

## **Chapter 11: Wind Microclimate**

WIND MICROCLIMATE	
AUTHOR	ARUP
SUPPORTING APPENDIX	<b>ES Addendum Volume 3, Appendix: Wind Microclimate</b> Annex 1: Wind Tunnel Testing Methodology Annex 2: Planning Policy and Legislation
KEY CONSIDERATIONS	<p>This ES chapter assesses the effects of the Amended Proposed Development on wind microclimate and considers if the resulting changes in wind speeds would be suitable, with regards to comfort and safety, for the intended usage of sensitive locations within and around the site.</p> <p>Key wind microclimate considerations associated with the Amended Proposed Development include whether any undesirable wind speeds would be created at ground level (specifically at building entrances, pedestrian thoroughfares and within amenity spaces with outdoor seating and play areas) within the site, around buildings surrounding the site and within nearby areas of offsite public open space once the Amended Proposed Development is fully completed.</p> <p>The wind microclimate across the site and surrounding area has been tested for the following configurations:</p> <ul style="list-style-type: none"><li>Configuration 1: Existing Baseline</li><li>Configuration 2: Proposed Development in Existing Surroundings (excluding proposed landscaping), including future schemes already under construction;</li><li>Configuration 3a: Proposed Development in Existing Surroundings (including proposed landscaping and initial wind mitigation), including future schemes already under construction;</li><li>Configuration 3b: Proposed Development with Landscaping and Updated Wind Mitigation (including future schemes already under construction) (assessed using professional judgment and partial sensitivity runs in the wind tunnel);</li><li>Configuration 4a: Amended Proposed Development in Existing Surroundings (including proposed landscaping), including future schemes already under construction;</li><li>Configuration 4b: Amended Proposed Development in Existing Surroundings (including proposed landscaping), including future schemes already under construction, and tower balcony mitigation with 50% porous screens; and</li><li>Configuration 4c: Amended Proposed Development in Existing Surroundings (including proposed landscaping), including future schemes already under construction, and tower balcony mitigation with solid screens.</li></ul> <p>Configurations 2, 3a and 3b, which were presented within the December 2023 ES, have subsequently been superseded by Configuration 4a, 4b, and 4c, following the implementation of the Proposed Amendments and the findings of this assessment are discussed in this ES chapter.</p>
CONSULTATION	<p>A Request for an EIA Scoping Opinion (EIA Scoping Report) was prepared and submitted to the London Borough of Camden (LBC) on 4 August 2023. A copy of this EIA Scoping Report is provided in <b>ES Volume 3, Appendix: EIA Methodology – Annex 1</b> of the December 2023 ES and sets out the proposed scope and methodology for the wind microclimate assessment and this ES chapter. A Scoping Opinion was received on 4 October 2023 and is provided in <b>ES Volume 3, Appendix: EIA Methodology – Annex 2</b> of the December 2023 ES.</p> <p>The EIA Scoping Opinion confirms that the methodology outlined within the EIA Scoping Report is appropriate. The following point was raised as part of the EIA Scoping Opinion:</p> <p><i>‘The Applicant should also give consideration to any off-site balcony locations. The ES should make clear all possible receptor locations considered for the purpose of the wind microclimate assessment.’</i></p> <p>This is discussed in this assessment in the <i>section ‘Off-site Private Balconies’</i> (starting at 11.63) All other aspects of the scope were confirmed as acceptable.</p> <p>A pre-app meeting was held on 16 March 2023 with members of the Arup Wind team and LBC planning officers, where the design approach and wind guidance was discussed.</p> <p>An ES Review Report was prepared by CBRE (on behalf of LBC) following the submission of the December 2023 ES. The following points were raised as part of this review and are addressed as appropriate within this ES Addendum chapter:</p> <ul style="list-style-type: none"><li>Consideration of off-site balconies was raised again, and it was agreed that qualitative narrative (based on professional judgement and significant amounts of wind tunnel testing undertaken in the surrounding area) would be appropriate to provide a summary of the anticipated conditions on the identified off-site balconies; and</li><li>Final mitigation – as agreed with CBRE on 23 October 2024, all final proposed mitigation has been tested in the wind tunnel and the findings reported in this ES chapter.</li></ul>

COMPARISON AGAINST THE DECEMBER 2023 ASSESSMENT

- 11.1
- Since the submission of the December 2023 ES, massing changes have been made to the Proposed Development with the potential to impact the conclusions of the wind microclimate assessment. These design changes have been assessed using wind tunnel testing.
- 11.2
- A replacement ES chapter has been provided due to the large number of changes with reference to the updated configuration tested. Some effects have been altered as a result of the revised massing; however the overall number of likely significant effects is the same as those presented in the December 2023 ES. This replacement ES chapter of this 2024 ES Addendum supersedes the December 2023 ES chapter.

ASSESSMENT METHODOLOGY

Defining the Baseline

- 11.3
- An assessment of the existing baseline conditions has been carried out as part of the wind microclimate assessment using wind tunnel testing and professional judgement. The baseline for the wind assessment considers the wind mechanisms and conditions around the existing site in its current state. The site includes existing structures and landscaping within the site boundary as well as in the streets within the immediate surroundings within a 360m radius. The size of the study area is chosen to capture all areas that could potentially be impacted by the presence of the Proposed Development and is based on standard wind tunnel methodology and professional judgment. The impact of the wind conditions on the current users of the study area (pedestrians, cyclists and vehicle users) was carried out using both qualitative and quantitative methods.
- 11.4
- Mean and peak wind speeds have been measured for both the windiest season (normally winter in the UK) 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) for all locations. Measurements have been taken at locations across the existing site and at other surrounding buildings, paths, roads, bus stops and areas of open spaces for 16 wind directions in 22.5° increments within a 360m radius of the site, which is considered a large enough scale to ensure all wind effects are captured. Measurements are assessed at a full-scale height of 1.5m above the surface upon which the probe is located. Details of the tunnel test methodology are presented in **ES Addendum Volume 3, Appendix: Wind Microclimate – Annex 1** of the December 2023 ES.
- 11.5
- The results have been combined with long-term meteorological climate data for the London area (including Holborn (location of the London Weather Centre), Heathrow and London City Airports. The meteorological data shown in Figure 11.1 have been used in this assessment as this is deemed to be representative of the local wind climate for the London area.
- 11.6
- The baseline conditions are reflected within the wind scenario ‘Configuration 1: Existing Baseline’.
- 11.7
- 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 Amended Proposed Development. However, a comparison of the measured wind environment for the Amended Proposed Development with the existing conditions does not take into account any change in pedestrian activity that would accompany the Amended Proposed Development. Comparisons between the baseline scenario and ‘completed development’ scenarios have therefore only been made where pedestrian activity is the same in the baseline and with the Amended Proposed Development in place.

Evolution of the Baseline

- 11.8
- The evolution of the baseline condition assumes the cumulative schemes (see paragraph below for a description the cumulative scheme included in the wind assessment) are built in the surrounding environment

and that the surrounding environment, including the site, has naturally evolved in the absence of the Proposed Development being implemented.

- 11.9
- The only cumulative scheme identified within the wind microclimate study area is the Network Building (95-100 Tottenham Court Road), 76- 80 Whitfield Street and 88 Whitfield Street, London, W1T 4TP (2020/5624/P). This is currently under construction and has therefore been included in the existing surroundings. Therefore, the conditions in the future baseline is considered to be the same as those in the existing baseline.
- 11.10
- The wind conditions and impact of those conditions on the users within the site and immediate surroundings streets have been assessed in the wind tunnel (see ‘Impact Assessment Methodology’ and ‘Methodology for Defining Effects’ sections).

Impact Assessment Methodology

Deconstruction and Construction

- 11.11
- Assessment of the wind microclimate effects during deconstruction and construction have not been quantitatively assessed. Deconstruction and construction activities are a temporary condition and would be highly variable as the Amended Proposed Development is constructed. Wind conditions do not fully develop until external cladding is installed on the buildings. This means that conditions will continually change as massing is removed and added and effects will be temporary and variable. The wind conditions experienced around the baseline will gradually develop into those experienced around the completed Amended Proposed Development, as the facades are built up to their final form. Conditions during construction can therefore be assumed to be between the two ranges, with the worst case developing once the facades on the Amended Proposed Development are installed, and before landscaping is in place.
- 11.12
- It should be noted that the impact of large construction machinery such as cranes and piling rigs are not considered in the assessment. Such machinery is temporary and is considered too slim or open to significantly impact wind conditions.

Completed Development

Overview

- 11.13
- The methodology for determining the wind microclimate effects around the completed Amended Proposed Development in existing surroundings has been determined through initial qualitative CFD analysis and verified with physical wind tunnel testing.
- 11.14
- Early massing and mitigation options were iteratively tested using high-level Computational Fluid Dynamics (CFD) steady state Reynolds-Average Navier-Stokes (RANS) for select wind directions to visualise the flow patterns. The favourable options have ultimately been assessed using physical wind tunnel testing, providing a detailed, quantitative assessment presented here in this ES chapter.
- 11.15
- Several wind tunnel test workshops were carried out throughout RIBA<sup>1</sup> Stages 1 and 2 of the design process. All workshops were held at RWDI’s (an engineering and modelling consultancy company) boundary layer testing facility in Milton Keynes, UK. Workshops were attended by members of the design team including 3XN (architects), DSDHA (landscape architects), G&T (project managers) and Arup (wind specialists). Various massing options were tested including tower shapes and podium configurations. The later workshops focused more on local ground level features including landscaping elements.
- 11.16
- The final wind tunnel workshop was held on the 28 November 2024 and the findings set out in this ES chapter.

Wind Tunnel Testing

- 11.17
- Wind tunnel testing and the application of professional judgement have been used to assess the baseline wind conditions and the effect of the Amended Proposed Development on environmental wind conditions within and around the site.
- 11.18
- Wind tunnel testing is used to measure wind speed acceleration or reduction from all directions. This is combined with information on the London wind climate, including wind strength, duration and direction from local anemometers, to determine the wind conditions at locations around the site.
- 11.19
- The assessment of the wind conditions requires a standard against which the measurements can be compared. The assessment of the wind tunnel results presented in this ES chapter adopts the Lawson Comfort Criteria (‘the Lawson Criteria’) (the London Docklands Development Corporation (LDDC) version<sup>2</sup>). The Lawson criteria are useful to describe windiness in terms of acceptability for particular activities. In this assessment, the words ‘Sitting’, ‘Standing’, ‘Strolling’ and ‘Business Walking’, ‘general public’, ‘able-bodied’ and ‘restricted access’ are used to describe safety levels of windiness as described in the Lawson criteria as set out in Table 11.2
- 11.20
- This is subsequently compared with acceptability levels for everyday activities for pedestrians around buildings, as described in more detail in the ‘Methodology for Defining Effects’ section. The Lawson Criteria used in this assessment, as set out in Table 11.2, set out four pedestrian activities (comfort categories) that reflect the fact that less active pursuits require more benign wind conditions. The ‘Plot Colour’ as described in Table 11.2 corresponds to the presentation of wind tunnel test results.
- 11.21
- Further detail on the wind tunnel testing methodology can be found in **ES Addendum Volume 3, Appendix: Wind Microclimate – Annex 1** of the December 2023 ES.

Testing Configurations

- 11.22
- The assessment of the wind microclimate is based on the results from a series of tests of physical models within the wind tunnel to provide a detailed, quantitative assessment. Several configurations were tested and the surroundings modelled were all within a 360m radius from the centre of the site.
- 11.23
- Table 11.1 lists the configurations tested in the wind tunnel and when.

Table 11.1 Configurations Tested

Configuration Number / Name	Description	Date Tested
Configuration 1: Existing Baseline	Existing site with the existing surrounding (i.e. existing site and surroundings construction at the time of testing, with existing landscaping).	10 October 2019
Configuration 2: Proposed Development without Proposed Landscaping	Proposed Development without proposed landscaping in the existing surroundings, including consented schemes already under construction.	3 October 2023
Configuration 3a: Proposed Development with Proposed Landscaping and Initial Wind Mitigation	Proposed Development with proposed landscaping and initial wind mitigation in the existing surroundings, including consented schemes already under construction.	14 November 2023
Configuration 3b: Proposed Development with Proposed Landscaping and Updated Wind Mitigation	Proposed Development with proposed landscaping and updated wind mitigation in existing surroundings, including consented schemes already under construction.	Sensitivity tests carried out 14 November 2023
Configuration 4a: Amended Proposed Development in Existing Surroundings (including proposed landscaping), including future consented schemes already under construction	Amended Proposed Development with proposed landscaping and mitigation measures including consented schemes already under construction.	28 November 2024

<sup>1</sup> Royal Institute of British Architects

<sup>2</sup> T.V. Lawson, London Docklands Development Corporation, “The Evaluation of the Windiness of a Building Complex Before Construction”



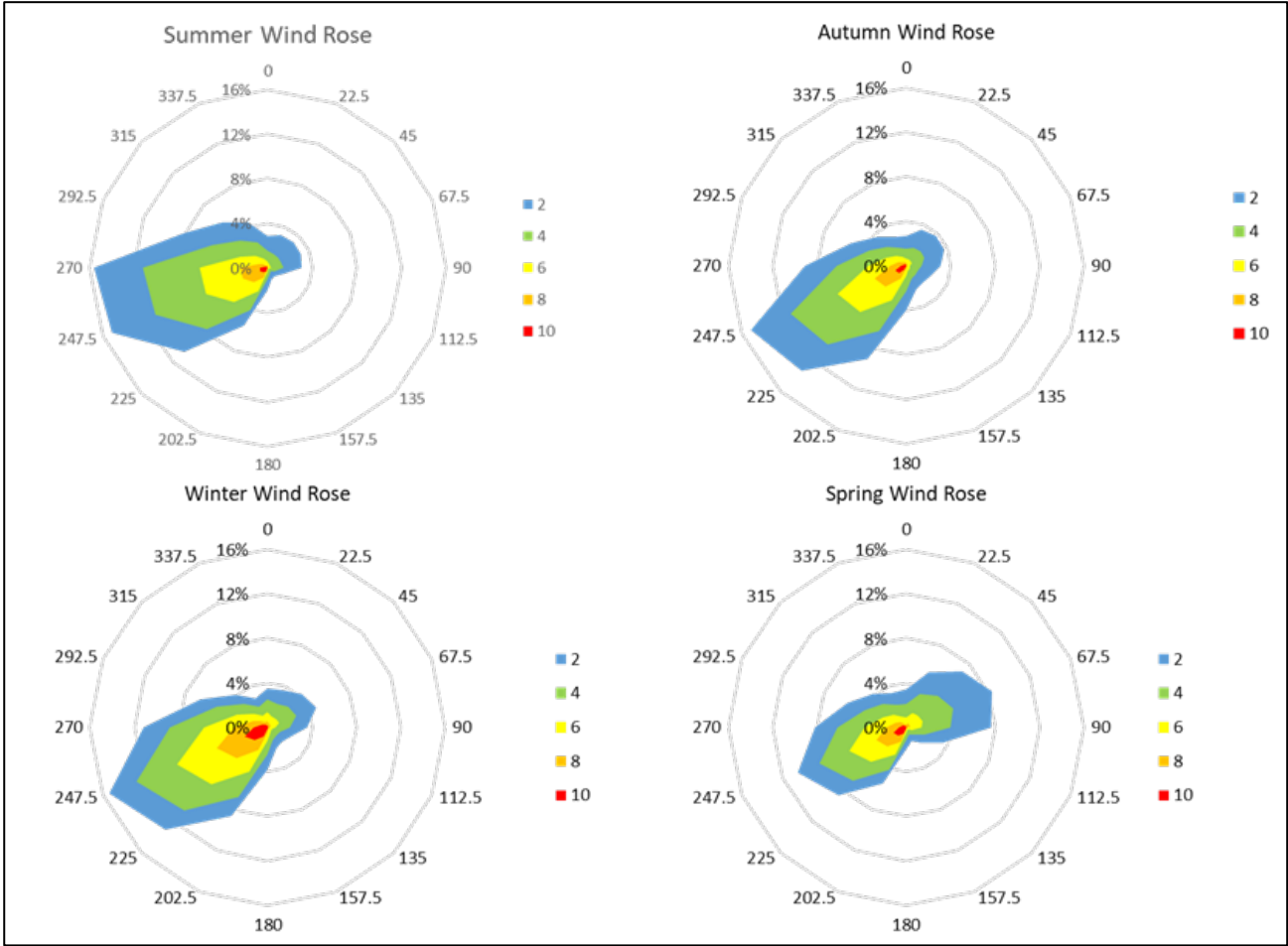
Configuration Number / Name	Description	Date Tested
<b>Configuration 4b:</b> Amended Proposed Development including Tower Balcony Mitigation with 50% Porous Screens.	Amended Proposed Development with proposed landscaping and mitigation measures including consented schemes already under construction. Additional 50% porous screens on all tower balconies.	30 October 2024
<b>Configuration 4c:</b> Amended Proposed Development including Tower Balcony Mitigation with Solid Screens.	Amended Proposed Development with proposed landscaping and mitigation measures including consented schemes already under construction. Additional solid screens on all tower balconies.	30 October 2024

- 11.24 The results for the Proposed Development (as submitted in the December 2023 Planning Application) (Configuration 2) concluded there were no significant effects in any locations on or off-site. A summary of the test and results is reported in paragraphs 11.99 to 11.119.
- 11.25 Following the December 2023 Planning Application, the Proposed Amendments were implemented and the resultant Amended Proposed Development was tested. Some of the low-level mitigation and embedded mitigation within the landscaping was re-adjusted to better incorporate with the updated scheme. Details of the test and results is reported within the ‘Potential Effects’ section of this ES chapter
- 11.26 The characteristics of the oncoming wind speed and turbulence are generated in the wind tunnel using distributed roughness elements and spires upwind of the wind tunnel model.
- 11.27 The arrangement of the roughness blocks and spires is chosen to reproduce the boundary layer profile predictions for the site obtained using the ESDU methodology<sup>3</sup>, which is a documented methodology and a computer program used to estimate the effects of terrain on wind speeds as they approach a site. This is used to ‘translate’ wind speeds measured at an airport or meteorological station to the target site. ESDU methodology is the basis of the wind modelling used in the UK National Annex to EN 1991-1-4 Wind Actions<sup>4</sup>, the UK wind loading code and is also widely used internationally.

Wind Climate

- 11.28 Wind conditions on the site have been assessed using the existing wind climate data in Figure 11.1. This shows statistical, mean hourly wind speeds and wind directions for London. The peer reviewed data was obtained from London Weather Centre, located in Holborn which analysed multiple sets of historical wind data from several London airports (including Heathrow and City Airport) and was peer reviewed for the Lawson LDDC criteria in 1990. This data creates a representative ‘London Climate’ model that is unbiased towards any particular airport. Arup have adjusted the representative climate model to the site using the ESDU methodology. These wind roses represent the wind behaviour (direction, frequency and speed) across all times of day for each season.

Figure 11.1 London Meteorological Data (London Weather Centre)



- 11.29 Overall, the wind climate in London is similar to the rest of the UK:
- The westerly winds are the most frequent and strongest winds in London at all times of the year. These winds are relatively warm and wet. Most cases of serious annoyance due to strong winds around buildings are caused by these winds;
  - North-easterly winds are almost as common as the southwest winds during spring but are weaker. They are often associated with cold dry conditions. North-east winds can be more unpleasant than suggested by their strength due to the lower-than-average air temperature;
  - Winds from the north-west can be as strong as the southwest winds but are less frequent. They are relatively cold; and
  - South-east winds are generally warm and light and are rarely associated with uncomfortable ground level winds.

Lawson Comfort and Distress Criteria

- 11.30 The criteria used to describe windiness in this assessment are the Lawson Criteria, developed for the LDDC as detailed above, which are used widely in the United Kingdom (UK) and around the world. These criteria are useful to describe windiness in terms of acceptability for particular activities. The Lawson Criteria are intended for areas used regularly and are generally not considered as applicable to areas of ‘good weather use’.

