

19th January 2021

FAO Susanna Bedford
Reading Borough Council
Civic Offices
Bridge Street
Reading, RG1 2LU

Trium Environmental Consulting LLP
68 - 85 Tabernacle Street
London, EC2A 4BD

+44 (0) 20 3887 7118
hello@triumenv.co.uk
www.triumenvironmental.co.uk



Ref: 182137/FUL - Broad Street Mall Broad Street Reading RG1 7QG

Dear Susanna,

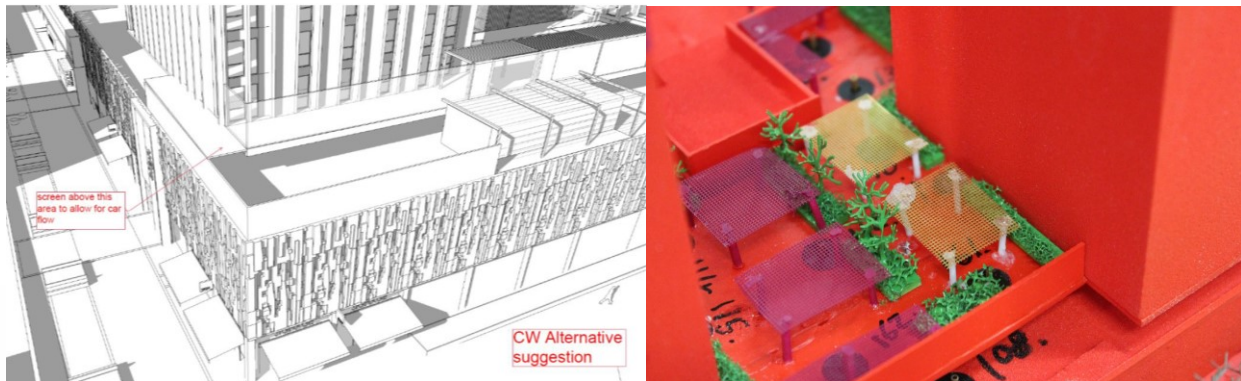
We write on behalf of Inception (Reading) Sarl (c/o Moorgarth Group Ltd) (the Applicant') regarding the mitigation of adverse wind conditions as reported in the Environmental Statement (ES Volume 1, Chapter 10: Wind Microclimate and Chapter 12: Likely Significant Effects and Conclusions).

Since the Planning Committee on 4th March 2020, where the scheme was permitted resolution to grant, the scheme has been subject to a Wind Mitigation Workshop. The Wind Mitigation Workshop was an iterative process during which suitable mitigation measures were identified to eliminate the adverse wind conditions present as a result of the Development.

As shown in Broad Street Mall Pedestrian Level Wind Microclimate Assessment RWDI #1803396 – Rev E (Appendix A), the wind tunnel testing identified that the corner balconies with 1.1m solid glazed balustrades present at the top two storeys of Blocks A and B (probe locations 188-191 and 194-197) will experience suitable wind conditions, and as such no mitigation is required. In addition, the mitigation workshop and further design development has identified the following mitigation measures for inclusion within the Proposed Development (Figure 1):

- An increase in the height of the balustrade on the south-western corner, from 1m to 2m;
- Approximately 50% porous canopy like balustrade to roof level screen adjacent to probe 116 for a total length of 14m;
- Installing an approximately 50% porous (open) pergola situated at probe location 110; and
- Installing an approximately 50% porous (open) pergola situated at probe location 161.

Figure 1. Wind Mitigation Measures



With the implementation of the identified mitigation measures all locations on and surrounding the Development would experience wind conditions suitable for their intended use and there would be no exceedances of the strong wind criteria.

Yours sincerely,

Juliette Callaghan

Partner

For and on behalf of Trium Environmental Consulting LLP



Appendix A: Broad Street Mall Pedestrian Level Wind Microclimate Assessment RWDI #1803396 – Rev E

BROAD STREET MALL

READING, UK

PEDESTRIAN LEVEL WIND MICROCLIMATE ASSESSMENT

RWDI #1803396 - REV E

19TH JANUARY 2021

SUBMITTED TO

Harry Young

Harry.Young@triumenv.co.uk

Trium Environmental Consulting LLP

Printworks House

7 Bermondsey St

London

SE1 2DD

SUBMITTED BY

Zain Khan

Project Engineer

Zain.Khan@rwdi.com

Jeniffer Lowther

Project Engineer

Jeniffer.Lowther@rwdi.com

Andrew Proud

Project Engineer

Jeniffer.Lowther@rwdi.com

Andy Gypps

Senior Project Manager

Andy.Gypps@rwdi.com

RWDI

Unit 1 Tilers Road

Milton Keynes

MK11 3LH

T: +44 (0)1908 776970

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VERSION HISTORY

RWDI Project #1803396 Broad Street Mall Reading, UK		
Report	Releases	Dated
Reports	Rev A	19 th March 2020
	Rev B	19 th May 2020
	Rev C	18 th November 2020
	Rev D	16 th December 2020
	Rev E	19 th January 2021
Project Team	Zain Khan	Project Engineer
	Jeniffer Lowther	Project Engineer
	Andrew Proud	Project Engineer
	Andy Gypps	Senior Project Manager

EXECUTIVE SUMMARY

The objective of this study was to determine the ground and upper levels wind environment within and around the proposed Broad Street Mall Site development in Reading, UK, through wind tunnel testing.

This report presents a description of the methodology used and the results of two configurations tested in the wind tunnel, namely:

- Configuration 1: Proposed Development with Existing Surrounding Buildings, Landscaping and Mitigation Measures; and
- Configuration 2: Proposed Development with Cumulative Surrounding Buildings, Landscaping and Mitigation Measures.

Results are presented in terms of the Lawson Comfort Criteria with the main focus on the windiest (generally winter) and summer seasons.

The meteorological data for the Site indicates prevailing winds from the south-west throughout the year with secondary winds from the north-east direction which are more prevalent during the spring months.

A mitigation workshop was undertaken to optimise the landscaping and where necessary develop wind mitigation measures to ensure that there would not be any safety concerns and all locations would have wind conditions suitable for their intended use.

The following wind mitigation measures were developed through iterative wind tunnel testing:

- An increase in the height of the Solid balustrade on the south-western corner, from 1m to 2m;
- Installing an approximately 50% porous (open) pergola, similar to the pergolas shown on the proposed landscaping scheme, situated at probe location 110; and
- Installing an approximately 50% porous (open) pergola, similar to the pergolas shown on the proposed landscaping scheme, situated at probe location 161.

Approximately 50% porous (open) floor to roof level screens adjacent to probe 116 for a total length of 14m were also developed during wind tunnel testing to improve wind conditions in this area. Subsequently, alternative mitigation has been considered for this area as detailed in Appendix D. The amended mitigation would be expected to be similarly effective to that as tested such that wind conditions would be suitable for the use of this area.

With the specified wind mitigation measures in place, wind conditions would be suitable for the intended pedestrian uses with no safety concerns. Additionally, wind conditions at corner balconies at the top two levels of Block A and Block B would be suitable for private amenity use with the proposed 1.1m tall solid glazed balustrades.

1. INTRODUCTION

RWDI was retained by Trium Environmental Consulting to conduct a pedestrian level wind microclimate assessment for the proposed Broad Street Mall development (referred to as the “Proposed Development” hereafter in this report) in Reading, UK. This report presents the background, objectives, results and conclusion from RWDI’s assessment. A summary of the overall recommendations from the investigation are presented in Section 6 “Conclusions”.

2. BACKGROUND AND APPROACH

An application was submitted to Reading Borough Council in 2019, at this stage the Proposed Development comprised Block A (22 Storeys) Block B (18 storeys) Block C (18 storeys) and Block E (5 storeys). The Proposed Development was subject to wind tunnel testing and assessment which were submitted alongside the planning application. Since the submission the design of the Proposed Development has been subject amendments, namely the reduction in height of Block A from 22 storeys to 20 storeys. As such further wind tunnel testing has been undertaken to identify suitable mitigation measures and confirm with the implementation of mitigation that wind conditions would be suitable for the intended uses with no potential safety concerns.

Wind tunnel tests were conducted on a 1:300 scale model of the Proposed Development. The investigation quantifies the wind conditions within and around the Site through comparing the measured wind velocity and frequency of occurrence with the Lawson Comfort Criteria. Meteorological data from London Heathrow Airport was analysed and adjusted to the Site conditions by modelling the effect of the surrounding terrain roughness on the wind velocities approaching the Site.

Measurements were taken at up to 206 locations for 36 wind directions, in 10° increments. The measurements covered ground level locations along the building façades and at corners, near main entrances, on pedestrian routes within and around the Site, terraces and balconies within the Site. Analysis was conducted on seasonal basis, however, the report focuses primarily on the windiest season (i.e. winter) and the summer season results, when pedestrian activity generally requires calmer conditions.

This report presents a description of the methodology used and the results of two configurations tested in the wind tunnel, namely:

- Configuration 1: Proposed Development with Existing Surrounding Buildings, Landscaping and Mitigation Measures;
- Configuration 2: Proposed Development with Cumulative Surrounding Buildings, Landscaping and Mitigation Measures.

2.1 Site Description and Surroundings

The Proposed Development is located in Reading, around 500m to the south west of Reading Station with the site bounded by Oxford Road to the north, Hosier Street to the south, St Mary's Butts to the east, and Queens Walk to the west. The OS Landranger reference grid for the Site is SU711734.

The site is currently occupied by Broad Street Mall to which three additional towers will be added, and the surrounding area comprises low- to medium-rise residential and commercial buildings. The surrounding area is characterised by 'suburban' terrain which results in a relatively turbulent wind environment with a lower mean wind speed (compared to an equivalent site in open terrain). A satellite view of the approximate Site location is highlighted in yellow with its surroundings in Figure 1.



Figure 1: Aerial view of the existing Site (approximate extent of the Site highlighted in yellow)

2.2 The Proposed Development

The Proposed Development retains the existing Broad Street Mall structure and adds three tall residential towers (Towers A, B and C) to be linked by a podium which will be used as outdoor amenity space. Balconies would be situated on Towers A and B. There are also a less substantial height increases to Quadrant house along the East of the site on St Mary's Butts, and along the North of the site on Oxford Road.

The wind tunnel tested the taller tower options, which result in Tower A being 20 storeys above Broad Street Mall, Tower B being 18 storeys above Broad Street Mall, and Tower C being 18 storeys above Broad Street Mall.

3. METHODOLOGY AND ASSESSMENT CRITERIA

Wind tunnel testing is the most well-established and robust means of assessing the pedestrian wind microclimate with the Proposed Development in place. It enables the wind conditions at the Site to be quantified and classified in accordance with the Criteria. To produce the results within the tunnel, a 1:300 scale model of the existing buildings at the Site and the surrounding area within a 360 metre (m) radius of the centre of the Site was constructed.

The basic methodology for quantifying the pedestrian level wind environment is outlined below:

1. Measure the wind speeds at pedestrian level in the wind tunnel relative to a reference wind speed;
2. Adjust standard meteorological data to account for conditions at the Site;
3. Combine these to obtain the expected frequency and magnitude of wind speeds at pedestrian level; and
4. Compare the results with the Criteria to 'grade' conditions around the Site.



Figure 2: Image of the Proposed Development with Cumulative Surrounding Buildings, Landscaping and Mitigation Measures. (View in the wind tunnel from south)

3.1 Simulation of Atmospheric Winds

The wind is turbulent, or gusty, and this turbulence varies depending upon the Site. It is necessary to reflect these differences in the wind tunnel test. In addition, the atmospheric boundary layer is a shear flow which means that the mean wind speed increases with height. Modelling these effects is achieved by a combination of spires and floor roughness elements to create a naturally grown boundary layer that is representative of urban or open country conditions, as appropriate. The detailed contoured proximity model around the Site is used for fine-tuning the flow and create conditions similar to those expected at full scale.

3.2 Measurement Technique

Wind speed measurements were made using Irwin probes. For pedestrian comfort studies, both the mean wind speed and the peak wind speed are measured at selected locations at the Site and surrounding area to represent sensitive receptors, such as entrances, amenity areas and thoroughfares, at a scaled height of 1.5m above ground level. The typical equivalent full-scale time period for measuring the mean wind speed is around 90 minutes, whereas the peak wind speed is taken as the wind speed exceeded for 1% of the time.

Wind speed at each location was measured for 36 wind directions in 10° increments, with 0° representing wind blowing from the north and 90° wind blowing from the east.

3.3 Scaling

The length scale of the model was 1:300 and the velocity scale was approximately 1:2 for strong winds. Consequently, the time scale for the tests was 1:150, or in other words 1 second in the wind tunnel is equivalent to 150 seconds at full scale.

3.4 Meteorological Data

Approximately 30 years of meteorological data for Reading (represented by a dataset from Heathrow airport) was used in this report and is presented in Appendix B as wind roses by season. The radial axis indicates the directional distribution of winds. The seasons are defined as spring (March, April and May), summer (June, July and August), autumn (September, October and November) and winter (December, January and February).

The wind data derived from the meteorological station of Heathrow airport has been corrected to standard conditions of 10m above open flat level country terrain, over which pedestrian level wind speeds are greatest. The meteorological station data are then adjusted to site conditions by assessing the terrain in all directions around the Development. Pedestrian level wind speeds at open, flat, level country terrain are typically greater than at an inner-city environment with low to medium rise buildings, due to the difference in boundary layer thickness for the vertical wind profile. Hence roughness lengths, a parameter for the wind profile equations that specifies the type of terrain, were estimated in all directions for appropriate upwind distances by use of virtual geographical software, and input into calculations for the wind profiles.

The meteorological data indicate that the prevailing wind direction throughout the year is from the south-west, which is a consistent feature of met stations in the South of the United Kingdom.

The combination of meteorological data and velocity ratios permits the percentage of time that wind speeds are exceeded on the site to be evaluated. The locations can then be assessed using the Criteria, as described below.

3.5 Pedestrian Comfort

The assessment of the wind conditions requires a standard against which the measurements can be compared. This report uses the Lawson Comfort Criteria, which have been established for over thirty years. The Criteria, which seek to define the reaction of an average pedestrian to the wind, are described in Table 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.

The Criteria sets out four pedestrian activities 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 for sitting need to be calmer than a location that people merely walk past.

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.

The Criteria are derived for open air conditions and assume that pedestrians will be suitably dressed for the season. Thermal comfort is discussed with reference to acceptable wind environments but not evaluated as part of the assessment.

