FINAL REPORT

CHAPEL GATE

BASILDON, UK

PEDESTRIAN LEVEL WIND MICROCLIMATE ASSESSMENT

RWDI #2101541 – REV D

12 APRIL 2021

SUBMITTED TO

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VERSION HISTORY

RWDI Project #2101541	Chapel Gate Basildon, UK	
Report	**Releases**	**Dated**
Reports	Rev A Rev B Rev C Rev D	17 February 2021 30 March 2021 01 April 2021 09 April 2021
Project Team	Hesham Ebrahim Andrew Proud Andy Gypps	Project Engineer Project Engineer Senior Project Manager

EXECUTIVE SUMMARY

RWDI was retained to conduct a pedestrian level wind assessment of the proposed Chapel Gate development (referred to as the "Proposed Development" hereafter in this report) in Basildon, UK. This report presents a description of the methodology used and the results of two configurations tested using Computational Fluid Dynamics (CFD) simulations, namely:

- Configuration 1: Existing Site with Existing Surrounding Buildings and Existing Landscaping; and
- Configuration 2: Proposed Development with Existing Surrounding Buildings and Existing and Proposed Landscaping.

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

The Baseline scenario (i.e. Configuration 1) indicates that the Site and nearby surrounding area is relatively exposed to the prevailing winds and has conditions ranging from suitable for sitting to strolling use during the windiest season. Generally during the summer season, wind conditions are one category calmer, and the majority of the Site area fulfils the standing criteria. No instances of strong winds are likely to occur in the Baseline scenario.

In the presence of the Proposed Development, wind conditions within the Site would improve in comparison to the Baseline as the massing of the Proposed Development itself would provide shelter to the rest of the Site from the prevailing winds. This, in combination with the retained existing and the proposed landscaping, would provide shelter to the Site and would improve wind conditions to be suitable for sitting use with localised areas suitable for standing use during the windiest season.

Thoroughfares, entrances, bus stops and pedestrian crossings surrounding the Proposed Development would be suitable for the intended use. Wind conditions at off-Site areas would remain similar to the Baseline scenario and thus would continue to be suitable for the intended use.

During the summer season, amenity spaces would be suitable for the intended use, except for several balconies which would be windier than suitable. The current Proposed Development incorporates mitigation measures recommended by RWDI. Following the identification of windier than suitable conditions, the design will evolve, to increase the proposed 1.1m balustrade to 1.5m tall at least 50% porous balustrades, as discussed in Section 6. Roof levels were not considered accessible for amenity use in this assessment. Strong winds exceeding the safety threshold are likely to occur at balcony locations and would require mitigation as recommend in Section 6.

Overall, the majority of wind conditions within and around the Proposed Development would be similar to the Baseline and suitable for the intended use. Mitigation measures have been recommended for the areas windier than suitable for the intended use and would be expected to improve wind conditions when implemented into the design. The effectiveness of these mitigation measures will be tested at a later design stage using CFD to ensure that adequate shelter is provided to achieve the desired wind conditions.

1 INTRODUCTION

RWDI was retained by Calford Seaden to conduct a pedestrian level microclimate assessment for the proposed Chapel Gate development in Basildon, UK. This report presents the background and objectives from RWDI's assessment. A summary of the overall recommendations from the study are presented in Section 7 "Concluding Remarks".

2 BACKGROUND AND APPROACH

Computational Fluid Dynamics (CFD) simulations were conducted on the proposed Chapel Gate development, in Basildon, UK. The assessment quantifies the wind conditions within and around the Site, by comparing the measured wind speed and frequency of occurrence with the Lawson Comfort Criteria. Meteorological data for Basildon, UK has been analysed and adjusted to the Site conditions by modelling the effect of terrain roughness in the computational domain.

Two configurations were simulated, as follows:

- Configuration 1: Existing Site with Existing Surrounding Buildings and Existing Landscaping; and
- Configuration 2: Proposed Development with Existing Surrounding Buildings and Existing and Proposed Landscaping.

Mitigation measures were suggested that would be expected to improve wind conditions within and around the Site as discussed in Section 6.

2.1 Site Description and Surroundings

The Site is located in Basildon, approximately 450m to the west of Basildon Railway Station. The Site is bound by Nether Mayne to the east, the Laindon Link to the north, an embankment railway lines to the south and large dense trees to the west. The Ordnance Survey Landranger grid reference is TQ699883.

The surrounding buildings to the north, east and south are generally low- to medium-rise development with more open surrounds to the south-west of the Site. This topology represents an open suburban terrain, which results in a relatively high mean wind speed with lower levels of turbulence compared to a dense urban environment, where the mean wind speeds are lower with greater turbulence. An aerial view of the approximate location of the Site is highlighted in yellow with its surroundings in Figure 1.

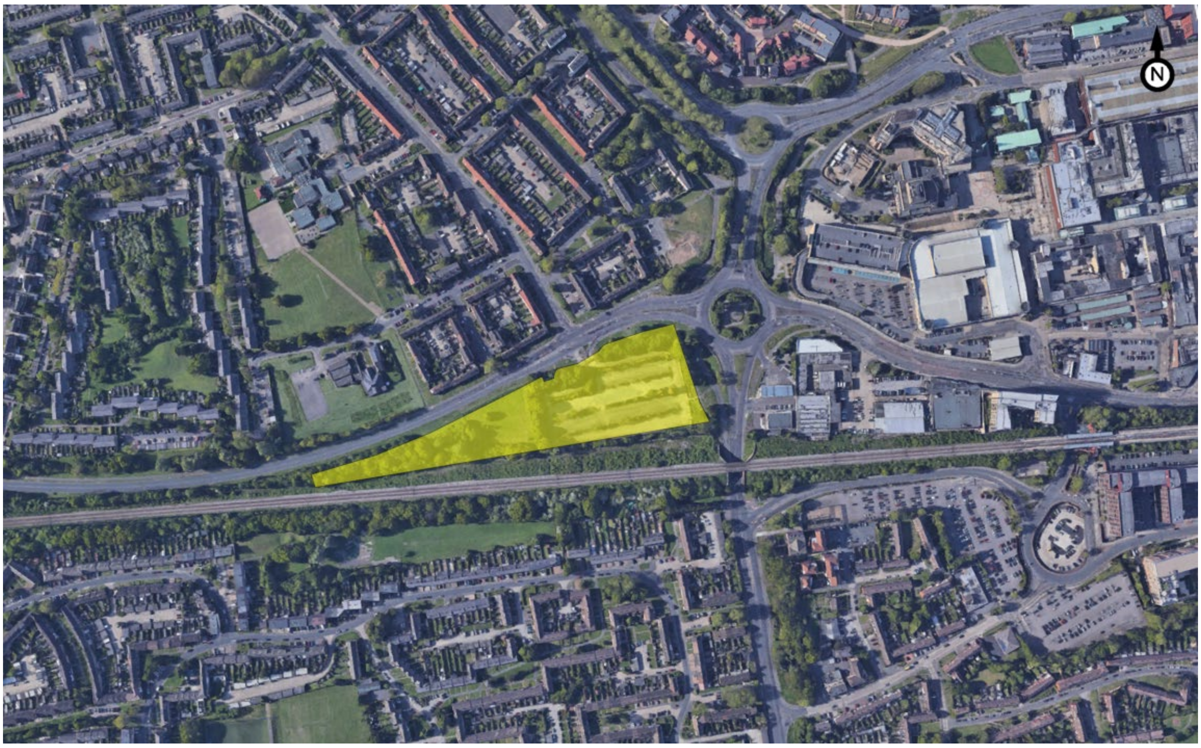


Figure 1: Aerial view of the existing Site (approximate extent of the Site highlighted in yellow)

2.2 The Proposed Development

The Proposed Development would comprise the construction of five apartment blocks ranging in height from five to 10 storeys with new parking spaces and ground level communal amenity spaces surrounding the buildings. In addition, five two storey house terraces will be located to the west of the Site.

Private amenity spaces would be provided at balconies on all the five blocks.

A 3D model of the Proposed Development is shown in Figure 2 below.

