



Globe and Simpson

Wind Microclimate

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Prepared For:

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Executive Summary

The current report confirms requirements for any wind mitigation measures as part of the Globe and Simpson development, based on wind tunnel tests carried out to support the revised planning application for the Union T2 development (also part of the St Johns masterplan) in January 2021.

The wind tunnel tests demonstrated that interim pedestrian level conditions in and around the G&S site, upon completion of the development, are likely to be relatively benign. Conditions are therefore expected to be suitable for existing and planned uses and no wind mitigation measures are considered to be required as part of the Globe & Simpson development.

For the final scenario, upon completion of the wider St Johns masterplan, conditions in and around the site will be dictated by the adjacent St Johns Place tower. Appropriate wind mitigation measures will therefore be developed as part of the detailed design process for the tower, in line with the planning condition attached to the outline consent, and details provided in a separate planning application.

1. Introduction

Urban Microclimate Ltd. has been commissioned by Allied London, on behalf of Manchester Quays Limited, to confirm the wind mitigation requirements associated with the Globe and Simpson (G&S) development, in accordance with Condition 19 for the planning consent reference 121721/FO/2018.

Planning condition 19 states:

“Prior to the commencement of the development, other than enabling works comprising demolition, piling and construction of the sub structure, full details of all wind mitigation measures, if required, shall be submitted to, and approved in writing by the City Council, as local planning authority. All such measures shall be fully wind tested, and accompanied by a detailed report confirming that wind conditions related to the development are satisfactory and acceptable.”

The G&S development forms part of the St Johns masterplan in Manchester and is located in the northeast of the masterplan.

The current report is based on wind tunnel tests carried out in January 2021 (on behalf of Vita Group), to support the revised planning application for the Union T2 development, which also forms part of the St Johns masterplan.

2. Methodology and Criteria

2.1. Guidelines

The assessment of environmental wind flows also lies outside the scope of BS EN 1991-1-4:2005, the current European Standard for wind actions on structures, which focuses on wind loading issues.

The impact of environmental wind on pedestrian spaces and the consequent suitability of these spaces for planned usage are described by and compared against the industry standard Lawson criteria, which are recognised by Local Authorities as a suitable benchmark for wind assessments.

2.2. Assessment Methodology

The assessment combines the following elements to determine the probability of local wind speeds exceeding thresholds that relate to pedestrian safety and to comfort levels perceived during standard pedestrian activities, based on the Lawson criteria for pedestrian comfort and safety:

- Measured pedestrian level wind speeds at key areas in and around the site, from model-scale boundary layer wind tunnel testing; with
- Long-term wind frequency statistics transposed from the nearest suitable weather centre to apply directly at the site.

Wind Tunnel Tests

Details of the wind tunnel testing are provided at Appendix A. The tests were conducted in RWDI Anemos Ltd's boundary layer wind tunnel facility, where an atmospheric boundary layer representative of that at the site was simulated. The wind tunnel model was constructed at a scale of 1:300 and covers a full-scale extent of 360 m from the approximate centre of the St Johns masterplan (up to and beyond the extent of potential significant effects of the development).

The wind tunnel model was constructed by RWDI for testing the proposed Union T1 and Union T2 developments. The model for the G&S development, including the public realm landscaping within the planning application boundary, was based on information sourced from the local authority planning portal for planning application reference 121721/FO/2018 (the latest consent at the time of the model construction).

The subsequent minor material amendment (application reference 125222/JO/2019) revised the ground floor (removing the colonnade) and roof-level plant, and increased the overall height by approximately 1 m. These minor amendments are discussed further below.

The remaining existing / consented surrounding area was constructed based on survey information provided for previous tests and new or future buildings were based on planning

application information sourced from the local authority planning portals (as at the time of the model construction).

Proposed semi-mature and existing surrounding trees were modelled in winter, or bare, format.

As discussed above, the testing was carried out for the Union T2 development. A small number of additional wind speed sensors were included in and around the G&S development, for simultaneous testing. To inform this additional testing, an initial experience-based assessment was carried out to identify areas of potential accelerated winds in and around the G&S site, and to identify the potential extent of likely significant wind effects within the surrounding area. Existing and proposed pedestrian activities were also reviewed to identify areas of increased sensitivity to wind effects, such as recreational areas and building entrances. Wind speed measurements at these key pedestrian level locations were then made using probes capable of measuring fluctuating pressure differences that are calibrated against wind speed. A system of probes running simultaneously were used to obtain results from the additional 20 pedestrian level locations. In accordance with best practice, measurements were taken for a full range of wind directions in increments of 22.5°. To fully meet the requirements of the Lawson criteria, recordings were taken for a sufficient length of time to determine the mean and gust wind speeds.

Wind tunnel tests were carried out for the following configurations:

- Development with existing surrounds (as the baseline for Union T2); and
- Development with consented future surrounds.

Committed surrounding developments were reviewed using publicly available information and professional experience to determine their relevance to the wind assessment. Buildings currently under construction or committed to completion prior to the development were included within the baseline, in their completed form. This included the following schemes:

- Union T1 (ref 125655/FO/2019)
- Manchester Goods Yard and No.1 Grape Street (ref 121511/FO/2018)
- St Johns Place Zone 2, Globe and Simpson (ref 121721/FO/2018)
- Old Granada Studios (ref 118040/FO/2017)
- The Factory (ref 119890/VO/2018)
- Salford Central Zone B (ref 16/68199/REM)
- Salford Central Zone C (ref 19/73721/REM)

Subsequent minor amendments to Old Granada Studios (ref 127612/FO/2020) are not expected to materially affect the conclusions of the assessment.

The future committed developments considered within the cumulative effects assessment comprised the following surrounding schemes:

- Union T2 (current application)
- St Johns Place Zones 1, 3 & 4 (ref 109660/FO/2015/C1)
- Middlewood Locks (ref 14/65457/OUTEIA)
- Middlewood Locks (ref 14/65793/OUT)
- Salford Central (ref 16/68325/OUT)
- Trinity Islands (ref 115107/FO/2017)

Further committed developments in the area lie beyond the extent of the wind tunnel model and are considered too distant to have any potential significant cumulative effects.

Conditions in and around the G&S site for the future surrounding context will be dictated by the St Johns Place tower (Zone 1). The massing considered for the above listed outline consent is not expected to be delivered and the design of the tower is expected to significantly change. Appropriate wind mitigation measures will therefore be developed as part of the detailed design process, in line with the planning condition attached to the outline consent, and details provided in a separate planning application. The future surrounding context is not therefore considered further in the current report, which focuses on mitigation requirements dictated by the G&S development.

Wind Climate Data

Long-term wind frequency statistics from Manchester Airport, for the period 2001 to 2015, were corrected to apply directly at the site, taking account of differences in upwind terrain and altitude between the weather centre and the site based on the widely accepted Deaves and Harris log law wind model of the atmospheric boundary layer and BS EN 1991-14:2005. This is considered suitable to provide a statistically robust climate model for the site.

Historical wind statistics are used as standard practice due, in part, to lack of certainty in potential future changes in wind patterns, though any changes are expected to be minor.