<sup>3</sup> ESDU, IHS Markit. Accessed October 2022, < [https://www.esdu.com/cgi-bin/ps.pl?sess=unlicensed\\_1200422114217xsj&t=doc&p=esdu\\_84011d-r1](https://www.esdu.com/cgi-bin/ps.pl?sess=unlicensed_1200422114217xsj&t=doc&p=esdu_84011d-r1)>

<sup>4</sup> Wind Actions to Bs En 1991-1-4. Available at: [chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.steelconstruction.info/images/archive/e/e7/20131220104934%21SCI\\_P394.pdf](chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.steelconstruction.info/images/archive/e/e7/20131220104934%21SCI_P394.pdf)



- 11.31 Acceptable comfort conditions for various activities in order of increasing windiness are described in Table 11.2.
- 11.32 The conditions described below are the limiting tolerable criteria for comfort. For ideal conditions, the windiness in an area with a known activity will be a category better (i.e. tolerable conditions at an entrance will be in the 'Standing' range but ideal conditions will be in the 'Sitting' range). For more sensitive activities, such as regular use for external sitting and eating, conditions should be well within the 'Sitting' category.

Table 11.2 Lawson LDDC Comfort Criteria

Criteria	5% Seasonal Exceedance Upper Threshold Speed	Description	Plot Colour
'Sitting'	4m/s	Reading a newspaper, eating and drinking (i.e. cafés)	Blue
'Standing' or short-term sitting	6m/s	Appropriate for building entrances, bus stops, window shopping and parks	Green
'Strolling'	8m/s	General areas of walking and sightseeing	Yellow
'Business Walking'	10m/s	Local areas around tall buildings where people are not expected to linger	Orange

- 11.33 In the assessment, the words 'Sitting', 'Standing', 'Strolling' and 'Business Walking' are used to describe comfort levels of windiness as described in Table 11.2.
- 11.34 There are also distress criterion. Exceedance of the distress criterion for 'General Public Access' as defined in Table 11.3 is equivalent to a mean speed of 15 m/s and a gust speed of 28 m/s (62 mph) to be exceeded less often than once a year. This is intended to identify wind conditions which less able individuals or cyclists may find physically difficult. Conditions in excess of this limit may be acceptable for optional routes and routes which less physically able individuals are unlikely to use.
- 11.35 There is a further exceedance of a limiting distress criterion within which even 'Able-bodied' individuals may find themselves in difficulties at times. This corresponds to a mean speed of 20 m/s and a gust speed of 37 m/s (83 mph) to be exceeded less often than once a year. Gust speed aerodynamic forces approach body weight and it rapidly becomes impossible for anyone to remain standing.

Table 11.3 Lawson LDDC Distress Criteria

Criteria	Annual Hourly-Average Exceedance Speed (once a year)	Description	Plot Key
'General public access'	up to 15m/s	Members of the general public and cyclists are expected to be able to access the area safely in normal windy weather	Grey No markings
'Able-bodied access'	Equal or Above 15m/s	Above this threshold, the less able and cyclists may at times find conditions physically difficult	A single red ring around the probe location
'Restricted access'	Equal and Above 20m/s	It may become impossible at times for an able-bodied person to remain standing	Two red rings around the probe location

- 11.36 In the following assessment the phrases 'general public', 'able-bodied' and 'restricted access' are used to describe distress levels of windiness as described in paragraph Table 11.3.

Assumptions and Limitations

- 11.37 It is assumed that there will be limited access (i.e. the site will not be accessible to the general public) to the site during the deconstruction and construction phase and as such a quantitative assessment has not been undertaken. As the area where works are underway would not typically be used by pedestrians, windier conditions would be tolerable when deconstruction and construction activities are underway.
- 11.38 Wind conditions in the wind tunnel can only be measured at finite locations, where the probes are installed. The conditions between probes are unknown, however, experience and expert judgement have been used to qualitatively assess areas where recordings have not been taken.

Methodology for Defining Effects

Receptors and Receptor Sensitivity

- 11.39 Receptors in the wind microclimate assessment are defined as regular users of the external spaces including pedestrians, cyclists and vehicular users. Probe layouts are shown in Figure 11.2 onwards.
- 11.40 The sensitivity of receptors is related to the intended 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 distress thresholds) at that particular location. All receptors are highly sensitive to the local wind microclimate conditions and are given an equal weighting.

Magnitude of Impact

- 11.41 The magnitude of the impact corresponds to the degree of distress and suitability of on-site locations as well as the difference between the assessed comfort category and the desired category for the intended use for off-site locations.

Defining the Effect

All Receptors

- 11.42 The criteria used in the assessment of existing, potential and residual effects both on and off-site is based upon the relationship between the desired pedestrian use of an area (based on the categories defined by the LDDC variant of the Lawson Criteria) and the predicted wind conditions at that area. This allows for the assessment to account for any change in pedestrian activity that might arise because of the Amended Proposed Development.
- 11.43 In terms of the nature of the effect, effects can either be beneficial (rectifying an existing adverse condition), adverse (windier conditions than required for the intended use), or neither (conditions are suitable for the use) and so are negligible. An adverse effect on-site implies that a location has a wind environment that is unsuitable for its intended use and mitigation would therefore be required. These are set out in Table 11.4 and are derived from professional judgement of the Lawson LDDC criteria within London.
- 11.44 The geographical extent of the wind microclimate is expected to be within the site and its immediate surroundings, i.e. a local impact, for all receptors. The wind tunnel model disc trace incorporates the site and all surroundings within a 360m radius of the site, as wind conditions beyond this radius are unlikely to be affected by the Amended Proposed Development.
- 11.45 Wind mitigation measures are required at on-site and off-site locations with Major Adverse effects. Moderate Adverse conditions both on-site and off-site should also be mitigated where this is practical considering other desirable features of the Amended Proposed Development.
- 11.46 Effects once the Amended Proposed Development is completed are direct, local and long-term (permanent) unless there is a future change in the surroundings or future modification to the Amended Proposed Development.

Table 11.4 Intended Pedestrian Use and Relationship to the Lawson Criteria

Intended Pedestrian Use	Areas Applicable	Description of Acceptable Conditions Defined by the Lawson Comfort and Safety Criteria	Description of Unacceptable Conditions Defined by the Lawson Comfort and Safety Criteria
Criterion for permanent outdoor café and long-term sitting spaces (i.e. all year)	Both on-site and off-site locations	'Standing' or better in winter or 'Sitting' in the summer	Exceedance of 'Standing' conditions in any season
Criterion for main entrances (i.e. The entrances expected to be used most often by all users, all year)	Both on-site and off-site locations	'Standing' or better in all seasons	Exceedance of 'Standing' at primary entrances in all seasons
Outdoor recreational spaces (i.e. parks, areas of 'good-weather' seating and bus stops)	Both on-site and off-site locations	A range of 'Sitting' and 'Standing' in the summer. Small areas of 'Strolling' may be tolerable within a larger space	Large areas of 'Strolling' in summer or exceedance of the safety criteria in any season.
Criterion for general public access and cycling	Both on-site and off-site locations	'General Public Access' in all seasons	Exceedance of 'General Public Access' distress criterion on main access routes with no reasonable alternatives.
Criterion for occasional or maintenance access	Both on-site and off-site locations	'Able-bodied Access' or better in all seasons	Exceedance of 'Able-bodied Access' criterion in any area likely to be used in windy weather.

- 11.47 The Lawson Criteria were not originally developed for applicability to areas of optional good weather use. They, and other similar criteria, were intended for areas of normal any-day use by the general public.
- 11.48 In particular, there is a developing consensus that desirable conditions for private residential balconies are similar to Lawson 'Standing' or better in summer. Therefore, all private balconies are assigned a preferred target threshold for the intended use of the area that best matches the Lawson summer conditions, i.e. Lawson 'Standing' or better in summer.
- 11.49 Experience and testing have shown that these conditions can often be met by either recessing, using solid balustrades or side/privacy-screens or creating winter gardens.
- 11.50 It should be noted that while 'Standing' conditions in summer are preferred, it is known that windiness of outdoor private terrace space may be partly mitigated by tenants, e.g. side screens or planting for local seating, or left open for more occasional use and to preserved views. Therefore, exceedance of 'Standing' in summer does not result in a significant adverse impact.

On-Site Effects

- 11.51 The scale of on-site measurement locations is defined by comparing the wind comfort/distress levels with the intended pedestrian activity at each location, shown in Table 11.5 below. These are derived from professional interpretation of the Lawson LDDC criteria within London.

Table 11.5 Scale of Effect – On-Site Measurement Locations

Scale of Effect	Trigger	Require Mitigation
Major Adverse	Conditions in public areas are beyond the 'Restricted Access' criteria	Yes
Moderate Adverse	Conditions are 'unsuitable' (in terms of comfort) for the intended pedestrian use	Desirable
Negligible	Conditions are 'acceptable' for the intended pedestrian use	No

Off-Site Effects

- 11.52 The scale of off-site measurement locations is defined not only by comparing the wind comfort levels with the intended pedestrian activity, but also by comparing the conditions to those experienced prior to the introduction of the Amended Proposed Development (Configuration 1: Existing Baseline), shown in Table 11.6 below.

Table 11.6 Scale of Effect – Off-Site Measurement Locations

Scale of Effect	Trigger	Require Mitigation
Major Adverse	Conditions in public areas that were 'safe' in the baseline scenario become 'unsafe' as a result of the Amended Proposed Development, even with wind mitigation. OR Conditions that were 'unsafe' in the baseline scenario are made worse as a result of the Amended Proposed Development.	Yes
Moderate Adverse	Conditions in public areas that were 'acceptable' in terms of comfort in the baseline scenario become marginally 'unacceptable' as a result of the Amended Proposed Development.	Desirable
Negligible	Conditions remain 'acceptable' for the intended use OR Conditions remain the same as in the baseline scenario.	No
Major Beneficial	Conditions in important areas that were 'unsafe' in the baseline scenario become 'safe' as a result of the Amended Proposed Development.	No
Moderate Beneficial	Conditions that were 'unacceptable' in terms of comfort in the baseline scenario become 'acceptable' as a result of the Amended Proposed Development. OR Conditions that were 'unsafe' in the baseline scenario are made better as a result of the Amended Proposed Development (but not so as to make them 'safe')	No

Categorising Likely Significant Effects

- 11.53 Any adverse effect either on-site or off-site is a 'significant effect' because it implies that a location, or area, has a wind microclimate that is undesirable for the use of that area. On this basis, effects that are adverse should be mitigated where possible.
- 11.54 Wind conditions which are negligible or beneficial of any scale would not represent a significant effect.

RECEPTORS AND RECEPTOR SENSITIVITY

- 11.55 This section describes where receptors have been identified both on- and off-site and how they are assessed using the above tables.
- 11.56 Receptors in the wind microclimate assessment are defined as regular users of the external spaces including pedestrians, cyclists and vehicular users. Main receptor locations comprise:
- On-site locations:
    - Pedestrian thoroughfares: includes areas that are immediately adjacent to the Amended Proposed Development (i.e. within 5m of the building line). This also includes thoroughfares within the Amended Proposed Development;
    - Entrances: includes entrances at ground level; and
    - Amenity areas: ground floor, podiums, and terraces.
  - Off-site locations:
    - All receptors falling outside the definition of the boundary of the Site, such as users of roads, bus stops, station platforms, surrounding building entrances and amenity areas.

Public Realm (Ground Level)

- 11.57 Each measurement location is assigned a maximum target threshold for the intended use of the area, based on the acceptable comfort or safety limits. The uses are coloured as described in Table 11.7. The intended uses are based on the architectural ground floor plans<sup>5</sup> in each scenario as well as the proposed landscaping design.
- 11.58 While the maximum target thresholds represent an upper limit of the tolerable comfort design range, it is desirable to achieve better results for the most comfortable experience, where possible.
- 11.59 The probe layout and the maximum tolerable wind conditions for each receptor are shown in Figure 11.2 to Figure 11.6 below.
- 11.60 Each figure includes the locations, ID's and chosen target conditions of ground level receptors for the respective configuration.
- 11.61 It should be noted that with the Proposed Development in place, many of the probe locations from the baseline were rearranged or renumbered and the total quantity increased in some areas. This was done to include more detail around areas of interest such as entrances or corners with main access routes.

Table 11.7 Target Criteria – Intended Uses of Public Areas

Lawson Comfort and Safety Criteria	Plot Colour to Identify Max Target Thresholds	Corresponding Intended Uses Associated with this Project	
		Summer	Worst-Case
'Sitting'	Blue	<ul style="list-style-type: none"><li>Outdoor café / permanent long-term sitting spaces</li></ul>	<ul style="list-style-type: none"><li>N/A</li></ul>
'Standing' or short-term sitting	Green	<ul style="list-style-type: none"><li>Main entrances</li><li>Public outdoor recreational spaces (including park and bus stops)</li></ul>	<ul style="list-style-type: none"><li>Main Entrances</li><li>Outdoor café / permanent long-term sitting spaces</li></ul>
'Strolling'	Yellow	<ul style="list-style-type: none"><li>N/A</li></ul>	<ul style="list-style-type: none"><li>Outdoor recreational spaces (including park and bus stops)</li></ul>
Within 'General Public Access' (i.e. no exceedances)	Grey	<ul style="list-style-type: none"><li>All other areas regularly used by the general public and cyclists for access</li></ul>	<ul style="list-style-type: none"><li>All other areas regularly used by the general public and cyclists for access</li></ul>

Existing Receptors

Table 11.8 Existing Receptors (Configuration 1: Existing Baseline)

Receptor Type (Season)	Receptor Reference
On-site	
Outdoor café / permanent long-term sitting spaces	60, 62, 63, 65
Main entrances	46, 70, 72, 74, 123
Public outdoor recreational spaces (including seating in parks)	59, 61, 64, 94, 99, 100, 101
All other areas regularly used by the general public and cyclists for access	44, 47, 49-53, 55-58, 67, 68, 71, 75, 77, 87, 90-93, 96, 102, 108-111, 121-127, 129, 135
Off-site	
Outdoor café / permanent long-term sitting spaces	107
Main entrances	20, 28, 43, 48, 98, 103, 105, 134

Receptor Type (Season)	Receptor Reference
Public outdoor recreational spaces (including bus stops)	25, 30
All other areas regularly used by the general public and cyclists for access	1-29, 31-42, 44, 45, 54, 76, 78-86, 88, 89, 95, 97, 104-106, 112-120, 128, 130-133, 136-141

Introduced Receptors

Table 11.9 Introduced Receptors Associated with the Proposed Development (Configuration 2)

Receptor Type (Season)	Receptor Reference
On-site	
Outdoor café / permanent long-term sitting spaces	None
Main entrances	51, 56, 58, 59, 66, 68, 189-191, 207, 209, 211, 212
Public outdoor recreational spaces (including possible seating around landscaping mounded over 1m)	53, 55, 57, 90-94, 96, 99, 124, 140, 141, 147, 152, 154-156, 158, 163, 168, 174, 175, 178-181, 186, 192, 195
All other areas regularly used by the general public and cyclists for access	46-47, 49-50, 52, 67, 70-72, 74, 77, 87, 100-102, 108-111, 121-122, 125-127, 129, 144, 148, 153, 157, 158, 164-165, 171-177, 182, 184-185, 187-188, 193-194, 197, 208, 210, 213
Upper-level Terraces	214-219, 221-225
Areas for Occasional or Maintenance Access	220
Off-site	
Outdoor café / permanent long-term sitting spaces	107
Main entrances *	20, 28, 43, 48, 98, 103, 105
Public outdoor recreational spaces (including bus stops)	25, 30, 183
All other areas regularly used by the general public and cyclists for access	1-19, 21-24, 26-27, 29, 31-42, 44-45, 54, 75-76, 78-86, 88, 89, 95, 97, 104, 106, 112-120, 128, 130-133, 137-139, 142-143, 146, 149-152, 159, 166-167, 169-170, 195-196, 198-201

<sup>5</sup> BLAC-FAP-ZZ-00-DR-AR-010004-PL



Figure 11.2 Configuration 1: Existing Baseline – Ground Level Probe Layout and the Maximum Tolerable Wind Conditions (Worst-Case, Winter)

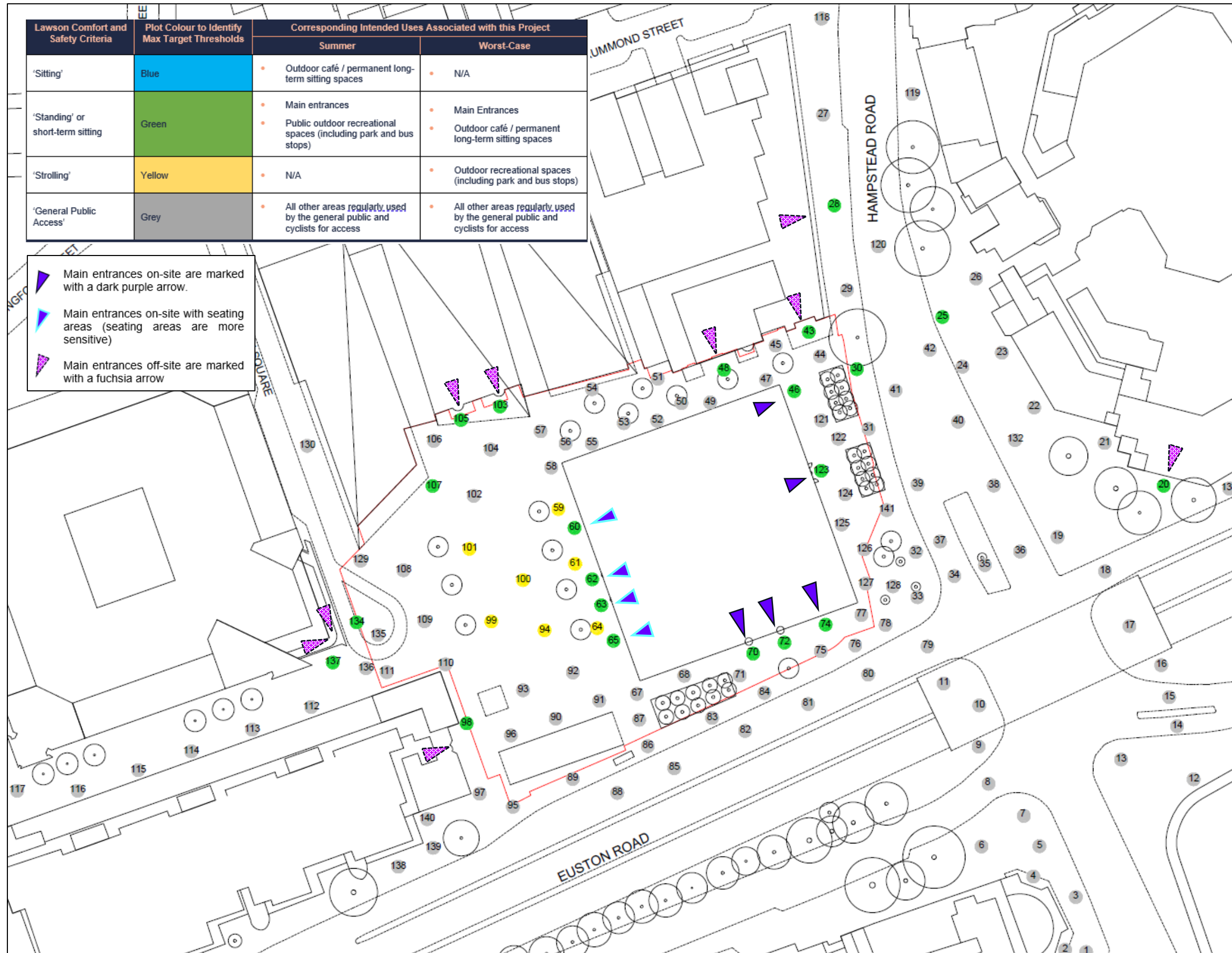


Figure 11.3 Configuration 1: Existing Baseline – Ground Level Probe Layout and the Maximum Tolerable Wind Conditions (Summer)