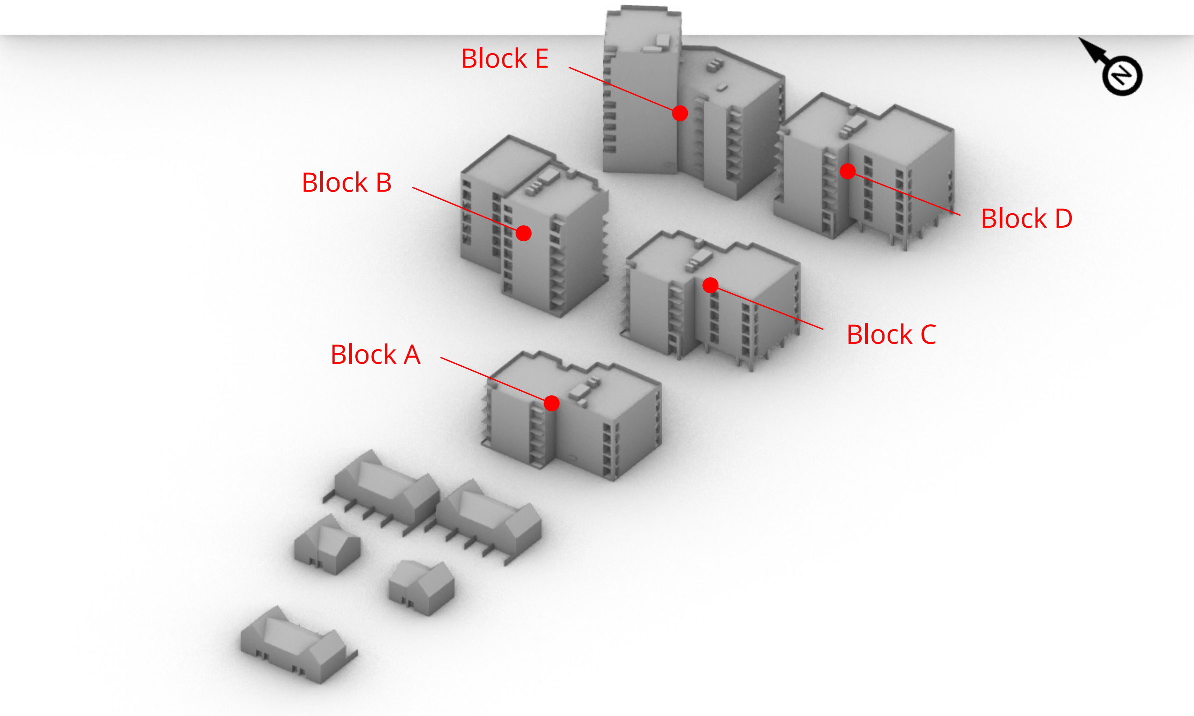


Figure 2: 3D model of the Proposed Development used for CFD simulations (view from the south-west)

3 METHODOLOGY AND ASSESSMENT CRITERIA

The three-dimensional CAD model of the Proposed Development used for CFD simulations of Configuration 2 is shown in Figure 2. Additional images of the 3D model in are presented in Appendix A. In each of the two assessed scenarios surrounding buildings within a 400m radius of the centre of the Site were included.

The 'Results' section, shows the windiest season (typically winter) and the summer season (June to August) comfort plots. The comfort results are assessed at a height of 1.5m above the ground or building surface to represent conditions around people. The colours correspond to the Lawson Comfort Criteria described below in 3.2 'Pedestrian Comfort'.

CFD is a computer modelling technique for numerically simulating wind flow in complex environments. For this study, computational modelling was undertaken using OpenFOAM version 4.1 with 18 wind angles tested for each scenario, equally spaced out around the compass (equal 20 degrees intervals). Although the strongest winds originate from the south-westerly sector, this quantity of wind angles will provide sufficient coverage of all aerodynamic interactions from winds from all angles.

The individual cases of the Proposed Development were solved using RANS approach with an RNG k-ε turbulence model. The steady state RANS type model with the RNG k-ε turbulence model is chosen over other turbulence models or transient type schemes for wind microclimate studies by RWDI for its ability to approximate highly complex flows within urban environments to a high level of accuracy against a practical computational time. The statistically steady-state solution obtained by RANS simulations does not have the ability to predict the fluctuating or gusty nature of wind. As comfort is a function of average conditions, this model is more suited to help analyse this.

The potential for strong winds leading to potential safety issues is assessed using informed engineering judgement.

All configurations were simulated with the existing landscaping. Configuration 2 included the proposed landscaping scheme provided in Appendix C.

3.1 Meteorological Data

Figure 3 shows the seasonal wind roses (meteorological data) for the London area which are based on data obtained from the meteorological station of London Heathrow airport. 0 Degrees represents winds blowing from the north and 90 degrees represents winds blowing from the east.

Approximately 30 years of meteorological data for London was used in this report, presented in the seasonal wind roses (Figure 3). The radial axis indicates the percentage time per season that the wind speed exceeds the particular wind speed range. 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 the north-westerly winds, especially during the spring.

Figure 3: Seasonal Wind Roses for London Heathrow (in km/hr) (Radial axis indicates the percentage of time the stated wind speed is exceeded)

3.2 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[1] that have been established for over thirty years and have been widely used on building developments across the United Kingdom. The comfort criteria seek to define the reaction of an average pedestrian to the wind as described in Table 1. If the measured wind conditions exceed the threshold wind velocity for more than 5% of the time, then they are deemed unacceptable for the intended pedestrian activity. The expectation is that there may be complaints of nuisance or people will not use the area for its intended purpose.

The Criteria sets out four pedestrian activities and reflect the fact that less active pursuits require more benign wind conditions. The categories are sitting, standing, strolling and walking, in ascending order of activity level, with a fifth category for conditions that are uncomfortable for all pedestrian uses. In other words, the wind conditions in an area for sitting need to be calmer than a location that people merely walk past.

The distinction between strolling and walking is that in the strolling scenario pedestrians are more likely to take on a leisurely pace, with the intention of taking time to move through the area, whereas in the walking scenario pedestrians are intending to move through the area quickly and are therefore expected to be more tolerant of stronger winds.

The Criteria are derived for open air conditions and assume that pedestrians will be suitably dressed for the season.

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

Table 1: Lawson Comfort Criteria

Key	Comfort Category	Threshold	Description
(light green)	Sitting	0-4 m/s	Light breezes desired for outdoor restaurants and seating areas where one can read a paper or comfortably sit for long periods
(light blue)	Standing	4-6 m/s	Gentle breezes acceptable for main building entrances, pick-up/drop-off points and bus stops
(yellow)	Strolling	6-8 m/s	Moderate breezes that would be appropriate for strolling along a city/town street, plaza or park
(magenta)	Walking	8-10 m/s	Relatively high speeds that can be tolerated if one's objective is to walk, run or cycle without lingering
(red)	Uncomfortable	>10 m/s	Winds of this magnitude are considered a nuisance for most activities, and wind mitigation is typically recommended

[1] Lawson T.V. (April 2001), Building Aerodynamics, Imperial College Press

3.3 Strong Winds

Lawson[1] also specified a lower limit strong wind threshold when winds exceed 15m/s for more than 0.025% of the time (approximately 2.2 hours per year). When winds exceed this threshold remedial measures or a careful assessment of the expected use of that location would be required; e.g. is it reasonable to expect elderly or very young pedestrians to be present at the location on the windiest day of the year?

Wind speeds that exceed 20m/s for more than approximately 2.2 hours per year represent a safety issue for all members of the population, which would require mitigation to provide an appropriate wind environment.

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

It should be noted that the CFD simulations will provide an average expected wind speed for the windiest (typically the winter months - December to February) and summer season in regard to pedestrian comfort. Areas which would have wind conditions suitable for walking use would be likely to have instances of strong winds. As such, professional judgement incorporating RWDI's experience of a large number of similar projects both within the UK and internationally has been applied, informed by the CFD results to identify areas of the Proposed Development likely to have instances of strong winds.

4 RESULTS

4.1 Details of Analysis

The difference in height and terrain roughness between meteorological conditions at the airport and the site is taken into account during the CFD simulations. For the Proposed Development, a suburban roughness factor was used to adjust the meteorological data due to the relatively built up surroundings of the site.

