Union T2 (St Johns)

Wind Microclimate

March 2021

Prepared For:

Union Living Ltd.
Horseshoe Farm
Elkington Way
Alderley Edge
Cheshire, SK9 7GU

Urban Microclimate Limited
16 Torrington Gardens, Perivale, Middlesex UB6 7EN
Tel 0799 097 2510
Registered in England and Wales No. 9286534

Contents

Executive Summary 1
1. Introduction 2
2. Methodology and Criteria 5
2.1. Policy and Guidelines 5
2.2. Assessment Methodology 6
3. Assessment 10
3.1. Existing / Baseline Site Conditions 10
3.2. Impact of Proposed Development 12
3.3. Cumulative Effects 17
3.4. Comparison with Consented Scheme 20
4. Conclusions 21
Appendix A – Wind Tunnel Testing and Results 22
Wind Tunnel 22
Instrumentation 22
Wind Tunnel Model 23
Wind Climate Statistics 23
Pedestrian Level Wind Environment Results 23

Executive Summary

In accordance with best practice, wind tunnel testing of a physical scale model has been combined with long-term wind statistics applicable to the site, to provide a detailed assessment of pedestrian level wind conditions in and around the site, based on the industry standard Lawson criteria for pedestrian safety and comfort.

The proposed development represents a significant structure and, in the context of existing surrounding buildings, is relatively exposed at mid-to-upper levels to prevailing southerly winds. The proposed development is more exposed, but better orientated, to the most frequent extreme winds from the west-south-west and west. The landscaping and localised building features have therefore been developed to help alleviate resulting accelerated pedestrian level winds.

As a result, the proposed development is not expected to have any significant adverse impacts on pedestrian level wind conditions with regards to pedestrian safety. As The Green Room's southern roof-top terrace will be for private residents' use only, it will be a fully managed space allowing it to be closed during periods of high winds. The proposed development also has a potentially beneficial effect on conditions around the east corner of the Salford Central Zone C development, across the river, to the northwest of the site.

In terms of pedestrian comfort, with respect to wind force, thoroughfares within and alongside the site are expected to be generally suitable, and at least tolerable, for pedestrian access to, and passage past, the proposed development.

Entrances to the proposed development are expected to enjoy suitable conditions for pedestrian ingress / egress.

Recreational spaces are generally expected to enjoy suitable conditions for planned activities, including outdoor seating on the southern terrace (beneath the porous canopy), the raised northern terrace (beneath the small solid canopy on The Green Room) and the northern roof terrace (above The Green Room) during at least summer. The southern roof terrace (above The Green Room) experiences windier conditions but will be limited to fair-weather usage, to retain the unobstructed views of the river.

The proposed development has a mixed effect on surrounding conditions. Most effects are insignificant, but there are few localised minor adverse effects, such as on the main entrance to Union T1 where winter conditions become slightly windy (but likely tolerable) for comfortable pedestrian ingress / egress, and some minor beneficial effects, such as the potential to remove some of the wind mitigation screens from the north and south side of Union T1.

With the introduction of future surrounding developments, conditions in and around the site are generally enhanced and there are no significant adverse cumulative effects associated with the proposed development.

1. Introduction

Urban Microclimate Ltd. has been commissioned by Select Property Group, on behalf of Union Living Ltd., to assess the potential impact of the amended design of Union T2, forming part of the St Johns masterplan in Manchester, on the pedestrian level wind environment in and around the site.

The assessment is based on boundary layer wind tunnel testing of a physical scale model, based on details of the proposed development issued by the design team in January 2021. This represent best industry practice and provides a detailed, robust, quantitative assessment.

The proposed development comprises a rectangular, 36-storey plus plant, tower which was previously the subject of a planning application (application reference 126648/FO/2020) that was supported by an Environmental Statement. Subsequent to this, the addition of a single-storey extension, referred to as 'The Green Room', wrapping around the west elevation of the tower is proposed. In addition, changes to the layout of Water Street, on the east side of the development, require revisions to the public realm landscaping (and wind mitigation) between the development and the neighbouring Union T1 development (under the same ownership as the proposed development). The scheme considered is illustrated in Figures 1.1, below.

Figure 1.1a: Proposed Siteplan

Figure 1.1b: Proposed Development (Viewed in Isolation, from South)

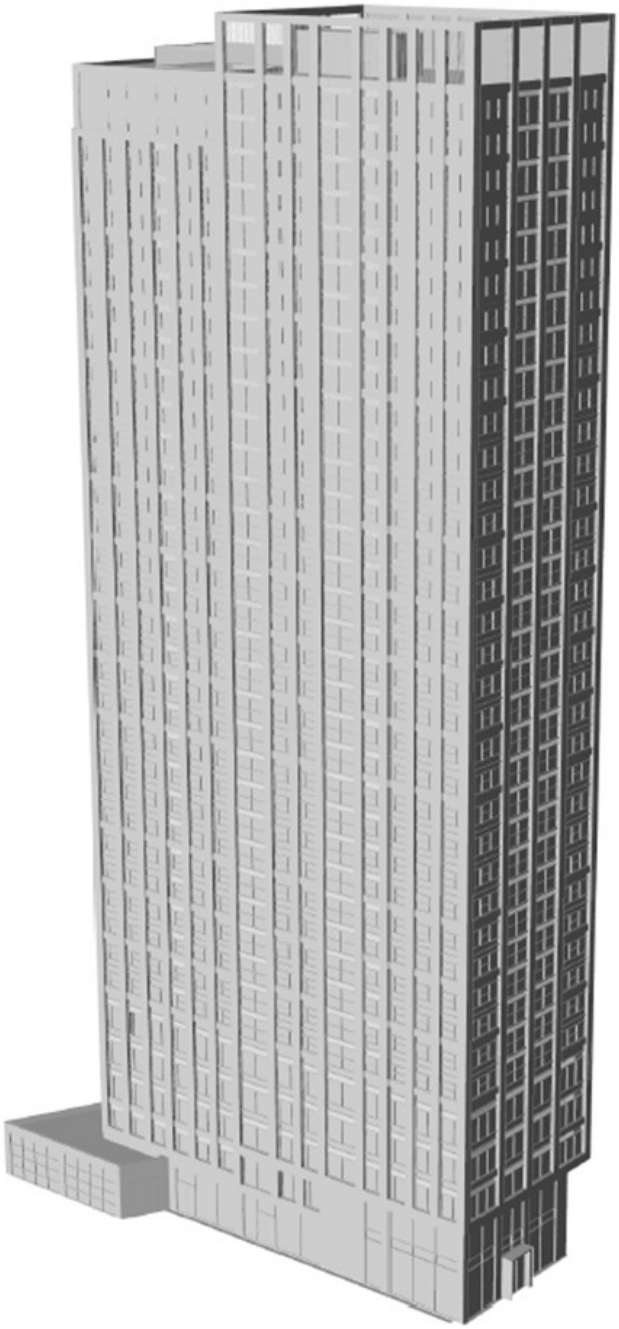
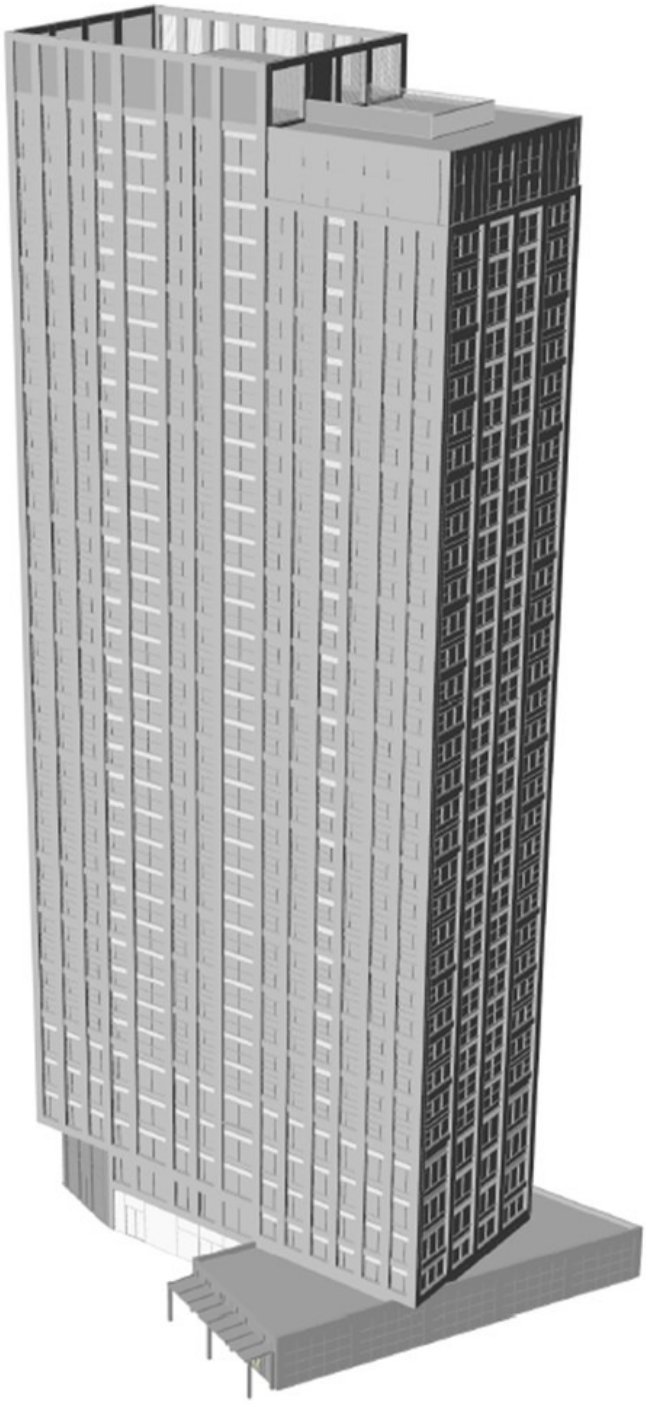


Figure 1.1c: Proposed Development (Viewed in Isolation, from North)



2. Methodology and Criteria

2.1. Policy and Guidelines

National Planning Policy and Guidelines

There are no national planning policies directly relating to wind microclimate issues. However, the National Planning Policy Framework (updated in June 2019) emphasises the benefits of a high-quality built environment. An example of this is presented in Section 12, which states that developments should:

> *"establish or maintain a strong sense of place, using the arrangement of streets, spaces, building types and materials to create attractive, welcoming and distinctive places to live, work and visit"*

The National Design Guide (October 2019) forms part of the associated planning practice guidance. Within this guide, the section Built Form B2 'Appropriate building types and forms' states that:

> *"Proposals for tall buildings (and other buildings with a significantly larger scale or bulk than their surroundings) require special consideration. This includes their location and siting; relationship to context; impact on local character, views and sight lines; composition - how they meet the ground and the sky; and environmental impacts, such as sunlight, daylight, overshadowing and wind. These need to be resolved satisfactorily in relation to the context and local character."*

The section Context C1 'Understand and relate well to the site, its local and wider context' goes on to state:

> *"Well-designed new development responds positively to the features of the site itself and the surrounding context beyond the site boundary. It enhances positive qualities and improves negative ones. Some features are physical, including:*
>
> - *environment – including landscape and visual impact, microclimate…".*

Local Planning Policy

Manchester City Council's Local Development Framework Core Strategy Development Plan Document (adopted July 2012) includes Policy EN2 Tall Buildings, for which tall buildings are defined as buildings which are substantially taller than their neighbourhoods and / or which significantly change the skyline. Policy EN2 states:

> *"...tall buildings can have a significant impact on the local environment and its micro-climate. It is therefore expected that this impact be modelled and that submissions for tall buildings also include appropriate measures to create an attractive, pedestrian friendly local environment."*

The Guide to Development in Manchester, Supplementary Planning Document and Planning Guidance (adopted April 2007), Section 2. Design, Paragraph 2.40 (Hard landscaped areas within the public realm should be attractive) states:

> *"Where the public realm includes hard landscaped areas, its design should reflect the level and nature of their use, and should consider issues such as overshadowing, prevailing winds..."*

Within the same guide, Section 12. The City Centre, Paragraph 12.8 (Development Quality) states:

> *"...Key questions will be ... the microclimate, including overshadowing and air turbulence effects, created by the relationship of the building to those adjacent; and the quality and usability of the spaces surrounding the building."*

Additional Standards and Guidance

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

In accordance with the above policies and guidelines, a detailed wind microclimate assessment has been undertaken. 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 centre of the site (up to and beyond the extent of potential significant effects of the proposed development).

