant) effect, and would require mitigation, as discussed in Section 16.7.3.

Off-Site

- 16.6.13 Wind conditions at off-Site thoroughfares (represented by probe locations 6, 7, 9, 12, 15, 19, 24, 27, 28, 31, 32, 34, 35, 38, 40, 54, 55 and 143) would be suitable for the intended strolling use or calmer during the windiest season. Wind conditions at these locations would represent a **negligible** effect.

Railway Platform

Off-Site

- 16.6.14 Wind conditions at railway platforms would range from suitable for standing to strolling use during the windiest season.
- 16.6.15 Probe locations 85 and 167 would be suitable for standing use and would represent a **negligible** (not significant) effect.
- 16.6.16 Probe locations 73, 79 and 91 would be suitable for strolling use and would thus be one category windier than suitable for the intended use. This would represent a **minor adverse** (significant) effect, and would require mitigation, as discussed in Section 16.7.3.

Pedestrian Crossings, Roadways and Car Parking

Off-Site

- 16.6.17 Wind conditions at pedestrian crossings and roadways would range from suitable for standing to strolling use during the windiest season.
- 16.6.18 Crossings (represented by probe locations 25, 58, 60) would be suitable for standing and would represent a **negligible** effect.
- 16.6.19 Roadways (represented by probe locations 1, 2, 37, 142, 147, 154 and 186) would be suitable for standing to strolling use and would thus correspond to a **negligible** effect.

- 16.6.20 Car parking (represented by probe locations 189, 190, 191, 194, 195 and 197) would be suitable for strolling to walking use during the windiest season and would thus correspond to a **negligible** effect.

Entrances

On-Site

- 16.6.21 Due to the outline nature of the Proposed Development, entrance locations are undetermined at this stage, however, it is highly recommended that entrances to be located in areas which would have wind conditions suitable for standing use or calmer otherwise mitigation measures would be required to provide localised shelter.

Off-Site

- 16.6.22 Wind conditions at entrances represented by probe locations 26, 36, 57, 59 and 69 would be suitable for standing use during the windiest season. This would represent a **negligible** effect.

Ground Level Amenity – Seating and Mixed Use

On-Site

- 16.6.23 Due to the outline nature of the Proposed Development, ground level amenity spaces are undetermined at this stage, however, it is highly recommended that large amenity spaces to be located in areas which would have wind conditions suitable for standing use or calmer otherwise mitigation measures would be required. It should be noted that any designated seating should only be located in areas which would be suitable for sitting use during the summer season. If seating is intended at any areas which would be suitable for standing use it would require mitigation.

Roof Amenity – Mixed Use

On-Site

- 16.6.24 Wind conditions at roof terrace amenity spaces would range from suitable for sitting use to walking use during the summer season.
- 16.6.25 Probe locations 233 and 236 would be suitable for sitting use and would represent a **negligible** effect.
- 16.6.26 Probe locations 212, 214, 218, 222, 227, 228, 234 and 241 would be suitable for standing use. This would represent a **negligible** effect. It should be noted that any designated seating should only be located in areas which would be suitable for sitting use during the summer season. If seating is intended at any areas which would be suitable for standing use, this would represent a **minor adverse** effect and would require mitigation.
- 16.6.27 Probe locations 213, 220, 221, 231, 232, 237, 239 and 240 would be suitable for strolling use one category windier than suitable for a mixed-use amenity space and would thus correspond to a **minor adverse** effect, and would require mitigation, as discussed in Section 16.7.3.
- 16.6.28 Probe locations 211, 219, 229 and 230 would be suitable for walking use two categories windier than suitable representing a **moderate adverse** effect, and would require mitigation, as discussed in Section 16.7.3.

Podium Amenity – Mixed Use

On-Site

- 16.6.29 Wind conditions at podium levels would range from suitable for sitting to strolling use during the summer season.
- 16.6.30 Probe locations 208, 210, 217, 225, 226, 235 and 238 would be suitable for sitting use. This would represent a **negligible** effect. Probe locations 209, 215, 216 and 224 would be suitable for standing use and thus corresponds to a **negligible** effect.
- 16.6.31 Probe location 223 would be suitable for strolling use one category windier than suitable for podium amenity use and would thus represent a **minor adverse** effect, and would require mitigation, as discussed in Section 16.7.3.
- 16.6.32 Note that any designated seating should only be located in areas which would be suitable for sitting use during the summer season. Seating located in areas suitable for standing use would require localised shelter to represent a negligible effect.

