

14 WIND MICROCLIMATE

14.1 INTRODUCTION

14.1.1 Company

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14.1.3 Chapter Purpose

This chapter of the ES assesses the likely significant effects of the proposed development on the environment in terms of wind microclimate. The chapter and its supporting appendices describe the planning policy context; the assessment methodology; the baseline conditions at the application site and surroundings; the likely significant effects caused by the proposed development; the mitigation measures required to prevent, reduce or offset any significant adverse effects; the likely residual effects after these measures have been employed; and the cumulative effects. In summary, the objectives of the chapter are to:

- Assess the wind microclimate at the proposed development and in its immediate surrounds; and
- Provide an analysis of mitigation measures that would ensure a safe and comfortable wind microclimate at the proposed development and in its immediate surrounds.

14.1.4 Chapter Updates for Revised 2020 Submission

Due to:

- The relevance and scale of the proposed development amendments;
- The implications of the proposed development amendments on the appropriateness of the previously identified mitigation measures; and
- The addition of new cumulative schemes,

a full new technical assessment has been undertaken and is reported within this chapter.

This wind ES Chapter has also been reviewed against the following aspects and for each it has been confirmed that whilst this is a full new technical chapter, no significant amendments have been required to the content of the chapter as a consequence of:

- Changes to the baseline data validity: there are no relevant changes to the baseline data; and
- Legislation/policy revisions: there have been no related updates to legislation/policy that have affected either the methodology or findings of this assessment.

No statutory consultee comments were received in relation to the assessment methodology or results that required a response.

14.1.5 Previous Wind Assessment Work

Prior to submission of the previous planning application in December 2019, the design of the proposed development had been developed over a two-year period (with the results presented in this chapter having been tested on 25/09/2019, 03/10/2019, 10/10/2019, and 19/11/2019) with extensive collaboration between the previous chapter author, RWDI, and the design team in order to ensure that the wind microclimate around the proposed development would be safe and suitable for the intended pedestrian usage.

As such, at the time the planning application was submitted in December 2019, over 65 wind tunnel tests had been conducted on multiple designs of the proposed development with four workshops conducted totalling more than 120 hours of wind tunnel work, in order to develop a suitable and sensible stadium design and set of mitigation measures that is expected to produce an appropriate wind microclimate around the proposed development whilst also ensuring that the desires of all stakeholders were met.

This wind tunnel testing was undertaken by RWDI and was supplemented by Computational Fluid Dynamics (CFD) testing, undertaken by Buro Happold.

Additional wind tunnel testing of the fixed scheme was subsequently undertaken in 2019 to inform the previous Wind Microclimate ES chapter (RWDI, December 2019) and the details of this testing are provided in that chapter. The 2019 ES chapter is provided in Appendix 14.1 in Volume III of this revised ES. The previous wind assessment work undertaken prior to that reported in the 2019 ES chapter, is also reported in an appendix to the 2019 ES chapter (also included within Appendix 14.1 in Volume III of this revised ES).

As described in more detail in Section 14.2 below, the revised wind microclimate assessment reported in this revised ES chapter has been informed by CFD testing, rather than wind tunnel testing. A full description of the calibration exercise that has been undertaken to illustrate the correlation between the results of the two methodologies is provided in Section 14.2 below and in Appendix 14.2.

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14.1.7 Appendices

- Appendix 14.1: Original Wind Microclimate ES Chapter (Chapter 14 of Volume II of previous ES (RWDI, 2019); and
- Appendix 14.2: Representative images of the calibration analysis showing wind tunnel test model, wind tunnel test results and CFD analysis plots for the same design.

14.2 METHODOLOGY

14.2.1 Guidance

- Guidance on tall buildings (1), 2007:

English Heritage and the Commission for Architecture and the Built Environment (CABE) produced a revised and updated version of their joint guidance on tall buildings. The final version was released in July 2007 and in the section Criteria for evaluation, it states that:

“... planning permission for tall buildings should ensure therefore that the following criteria are fully addressed: [...] The effect on the local environment, including microclimate”.