The development was modelled based on a 3D CAD model provided by the design team in January 2021. The surrounding existing and consented buildings were represented to a sufficient level of detail to reproduce the wind flows at the site and on surrounding land. Proposed semi-mature and existing mature trees were modelled in winter, or bare, format.

To inform the testing, an initial experience-based assessment was carried out to identify areas of potential accelerated winds in and around the 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 were then taken at the 125 locations identified. Measurements were taken at a height corresponding to 1.5 metres at full scale, for a full range of wind directions in increments of 22.5°. Recordings were taken for a sufficient length of time to determine the mean and maximum gust wind speeds.

Wind tunnel tests were carried out for the following configurations:

- Existing / baseline site conditions;
- Proposed development with existing (baseline) surrounds; and
- Proposed development with future surrounds.

Buildings under construction at the time of assessment were included within the baseline, in their completed form. This includes the following schemes:

- Union T1 (St. Johns) (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)

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

- 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 consented schemes in the area were reviewed and considered too distant to have any significant cumulative effects with the development.

Wind Climate Data

A Weibull distribution was applied to long-term wind frequency statistics from Manchester Airport, with annual and seasonal data derived for 16 evenly spaced sectors. The Weibull parameters were corrected to open-country terrain at sea-level and then 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 1991-1-4:2005. Historical data is 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

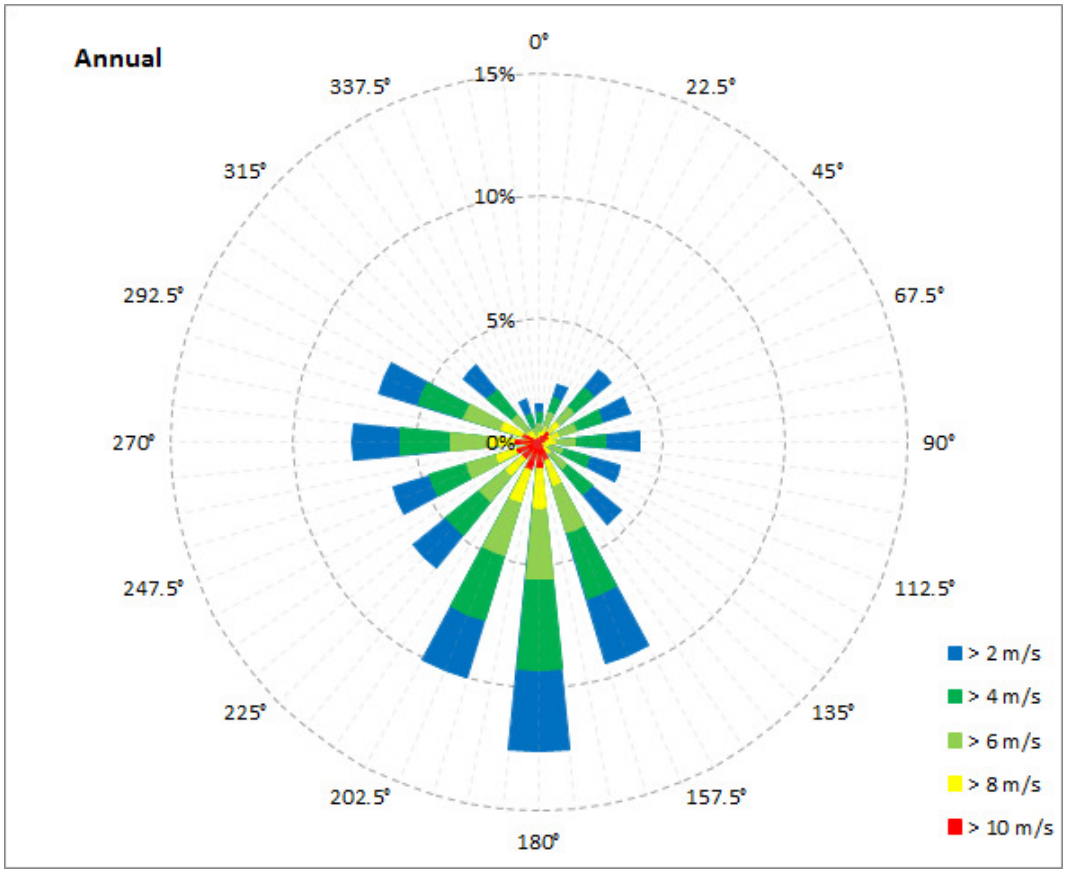
Suitability		**Target Lawson comfort and safety criteria for specified seasons**
Outdoor seating	For long periods of sitting, such as for an outdoor café or picnic area.	'Long term sitting' (C4) in at least summer.
Entrances, waiting areas	For pedestrian ingress/egress at entrances, or short periods 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. Existing / Baseline Site Conditions

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 114 m, corresponding to the approximate maximum roof height of the proposed development, relative to 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 114 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.

The existing open site is partially sheltered from prevailing southerly winds by The Factory. The site is exposed to the stronger, but less frequent, westerly winds but the back-pressure created by Union T1 and Manchester Goods Yard helps limit the resulting wind speeds across the site. The exposure of Union T1, Manchester Goods Yard and No.1 Grape Street to

these westerly winds does however result in downdraughts and subsequent channelling of winds around and between the buildings to the east of the site. Also within the surrounding area, Salford Central Zone C (on the opposite side of the River Irwell) is exposed to prevailing southerly winds and westerly winds, and has potential to create strong downdraughts and subsequent channelling of winds around and through the passage cutting through the building.

The resulting pedestrian level wind environment in and around the existing site is presented in terms of the Lawson comfort and safety criteria in Appendix A and is summarised below.

Pedestrian Safety

As discussed above, Salford Central Zone C is exposed to prevailing southerly winds and stronger westerly winds. In the current study, the scheme has been modelled as basic massing, sufficient to demonstrate any potential effects of the proposed development but excluding any detailed components which may be introduced to help mitigate localised wind effects. In this form, there appears potential for pedestrian level wind conditions to rate as unsuitable, in terms of pedestrian safety, for the general public within the central passage and around the east corner of the building.

Otherwise, 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 across the existing site are suitable for recreational activities including at least short periods of standing or sitting (such as for a meeting point, for example), with suitable conditions for long periods of outdoor sitting (such as for picnics, for example) enjoyed during at least summer.

The bus stop on Water Street, near the entrance to the Marriott Hotel, is also expected to enjoy suitable conditions for awaiting a bus, though this bus stop will be removed for proposed site conditions.

Within the surrounding area, wind conditions within the central passage and around the east corner of Salford Central Zone C have potential to be suitable only for fast walking, normally associated with business activities, during winter. Otherwise, surrounding conditions are suitable for at least leisurely strolling and are considered suitable for pedestrian passage.

With the potential exception of the Salford Central Zone C entrance within the central passage, main entrances to the existing surrounding buildings enjoy suitable conditions for pedestrian ingress / egress.

The Marriott Hotel’s outdoor seating areas both enjoy suitable conditions for long periods of outdoor sitting, such as for an outdoor café, during at least summer and spring.

Factory Square (to the west of The Factory) enjoys suitable conditions for general recreational uses including at least short periods of sitting (such as for a meeting point), with summer conditions further suitable for long periods of outdoor sitting (such as for picnics).

Most of Festival Square (on the north side of and beneath The Factory) enjoys suitable conditions for recreational uses including at least short periods of sitting, with much of the space further suitable for long periods of outdoor sitting during at least summer. The northern area, towards to the southwest corner of Union T1, and around the north-eastern core have suitable conditions for leisurely strolling but are marginally windy for sedentary activities during winter. The eastern area is marginally windy for sedentary activities during spring, though the north-easterly winds causing this are typically cold and would limit sedentary activities anyway. Given the extent of areas affected, the overall conditions across the square are expected to be at least tolerable for associated recreational uses.

The open space around the southwest corner of Union T1 has suitable conditions for recreational activities including short periods of sitting from spring to autumn. Suitable conditions for long periods of sitting in summer, such as for an outdoor café, are limited to small areas close to the west and south frontages.

The open space at St Johns Place has suitable conditions for recreational activities including at least short periods of sitting and conditions are expected to be considered acceptable for associated temporary uses.

Salford Central Zone C enjoys suitable conditions for general recreational activities along most of the waterfront, from spring through to autumn, with parts of the space further suitable for outdoor seating in at least summer. In the absence of landscaping measures, the podium-top terrace is considered too windy for outdoor seating during summer. However, with inclusion of the landscaping proposals, conditions may be acceptable.

3.2. Impact of Proposed Development

The proposed development presents a relatively wide obstruction to prevailing southerly winds, particularly the stronger south-south-westerly winds. The development is partially sheltered at lower levels from these winds but is relative exposed at mid-to-upper levels. Downdraughts from the southerly elevation have potential to reach pedestrian level before channelling along the façade and around the southwest corner of The Green Room and the southeast corner of the tower. The downdraughts may extend some distance upwind towards The Factory and to the east (towards the T1 site), before channelling along Water Street, to the northeast of the proposed development.

The proposed development is more exposed to, but presents a narrow obstruction to, the most frequent extreme winds from the west-south-west and west. The building orientation helps limit the potential for downdraughts and subsequent channelling of resulting pedestrian level winds for these wind directions, but there is still potential for significant accelerated winds around the northwest corner of The Green Room.

The proposed development is orientated to present a corner to north-easterly winds, common in spring. This limits the potential for significant effects for these winds, though there is still some potential for accelerated winds around the northwest corner of The Green Room.

The landscaping and localised building features were developed during a series of interactive workshops to allow the proposed development and the public realm / Union T1 landscaping to respond to the potential wind effects discussed above, the proposed pedestrian and occupant activities and the required changes to the layout of Water Street. Resulting key features embedded into the updated design and public realm include:

Proposed Development

- 4 m deep, 50% porous canopy, extending from south elevation at Level 1 (~ 5.3 m above ground);
- ~ 6 - 8 m high trees across the open space in the south of site, with denser planting along the south elevation of The Green Room;
- ~ 4 - 6 m high trees along the edges of Water Street and Canal Basin;
- Two 2.4 m high x 1.8 m wide, 50% porous, screens between Water Street and Canal Basin, to the northeast of the development;
- Two 3.0 m high x 4.5 m wide, 50% porous, arches with 2.4 m high x 1.5 m wide openings in the centre, extending out from the southwest corner and northwest elevation (~ 7.8 m from the northwest corner) of The Green Room, towards the river;
- ~ 1.1 - 1.2 m high, 50% porous, barriers along the river edge; and
- ~ 1.1 - 1.2 m high, solid glazed, barriers
    - along the south and east edges of the southern terrace (beneath the porous canopy);
    - along the north and west edges of the raised northern terrace (beneath the small solid canopy on The Green Room); and
    - along the top of the level change between the development and Canal Basin.

