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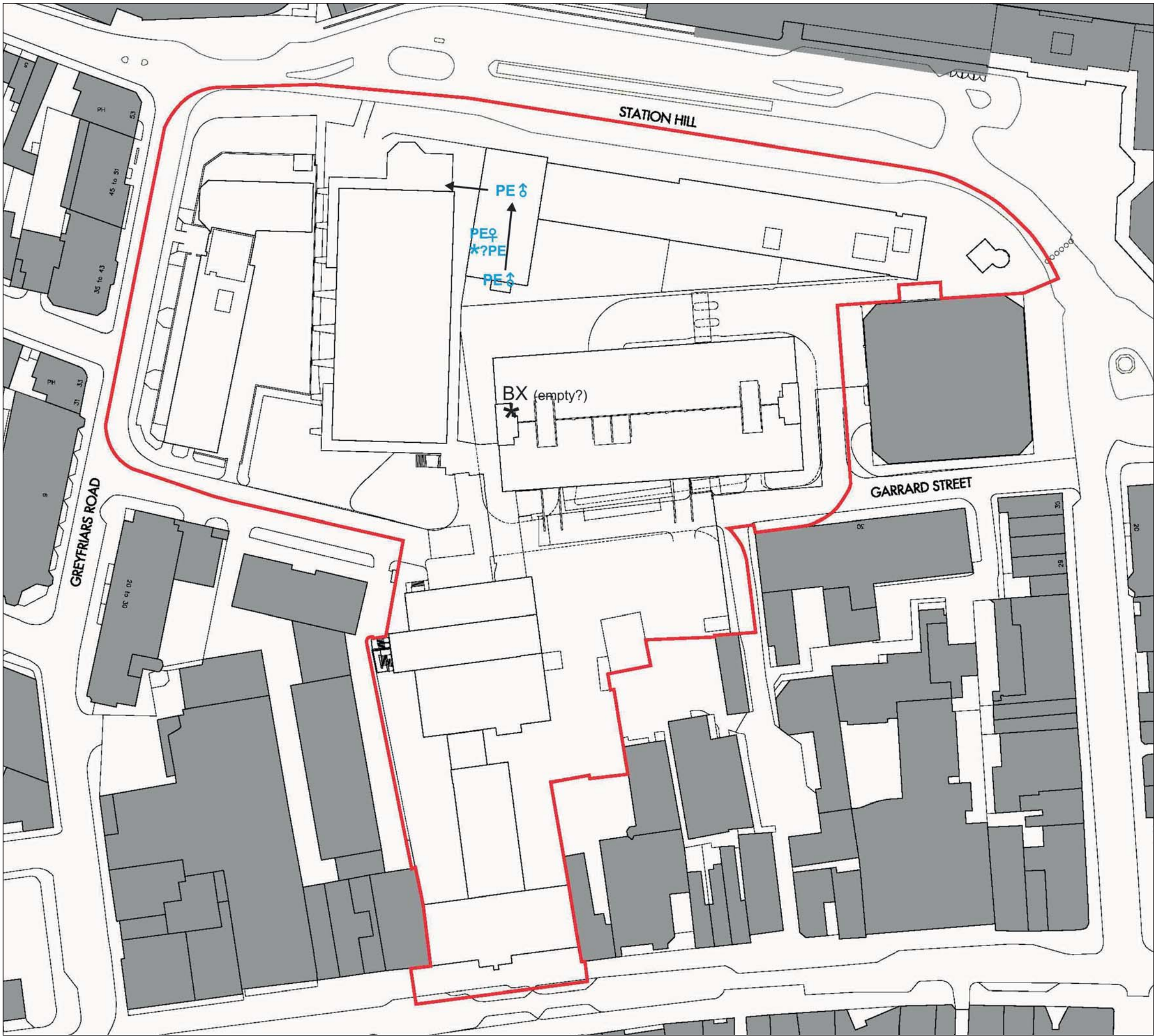
Site Boundary
- Bird Survey



Black Redstart



Peregrine Falcon



Project Details	E12350-101: Station Hill, Reading
Figure Title	Figure 3: Bird Survey - Visit 3 - 14/06/12
Figure Ref	E12350-101_GR_EC_4A
Date	August 2012
File Location	\\nt-lncs\weed\projects\12350\graphics\ec\issued figures
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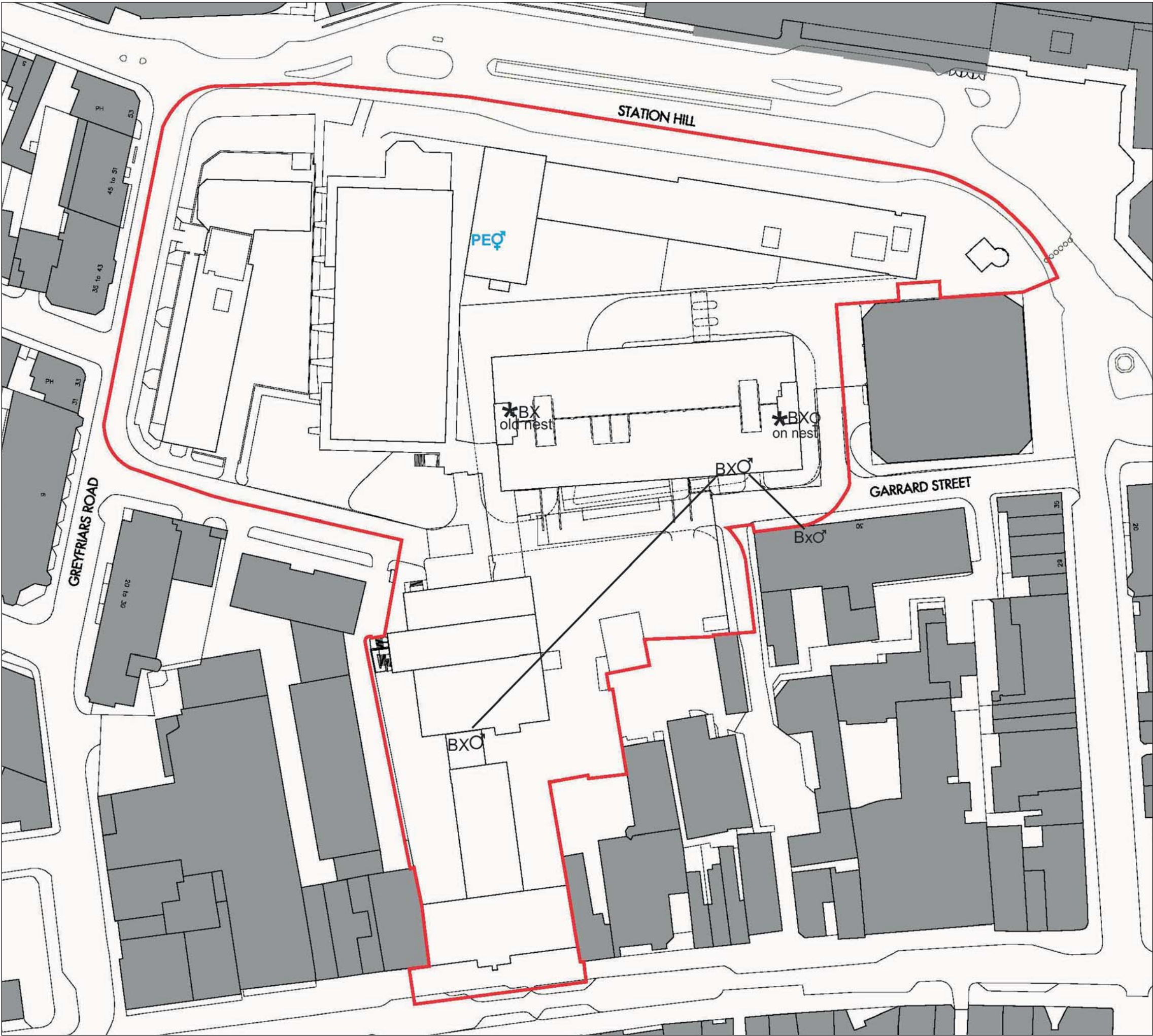
Site Boundary
- Bird Survey**



Black Redstart



Peregrine Falcon



Project Details	E12350-101: Station Hill, Reading
Figure Title	Figure 4: Bird Survey - Visit 4 - 25/06/12
Figure Ref	E12350-101_GR_EC_5A
Date	August 2012
File Location	\\nt-lncs\weed\projects\12350\graphics\ec\issued figures

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Site Boundary
- Bird Survey**



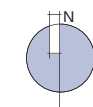
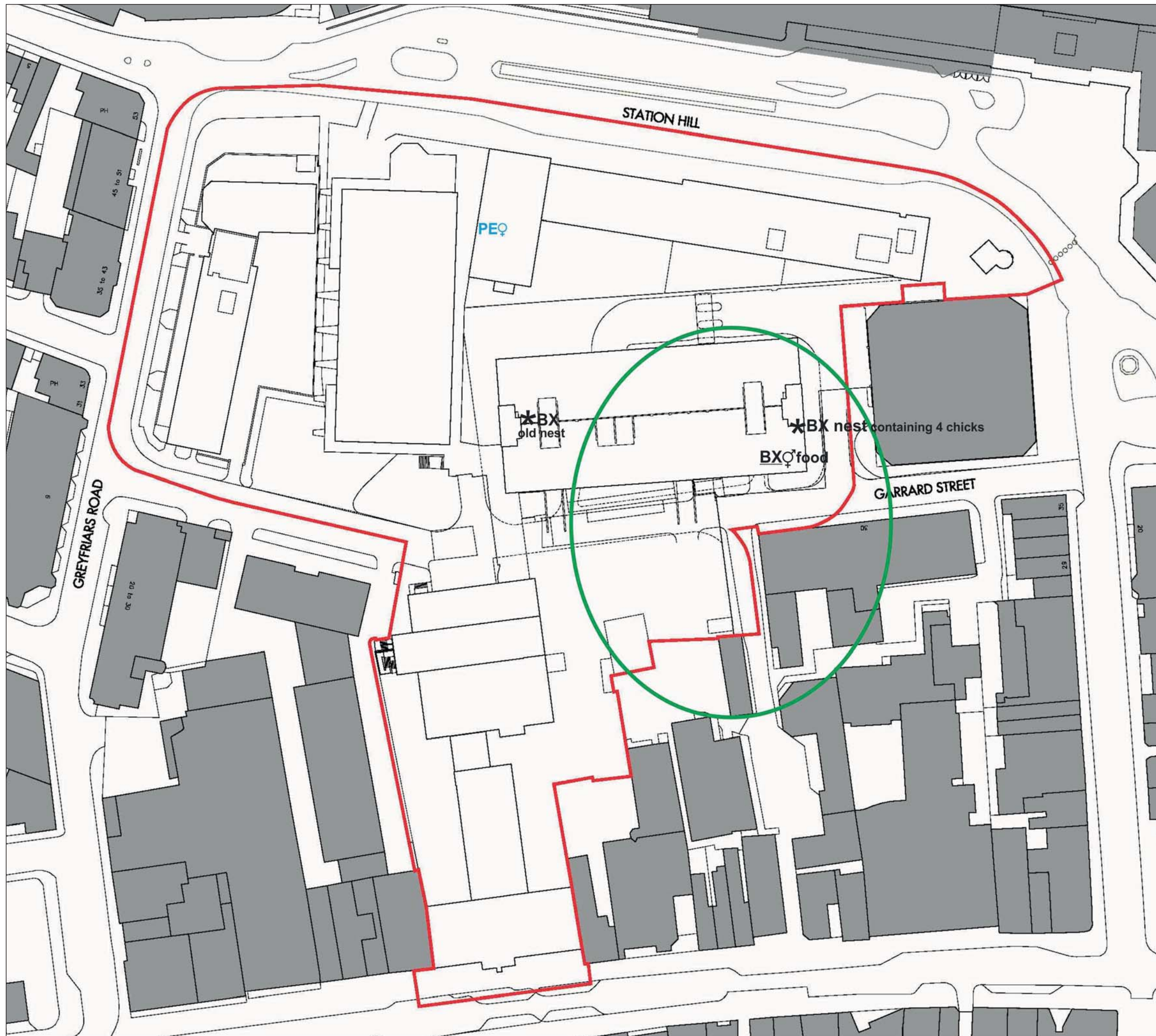
Black Redstart