Assessment Criteria

Details of the Lawson criteria for pedestrian comfort are presented in Table 2.1 and are based on the exceedance of threshold wind speeds, considering mean-hourly and gust-equivalent-mean values, occurring less than 5% of the time. The thresholds represent upper bounds of acceptability for a range of common activities. The value of 5% has been established as giving a reasonable allowance for extreme and relatively infrequent winds that are acceptable within each category.

Table 2.1: Lawson Criteria for Pedestrian Comfort

Threshold Mean-hourly Wind Speed Exceeded < 5% of the Time	Comfort Rating / Activity		Qualifying Comments
4m/s	C4	Long-term Sitting	Reading a newspaper and eating and drinking.
6m/s	C3	Standing or short-term Sitting	Appropriate for bus stops, window shopping and building entrances.
8m/s	C2	Walking and Strolling	General areas of walking and sightseeing.
10m/s	C1	Business walking	Local areas around tall buildings where people are not likely to linger.

Details of the Lawson criteria for pedestrian safety, or distress, are presented in Table 2.2 and are based on the exceedance of the threshold wind speeds, considering mean-hourly and gust-equivalent-mean values, occurring once per annum. These thresholds represent wind speeds with the potential to destabilise the less able or more susceptible members of the public (including elderly, cyclists and children) and able-bodied users.

Table 2.2: Lawson Criteria for Pedestrian Safety or Distress

Threshold mean-hourly wind speed exceeded once a year	Safety Rating		Qualifying Comments
15 m/s	S2	Unsuitable for general public	Less able and cyclists find conditions physically difficult.
20 m/s	S1	Unsuitable for able-bodied	Able-bodied persons find conditions difficult. Physically impossible to remain standing during gusts.

The pedestrian level wind environment assessment is summarised in terms of suitability for various activities, based on the Lawson criteria described above. The assessment takes full account of seasonal variations in wind conditions and pedestrian activities. Thus conditions for recreational activities focus on summer, but also consider spring and autumn.

Recreational activities do not consider winter comfort ratings as it is anticipated that users would not demand suitable conditions 95% of the time in winter but would instead be satisfied to use the amenity spaces on occasions when conditions, including precipitation and temperature, permit. Conditions for pedestrian thoroughfare, access or waiting (for example at bus stops) consider all seasons, with winter being predominantly the critical season due to generally higher wind speeds in the winter months.

The activities considered, and their relation to the comfort criteria detailed above, are shown in Table 2.3. The table is ordered in terms of decreasing sensitivity to wind speeds. Conditions considered suitable for the more sensitive activities would also be suitable for the subsequent, less sensitive, uses.

Table 2.3: Suitability Assessment

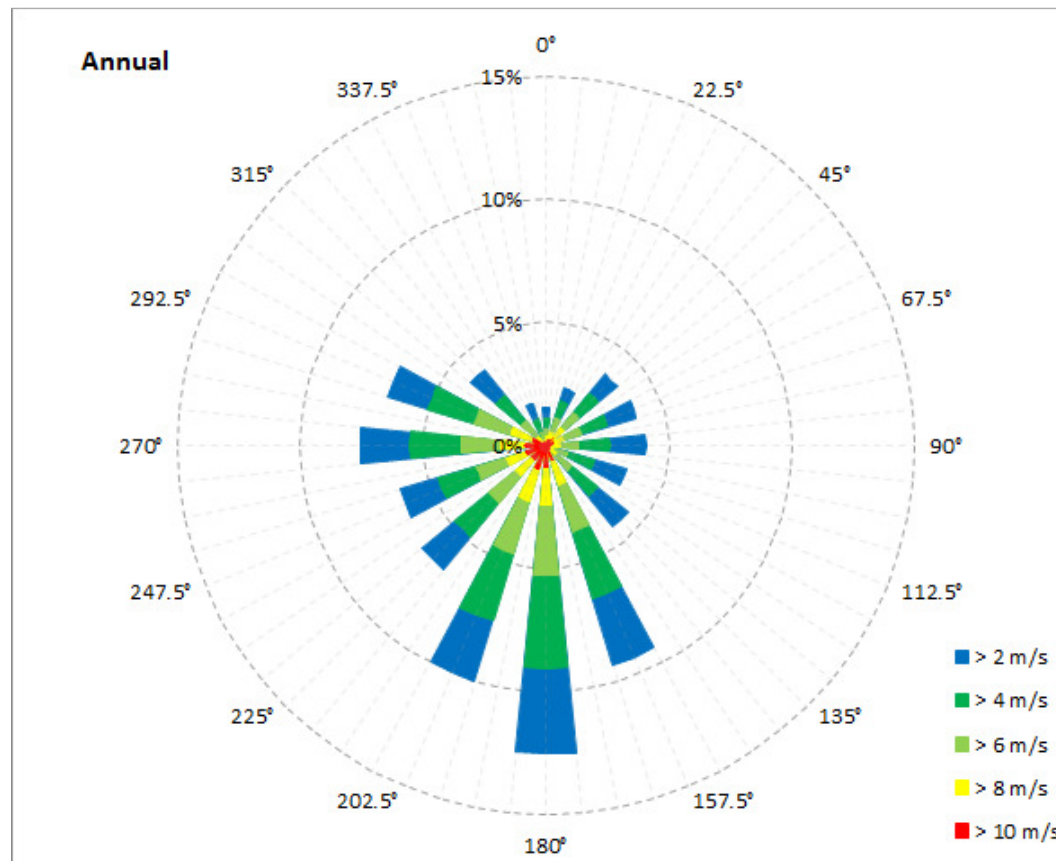
Suitability		Target Lawson comfort and safety criteria for specified seasons
Outdoor seating	For long periods of sitting, such as for an outdoor café or picnic area.	'Long-term sitting' (C4) in at least summer.
Entrances, waiting areas	For pedestrian ingress/egress at entrances, or short periods of sitting or standing such as at a bus stop, taxi rank, meeting point, window shopping, etc.	'Standing or short-term sitting' (C3) in all seasons.
General leisure (excluding seating areas)	For leisure uses excluding long periods of outdoor sitting, such as active leisure, general park spaces, children's play area, etc.	'Standing or short-term sitting' (C3) from spring to autumn.
Thoroughfare	For pedestrian access to, and passage through, the Site and surrounding area.	'Business walking' / 'Walking or strolling' (C1/C2) in all seasons - 'Walking or strolling' (C2) desired but 'Business walking' (C1) may be acceptable in some areas.
Unsuitable	Unsuitable for all activities.	Exceeds comfort criterion for 'Business walking' (C1) or safety criteria (S1/S2).

3. Assessment

3.1. Wind Climate

The wind climate expected at the site is summarised in Figure 3.1 in terms of the annual wind speed and direction probability distributions at a reference height of 100 m above local ground level. Seasonal wind speed and direction probability distributions are presented in Appendix A.

Figure 3.1: Wind Climate at Site (at reference height of 100 m)



Based on the wind climate statistics, winds from the southerly quadrant are prevalent. Light to moderate winds from the south and south-south-east are most common, whilst stronger winds more frequently blow from the south-south-west. Winds from the west-south-west and west also occur frequently, and extreme wind speeds (relevant to pedestrian safety) are most likely to blow from this direction. Northerly winds are generally light and rare, though cold north-easterly winds are common during spring. Wind speeds are generally higher during winter and lower during summer.