Strong winds

Ground Level

- 16.6.33 Strong winds exceeding the 15m/s threshold for more than 2.2 hours per year would occur at probe locations 23, 67, 74, 98, 102, 103, 107, 109, 133, 160, 171, 173, 175, 199 and 207, exceeding the threshold for up to a maximum of 21.8 hours per year. Strong winds at these locations would be a potential safety concern for pedestrians at these locations and therefore mitigation measures would be required, as discussed in Section 16.7.3.
- 16.6.34 Off-site car park location 189 would have strong winds exceeding 15m/s for 8 hours per year and would therefore require mitigation, as discussed in Section 16.7.3.

Podium Level

- 16.6.35 Probe location 223 would have strong winds exceeding 15m/s for 3.8 hours per year and would therefore require mitigation, as discussed in section 16.7.3.

Rooftop

- 16.6.36 Roof terraces represented by probe locations 211, 213, 220, 221, 223, 229-232, 237, 239 and 240 would have strong winds exceeding the 15m/s for up to a maximum of 40 hours per year. Strong winds at these locations would be a potential safety concern and therefore mitigation measures would be required, as discussed in Section 16.7.3.
- 16.6.37 Strong winds exceeding the 20m/s threshold for more than 2.2 hours per year would occur at probe location 219 for 3.3 hours per year, which would be a safety concern for all pedestrians and therefore would require mitigation, as discussed in Section 16.7.3.

16.7 Additional Mitigation and Monitoring Measures

- 16.7.1 Mitigation measures are to be finalised at the future RMA stage, where the intended use of the areas would be confirmed and therefore clarify the required wind conditions. Furthermore, the detailed design will alter the aerodynamic effects and wind conditions presented in the outline assessment, meaning refinement of a mitigation scheme should be undertaken at that stage.

Mitigation during Demolition and Construction

- 16.7.2 During the demolition and construction phase, the areas under construction would be surrounded by solid hoarding until the point where the building becomes complete and operational. At off-site windy locations to the north and on the railway-platform, wind mitigation measures would be required to be in place prior to the completion and operation of the Proposed Development. The details of these mitigation measures are discussed in Paragraph 16.7.6.

Mitigation Once the Proposed Development is Operational

- 16.7.3 The following areas in Table 16.7-1 of the Proposed Development will require wind mitigation measures. All other locations in and around the Proposed Development would have wind conditions suitable for their intended uses with no safety exceedances.

Table 16.7-1: Summary of probe locations requiring wind mitigation

Areas	Probe Locations	
	Pedestrian Comfort	Strong Winds
Thoroughfares	On-Site: 67, 74, 93, 98, 102, 103, 107, 109, 160, 171, 173, 175, 199 and 207 Off-Site: 189	On-Site: 23, 67, 74, 98, 102, 103, 107, 109, 133, 160, 171, 173, 175, 199 and 207 Off-Site: 189
Entrances	None	None
Ground Level – Seating	None	None
Roof Amenity – Mixed Use	On-Site: 211, 213, 219-221, 229-232, 237, 239 and 240	On-Site: 211, 213, 219-221, 229-232, 237, 239 and 240
Podium Amenity – Mixed Use	On-Site: 223	On-Site: 223
Railway Platform	Off-Site: 73, 79 and 91	None

- 16.7.4 The wind microclimate was initially assessed with the existing landscaping only to provide a worst-case scenario. The proposed landscaping shown in *ES Volume III Appendix 16.1* and Figures 16.22 through to 16.24 is expected to improve wind conditions in the gap between Development Parcels A and C, Development Parcels C and D, podiums and roof terraces, however, the wind environment is likely to remain windier than suitable for the intended use.
- 16.7.5 Given the nature of the outline planning application, the mitigation below is provided to identify ways in which adverse effects can be mitigated at the future RMA stage. Due to the presence of strong winds, the RMA will need to be quantitatively assessed by an experienced wind engineer to confirm that these measures would be effective, based on the final massing.
- 16.7.6 Typical wind mitigation measures which are likely to improve wind conditions for the respective locations in the Proposed Development would consist of:

Ground Level:

- Probe locations 23, 133 and 199 – landscaping such as shrubs in planters at least 1.5m high and additional trees at least 5m high to the west and east of each probe position;
- Probe locations 73, 74, 79 and 91 – landscaping such as shrubs in planters at least 1.5m high and additional trees at least 7m - 9m high along the north-eastern boundary of the Site that matches the length of the railway platform;
- Probe location 67 – landscaping such as trees 3-5m tall to the east and south of the façade close to the south-eastern corner of Development Parcel A;
- Probe locations 93, 98, 102, 103, 107 and 109 – landscaping in the form of trees 5m tall distributed along the gap between Development Parcels A and C with shrubs 1.5m high underneath. Otherwise, elevated screens of 50% porosity at least 3m high and 2m wide placed perpendicular to Development Parcels A and C and distributed along the gap;
- Probe locations 160, 171, 173, 175 and 207 – landscaping in the form of trees 7-9m tall distributed along the gap between Development Parcels C and D with shrubs 1.5m high underneath. Otherwise, elevated screens of 50% porosity at least 5m high and 3m placed perpendiculars to Development Parcels C and D and distributed along the gap; and
- Probe locations 189 – landscaping such as shrubs in planters at least 1.8m high and additional trees at least 5m high along the northern boundary of the Site.

Podium Level and Rooftops:

- Probe locations 211, 213, 219-221, 223, 229-232, 237, 239 and 240 – solid balustrades at least 1.5m high along the perimeter of each roof terrace or podium would improve wind conditions and landscaping elements 1-2m high distributed throughout the roof terraces. Note that any designated seating should only be located in areas which would be suitable for sitting use during the summer season. Seating located in areas suitable for standing use would require localised shelter in the form of shrubs in planters totalling a height of 1.5m or screens of similar size placed at two locations of each seating area.

General:

- Ground Level Amenity – mixed-use amenity areas must be located in areas with wind conditions suitable for standing (or calmer) use during the summer season. If they are located in windier locations, mitigation will be required to ensure they are suitable for their intended use. Amenity areas where seating is proposed must be located in areas with conditions suitable for sitting use during the summer season. If located in areas with conditions suitable for standing use, additional localised shelter at least 1.5m in height would be required in the windward and leeward prevailing wind direction; and
- Entrances – these must not be located in areas with unsuitable wind conditions. Entrance to the Proposed Development must be located in areas with wind conditions suitable for standing (or calmer) use during the windiest season. If they are located in windier locations, mitigation will be required to ensure they are suitable for their intended use. Mitigation measures could include recessing the entrance or providing some shelter through landscaping or screens on either side of entrances;

16.7.7 The specific mitigation measures that will be implemented will be determined and tested at the reserved matters application stage. The measures above would be expected to reduce the occurrence of strong

winds and it is likely that comfort conditions would be improved as the safety exceedances are mitigated to a suitable wind environment.

16.8 Residual Effects and Conclusions

- 16.8.1 As discussed above (in the Mitigation Measures Section 16.7, mitigation measures are to be finalised in the future RMA stage. It is expected that wind conditions can be mitigated using a developed mitigation scheme consisting of hard and soft landscaping, as well as considered entrance and amenity locations.
- 16.8.2 With these wind mitigation measures in place, wind conditions would be expected to improve such that the locations exceeding the comfort and safety criteria would be safe and suitable for the intended pedestrian use. All locations on-site and off-site would therefore have **Negligible to Moderate Beneficial** residual effects.
- 16.8.3 This section should identify and address all residual effects, which cannot be eliminated through design changes or the application of standard mitigation measures in Table 16-2:

Table 16-2: Wind Microclimate Summary of Potential Effects

Description of Effect	Sensitivity of Receptor	Nature of effect/Geographic Scale	Magnitude of Impact	Initial Classification of Effect (with embedded mitigation)	Additional Mitigation	Residual Effect and Significance
Demolition and Construction Phase						
Thoroughfares	High	Temporary/Local	High	Minor Beneficial to Minor Adverse	Landscaping along the northern boundary of the Site	Minor Beneficial to Negligible
Railway Platform	High	Temporary/Local	High	Negligible to Minor Adverse	Landscaping in the form of trees along the eastern boundary of the Site	Negligible
Complete and Operational Phase						
Thoroughfares	High	Permanent/Local	High	Moderate Beneficial to Moderate Adverse	Landscaping in the form of soft or hard elements distributed around the Site	Moderate Beneficial to Negligible
Roof Terrace Amenity – Mixed Use	High	Permanent/Local	High	Negligible to Moderate Adverse	Solid balustrade 1.5m-2m high and landscaping elements distributed on roof terraces	Negligible
Podium Amenity – Mixed Use	High	Permanent/Local	High	Negligible to Minor Adverse	localised landscaping in the form of trees 3m tall or screens 2x2m positioned to the south	Negligible
Railway Platform	High	Permanent/Local	High	Negligible to Minor Adverse	Landscaping in the form of trees along the eastern boundary of the Site	Negligible