Table 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 acceptable for main building entrances, pick-up/drop-off points and bus stops
	Strolling	6-8 m/s	Moderate breezes that would be appropriate for leisure walking along a city/town street, plaza or park
	Business Walking	8-10 m/s	Relatively high speeds that can be tolerated if one's objective is to walk, run or cycle without lingering
	Roadway	>10 m/s	Winds of this magnitude are considered a nuisance for most activities, and wind mitigation is typically recommended

3.6 Strong Winds

Lawson¹ also specified a lower limit strong wind threshold when winds exceed 15m/s for more than 2.2 hours of the year. Exceedance of this threshold may indicate a need for remedial measures or a careful assessment of the expected use of that location; e.g. is it reasonable to expect elderly or very young pedestrians to be present at the location on the windiest day of the year?

Wind speeds that exceed 20m/s for more than 2 hours of the year represent a safety issue for all members of the population, which would require mitigation to provide an appropriate wind environment.

Strong winds are generally associated with areas which would be classified as acceptable for walking or as uncomfortable. In a mixed-use urban development scheme, walking and uncomfortable conditions would not usually form part of the 'target' wind environment and would usually require mitigation due to pedestrian comfort considerations. This mitigation would also reduce the frequency of, or even eliminate, any strong winds.

¹ Lawson T.V. (April 2001), Building Aerodynamics, Imperial College Press
rwdi.com

4. RESULTS

4.1 Details of Analysis

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 0° through to 360°. The reference height in the wind tunnel was at the equivalent full-scale height of 120 metres. Table 2 presents the mean factors for the Site.

Table 2: BREVe3 mean factors at 120m above ground level

Wind Direction	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°
Mean Factor at 120m	1.41	1.42	1.44	1.43	1.39	1.45	1.46	1.51	1.46	1.41	1.41	1.40

4.2 Desired Pedestrian Activity around the Development

For the Proposed Development, the target conditions are:

1. Strolling during the windiest season on pedestrian thoroughfares;
2. Standing conditions at main entrances, drop off areas or taxi ranks, and bus stops throughout the year;
3. Standing use wind conditions at private balconies or mixed-use amenity areas where outdoor seating is not designated during the summer season; and
4. Sitting conditions at outdoor seating and amenity areas during the summer season when these areas are more likely to be frequently used by pedestrians.

The walking and uncomfortable classifications are usually avoided because of their association with occasional strong winds, unless they are on a minor pedestrian route or a route where pedestrian access could be controlled in the event of strong winds.

Achieving a sitting classification in the summer usually means that the same receptor would be acceptable for standing in the windiest season because winds are stronger at this time of year. This is considered an acceptable occurrence for the majority of external amenity spaces because other factors such as air temperature and precipitation influence people's perceptions about the 'need' to use seating in the middle of winter.

It should be noted that a mixture of sitting and standing uses is acceptable for a large terrace spaces, provided that any desired seating areas are situated in areas having sitting wind conditions. In addition, standing use conditions are also considered tolerable at private amenity areas (such as balconies) where the occupant has control over the use of the space.

4.3 Performance against the Lawson Comfort Criteria

The results of the assessment for each configuration against Lawson Comfort Criteria are presented graphically in Figures 3 to 22. The proposed landscaping scheme (as per information sent through on 14th February 2020, titled '1205-005 I Landscaping General Arrangement Plan Ground Floor.pdf' and '1205-008 I General Arrangement Plan Amenity Terrace – Block A, B, C and E.pdf') was applied for all configurations.

An assessment of the suitability of wind conditions at the Proposed Development is dependent on knowing the intended pedestrian use of any given area at or surrounding the Site. The table below outlines the expected intended pedestrian uses of the Site and surrounding area as understood by RWDI for the purposes of this assessment in reference to the measurement locations.

Table 3: Expected intended pedestrian use table

Expected Intended Use	Measurement Locations
Thoroughfares	3, 4, 8, 13, 14, 16, 17, 19, 22, 23, 24, 25, 26, 28, 30, 32, 33, 37, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 52, 53, 54, 56, 58, 59, 60, 61, 62, 63, 65, 66, 68, 70, 71, 72, 73, 75, 76, 77, 78, 79, 80, 81, 82, 83, 86, 87, 88, 90, 91, 103, 105, 142, 143, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 157, 158, 159, 160, 161, 162, 163, 164
Bus Stops	69, 156, 181
Balconies	188, 189, 190, 191, 194, 195, 196, 197
Car Park	93, 94, 95, 96, 97, 98, 99, 101, 106, 108, 116, 117, 119, 126, 138, 139, 140, 141
Entrances (Off-Site)	1, 2, 10, 20, 21, 27, 35, 36, 51, 55, 67
Entrances (On-Site)	7, 15, 18, 29, 31, 34, 38, 39, 57, 84, 85, 89, 92, 155
Ground Level Amenity – Mixed Use	5, 6, 9, 11, 12, 64, 74, 144, 182, 183, 184
Podium – Mixed Use	100, 102, 104, 105, 109, 110, 112, 113, 114, 115, 121, 127, 128, 133, 165, 166, 168
Roof Terrace – Mixed Use	169, 171, 185, 186, 187, 192, 193, 198, 199, 200, 201, 202, 203, 204, 205, 206

4.3.1 Configuration 1: Proposed Development with Existing Surrounding Buildings, Landscaping and Mitigation Measures

The wind microclimate results for Configuration 1 are shown in the following figures:

- Figure 3: Windiest Season (Ground Level);
- Figure 4: Windiest Season (Terrace Levels);
- Figure 5: Summer Season (Ground Level);
- Figure 6: Summer Season (Terrace Levels);
- Figure 7: Annual Strong Winds Exceedances (Ground); and
- Figure 8: Annual Strong Winds Exceedances (Terrace Levels).

The following mitigation measures were implemented (shown in Figures 20-23):

- An increase in the height of the solid balustrade on the south-western corner, from 1m to 2m.
- Addition of an approximately 50% porous (open) screen, next to probe 116 from ground level up to the roof and a total length of 14m (please refer to Appendix D for an update on this mitigation).
- Installing an approximately 50% porous (open) pergola, similar to the pergolas shown on the proposed landscaping scheme, situated at probe location 110.
- Installing an approximately 50% porous (open) pergola, similar to the pergolas shown on the proposed landscaping scheme, situated at probe location 161.

4.3.2 Configuration 2: Proposed Development with Cumulative Surrounding Buildings, Landscaping and Mitigation Measures

The wind microclimate results for Configuration 2 are shown in the following figures:

- Figure 9: Windiest Season (Ground Level);
- Figure 10: Windiest Season (Terrace Levels);
- Figure 11: Summer Season (Ground Level);
- Figure 12: Summer Season (Terrace Levels);
- Figure 13: Annual Strong Winds Exceedances (Ground Level); and
- Figure 14: Annual Strong Winds Exceedances (Terrace Levels).

The following future schemes were considered for the cumulative assessment:

- Chatham Street (Application Reference: 170326);
- 20 Hosier Street (Application Reference: 182054);
- 52 – 55 Friar Street (Application Reference: 162210);
- Plot E & Telecom House Land Friar Street/ Garrard Street Station Hill (Application Reference: 151426); and
- Station Hill (Application Reference: 151427).

The following mitigation measures were implemented (shown in Figures 20-23):

- An increase in the height of the solid balustrade on the south-western corner, from 1m to 2m.
- Addition of an approximately 50% porous (open) screen, next to probe 116 from ground level up to the roof and a total length of 14m (please refer to Appendix D for an update on this mitigation).
- Installing an approximately 50% porous (open) pergola, similar to the pergolas shown on the proposed landscaping scheme, situated at probe location 110.
- Installing an approximately 50% porous (open) pergola, similar to the pergolas shown on the proposed landscaping scheme, situated at probe location 161.

4.4 Occurrence of Strong Winds

Areas with occasional strong winds exceeding the 15m/s or 20m/s thresholds are presented in the annual safety exceedances figures. Strong winds in excess of 15m/s are considered a safety issue and would require mitigation, apart from where these conditions are pre-existing and occurring in the baseline.

Table 4: Annual exceedance of strong winds

Location	Strong Wind Exceedance	Main Wind Direction	Hours exceeding 15m/s
Configuration 1: Proposed Development with Existing Surrounding Buildings, Landscaping and Mitigation Measures			
No exceedance of Strong Winds threshold			
Configuration 2: Proposed Development with Cumulative Surrounding Buildings, Landscaping and Mitigation Measures			
No exceedance of Strong Winds threshold			

5. MITIGATION MEASURES

Initial wind tunnel tests of the proposed development for the 2019 submission identified conditions on podium amenity space (locations 110, 127, 162, 163 and 166), which would have strolling use wind conditions, up to two categories windier than suitable, even in the presence of the proposed landscaping scheme. Additionally, a number of areas would have strong winds that would be a safety concern for pedestrians. These areas include the south-west corner or the site on the car park level (location 116) and in the amenity space on the podium (locations to the south 110, 127, 162, 163, 166 and 167) and on the Block A private terrace (location 118 in 2019 submission).

Therefore, a mitigation workshop was undertaken to optimise the landscaping to ensure that there would not be any occurrences of strong winds, and that all locations have wind conditions suitable for their intended use.

Iterative wind tunnel testing has been used to develop wind mitigation measures to improve wind conditions and ensure wind conditions at the Proposed Development would be safe for pedestrian and cyclist use. With the wind mitigation measures detailed below integrated into the Proposed Development and landscaping scheme, wind conditions located on the amenity terrace adjacent to the south of Block A (locations 162 and 163), west of Block B (location 110), north of Block C (locations 127, 166 and 167) and located on the southwest corner of the car park (location 116) identified as windier than suitable in the 2019 submission would have suitable wind conditions and no strong winds with the potential to be a safety concern across the site. Wind conditions at the Block A private terrace (location 118 in 2019 submission) and would also have suitable wind conditions at the amended development (location 193).

In addition, it is noted that the wind tunnel testing identified that the corner balconies with 1.1m solid glazed balustrades at the top two storeys of Blocks A and B (probe locations 188-191 and 194-197) would have suitable wind conditions, and as such no mitigation is required.

Those wind mitigation measures developed through iterative wind tunnel testing are as follows:

South-West Corner (Car Park)

- An increase in the height of the balustrade on the south-western corner, from 1m to 2m.
- Addition of an approximately 50% porous (open) screen, next to probe 116 from ground level up to the roof and a total length of 14m (please refer to Appendix D for an update on this mitigation).

Podium Amenity Space

- Installing an approximately 50% porous (open) pergola, similar to the pergolas shown on the proposed landscaping scheme, situated at probe location 110.
- Installing an approximately 50% porous (open) pergola, similar to the pergolas shown on the proposed landscaping scheme, situated at probe location 161.

Images of mitigation measures can be found in Appendix C.

As detailed above, with the implementation of the above mitigation measures, all locations would have wind conditions suitable for their intended use and there would be no occurrences of safety concerns (as presented in Figures 3 to 8 for Configurations 1 and Figures 9 to 14 for Configuration 2).

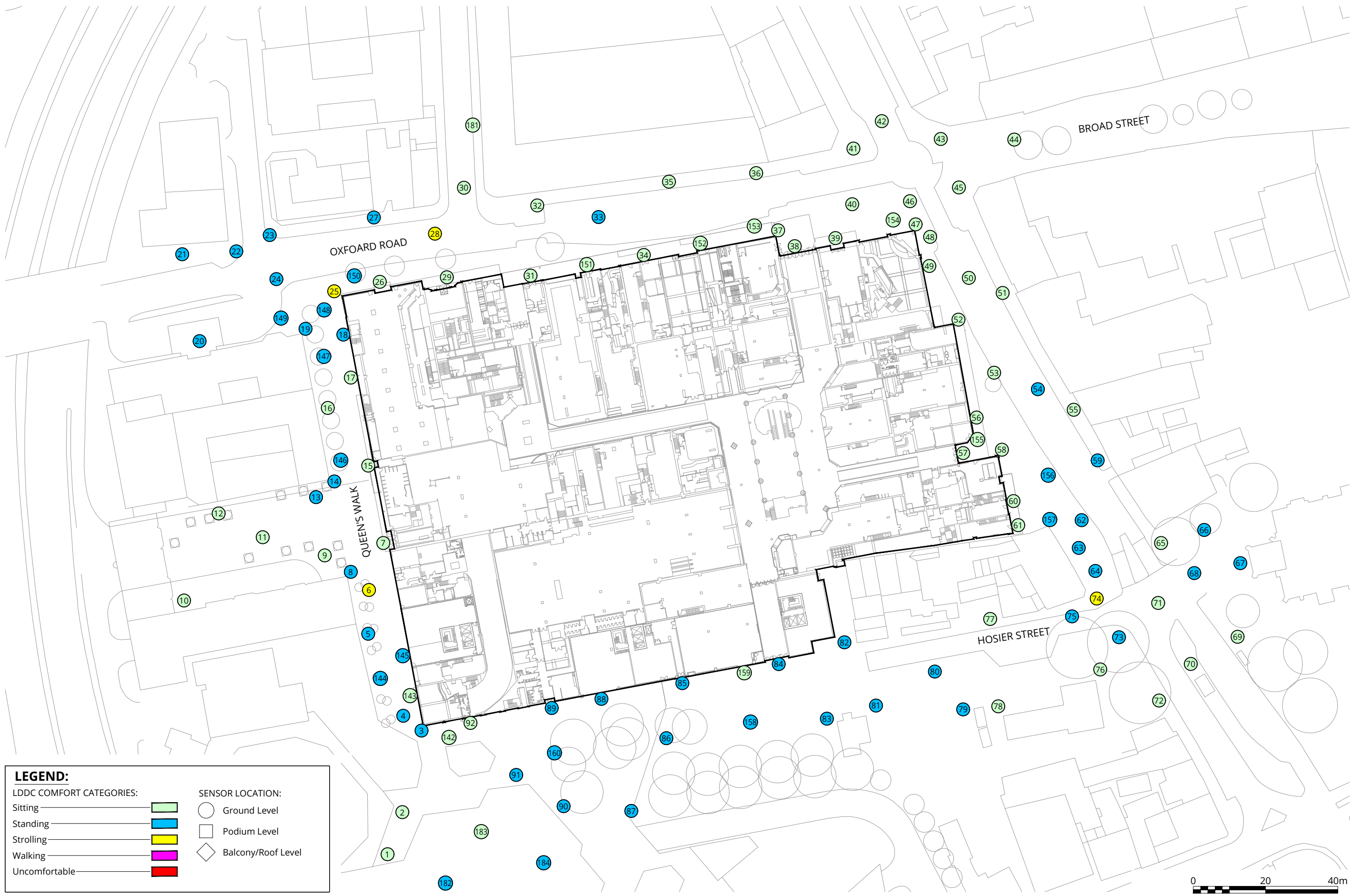
Subsequent to development of the wind mitigation strategy above, it is proposed to replace the approximately 50% porous (open) floor to roof level screens adjacent to probe 116 totally 14m length with alternative mitigation. These measures and the assessment are detailed in Appendix D. The effectiveness of the mitigation would be expected to be similar to that as tested, and as such wind conditions would be anticipated to remain suitable for the use of this area.