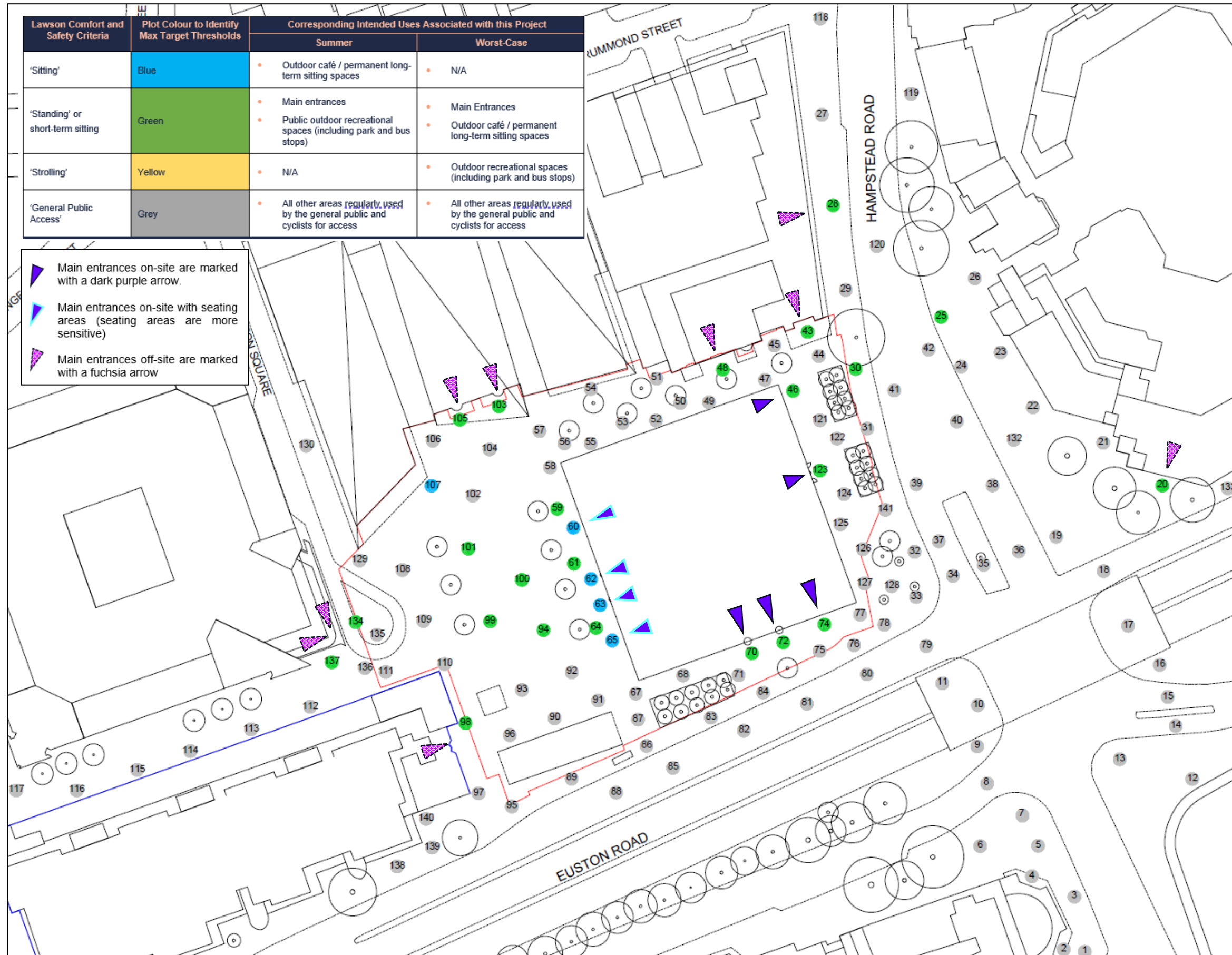




Figure 11.4 Ground Floor Plan of the Amended Proposed Development Showing the Locations of Entrances.

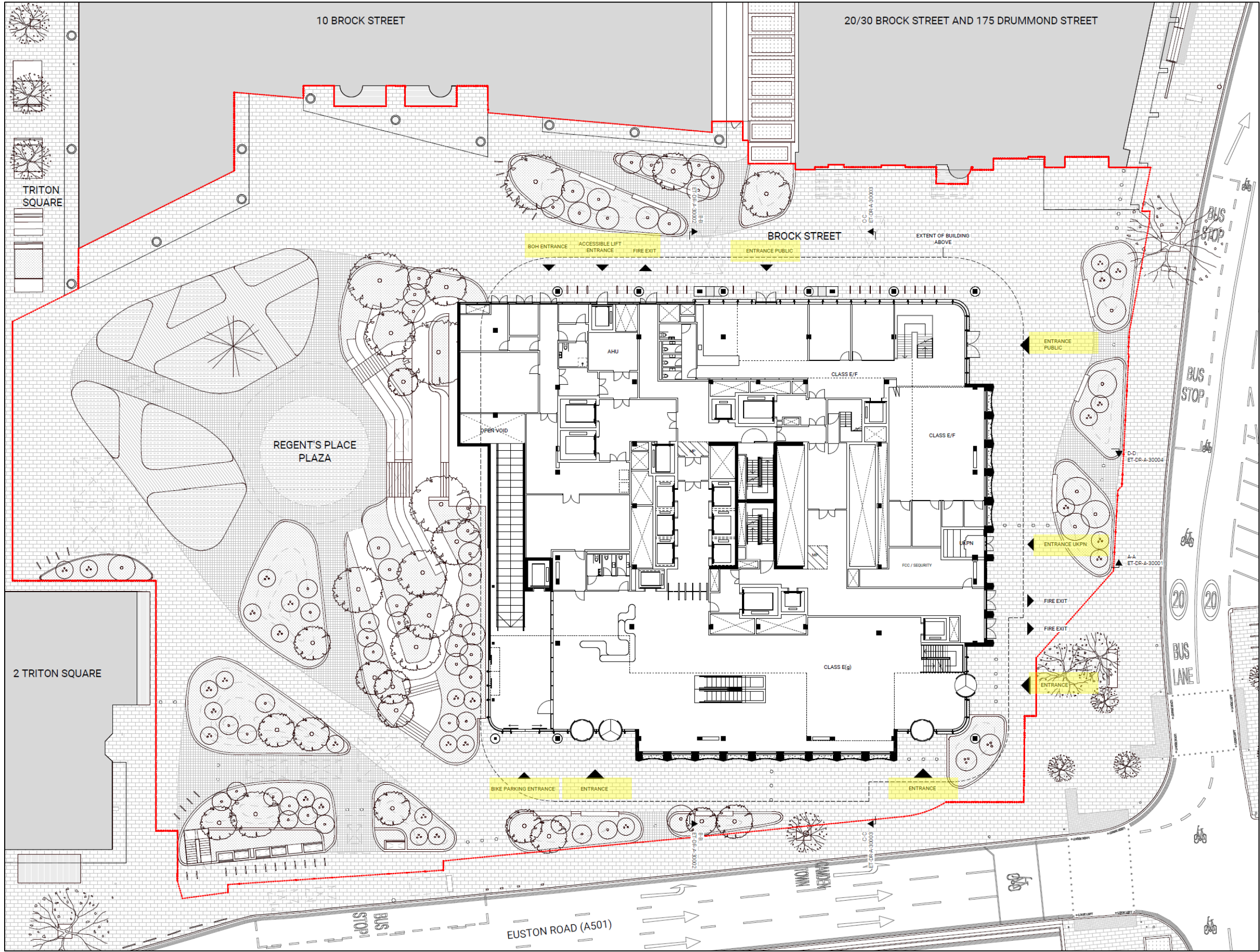




Figure 11.5 Configuration 4: Amended Proposed Development Ground Level Probe Layout and the Maximum Tolerable Wind Thresholds (Worst-Case, Winter)

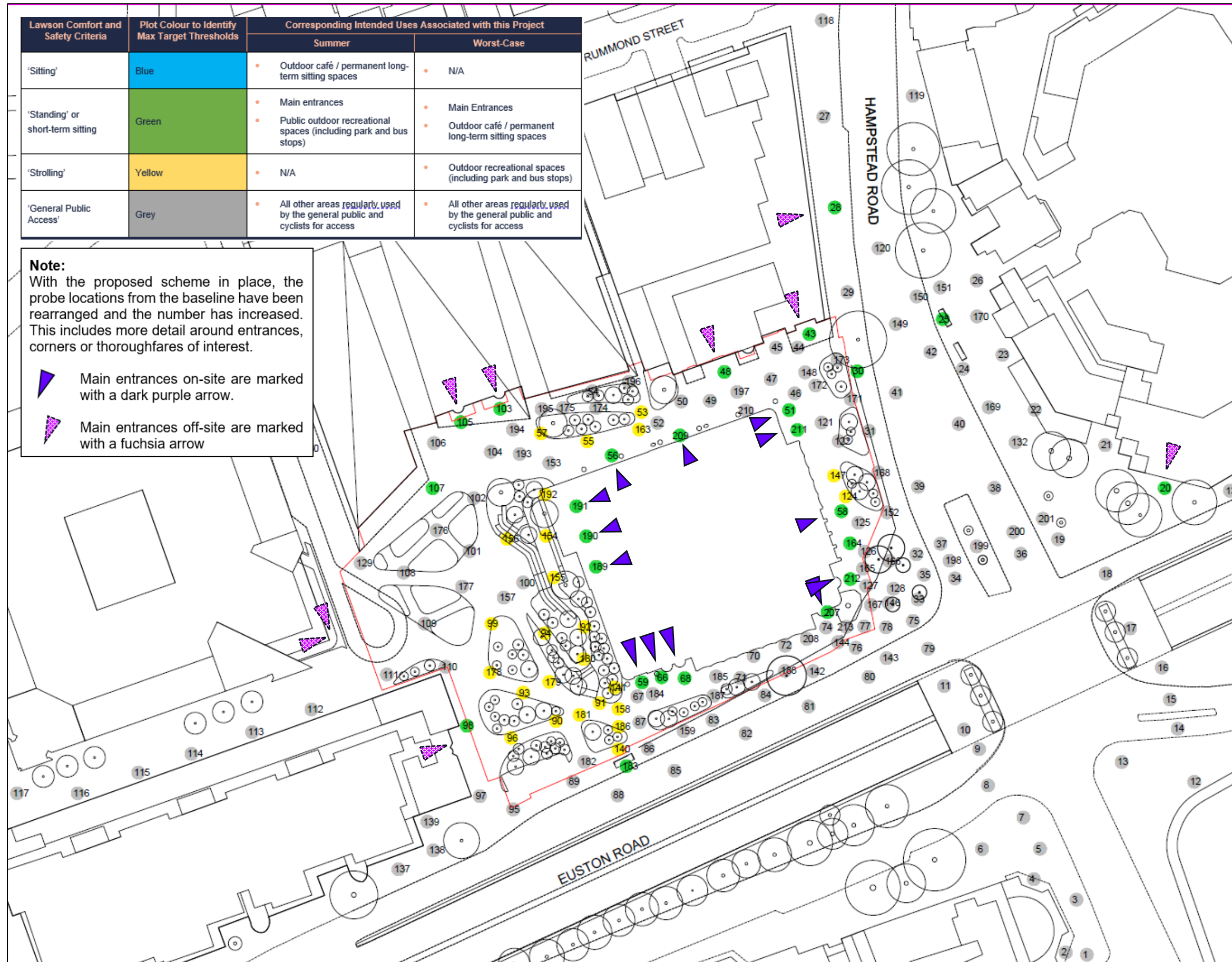
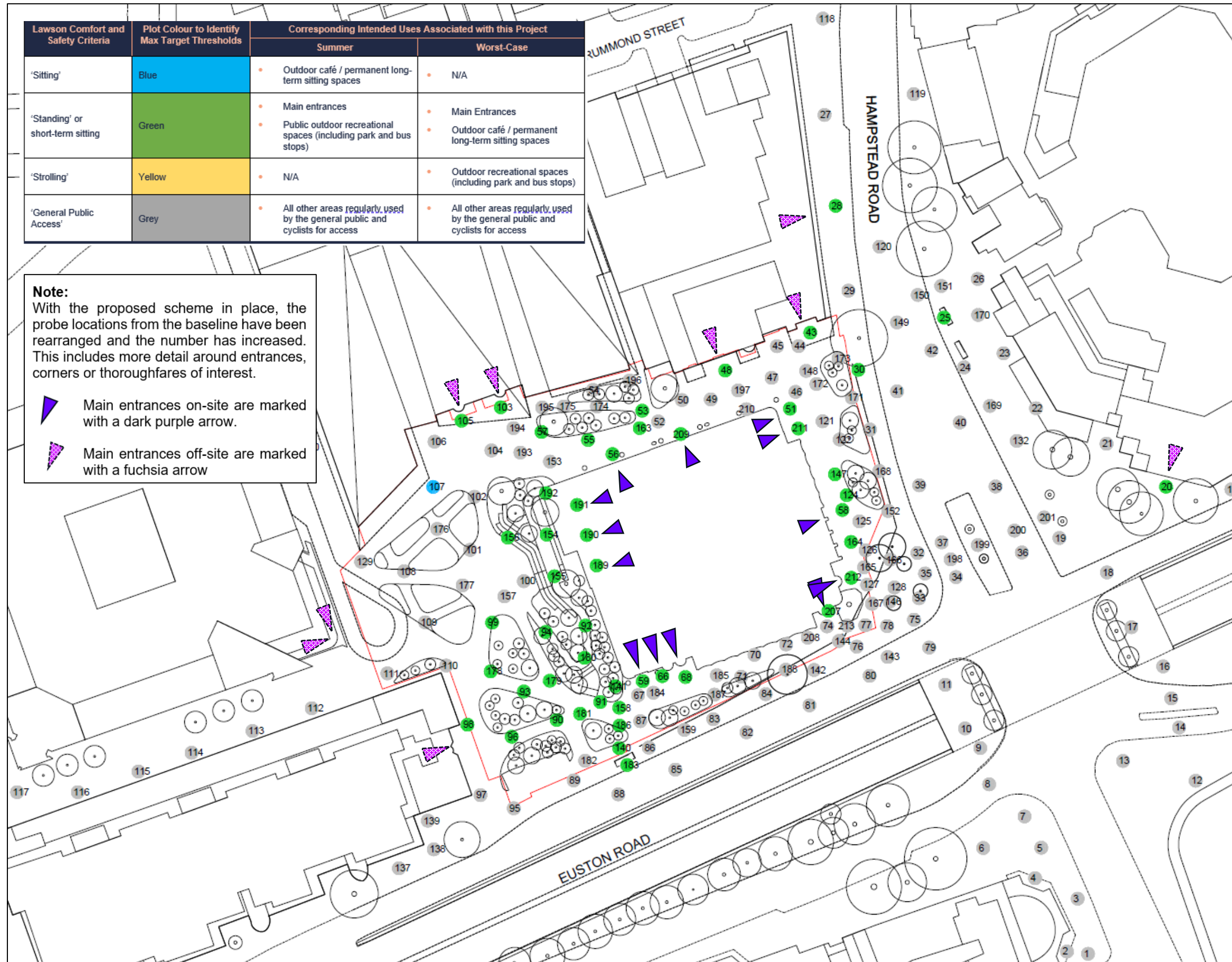


Figure 11.6 Configuration 4: Amended Proposed Development Ground Level Probe Layout and the Maximum Tolerable Wind Thresholds (Summer)

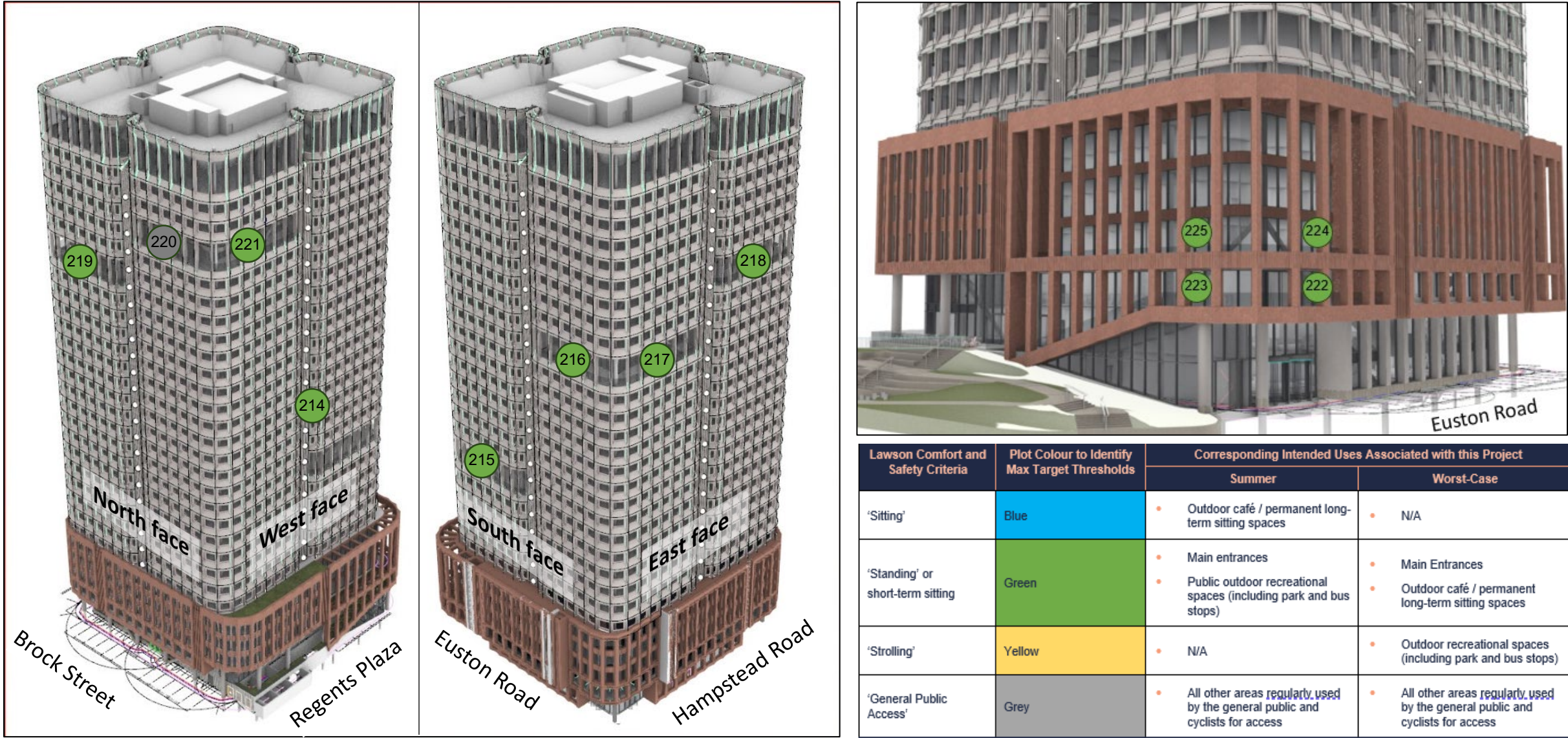




On-Site Balconies and Terraces

11.62 The probe layout and the maximum tolerable wind conditions for each receptor for on-site balconies and terraces are shown in Figure 11.7. The receptor locations measured in the wind tunnel were limited due to physical model restrictions and were chosen to best capture conditions at possible entrance locations, where users are more sensitive.