Public Realm and Union T1

- ~ 6 - 8 m high trees across the public realm between Water Street and Union T1, to the north of Union T1 and along the south side of Union T1;
- ~ 4 - 6 m high trees along the edges of Water Street around the northwest corner of Union T1;
- Two 2.4 m high x 1.5 m wide, 50% porous, screens on the east side of Water Street, to the west of Union T1;
- ~ 1.1 - 1.2 m high shrubs in planter around the northwest corner of Manchester Goods Yard; and
- Removal of the 2.4 m high x 1.8 m wide, 50% porous, screens from the north and south sides of Union T1 (required in the absence of the proposed development).

The above features, as modelled, are illustrated in Appendix A. The proposed trees are assumed to be planted semi-mature (at the approximate heights stated above) and be of a species with substantial retained solidity in winter (i.e. significant canopies with numerous branches).

The resulting pedestrian level wind environment in and around the site is presented in terms of the Lawson comfort and safety criteria in Appendix A and is further summarised graphically in Figure 3.2 in terms of suitability for pedestrian activities (in accordance with the targets outlined in Table 2.3). This presentation applies expert judgement to extrapolate from the key-point measurements in order to indicatively cover the site and surrounding area.

Pedestrian Safety (Baseline Surrounds)

Within the site, conditions rated as unsuitable, in terms of pedestrian safety, for the general public are limited to The Green Room's southern roof-top terrace, around the southwest corner of the tower. Whilst physical mitigation measures such as taller parapets on the rooftop would potentially address this exceedance, this is not considered the preferred approach as it would obscure the open views across the river, potentially reducing the overall amenity of the space. As such, the operator will limit the space to fair-weather usage and access will be prevented during periods of high winds. As this is a private residents-only space, as part of a managed development, this managed access approach is considered adequate mitigation.

Within the surrounding area, the proposed development has a beneficial effect on Salford Central Zone C, partially sheltering the northeast tower from prevailing southerly winds. Resulting conditions rate as safe for all users around the building's east corner. Conditions within the central passage also improve but, despite the beneficial effect of the proposed development, have potential to remain rated as unsuitable for the general public.

The proposed development therefore has no significant adverse effects on pedestrian safety.

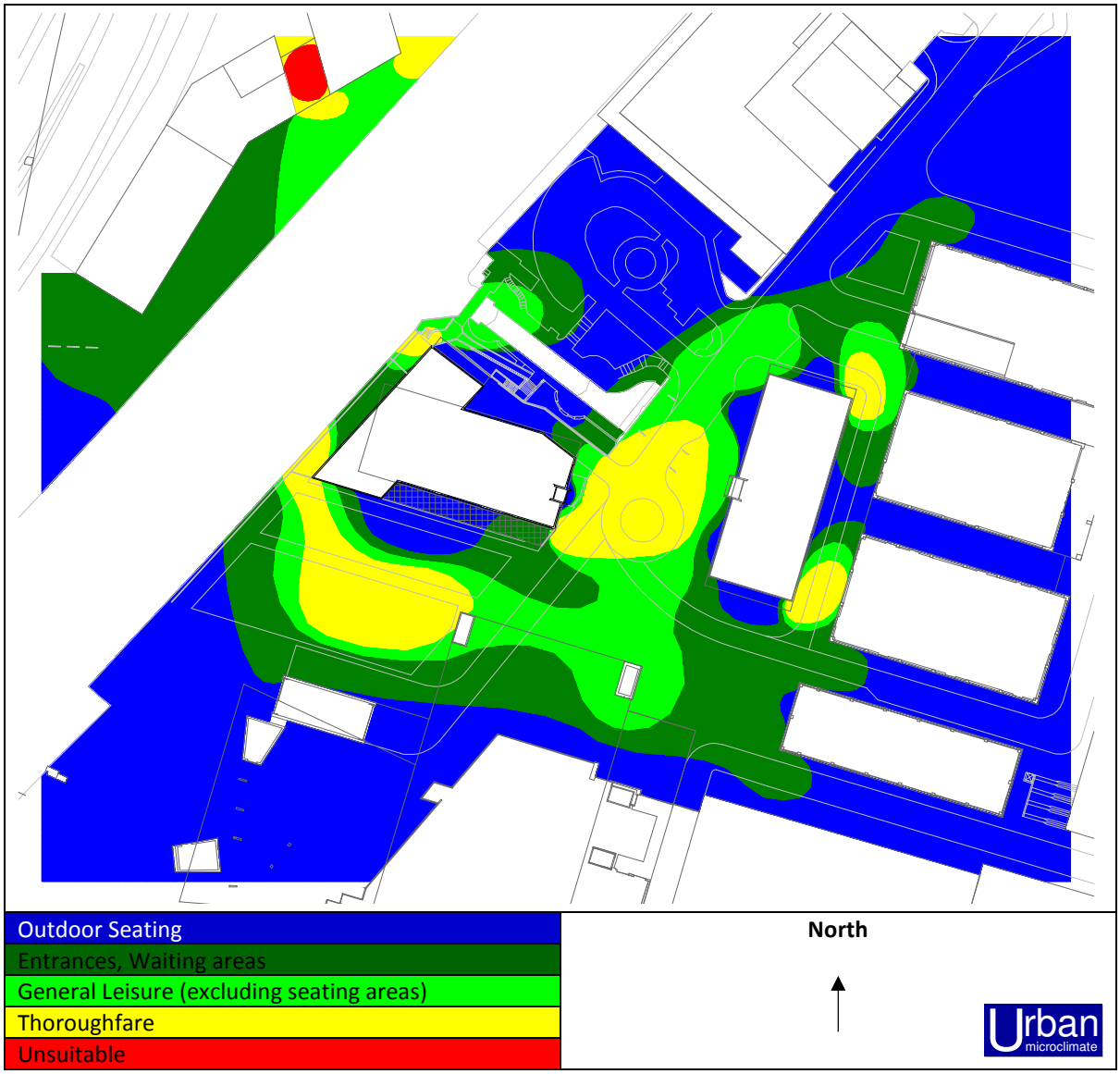
Pedestrian Comfort (Baseline Surrounds)

Thoroughfares

In terms of pedestrian comfort, with respect to wind force, wind conditions at the southwest corner of The Green Room are considered suitable, ideally, only for fast walking, normally associated with business activities, during winter. However, these localised conditions only marginally exceed the Lawson criterion for leisurely strolling and are expected to be considered tolerable for pedestrian passage, particularly given the waterfront location.

Otherwise, 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 site.

Figure 3.2: Pedestrian Level Suitability Assessment



Building Entrances

The main entrances to the proposed development are located away from areas of potential accelerated winds or a locally sheltered. As a result, conditions at the development's main entrances are suitable for pedestrian ingress / egress.

Amenity Spaces

The central and western areas of the southern terrace, beneath the porous canopy, enjoy suitable conditions for long periods of outdoor sitting, such as for café seating, throughout the year. The slightly windier conditions on the ramped eastern area are suitable for short periods of standing and would be considered suitable for uses such as a meeting point.

The raised northern terrace (beneath the small solid canopy on The Green Room) enjoys suitable conditions for café outdoor seating during summer. Similar conditions are enjoyed on the northern roof terrace, above The Green Room.

Conditions on the southern roof terrace, above The Green Room, are considered too windy for sedentary recreational uses (based on the Lawson criteria for pedestrian comfort which considers wind speeds exceeded for more than 5% of the time). However, as discussed above, the preference for this area is to limit the space to fair-weather usage and retain the unobstructed views of the river. For this it is expected that amenable conditions for outdoor seating may be enjoyed around 70% of the time during summer.

The open space on the south side of the proposed development is susceptible to some downdraughts from the tower. Summer conditions are suitable for recreational activities including at least short periods of sitting or standing, such as for a meeting point or children's play. Conditions from autumn to spring, whilst suitable for leisurely strolling, are considered too windy for sedentary activities across much of the space. However, given the open nature of this space, conditions are expected to be considered tolerable.

The area around the Canal Basin enjoys suitable conditions for recreational activities, including at least short periods of sitting or standing from spring through to autumn, with much of the space further suitable for long periods of outdoor sitting during at least summer. Overall, conditions are expected to be suitable for proposed uses.

Surrounding Area

With the introduction of the proposed development, conditions around the east corner of Salford Central Zone C improve but still have potential to remain suitable (ideally) only for fast or business walking during winter, though conditions are expected to only marginally exceed the criterion for leisurely strolling and should therefore be tolerable for pedestrian passage.

Otherwise, conditions in the immediate surrounding area, including within Salford Central Zone C's central passage, are suitable for at least leisurely strolling and would be considered suitable for pedestrian passage.

The main entrance to the Union T1 development is marginally windy, but likely tolerable, for pedestrian ingress / egress during winter. This represents a minor adverse effect of the proposed development. Otherwise, conditions at surrounding building entrances are not materially changed in terms of suitability for pedestrian ingress / egress, with most entrances (with the potential exception of Salford Central Zone C's central passage) retaining suitable conditions for pedestrian ingress / egress.

The Marriott Hotel's outdoor seating areas both enjoy suitable conditions for long periods of outdoor sitting, such as for an outdoor café, from spring through to autumn. This represents a very slight enhancement (during autumn) at the eastern space, adjacent to Water Street.

Factory Square retains suitable conditions for general recreational uses including at least short periods of sitting (such as for a meeting point), with summer conditions further suitable for long periods of outdoor sitting (such as for picnics) across most of the space. The northeast corner of the square becomes slightly windy for outdoor seating during summer but, given the extent of area affected and its proximity to the loading area, this effect is not considered significant.

Most of Festival Square retains suitable conditions for recreational uses including at least short periods of sitting, particularly from spring through to autumn. The area along the north elevation of The Factory is further suitable for long periods of outdoor sitting during at least summer. Relative to the existing site conditions, the area with suitable summer conditions for outdoor seating is reduced but conditions in the east are enhanced in spring. As for existing site conditions, conditions are overall expected to be at least tolerable for associated recreational uses.

The open space around the southwest corner of Union T1 retains suitable conditions for recreational activities including short periods of sitting from spring to autumn. Suitable conditions for long periods of sitting in summer, such as for an outdoor café, remains limited to small areas close to the west and south frontages, but the extent of amenable conditions on the south frontage (away from the building corners) is slightly increased relative to existing site conditions.

The open space at St Johns Place is slightly enhanced relative to existing site conditions, with resulting conditions suitable for recreational activities including at least short periods of sitting from autumn to spring and long periods of outdoor sitting during summer. However, as existing conditions are expected to be considered acceptable for associated temporary uses, this effect is not considered significant.

Salford Central Zone C retains suitable conditions for general recreational activities along most of the waterfront. Relative to existing site conditions, the area enjoying such conditions is slightly increased, though the parts of the space further suitable for outdoor seating in at least summer is slightly reduced. The podium-top terrace is slightly enhanced but, in the absence of landscaping measures, remains too windy for outdoor seating during summer. The overall effect of the proposed development on the amenity spaces is not considered significant.

3.3. Cumulative Effects

With the introduction of committed future surrounding developments, both the proposed development and Salford Central Zone C enjoy greater shelter from prevailing southerly winds and are significantly sheltered from the most frequent strong winds from the west-south-west and west.

This additional shelter allows for the removal of the following design features which are included for wind mitigation:

- The two 2.4 m high x 1.8 m wide, 50% porous, screens between Water Street and Canal Basin, to the northeast of the development; and
- The two 2.4 m high x 1.5 m wide, 50% porous, screens on the east side of Water Street, to the west of Union T1.