16.9 Statement of Effect Significance

- 16.9.1 Provided that the mitigation measures (described in paragraph 16.7.6) are tested and verified through further wind tunnel testing at the Reserve Matters stage; the residual effects at ground and elevated levels would be expected to have a **negligible** (not significant) effect.

16.10 Cumulative Effects Assessment

- 16.10.1 Cumulative development identified within the 360m radius of the Site (due to the 1:300 model scale and dimensions of the tunnel model board) assessed in the wind tunnel models are:
- Co-op Site 1-13 Cricklewood Lane (Ref. No. 18/6353/FUL); and
 - 194-196 Cricklewood Broadway London (Ref. No. 17/0233/FUL).
- 16.10.2 Any cumulative schemes outside this radius form part of the wider terrain which contributes to the background wind climate / “gustiness” (see Section 16.3.9).

Demolition and Construction

- 16.10.3 The cumulative schemes would not be likely to have a material impact on the wind microclimate at the Site. Therefore, wind conditions during the construction works at the Site and surrounding area would be expected to be similar to that discussed for the Proposed Development in the context of the existing surrounding buildings as the microclimate gradually adjusts to that of the Proposed Development in the context of the cumulative surrounding buildings.

Complete and Operational

Configuration 3: Proposed Development with Cumulative Surrounding Buildings and Existing Landscaping

- 16.10.4 The assessment presented below has been undertaken based on Configuration 3: Proposed Development with Cumulative Surrounding Buildings. Figure 16-9 and Figure 16-10 show wind conditions for the windiest and summer seasons respectively, and in Figure 16-11 for the summer season at elevated levels. Figure 16-12 and Figure 16-13 present locations with strong winds exceedances for this configuration.

Figure 16-9 Complete and Operational Conditions of Configuration 3 during the Windiest Season



Figure 16-10 Complete and Operational Conditions of Configuration 3 during the Summer Season



Figure 16-11 Complete and Operational Conditions of Configuration 3 Roof Floor during the Summer Season