3.2. Effects of Development with Existing Surrounds

The G&S building represents a modest structure with regards to wind effects and is substantially sheltered from winds approaching from most directions by the surrounding buildings of generally similar heights. The south end of the building is more exposed to

prevailing southerly winds, approaching between Manchester Goods Yard and the taller parts of Old Granada Studios, but presents a corner and narrow end elevation to these winds. There remains potential for some channelling of prevailing southerly winds around the east corner of the building, but this is not expected to affect any sensitive uses.

As indicated above, the minor material amendments introduced by application reference 125222/JO/2019 were not represented on the model. The removal of the colonnade slightly reduces the shelter to the main entrances but conditions in these areas are relatively benign. The changes to the roof-level plant and slight increase in the overall building height are not expected to significantly affect pedestrian level wind conditions.

It is understood that the landscaping proposals are being developed in conjunction with the revisions to the St Johns Place tower. This is expected to reduce the number of trees in the public realm around the G&S building, relative to illustrative scheme presented as part of the planning application reference 121721/FO/2018 and thus modelled for the wind tunnel tests. This is expected to reduce the extent of temporary open space with amenable conditions for outdoor seating activities but is not otherwise expected to materially affect conditions in terms of suitability for existing and planned uses.

The pedestrian level wind environment in and around the site resulting from the above effects is presented in terms of the Lawson comfort and safety criteria in Appendix A, as tested. Conditions are further summarised graphically in terms of likely suitability for pedestrian activities (based on the seasonal targets outlined in Table 2.3) in Figure 3.2, taking account of the proposed minor amendments to both the building and the public realm landscaping. This presentation also applies expert judgement to extrapolate from the key-point measurements in order to indicatively cover the site and surrounding area.

Pedestrian Safety

Pedestrian level wind conditions in and around the site rate as safe for all users.

Pedestrian Comfort

In terms of pedestrian comfort, with respect to wind force, wind conditions within the site are suitable for at least leisurely strolling and are thus considered suitable for pedestrian access to, and passage through or past, the development.

The main entrances to the building are located away from areas of potential accelerated winds. As a result, conditions at the main entrances are expected to be suitable for pedestrian ingress / egress.

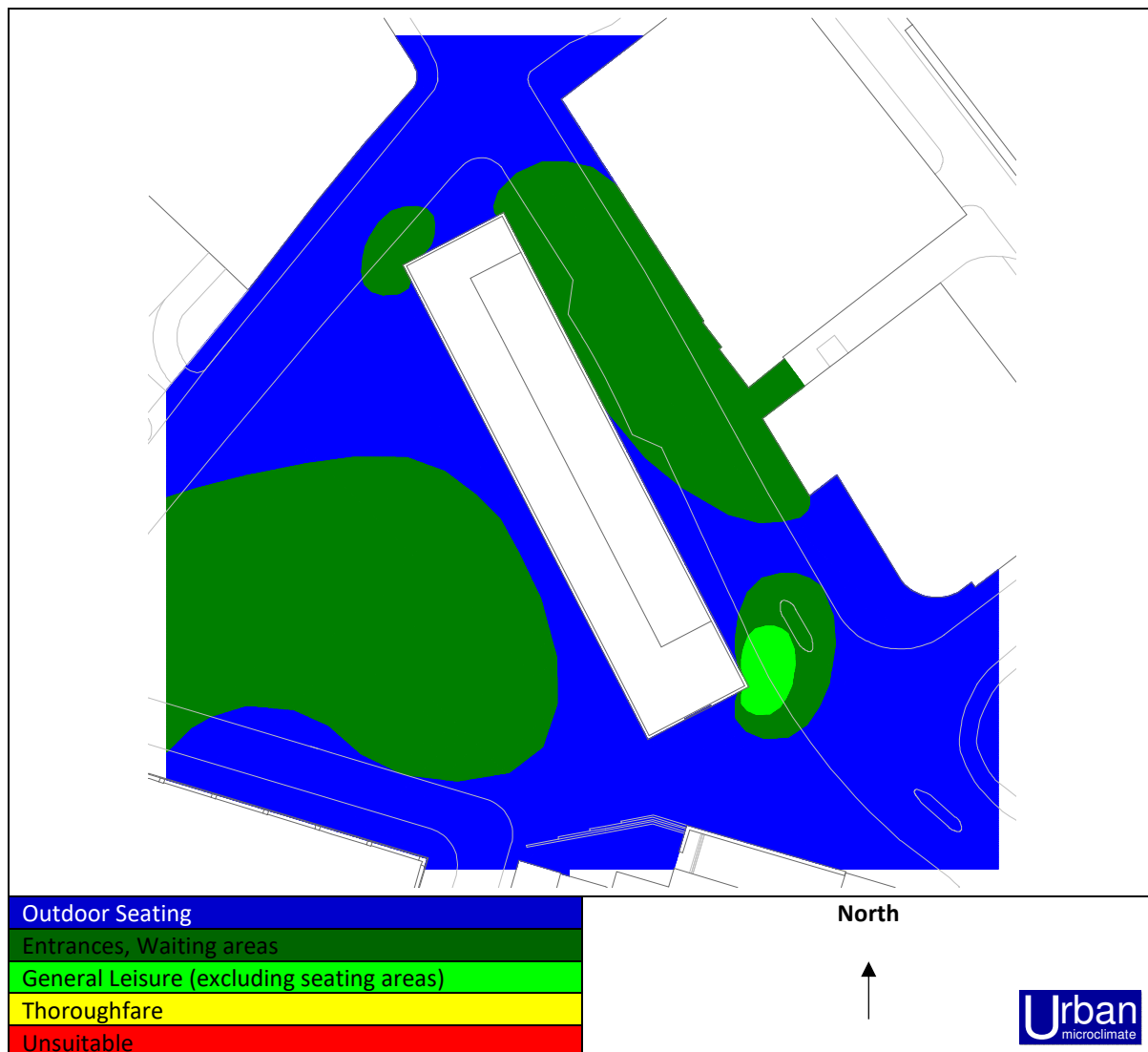
The open space in the southwest of the site enjoys suitable conditions for recreational activities including at least short periods of sitting and standing (such as for a meeting point, for example) with much of the space further suitable for long periods of outdoor sitting (such for picnics, for example) during at least summer, particularly along the building

frontage. Conditions are therefore expected to be considered acceptable for associated temporary uses.

Within the surrounding area, conditions remain suitable for at least leisurely strolling along thoroughfares and entrances to surrounding buildings are expected to enjoy suitable conditions for pedestrian ingress / egress.

On the basis of the above, conditions are expected to be considered suitable for existing and planned uses and no mitigation measures are considered to be required.

Figure 3.2: Indicative Suitability Assessment (accounting for minor amendments)



4. Conclusions

Pedestrian level conditions in and around the development are expected to be relatively benign and are expected to be suitable for existing and planned uses. No wind mitigation measures are therefore considered to be required as part of the Globe & Simpson development.