14.2.2 Legislation and Policy

14.2.2.1 Local Policy

The statutory development plan for Liverpool currently comprises the Unitary Development Plan (UDP) which was adopted in 2002; there are no policies within the adopted UDP in relation to wind microclimate.

The World Heritage SPD (4), 2009, which is a material consideration in decision-taking, provides specific design criteria for tall buildings and states in the ‘design section’:

“Ensure new tall buildings do not have a negative impact on local microclimate, in particular on key pedestrian routes and public spaces, through [...] uncomfortable wind conditions”.

The new Liverpool Local Plan (5), 2018 is presently awaiting examination. The following policies therefore have some ‘weight’ in decision taking (as per NPPF paragraph 48 provisions):

Policy UD2 Development Layout and Form, states that:

“Development proposals should demonstrate that the layout and form of the proposal ensures that [...] The design has been considered [...] with adequate responses to issues of [...] scale, relationship to existing structures, function, amenity, and its relationship to the public realm”

Policy UD5 New Buildings, states that:

“Design proposals for new buildings must demonstrate that [...] Orientation and micro-climate [...] issues that may impact on existing structures or neighbouring plots have been considered”

Policy UD6 Tall Buildings, states that:

“The City Council will expect the submitted proposal to contribute to the sustainability of Liverpool now and in the future [...] Ensuring that [...] there has been a robust assessment of the proposals impact on its surroundings that demonstrates the building will not result in an adverse impact in terms of microclimate, wind turbulence”

14.2.2.2 National Policy

- National Planning Policy Framework (6), 2019:

In February 2019, the Government published an updated version of the NPPF. There are no policies pertaining to wind microclimate in the NPPF.

- National Planning Practice Guidance (7), 2019:

The NPPG was published in November 2016 to support the NPPF and was updated in October 2019. There is no guidance within the NPPG related to tall buildings and wind microclimate issues.

14.2.3 Scoping & Consultation

14.2.3.1 Scoping Consultation

Section 6.5 of the document ‘Environmental Impact Assessment Scoping Report’ produced by CBRE on 15/05/2017, set out the proposed scope of the wind microclimate assessment in the original ES chapter, including wind tunnel testing:

‘Wind tunnel tests will be carried out to quantify conditions around the proposed development. The tests will include the effects of all nearby existing and consented schemes that would affect wind conditions around the site. Likely future surroundings, if any, will also be considered.’

The study conducted by RWDI encompasses all the requirements laid out for the assessment of wind through wind tunnel testing in section 6.5 of the Environmental Impact Assessment Scoping Report. There were no comments from any relevant consultees on the Scoping Report with regards to the proposed wind assessment scope.

No technical planning application consultee responses have been provided to date in relation to the original Wind Microclimate ES chapter. As noted in the Consultee section above, it was agreed with Liverpool City Council at a meeting in March 2020 that the wind microclimate assessment in this revised chapter could be informed by CFD assessment only, with no wind tunnel testing required.

14.2.3.2 Pre-Application Consultations

The following were consulted with in regard to the previous ES chapter assessment:

- Historic England (HE);
- Liverpool City Council (LCC);

A meeting took place on 25th October 2019 with representatives from Liverpool City Council, Historic England and the Design Team present to discuss the wind mitigation strategy for the proposed development. The minutes for this meeting outlining can be found in the previous ES chapter (RWDI, 2019), provided in Appendix 14.1, in Volume III of this revised ES.

14.2.3.3 Post-Submission Consultations

14.2.4 On 27 March 2020, it was agreed with Liverpool City Council at a meeting that the wind microclimate assessment in this revised chapter would be informed by CFD assessment only, with no wind tunnel testing required. To ensure its accuracy, the CFD assessment work has been calibrated against the previous wind tunnel testing results. The results of this calibration exercise are provided in Appendix 14.2, in Volume III of this revised ES. There have been substantial engagement with LCC and Historic England these are listed in the Built Heritage of this ES (Chapter 18 ES Vol.2)

14.2.5 Consideration of Climate Change

The ‘Climate Projects Report’ published by UKCP18 (8) presents the probable changes in wind speed for 2070-2099 (timeframe considered most relevant for urban regeneration projects) in both the summer and winter seasons.