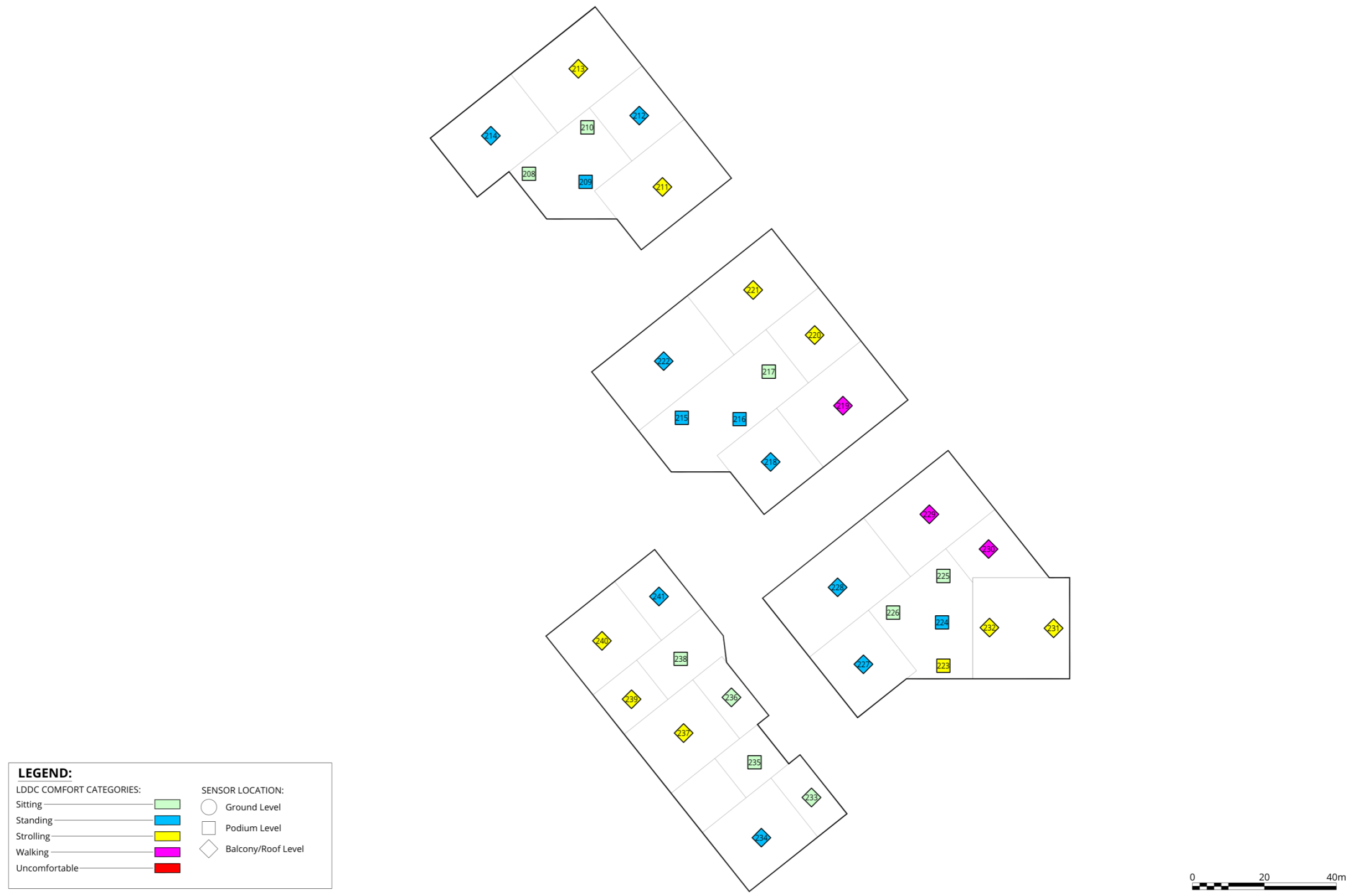


Figure 16-12 Complete and Operational Conditions of Configuration 3 Annual Safety Exceedances