Peregrine Falcon



Approximate Foraging Area



Project Details	E12350-101: Station Hill, Reading
Figure Title	Figure 5: Bird Survey - Visit 5 - 12/07/12
Figure Ref	E12350-101_GR_EC_6A
Date	August 2012
File Location	\\nt-lncs\weed\projects\12350\graphics\ec\issued figures

A. Bird Species List

The table below gives an alphabetical Presence/Absence list of all bird species recorded on, overflying or around the perimeter of the site.

Species	Species	Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	Combined
	Code	21/05/12	28/05/12	14/06/12	25/06/12	12/07/12	(all Visits)
Blackbird	B.	X	X	X	O		X
Black-headed Gull	BH		F				F
Black Redstart	BX	X	X		X	X	X
Blue Tit	BT	X	X	O			X
Carrion Crow	C.	X	X	X		O	X
Chaffinch	CH		O				O
Collared Dove	CD	X	X	O	X	O	X
Feral Pigeon	FP	X	X	X	X	X	X
Grey Wagtail	GL		X		X	X	X
Goldfinch	GO	O & F	O & F	O & F	O		O & F
Greenfinch	GR				O		O
Herring Gull	HG	F	F	X	X	O & F	X
House Sparrow	HS	O	O	O	O	O	O
Jackdaw	JD	F		O			F
Lesser Black-backed Gull	LB	X	F	X		F	X
Magpie	MG	X		X	O	X	X
Mallard	MA	F					F
Mute Swan	MS				F		F
Peregrine	PE		X	X	X	X	X
Pied Wagtail	PW	X	X	X	X	X	X
Red Kite	KT	O					O

Robin	R.	X	O		X	H	X
Starling	SG	F	F	O & F		O	F
Swift	SI	F	F	F	F	O	F
Woodpigeon	WP		X	X		O	X
Wren	WR				O		O
No. Species		18	19	16	15	15	25

Key:

X - present on site

H - Heard only

Red List Species

Amber List Species

Under Birds of Conservation Concern 3; 2009)

F - overflying site

Schedule 1 Species emboldened

O - Seen/heard outside the site

B. Photographs



Photograph 1 Protective measures put in place to protect the 1st nest (close up)



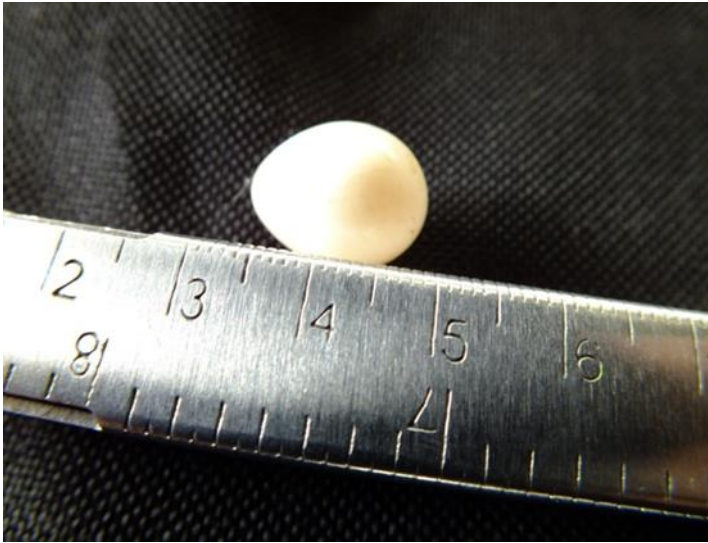
Photograph 2 - Protective measures put in place to protect the 1st nest – the barricade fencing & tape can be seen



Photograph 3 -Peregrine on Western Tower – part of the open area below the roof where the birds have nested in the past can be seen on the right hand side of the picture



Photograph 4 -Male Peregrine on the very top of Western Tower



Photograph 5 -Close-up of Black Redstart egg taken from 1st nest for inspection



Photograph 6 -Male Black Redstart with food



Photograph 7-Female Black Redstart



Photograph 8- Black Redstart Nest – 2nd brood (the head of a chick can is visible)



Photograph 9 - Black Redstart Chick (temporarily extracted from the nest for inspection)



Appendix 15.1

Pedestrian Level Microclimate Assessment (July 2015)

Station Hill, Reading – Revised Plot E

Reading, UK

Final Report

Pedestrian Level Wind Microclimate Assessment

RWDI # 1402222-PLW
July 10, 2015

SUBMITTED TO

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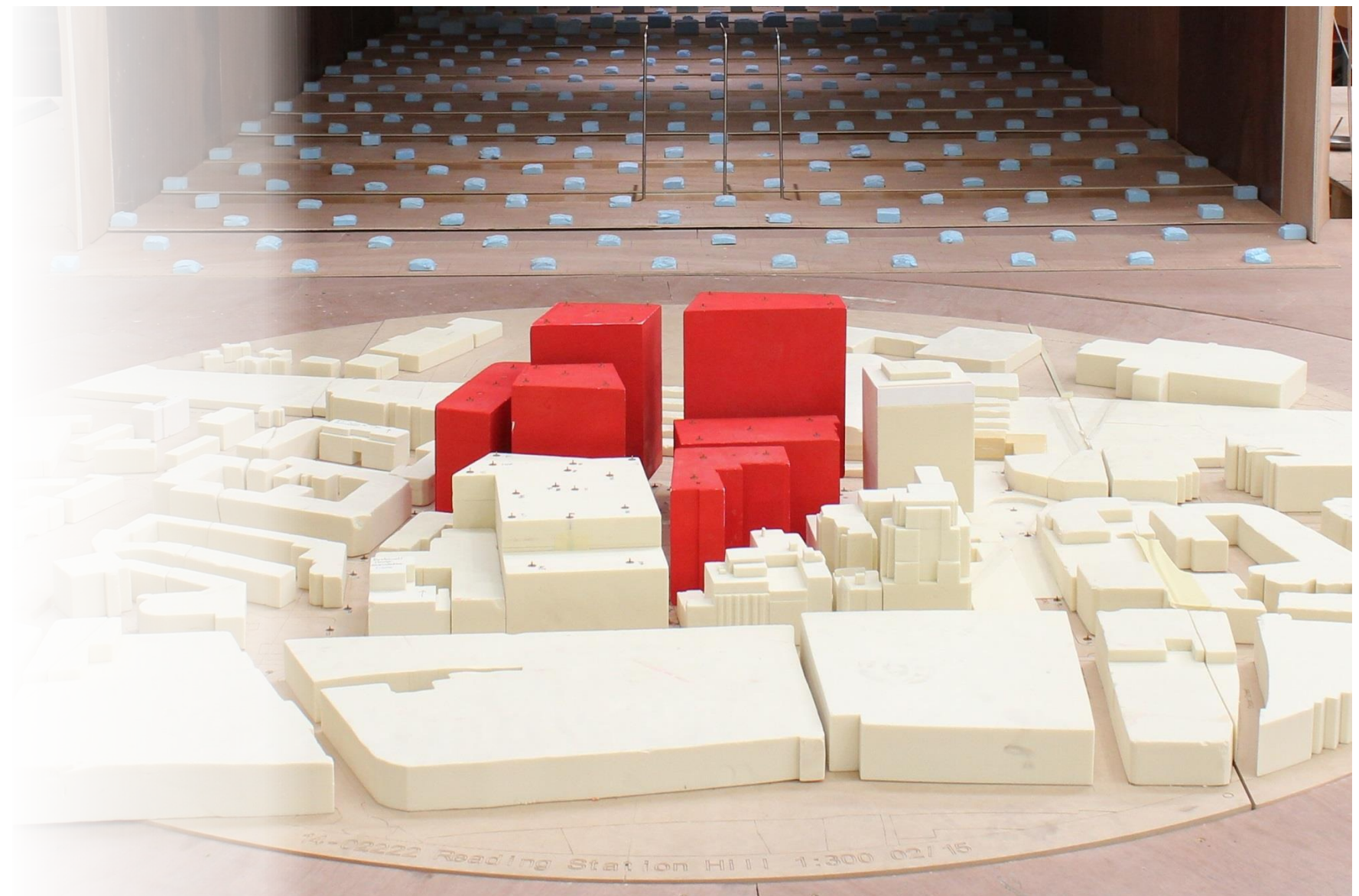
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Version History

Index	Date	Pages	Author
A	July 7, 2015	All	M. Terrelonge
B	July 10, 2015	All	D. Hackett

Checked by:

D. Hackett

Executive Summary

The objective of this study was to determine the ground and terrace level wind environment within and around the Proposed Station Hill Development in Reading, UK. This assessment follows an earlier assessment conducted in 2013 (referred to as the 'SH3' scheme), and but includes an updated Plot E layout (incorporating the Telecom House Site) and updates to the surrounding buildings since the time of the previous assessment.