Figure 11.7 Configuration 4: Probe Locations and Maximum Tolerable Wind Thresholds (Summer only)





Off-Site Private Balconies

- 11.63 Several private balconies and terraces were identified on the surrounding buildings that could be impacted by changes to the local wind climate, as shown in Figure 11.8 to Figure 11.10. All other off-site private terraces or balconies are considered to be outside the zone of influence of the Amended Proposed Development.
- 11.64 All of the balconies and terraces identified included one or more significant sheltering features. For example, Figure 11.8 below shows a solid balustrade on the private balconies of one of the units at 175 Drummond Street, and Figure 11.9 shows tall porous screen elements between terraces on units along Hampstead Road, alongside solid balustrades.
- 11.65 Given how sheltered these locations are, there were physical limitations when trying to representatively model and instrument the spaces in the scaled 1:300 wind tunnel model. It was ultimately concluded that the spaces should be assessed qualitatively using professional judgment, as Arup has experience with wind conditions in the area, including the design of several local mitigation features.
- 11.66 The balconies identified all included high solid balustrades along the edges. Some, such as those in Tolmer's Square, were also recessed, leaving only one side of an enclosed space open for air to move in and out. Additional large porous fins are installed between balconies along Hampstead Road, providing more than enough shelter to users. Balustrades on 175 Drummond Street are above the height of the handrail, suggesting they are 'chest height' and would provide adequate shelter to users, especially when sitting.
- 11.67 Balconies with such high levels of mitigation / sheltering are expected to experience acceptably calm wind conditions such as 'Sitting' to 'Standing' in summer and are not expected to be adversely affected by any changes created by the presence of the Amended Proposed Development. No adverse effects are expected on the surrounding elevated levels.

Figure 11.8 175 Drummond Street – Solid Balustrade on Private Residential Units



Figure 11.9 Hampstead Road – Street View of the Solid Balustrades and Large Porous Fins Sheltering the Private Balconies

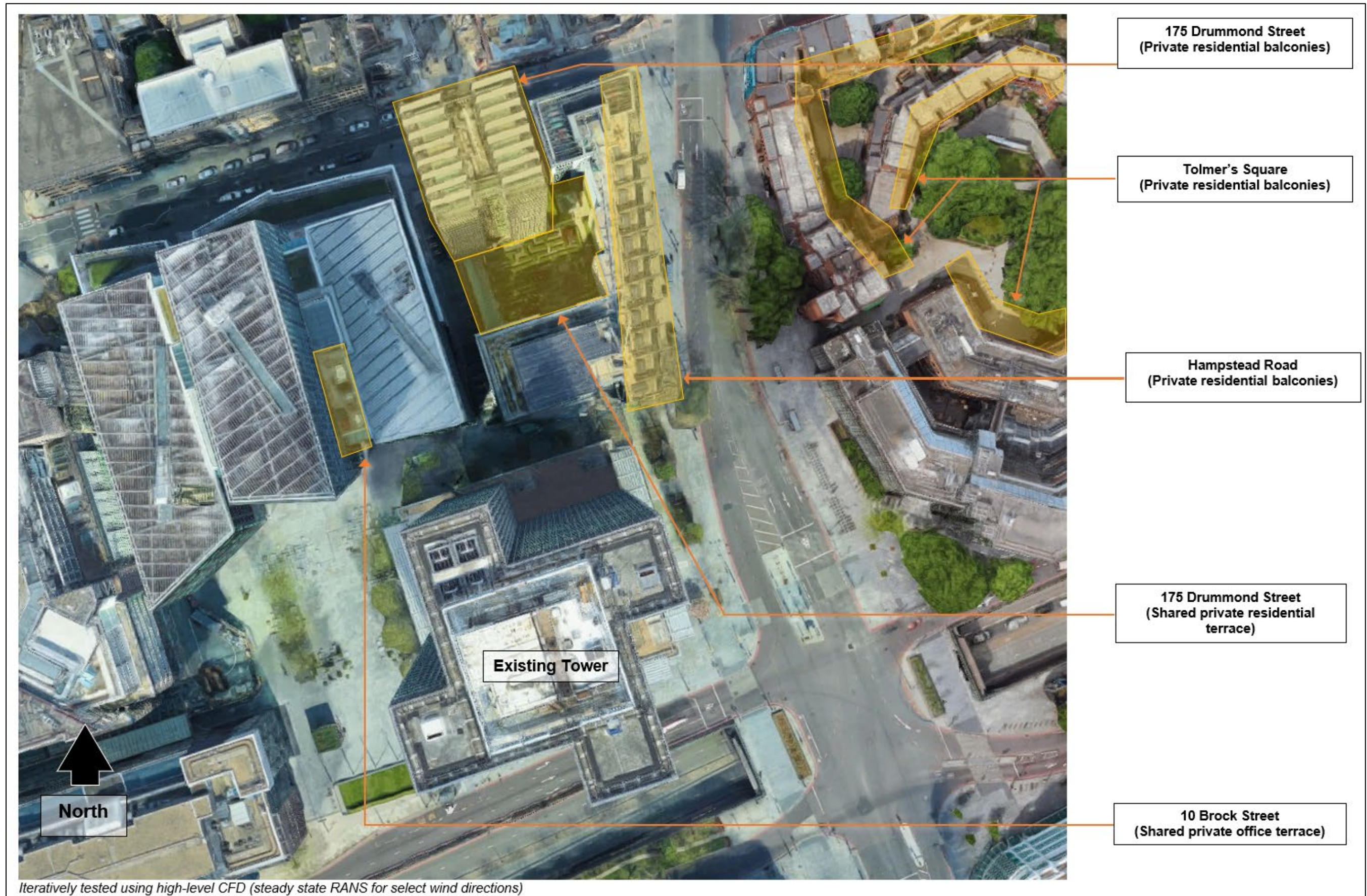


Figure 11.10 Tolmer's Square – Street View of Residential Recessed Balconies





Figure 11.11 Off-Site Private Balconies and Terraces





BASELINE CONDITIONS

Configuration 1: Existing Baseline

- 11.68 Photos of the scale model tested in the wind tunnel for Configuration 1: Existing Baseline is shown in Figure 11.13 and a plot of the wind conditions at ground level are shown in Figure 11.14 to Figure 11.17. A ground floor plan of the existing site, redline boundary and existing landscaping (including Transport for London (TfL) trees) is shown in Figure 11.12.
- 11.69 The site is bounded by Euston Road (south), Hampstead Road (east), Brock Street (north) and Regent's Place Plaza (west). The site covers an area of 0.8 hectares (ha), comprised of an existing single, ground plus 36-storey tower. The tower has been largely vacant for several years, predominantly comprising office uses on the upper floors, however there are still retail uses currently in operation at ground floor level.
- 11.70 The site is mainly served by Warren Street Underground Station (south), Euston Square Underground Station (east) and Great Portland Street Underground Station (west). There are also several bus routes that serve the site along Euston Road (south) and Hampstead Road (east).
- 11.71 The land surrounding the site consists of a range of uses. The neighbouring Regent's Campus comprises commercial, office and cultural land uses, as well as pedestrianised streets and public realm incorporated into the space. The closest residential properties are located along Drummond Street (north) and Hampstead Road (east).

Figure 11.12 Existing Site and Existing Landscaping



Figure 11.13 Configuration 1: Existing Baseline Model

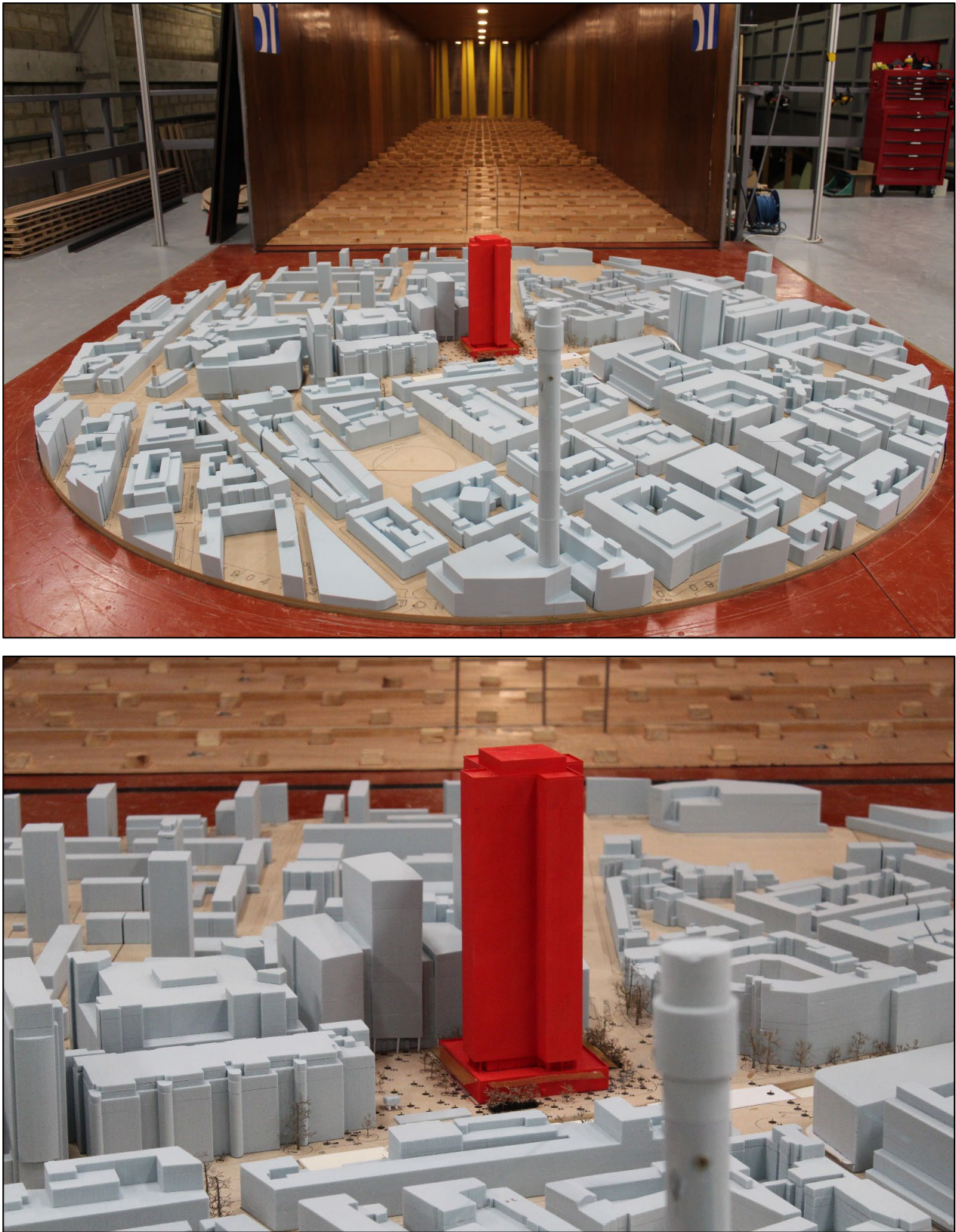




Figure 11.14 Configuration 1: Existing Baseline (Maximum Target Thresholds, Worst-Case (Winter))

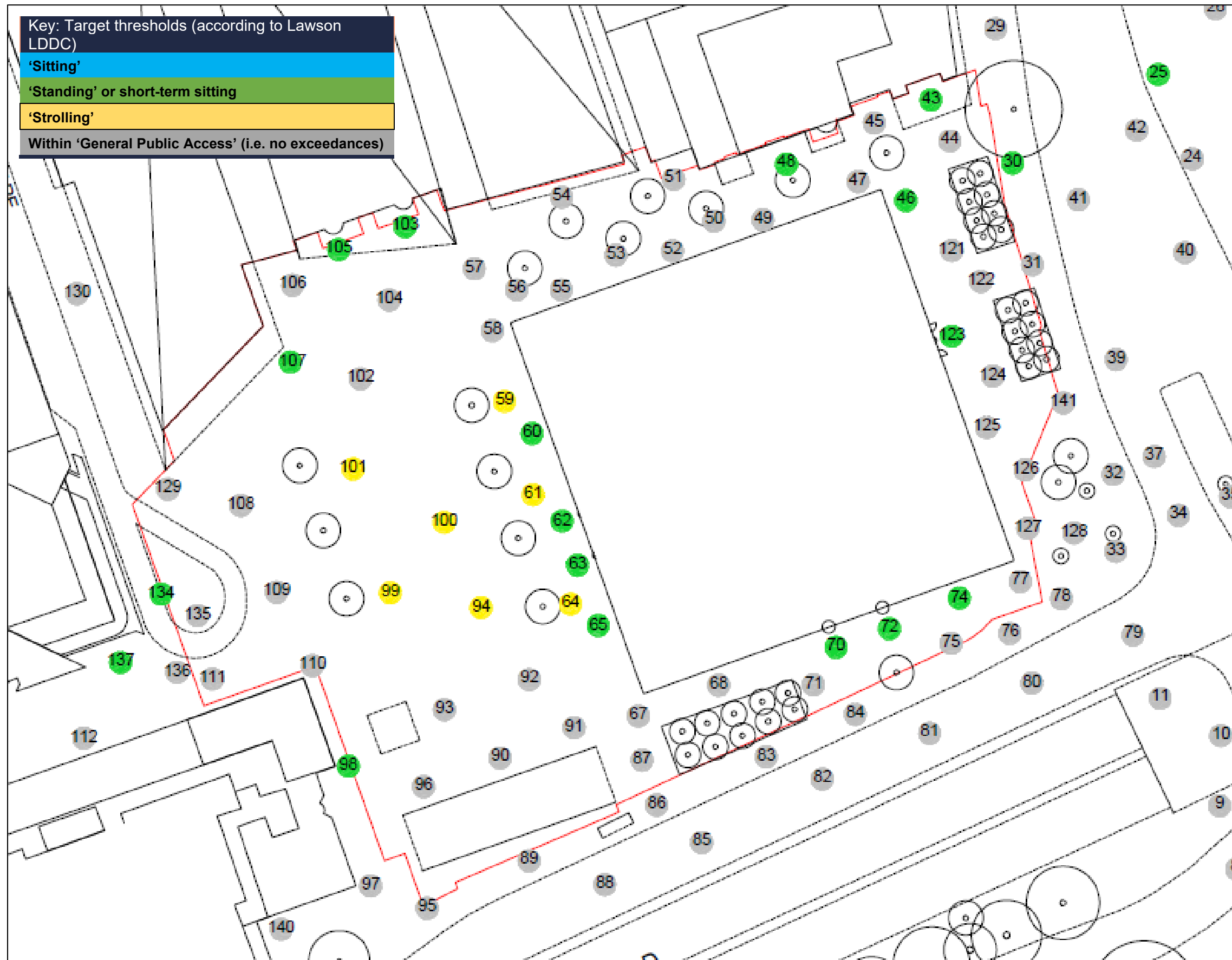


Figure 11.15 Configuration 1: Existing Baseline (Maximum Target Thresholds, Summer)