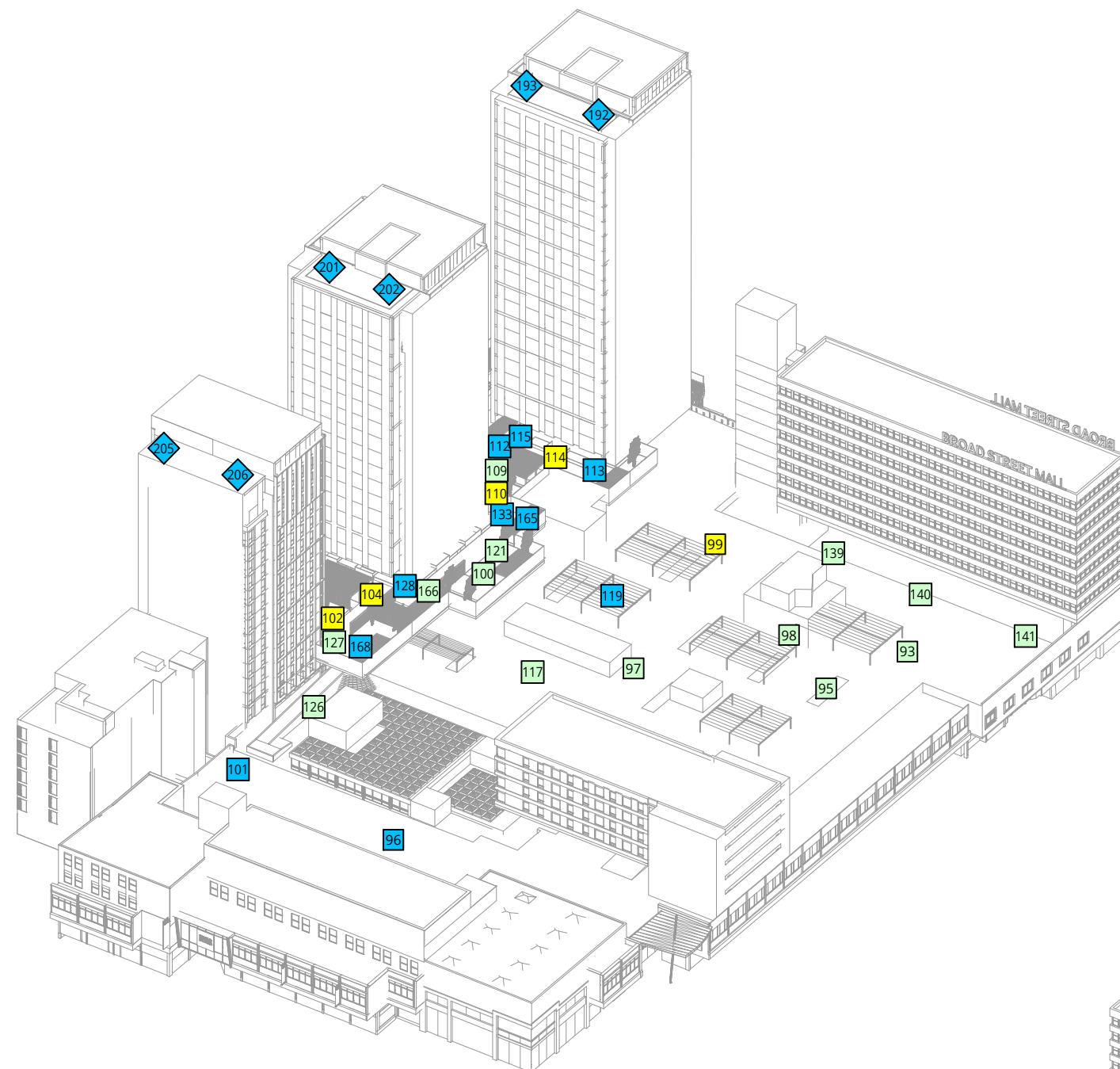
6. CONCLUSIONS

1. The meteorological data for the application Site indicates prevailing winds from the south-west throughout the year with secondary winds from the north-easterly direction, particularly during spring.
2. Initial wind tunnel tests of the development identified appropriate wind conditions for the majority of the Proposed Development during the windiest and summer season. Localised windy conditions would, however, occur at the podium (locations 110 and 161) which would be suitable for strolling use during the summer season, one category windier than suitable. Two locations would also have winds exceeding the safety threshold on the podium (probe location 110) and on the car park (location 116) at the south-western corner.
3. Mitigation measures were developed and assessed through an interactive wind mitigation workshop to improve wind conditions and eliminate safety concerns at areas represented by locations 110, 116 and 161. The following mitigation measures would be required to ensure suitable and safe wind conditions:
 - An increase in the height of the balustrade on the south-western corner, from 1m to 2m.
 - Addition of an approximately 50% porous (open) screen, next to probe 116 from ground level up to the roof and a total length of 14m (please refer to Appendix D for an update on this mitigation).
 - Installing an approximately 50% porous (open) pergola, similar to the pergolas shown on the proposed landscaping scheme, situated at probe location 110.
 - Installing an approximately 50% porous (open) pergola, similar to the pergolas shown on the proposed landscaping scheme, situated at probe location 161.
4. In addition to the wind mitigation measures, corner balconies have been proposed at the top two floors of Block A (locations 188 – 191) and Block B (locations 194 – 197) with solid glazed balustrades 1.1m in height. These balcony spaces would have suitable wind conditions for private amenity use and no mitigation would be required.
5. Subsequent to wind tunnel testing of the wind mitigation strategy the approximately 50% porous (open) floor to roof level screens adjacent to probe 116 at 14m length are proposed to be replaced by a solid canopy (see Appendix D). The amended mitigation would be expected to be similarly effective to that as tested such that wind conditions would be suitable for the intended use of this area.
6. The mitigation measures were tested in the context of both the existing surroundings and the cumulative surroundings (Configurations 1 and 2 respectively). Wind conditions in both configurations would be suitable for their intended usage, with no strong wind safety concerns.

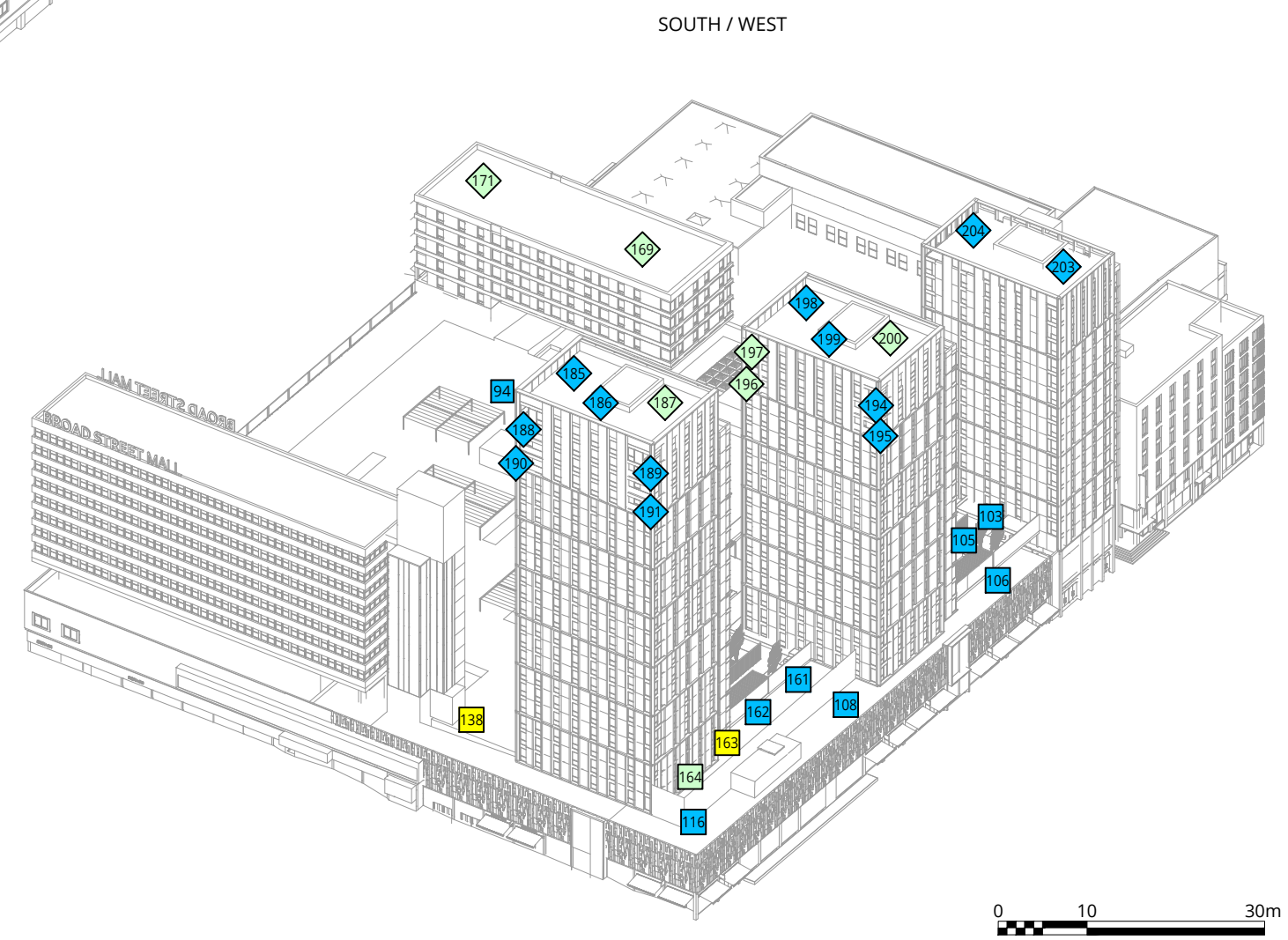
FIGURES







NORTH / EAST



SOUTH / WEST

LEGEND:

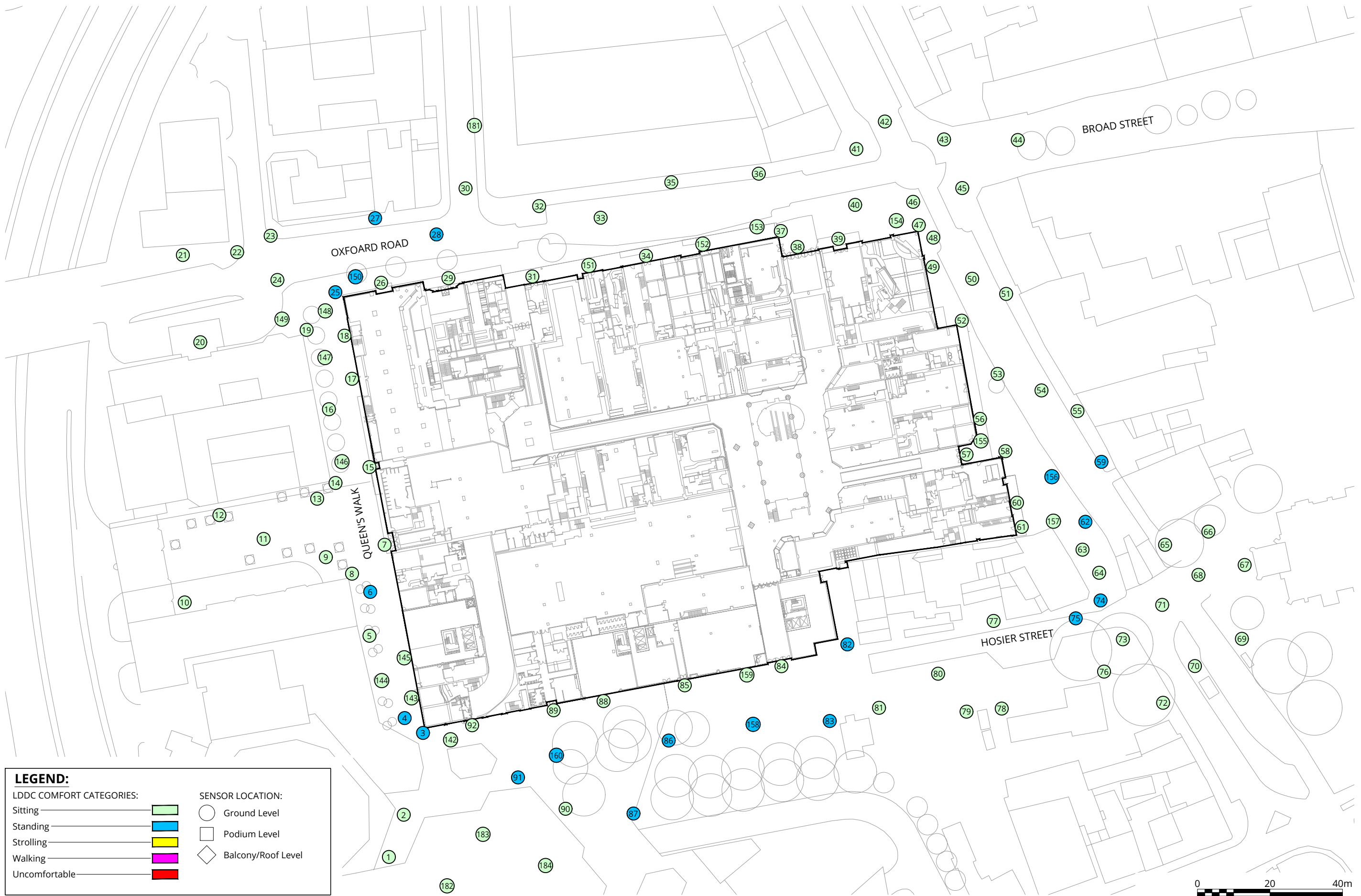
LDDC COMFORT CATEGORIES:

Sitting	
Standing	
Strolling	
Walking	
Uncomfortable	

SENSOR LOCATION:

	Ground Level
	Podium Level
	Balcony/Roof Level





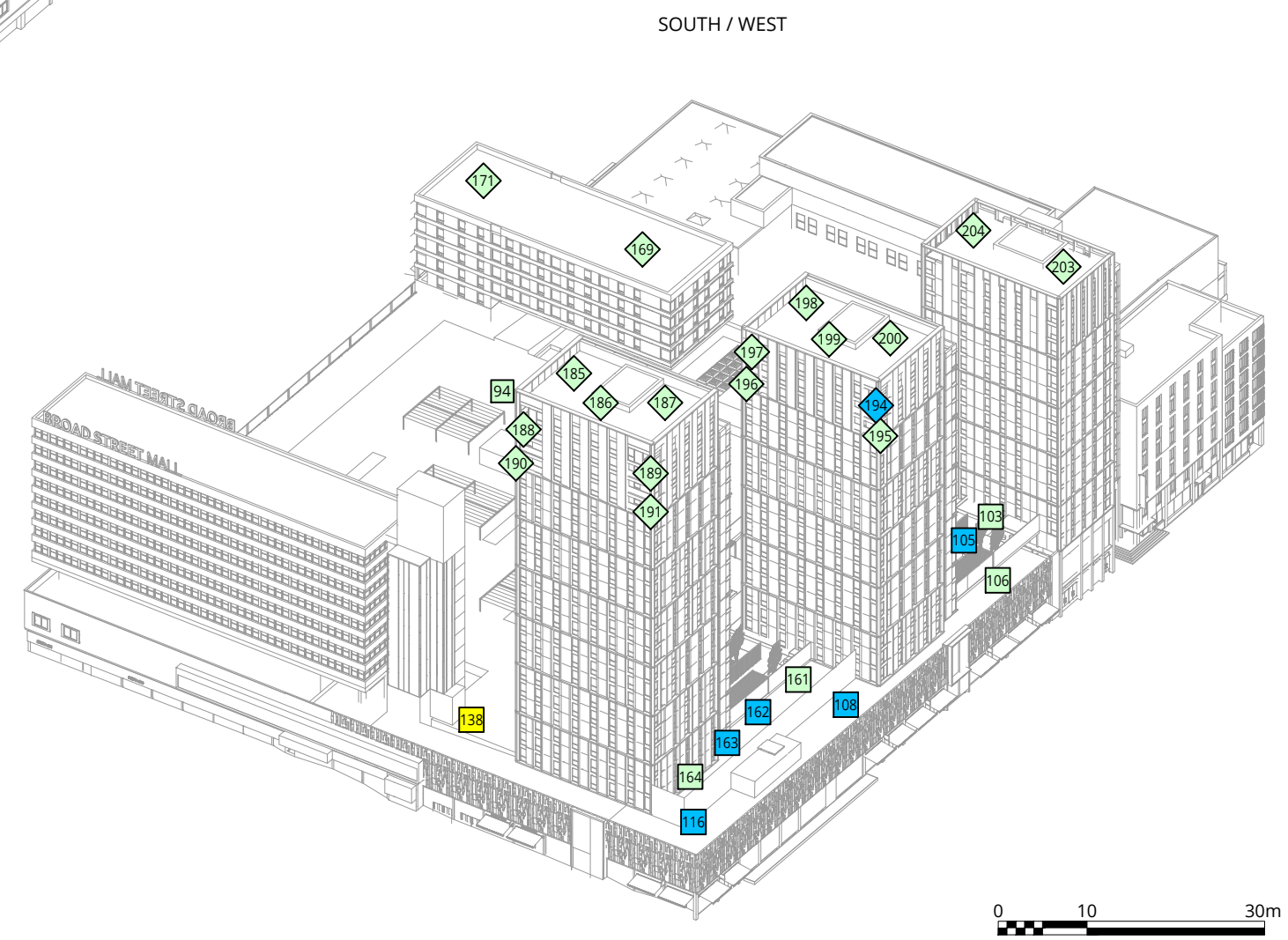
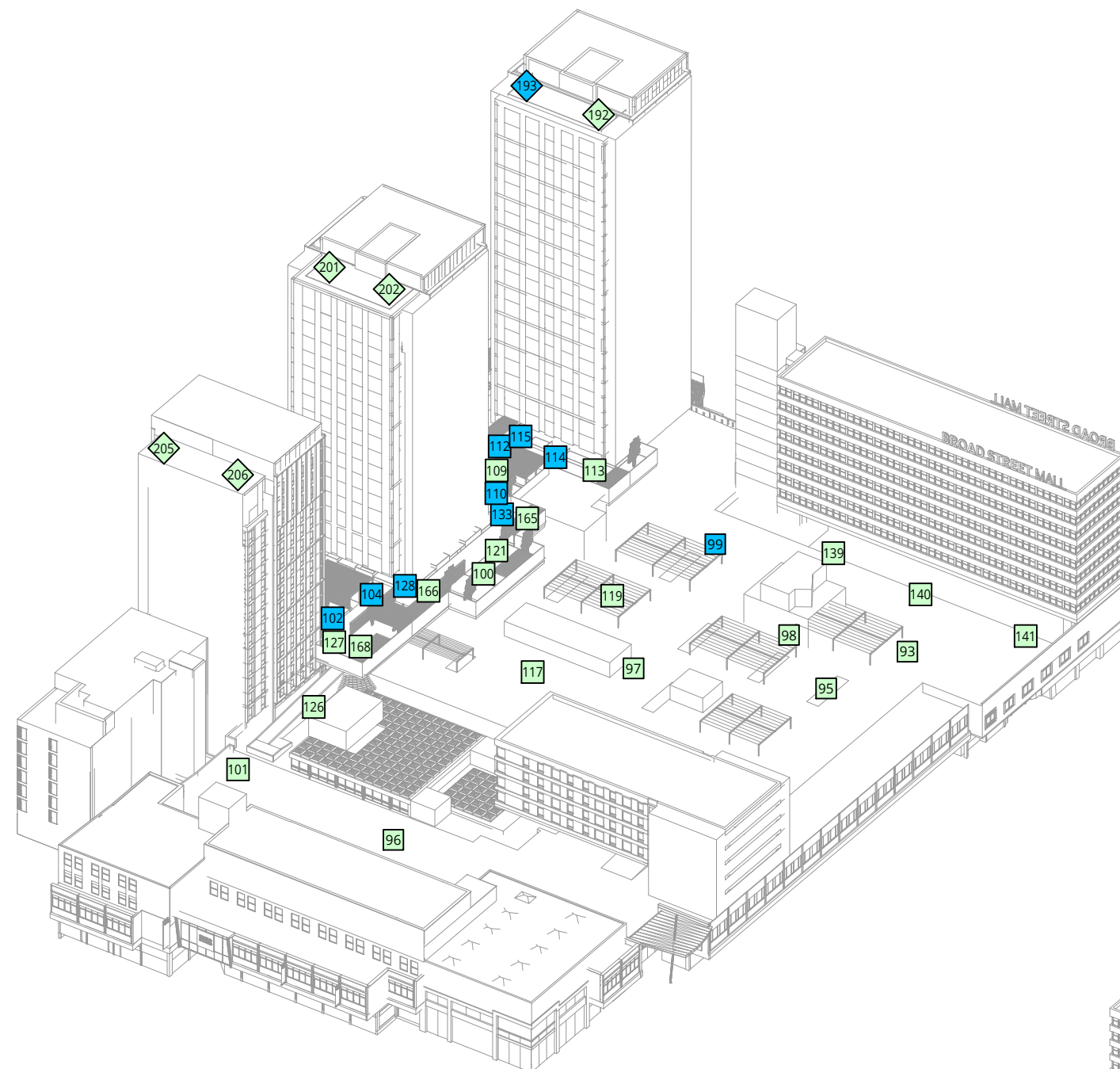
LEGEND:

LDDC COMFORT CATEGORIES:

Sitting	Green
Standing	Blue
Strolling	Yellow
Walking	Magenta
Uncomfortable	Red

SENSOR LOCATION:

Ground Level	Circle
Podium Level	Square
Balcony/Roof Level	Diamond



LEGEND:

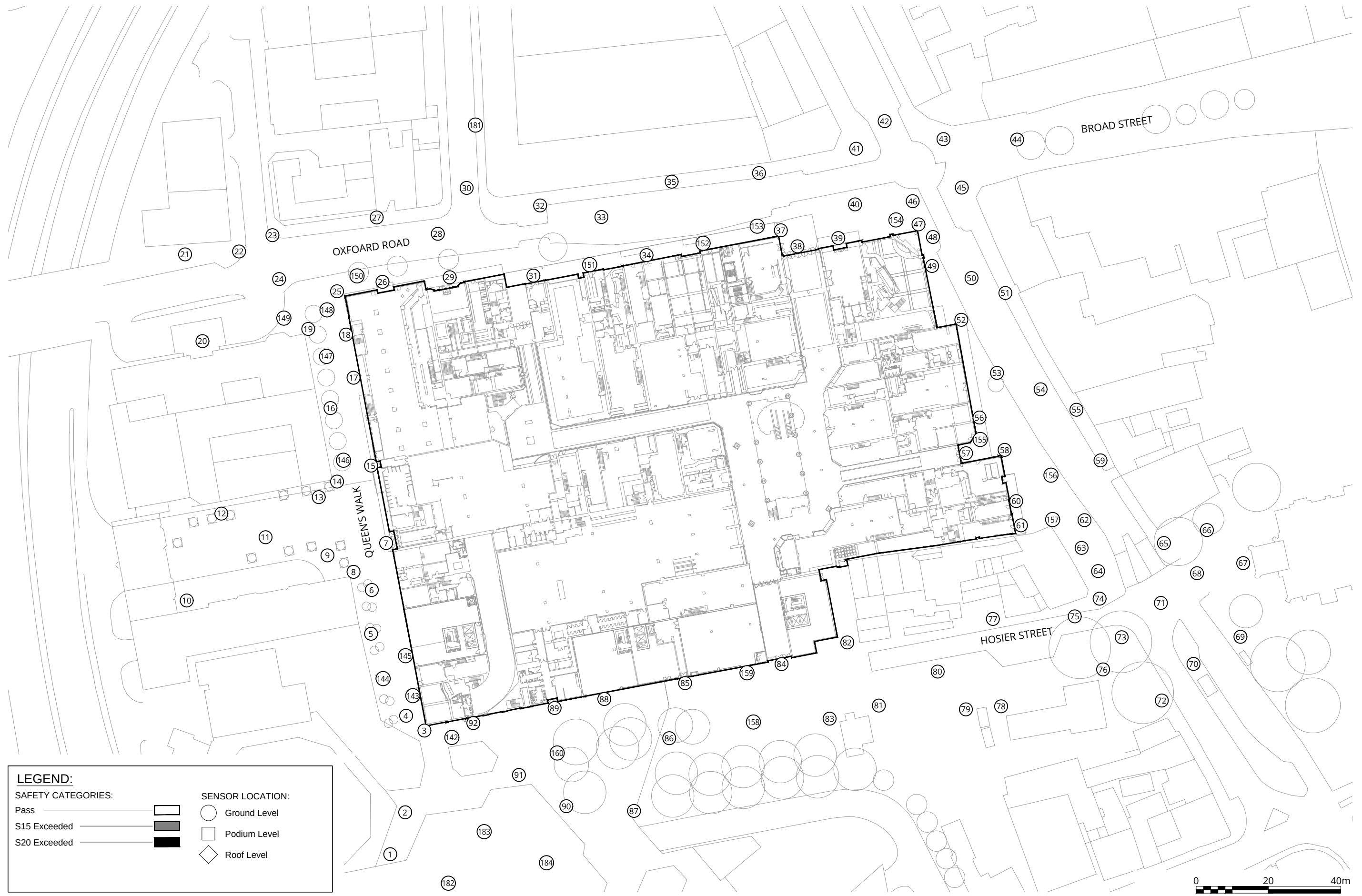
LDDC COMFORT CATEGORIES:

Sitting	
Standing	
Strolling	
Walking	
Uncomfortable	

SENSOR LOCATION:

	Ground Level
	Podium Level
	Balcony/Roof Level





LEGEND:

SAFETY CATEGORIES:

Pass ———— 

S15 Exceeded ———— 

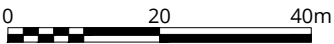
S20 Exceeded ———— 

SENSOR LOCATION:

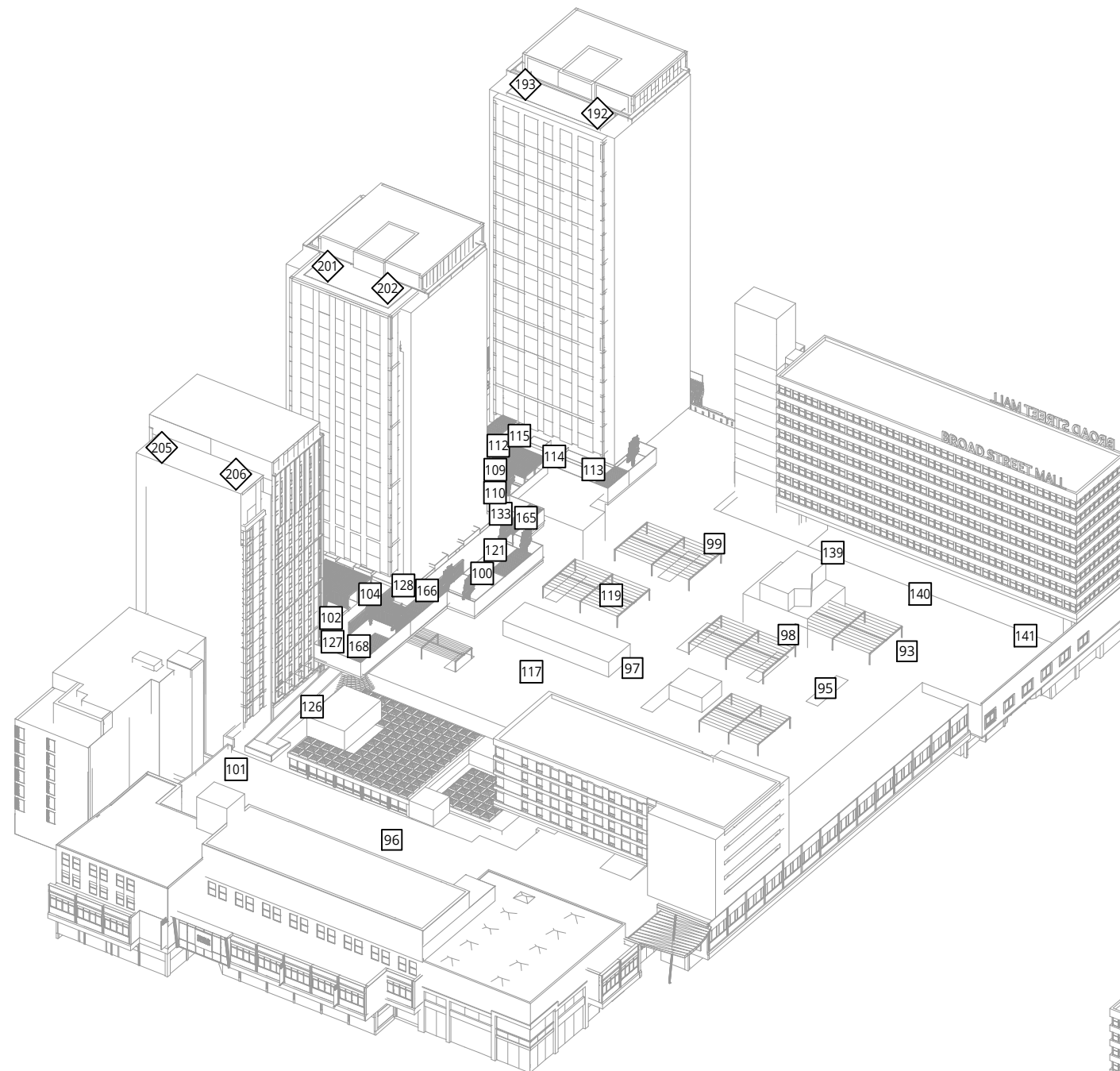
 Ground Level

 Podium Level

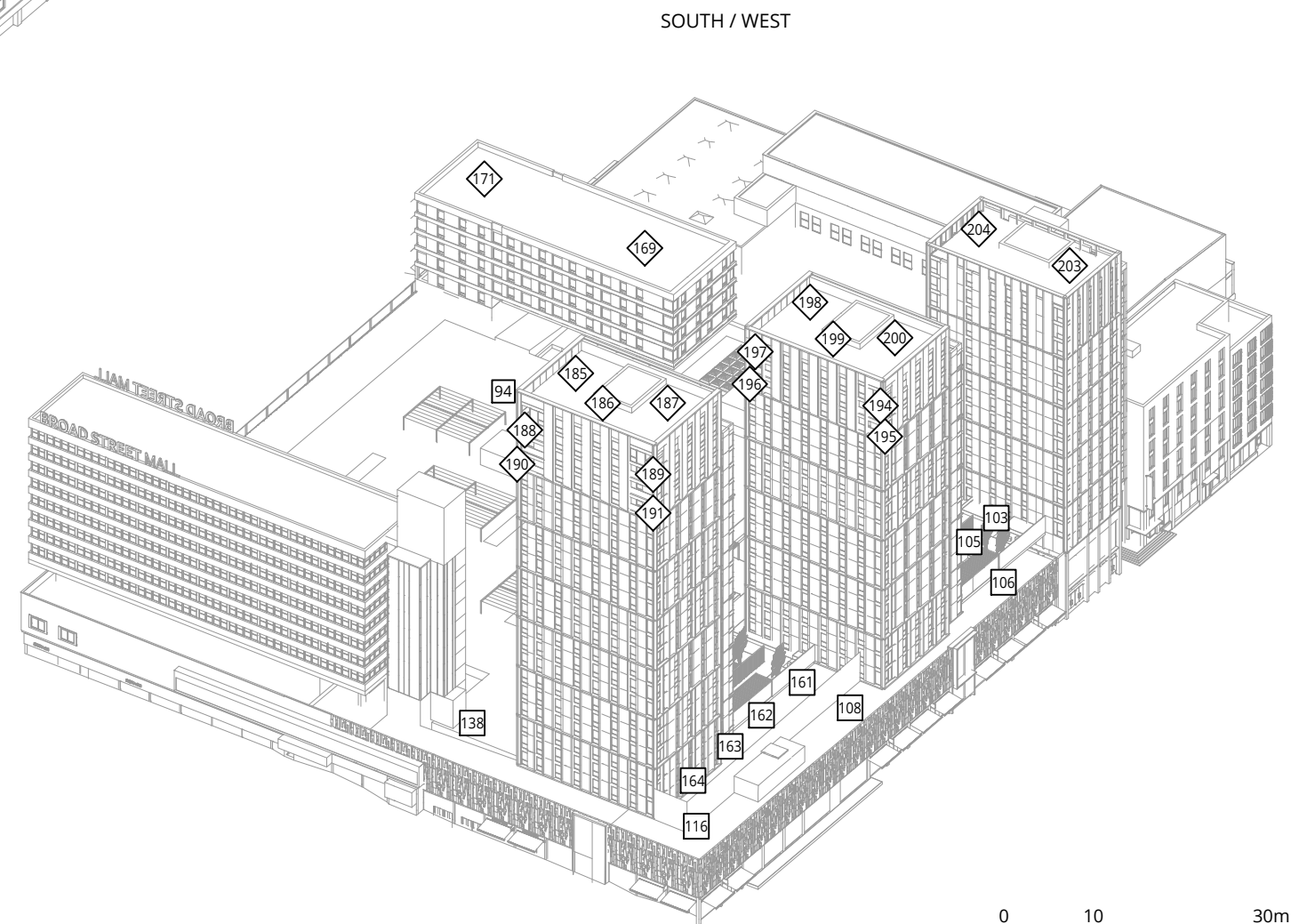
 Roof Level



Project #1803396



NORTH / EAST



SOUTH / WEST

LEGEND:

SAFETY CATEGORIES:

Pass ———— 

S15 Exceeded ———— 

S20 Exceeded ———— 

SENSOR LOCATION:

 Ground Level

 Podium Level

 Roof Level



Pedestrian Wind Safety Conditions - Roof Level

Configuration 1: Proposed Development with Existing Surrounding Buildings, Landscaping and Mitigation Measures

Annual

Broad Street Mall- Reading, UK

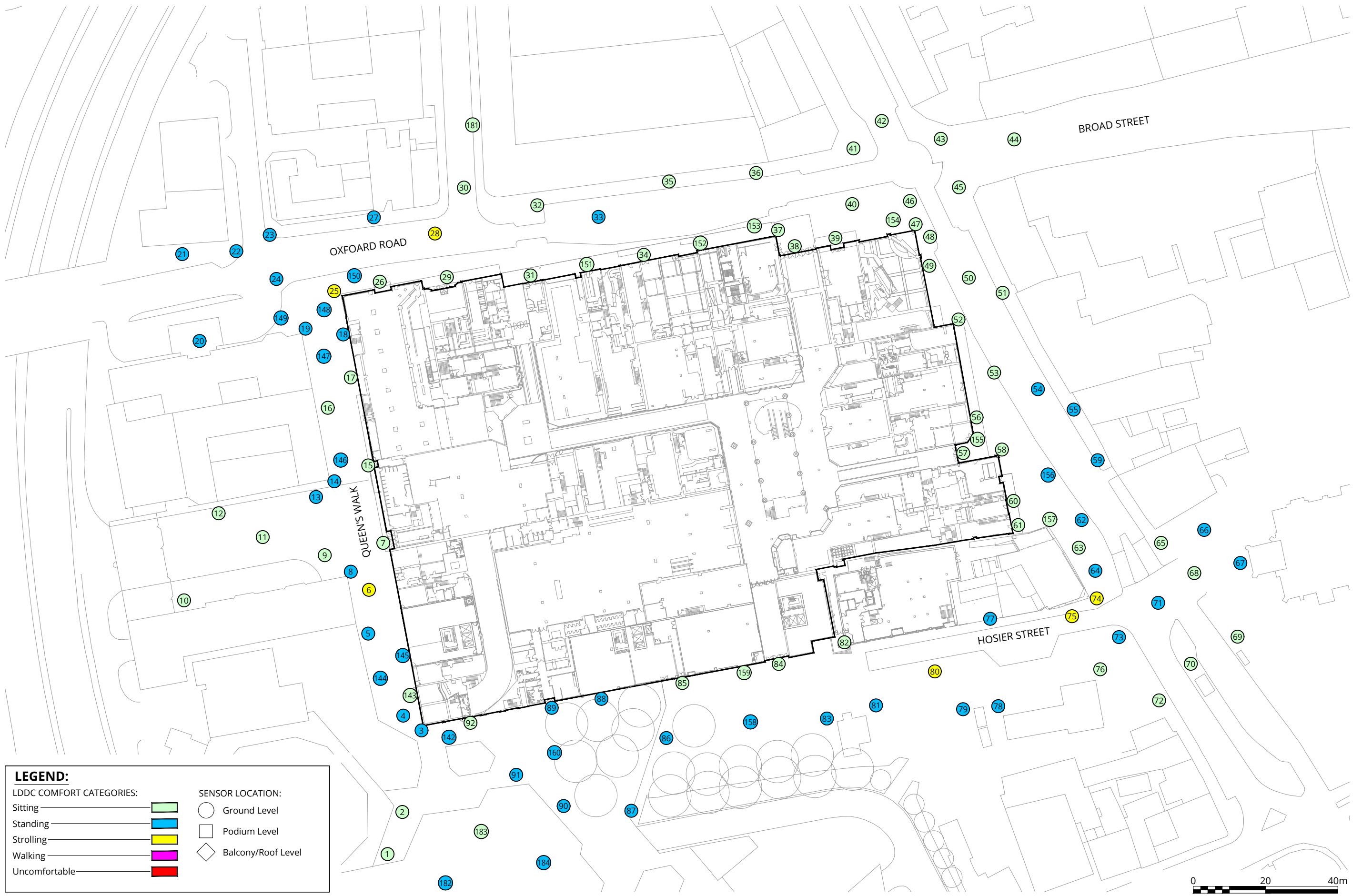
Drawn by: JLF Figure: 8

Approx. Scale @A3: 1:1000

Date Revised: Mar. 18, 2020

Project #1803396





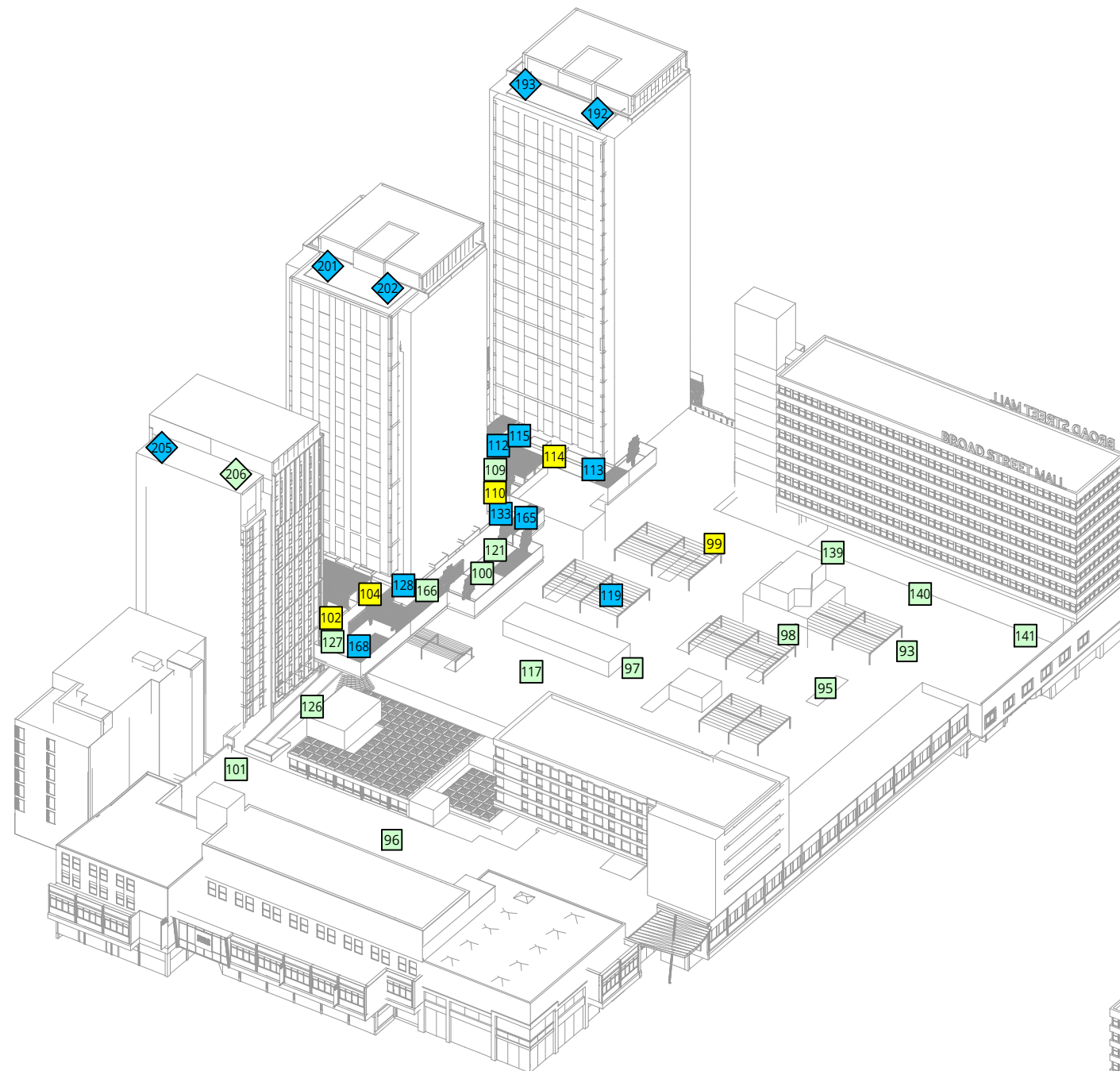
LEGEND:

LDDC COMFORT CATEGORIES:

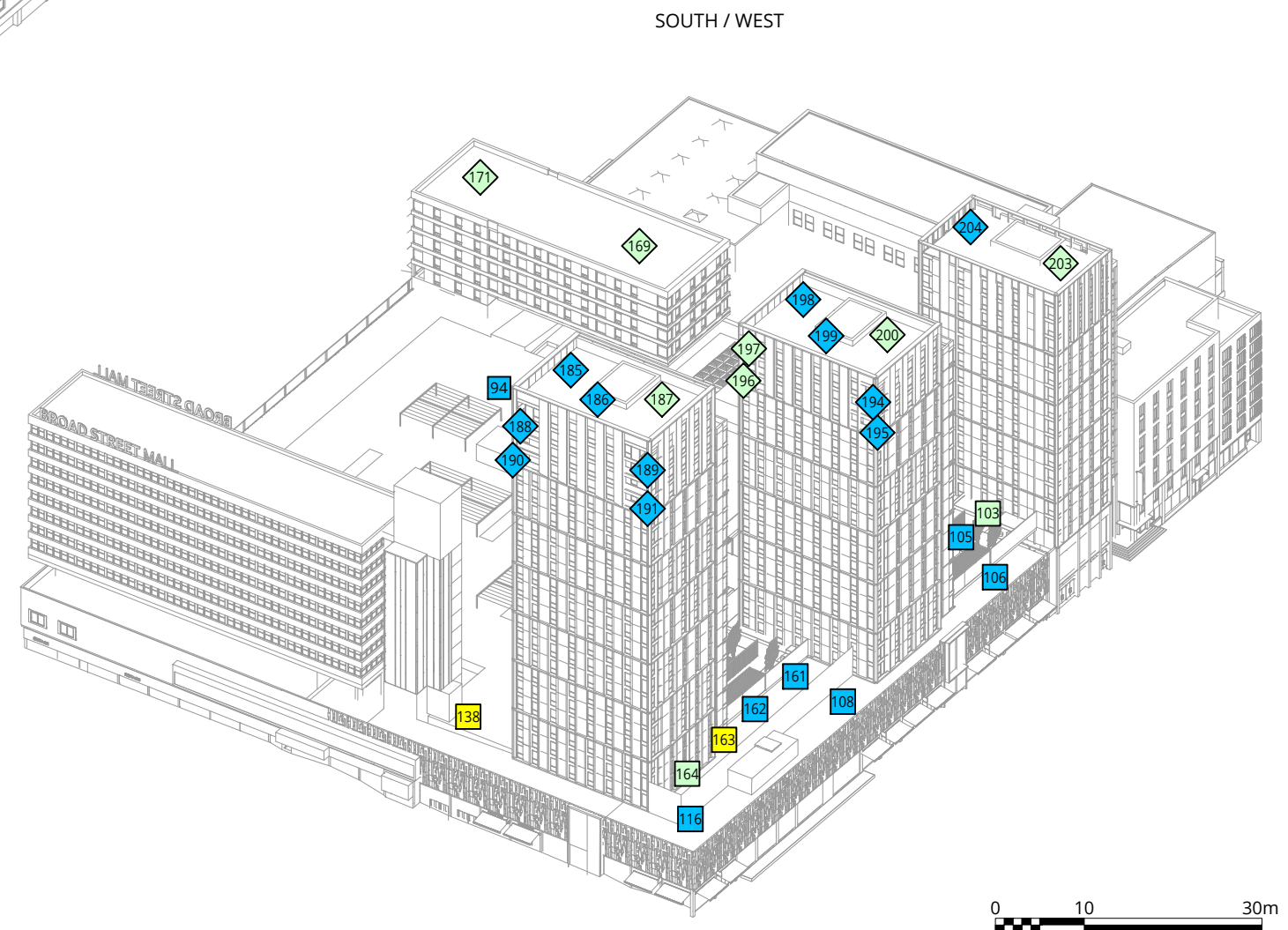
Sitting	Green
Standing	Blue
Strolling	Yellow
Walking	Magenta
Uncomfortable	Red

SENSOR LOCATION:

Ground Level	Circle
Podium Level	Square
Balcony/Roof Level	Diamond



NORTH / EAST



SOUTH / WEST

LEGEND:

LDDC COMFORT CATEGORIES:

Sitting	
Standing	
Strolling	
Walking	
Uncomfortable	

SENSOR LOCATION:

	Ground Level
	Podium Level
	Balcony/Roof Level



Pedestrian Wind Comfort Conditions - Roof Level

Configuration 2: Proposed Development with Cumulative Surrounding Buildings, Landscaping and Mitigation Measures
Windiest Season

Broad Street Mall- Reading, UK

Drawn by: JLF Figure: 10

Approx. Scale @A3: 1:1000

Date Revised: Mar. 18, 2020

Project #1803396





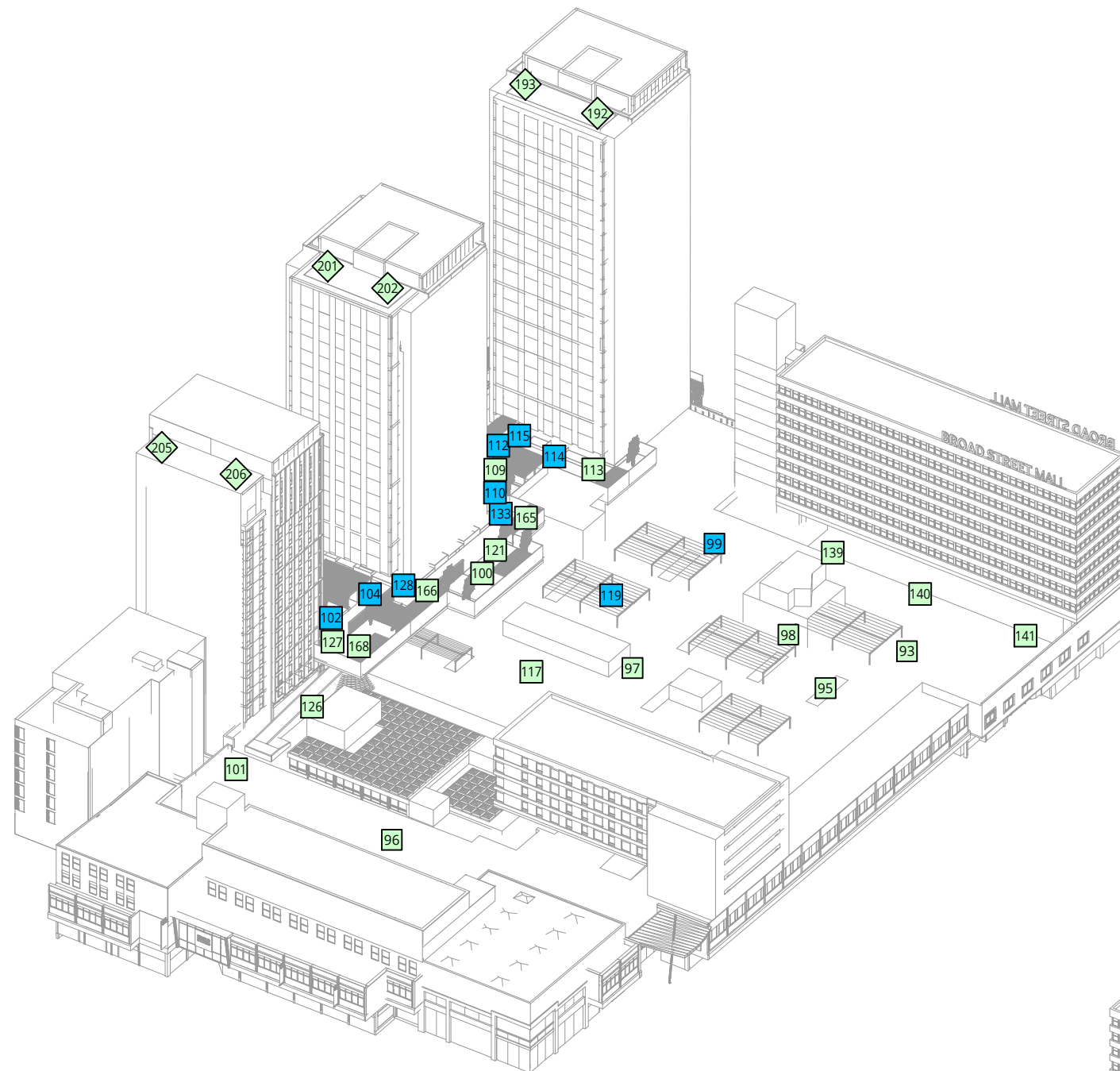
LEGEND:

LDDC COMFORT CATEGORIES:

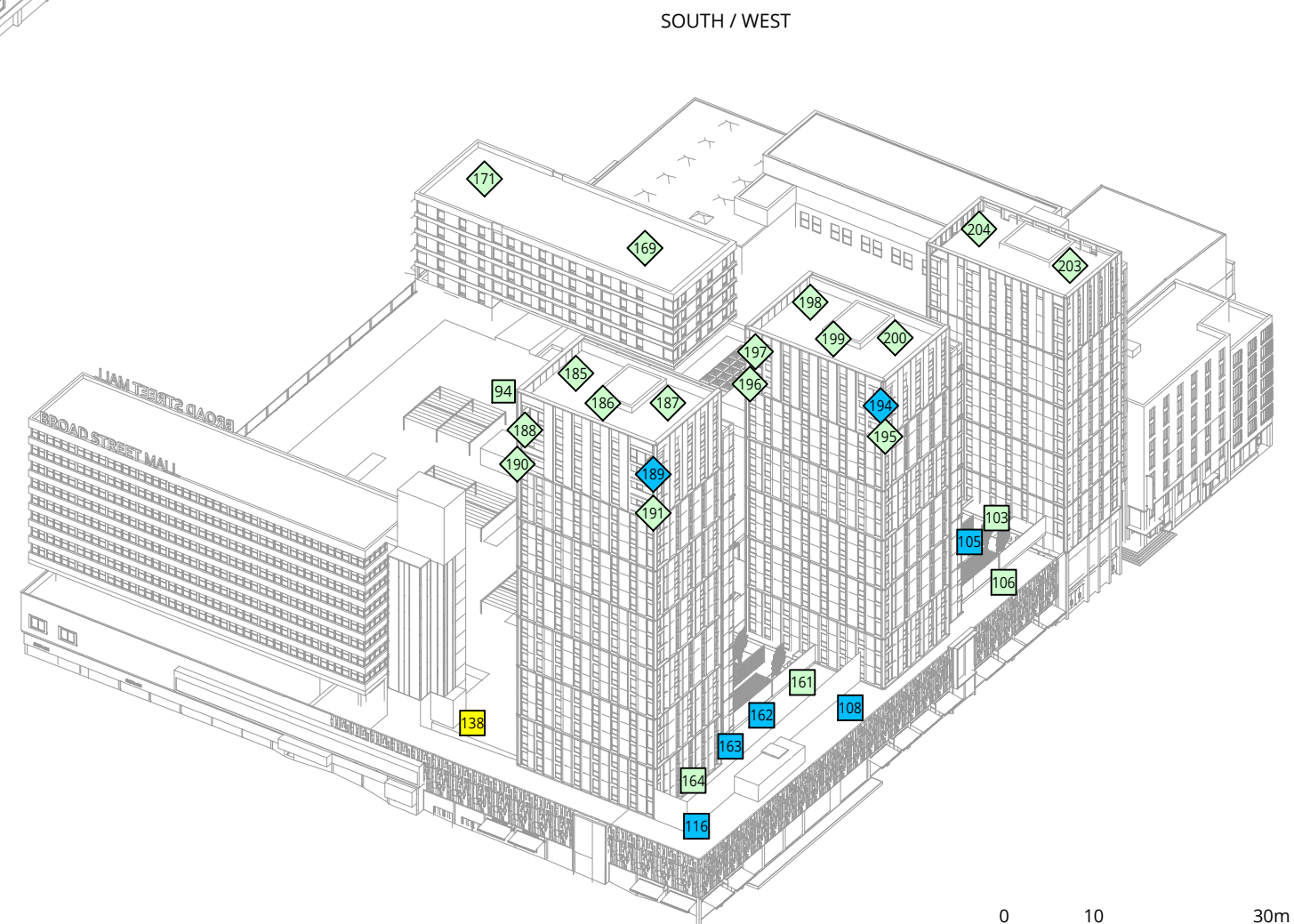
Sitting	Light Green
Standing	Blue
Strolling	Yellow
Walking	Pink
Uncomfortable	Red

SENSOR LOCATION:

○	Ground Level
□	Podium Level
◇	Balcony/Roof Level



NORTH / EAST



SOUTH / WEST

LEGEND:	
LDDC COMFORT CATEGORIES:	
Sitting	Light Green
Standing	Blue
Strolling	Yellow
Walking	Magenta
Uncomfortable	Red
SENSOR LOCATION:	
Ground Level	Circle
Podium Level	Square
Balcony/Roof Level	Diamond



Pedestrian Wind Comfort Conditions - Roof Level

Configuration 2: Proposed Development with Cumulative Surrounding Buildings, Landscaping and Mitigation Measures
Summer Season

Broad Street Mall- Reading, UK

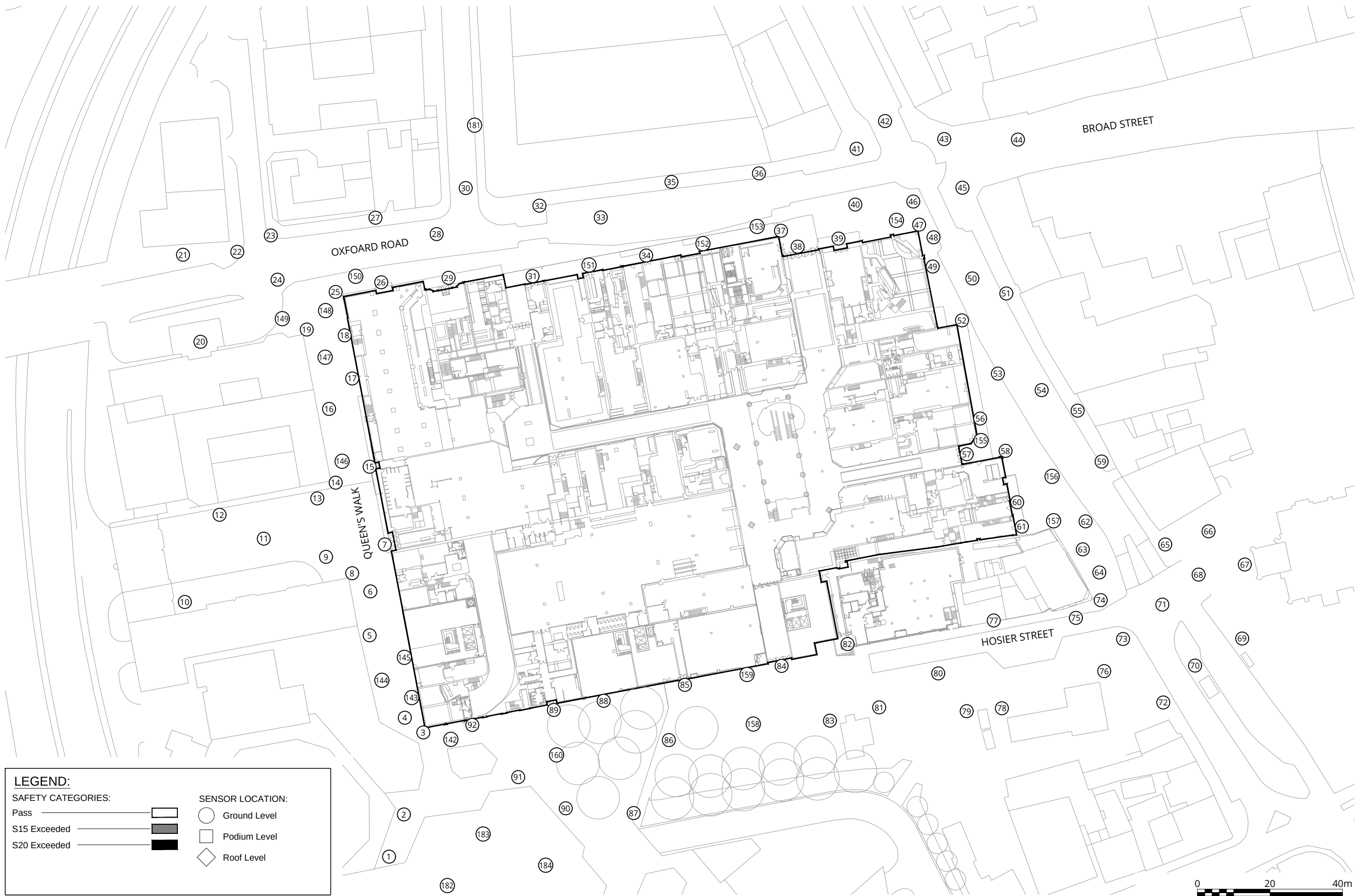
Drawn by: JLF Figure: 12

Approx. Scale @A3: 1:1000

Date Revised: Mar. 18, 2020

Project #1803396





LEGEND:

SAFETY CATEGORIES:

Pass ———— 

S15 Exceeded ———— 

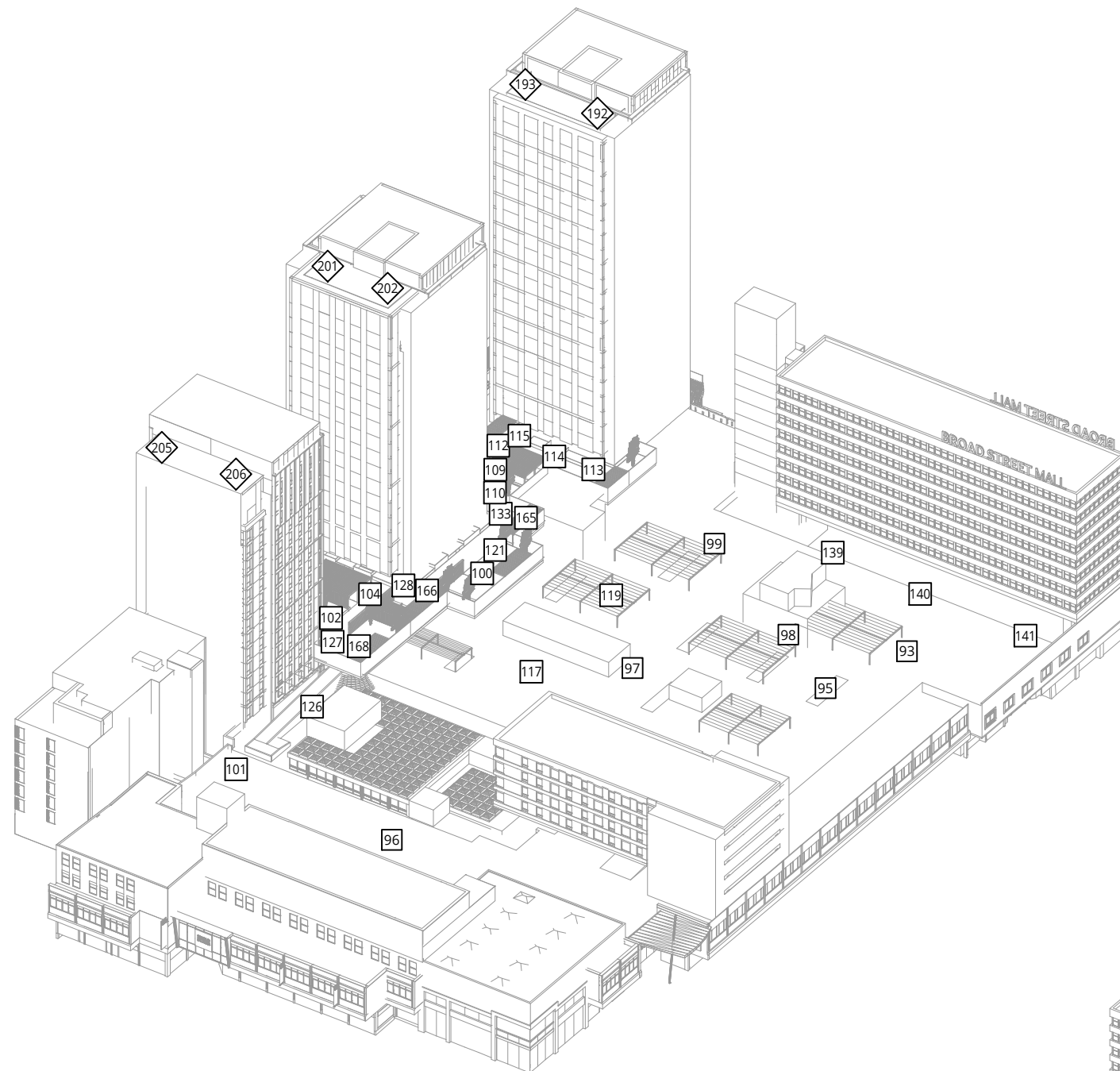
S20 Exceeded ———— 

SENSOR LOCATION:

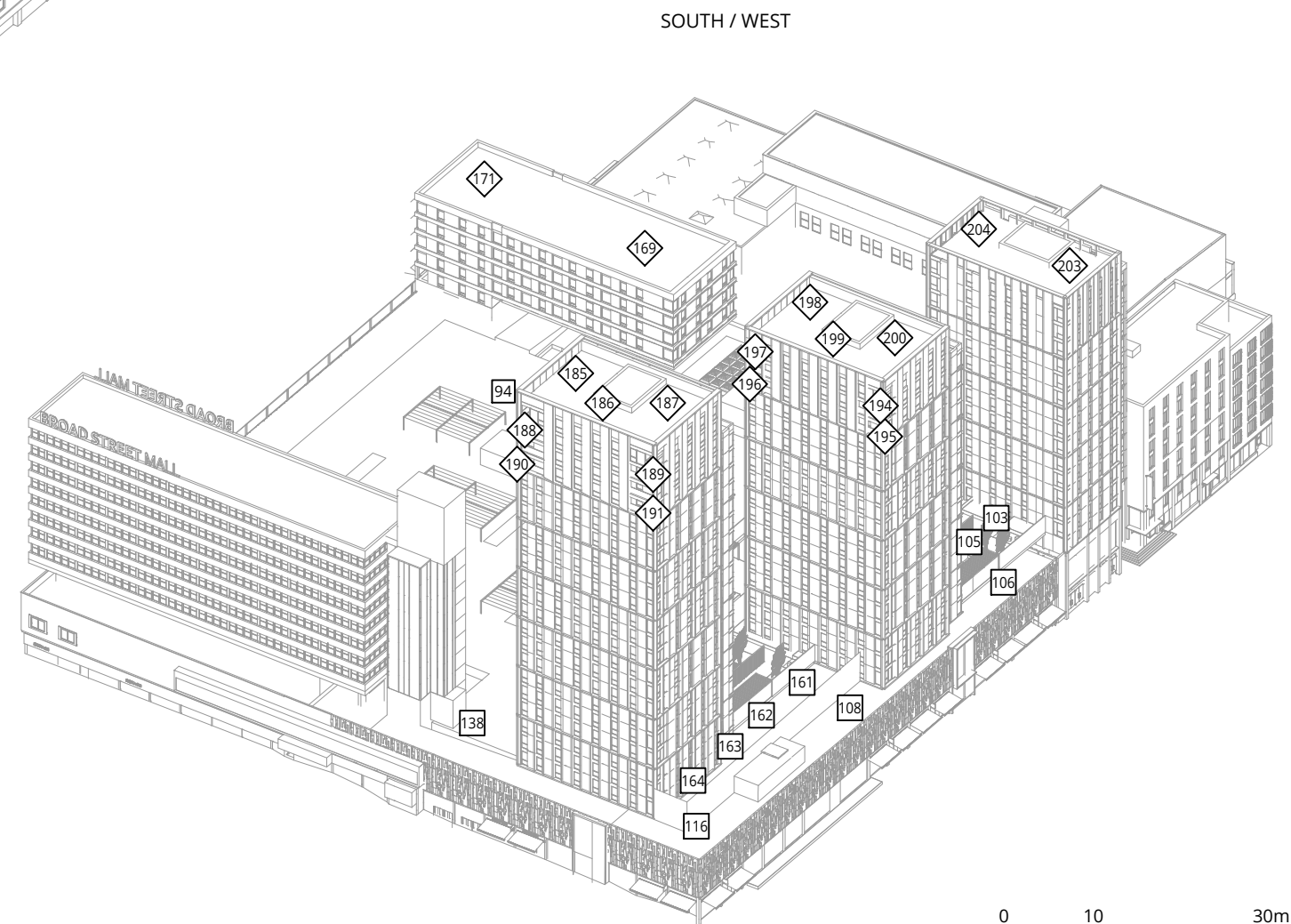
 Ground Level

 Podium Level

 Roof Level



NORTH / EAST



SOUTH / WEST

LEGEND:

SAFETY CATEGORIES:

Pass 

S15 Exceeded 

S20 Exceeded 

SENSOR LOCATION:

 Ground Level

 Podium Level

 Roof Level



Pedestrian Wind Safety Conditions - Roof Level
 Configuration 2: Proposed Development with Existing Surrounding Buildings
 Annual

Broad Street Mall- Reading, UK

Project #1803396

Drawn by: JLF	Figure: 14
Approx. Scale @A3: 1:1000	
Date Revised: Mar. 18, 2020	



APPENDICES



APPENDIX A: WIND TUNNEL PHOTOGRAPHS



Figure 15: Configuration 1 – Proposed Development with Existing Surrounding Buildings, Landscaping and Mitigation Measures – View in the Wind Tunnel (from the south)

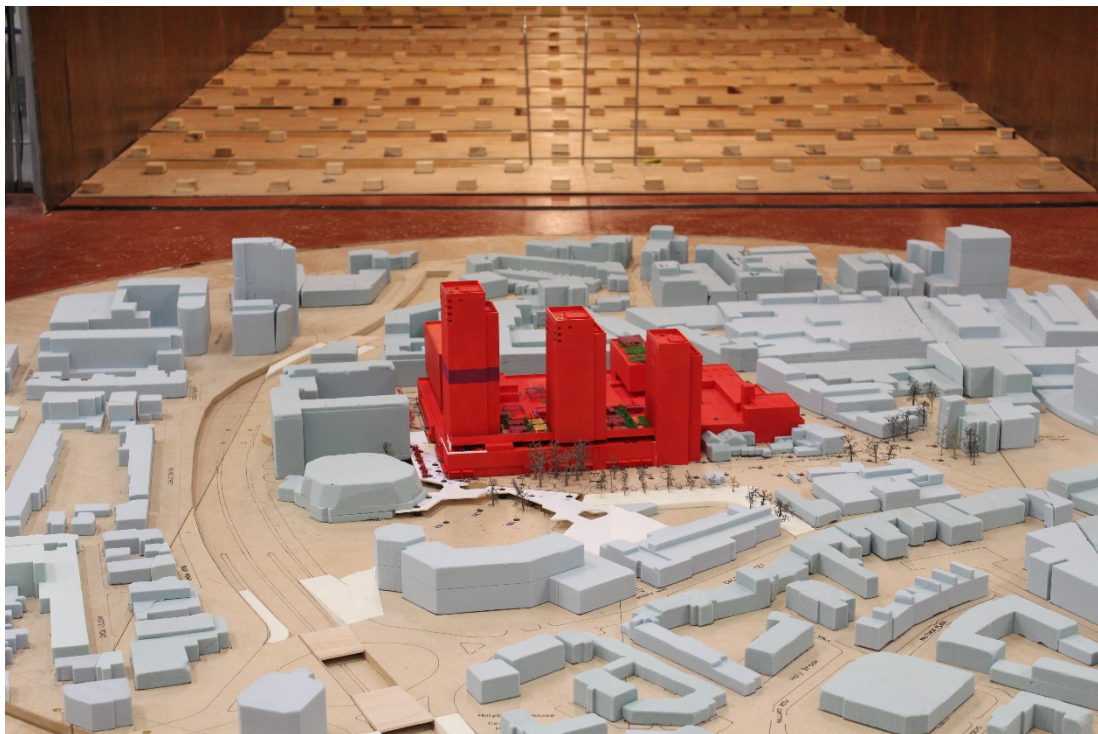


Figure 16: Configuration 1 – Proposed Development with Existing Surrounding Buildings, Landscaping and Mitigation Measures – View in the Wind Tunnel (from the south)



Figure 17: Configuration 2 - Proposed Development with Cumulative Surrounding Buildings, Landscaping and Mitigation Measures - View in the Wind Tunnel (from the south)



Figure 18: Configuration 2 - Proposed Development with Cumulative Surrounding Buildings, Landscaping and Mitigation Measures - View in the Wind Tunnel and Landscaping (from the south)