This report presents a description of the methodology used and the results of 4 configurations tested in the wind tunnel, namely

- Configuration 1: Future Baseline;
- Configuration 2: Temporary Scenario (with Temporary Event Space);
- Configuration 3: Completed Development (maximum parameter massing) with existing surrounds; and
- Configuration 4: Completed Development (Plot B in detail, other plots with maximum parameter massing) with cumulative surrounds.

Note, the maximum parameter plan was modified for the purposes of the wind microclimate assessment to include the set-back at ground level of Plots B, C, D and G. This configuration was chosen as it would have the potential to channel wind at ground level and generate the worst case wind conditions within and around the site.

A further configuration is referenced in this report, namely the Plot B Reserved Matters scenario which included illustrative parameters for the wider site. This has been used to inform the recommendations for mitigation on the rooftop areas, because it represents a more realistic rooftop wind climate compared to the maximum parameter scheme (which does not include balustrades or other roof detail).

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

The wind microclimate for the future baseline presented in Configuration 1 ranges from Leisure walking to sitting conditions. During the summer season when conditions are generally calmer, the majority of the site is acceptable for standing or sitting use, with the exception of receptors 37, 39 and 55 which are classified as acceptable for leisure walking.

For Configuration 2, an interim construction phase was tested, comprising a demolished northern site (except Xfinity House and the NCP car park) with the future baseline schemes and the Temporary Event Space in place. The wind microclimate in this case is predominantly suitable for standing/entrance use and sitting, with occurrences of leisure walking conditions along Station Road and between Thames Tower and the adjacent carpark. Overall the ground level wind conditions are acceptable for thoroughfare use. Within ground level amenity areas, a mix of standing and sitting conditions occur within the Temporary Event Space which is considered to be acceptable for the intended pedestrian use. Station Square is predominantly acceptable for standing use during the summer season. If it is the intention to include seating in this area, then it is advised that soft landscaping or screening be included within this area to provide localised shelter.

In Configuration 3, the Completed Proposed Development (comprising the SH3 Scheme as amended and extended by the Telecom House / Plot E Scheme, in the context of future baseline surrounding schemes) was added to the wind tunnel model before testing. Conditions around the Completed Proposed Development ranged from those acceptable for business walking through to sitting during the windiest season. Conditions along thoroughfares during the windiest season were predominantly leisure walking at worst, with one ground level receptor classified as acceptable for business walking use (receptor 69 located at the northwest corner of Plot A). Conditions at receptor 69 are windier than desired for a thoroughfare based on the worst case maximum parameters. However, it should be noted that it is anticipated that conditions within this area would improve as a result of the detailed design of Plot A and additional mitigation measures are not expected to be

required within this area. Within Station Square, conditions during the summer season would be largely one-category windier than desired. If it is the intention to include seating within this area, localized shelter in the form of additional planting would be required to ensure users of this space could sit comfortably during the summer. Conditions within the Central Square would be acceptable for a mixture of standing and sitting conditions, this mix of conditions is considered to be acceptable as seating areas could be relocated to zones classified as acceptable for sitting use. If it is the intention to include seating within standing zones, additional mitigation measures could be included in the form of screening to provide localised shelter.

For Configuration 4 the cumulative surrounding buildings were added. The ground level wind microclimate was marginally calmer than in Configuration 3, and ranged from business walking to sitting; acceptable for thoroughfare use at all locations with the exception of receptor 69. Central Square observed a mix of sitting and standing conditions and is deemed acceptable for a mixed-use amenity space. Within the Station Square amenity area, conditions during the summer season would remain as reported within Configuration 3 and so if it is the intention to include seating within this area, localised shelter in the form of additional planting or screening would be required to achieve conditions suitable for sitting during the summer.

Conditions on the rooftop terrace areas were found to be significantly windier than desired in both Configurations 3 and 4, due mainly to the fact that the maximum parameter scheme (which does not include balustrades or other roof detailing) demonstrates a conservative worst-case assessment. These rooftop areas will be sensitive to the detailed design of the buildings. To illustrate the types of measures that could be used to create a suitable wind environment at roof level, this report references the assessment conducted for the Reserved Matters of Plot B, which included an illustrative wider Site. The illustrative scheme featured balustrades and screening around the rooftop areas which, combined with the larger scale effect of the change in massing of the building from the maximum parameters, demonstrates that an improvement in wind conditions of up to two categories is possible at these rooftop areas. As such, it is recommended that these rooftop areas are reassessed through further wind tunnel testing at the detailed design stage, and appropriate further mitigation measures developed at that time if they are required.

1. Introduction

Wind tunnel tests were conducted on a 1:300 scale model of the Station Hill Development (referred to as the Development hereafter in this report) in Reading. The investigation quantifies the wind conditions within and around the site, by comparing the measured wind speed and frequency of occurrence with the well-established Lawson Comfort Criteria. Meteorological data for London has been combined, analysed and adjusted to the site conditions by modelling the effect of terrain roughness on the wind speeds approaching the site.

Measurements were taken at up to 152 locations for 36 directions with a 10 degree interval. These covered ground level locations along the building facades and at corners, within open amenity spaces, terrace locations and on pedestrian routes within and around the site.

Analysis was conducted on a seasonal basis but the report focuses on the windiest season results (i.e. winter) and those for the summer season, when pedestrian activity generally requires calmer conditions.

Four configurations of the wind tunnel model were tested, as follows:

- Configuration 1: Future Baseline;
- Configuration 2: Temporary Scenario (with Temporary Event Space);
- Configuration 3: Completed Development (maximum parameter massing) with existing surrounds; and
- Configuration 4: Completed Development (Plot B in detail, other plots with maximum parameter massing) with cumulative surrounds.

Results are presented in a series of 'dot-plots' which indicate the measured comfort criteria for the windiest and summer seasons for each configuration.

A further configuration is referenced in this report, namely the Plot B Reserved Matters scenario which included illustrative parameters for the wider site. This has been used to inform the recommendations for mitigation on the rooftop areas, because it represents a more realistic rooftop wind climate compared to the maximum parameter scheme (which does not include balustrades or other roof detail).

2. Site Description

The development site is located in Reading. The OS Landranger grid reference is SU714737.

The Site is bounded by Reading Mainline Station to the north; Friar Street and Garrard Street (which intersects the Site) to the south; Greyfriars Road and existing buildings to the west; and the Thames Tower office building and existing buildings to the east.

The surrounding area comprises of low to medium rise residential/commercial development.

Figure 1 shows an aerial view of the site and surroundings, with the approximate site location highlighted in yellow.

2.1 Proposed Development

The Development is intended for mixed use, providing residential, retail and office units. The Development will comprise several medium-rise buildings. Plot C is the tallest block at approximately 88m above local ground level (maximum parameters) and is located on the east side of the Site. Plots, E, F and G are the shorter blocks and are located south of Buildings B and C. Amenity areas will be provided in two public spaces (Central Square and Station Square) and at the roof-top terrace levels within the Development.

Access to the Development is from Friars Street, Station Road, Greyfriars Road, Garrard Street and Station Hill.

Appendix A shows a selection of photographs of wind tunnel models of the Proposed Development used in this assessment.

3. Methodology

3.1 Wind Tunnel Testing: Procedure and Methodology

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

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

This methodology is consistent with the standard industry approach, and has been used by RWDI for assessing the wind microclimate for sites in London and throughout the UK.

3.2 Simulation of Atmospheric Winds

The wind is turbulent, or gusty, and this turbulence varies depending upon the site and elevation. 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 grid, barrier 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 to fine-tune the flow and create conditions similar to those expected at full scale.

3.3 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 each location 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 15 minutes, whereas the peak wind speed is taken as the wind speed exceeded for 1% of the time.

Wind speeds at each location were measured for 36 wind directions with 0° representing a wind blowing from the North and 90° a wind blowing from the East.

3.4 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.

3.5 Meteorological Data

Combined meteorological data derived from Heathrow airport meteorological station have been corrected to standard conditions of 10m above open flat level country terrain. The meteorological station data are then adjusted to the site conditions using the methodology implemented in the BREVe3 software package.

Approximately 30 years of meteorological data for Heathrow was used in this report and is presented in Appendix B as wind roses by season (refer to Figure 19 Appendix B) with the wind speed divided into Beaufort Force ranges (see Table 4, Appendix C). The radial axis indicates the cumulative number of hours per season that the wind speed exceeds the particular Beaufort Force. 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 meteorological data indicate that the prevailing wind direction throughout the year is from the South-West. This is typical for many areas of Southern England. There is a secondary peak from North-Easterly winds, especially during the spring, and these tend to be cold winds.

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 'comfort criteria', as described below.

3.6 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 and have been widely used on building developments across the United Kingdom. The comfort criteria, which seek to define the reaction of an average pedestrian to the wind, are described in Table 1 and illustrated in Figure 20, in Appendix C. If the measured wind conditions exceed the threshold 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 set out six pedestrian activities and reflect the fact that less active pursuits require more benign wind conditions. The six categories are sitting, standing, entering/leaving a building, leisure walking, business walking and roadway/car-park, in ascending order of activity level. 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 leisure walking and business walking is that in the business scenario, where pedestrians are on site because their livelihood depends upon it, they will 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 not part of the assessment.

The coloured key in Table 1 corresponds to the presentation of wind tunnel test results described in Section 4 of this report.

Table 1: Lawson Comfort Criteria

Key	Comfort Category	Threshold	Description
	Sitting	1% > B3	Light breezes desired for outdoor restaurants and seating areas where one can read a paper or comfortably sit for long periods
	Standing/Entrance Use	6% > B3	Gentle breezes suitable for main building entrances, pick-up/drop-off points and bus stops
	Leisure Walking	4% > B4	Moderate breezes that would be appropriate for window shopping and strolling along a city/town centre street, plaza or park
	Business Walking	2% > B5	Relatively high speeds that can be tolerated if one's objective is to walk, run or cycle without lingering
	Roadway/Car-park	6% > B5	Winds of this magnitude are considered a nuisance for most activities, and wind mitigation is typically recommended

3.7 Strong Winds

Lawson also specified a lower limit strong wind threshold when winds exceed Beaufort Force 6. 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?

In the UK, stronger winds are associated with areas which would be classified as suitable for business walking or roadway use. In a mixed-use, urban development scheme, business walking and roadway 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.

For locations on a pedestrian thoroughfare, where the wind speed occasionally exceeds the lower Beaufort Force 6 wind speed threshold, the wind is unlikely to generate nuisance to pedestrians. However, pedestrians are likely to experience difficulty in walking when the wind speed exceeds Beaufort Force 7 or 8.