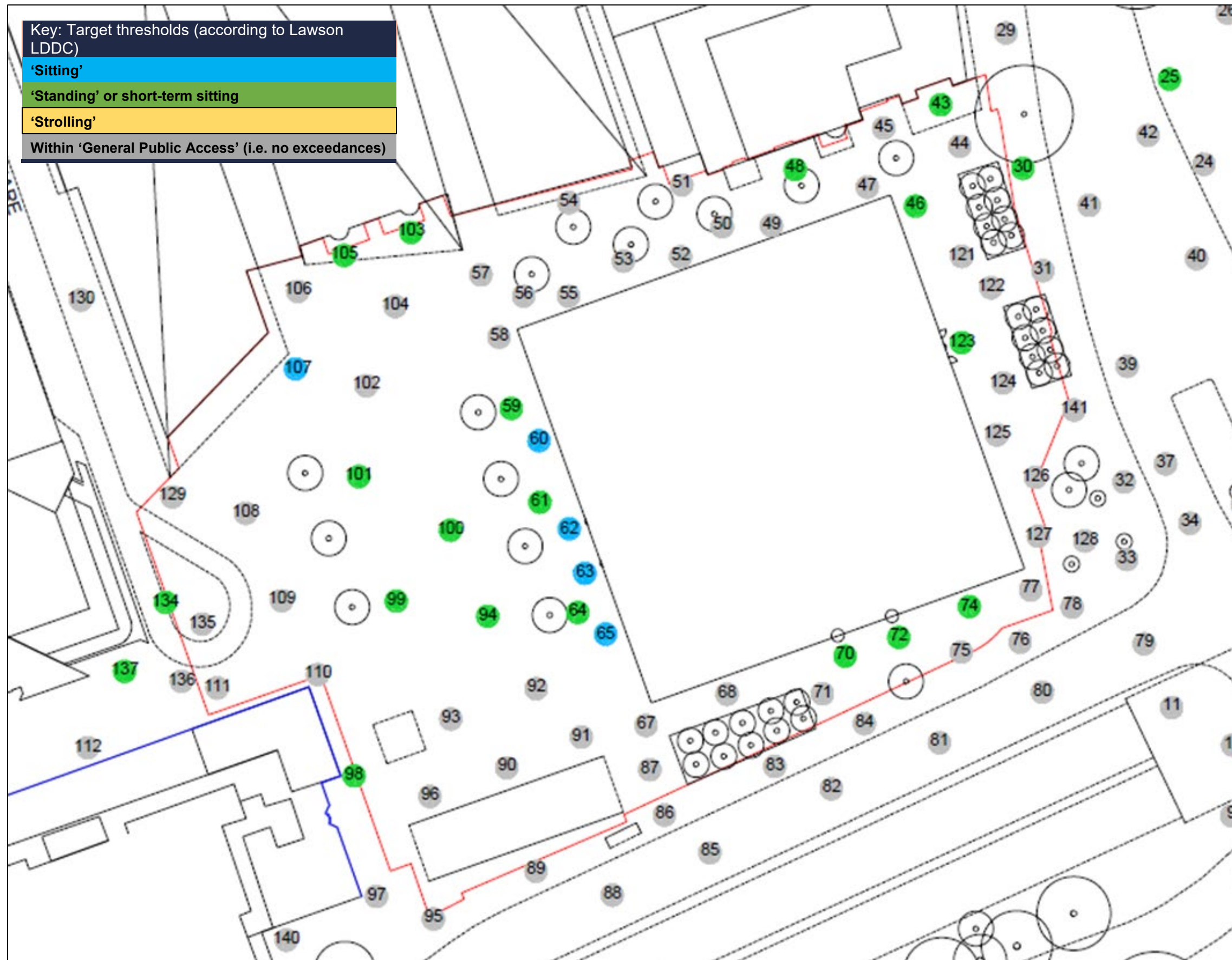




Figure 11.16 Configuration 1: Existing Baseline (Worst-Case) Wind Tunnel Results

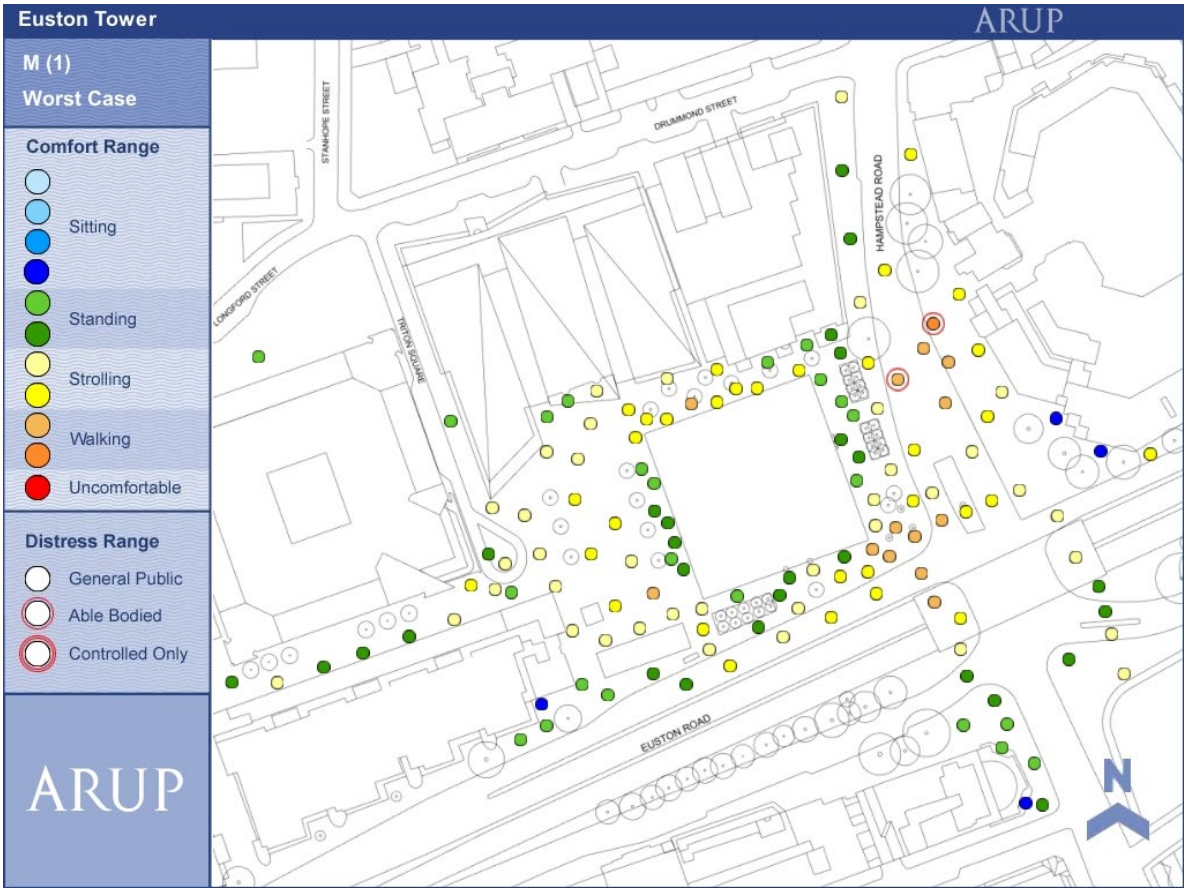
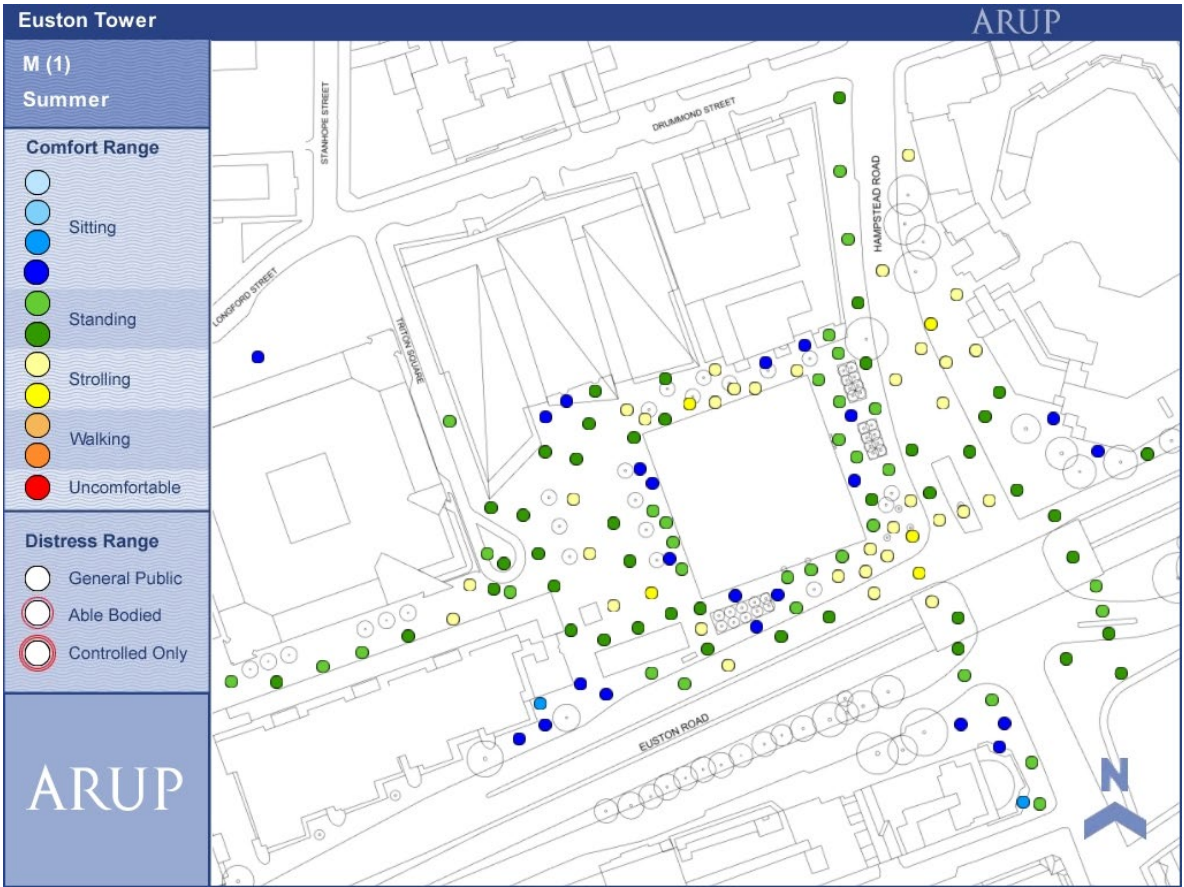


Figure 11.17 Configuration 1: Existing Baseline (Summer) Wind Tunnel Results



**On-Site Receptors**

11.72 Figure 11.16 and Figure 11.17 show the results of Configuration 1: Existing Baseline. Please refer to Figure 11.14 for the receptors numbers and locations discussed in this section.

*Permanent Outdoor Café and Long-Term Sitting Spaces – Probe Locations 60, 62, 63 and 67)*

11.73 Probes 62, 63, and 65 are all located on the west façade of the existing building where tables and seating are located for the ground floor retail units. These all record ‘Standing’ conditions, which is one category above the summer threshold for long-term sitting spaces and are therefore unacceptable in summer. However, these spaces do achieve acceptable ‘Standing’ conditions in the winter (worst-case).

11.74 The other on-site long-term seating location (probe 60) records acceptable ‘Sitting’ conditions in summer and ‘Standing’ in the winter (worst-case).

*Main Entrances – Probes 46, 70, 72, 74, 123*

11.75 Probe 72 located on the south façade, facing Euston Road, records ‘Strolling’ conditions in the worst-case season, which is one category above the threshold for entrances. This condition is unacceptable in the baseline.

11.76 All other on-site entrance locations (located along the northern façade, southern façade and eastern façade) record acceptable ‘Sitting’ to ‘Standing’ conditions all year round.

*Outdoor Recreational Spaces and Bus Stops – Probes 59, 61, 64, 94, 99, 100, 101*

11.77 Probes 99 and 101 are located in the middle of Regent’s Place Plaza, to the west of the existing tower. These two probes record ‘Strolling’ conditions in the summer. While this is above the preferred threshold, they are located within a large space that does achieve acceptable ‘Standing’ conditions so users can choose to move to calmer areas if they desire. Therefore, these conditions are acceptable.

11.78 All other on-site recreational locations also located within Regent’s Place Plaza record acceptable ‘Standing’ conditions in the summer.

11.79 No bus stops are located on-site.

*Areas for General Public Access and Cycling – Probes 44, 47, 49-53, 55-58, 67, 68, 71, 75, 77, 87, 90-93, 96, 102, 108-111, 121-127, 129, 135*

11.80 All on-site locations for general public access and cycling record acceptable ‘Standing’ to ‘Business Walking’ conditions all year round.

11.81 It should be noted that one location at the south-east corner (probe 77) is marginal and very close to exceeding the Lawson general public access safety limit.

*Areas for Occasional or Maintenance Access*

11.82 No areas were identified as only being occasional or maintenance access. All receptors have been covered in the lower comfort categories listed above. Therefore, there is a negligible (not significant) effect.

**Off-site Receptors**

*Permanent Outdoor Café and Long-Term Sitting Spaces – Probe 107*

11.83 One café was identified as permanent off-site seating. This is measured with probe 107 and represents conditions outside the existing Refinery at Regent’s Place restaurant and bar. Conditions are ‘Strolling’ in the



worst-case and 'Standing' in the summer. These conditions are above the desired thresholds for a permanent seating area.

**11.84** No other existing café spaces or long-term seating areas identified in the existing off-site surroundings.

## Main Entrances – Probes 20, 43, 48, 98, 103, 105, 134

**11.85** Probe 98 located at the Entrance to 2 Triton Square and probe 137 located at one of the entrances to 1 Triton Square (to the west of the site), are 'Strolling', i.e. one category above the threshold for entrances in the worst-case. This condition is unacceptable.

**11.86** All other off-site entrance locations record acceptable 'Sitting' to 'Standing' conditions all year round.

## Outdoor Recreational Spaces and Bus Stops – Probes 25, 30

**11.87** No existing recreational spaces were identified the existing off-site surroundings.

**11.88** Measurements were taken at a bus stop on the east side of Hampstead Road (probe 25). Conditions exceed the safety criteria for Able Bodied Access in the worst case, and 'Strolling' in summer. Conditions are unacceptable in both the summer and worst-case conditions. It should be noted that the bus shelter was missing from the test set-up at the time of testing for the baseline. It is included in Configurations 2.

**11.89** Conditions at the bus stop on the east side of Hampstead Road (probe 30) achieve acceptable 'Standing' conditions in the summer and 'Strolling' conditions in the winter.

## Areas for General Public Access and Cycling – Probes 1-29, 31-42, 44, 45, 54, 76, 78-86, 88, 89, 95, 97, 104-106, 112-120, 128, 130-133, 136-141

**11.90** Probe 41 located in the middle of Hampstead Road to the east of the site, is above the Lawson safety threshold for able-bodied access in the worst-case. This condition is unacceptable.

**11.91** All other off-site locations for general public access and cycling record acceptable conditions all year round.

## Areas for Occasional or Maintenance Access

**11.92** No obvious areas of occasional access or maintenance were found in the baseline surroundings.

## POTENTIAL EFFECTS

**11.93** This section presents the impact assessment once the (Amended) Proposed Development is complete and in use.

## Embedded Mitigation

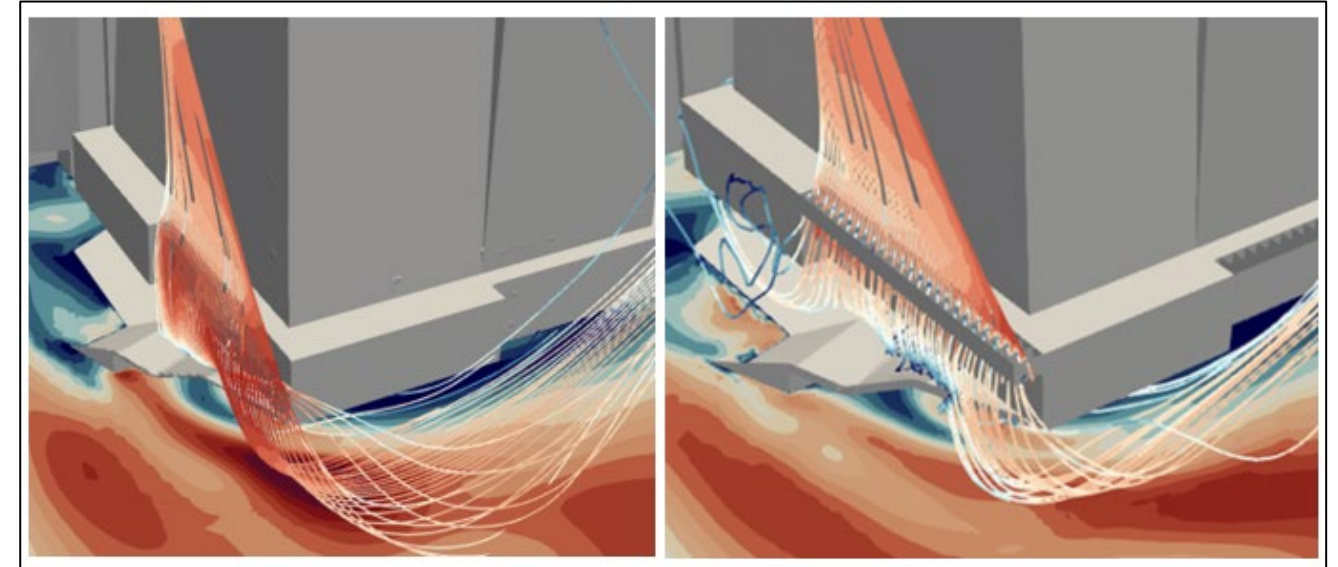
**11.94** The configurations tested of both the Proposed Development (as assessed within the December 2023 ES) and Amended Proposed Development include existing off-site landscaping (including elements of existing TfL landscaping) as these elements were found to have an impact on the local wind conditions.

**11.95** Extensive design and testing showed direct links between specific architectural elements and calmer wind conditions at ground level. Many of these were incorporated where possible in the Amended Proposed Development and include:

- Wide podium (to disrupt downdrafting);
- Porous fin arrays through the podium at the south-west corners (to create an intentional 'air-curtain that disrupts direct ground-level accelerations); and
- Recessing main entrances facing Euston Road (to create local shelter).

**11.96** The architectural embedded mitigation features mentioned above were iteratively tested using high-level CFD (steady state RANS for select wind directions) throughout the early design stages and confirmed with boundary layer wind tunnel testing for planning. Examples of the CFD outputs and design iterations are shown in Figure 11.18 below. The final design was tested on 28 November 2024 and the results are discussed in the following sections.

**Figure 11.18** 3D Visualisation of Early CFD Analysis of the Proposed Development



**11.97** The above figure shows simplified streamlines interacting with early versions of the south-west corner of the Proposed Development, (left) without porous fin arrays and (right) with an early version of the porous fin array that was developed into the final design. Colours are qualitative and show areas of relative acceleration (red) and sheltering (blue) and are not directly comparable to Lawson conditions.

**11.98** Additional embedded mitigation adopted in the Amended Proposed Development includes:

- Curved tower corners (to reduce downdraft and keep strong winds close to the upper tower and south-east podium).
- Raised planter around the south-east corner (see 11.120 - 11.146 for details and images).

## Testing of the December 2023 Proposed Development

**11.99** The Proposed Development (as assessed within the December 2023 ES) has now been superseded by Configuration 4a, 4b, and 4c. However, this section contains the results of the superseded tests and findings of the December 2023 ES for reference.

**Table 11.10 Introduced Receptors Associated with the Superseded Development (Configuration 2 , 3a and 3b)**

Receptor Type (Season)	Receptor Reference
<b>On-site</b>	
Outdoor café / permanent long-term sitting spaces	None
Main entrances	56, 66, 121, 189, 190, 191
Public outdoor recreational spaces (including park and bus stops)	47, 53, 55, 57, 71, 87, 90, 92-94, 96, 99, 110, 122, 124, 148, 154-156, 168, 174, 175, 178-180, 186-188, 192, 197
All other areas regularly used by the general public and cyclists for access	46, 49-52, 67, 68, 70, 72, 74, 77, 91, 100-102, 108, 109, 111, 125-127, 129, 140, 141, 144, 147, 153, 157, 158, 160-164, 165, 171-173, 176, 177, 181, 182, 184, 185, 193, 194
<b>Off-site</b>	
Outdoor café / permanent long-term sitting spaces	107
Main entrances *	20, 28, 43, 48, 98, 103, 105
Public outdoor recreational spaces (including park and bus stops)	25, 30, 44, 183
All other areas regularly used by the general public and cyclists for access	1-29, 31-42, 45, 54, 75, 76, 78-86, 88, 89, 95, 97, 104, 106, 112-120, 128, 130-133, 137-139, 142, 143, 146, 149-152, 159, 166, 167, 169, 170, 195, 196, 198-201
Upper-level Terraces	202-206

## Configuration 2: Proposed Development Without Landscaping

**11.100** Photos of the scale model tested in the wind tunnel for Configuration 2: Proposed Development without Landscaping is shown in Figure 11.20 and a plot of the wind conditions at ground level are shown in Figure 11.21 to Figure 11.22.

**11.101** The Proposed Development included a 32-storey tower on top of a podium and associated public realm works. The external uses included a mix of pedestrian and cycle thoroughfares, outdoor recreational space, and entrances. Configuration 2 includes existing off-site landscaping, except landscaping included within TfL owned land at the west corner of Euston Road and Hampstead Road.

**11.102** A plan view of the Proposed Development, embedded mitigation and entrance locations are shown in Figure 11.19 below.

**11.103** In this configuration, several receptors on and off-site recorded Moderate Adverse (**significant**) effects:

### On-Site:

- A receptor at the main entrance at the south-west corner (probe 66) records 'Strolling' conditions in the worst-case. This is one category above the acceptable limit for main entrances and represents a direct, permanent, long-term Moderate Adverse (**significant**) effect.
- The 'Public use secondary entrance' on Brock Street (no probe at entrance) is expected to experience 'Strolling' conditions all year round, similar to the conditions recorded at nearby probes (probes 52 and 163). Therefore, it represents a direct, permanent, long-term Moderate Adverse (**significant**) effect.

- Three probes in Brock Street (north side of the site) record conditions above the Lawson safety threshold for General Public Access (probes 55, 174, 53) and two probes (148 and 197) record conditions 'Strolling' conditions in the summer. All of these conditions represent a direct, permanent, long-term Moderate Adverse (**significant**) effect.
- Several probes in an area to the south of Regent's Place Plaza (probes 90, 93, 96, and 178), records 'Strolling' conditions in the summer. These conditions are above the desired threshold for outdoor recreational spaces and covers a large area. Therefore, it represents a direct, permanent, long-term Moderate Adverse (**significant**) effect.
- Three probes clustered around the south-west corner (probes 67, 160 and 184) record conditions above the Lawson safety threshold for General Public Access. This represents a direct, permanent, long-term Moderate Adverse (**significant**) effect.

### Off-site:

- One location at the north-east corner of the site (probe 43) records 'Strolling' conditions in the worst-case. This is one category above the acceptable limit for main entrances and represents a direct, permanent, long-term Moderate Adverse (**significant**) effect.
- Two locations (probes 32 and 146) close to the south-east corner of the site (at the corner of Euston Road and Hampstead Road) record conditions above the Lawson safety threshold for General Public Access. This represents a direct, permanent, long-term Moderate Adverse (**significant**) effect.

**11.104** All other receptors for Permanent Outdoor Café and Long-Term Sitting Spaces, Main Entrances, Outdoor Recreational Spaces and Bus Stops, Areas for General Public Access and Cycling, and Areas for Occasional or Maintenance Access both on-site and off-site recorded Negligible (not significant) effects.