With these predictions, the current trends in climate change are not likely to result in any significant changes in the predicted wind microclimate conditions in and around the application site from those considered in this ES chapter.

14.2.6 Consideration of Human Health

The objective of the pedestrian level wind microclimate assessment is to assess whether the spaces intended for pedestrian activities meet both the safety and comfort criteria that are required. The comfort and safety of pedestrians is therefore considered within this chapter using the widely accepted Lawson Criteria (further discussed in Section ‘Pedestrian Wind Comfort’ of this report).

14.2.7 Consideration of Risk of Major Accidents and/or Disasters

Severe Weather and Storms have been considered in the pedestrian level wind microclimate assessment. Severe Weather and Storm conditions have been taken into account via the metrological data used in the analysis and the range of wind speeds that have informed the various Lawson Comfort grades, as well as in the assessment of pedestrian safety at the site and the immediate surrounding area.

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14.2.8 Alternatives

Over a two-year period between 2017 and 2019, numerous wind tunnel tests and Computational Fluid Dynamics (CFD) tests have been undertaken in relation to the proposals. In response to these tests, the design of the stadium has been adapted numerous times over this period to generate a safer and more comfortable wind microclimate.

The results of these studies have been compiled within the submitted full planning application (December 2019). The relevant wind microclimate chapter from the previous ES submission is provided at Appendix 14.1.

Further changes to the scheme have taken place from February 2020, including further changes to the design of the stadium and surrounding public realm areas.

Further information on the design evolution of the proposed development is provided in Chapter 4 of the ES. Information on the design and assessment work specific to the consideration of the wind microclimate is provided in the section below.

The future baseline scenario, comprising the approved outline planning permission for the Liverpool Waters scheme (LPA ref. 19NM/1121 – variation of 10O/2424) has also been assessed within this report. The effects on wind conditions around the existing application site (without the proposed stadium scheme) with the Liverpool Waters Masterplan built out to the maximum massing parameters has been assessed and compared to the effects that the proposed development would have on wind conditions around the application site to ensure all relevant alternative scenarios have been analysed.

14.2.9 Technical Assessment Methodology

The following section outlines the methodologies applied to identify and assess the range of potential wind impacts likely to result from the proposed development.

As previously noted, in March 2020 it was agreed with Liverpool City Council that the wind studies that inform this revised ES chapter can be carried out via CFD assessment only. To ensure its accuracy, the CFD work has been calibrated against the previous Wind Tunnel testing results. This information can be found in Appendix 14.2, in ES Volume III. CFD, as well as the previous Wind Tunnel studies have enabled the pedestrian level wind microclimate at the application site to be quantified and classified in accordance with the widely accepted Lawson Comfort Criteria.

The CFD studies deliver a detailed assessment of the wind conditions for all wind directions (in 30° increments) in terms of pedestrian comfort, and strong winds are also reported when they occur.

14.2.9.1 CFD Testing and Model Details

A virtual full scale model of the existing buildings at and surrounding the application site within a 360 m radius of the centre of the application site was constructed, i.e. the same area covered by the wind tunnel studies.

Models of the proposed development and the approved Nelson Dock element (development block parameters) of the wider Liverpool Waters scheme (LPA ref. 19NM/1121 - as the most recent approved non-material amendment of the original outline permission ref. 10O/2424) were also built and inserted in the surrounding model as necessary. A more recent non-material amendment application has been submitted in relation to the Liverpool Waters development and is pending determination (ref. 20NM/1801). However, this application does not relate to the part of the scheme on Nelson Dock so is not relevant to this assessment. The results of the CFD assessments are presented in composite comfort and safety maps across ground level and elevated levels on-site, and at ground level off-site.

The study area of 360 m is used as buildings beyond this radius will have no aerodynamic impact on the application site during wind testing. Additionally, the impact of locations further than 360 m from the application site are taken into account by an additional 150 m radius modelled beyond this. A roughness height is applied to this external terrain surface, to represent town or sea terrain.

This geographic scale has enabled the testing of off-site receptor locations including the United Utilities Wastewater Treatment Works (UU WwTW) to the north of the application site, Regent Road to the east and Nelson Dock (existing and future baseline) to the south. Beyond the western boundary of the application site lies the River Mersey. This is severed from the application site by the River Mersey wall and a further concrete structure sitting immediately to the eastern rear of the River Mersey wall.