4.2 Desired Pedestrian Activity around the Proposed Development

Generally, for the Development, the target conditions are:

1. Strolling during the windiest season on pedestrian thoroughfares;
2. Standing conditions at main entrances, drop off areas or taxi ranks, and bus stops throughout the year; and
3. Sitting and standing conditions at outdoor seating and amenity areas during the summer season when these areas are more likely to be frequently used by pedestrians.

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

Achieving a sitting classification in the summer usually means that the same receptor would be acceptable for standing in the windiest season because winds are stronger at this time.

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 windiest season.

It should be noted that a mixture of sitting use and standing use is acceptable for larger amenity spaces, provided designated seating is not located at the windier locations suitable for standing use.

4.3 Performance against the Lawson Comfort Criteria

The results of the assessment for each configuration against Lawson Comfort Criteria are described below and presented graphically in Figures 4 to 11.

4.3.1 Configuration 1 – Existing Site with Existing Surrounding Buildings and Existing Landscaping

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

- Figure 4: Windiest Season (Ground Level); and
- Figure 5: Summer Season (Ground Level).

Wind conditions in Configuration 1 were assessed with the existing landscaping (Appendix C)

4.3.2 Configuration 2 – Proposed Development with Existing Surrounding Buildings and Existing and Proposed Landscaping

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

- Figure 6: Windiest Season (Ground Level);
- Figure 7: Summer Season (Ground Level); and
- Figures 8-11: Summer Season (Elevated Levels).

Wind conditions in Configuration 2 were assessed with the existing and proposed landscaping scheme implemented (Appendix C).

5 DISCUSSION

This discussion compares the measured wind conditions (shown in the contour plots in Figure 4 – 11) to the anticipated use of the Site, to provide an assessment of whether the conditions would be suitable or too windy for the intended use.

Any areas not specifically mentioned would be suitable, or calmer than required, for the desired pedestrian use. Areas that are windier than suitable for the intended pedestrian use would require mitigation.

5.1 Configuration 1: Existing Site with Existing Surrounding Buildings and Existing Landscaping

The following discussion of the wind microclimate is based on the results shown in Figures 4 and 5 for the windiest and summer seasons for the ground level respectively.

5.1.1 Pedestrian Comfort

The Baseline scenario (i.e. Configuration 1) indicates that the Site is relatively sheltered by the existing landscaping and railway embankment and has conditions ranging from suitable for sitting to strolling use during the windiest season. Generally during the summer season, wind conditions are one category calmer, and the majority of the Site area fulfils the standing criteria.

Thoroughfares (Figure 4)

The Site is currently a former car park and has no formal pedestrian use.

Wind conditions on surrounding off-Site thoroughfares range from suitable for standing to strolling use during the windiest season, with localised areas at building corners suitable for walking use.

Entrances (Figure 4)

Existing off-site entrances around the Site along Great Kinightleys, Wickhay, Great Gregone and Nether Mayne have wind conditions suitable for sitting to standing use during the windiest season.

Bus Stops (Figure 4)

Bus stops on Laindon Link have wind conditions ranging from standing use to strolling use during the windiest season.

Amenity Spaces – Ground Level (Figure 5)

Off-Site amenity spaces at Raphael's Park would have wind conditions suitable for standing use during the summer season.

5.1.2 Strong Winds

There are instances of strong winds expected at localised building corners where comfort conditions are suitable for walking use. Walking use conditions are generally associated with strong winds.

5.2 Configuration 2: Proposed Development with Existing Surrounding Buildings and Existing and Proposed Landscaping

The following discussion of the wind microclimate is based on the results shown in Figures 6 and 7 during the windiest and summer seasons for ground level respectively. Figures 8 to 11 present results for the elevated levels of the Proposed Development during the summer season.

5.2.1 Pedestrian Comfort

In the presence of the Proposed Development, wind conditions within the Site would improve in comparison to the Baseline as the Proposed Development reduces the exposure of the Site to wind and would act as a barrier to the wind. This, in combination with the retained existing and proposed landscaping, would provide shelter within the Site and would improve wind conditions to be suitable for sitting use with localised areas suitable for standing use during the windiest season.

Wind conditions surrounding the Site would remain similar to the Baseline scenario.

Thoroughfares (Figure 6)

Wind conditions on thoroughfares between the Proposed Development buildings as shown in Appendix C, would range from sitting to strolling use during the windiest season, suitable for the intended use.

Off-Site thoroughfares, as discussed for Configuration 1, would have wind conditions similar to the Baseline scenario, and thus would remain suitable for the intended use.

Entrances (Figure 6)

Wind conditions around entrances to the Proposed Developed (shown in Appendix D) would range from suitable for sitting to standing use during the windiest season, suitable for the intended use.

Off-Site entrances identified in Configuration 1 would have wind conditions similar to the Baseline scenario and thus would remain suitable for the intended use.

Bus Stops (Figure 6)

Bus stops along Laindon Link would have wind conditions ranging from sitting use to strolling use during the windiest season, improved from the Baseline scenario. These conditions would therefore be suitable for the intended use.

Amenity Spaces – Ground Level (Figure 7)

The Proposed Development would have amenity gardens surrounding the five blocks on the western half of the Site, including designated benches between Blocks A and C, between Blocks C and D and between Blocks B and E.

The amenity spaces would have wind conditions ranging from sitting to standing use during the summer season, suitable for the intended use. Benches would be located in areas suitable for sitting use, acceptable for the intended use.

Amenity Spaces – Elevated Levels (Figure 8-11)

Wind conditions at the majority of balconies would range from sitting to standing use wind conditions during the summer season, suitable for the intended use. The exception to these would be as follows:

- Block A, level 4, north-western corner balcony;
- Block B, levels 4 and 5 south-western corner balconies;
- Block B, level 4, north-western corner balcony;
- Block C, level 5, north-western corner balcony;
- Block D, levels 5 and 6, north-western corner balconies;
- Block E (southern block), level 6, south-western corner balcony;
- Block E (northern block), levels 8 and 9, south-eastern corner balconies;
- Block E (northern block), levels 3 to 9, north-western balconies; and
- Block E (northern block), levels 3 to 9, north-eastern balconies.

These balconies would be up to two categories windier than suitable for the intended use during the summer season and would require mitigation as discussed in Section 6.

Roof levels would be up to two categories windier than suitable for an amenity space. If these roof levels are intended for amenity use wind mitigation measures would be required to ensure they are safe and suitable for the intended use.

5.2.2 Strong Winds

No instances of strong winds would be likely to occur on-Site at ground level, however, instances of strong winds would be expected at the following balcony levels:

- Block B, level 5, south-western corner balcony;
- Block D, level 6, north-western balcony; and
- Block E (northern block), levels 4 to 9, north-western and north-eastern balconies.

These balconies would require mitigation to ensure they would be safe and suitable for the intended use as discussed in Section 6.

6 MITIGATION MEASURES

The current Proposed Development incorporates mitigation measures recommended by RWDI to improve wind conditions at balconies, in the form of full height 50% perforated panels on balconies that were reported to be windy on Blocks B, C and D. However, additional mitigation measures would be required, as suggested in this section, to reduce the occurrence of windy conditions within and around the Proposed Development as well as identify the areas requiring mitigation with the design progression.

Configuration 2 concluded that wind conditions would be windier than suitable at the following area:

- Balconies with wind conditions exceeding standing use conditions during the summer season.

The mitigation measures suggested below (examples shown in Appendix E) would be expected to improve wind conditions at balconies:

- For balconies on Blocks A through to D, a full height 50% perforated panel as wide as the balcony would result in suitable conditions for a private amenity space. Therefore, adopting this mitigation strategy for other balconies that are one category windier than suitable would likely achieve a similar result.
- For balconies on Block E, increasing the perforated balustrade height to 1.5m, in addition to the existing full height perforated side screens, would likely improve wind conditions at those balconies.

The effectiveness of these mitigation measures will be tested at a later design stage using CFD to ensure that adequate shelter is provided to achieve the desired wind conditions at all balconies during the summer season.

7 CONCLUSIONS

In conclusion:

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

2. The Baseline scenario (i.e. Configuration 1) indicates that the Site and nearby surrounding area is relatively exposed to the prevailing winds and has conditions ranging from suitable for sitting to strolling use during the windiest season. Generally during the summer season, wind conditions are one category calmer, and the majority of the Site area fulfils the standing criteria. No instances of strong winds are likely to occur in the Baseline scenario.