**Figure 11.19 Ground Floor of the Proposed Development**

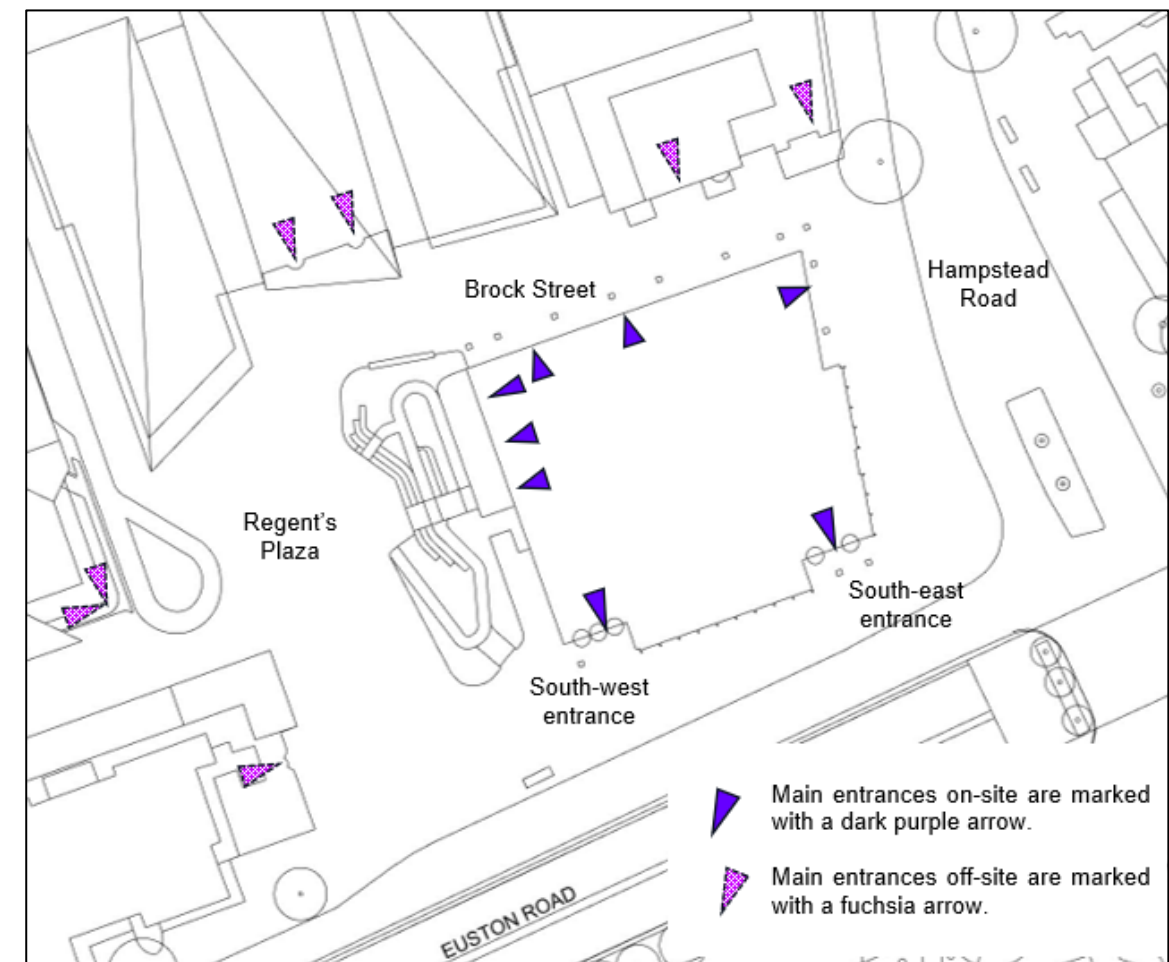




Figure 11.20 Configuration 2: Proposed Development Without Landscaping

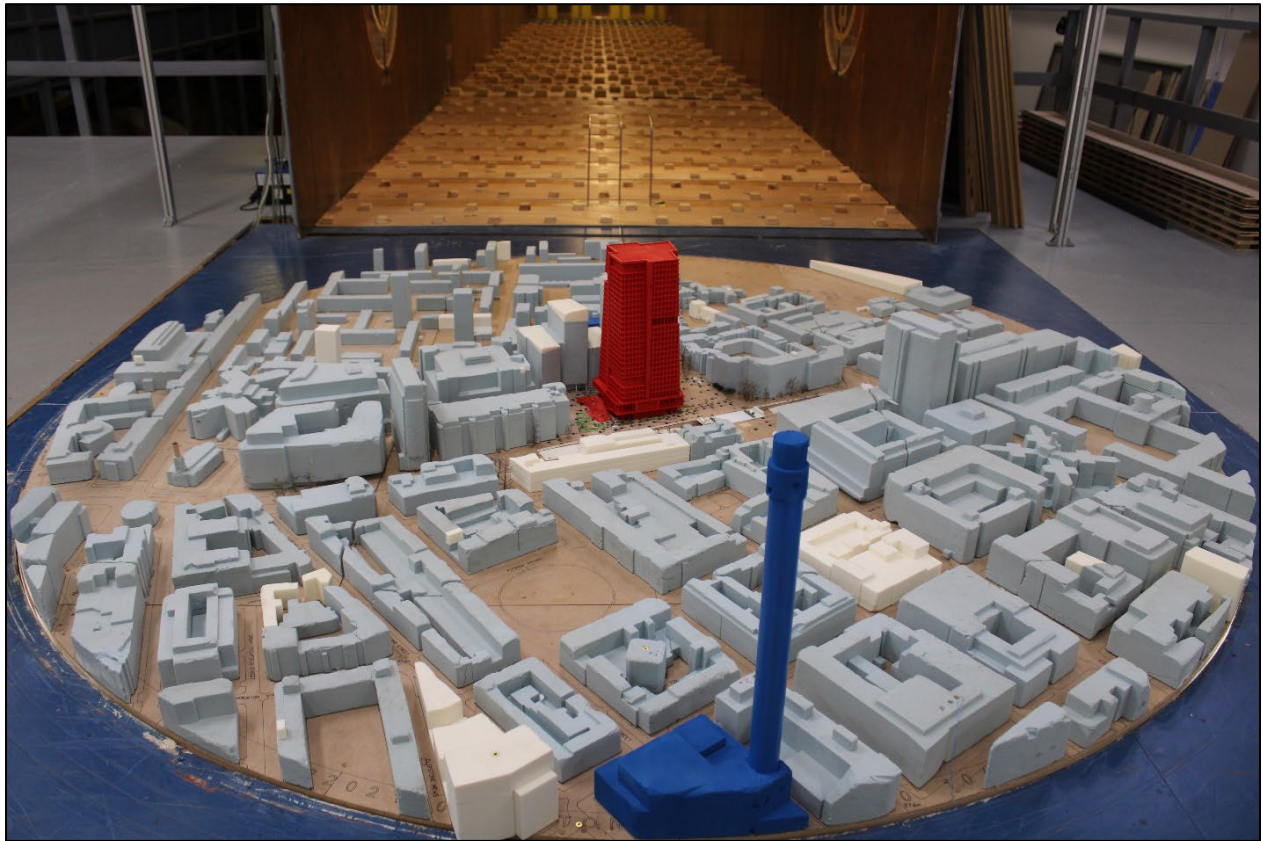


Figure 11.21 Configuration 2: Proposed Development Without Landscaping (Worst-Case)

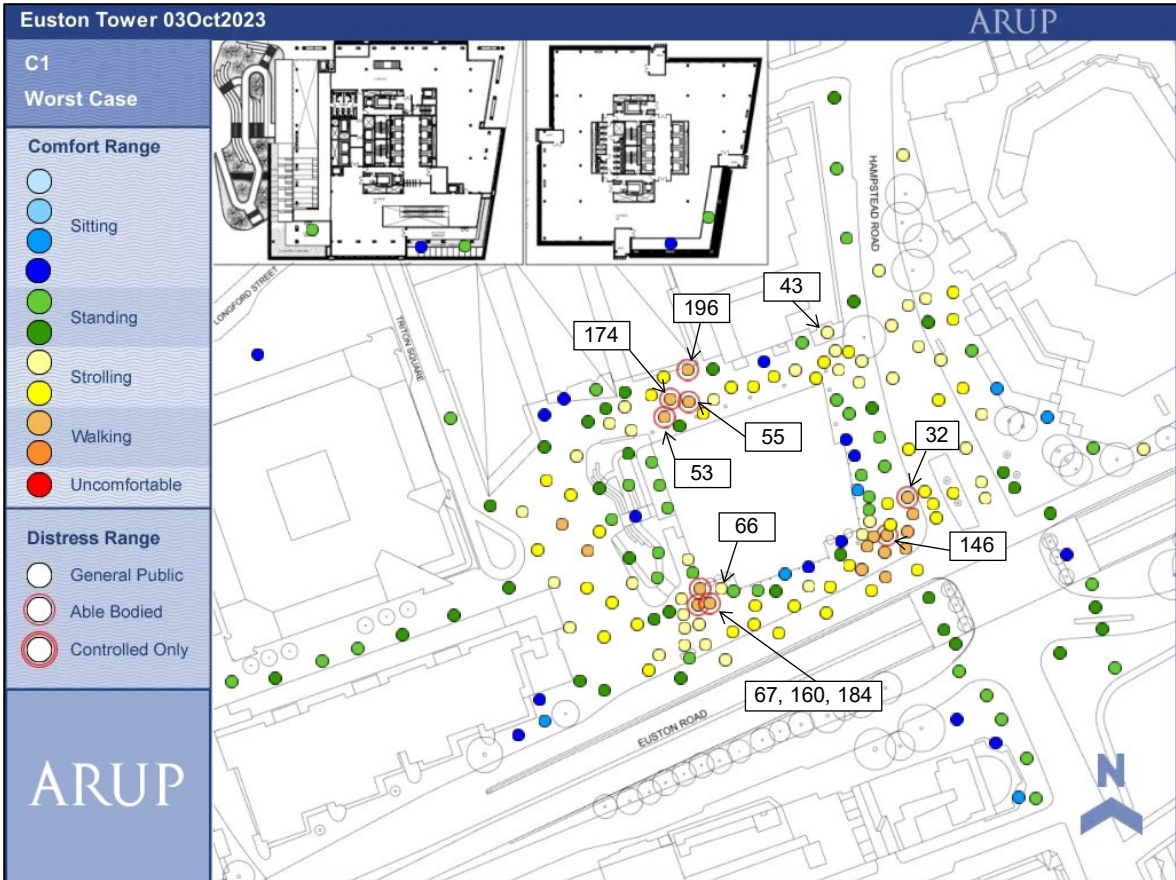
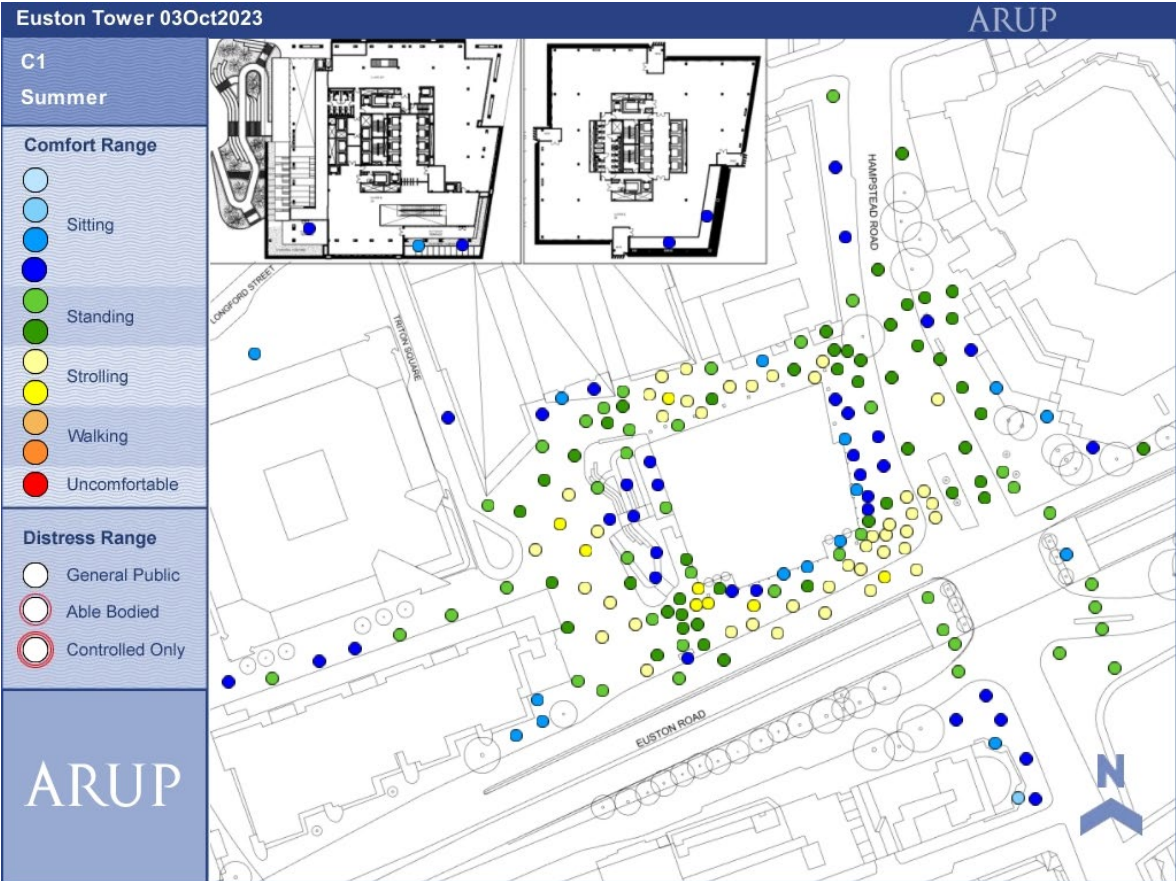


Figure 11.22 Configuration 2: Proposed Development Without Landscaping (Summer)





## Configuration 3a: Proposed Development with Landscaping and Initial Mitigation

- 11.105** Photos of the scale model tested in the wind tunnel for Configuration 3a: Proposed Development with Landscaping and initial mitigation is shown in Figure 11.23 and a plot of the wind conditions at ground level are shown in Figure 11.25 to Figure 11.26.
- 11.106** Configuration 3a includes all existing off-site landscaping, including TfL landscaping at the west corner of Euston Road and Hampstead Road. Local wind mitigation measures were also included these are described below and shown in Figure 11.24.
- South-east corner:
    - No. 2 raised planters (800mm) and five trees circling the south-east corner
      - Western planter includes No. 2 deciduous multi-stem trees, 2-3m tall
      - Eastern planter includes No. 2 deciduous 3-5m tall trees and one deciduous multi-stem 2-3m tall
    - One 'totem' perpendicular to the south-east entrance (1.2m wide x 3m tall, 50% porous) forming part of the security bollards around the entrance.
  - South-west corner:
    - One solid 'totem'/screen, (1.5m tall x 1.2m wide) located between the southern façade and the external podium column.
  - Brock Street (north road on site)
    - No. 3 planters:
      - Western raised planter: mounded to 1.5m tall with No. 7 deciduous trees 3-5m tall & No. 1 evergreen tree 8.5m tall
      - Northern raised planter: mounded to 1m tall with No. 3 deciduous trees 3-5m tall & No. 1 evergreen tree 5-7m tall
      - Eastern level planter: No. 1 evergreen tree 10m tall.
- 11.107** With landscaping, all receptors except one recorded acceptable conditions for their proposed uses. These represent a direct, permanent, long-term Negligible (not significant) effect.
- 11.108** The one receptor at the accessible lift access on the west side of Brock Street (Probe 56) recorded 'Strolling' in the worst-case, which is one category above the required range for entrances. This represented a direct, permanent, long-term Moderate Adverse (**significant**) effect.
- 11.109** However, using professional judgment, it was determined that conditions at this access point could be mitigated with local landscaping/sheltering. A totem/screen was therefore placed immediately west of the entrance within the design (solid to 50% porous). The implementation of any of this mitigation was expected to result in a direct, permanent, long-term Negligible (not significant) effect at the entrance.
- 11.110** Note, some updates to the landscaping took place after the wind tunnel testing on the 14 November 2023, particularly around the south-east entrance. These changes are highlight and their impacts discussed in the following section 'Configuration 3b: Proposed Development with Landscaping and Updated Mitigation'.

Figure 11.23 Photos of the Model Used in the Wind Tunnel for Configuration 3a: Proposed Development with Landscaping and Initial Mitigation Model