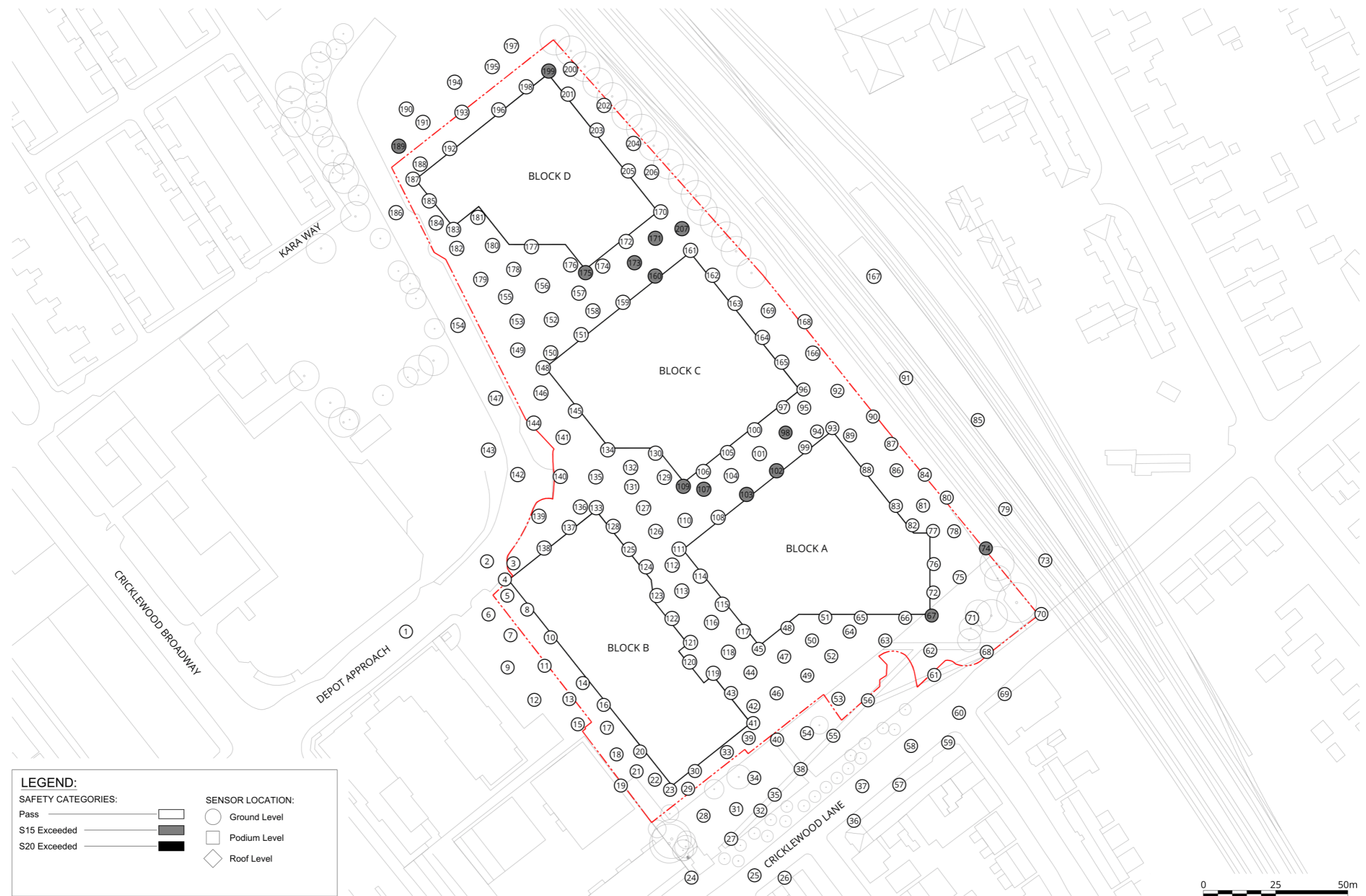


Figure 16-13 Complete and Operational Conditions of Configuration 3 Roof Floor Annual Safety Exceedances



Pedestrian Comfort

- 16.10.5 In the context of cumulative surrounding buildings, the wind environment would be similar to that in the context of the existing surrounding buildings, with strong winds persisting at ground and terrace levels.
- 16.10.6 The cumulative surrounding building to the west of the Proposed Development would provide localised shelter to Building B (probe locations 12, 15, 19, 21, 28, 30, 33 and 39), however the majority of the Site wind conditions would remain similar to those in Configuration 2 during the windiest season.
- 16.10.7 During the summer season, amenity spaces would have similar wind conditions to those with the existing surrounding buildings in place.

Strong winds

Ground Level

- 16.10.8 Strong winds exceeding the 15m/s threshold for more than 2.2 hours per year would occur at probe locations 67, 74, 98, 102, 103, 107, 109, 160, 171, 173, 175, 199 and 207, exceeding the threshold for up to a maximum of 19.7 hours per year. Strong winds at these locations would be a potential safety concern for pedestrians at these locations and therefore mitigation measures would be required, as discussed in Section 16.7.3.
- 16.10.9 Off-site car park location 189 would have strong winds exceeding 15m/s for 9.4 hours per year and would therefore require mitigation, as discussed in Section 16.7.3.

Podium Level

- 16.10.10 Probe location 223 would have strong winds exceeding 15m/s for 3.2 hours per year and would therefore require mitigation, as discussed in section 16.7.3.

Rooftop

- 16.10.11 Roof terraces represented by probe locations 211, 213, 220, 221, 223, 229-232, 237, 239 and 240 would have strong winds exceeding the 15m/s for up to a maximum of 40 hours per year. Strong winds at these locations would be a potential safety concern and therefore mitigation measures would be required, as discussed in Section 16.7.3.
- 16.10.12 Strong winds exceeding the 20m/s threshold for more than 2.2 hours per year would occur at probe location 219 for 3.4 hours per year, which would be a safety concern for all pedestrians and therefore would require mitigation, as discussed in Section 16.7.3.

Additional Mitigation and Monitoring Measures

- 16.10.13 The mitigation measures suggested in Section 16.7.6 would be expected to improve wind conditions and will be assessed and developed such that all locations would have wind conditions suitable for the intended use and represent a **negligible** effect.

Residual Effects

- 16.10.14 Provided that the mitigation measures (described in Section 16.7.6) are tested and verified through further wind tunnel testing at the Reserve Matters stage; the residual effects at ground and elevated levels would be expected to have a **negligible** effect.