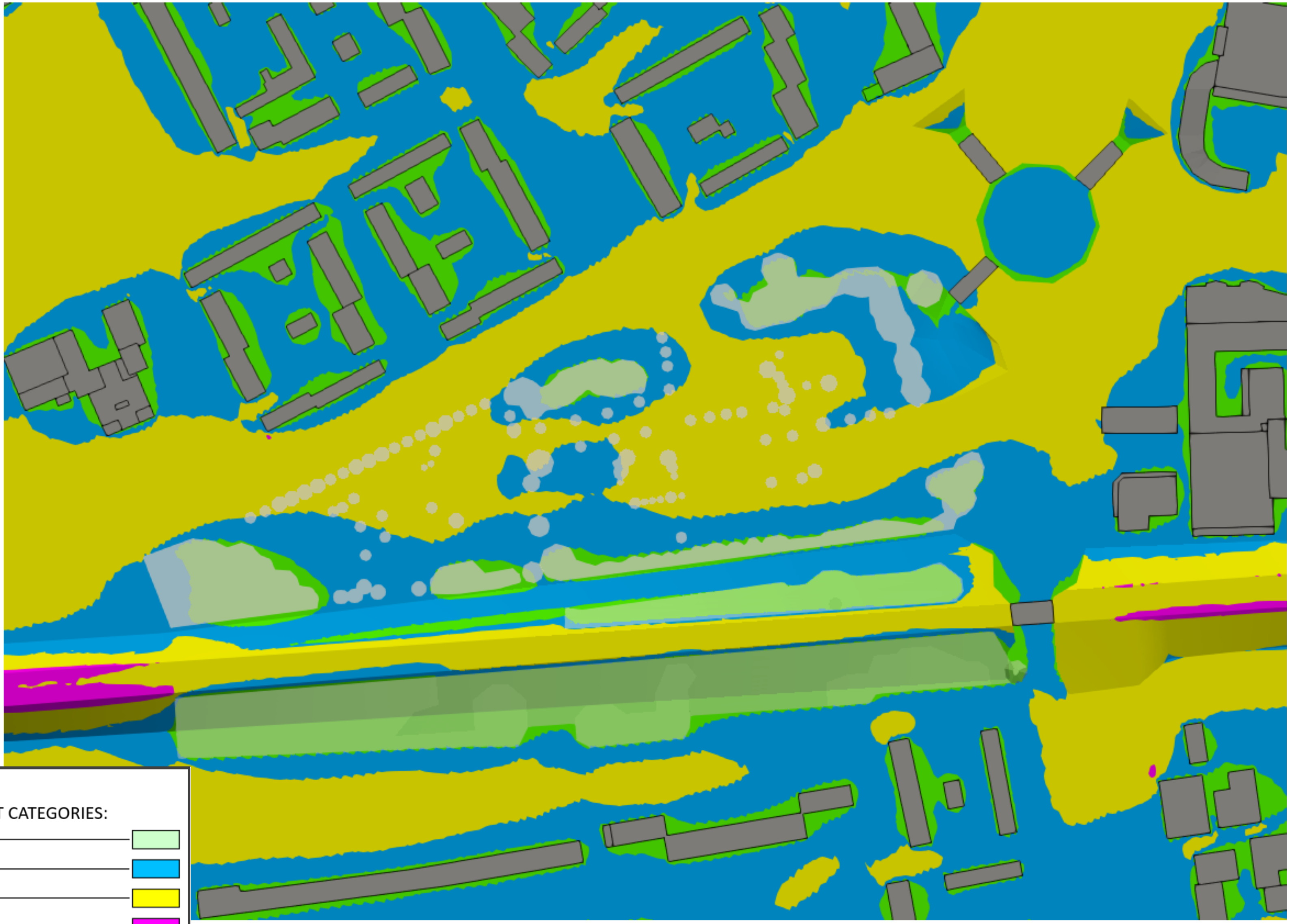
3. In the presence of the Proposed Development, wind conditions within the Site would improve in comparison to the Baseline as the massing of the Proposed Development itself would provide shelter to the rest of the Site from the prevailing winds. This, in combination with the retained existing and the proposed landscaping, would provide shelter to the Site and would improve wind conditions to be suitable for sitting use with localised areas suitable for standing use during the windiest season.

4. Thoroughfares, entrances, bus stops and pedestrian crossings surrounding the Proposed Development would be suitable for the intended use. Wind conditions at off-Site areas would remain similar to the Baseline scenario and thus would continue to be suitable for the intended use.

5. During the summer season, amenity spaces would be suitable for the intended use at ground level, except for several balconies which would be windier than suitable. The current Proposed Development incorporates mitigation measures developed through discussions with RWDI on balconies that were identified as windier than suitable. However, further evolution of the design will incorporate additional mitigation measures as discussed in Section 6. Roof levels would not be accessible for use other than for maintenance. Strong winds exceeding the safety threshold are likely to occur at balcony locations and would require mitigation as recommend in Section 6.

6. Overall, the majority of wind conditions within and around the Proposed Development would be similar to the Baseline and suitable for the intended use. Mitigation measures have been recommended for the areas windier than suitable for the intended use and would be expected to improve wind conditions when implemented into the design. The effectiveness of these mitigation measures will be tested at a later design stage using CFD to ensure that adequate shelter is provided to achieve the desired wind conditions

FIGURES



LEGEND:

LDDC COMFORT CATEGORIES:

- Sitting
- Standing
- Strolling
- Walking
- Uncomfortable

Pedestrian Wind Comfort Conditions – Ground Floor

Configuration 1: Existing Site with Existing Surrounding Buildings and Existing Landscaping