All other design features within the proposed development and immediate surrounding public realm are retained.

The St Johns Place Zone 1 tower development represents a substantial structure with potential to create areas of accelerated pedestrian level winds within the area surrounding the tower. The current assessment has considered only the illustrative canopies and landscaping presented within the latest relevant planning application for this development and does not include further mitigation measures which are expected to be developed during the detailed design stages for this plot to address the planning condition requiring submission of a final wind mitigation scheme. Although sheltered at lower levels, the St Johns Place tower is exposed to both prevailing southerly winds and north-easterly winds, common in spring. Downdraughts from the mid-to-upper levels of the south and north elevations have potential to spill over the southern canopy and northern podium, respectively, reaching pedestrian level to the southwest of the tower, by Water Street.

The resulting pedestrian level wind conditions in and around the site is presented in terms of the Lawson comfort and safety criteria in Appendix A and is summarised below.

Pedestrian Safety (Future Surrounds)

Within the site, conditions remain rated as unsuitable, in terms of pedestrian safety, for the general public on The Green Room's southern roof-top terrace. Again, this space will be limited to fair-weather usage and access to the terrace will be prevented during storms. This managed access approach is considered adequate mitigation.

Within the surrounding area, pedestrian level wind conditions rate as unsuitable, in terms of pedestrian safety, for the general public around the southwest of the St Johns Place tower. However, the accelerated winds are dictated by downdraughts from St Johns Place tower, particularly from the northern elevation for north-easterly winds. This is not therefore considered a combined effect of the proposed development with this future development.

Elsewhere, pedestrian level wind conditions in and around site rate as safe for all users.

Pedestrian Comfort (Future Surrounds)

Thoroughfares

With the increased shelter provided by future surrounding developments, pedestrian level 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 site.

Building Entrances

The main entrances to the proposed development enjoy suitable conditions for pedestrian ingress / egress.

Amenity Spaces

Conditions across the proposed development's amenity spaces are similar or very slightly enhanced relative to with the existing / baseline surrounding context. In particular, suitable conditions for outdoor seating on the raised northern terrace and northern roof terrace are extended into autumn. However, the overall suitability is not materially changed.

Surrounding Area

Within the surrounding area, conditions to the southwest of the St Johns Place tower are considered suitable only for fast or business walking during winter and spring but are only marginally windy for leisurely strolling and are expected to be considered tolerable. However, as discussed above, these accelerated winds are expected to be dictated by the St Johns Place tower and are not considered to represent a combined effect of the proposed development with this future development. There is also a planning condition attached to the St. Johns Place Planning Permission requiring submission of a final wind mitigation scheme to address this issue.

Otherwise, thoroughfares in the immediate surrounding area are suitable for at least leisurely strolling and are considered suitable for pedestrian passage.

Entrances to surrounding buildings, including Union T1 and Salford Central Zone C, are expected to enjoy suitable conditions for pedestrian ingress / egress.

Conditions at the Marriott Hotel's outdoor seating areas and across Factory Square are similar to those discussed above for the proposed development with existing surrounds. Conditions within Festival Square are slightly enhanced, to become suitable for recreational uses including at least short periods of sitting throughout the year. Relative to the existing site conditions, the area with suitable summer conditions for outdoor seating is still slightly reduced but conditions in the east are further enhanced and conditions are, overall, expected to be at least tolerable for associated recreational uses.

The open space around the southwest corner of Union T1 is also enhanced, with conditions considered suitable for recreational activities including short periods of sitting throughout the year and the extent of area enjoying amenable conditions for café outdoor seating also increases on the south side of the tower.

Salford Central Zone C also benefits from increased shelter from approaching winds, with suitable conditions for general recreational activities along most of the waterfront. Relative to existing / baseline site conditions, the area enjoying such conditions and the area further suitable for outdoor seating in at least summer are increased. The podium-top terrace is also enhanced, with summer conditions considered suitable for outdoor seating.

3.4. Comparison with Consented Scheme

As indicated above, the proposed development was previously the subject of a planning application (reference 126648/FO/2020) that was supported by an Environmental Statement. The ES included an assessment of residual effects, taking account of preliminary wind mitigation measures and the neighbouring Union T1 development (in place of the then consented St John's T1).

In addition to the amendments to the proposed development and public realm landscaping, the current assessment also accounts for updates to the surrounding context. In particular, this includes consideration of the Union T1 and Salford Central Zone C developments as part of the baseline.

Relative to the 2020 ES, the differences in reported effects on Salford Central Zone C are expected to be due to the surrounding context considered, i.e. the inclusion of Salford Central Zone C as part of the baseline, in the absence of other future surrounding developments.

Otherwise, the significant changes to conditions, in terms of suitability for existing and proposed activities, are limited to the following:

- Conditions around the east of the site and on Water Street are improved such that the main entrance to the proposed development enjoys suitable conditions for pedestrian ingress / egress and Water Street conditions are suitable for at least leisurely strolling; and
- Conditions around the southwest of the site deteriorate such that conditions are marginally windy, but tolerable, for pedestrian passage around the southwest corner of The Green Room.

Other than the new, mainly beneficial, effects on Salford Central Zone C, the residual effects summarised in the 2020 ES are considered to remain valid or are slightly improved. Effects on pedestrian safety remain negligible. In terms of pedestrian comfort, effects on thoroughfares remain generally negligible with some (different) localised minor adverse effects; effects on entrances remain generally negligible with a reduced number of localised minor adverse effects; and effects on amenity spaces remain minor beneficial to minor adverse.

4. Conclusions

Existing / Baseline Site Conditions

For baseline conditions, Salford Central Zone C is exposed to prevailing southerly winds and stronger westerly winds and has potential for unsuitable conditions within the central passage and around the east corner. Otherwise, pedestrian level wind conditions in and around the existing site rate as safe for all users and are considered generally comfortable, and at least tolerable, for existing uses.

Impact of Proposed Development

With managed access to The Green Room's southern roof-top terrace, the proposed development has no significant adverse impacts on pedestrian level wind conditions with regards to pedestrian safety. The proposed development has a potentially beneficial effect on conditions around the east corner of the Salford Central Zone C development.

In terms of pedestrian comfort, with respect to wind force, thoroughfares within and alongside the site are expected to be generally suitable, and at least tolerable, for pedestrian access to, and passage past, the proposed development.

Entrances to the proposed development are expected to enjoy suitable conditions for pedestrian ingress / egress.

Recreational spaces are generally expected to enjoy suitable conditions for planned activities, including outdoor seating on the southern terrace (beneath the porous canopy), the raised northern terrace (beneath the small solid canopy on The Green Room) and the northern roof terrace (above The Green Room) during at least summer. The southern roof terrace (above The Green Room) experiences windier conditions but will be limited to fair-weather usage, to retain the unobstructed views of the river.

The proposed development has a mixed effect on surrounding conditions. Most effects are insignificant, but there are few localised minor adverse effects, such as on the main entrance to Union T1, and some minor beneficial effects, such as the potential to remove some of the wind mitigation screens from the north and south sides of Union T1.

With the introduction of future surrounding developments, conditions in and around the site are generally enhanced and there are no significant adverse cumulative effects associated with the proposed development.

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 a turbulence grid and an arrangement of roughness elements distributed over the floor of the wind tunnel.

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 and longitudinal turbulence intensity used in the tests. The mean wind speed profile is normalised by the mean wind speed at a height of 114 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 1.5m 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.

In accordance with best practice, 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 of the proposed development and existing / future surrounding area was constructed by RWDI, based on a 3D model, plans and elevations provided by the design team in January 2021. Existing surrounding building were 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 on the approximate centre of the St Johns masterplan.

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

Figure A.2a illustrates the models for existing / baseline site conditions, the proposed development in the context of existing / baseline surrounding conditions and the proposed development with consented future surrounding developments.

Figure A.2b shows close-up images and a plan of the designed-in features and landscaping modelled.

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 114 m, corresponding to the approximate maximum roof height of the proposed development above the local ground level. The factors applied to correct the statistics from open-country terrain to reference height at the site are also presented.

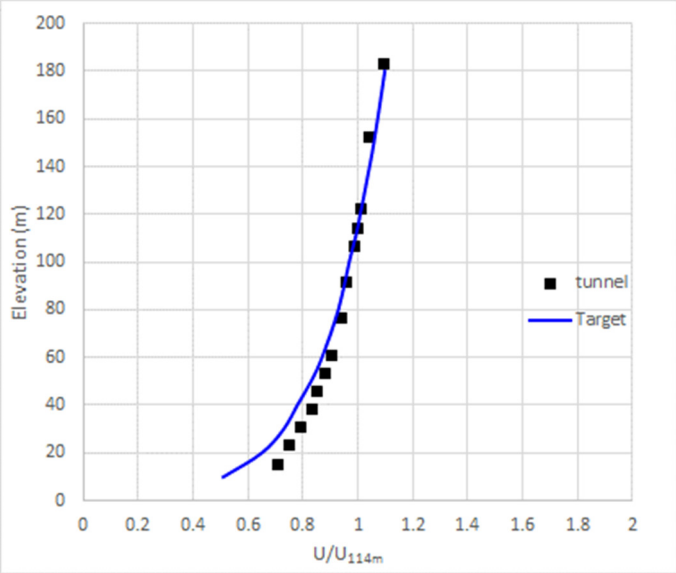
Pedestrian Level Wind Environment Results

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:

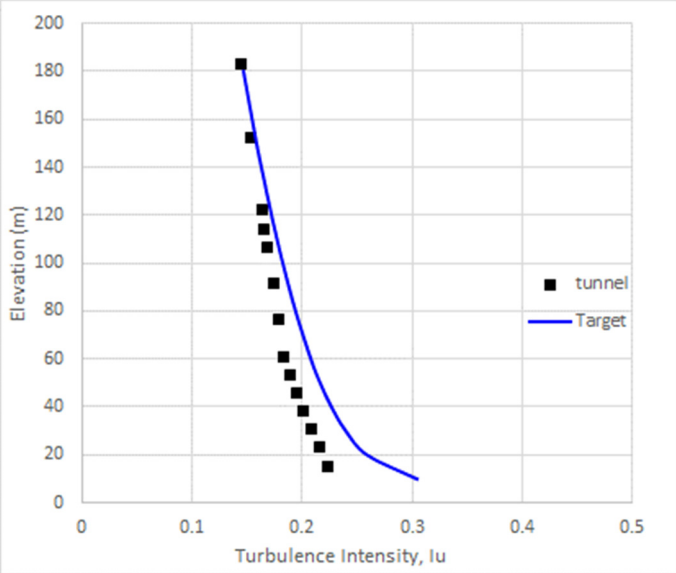
- Existing (baseline) site conditions
- Proposed development with existing (baseline) surrounds
- Proposed development with future surrounds