If the wind speed exceeds B6 wind speed threshold in a proposed external seating area or outside an entrance, these conditions would be unacceptable and would require mitigation. However, in such cases the area is likely to be classified as suitable for leisure walking, business walking or roadway use and so would require mitigation to satisfy the Lawson Comfort Criteria in any case.

It is RWDI's practice to report incidence when the B6, B7 and B8 thresholds are exceeded for more than 1 hour per annum. The results for this study are presented in Table 3, which also shows the wind direction that contributes most to the strong winds.

4. Results

4.1 Details of the Analysis

To account for the difference in measurement 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 a full range of 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°	160°	180°	210°	240°	270°	300°	330°
Mean Factor at 120m	1.41	1.42	1.44	1.43	1.40	1.45	1.46	1.51	1.46	1.41	1.41	1.40

4.2 Desired Pedestrian Activity around the Development

Generally, for a mixed-use development, the target conditions are:

- Leisure walking during the windiest season on pedestrian thoroughfares;
- Standing/entrance conditions at main entrances, drop off areas or taxi ranks, and bus stops throughout the year; and
- 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 business walking and roadway 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 same receptor would be suitable for standing in the windiest season because winds are stronger at this time. 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.

For the Plot C Temporary Event Space, conditions acceptable for a mixture of leisure walking and standing are considered appropriate during the windiest season. During the summer season, sitting conditions are targeted within the Temporary Event Space area.

4.3 Performance against the Lawson Comfort Criteria

The wind microclimate within and around the site has been assessed and classified using the Lawson Comfort Criteria defined in Table 1. The results of the assessment for each configuration are described below and presented graphically in Figures 3 to 10.

Fewer probes are included in the assessments of the Future Baseline and Temporary Scenario, because the placement of probes within the model is tailored towards the layout of the proposed scheme. As such, a number of probes are either covered by existing buildings or else are located on proposed roof terraces that do not exist in Configurations 1 and 2.

4.3.1 Future Baseline

Figure 3 shows the ground level results for the windiest season.

For the purpose of comparison with the other tested configurations, the wind microclimate at 104 locations for the windiest season are summarised as follows:

- 38 locations are suitable for sitting use;
- 48 locations are suitable for standing/entrance use; and
- 18 locations are suitable for leisure walking use.

Figure 4 shows the ground level results for the summer season and is summarised as follows:

- 68 locations are suitable for sitting use;
- 33 locations are suitable for standing/entrances use; and
- 3 locations are suitable for leisure walking use.

4.3.2 Temporary Scenario (with Temporary Event Space) with future baseline surrounds

Figure 5 shows the ground level results for the windiest season.

For the purpose of comparison with the other tested configurations, the wind microclimate at 124 locations for the windiest season are summarised as follows:

- 64 locations are suitable for sitting use;
- 48 locations are suitable for standing/entrance use; and
- 12 locations are suitable for leisure walking use.

Figure 6 shows the ground and terrace results for the summer season and is summarised as follows:

- 97 locations are suitable for sitting use;
- 25 locations are suitable for standing/entrance use; and
- 2 locations are suitable for leisure walking.

4.3.3 Completed Development (maximum parameter massing) with future baseline surrounds

Figure 7 shows the ground and terrace level results for the windiest season.

For the purpose of comparison with the other tested configurations, the wind microclimate at 152 locations for the windiest season are summarised as follows:

- 31 locations are suitable for sitting use;

- 57 locations are suitable for standing/entrance use;
- 52 locations are suitable for leisure walking use;
- 3 locations are suitable for business walking use; and
- 9 locations are suitable for carpark/roadway use.

Figure 8 shows the ground and terrace results for the summer season and is summarised as follows:

- 65 locations are suitable for sitting use;
- 67 locations are suitable for standing/entrance use; and
- 20 locations are suitable for leisure walking use.

4.3.4 Completed Development (Plot B in detail, other plots with maximum parameter massing) with cumulative surrounds

Figure 9 shows the ground and terrace level results for the windiest season.

The cumulative schemes in the nearby surrounding area comprised a 2 storey extension on Garrard House, Garrard Street, a 22 storey building at 29-35 Station Road, the Reserved Matters Plot B application and the former sorting offices, Caversham Road.

For the purpose of comparison with the other tested configurations, the wind microclimate at 152 locations for the windiest season are summarised as follows:

- 39 locations are suitable for sitting use;
- 64 locations are suitable for standing/entrance use;
- 43 locations are suitable for leisure walking use;
- 3 locations are suitable for business walking; and
- 3 locations are suitable for carpark roadway use.

Figure 10 shows the ground and terrace results for the summer season and is summarised as follows:

- 73 locations are suitable for sitting use;
- 65 locations are suitable for standing/entrance use; and
- 14 locations are suitable for leisure walking.

4.4 Occurrence of Strong Winds

Areas with occasional strong winds exceeding Beaufort Force 6 are listed in Table 3 together with the primary wind direction and the number of hours per annum for which the threshold wind speed is exceeded.

Table 3: Annual Exceedance of Strong Winds

Location	Beaufort Force Exceedance	Main Wind Direction	Hours per annum
Future Baseline			
29	B6	210	1.3
33	B6	40	1.3
37	B6	80	1.9
39	B6	350	4.3
43	B6	220	3.8
55	B6	0	3.4
Temporary Scenario (with Temporary Event Space)			
37	B6	50	3.6
39	B6	70	3.7
43	B6	230	2.3
Completed Development (maximum parameter massing) with existing surrounds			
13	B6	230	3.7
20	B6	200	1.0
39	B6	0	3.9
43	B6	200	1.0
44	B6	210	1.2
45	B6	0	2.7
46	B6	20	1.9
51	B6	20	2.0
61	B6	20	1.2
62	B6	0	2.8
84	B6	220	1.2
111	B6	0	2.2
113	B6	230	1.8
120	B6	240	1.9
121	B6	220	1.3
131	B6	290	6.3
132	B6	180	2.8
137	B6	10	2.9
160	B6	220	1.1
163	B6	230	1.4
41	B7	0	1.5
55	B7	0	1.2
69	B7	230	2.0
115	B7	240	2.1
116	B7	230	2.8
117	B7	220	5.5

Location	Beaufort Force Exceedance	Main Wind Direction	Hours per annum
118	B7	300	4.3
122	B7	280	1.3
123	B7	230	2.0
124	B7	280	3.9
127	B7	210	7.1
129	B7	210	6.1
130	B7	230	6.9
161	B7	220	1.4
119	B8	220	1.5
125	B8	230	1.3
126	B8	220	1.4
128	B8	210	2.2
Completed Development (Plot B in detail, other plots with maximum parameter massing) with cumulative			
13	B6	270	1.6
20	B6	200	1.0
39	B6	350	1.3
41	B6	10	2.9
43	B6	190	1.1
51	B6	10	1.5
55	B6	10	3.1
69	B6	270	5.0
84	B6	220	1.1
111	B6	80	1.6
120	B6	300	2.0
121	B6	280	1.0
125	B6	210	1.8
131	B6	300	5.4
132	B6	190	1.7
137	B6	20	1.1
142	B6	30	1.0
160	B6	220	1.1
115	B7	290	2.0
116	B7	230	1.8
117	B7	220	4.1
118	B7	210	6.0
119	B7	220	6.6
122	B7	290	1.1
123	B7	210	1.5
124	B7	280	2.0
130	B7	220	3.0
161	B7	220	1.2

5. Discussion

Wind conditions at receptors which are not discussed are expected to be acceptable for comfortable pedestrian use. Mitigation would be required for areas where conditions are windier than desired. Suggestions for mitigation measures are described where relevant in this section.

As this is an outline application the locations of entrances are unknown, and so it is advised that entrances are situated within areas suitable for standing/entrance use or sitting. Where it is the intention to locate entrances within windier zones, it is advised that mitigation measures be included for these entrances at the detailed design stage to ensure the target conditions are met during the windiest season.

5.1 Configuration 1

(Future Baseline)

The discussion of the wind microclimate in Configuration 1 is based on the results shown in Figure 3 for the windiest season and Figure 4 during the summer season. The baseline conditions were taken to be those of the Site prior to demolition with surrounding land uses including the upgraded Reading Mainline Station and in-construction buildings comprising Chatham Place, 21 Caversham Road, Energis House, Thames Tower and Aldwych House. Wind tunnel testing of this configuration therefore established the wind microclimate that would likely exist immediately surrounding the Site.

5.1.1 Pedestrian Comfort – Ground Level

The existing Site observed wind conditions acceptable for leisure walking to sitting use.

5.1.1.1 Thoroughfares

The wind microclimate throughout the site is acceptable for thoroughfare use with conditions acceptable for leisure walking or calmer during the windiest season.

During the summer season when conditions are generally calmer, the majority of the existing Site would be acceptable for sitting.

5.1.2 Strong Winds

There were six occurrences of strong winds in excess of Beaufort 6: receptors 29, 33, 37, 39, 43 and 55 observed winds exceeding Beaufort 6 for up to 4.3 hours per year.

5.2 Configuration 2

(Temporary scenario with Temporary Event Space and future baseline surrounds)

The discussion of the wind microclimate in Configuration 2 is based on the results shown in Figure 5 for the windiest season and Figure 6 for the summer season. This Configuration tested the Temporary Event Space with the buildings in the northern part of the site, to the north of Garrard Street, demolished (with the exception of Xafinity House and the NCP car park) and the future baseline schemes in place..

5.2.1 Pedestrian Comfort – Ground Level

During the windiest season, the wind microclimate conditions at ground level locations range from conditions acceptable for leisure walking through to sitting.

5.2.1.1 Thoroughfares

During the windiest season, all locations are acceptable for thoroughfare use; with wind conditions ranging from leisure walking to sitting. For this configuration, leisure walking conditions largely occur around Thames Tower at the northeastern corner of the Site.

5.2.1.2 Amenity spaces

During the summer season the Plot C Temporary Event Space would be acceptable for sitting use. As a result this area would be acceptable for the intended use.

Station Square is predominantly acceptable for standing use during the summer season; if it is the intention to include seating in this area, then it is advised that soft landscaping be included within this area to provide localised shelter.

5.2.2 Strong Winds

There were three occurrences of strong winds in excess of Beaufort Force 6 for up to 3.7 hours per annum.

The strong winds measured at receptors 37, 39 and 43 occur along thoroughfares where such infrequent strong winds are unlikely to cause nuisance. The locations of these strong winds is consistent with the future baseline configuration.

5.3 Configuration 3

(Completed Development – maximum parameter massing with existing surrounds)

The discussion of the wind microclimate in Configuration 3 is based on the results shown in Figure 7 for the windiest season and Figure 8 for the summer season. This Configuration consists of the updated Plot E with the remaining Station Hill Development (maximum parameter plan, modified to include the set-back at ground level of Plots B, C, D and G) and future baseline surrounding buildings.