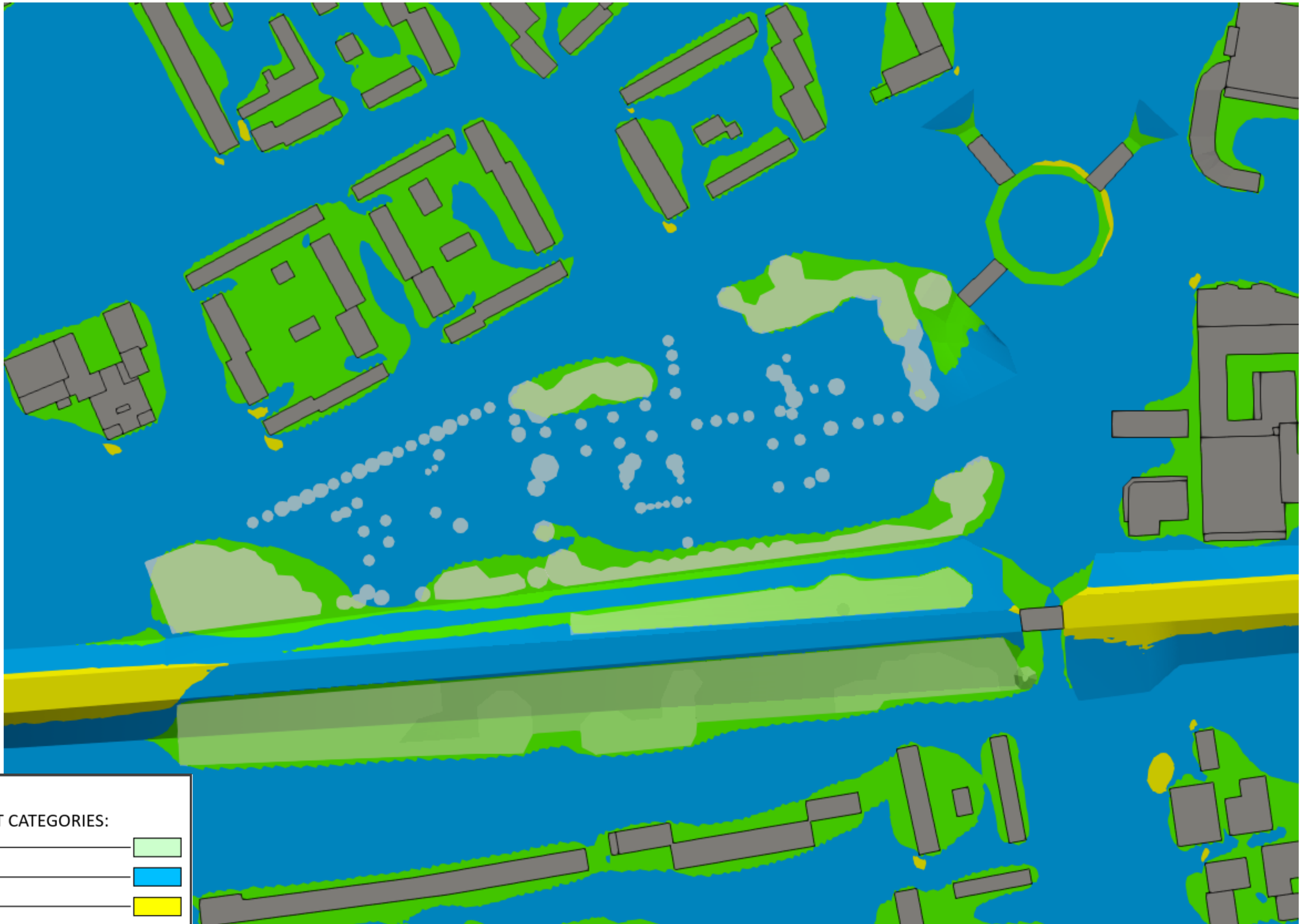
Windiest Season

Chapel Gate – Basildon, United Kingdom

Project #2101541

Drawn By: HME

Figure: 4



LEGEND:

LDDC COMFORT CATEGORIES:

- Sitting
- Standing
- Strolling
- Walking
- Uncomfortable

Pedestrian Wind Comfort Conditions – Ground Floor

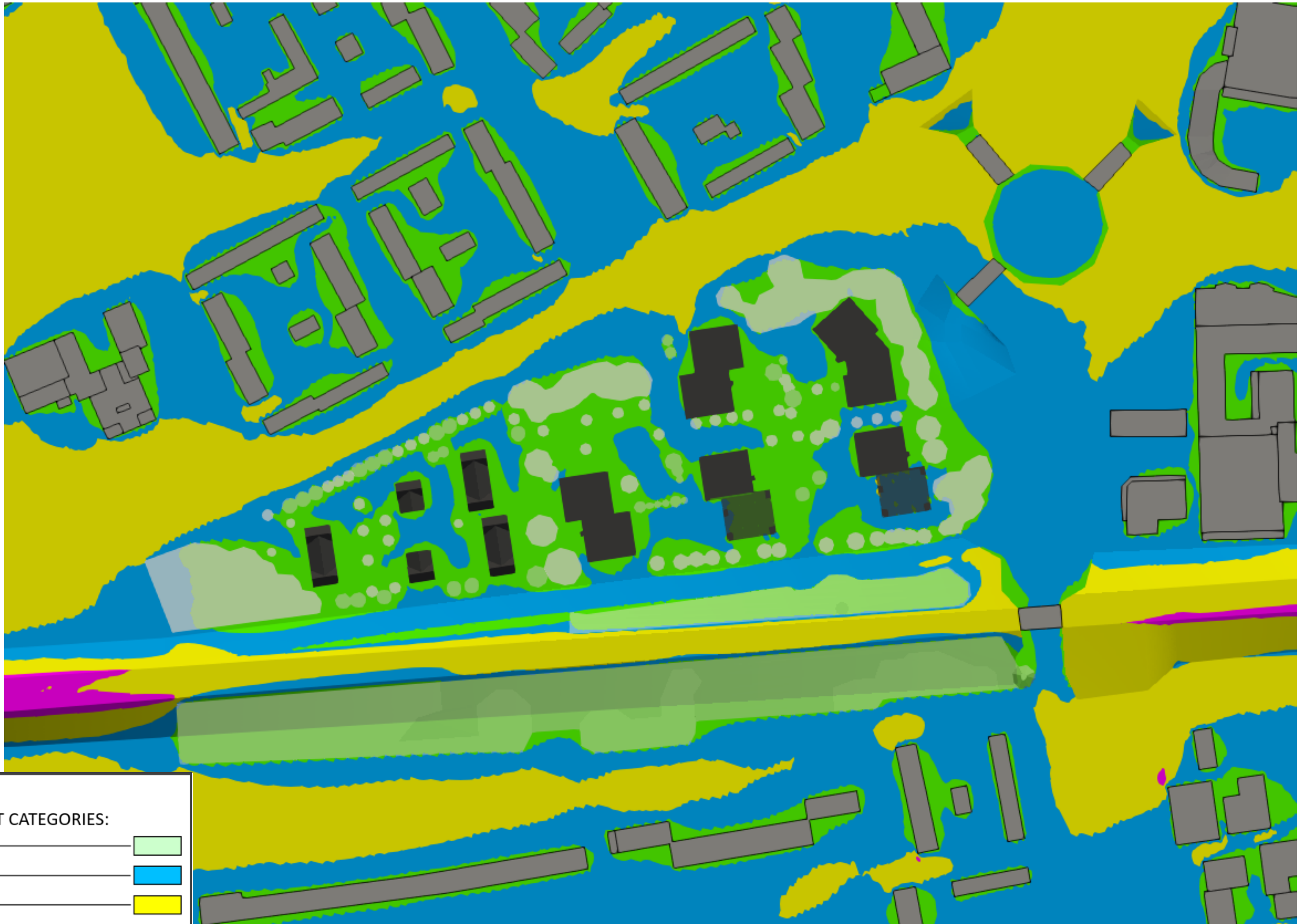
Configuration 1: Existing Site with Existing Surrounding Buildings and Existing Landscaping
Summer Season

Chapel Gate – Basildon, United Kingdom

Project #2101541

Drawn By: HME

Figure: 5



LEGEND:

LDDC COMFORT CATEGORIES:

- Sitting
- Standing
- Strolling
- Walking
- Uncomfortable

Pedestrian Wind Comfort Conditions – Ground Floor

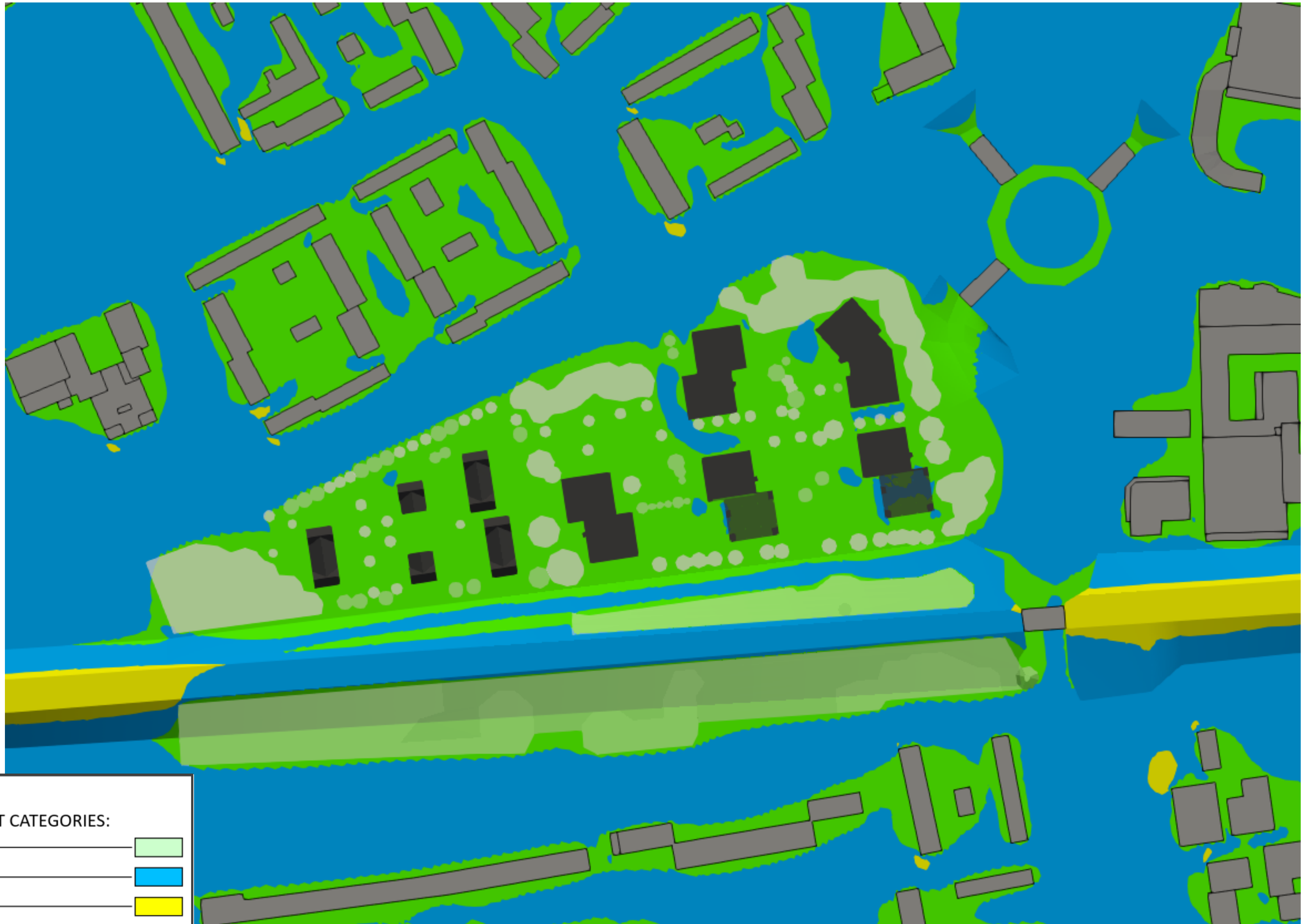
Configuration 2: Proposed Development with Existing Surrounding Buildings and Existing/Proposed Landscaping
Windiest Season