APPENDIX B: METEOROLOGICAL DATA

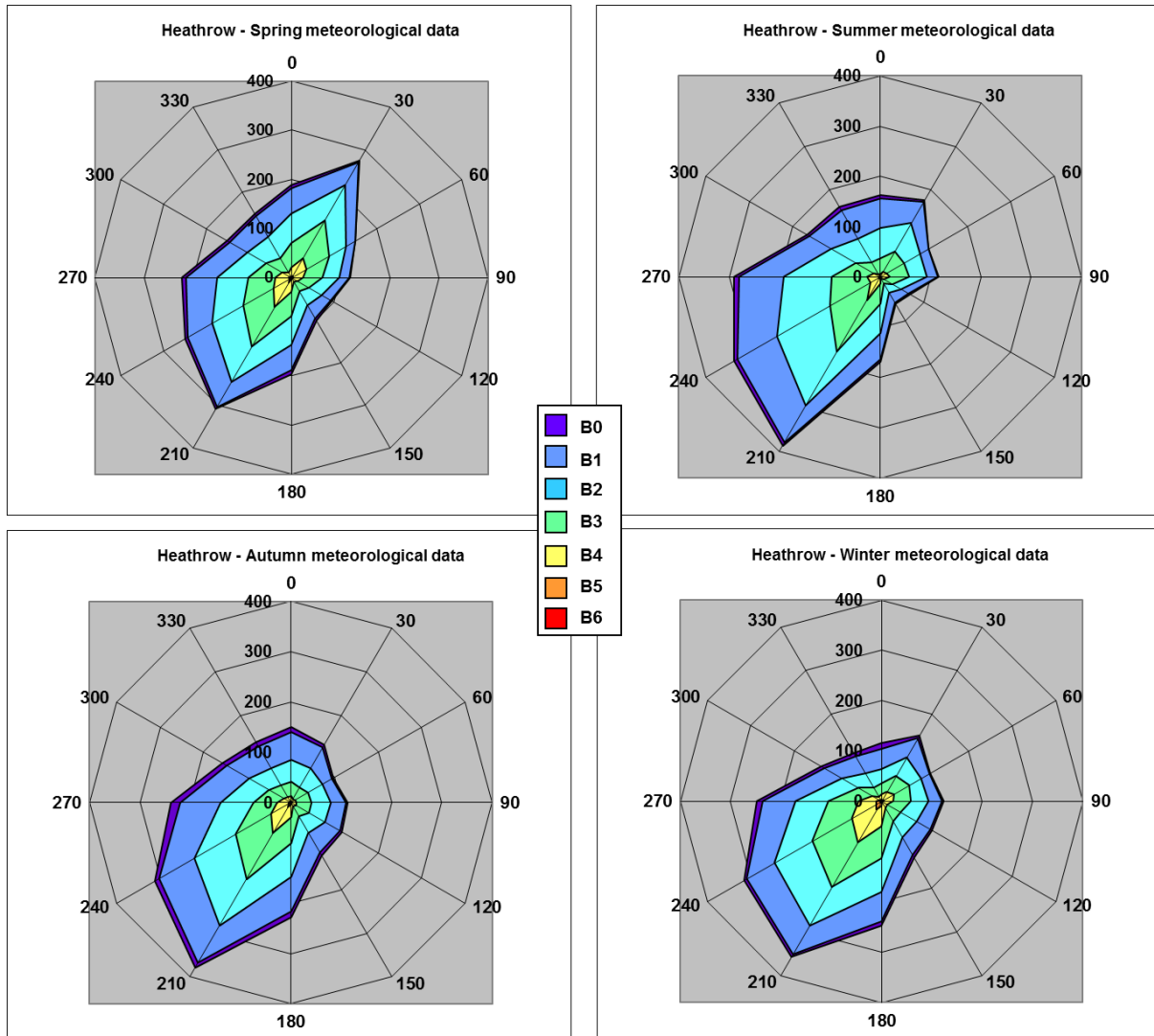


Figure 19: Seasonal wind roses from London Heathrow (in Beaufort Force)
(Radial axis indicates the percentage of time for which the stated Beaufort Range is exceeded)

APPENDIX C: MITIGATION DETAIL PHOTOGRAPHS



Figure 20: An increase in the height on the balustrade on the south-western corner, from 1m to 2

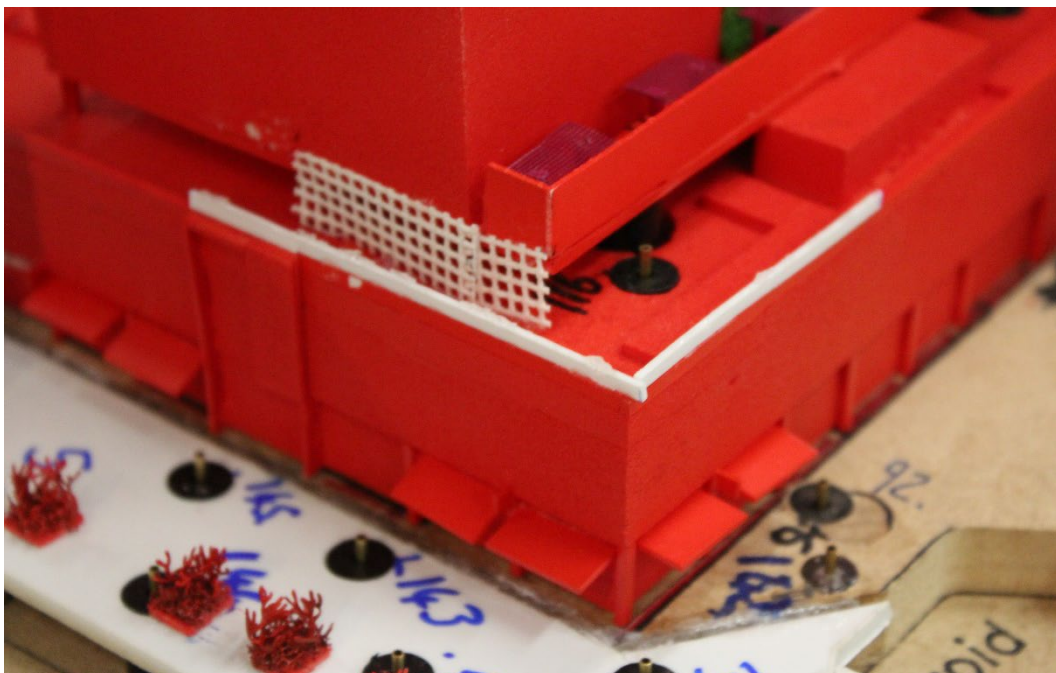


Figure 21: An addition of approximately 50% porous screen, next to probe 116 from the ground up to the roof, with length 14m.

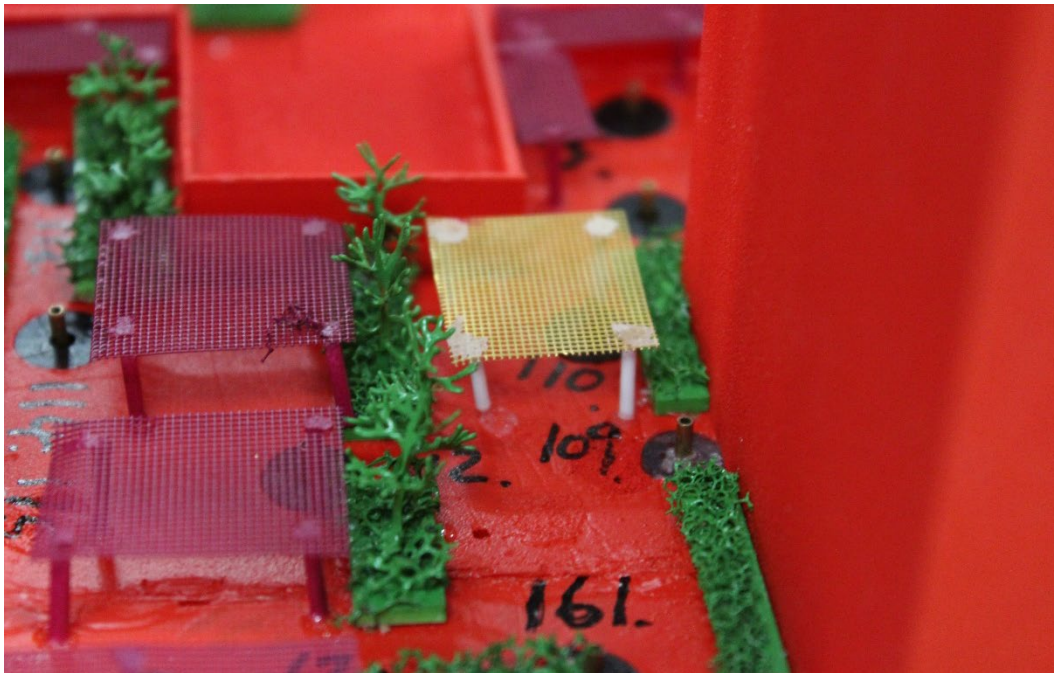


Figure 22: Addition of a pergola on the podium, situated on top of probe 110

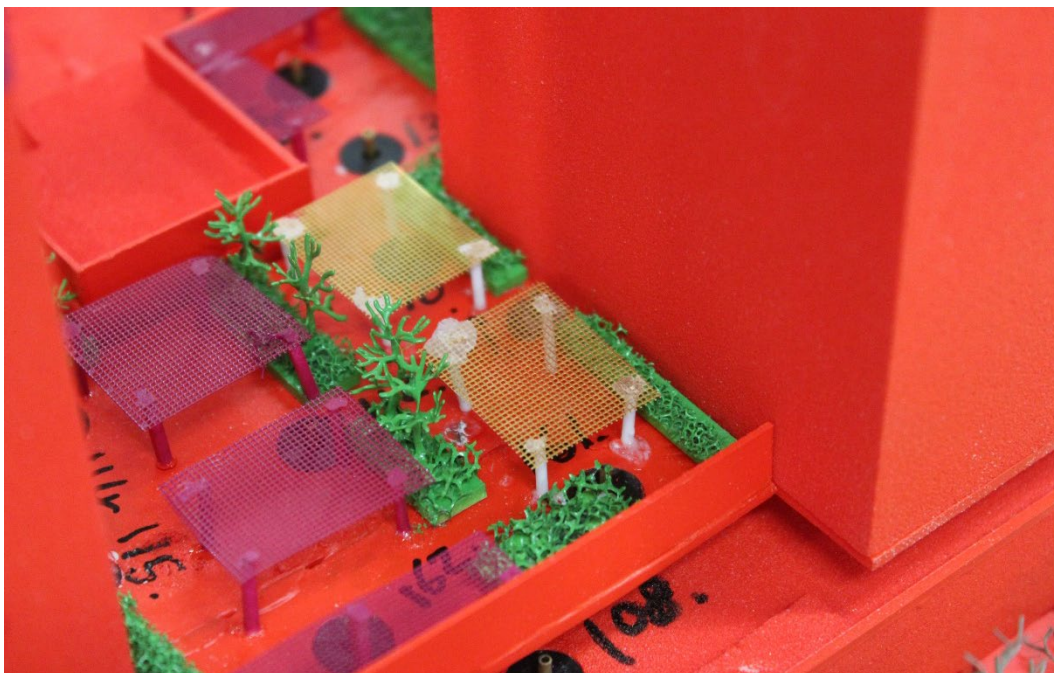


Figure 23: Addition of a pergola on the podium, situated on top of probe 161

APPENDIX D: TECHNICAL MEMO

Date: 2020-11-18

RWDI REFERENCE #: 1803396

To: Rebecca Kaur Bassan-Jheeta
Corstorphine + Wright Architects
Warwick Studio
Brook Hall
Warwick, CV34 4BL

EMAIL: RJheeta@cw-architects.co.uk

From: Andy Gypps
Zain Khan

Email: Andy.Gypps@rwdi.com
Zain.Khan@rwdi.com

RE: Impact of Alternative Wind Mitigation
Broad Street Mall
Reading -

Dear Rebecca,

Please find below a summary on the potential impacts of the alternative mitigation suggested to improve conditions at location 116 (in the carpark underneath Tower A at the south-western corner).

Introduction

Wind tunnel testing was undertaken in March 2020 to assess conditions around the Proposed Development (taller tower option, with Site A 20 storeys above Broad Street Mall, Site B 18 storeys above Broad Street Mall, Site C 18 storeys above Broad Street Mall, and Site E 5 storeys above Broad Street Mall), and mitigation measures were developed through testing. There was a strong wind representing a potential safety concern in the car park underneath Tower A (location 116). The mitigation measures below were tested and required to achieve suitable conditions and can be seen in Figure 24:

- An increase in the height of the balustrade on the south-western corner of the podium, from 1m to 2m; and
- Addition of an approximately 50% porous (open) screen, from the floor level up to the roof and a total length of 14m from the southern side.

Proposed Amendments

RWDI understand that since the assessment was undertaken, the porous screen can not be implemented as this will obstruct ramp access to the existing carpark. Therefore, an alternative measure has been proposed in the form of rotating the screen 90 degrees so that it forms a canopy-like structure. A concept sketch of this proposal can be seen in Figure 2.

Expected Wind Conditions

Prevailing south-westerly winds would interact with the western façade of Tower A and flowing underneath Tower A in the vicinity of the south-western corner. The porous screen developed through wind tunnel testing would diffuse this wind and would locally improve wind conditions. Rotating this screen 90 degrees from a vertical to a horizontal orientation, such that it provides a roof like structure, would be expected to deflect these winds away from location 116. This measure would therefore be expected to have a similar effect in locally reducing wind speeds and providing suitable conditions to the tested measure.



Figure 1: Image of mitigation tested in the wind tunnel

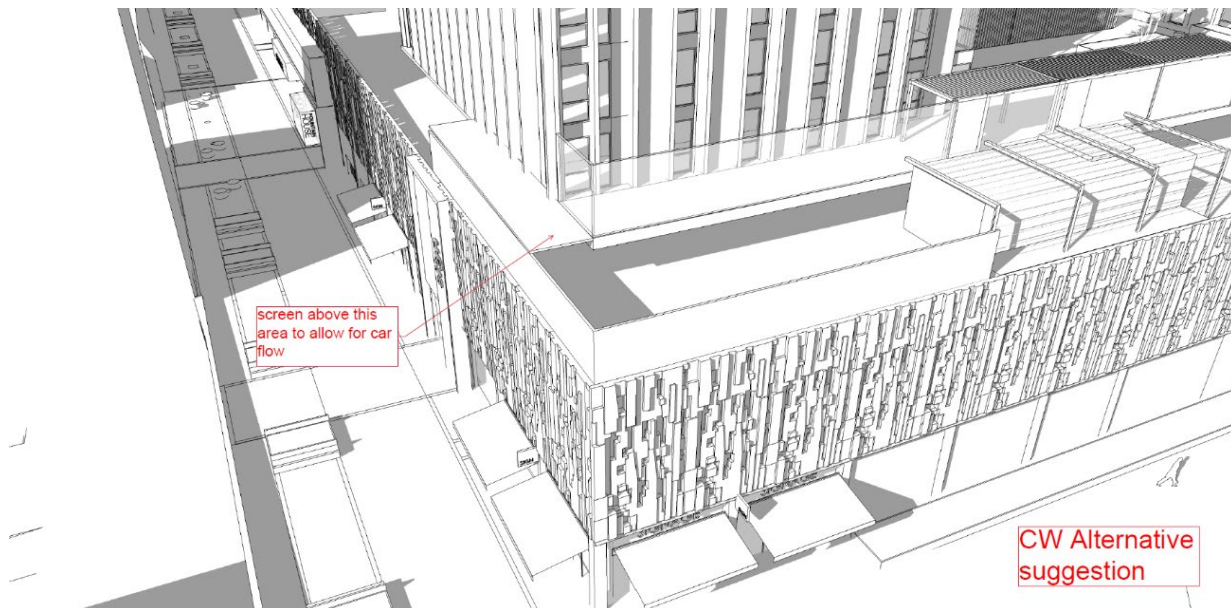


Figure 2: Image of proposed alternative mitigation

Summary

In conclusion, implementing this alternative mitigation would be expected to have a similar effect to the mitigation tested in the wind tunnel, providing suitable conditions in the carpark underneath tower A at the south-western corner (location 116).

Yours sincerely,

RWDI



Andy Gypps

Senior Project Manager



Zain Khan

Project Engineer