For the final scenario, upon completion of the St Johns masterplan, conditions in and around the site will be dictated by the St Johns Place tower. Appropriate wind mitigation measures will therefore be developed as part of the detailed design process for the tower, in line with the planning condition attached to the outline consent, and details provided in a separate planning application.

Appendix A – Wind Tunnel Testing and Results

Wind Tunnel

The wind tunnel tests were carried out in RWDI Anemos Ltd's boundary layer wind tunnel facility, in Milton Keynes. This tunnel has an open working section with an effective width of 3.0 m.

An atmospheric boundary layer, representative of the conditions at the site, was simulated using an arrangement of roughness elements distributed over the floor of the wind tunnel and a turbulence grid at the entrance to the test section.

The boundary layer simulation was calibrated against the variation in mean wind speed and the intensity and scale of the turbulence with height above ground level appropriate to the site, based on profiles derived using the widely accepted Deaves and Harris log law wind model and a detailed terrain analysis for the area surrounding the site. This method yields a good approximation of the mean flow and turbulence characteristics and fully meets the requirements of clause NA2.2 'Guidance on design assisted by testing and measurements' from the UK National Annex to BS EN 1991-1-4:2005.

Figure A.1 presents the variation of mean wind speed, longitudinal turbulence intensity and gust wind speed used in the tests. The wind speed profiles are normalised by the mean wind speed at a reference height of 100 m.

Instrumentation

Measurements of pedestrian level wind speed were made using instruments known as Irwin probes. These are standard devices for such measurements. The probes consist of a small tube with a pit at its base. The pressure difference between the top of the tube and the pit is calibrated against wind speed. The top of the tube is set at an equivalent full-scale height of 1.5 m to measure wind speeds at pedestrian height. The sampling rate, combined with the wind tunnel running speed and the linear scale of the model, were appropriate to the model scale simulation used.

People subjected to fluctuating or gusty wind conditions will react to either the mean wind strength or to the maximum gust that occurs. For this reason, both the mean and maximum gust speeds were determined for each measurement location. The gust speed was then converted to a gust-equivalent-mean value based on a factor of $1 / 1.85$.

Measurements were made for a full range of wind directions in 22.5° increments. The wind tunnel measurements were recorded as non-dimensional wind speed ratios relative to the wind tunnel reference wind speed.

Wind Tunnel Model

The wind tunnel model was constructed by RWDI for testing the Union T1 and Union T2 developments. As such, the model of Globe and Simpson was based on information sourced from the local authority planning portal at the time of the model construction, in 2019. The remaining existing / consented surrounding area was constructed based on survey information provided for previous tests and new or future buildings were based on planning application information sourced from the local authority planning portals. The linear scale of the model is 1:300. The model was constructed on a circular baseboard of diameter 2.4 m, centred around the site's centre.

Proposed semi-mature and existing surrounding trees were modelled in winter, or bare, format.

Figure A.2 illustrates the model for the development in the context of existing surrounding conditions.

Wind Climate Statistics

The wind climate, based on statistics from Manchester Airport for the period 2001 to 2015 transposed to apply to the site, is summarised in Figure A.3 in terms of the seasonal wind speed and direction probability distributions at a reference height of 100 m. The factors applied to correct the statistics from open-country terrain to reference height at the site are also presented.

Pedestrian Level Wind Environment Results

The measured wind speed ratios from the wind tunnel tests are combined with the wind statistics applicable to the site to assess the pedestrian level wind environment based on the Lawson criteria for pedestrian comfort and safety. The resulting annual and seasonal ratings for each measurement location are summarised in Figures A.4 for the following scenarios:

- Development with existing surrounds

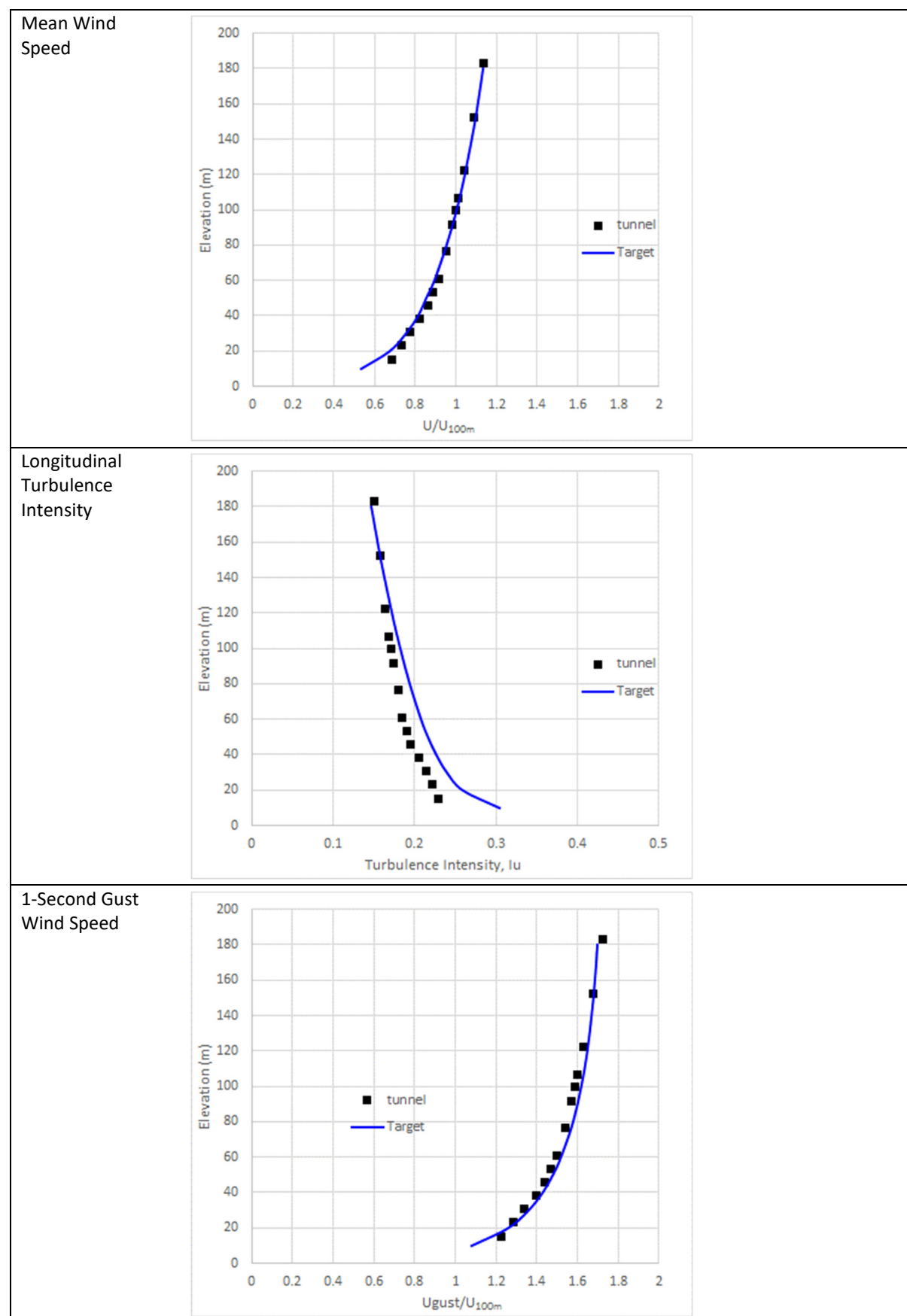
Figure A.1: Wind Tunnel Boundary Layer Simulation