5.3.1 Pedestrian Comfort – Ground Level

All ground level wind microclimate conditions ranged from business walking through to sitting. It should be noted that business walking conditions occur at one location on the northwest corner of plot A; this is the windiest location on site with all other receptors being classified as acceptable for leisure walking use or calmer.

5.3.1.1 Thoroughfares

The majority of thoroughfare locations observed the desired leisure walking (or calmer) wind conditions during the windiest season. Location 69 is situated at the northwestern corner of Plot A, where business walking conditions were measured. The conditions at this location are expected to be sensitive to the detailed design of Plot A, and potentially also Plot E due to wind being channeled at ground level along the west side of the Site. Wind speeds are expected to be reduced by the detailed design of Plot A in particular, as the maximum parameter scheme generates a worst-case wind environment around the perimeter of the Site. Further mitigation is not expected to be required; however, this should be confirmed through wind tunnel testing at detailed design, and localised mitigation measures developed at that stage if they are required.

5.3.1.2 Entrances

As this is an outline application, entrance locations are unknown. Therefore it is advised that entrances are situated within areas where standing/entrance conditions or calmer are identified. If it is the intention to locate entrances in windier leisure walking zones, mitigation measures would be required to ensure the targeted conditions suitable for entrance use are met.

5.3.1.3 Amenity spaces

Amenity space is proposed at ground level within the Central Square and Station Square. Within these areas conditions are acceptable for a mix of standing and sitting wind conditions during the summer. This is deemed acceptable for a mixed-use amenity space provided that seating areas are located in the calmer areas; if long term seating is intended in areas suitable for standing during the summer then localised soft landscaping in the form of small trees and shrubs in planters will help to reduce wind speeds and render them suitable for the intended use.

5.3.2 Pedestrian Comfort – Terraces

Roof terrace areas throughout the proposed Development are generally windier than desired, which is mainly due to the absence of balustrades or other beneficial shelter in the maximum parameter scheme. As shown in Figure 8, the conditions during the summer are suitable for leisure walking on the roofs of Plots B and C (i.e. two categories windier than the target conditions), a mixture of leisure walking and standing/entrance use on the roofs of Plots A, D and E (two and one categories windier respectively), and standing/entrance use on the roofs of Plots F and G.

Conditions during the windiest season are shown in Figure 7, which shows a wind environment suitable for business walking and carpark/roadway use on the roof areas of Plots A, B and C. While this does not directly relate to the assessment with regard to intended use (which assesses amenity spaces during the summer when they are most frequently in use), it does illustrate that these terraces have the potential to be uncomfortably windy throughout the year in this worst-case assessment.

An illustrative scheme was tested as part of the Plot B Reserved Matters assessment. This configuration represents a more realistic scenario for the roof terraces, including the beneficial effects of screening and balustrades around the terrace areas. Photographs of this configuration are included in Appendix D of this report.

Wind conditions improved by up to two categories during the summer in the rooftop areas of Plots A, B, C and D that were sheltered by perforated or solid screening around the building crowns (visible in the photographs in Appendix D). Other parts of the terraces improved by one category where 1.1m high balustrades and the indicative massing of the building combined provided a small amount of shelter from windy conditions.

The results of the wind microclimate assessment on the illustrative scheme are shown in the figures in Appendix D for the windiest and summer seasons. Overall, in the indicative scheme, conditions on the rooftop terraces were found to be predominantly suitable for standing or sitting use during the summer, with only one area (at the northwest corner of Plot C) remaining suitable for leisure walking use. These results identify the types of mitigation that can be effective, and should be developed further at the detailed design stage of each plot to ensure that conditions are comfortable for their intended use.

5.3.3 Strong Winds

There were 38 occurrences of strong winds in excess of Beaufort Force 6, 7 or 8 in Configuration 3, as shown in Table 3 above.

Receptors 13, 20, 39, 43-46, 51, 61, 62 and 84 are ground level locations situated on thoroughfares or at building corners which observed strong winds in excess of B6; however infrequent winds of this magnitude are unlikely to cause a nuisance to pedestrians.

The remaining occurrences of strong winds (which exceed B6, B7 and B8) occur on roof top terraces. However, these areas have already been identified as areas that would require mitigation to address pedestrian comfort. The conditions on these terraces will change as a result of the detailed design of the respective plots (particularly the design of the balustrades), and so the requirement for mitigation should be reassessed at detailed design stage.

In the tests conducted on the illustrative scheme for the Plot B Reserved Matters assessment, as shown in the photographs in Appendix D, the inclusion of balustrades and screening (in addition to the improvement caused by the change in massing from the maximum parameters to the illustrative design) significantly reduced the occurrence of strong winds at terrace level. Strong winds in this configuration exceeded B6 at the largely exposed northwest corner of Plot C and were eliminated at all other rooftop locations.

5.4 Configuration 4

(Completed Development – Plot B in detail, other plots with maximum parameter massing, with cumulative surrounding buildings)

The discussion of the wind microclimate in Configuration 4 is based on the results shown in Figure 9 for the windiest season and Figure 10 for the summer season. This Configuration consists of the Station Hill Maximum Parameter Plan (modified to include the set-back at ground level of Plots C, D and G) plus Plot B in detail and cumulative surrounding buildings. Generally the wind microclimate is consistent with configuration 3.

5.4.1 Pedestrian Comfort – Ground Level

Within cumulative buildings in situ, conditions at ground level ranged from those acceptable for business walking through to sitting. These conditions are consistent with Configuration 3. Where business walking conditions occur, mitigation measure would be required to ensure the targeted leisure walking conditions are met.

5.4.1.1 Thoroughfares

All thoroughfare locations experienced the required leisure walking (or calmer) conditions, with the exception of receptor 69 which is classified as acceptable for business walking (as per Configuration 3 described above). Conditions at this receptor are likely due to the maximum parameter plans being tested, and so it is expected that conditions at this location would calm once the detailed design of Plot A is tested. Therefore mitigation measures are not anticipated to be required within this area.

5.4.1.2 Entrances

As this is an outline application, entrance locations are unknown, and so it is advised that entrances are situated within areas where standing/entrance conditions or calmer are identified. If it is the intention to locate entrances in windier leisure walking zones, mitigation measures would be required to ensure the targeted conditions suitable for entrance use are met.

5.4.1.3 Amenity spaces

Within Central Square and Station Square conditions are acceptable for a mix of standing and sitting wind conditions during the summer. This is deemed acceptable for a mixed-use amenity space provided that seating areas are located in the calmer regions of the square; however if long term seating is intended in areas suitable

for standing during the summer then localised soft landscaping in the form of small trees and shrubs in planters will help to reduce wind speeds.

5.4.2 Pedestrian Comfort – Terraces

With cumulative developments in situ, conditions at roof terrace level remained similar to the conditions described for Configuration 3, except on the roof of Plot B where the detailed design provides significant shelter to the rooftop terrace areas. Conditions at receptors 125-129 (Plot B) improved by up to two categories in the summer season, as shown by a comparison of Figures 8 and 10.

On the rooftop areas of the other plots, minor differences of up to one category were observed, where the influence of cumulative schemes and the detailed Plot B has caused previously marginal results to change category. Overall however, the wind microclimate on these plots was largely consistently with the results of Configuration 3; i.e. predominantly one and two categories windier than desired for amenity use during the summer.

The detailed design of the buildings will be influential in creating suitable conditions on the rooftop amenity spaces, as noted previously in Configuration 3, and the requirement for mitigation should be reassessed at the detailed design stage.

5.4.3 Strong Winds

With cumulative buildings in situ there were 28 occurrences of strong winds in excess of Beaufort Force 6 or 7. Receptors 13, 20, 39, 41, 51, 55 and 69 are located along thoroughfares or at building corners where the infrequent exceedance of B6 is unlikely to cause nuisance.

Receptor 43 is located within Station Square, this location has been identified as requiring mitigation in terms of pedestrian comfort. Mitigation in the form of planting or screening is expected to reduce the frequency of strong winds within this area.

All remaining receptors are situated within the rooftop amenity spaces which observe wind exceeding B6 or B7. These receptors have been identified as being windier than desired in terms of pedestrian comfort, and so the mitigation measures advised for Configuration 3 to achieve the desired wind conditions would also be expected to reduce the frequency of strong winds.

6. Concluding Remarks

In conclusion:

1. The meteorological data for the site indicate prevailing winds from the south-west quadrant throughout the year with secondary winds from the north-easterly direction, particularly during spring.
2. In Configuration 1, the wind microclimate around the Development ranges from sitting to leisure walking wind conditions during the windiest season. During the summer season conditions are largely acceptable for sitting use, with standing/entrance and leisure walking conditions reported in more exposed areas.
3. Configuration 2 comprised a demolished northern part of the site (with the exception of Xafinity House and the NCP Car Park) with Plot C as a temporary events space, and the future baseline schemes. The wind microclimate ranges from leisure walking to sitting during the windiest season. Overall the ground level is acceptable for thoroughfare use. The Temporary Event Space is considered to be acceptable for the intended pedestrian use throughout the year. During the summer season the Station Square amenity area, observed standing conditions. If seating is desired within this area, localised mitigation would be required to lower wind speeds; however, since this area is expected to be sensitive to the detailed design of the buildings, the need for mitigation should be reassessed at the detailed design stage.
4. For Configuration 3, the completed development including the updated Plot E (maximum parameter plan) was added to the wind tunnel model before testing. The ground level wind microclimate ranged from business walking to sitting. Along thoroughfares conditions measured are predominantly suitable for leisure walking use (at worst) or calmer, these conditions are considered to be acceptable for the intended use. Where business walking conditions were identified at receptor 69, mitigation measures are not expected to be required as this conditions is likely to be a result of the maximum parameter being tested, and so at the detailed design stage it is expected that conditions at receptor 69 would calm to those acceptable for the intended pedestrian use. The Central Square amenity space observed a mix of sitting and standing conditions and is deemed acceptable for a mixed-use amenity space; however if long term seating is intended, localised soft landscaping or screening should be incorporated within the amenity space to achieve sitting conditions. The Station Square amenity space is largely classified as acceptable for standing entrance use, and so if it is the intention to include seating with this area soft landscaping should be incorporated to provide shelter to the users of this space.
5. In Configuration 4, the maximum parameter plan with cumulative surrounding buildings was tested. The ground level microclimate ranged from business walking to sitting conditions and is largely acceptable for their intended thoroughfare use, with the exception of receptor 69 (similar to configuration 3). Conditions within the Central Square and Station Square amenity spaces observed a mix of sitting and standing conditions during the summer season and are acceptable for a mixed-use amenity space (if long term seating is desired, additional soft landscaping would be required to lower wind conditions to a sitting classification).
6. Conditions on the rooftop terrace areas were found to be significantly windier than desired in both Configurations 3 and 4, due mainly to the fact that the maximum parameter scheme (which does not include balustrades or other roof detailing) demonstrates a conservative worst-case assessment. These rooftop areas will be sensitive to the detailed design of the buildings. To illustrate the types of measures that could be used to create a suitable wind environment at roof level, this report references the assessment conducted for the Reserved Matters of Plot B, which included an illustrative wider Site. The illustrative scheme featured balustrades and screening around the rooftop areas which, combined with the larger scale effect of the change in massing of the building from the maximum parameters, demonstrates that an improvement in wind conditions of up to two categories is possible at these rooftop areas. As such, it is recommended that these rooftop areas are reassessed through further wind

tunnel testing at the detailed design stage, and appropriate further mitigation measures developed at that time if they are required.