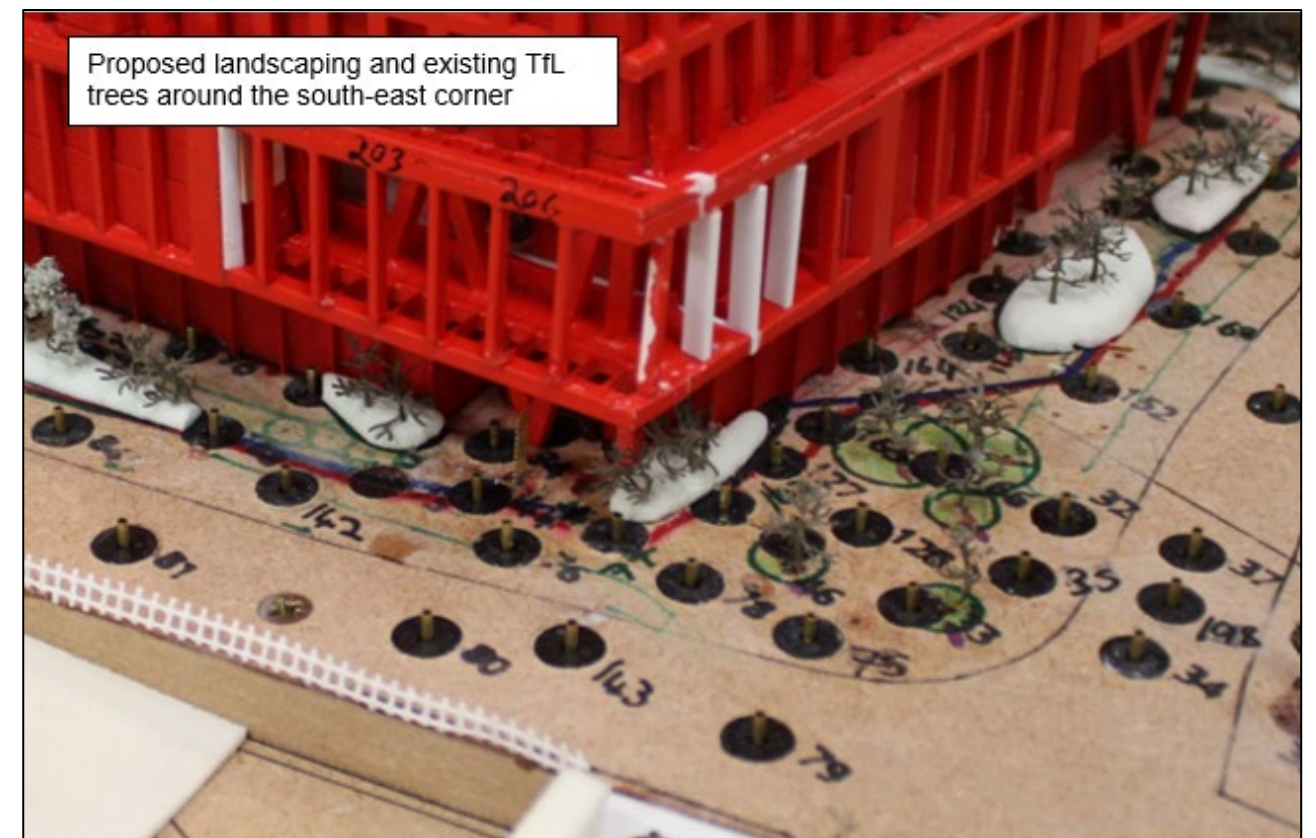






Figure 11.24 Proposed Development with Landscaping and Initial Mitigation

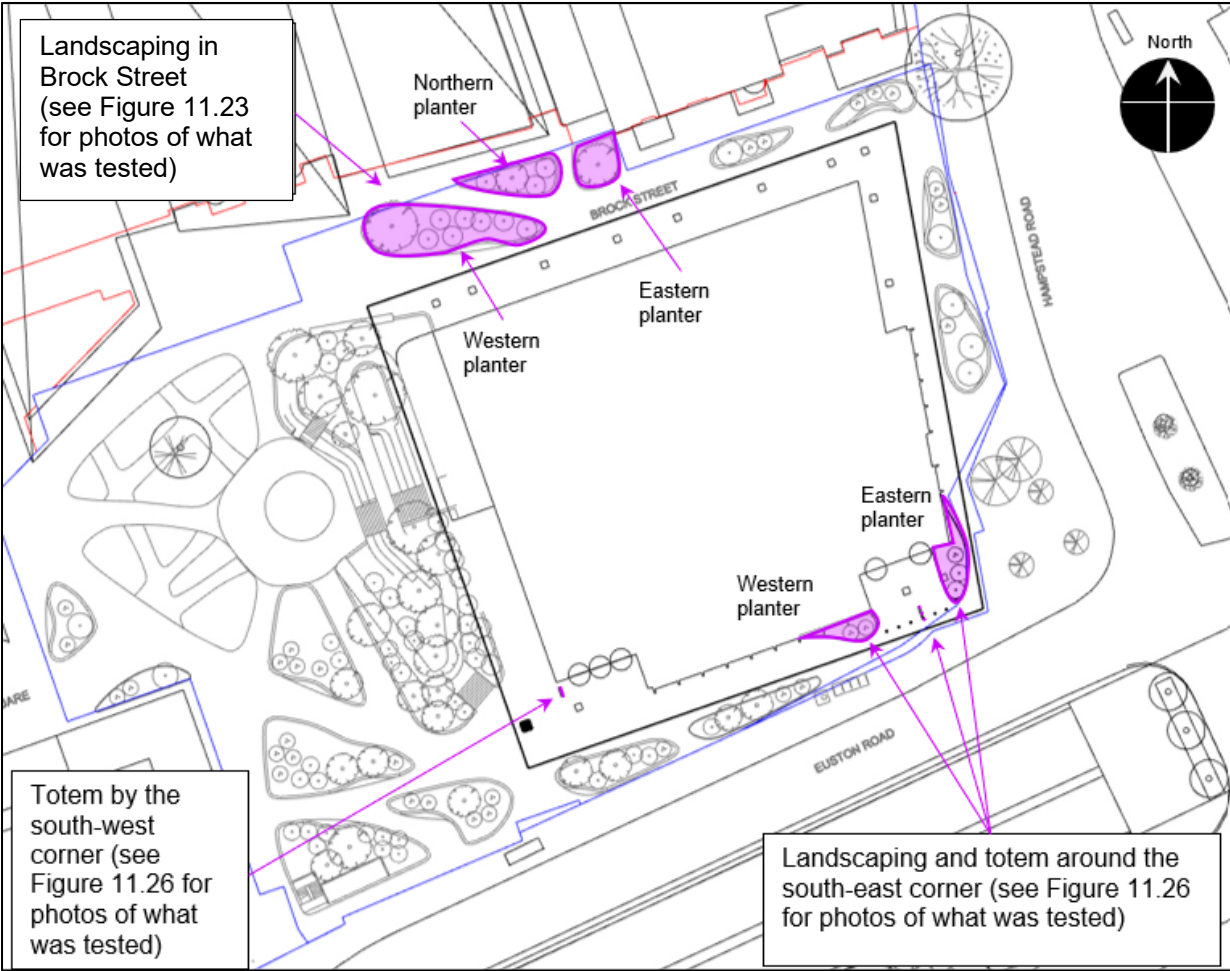


Figure 11.25 Configuration 3a: Proposed Development with Landscaping and Initial Mitigation Measures (Worst-Case)

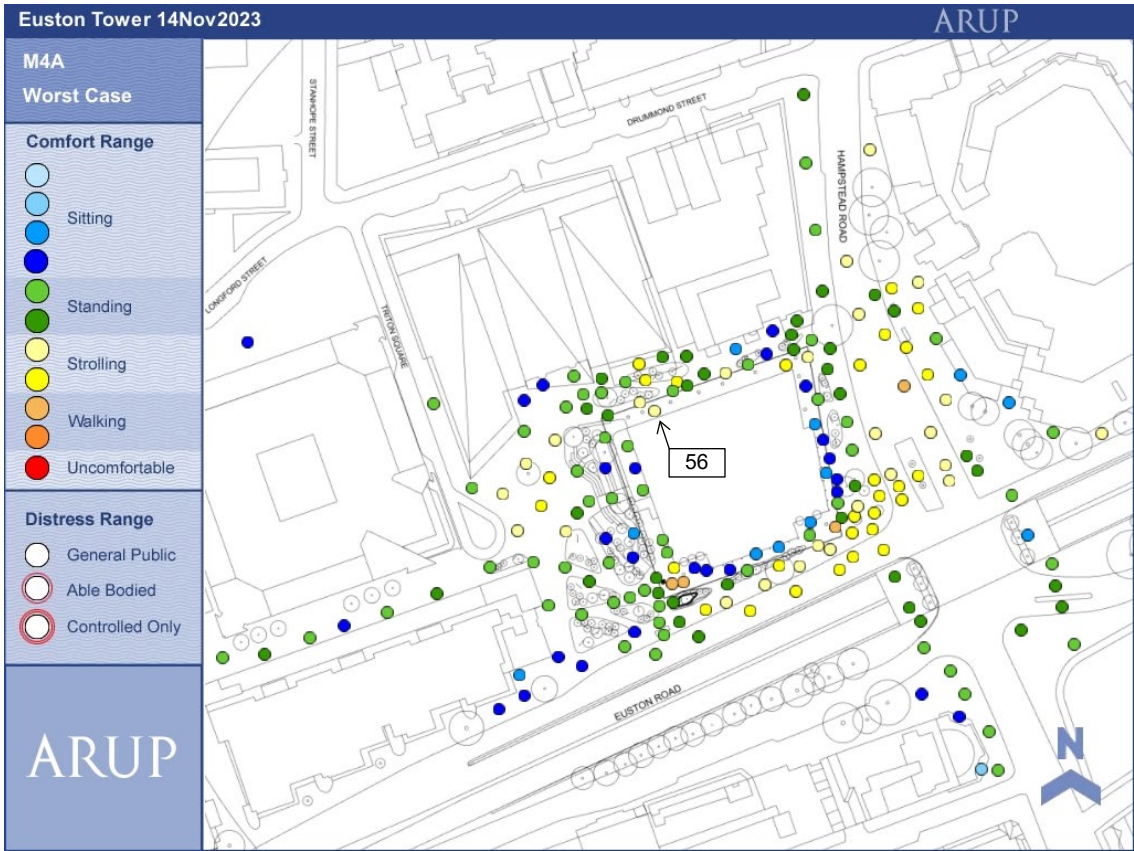
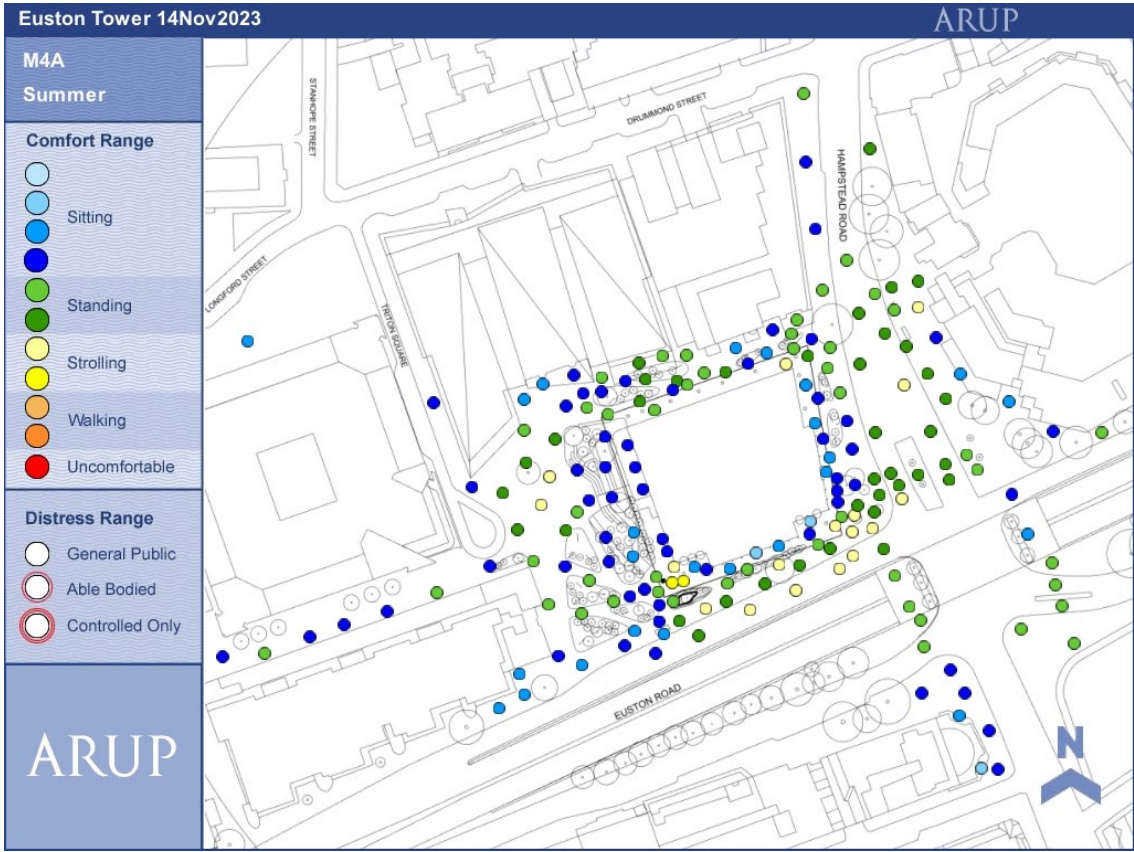


Figure 11.26 Configuration 3a: Proposed Development with Landscaping and Initial Mitigation Measures (Summer)





## Configuration 3b: Proposed Development with Landscaping and Updated Wind Mitigation

- 11.111** Following the final wind tunnel workshop on the 14 November 2023, details of the landscaping and mitigation elements were refined by the design team. These refinements have been qualitatively reviewed by the wind specialists using professional judgement and sensitivity tests carried out during the wind tunnel workshop day.
- 11.112** A plan view of the Proposed Development, proposed landscaping, and updated mitigation are shown in Figure 11.27 and highlights the changes from Configuration 3a. Changes to Configuration 3b include:
- Removing the porous totem in front of the south-east entrance
  - Extending the western raised planter and changing the soft landscaping to incorporate No.4 deciduous multi-stem trees 2-3m tall.
- 11.113** The changes described above can be seen in the planning documents including ground-level plans and landscaping documents. The updates to the landscaping around the south-east corner are expected to produce similarly acceptable results to those tested in the wind tunnel.
- 11.114** A version of this design was tested with partial wind directions, south through west ( $180^{\circ}$ - $270^{\circ}$  from north) on 14 November 2023. The Lawson results (using data from Configuration 3a to fill in the untested directions) have been included in this report to provide assurance of the conclusions of the professional judgement.
- 11.115** Note, this method of using data from two similar runs is a common method used in the wind tunnel when a select number of wind angles are identified as significant for an area of interest. Only testing the significant wind angles and filling non-critical wind angles with other configurations allows for faster turn-around within a workshop slot. However, it is preferable to test all directions to ultimately verify the conditions according to the methodology agreed within the scoping report.
- 11.116** Photos of the scale model tested in the wind tunnel for Configuration 3b: Proposed Development with Landscaping and Updated Wind Mitigation is shown in Figure 11.29 and a plot of the worst-case wind conditions at ground level are shown in Figure 11.30.
- 11.117** Configuration 3b includes all existing off-site landscaping, including TfL landscaping at the west corner of Euston Road and Hampstead Road.

Figure 11.27 Configuration 3b: Proposed Development with Landscaping and Updated Wind Mitigation

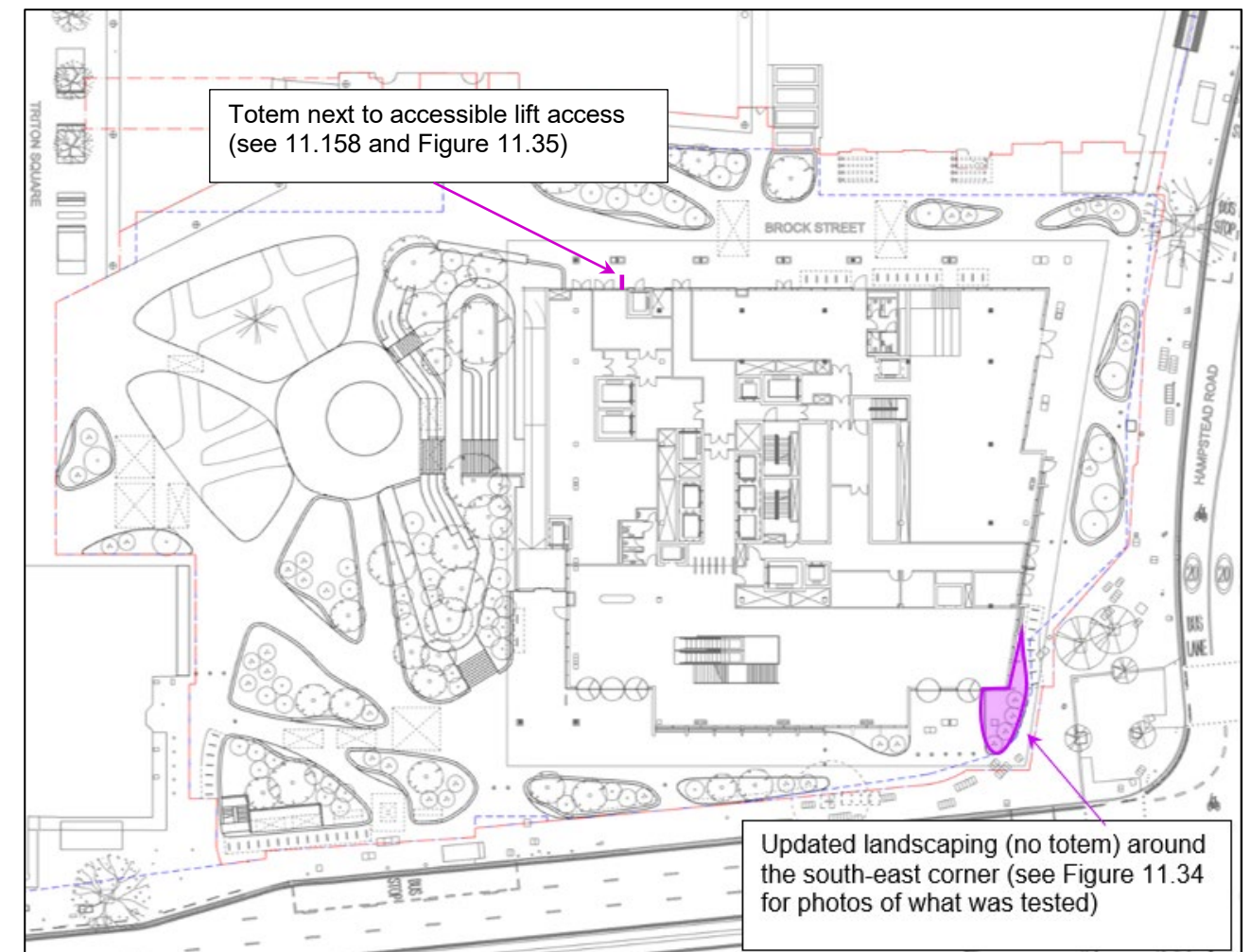


Figure 11.28 Bar Chart Highlighting Significant Wind Angles at Receptor 77 at the South-East Corner (Taken from Configuration 3a)

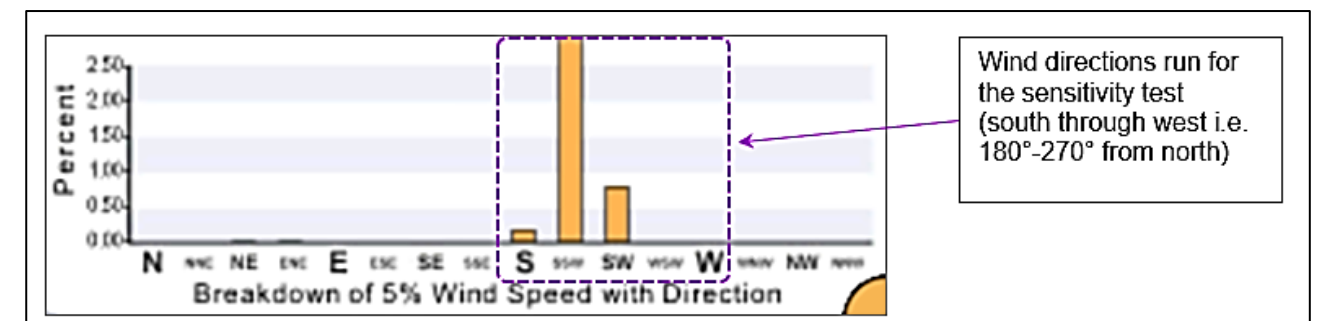
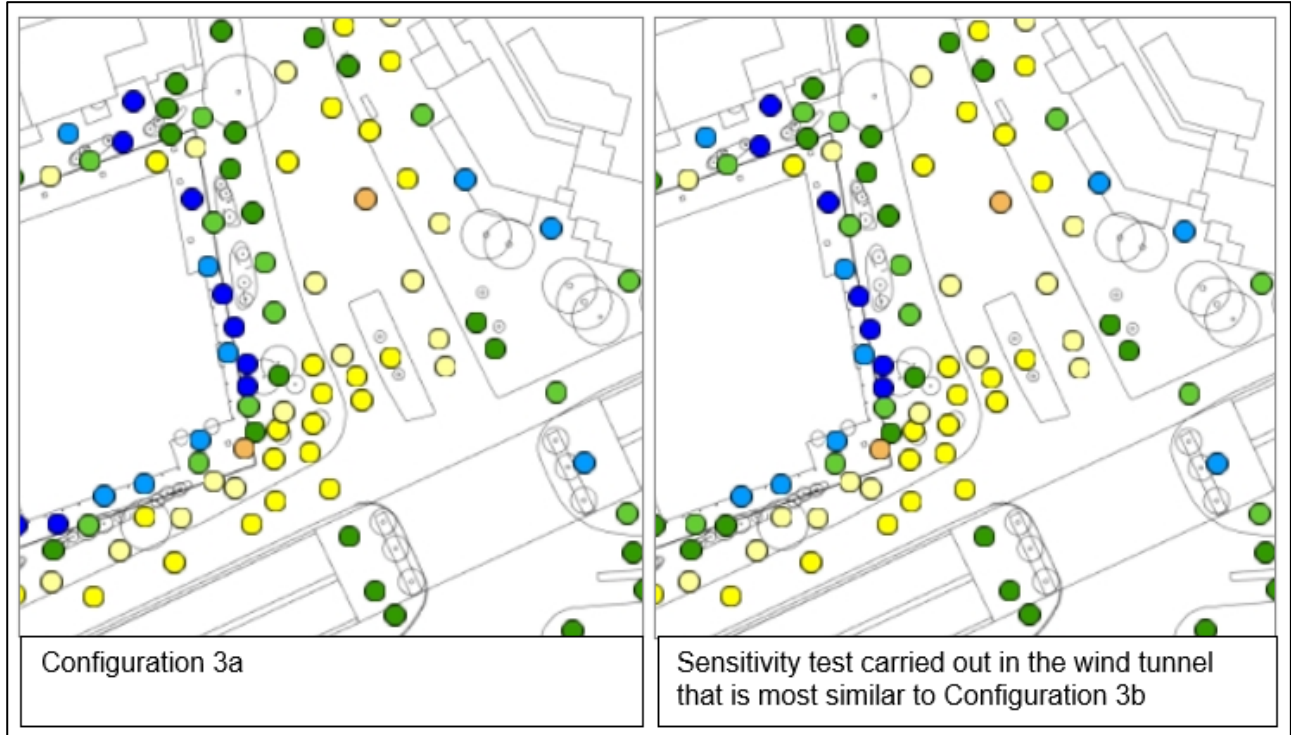




Figure 11.29 Configuration 3b: Proposed Development with Landscaping and Updated Wind Mitigation Model



Figure 11.30 Configuration 3a and 3b Comparison (Worst-Case, Winter)



11.118 Based on the results above and an understanding of how the winds move from south-south-west to north-east, the final landscaping proposed is expected to produce similar conditions to those in Configuration 3a. Therefore, all effects are the same as in Configuration 3a.