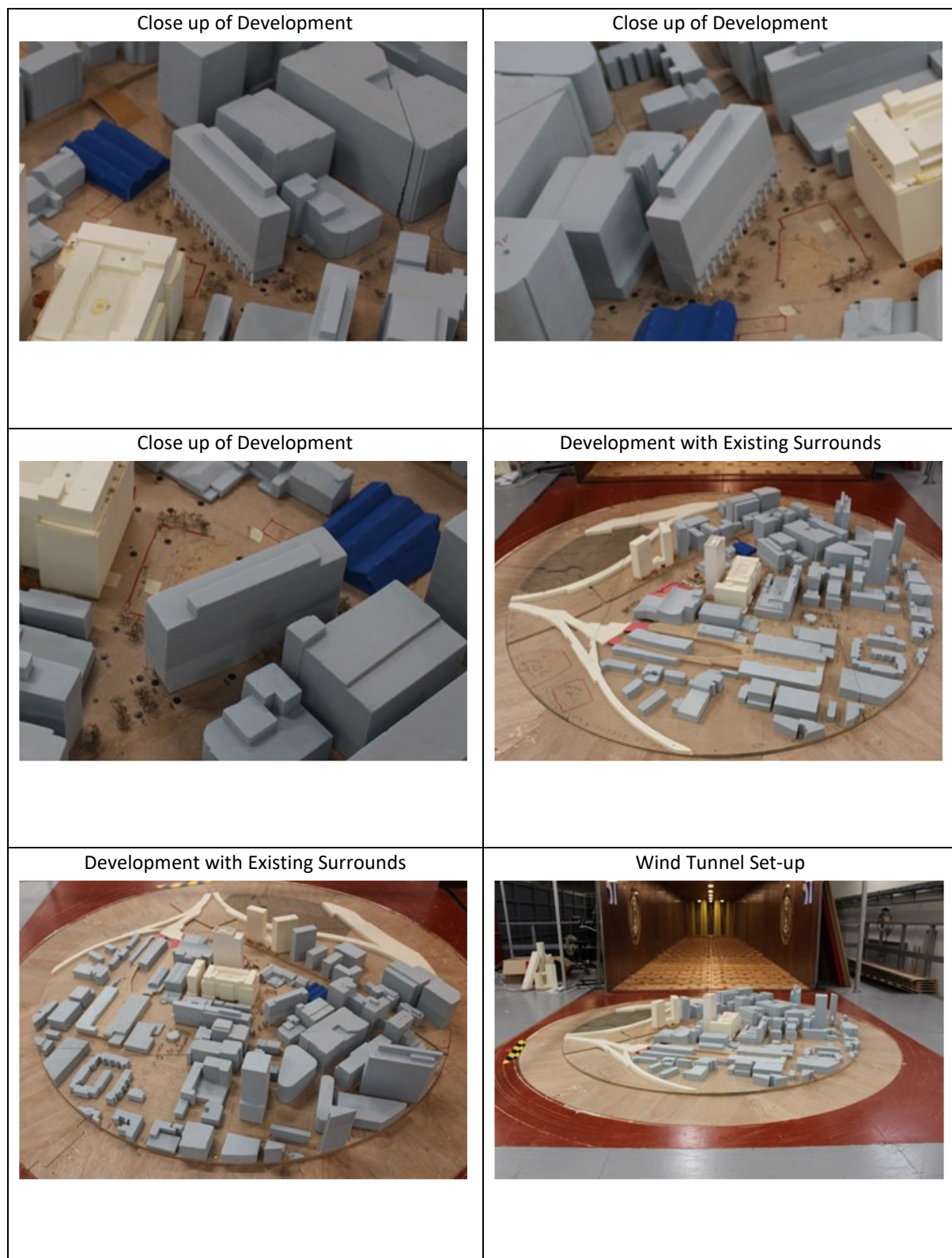
Figure A.2: Wind Tunnel Models

Figure A.3a: Wind Speed Correction Factors, Open Country to Ref. Height (100m) at Site

Direction	0°	22.5°	45°	67.5°	90°	112.5°	135°	157.5°
Factor	1.30	1.28	1.27	1.26	1.26	1.27	1.28	1.28
Direction	180°	202.5°	225°	247.5°	270°	292.5°	315°	337.5°
Factor	1.28	1.27	1.29	1.31	1.31	1.31	1.31	1.31