Figures

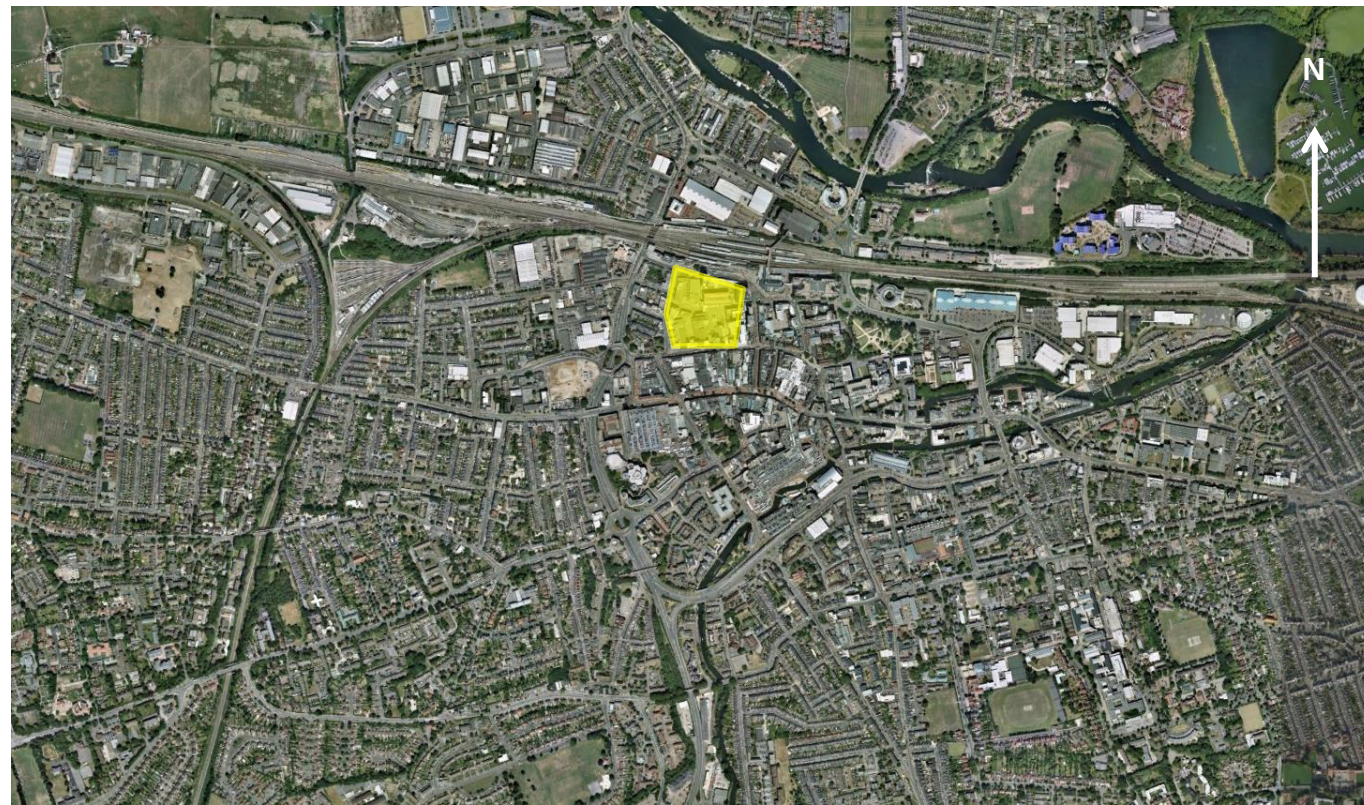


Figure 1: Aerial Photograph of the Existing site (approx. site highlighted in yellow)

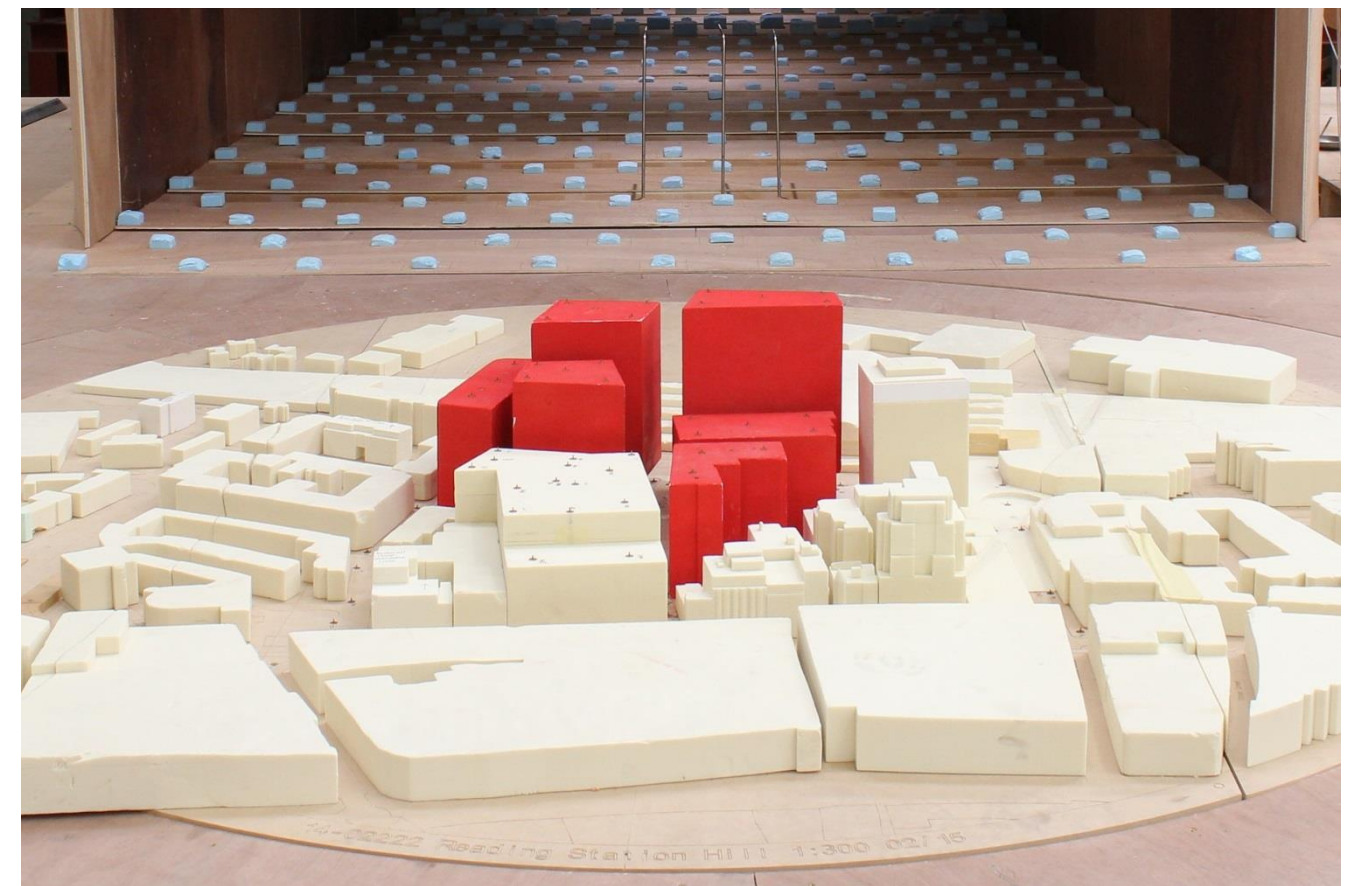
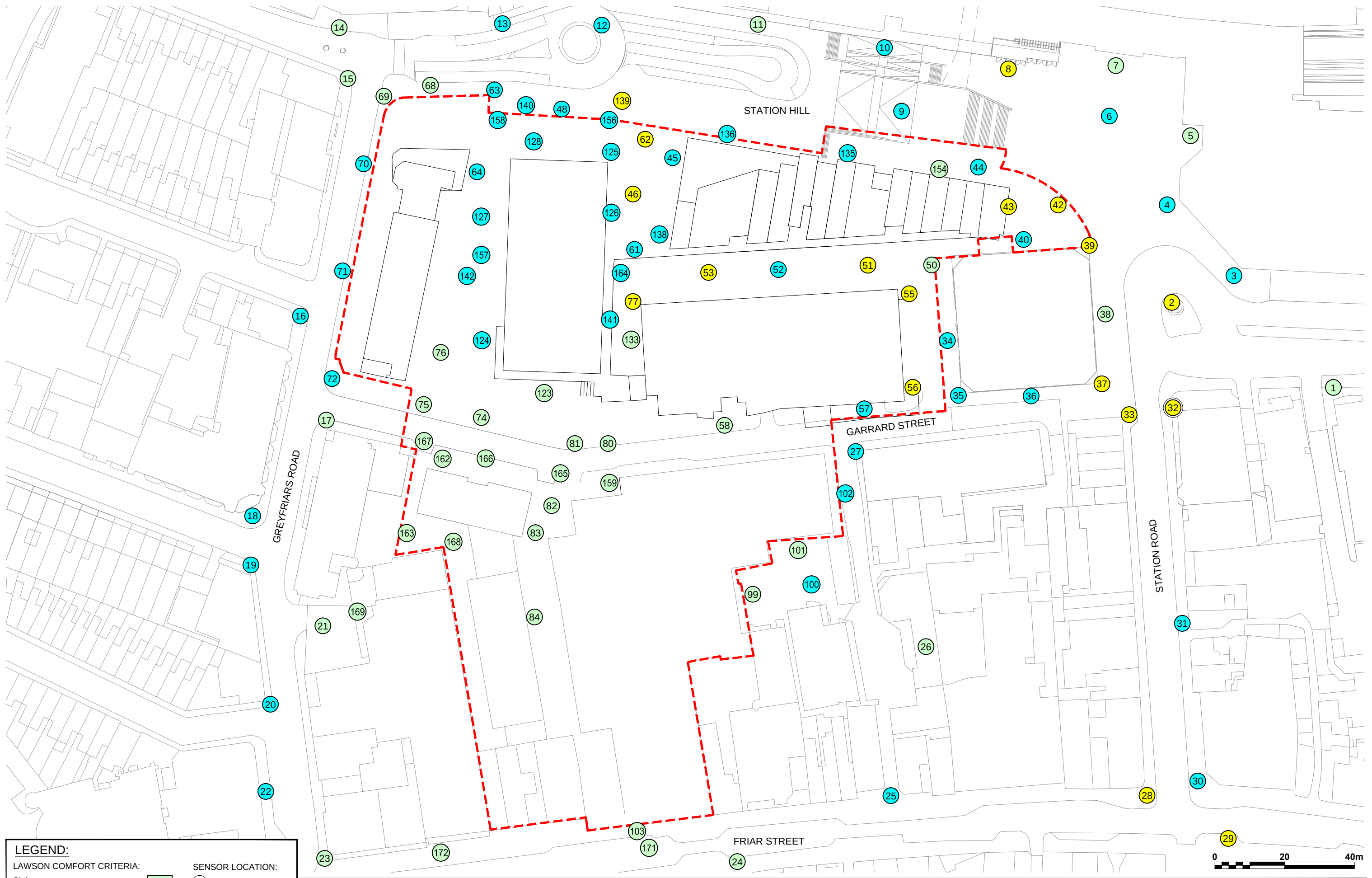