Chapel Gate – Basildon, United Kingdom

Project #2101541

Drawn By: HME

Figure: 6



LEGEND:

LDDC COMFORT CATEGORIES:

- Sitting
- Standing
- Strolling
- Walking
- Uncomfortable

Pedestrian Wind Comfort Conditions – Ground Floor

Configuration 2: Proposed Development with Existing Surrounding Buildings and Existing/Proposed Landscaping

Summer Season

Chapel Gate – Basildon, United Kingdom

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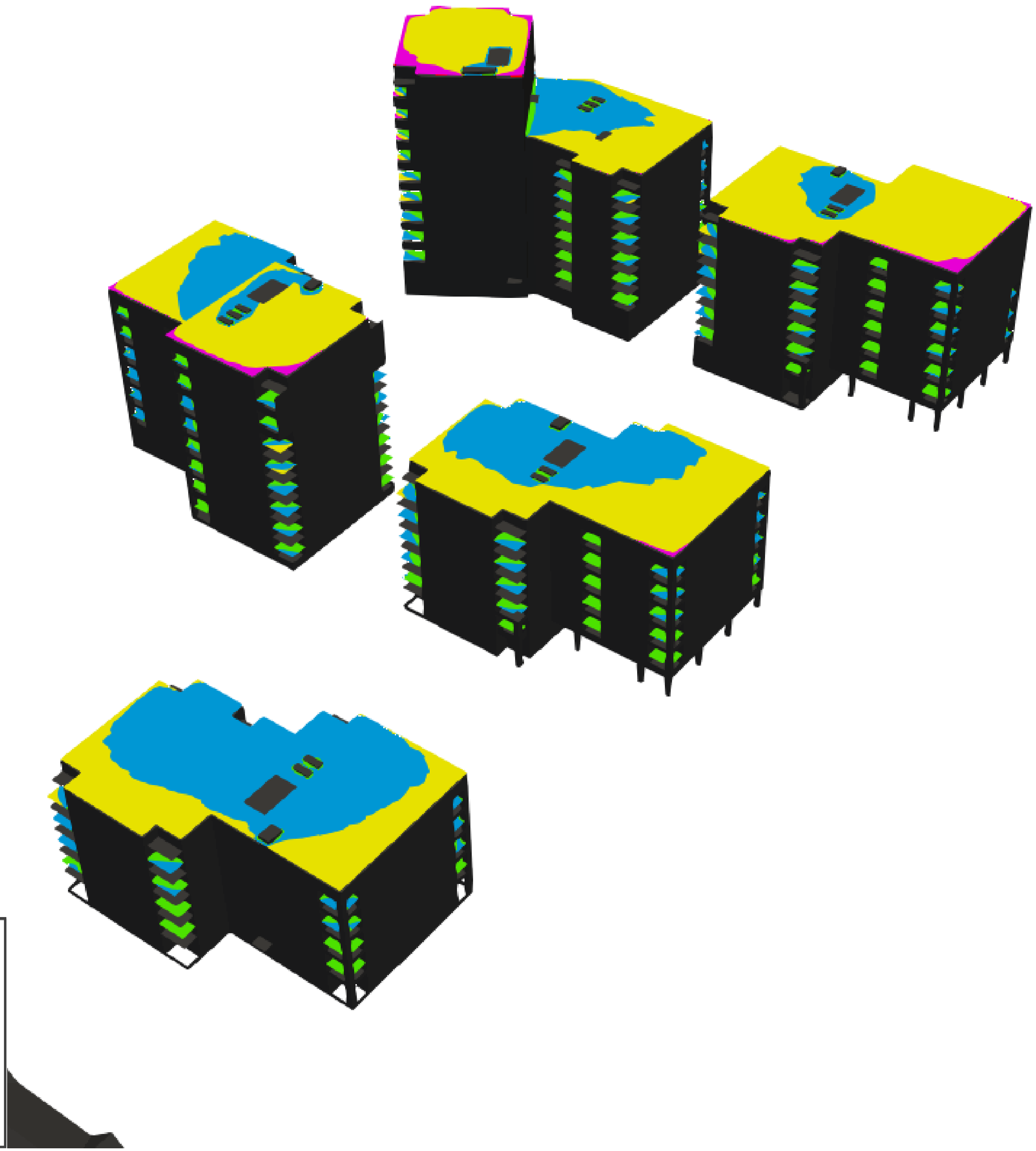
Project #2101541

Drawn By: HME

Figure: 7

RWDI



LEGEND:

LDDC COMFORT CATEGORIES:

- Sitting
- Standing
- Strolling
- Walking
- Uncomfortable

Pedestrian Wind Comfort Conditions – Elevated Levels

Configuration 2: Proposed Development with Existing Surrounding Buildings and Existing/Proposed Landscaping

Summer Season

Chapel Gate – Basildon, United Kingdom

Project #2101541

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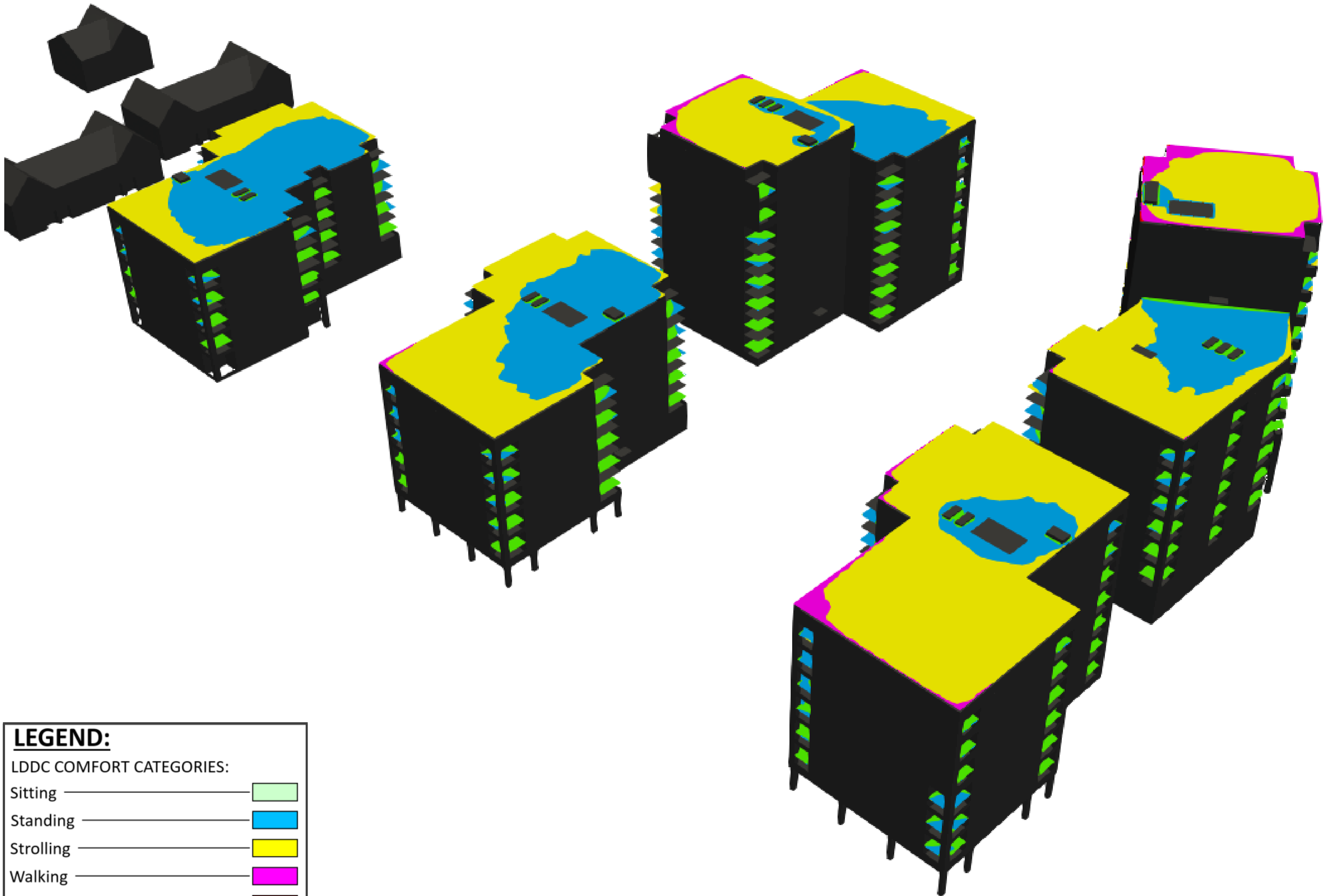
Figure: 8