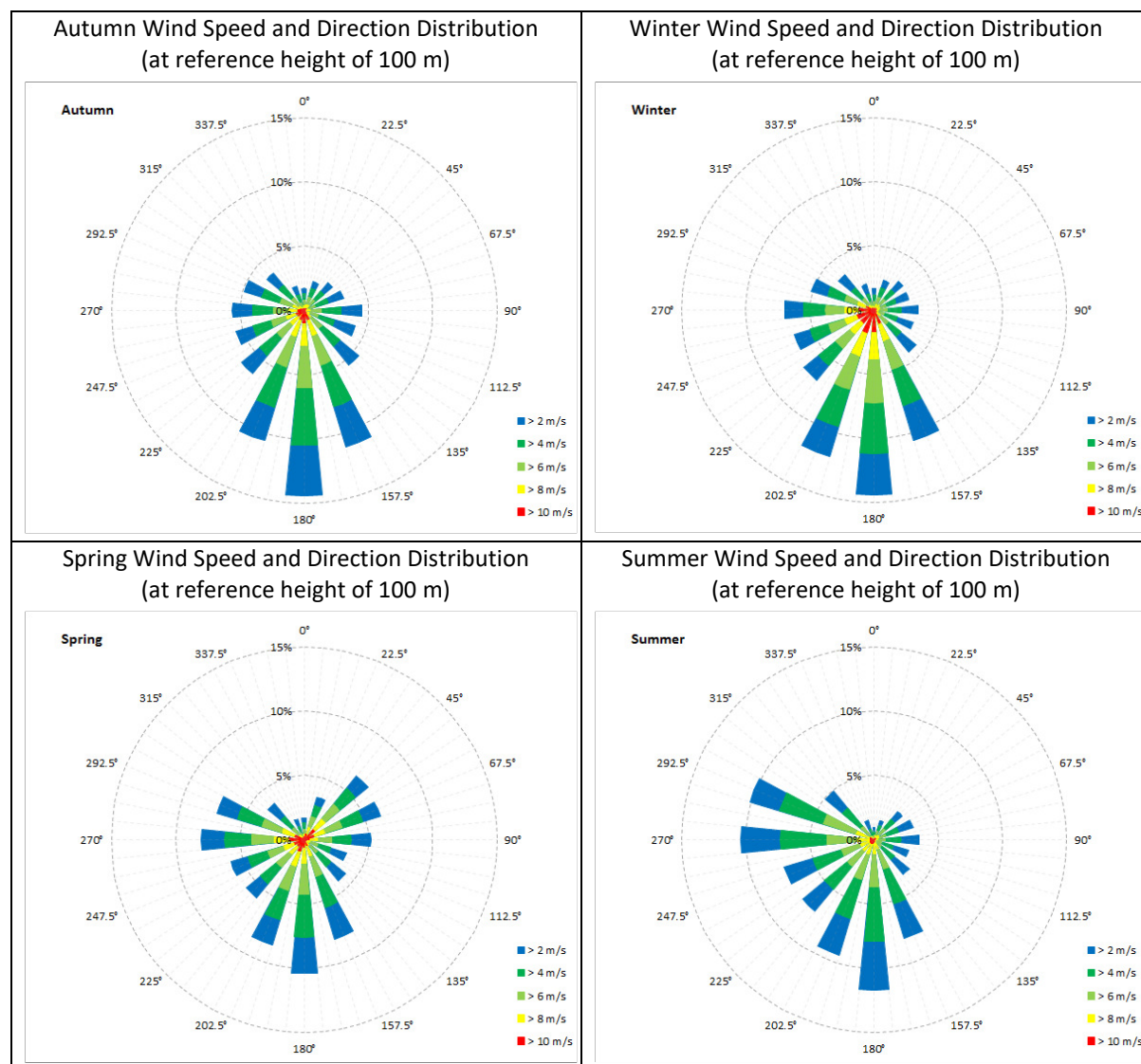
Figure A.3b: Wind Climate at Site

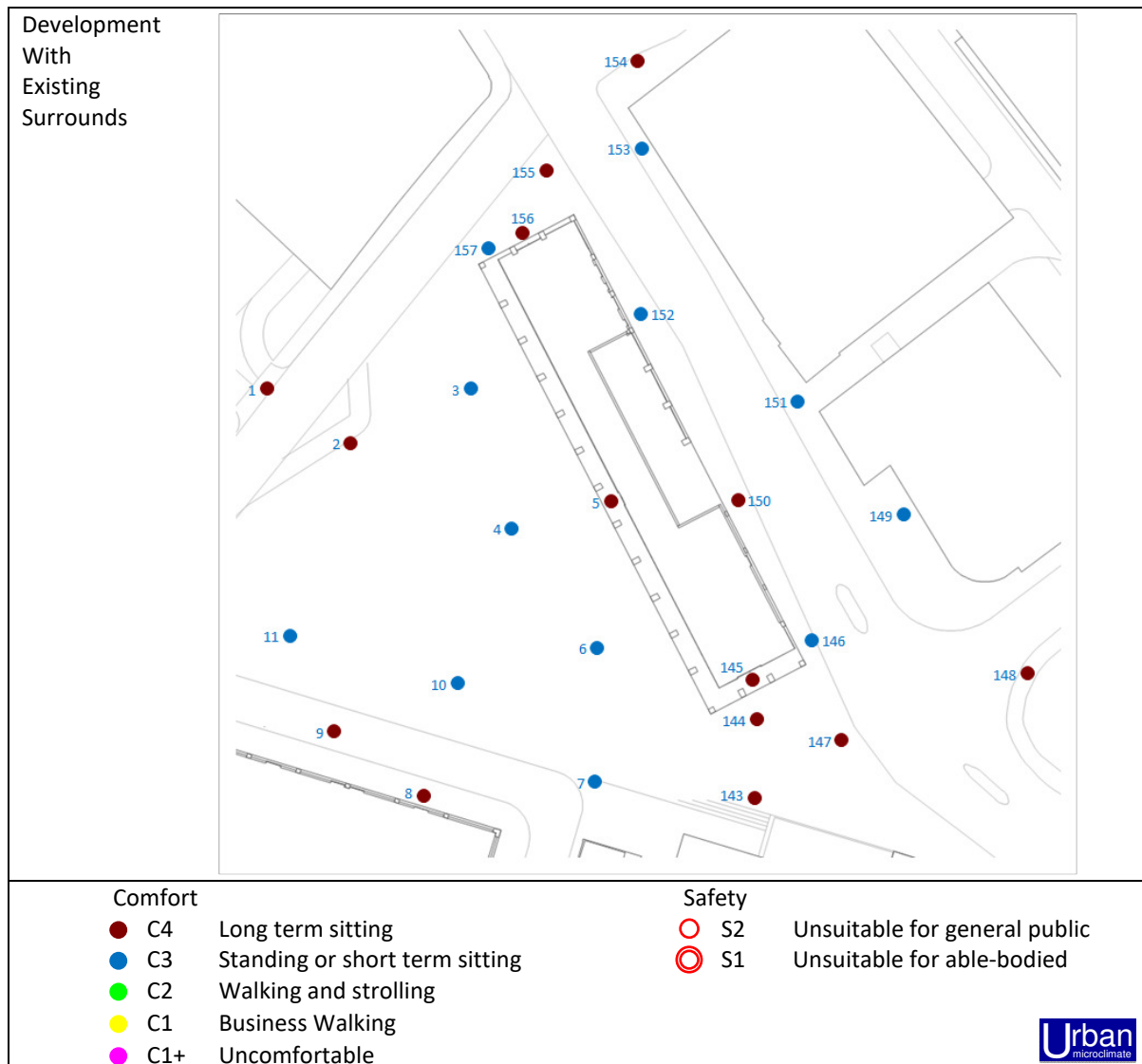
Figure A.4a: Wind Environment – Annual Comfort and Safety Ratings