Figure A.1: Wind Tunnel Boundary Layer Simulation

Mean Wind Speed



Longitudinal Turbulence Intensity



1-Second Gust Wind Speed

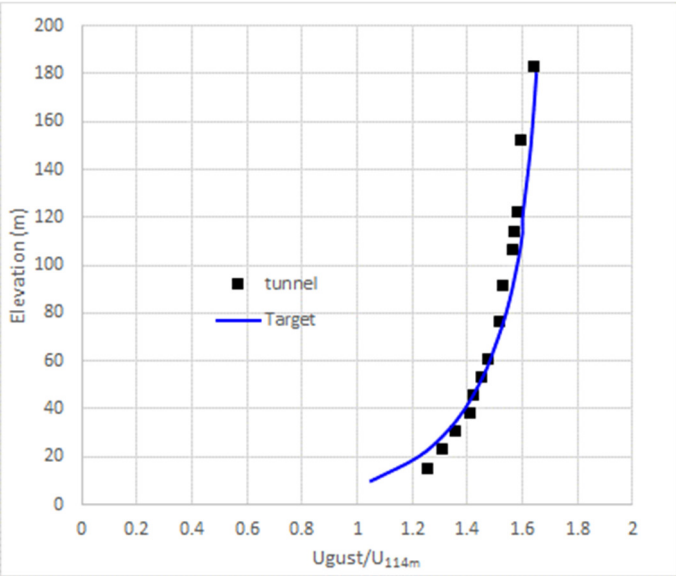


Figure A.2a: Wind Tunnel Models

Existing Site Conditions

Close up of Proposed Development

Close up of Proposed Development

Proposed Development with Existing Surrounds

Proposed Development with Future Surrounds

Wind Tunnel Set-up

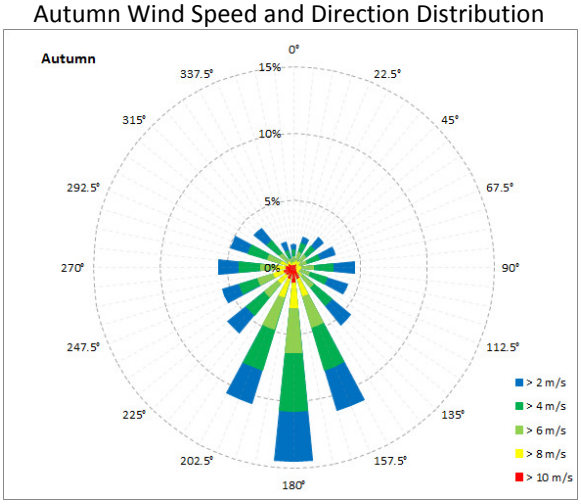
Figure A.2b: Wind Tunnel Models (Designed-In Features and Landscaping)

Figure A.3a: Wind Speed Correction Factors, Open Country to Ref. Height (114m) at Site

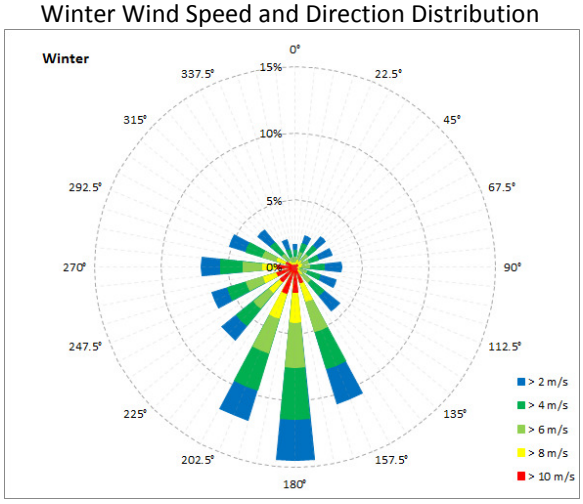
Direction	0˚	22.5˚	45˚	67.5˚	90˚	112.5˚	135˚	157.5˚
Factor	1.34	1.32	1.31	1.30	1.30	1.31	1.31	1.32
Direction	180˚	202.5˚	225˚	247.5˚	270˚	292.5˚	315˚	337.5˚
Factor	1.32	1.31	1.33	1.34	1.34	1.34	1.34	1.34

Figure A.3b: Wind Climate at Site (at reference height of 114 m)

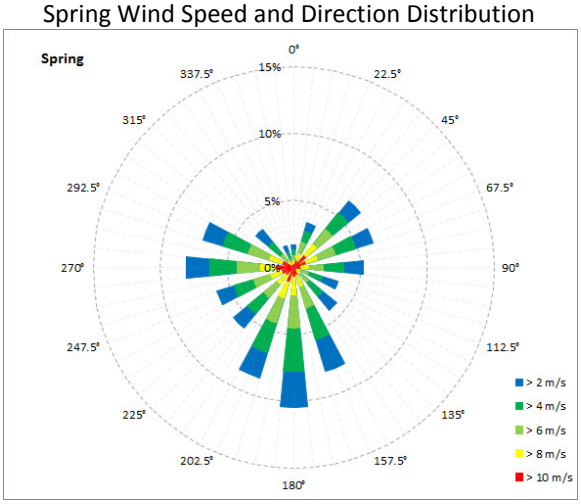
Autumn Wind Speed and Direction Distribution



Winter Wind Speed and Direction Distribution



Spring Wind Speed and Direction Distribution



Summer Wind Speed and Direction Distribution

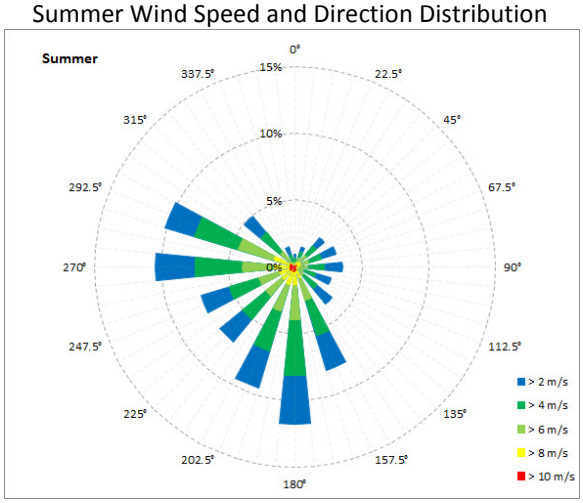
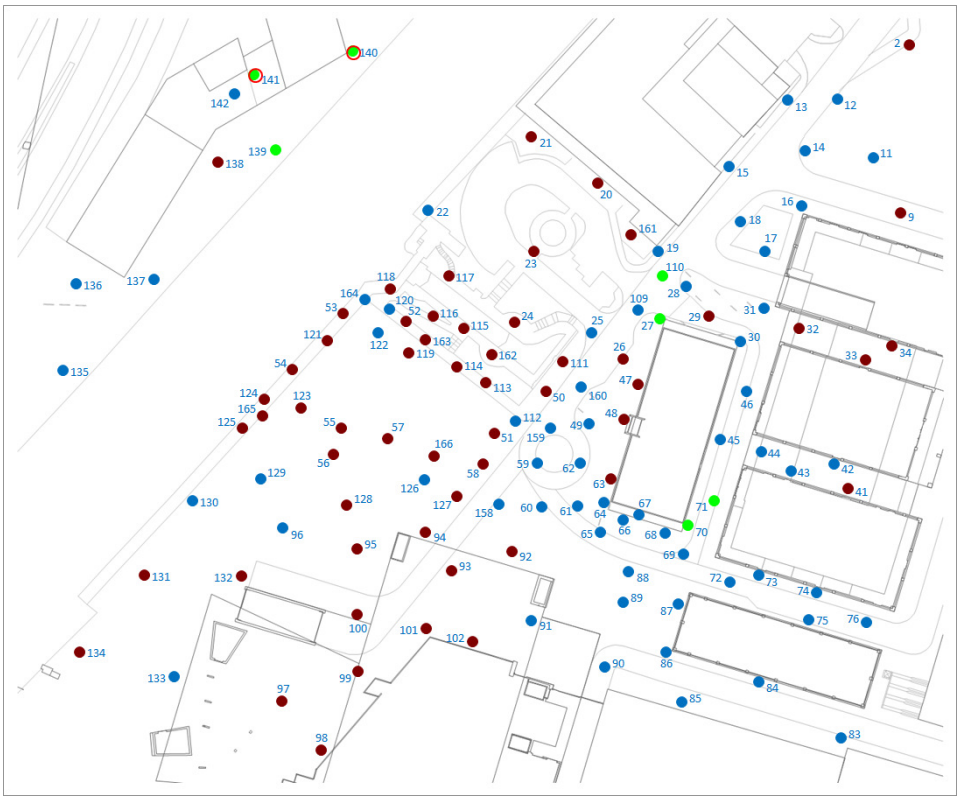
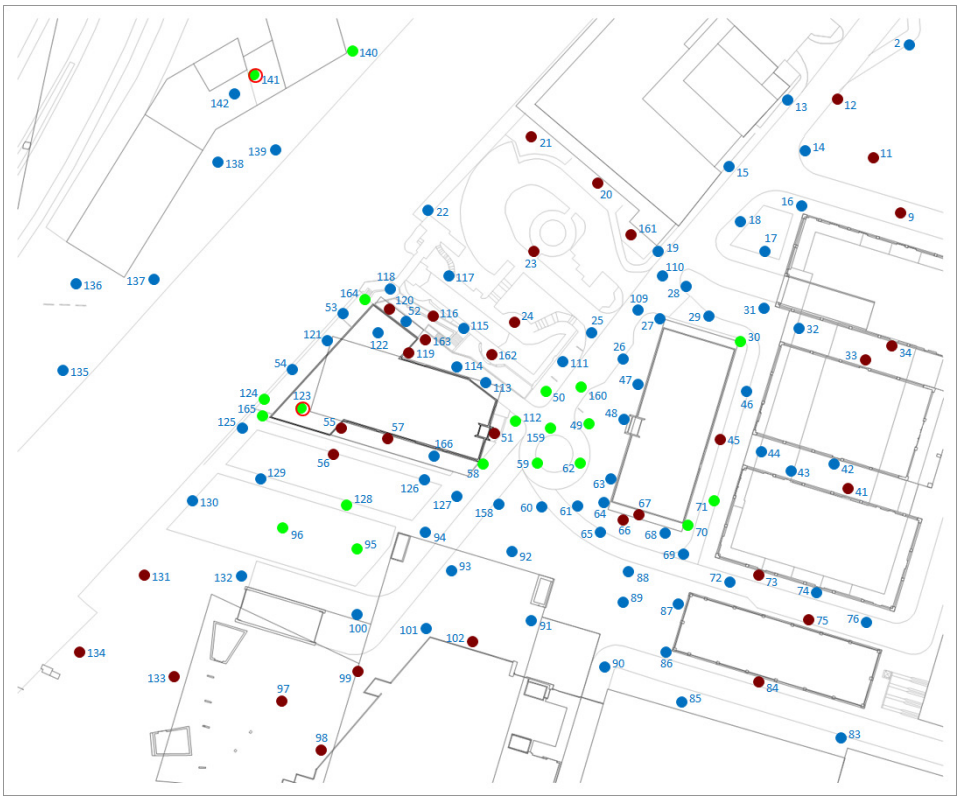