LEGEND:

LDDC COMFORT CATEGORIES:

- Sitting
- Standing
- Strolling
- Walking
- Uncomfortable

Pedestrian Wind Comfort Conditions – Elevated Levels

Configuration 2: Proposed Development with Existing Surrounding Buildings and Existing/Proposed Landscaping

Summer Season

Chapel Gate – Basildon, United Kingdom

Project #2101541

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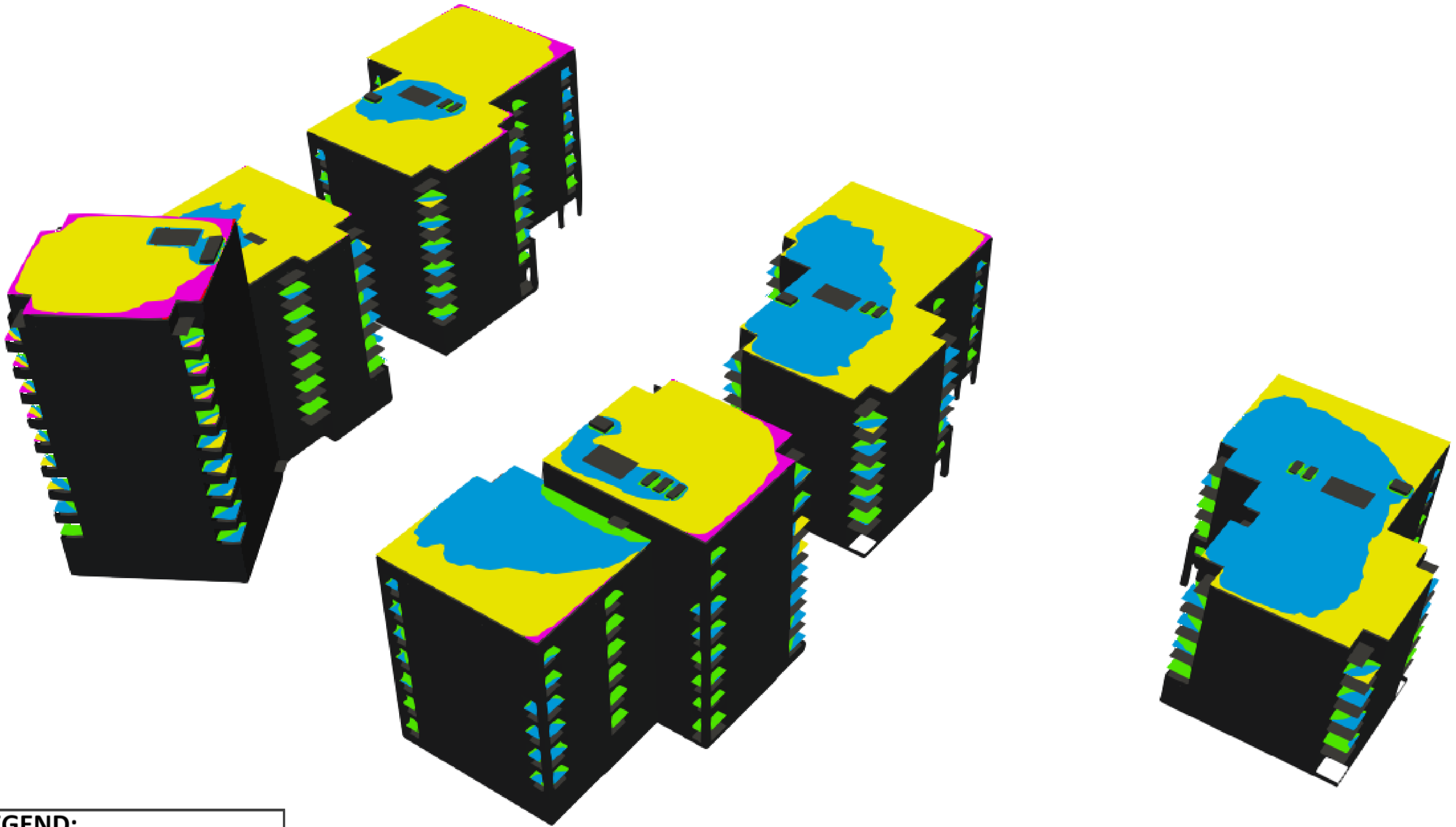
Figure: 9



LEGEND:

LDDC COMFORT CATEGORIES:

- Sitting
- Standing
- Strolling
- Walking
- Uncomfortable

Pedestrian Wind Comfort Conditions – Elevated Levels

Configuration 2: Proposed Development with Existing Surrounding Buildings and Existing/Proposed Landscaping