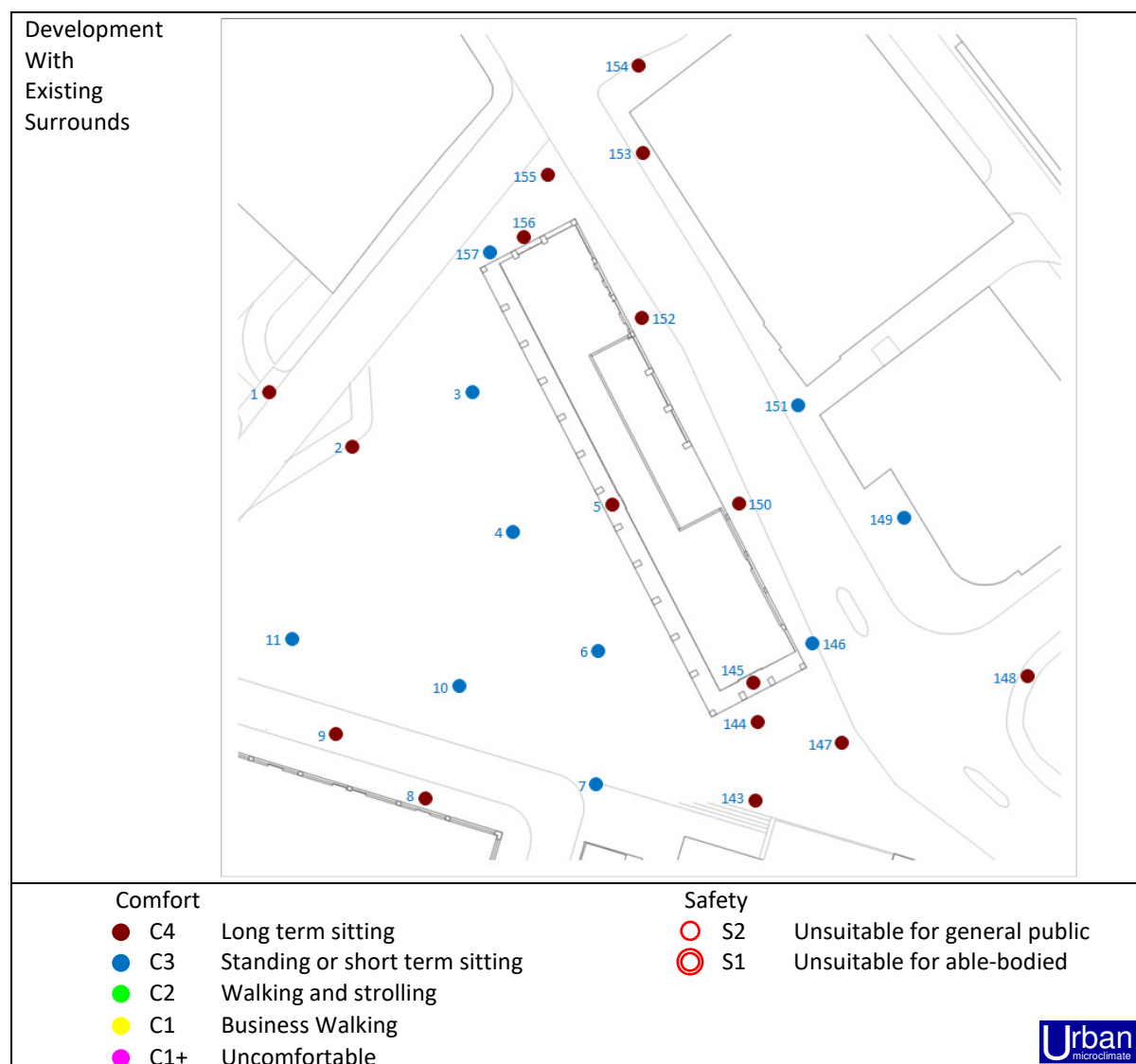
Figure A.4b: Wind Environment – Autumn Comfort and Safety Ratings

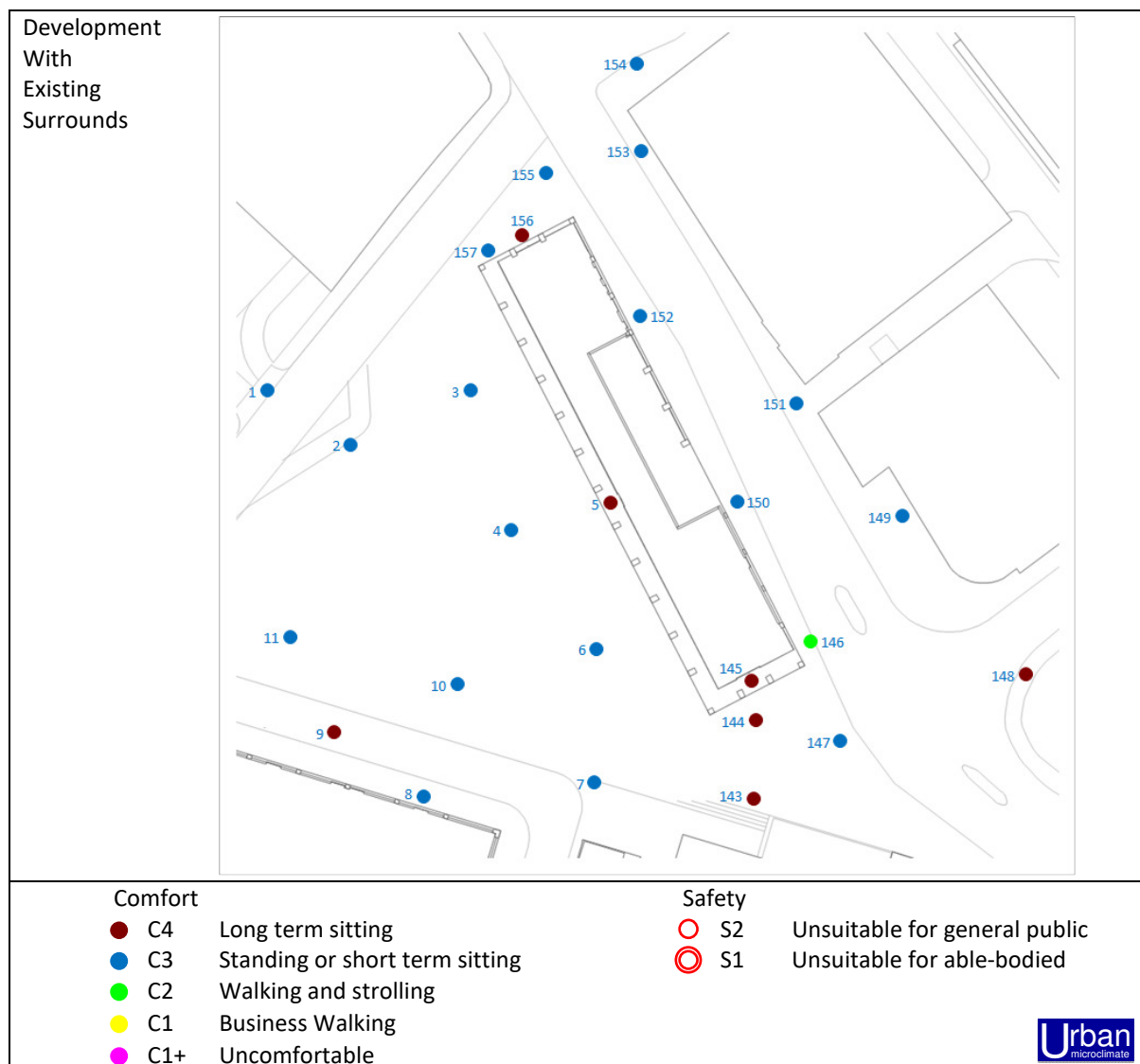
Figure A.4c: Wind Environment – Winter Comfort and Safety Ratings