Figure A.4a: Wind Environment – Annual Comfort and Safety Ratings

Existing Site Conditions



Proposed Development With Existing Surrounds



Comfort

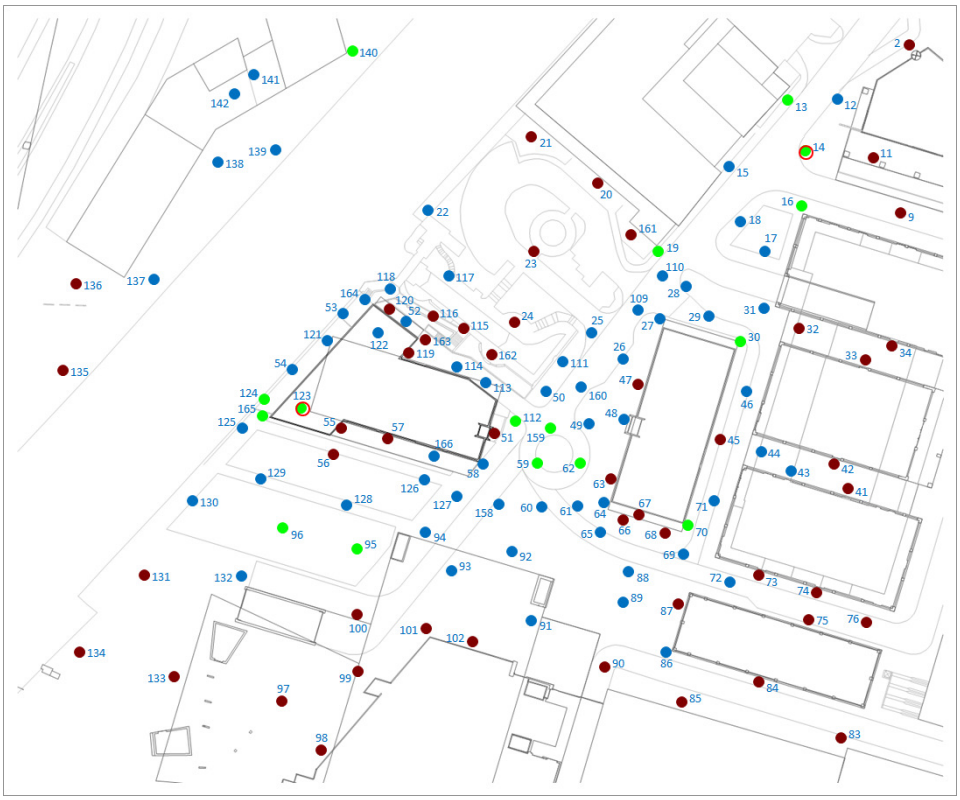
- C4 Long term sitting
- C3 Standing or short term sitting
- C2 Walking and strolling
- C1 Business Walking
- C1+ Uncomfortable

Safety

- S2 Unsuitable for general public
- S1 Unsuitable for able-bodied

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

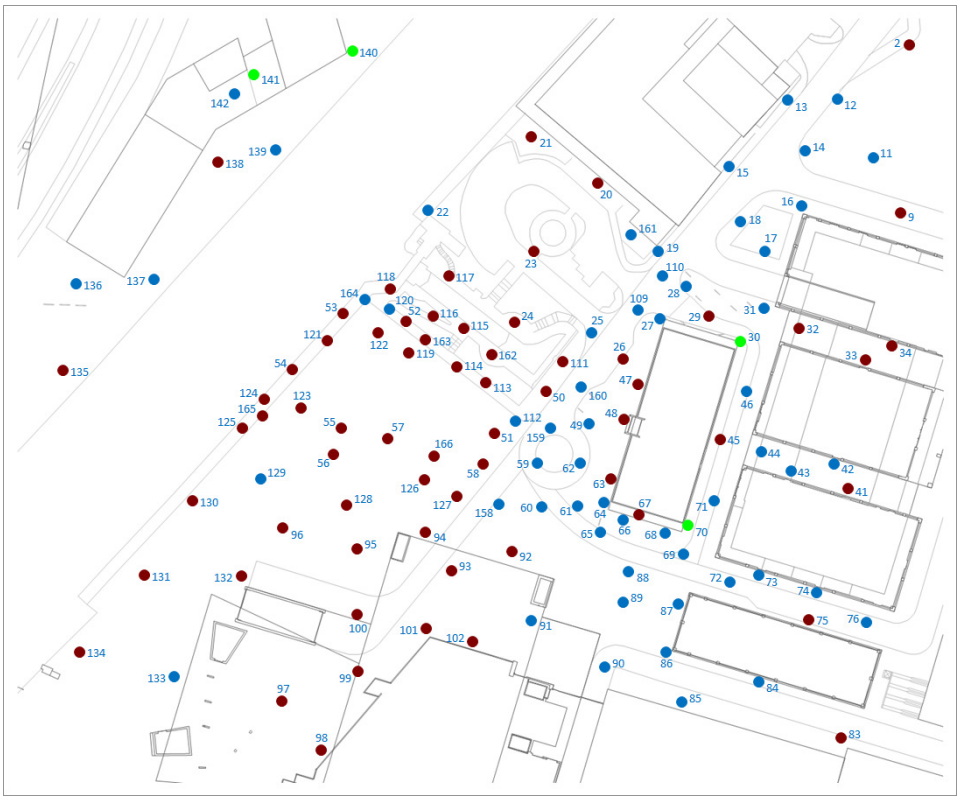
Proposed Development With Future Surrounds



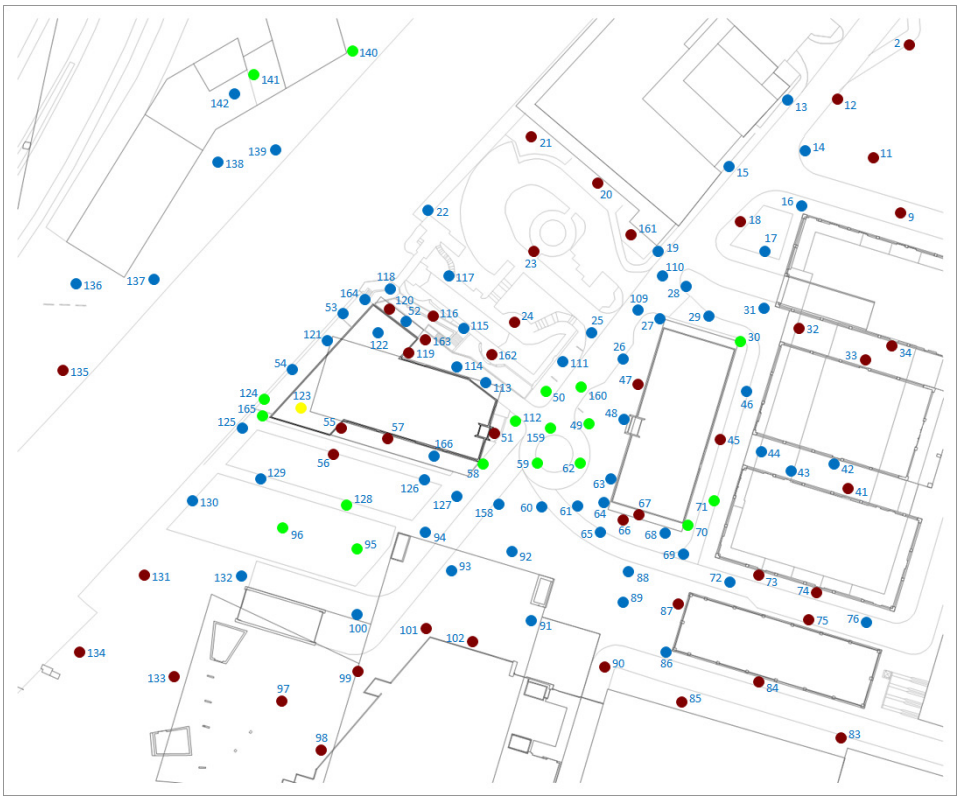
Comfort		Safety	
C4	Long term sitting	S2	Unsuitable for general public
C3	Standing or short term sitting	S1	Unsuitable for able-bodied
C2	Walking and strolling		
C1	Business Walking		
C1+	Uncomfortable		

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

Existing Site Conditions



Proposed Development With Existing Surrounds



Comfort

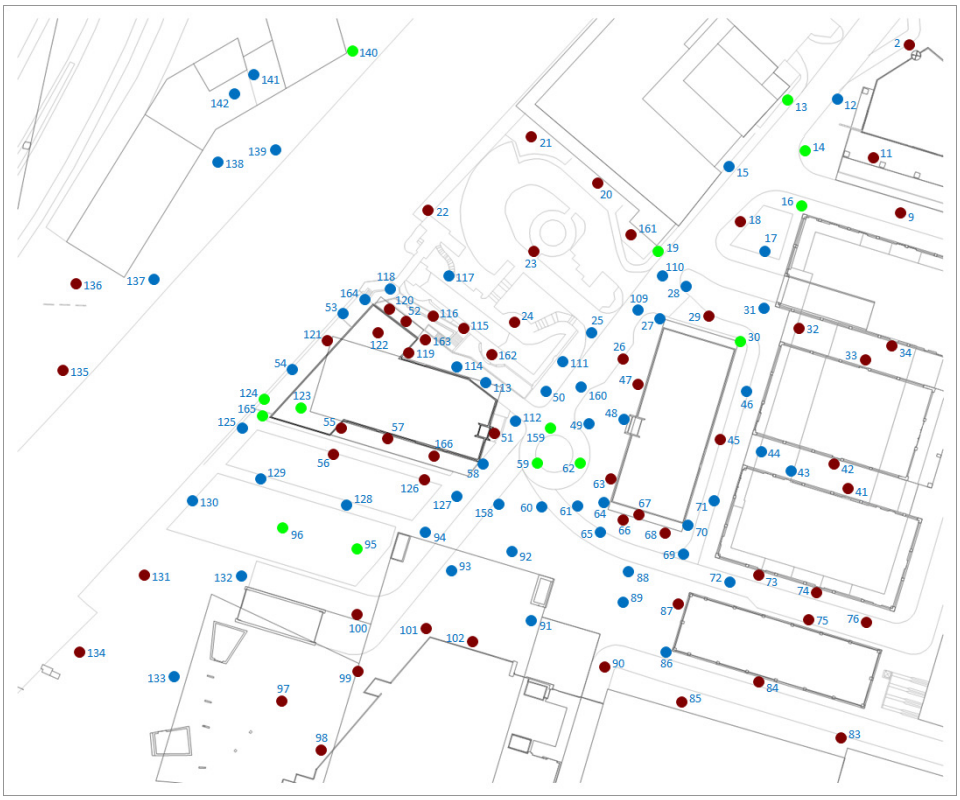
- C4 Long term sitting
- C3 Standing or short term sitting
- C2 Walking and strolling
- C1 Business Walking
- C1+ Uncomfortable

Safety

- S2 Unsuitable for general public
- S1 Unsuitable for able-bodied

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

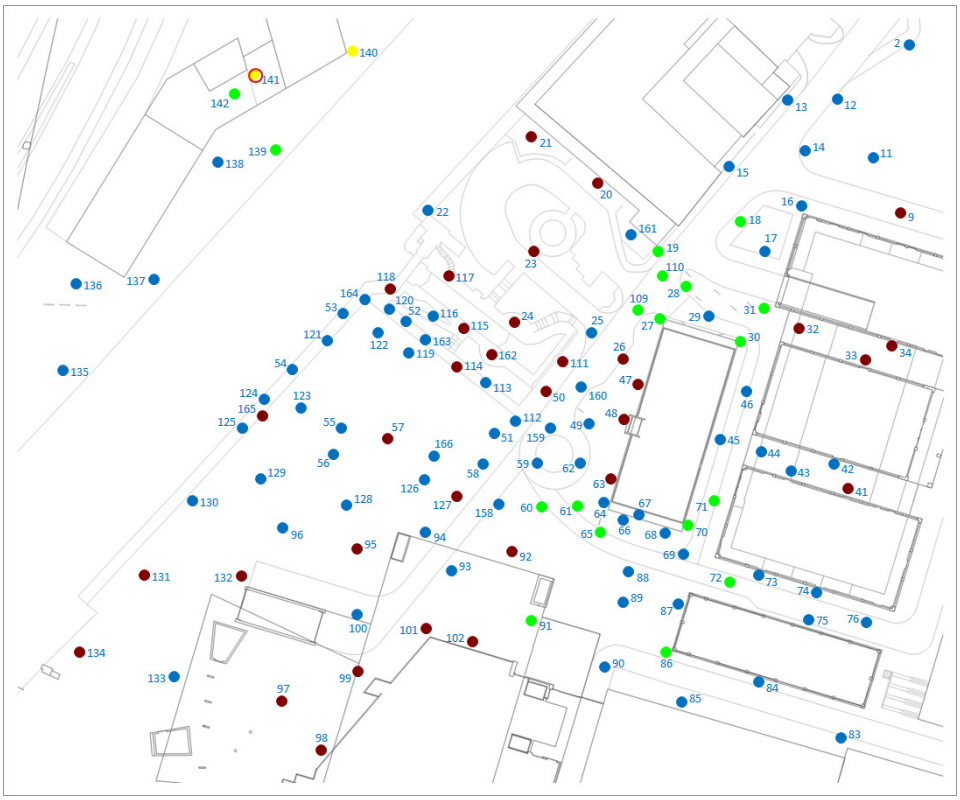
Proposed Development With Future Surrounds