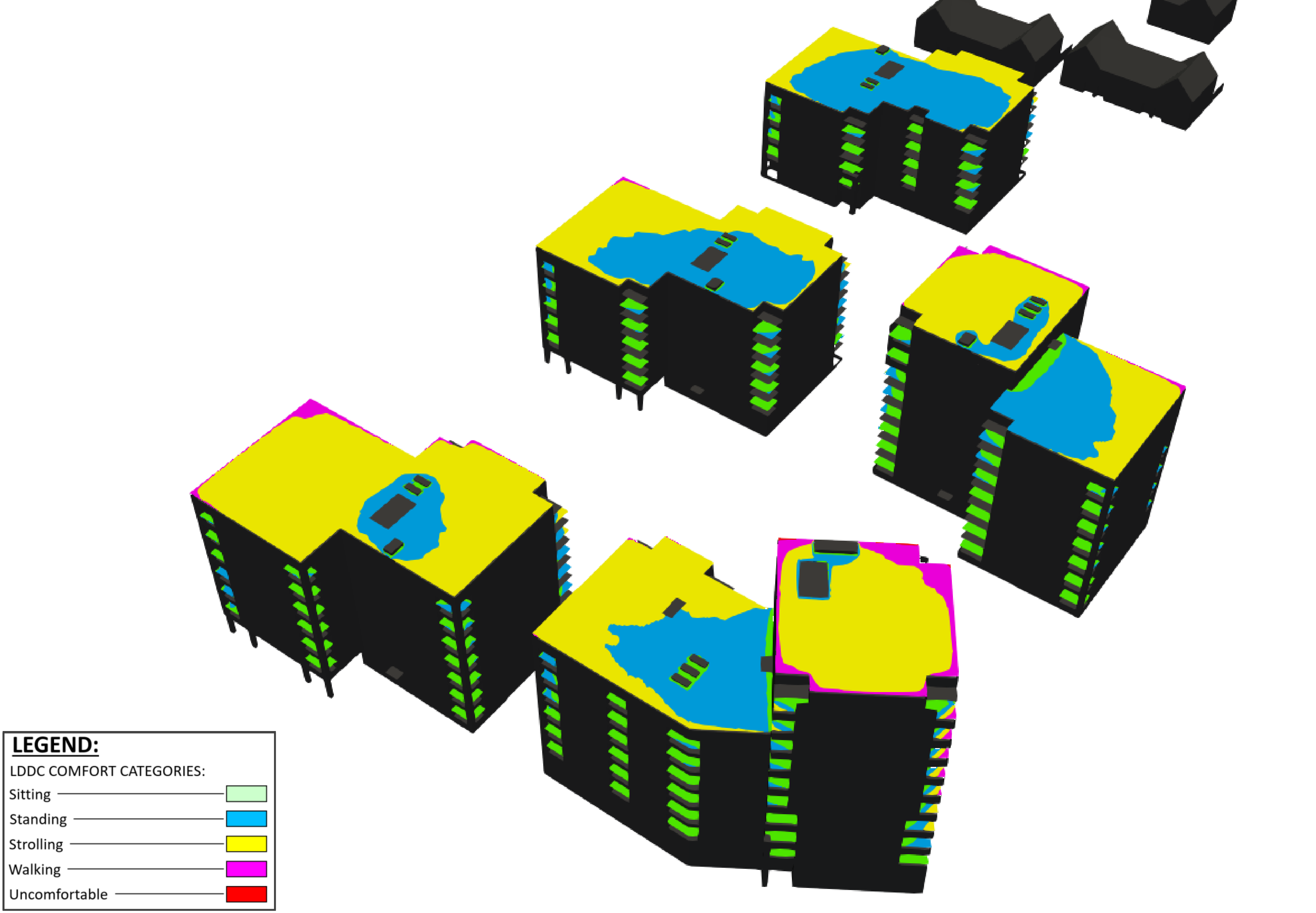
Summer Season

Chapel Gate – Basildon, United Kingdom

Project #2101541

Drawn By: HME

Figure: 10



Pedestrian Wind Comfort Conditions – Elevated Levels

Configuration 2: Proposed Development with Existing Surrounding Buildings and Existing/Proposed Landscaping

Summer Season

Chapel Gate – Basildon, United Kingdom

Project #2101541

Drawn By: HME

Figure: 11

APPENDICES

APPENDIX A: 3D MODEL IMAGES

Figure 12 - Existing Site with Existing Surrounding Buildings and Existing Landscaping (Configuration 1) – View of 3D model (from the south-west)

Figure 13 – Proposed Development with Existing Surrounding Buildings and Existing and Proposed Landscaping (Configuration 2) – View of 3D model (from the south-west)

APPENDIX B: MEAN FACTORS

Table 2: ESDU Mean Factors at 120m above ground level

Wind Direction	0˚	10˚	20˚	30˚	40˚	50˚	60˚	70˚	80˚	90˚	100˚	110˚
Mean Factor at 120 m	1.28	1.28	1.28	1.28	1.24	1.24	1.24	1.24	1.24	1.24	1.25	1.34
Wind Direction	**120˚**	**130˚**	**140˚**	**150˚**	**160˚**	**170˚**	**180˚**	**190˚**	**200˚**	**210˚**	**220˚**	**230˚**
Mean Factor at 120 m	1.29	1.28	1.28	1.28	1.28	1.28	1.28	1.31	1.31	1.30	1.30	1.30
Wind Direction	**240˚**	**250˚**	**260˚**	**270˚**	**280˚**	**290˚**	**300˚**	**310˚**	**320˚**	**330˚**	**340˚**	**350˚**
Mean Factor at 120 m	1.30	1.26	1.26	1.26	1.26	1.27	1.27	1.28	1.28	1.28	1.28	1.28

APPENDIX C: PROPOSED LANDSCAPING

Figure 14 – Proposed landscaping scheme of the ground floor (received 09/04/2021)

APPENDIX D: INTENDED USE PLOT

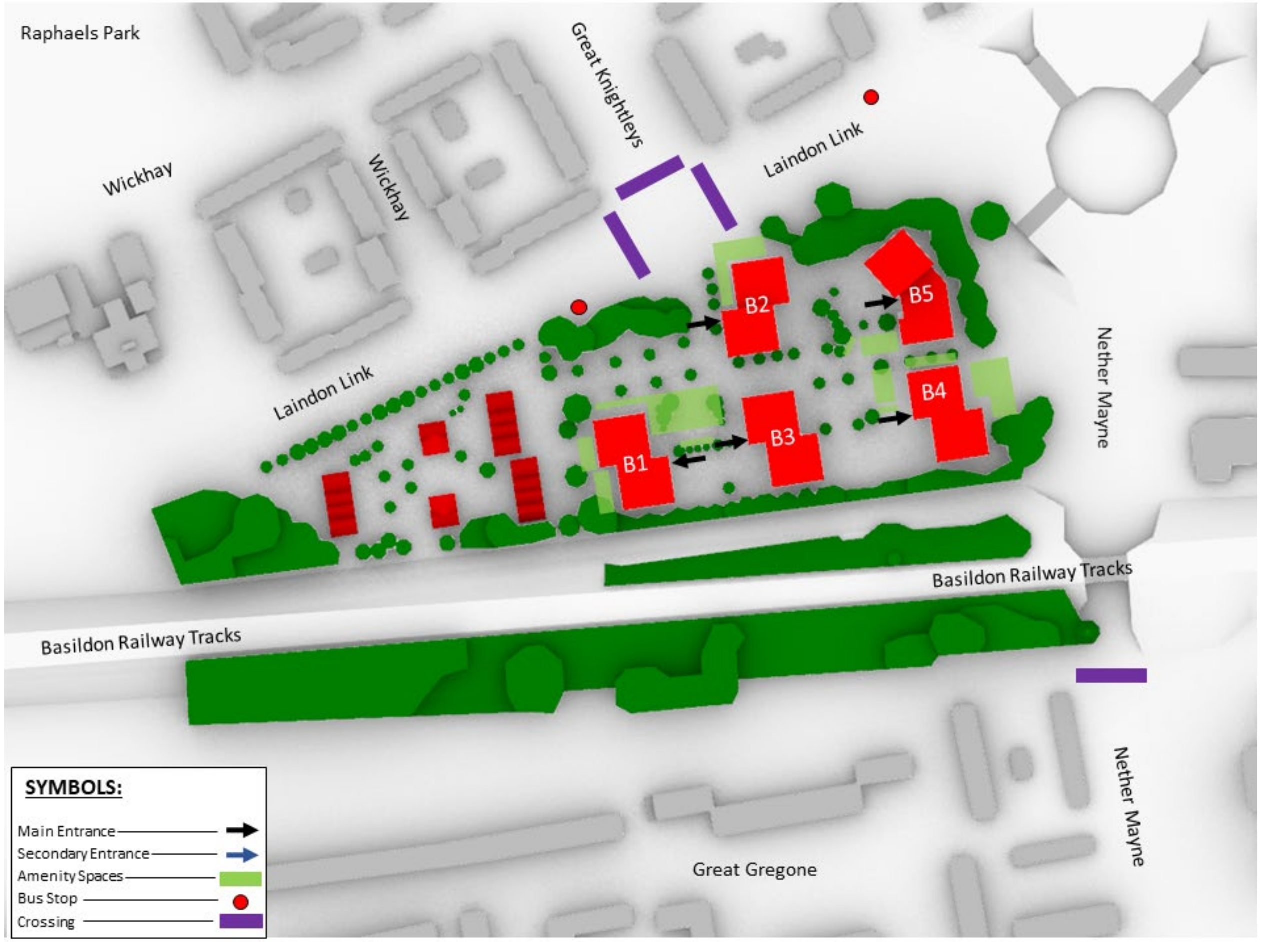


Figure 15 – Intended Use Plot highlighting the key areas within and surrounding the Proposed Development

APPENDIX E: MITIGATION MEASURES

Figure 16 – Porous full height screen on one side of balcony to mitigate corner balconies

Figure 17 – Example of Solid balustrade 1.5m in height to mitigate windy balconies

Figure 18 – 50% porous balustrade on balcony