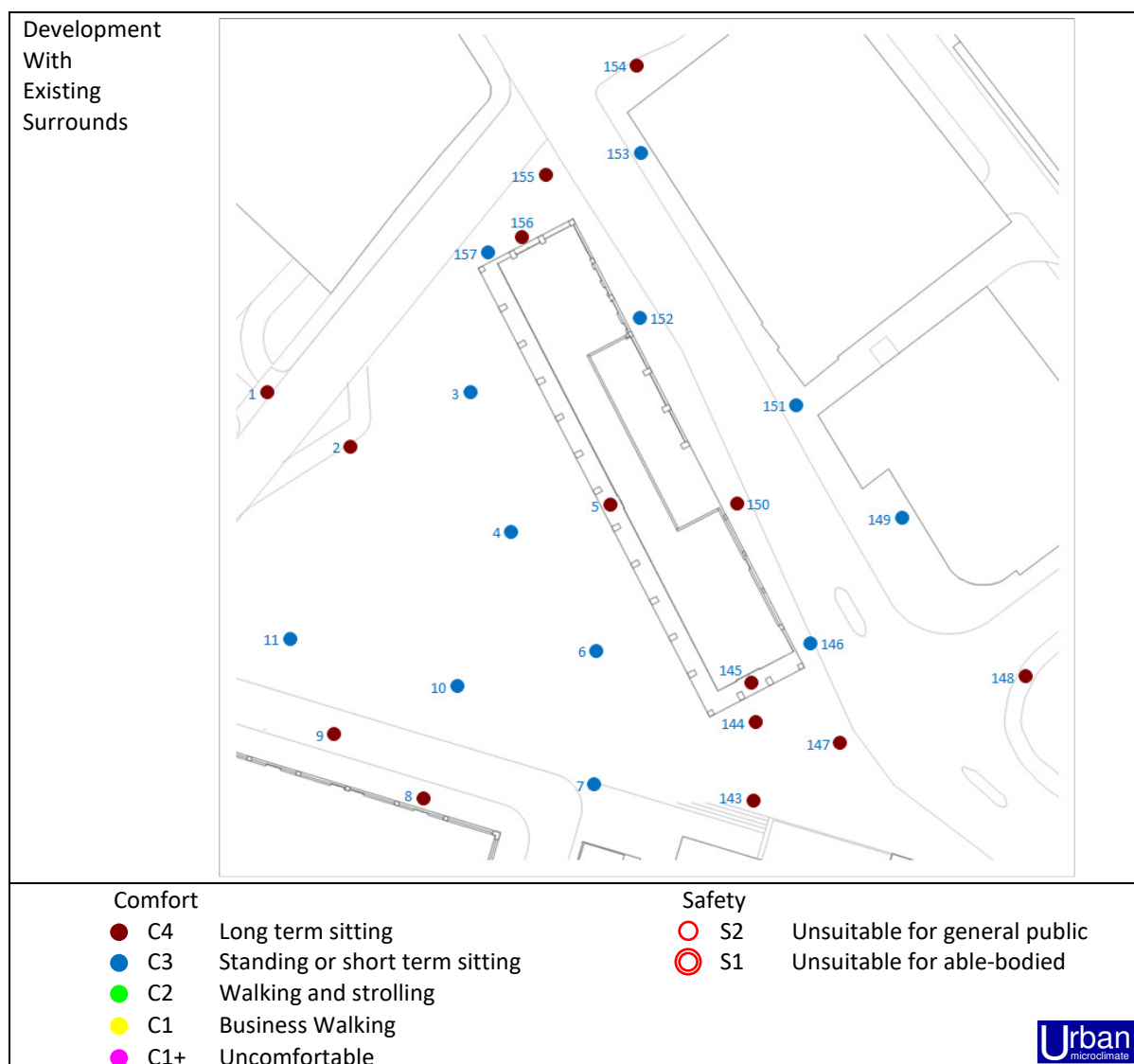
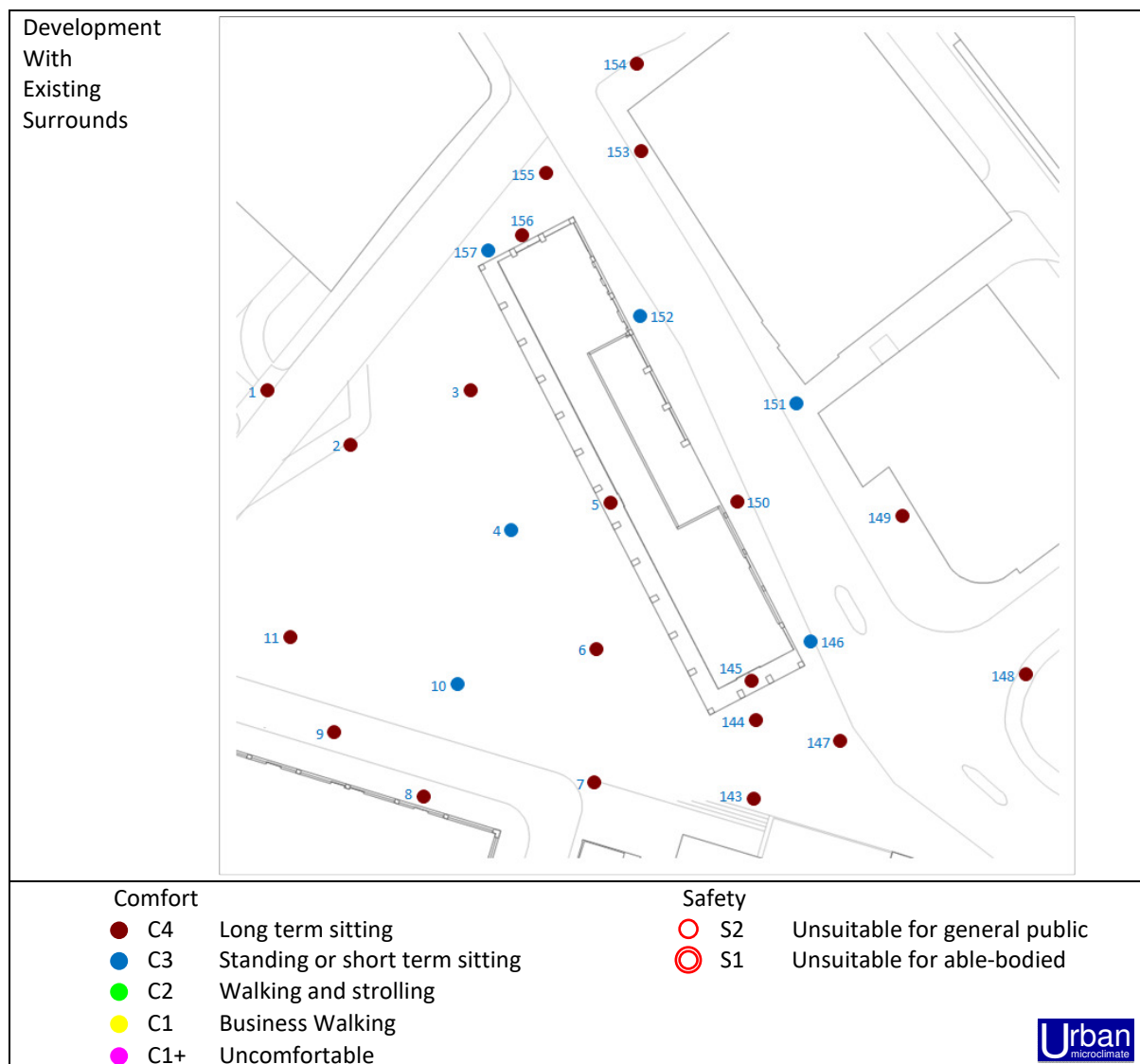
Figure A.4d: Wind Environment – Spring Comfort and Safety Ratings

Figure A.4e: Wind Environment – Summer Comfort and Safety Ratings

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