Figure 2: Image of the Proposed Development –Configuration 3 in the Wind Tunnel (view from the South)



LEGEND:

LAWSON COMFORT CRITERIA:

Sitting	Light Green
Standing/Entrance	Blue
Leisure Walking	Yellow
Business Walking	Magenta
Carpark/Roadway	Red

SENSOR LOCATION:

○	Grade Level
□	Podium Level
◇	Terrace/Balcony Level

Pedestrian Wind Comfort Conditions - Configuration 1: Future Baseline, Existing Site with Existing Surrounding Buildings.
Windiest Season

Station Hill Plot E - Reading, United Kingdom

0 20 40m

True North

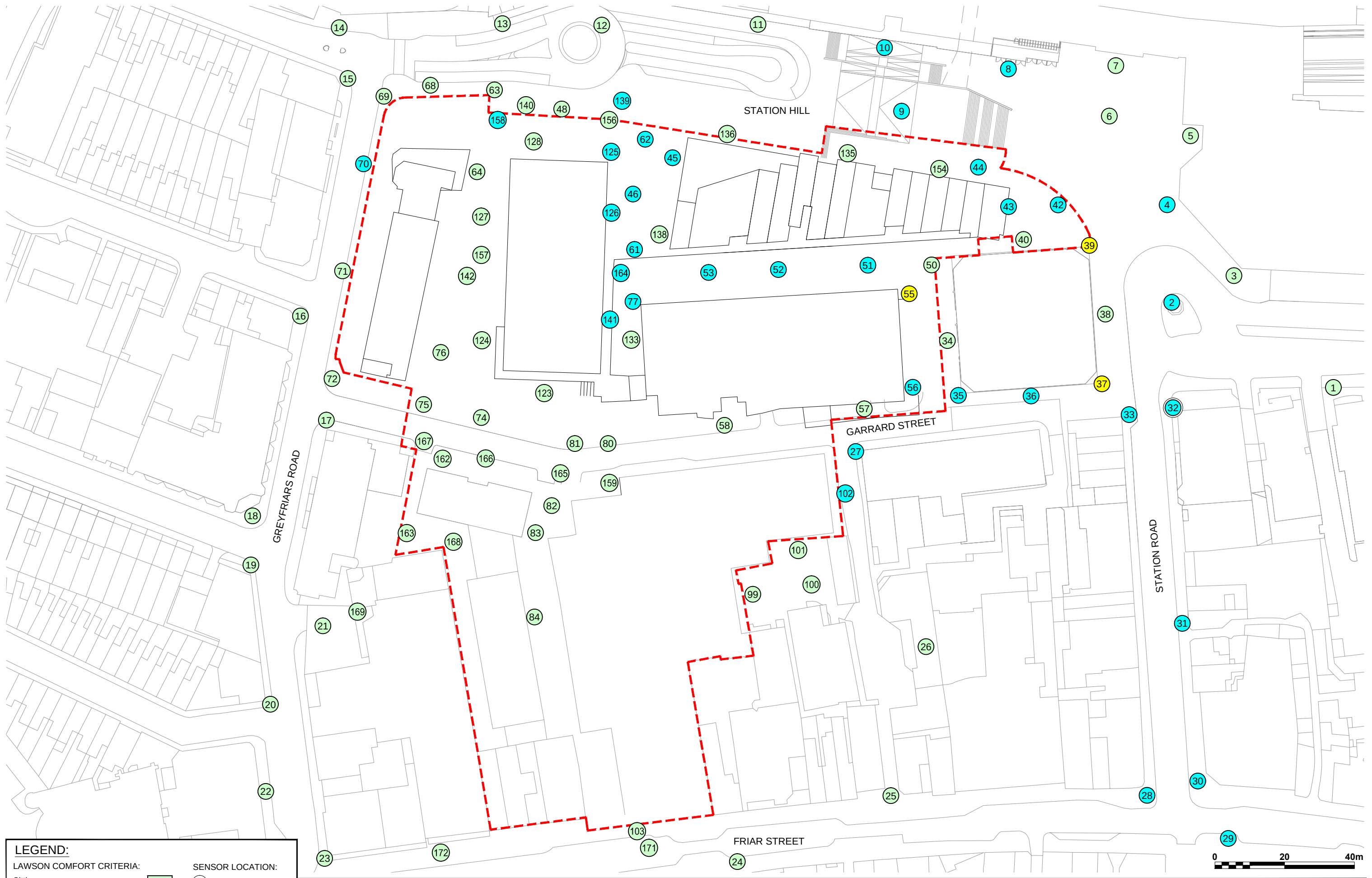
Drawn by: SM Figure: 3

Approx. Scale: 1:1000

Date Revised: June 19, 2015

Project #1402222

RWDI



LEGEND:

LAWSON COMFORT CRITERIA:

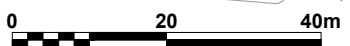
Sitting	Light Green
Standing/Entrance	Blue
Leisure Walking	Yellow
Business Walking	Magenta
Carpark/Roadway	Red

SENSOR LOCATION:

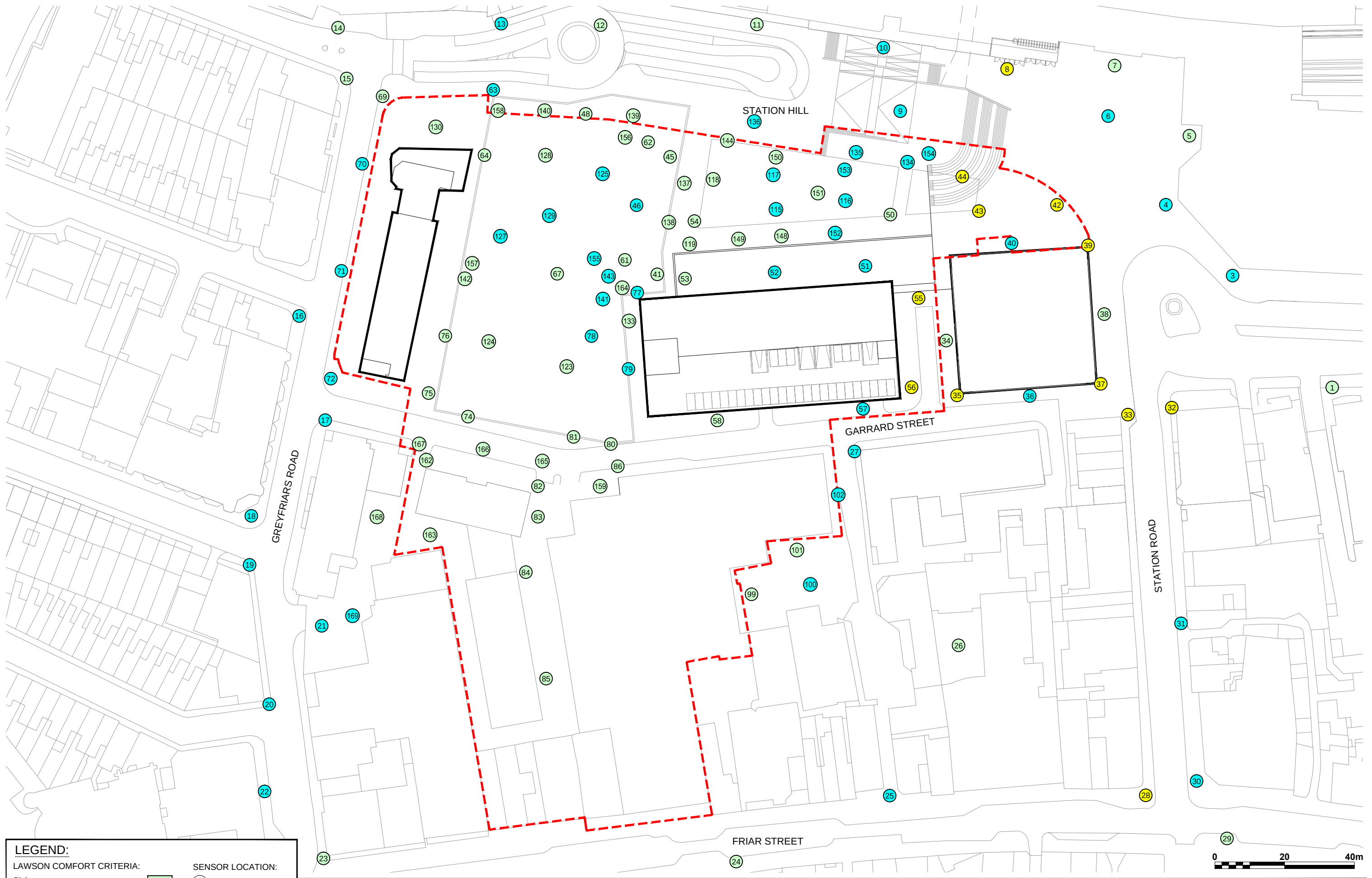
○ Grade Level
□ Podium Level
◇ Terrace/Balcony Level