11.119 It should be noted that the sensitivity tests in the wind tunnel identified that success of the updated landscaping was dependant on several factors:

- Landscaping farther west of the site along (i.e. landscaping within Regent's Place Plaza and along Euston Road) should not be reduced from what was tested (the heights and sizes have been captured in the landscaping documents submitted with this application).
- Landscaping on the extended western mitigation planter next to the south-east entrance needs to be clustered on the southern end of the planter, away from the building facade. Results were not as favorable when landscaping was thin on the southern end of the planter.
- Extra space has been designed into the planter to potentially include more solid elements such as trellises or other supports to help the trees grow in this windy space. These will be important to ensure the resilience of the mitigation measures. These features can be porous or transparent to preserve views and daylighting.

### Configuration 4a: Amended Proposed Development with Landscaping

11.120 Configurations 2, 3a and 3b, which were presented within the December 2023 ES, have subsequently been superseded by Configuration 4a, 4b, and 4c, following the implementation of the Proposed Amendments and the findings of this assessment are discussed below.

11.121 Photos of the scale model tested in the wind tunnel for Configuration 4a: Amended Proposed Development with Landscaping are shown in Figure 11.31 and Figure 11.32 and a plot of the wind conditions at ground level are shown in Figure 11.35 to Figure 11.38.

11.122 The Amended Proposed Development includes a tower with rounded corners on top of a podium and associated public realm works. The full description of the Amended Proposed Development can be found in



**ES Addendum Volume 1, Chapter 1: Introduction, Proposed Design Amendments and ES Addendum Approach.** The external uses include a mix of pedestrian and cycle thoroughfares, outdoor recreational space, and entrances. Configuration 4 includes existing off-site landscaping, including landscaping included within TfL owned land at the south-east corner of Euston Road and Hampstead Road.

**11.123** A plan view of the Amended Proposed Development, embedded mitigation and entrance locations are shown in Figure 11.33 below.

**11.124** Configuration 4a includes all existing off-site landscaping, including TfL landscaping at the south-east corner of Euston Road and Hampstead Road. Proposed local wind mitigation measures were also included these are described in the lists below and shown in Figure 11.31 to Figure 11.36.

**11.125** The list below details the key mitigation measures that have been specifically incorporated into the landscaping and should be retained to ensure a safe wind condition, it is not an exhaustive list of all landscaping tested. Details of the landscaping plan can be found the in the detailed landscaping documents submitted.

- South-east corner:
  - No. 1 raised planter (1.2m) circling the column at the south-east corner including:
    - 1m tall shrubs across the whole planter;
- South-west corner:
  - Landscaped stairs along the western façade (see Figure 11.31 and Figure 11.32);
  - No.5 planters:
    - North raised planter: mounded to 1.5m tall with No. 6 deciduous trees 3-5m tall & No. 1 evergreen tree 6m tall;
    - North-west planter: mounded to 2m tall with No. 8 deciduous trees 3-5m tall & No. 2 evergreen tree 6m tall;
    - West planter: mounded to 2m tall with No. 9 deciduous trees 3-5m tall & No. 2 evergreen tree 6m tall;
    - South-west planter: mounded to 1.5m tall with No. 3 deciduous trees 3-5m tall & No. 1 evergreen tree 6m tall; and
    - South planter: mounded to 1m tall with No. 4 deciduous trees 3-5m tall & No. 2 evergreen tree 6m tall.
- Brock Street (north road on site)
  - No. 3 planters:
    - Western raised planter: mounded to 1.5m tall with No. 7 deciduous trees 3-5m tall & No. 1 evergreen tree 8.5m tall;
    - Northern raised planter: mounded to 1m tall with No. 5 deciduous trees 3-5m tall & No. 1 evergreen tree 6m tall; and
    - Eastern level planter: No. 1 evergreen tree 10m tall.

**11.126** An existing tree along Euston Road (highlighted in orange in Figure 11.34) was found to be beneficial to the wind conditions and should be retained or replaced if removed in order to achieve the conditions reported in this ES.

**Figure 11.31 Plan of the Amended Proposed Development with Mound Heights of the Landscaping<sup>6</sup>**



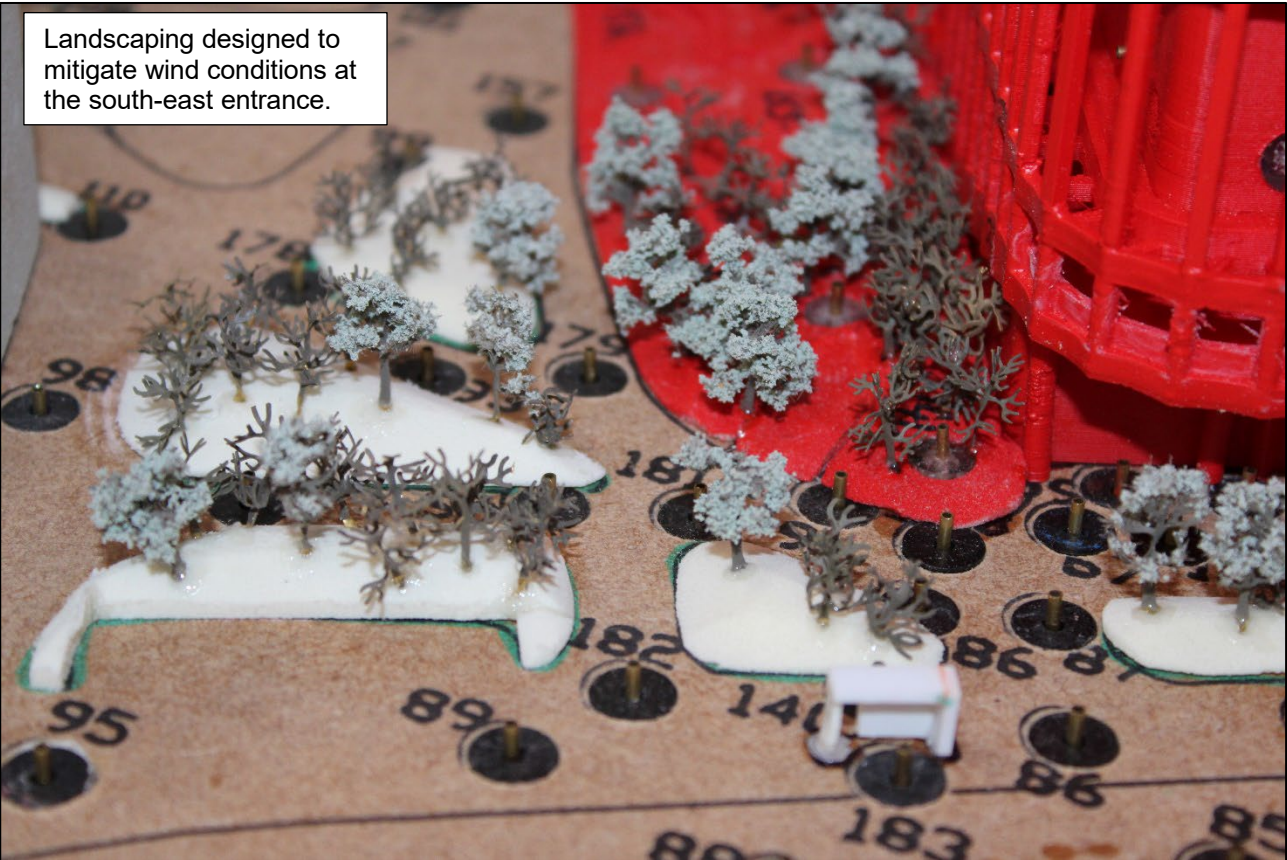
<sup>6</sup> Mounds that form part of the key wind mitigation elements detailed in the text are highlighted in purple (Part of the Embedded Mitigation)







Figure 11.34 Photos of Configuration 4a: Amended Proposed Development with Landscaping and Embedded Mitigation Model





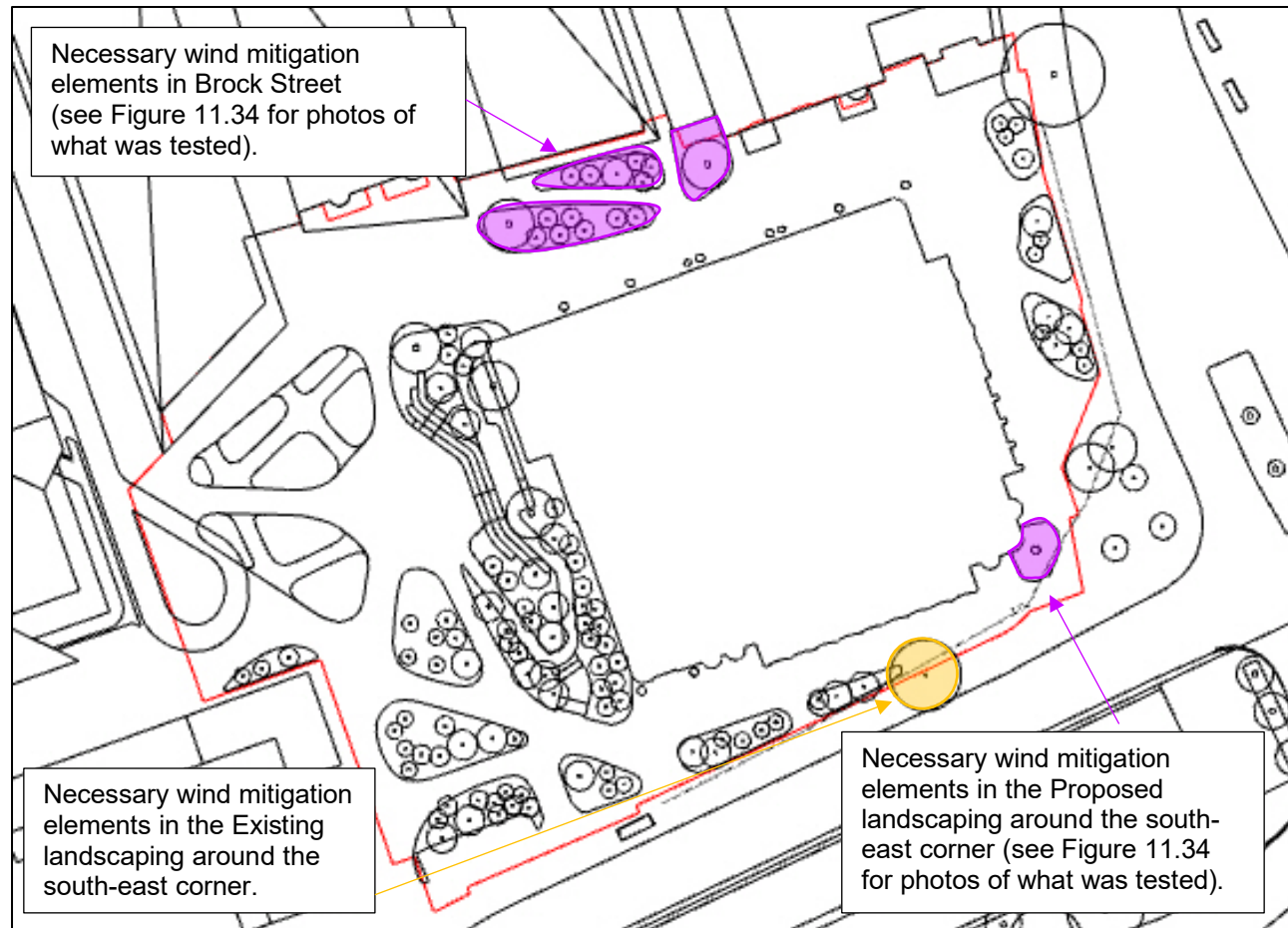
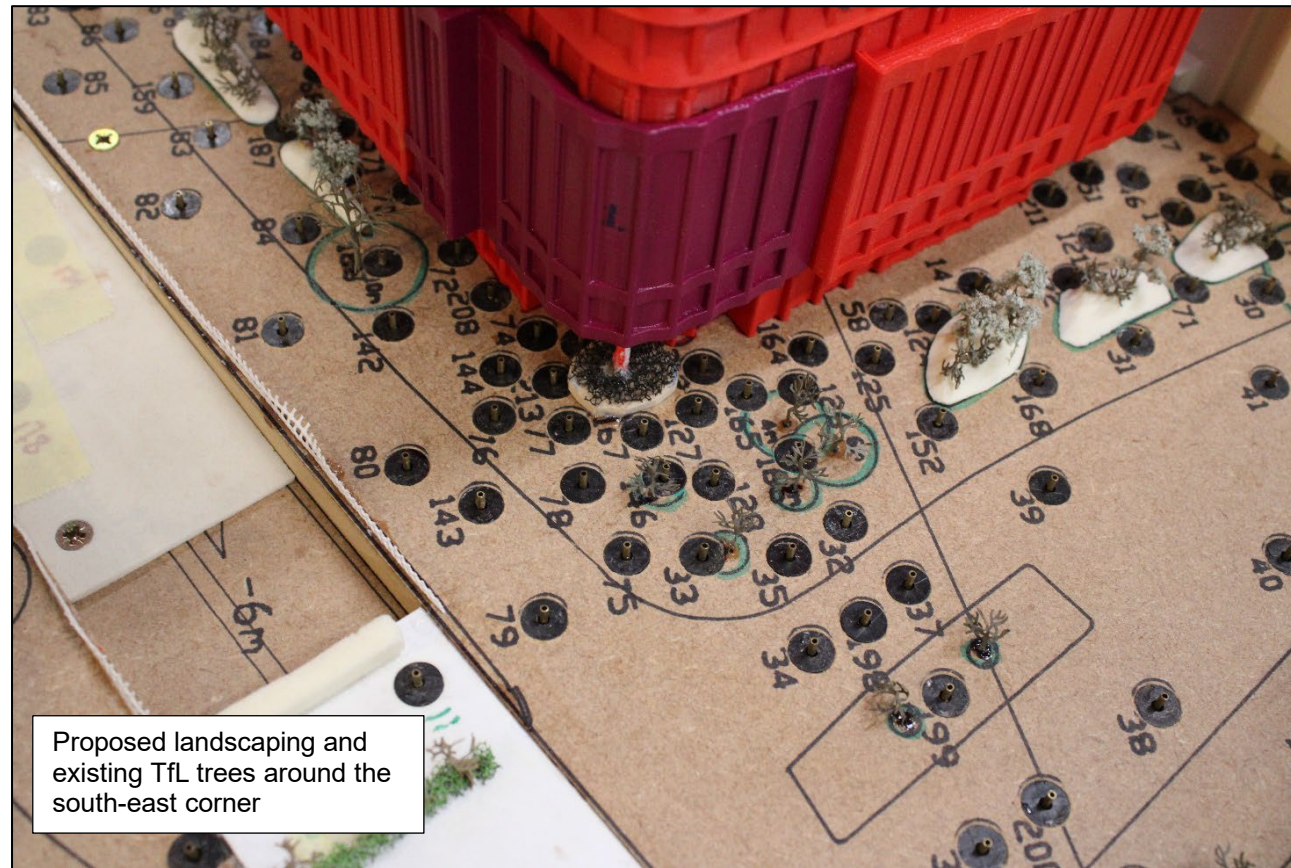




Figure 11.35 Configuration 4a: Amended Proposed Development with Landscaping (Maximum Target Thresholds, Worst-Case (Winter))

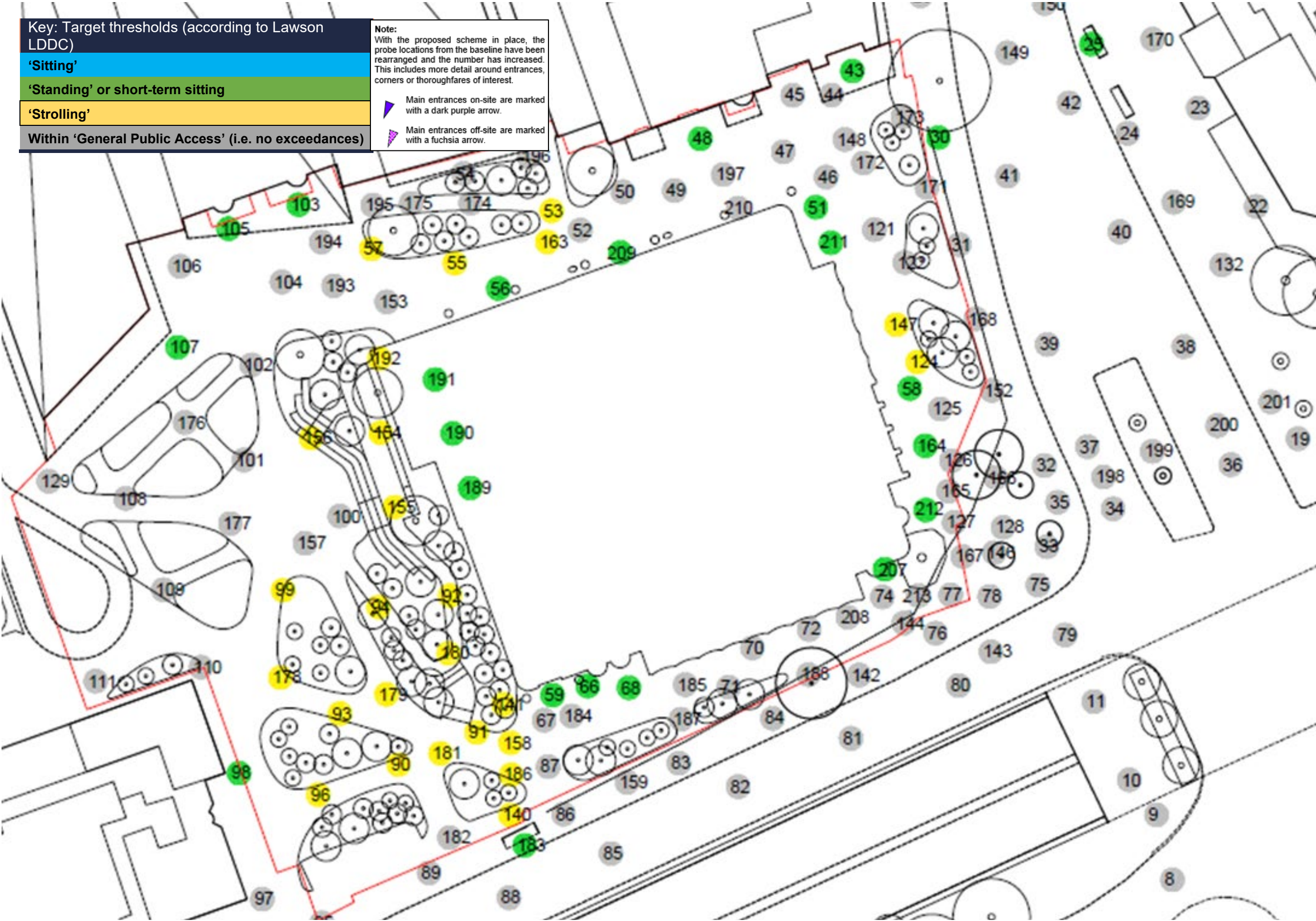




Figure 11.36 Configuration 4a: Proposed Development With Landscaping (Maximum Target Thresholds, Summer)