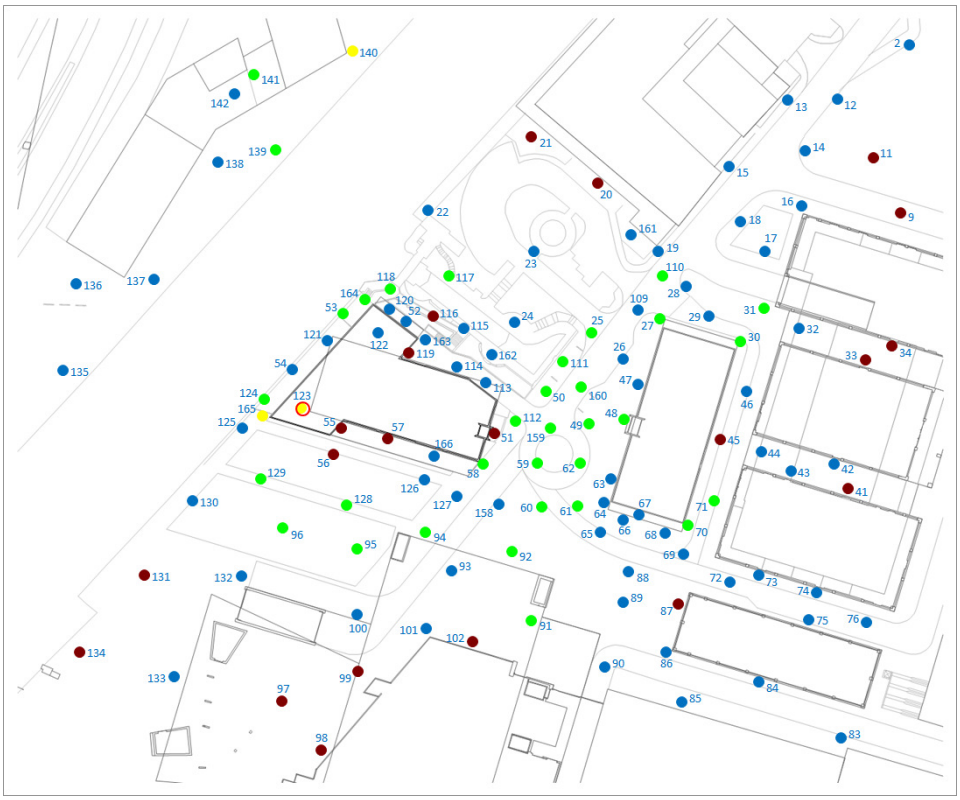
Comfort		Safety	
C4	Long term sitting	S2	Unsuitable for general public
C3	Standing or short term sitting	S1	Unsuitable for able-bodied
C2	Walking and strolling		
C1	Business Walking		
C1+	Uncomfortable		

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

Existing Site Conditions



Proposed Development With Existing Surrounds



Comfort

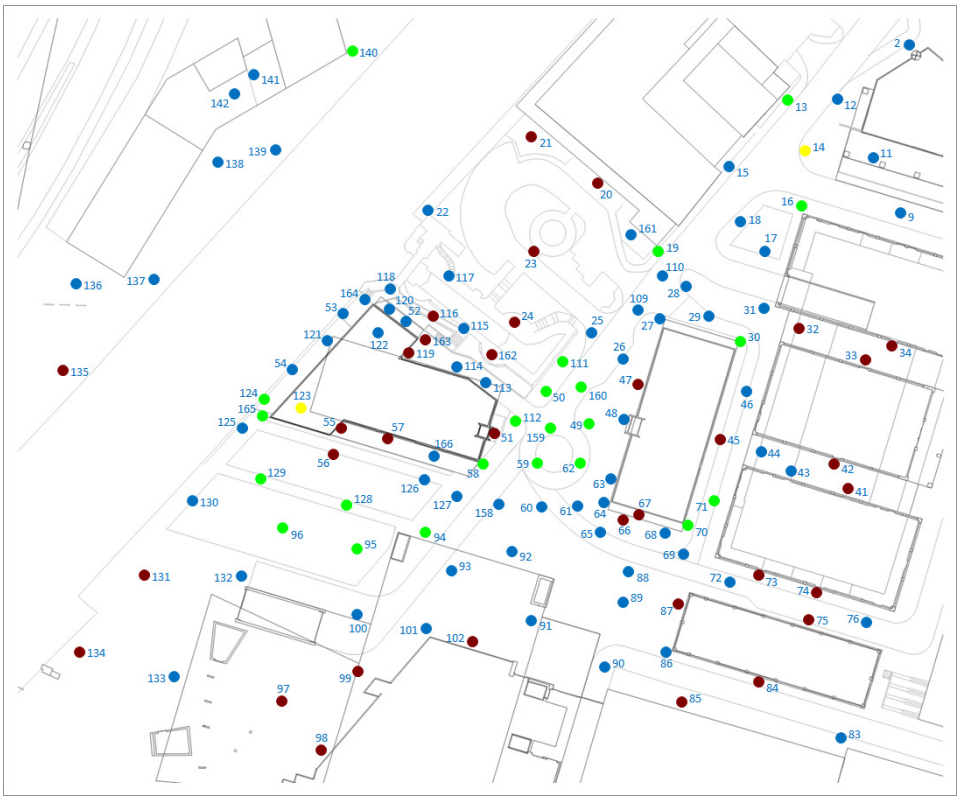
- C4 Long term sitting
- C3 Standing or short term sitting
- C2 Walking and strolling
- C1 Business Walking
- C1+ Uncomfortable

Safety

- S2 Unsuitable for general public
- S1 Unsuitable for able-bodied

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

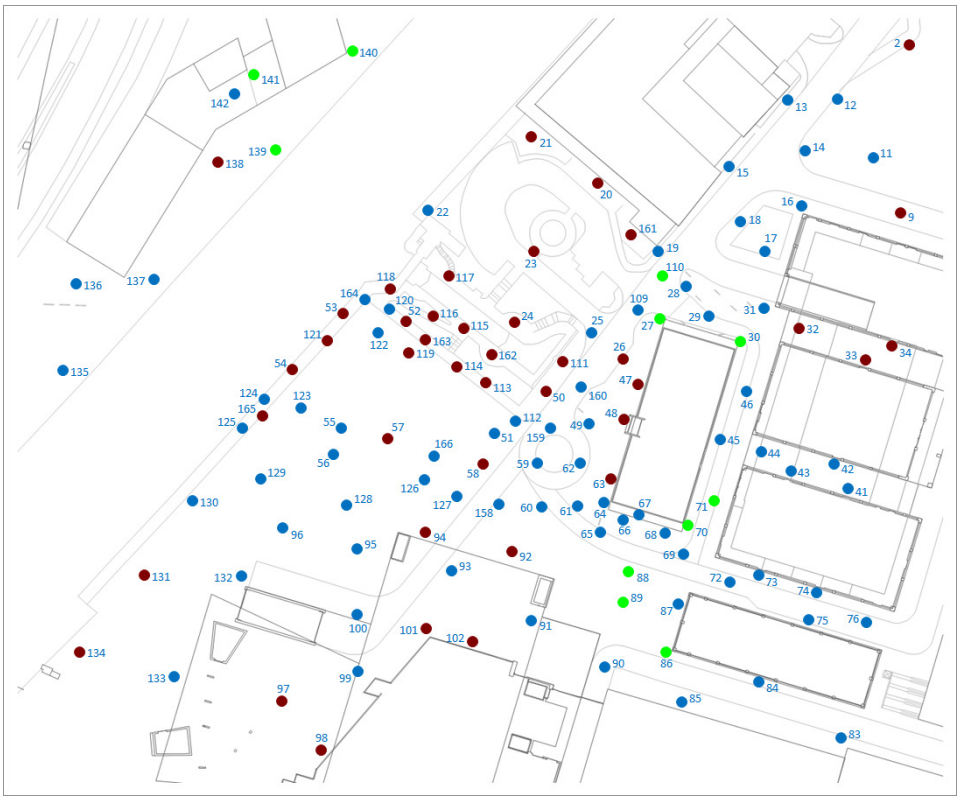
Proposed Development With Future Surrounds



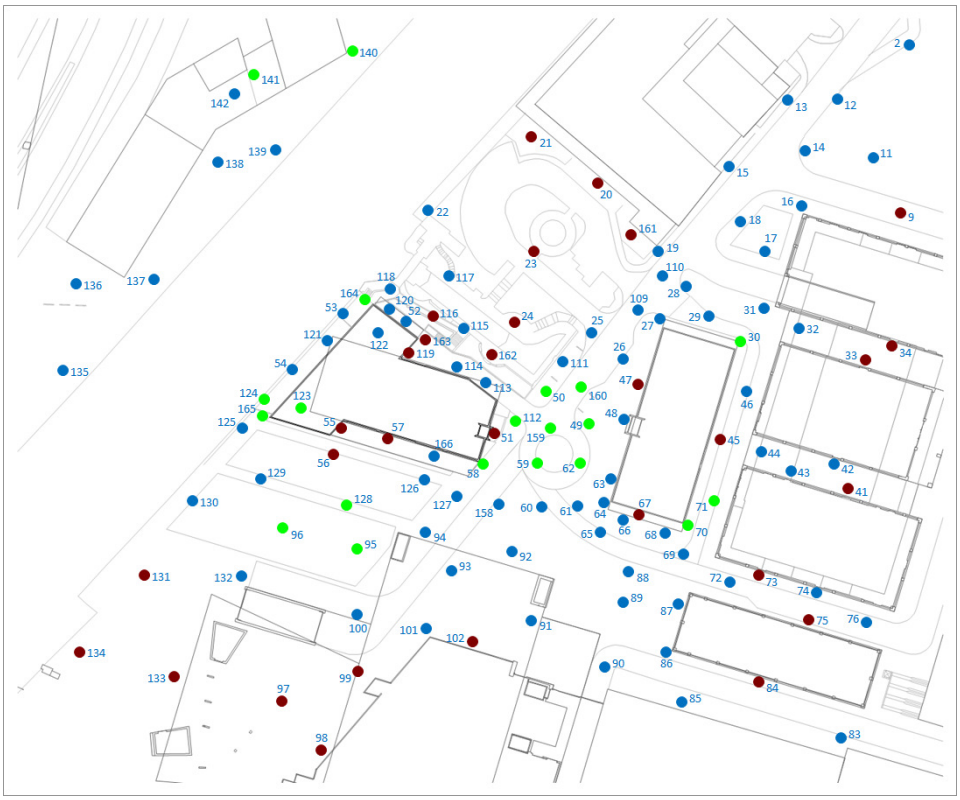
Comfort		Safety	
C4	Long term sitting	S2	Unsuitable for general public
C3	Standing or short term sitting	S1	Unsuitable for able-bodied
C2	Walking and strolling		
C1	Business Walking		
C1+	Uncomfortable		