Pedestrian Wind Comfort Conditions - Configuration 1: Future Baseline, Existing Site with Existing Surrounding Buildings.
Summer Season

Station Hill Plot E - Reading, United Kingdom



Drawn by:	SM	Figure:	4
Approx. Scale:	1:1000		
Date Revised:	June 19, 2015		



LEGEND:

LAWSON COMFORT CRITERIA:

Sitting

Standing/Entrance

Leisure Walking

Business Walking

Carpark/Roadway

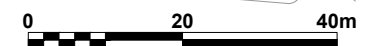
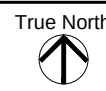
Grade Level

Podium Level

Terrace/Balcony Level

Pedestrian Wind Comfort Conditions - Configuration 2: Demolished Site with Existing Surrounding Buildings.
Windiest Season

Station Hill Plot E - Reading, United Kingdom



Drawn by: SM

Figure: 5

Approx. Scale: 1:1000

Date Revised: June 19, 2015

Project #1402222



LEGEND:

LAWSON COMFORT CRITERIA:

Sitting

Standing/Entrance

Leisure Walking

Business Walking

Carpark/Roadway

SENSOR LOCATION:

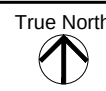
Grade Level

Podium Level

Terrace/Balcony Level

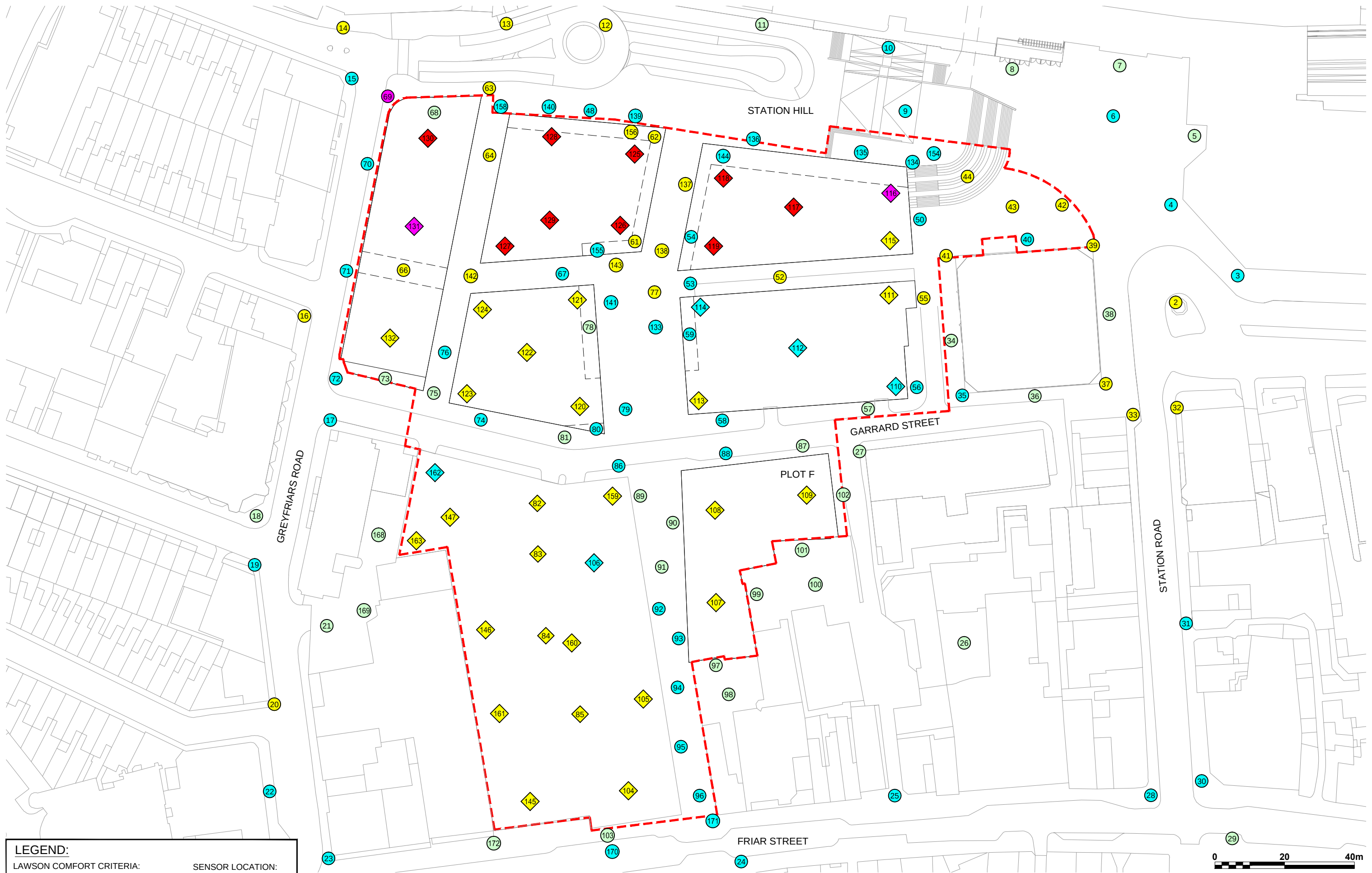
Pedestrian Wind Comfort Conditions - Configuration 2: Demolished Site with Existing Surrounding Buildings.
Summer Season

Station Hill Plot E - Reading, United Kingdom



Project #1402222

Drawn by:	SM	Figure:	6
Approx. Scale:	1:1000		
Date Revised:	June 19, 2015		



LEGEND:

LAWSON COMFORT CRITERIA:

Sitting

Standing/Entrance

Leisure Walking

Business Walking

Carpark/Roadway

Grade Level

Podium Level

Terrace/Balcony Level

Pedestrian Wind Comfort Conditions - Configuration 3: Completed Development (maximum parameter) with Existing Surrounding Buildings.
Windiest Season

Station Hill Plot E - Reading, United Kingdom

True North

0 20 40m

Drawn by: SM

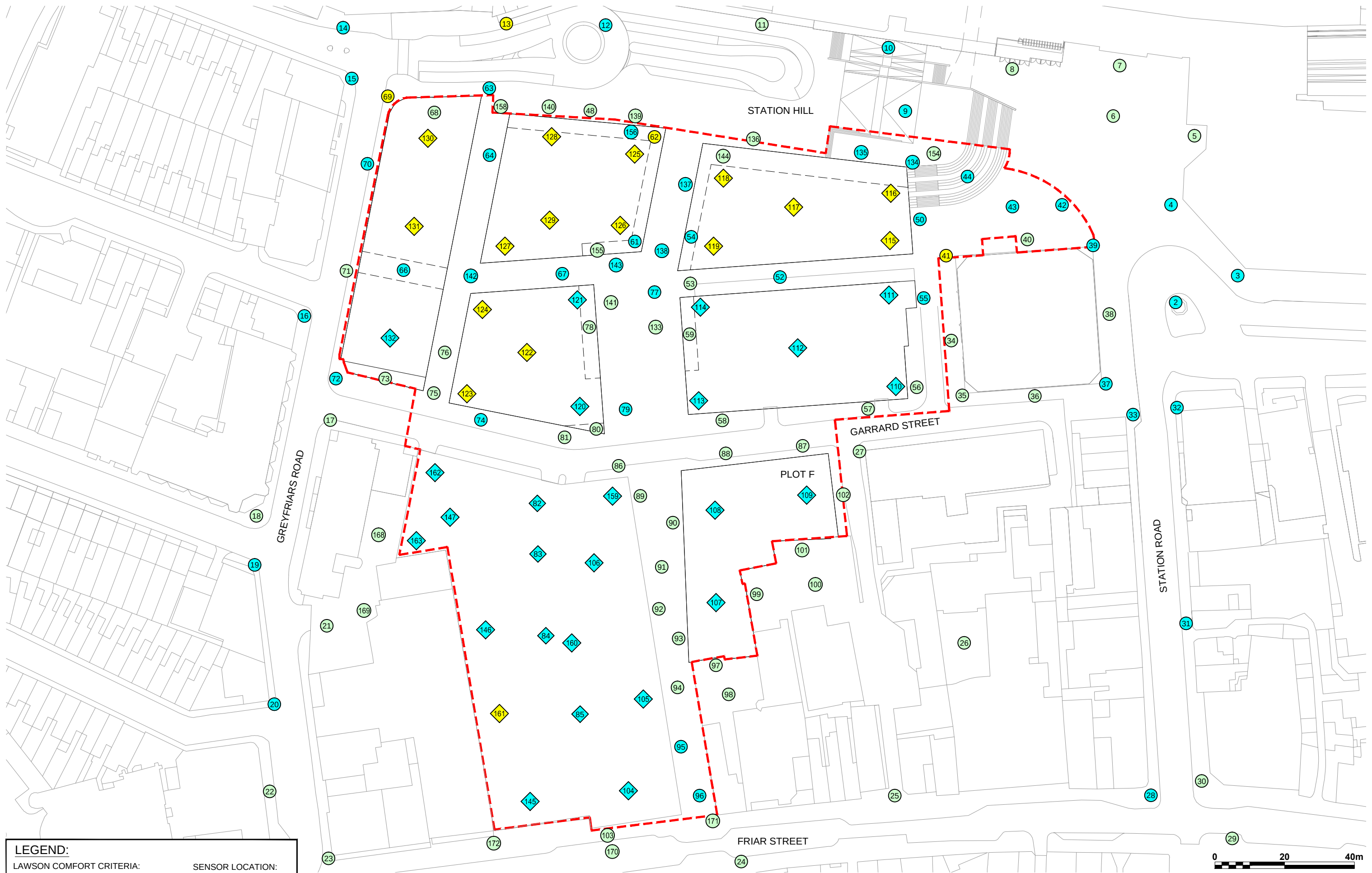
Figure: 7

Approx. Scale: 1:1000

Date Revised: June 19, 2015

Project #1402222

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LEGEND:

LAWSON COMFORT CRITERIA:

Sitting	Light Green
Standing/Entrance	Blue
Leisure Walking	Yellow
Business Walking	Magenta
Carpark/Roadway	Red

SENSOR LOCATION:

Grade Level	Circle
Podium Level	Square
Terrace/Balcony Level	Diamond

Pedestrian Wind Comfort Conditions - Configuration 3: Completed Development (maximum parameter) with Existing Surrounding Buildings. Summer Season

Station Hill Plot E - Reading, United Kingdom

True North

0 20 40m

Drawn by: SM Figure: 8

Approx. Scale: 1:1000

Date Revised: June 19, 2015

Project #1402222

RWDI