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

Existing Site Conditions



Proposed Development With Existing Surrounds



Comfort

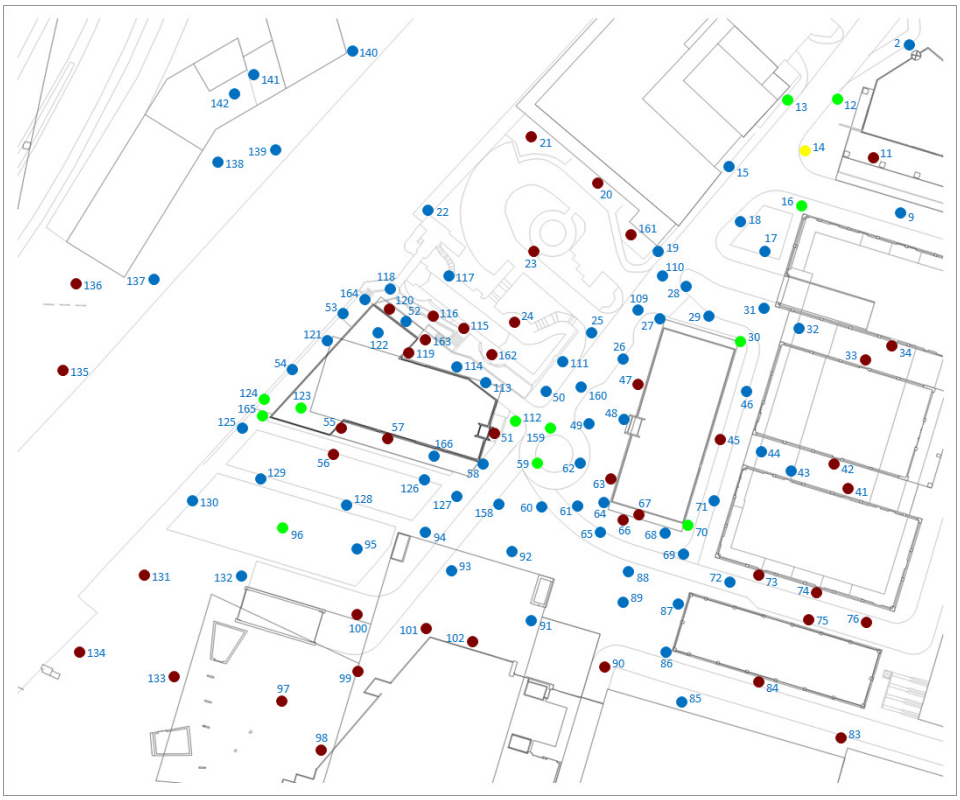
- C4 Long term sitting
- C3 Standing or short term sitting
- C2 Walking and strolling
- C1 Business Walking
- C1+ Uncomfortable

Safety

- S2 Unsuitable for general public
- S1 Unsuitable for able-bodied

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

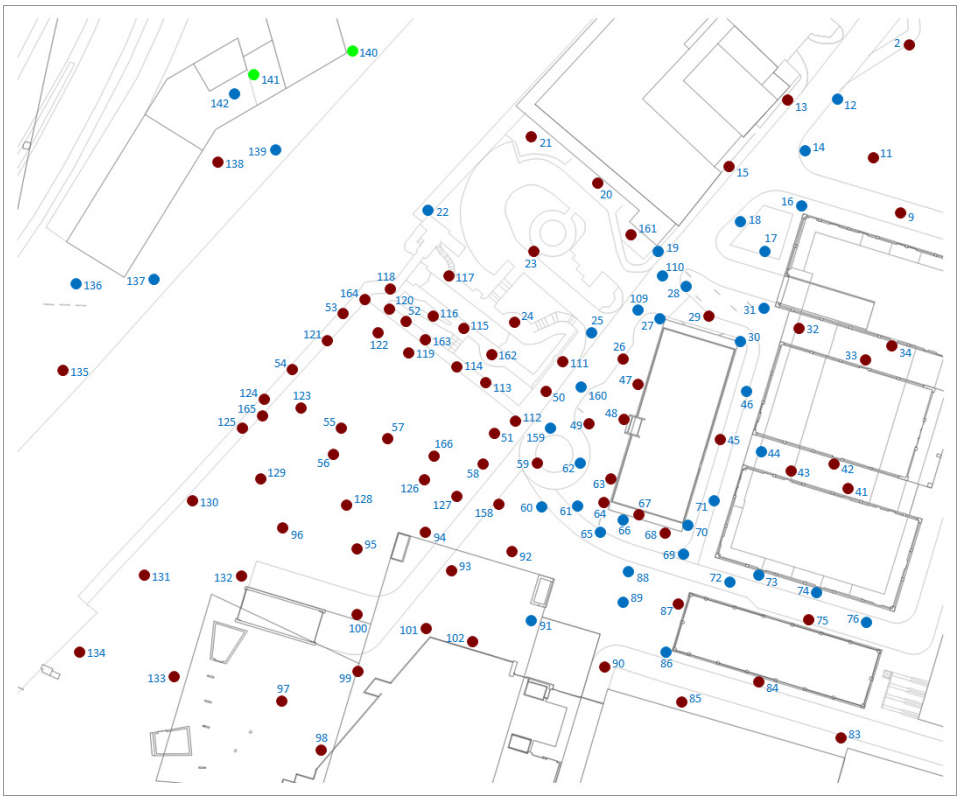
Proposed Development With Future Surrounds



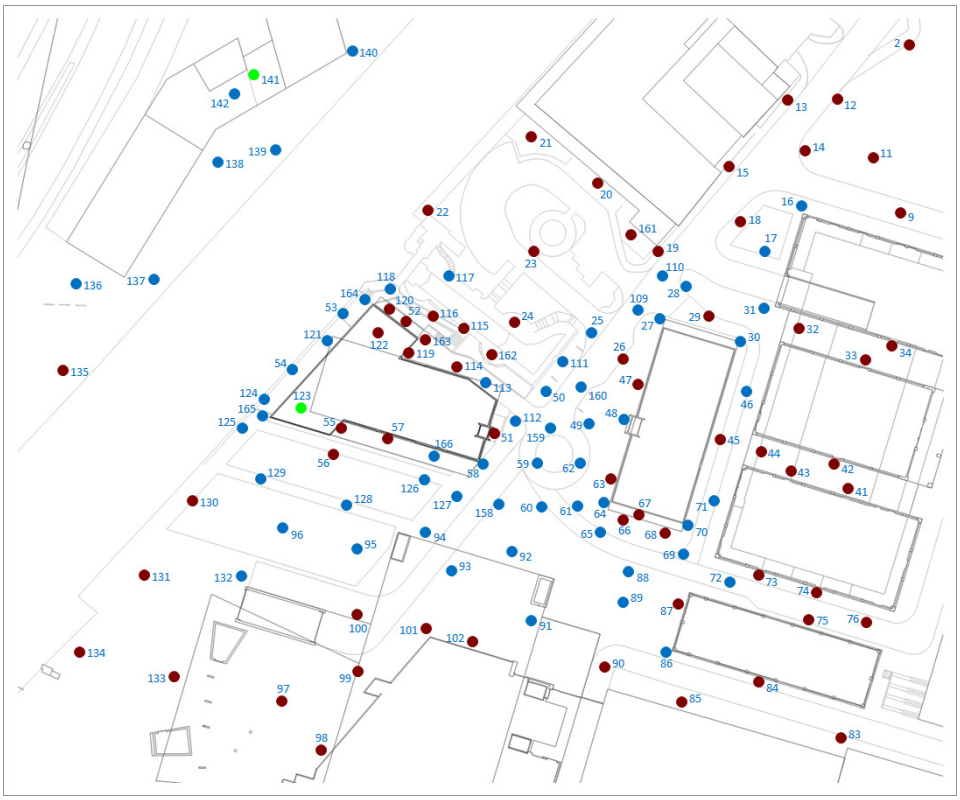
Comfort		Safety	
C4	Long term sitting	S2	Unsuitable for general public
C3	Standing or short term sitting	S1	Unsuitable for able-bodied
C2	Walking and strolling		
C1	Business Walking		
C1+	Uncomfortable		

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

Existing Site Conditions



Proposed Development With Existing Surrounds



Comfort

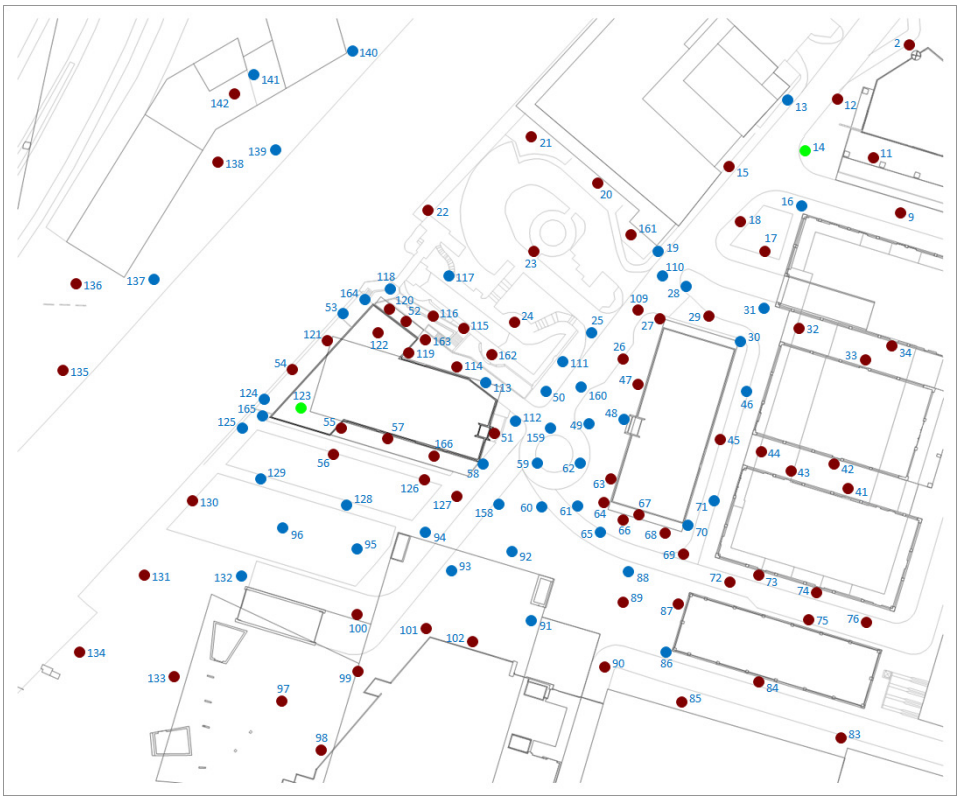
- C4 Long term sitting
- C3 Standing or short term sitting
- C2 Walking and strolling
- C1 Business Walking
- C1+ Uncomfortable

Safety

- S2 Unsuitable for general public
- S1 Unsuitable for able-bodied

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

Proposed Development With Future Surrounds



Comfort		Safety	
C4	Long term sitting	S2	Unsuitable for general public
C3	Standing or short term sitting	S1	Unsuitable for able-bodied
C2	Walking and strolling		
C1	Business Walking		
C1+	Uncomfortable		

Urban Microclimate Limited
16 Torrington Gardens, Perivale, Middlesex UB6 7EN
Tel 0799 097 2510
Registered in England and Wales No. 9286534