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

- Step 1: Measure the building-induced wind speeds at pedestrian level from the CFD simulations;
- Step 2: Adjust standard meteorological data to account for conditions at the application site;
- Step 3: Combine these to obtain the expected frequency and magnitude of wind speeds at pedestrian level; and
- Step 4: Compare the results with the Lawson Comfort Criteria to 'grade' conditions around the application site.

14.2.9.2 Simulation of Atmospheric Winds

Wind is unsteady, or gusty, and this 'gustiness' or turbulence, varies depending upon the application site. Modelling these effects is achieved by roughness heights applied to the outer terrain surfaces, as well as the velocity profile used to represent the incoming wind, to create a boundary layer that is representative of urban conditions for the application site. The detailed proximity model around the application site is used to fine-tune the flow and create conditions similar to those expected at full scale.

The upwind boundaries of the CFD model were prescribed with an atmospheric velocity and turbulence profile corresponding to natural winds.

The atmospheric velocity profile was modelled using a log-law, based on communications with ANSYS (i.e. the developers of the CFX CFD software used). This log-law is also described in reference [9].

The downwind and upper boundaries were represented as pressure opening boundaries. These are representative of the atmosphere surrounding the proposed development. They allow air to be entrained into the model domain or air to flow out of the domain.

14.2.9.3 Measurement Technique

The physical layout of the site as described was analysed using a 3D CFD model. CFD modelling involves the solution of the fundamental equations of fluid motion using numerical techniques. The region of interest is divided into numerous small volumes, or cells, and equations are solved within each cell. Values of the variables that are solved in the model are determined in each cell and so a comprehensive assessment of velocity variation within the calculation domain is obtained. To improve the resolution of the results, the computational cell size has been reduced in the areas of most interest. This ensures that large gradients of velocity at street level are modelled accurately.

■ Model Extents and Detail:

The drawings and models are described in detail within this section. For buildings outside the application site, a 3D context model was acquired from Zmapping, this has been simplified and updated to match footprints and building heights from aerial survey data. The proposed buildings have been modelled according to the information provided, with reference to the wind tunnel information and architectural design. These buildings have been merged with the Zmapping information and simplified accordingly for CFD modelling purposes. Within the assessment area the cumulative schemes were built following the application reference information. Only two cumulative schemes were considered, as per the latest approved Liverpool Waters Masterplan (LPA ref. 19NM/1121 and the proposed Bramley Hotel development at Regent Road/Blackstone Street (LPA ref. 20F/0217).

The CFD model is contained within one single domain. This domain includes the proposed development and the surrounding buildings and features, around which the wind environment is analysed. Surrounding buildings and terrain were included in the model up to a radius equal to that of the wind tunnel tests. The total simulation domain modelled was increased by 150m to account for the roughness effects of further surrounding buildings and structures. The total distance modelled is appropriate as it explicitly contains all buildings and structures surrounding the application site that are likely to affect the wind flows around it.

The typical edge length of the computational cells in this domain is approximately 1 m to 3 m, with greater cell sizes at points further from the development buildings. A refined layer of cells exists adjacent to the ground, to allow for an accurate prediction of pedestrian level wind speeds. The total number of computational cells is approximately 18 to 20 million.

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for this study. Roughness has been applied in the outer region beyond the modelled buildings, to account for the presence of buildings terrain features, and water.

For each of the 12 wind directions, a single, steady-state RANS (Reynolds Averaged Navier-Stokes) calculation was undertaken using the commercial ANSYS CFX software. Turbulence was modelled, with a production limiter used to ensure realistic flow predictions close to stagnation points. This method allows for the assessment of mean wind speeds for the development.

The Met Office supply joint frequency tables of wind speeds divided into ranges of the Beaufort scale, and direction on a monthly and annual basis for the tested sectors around the compass. The frequency of winds of various strengths for standard reference conditions (10m height in open flat level country terrain) is shown in Figure 14.2 for the Annual profile. The prevailing north westerly and westerly winds and south easterly account for the most frequent winds for this study.

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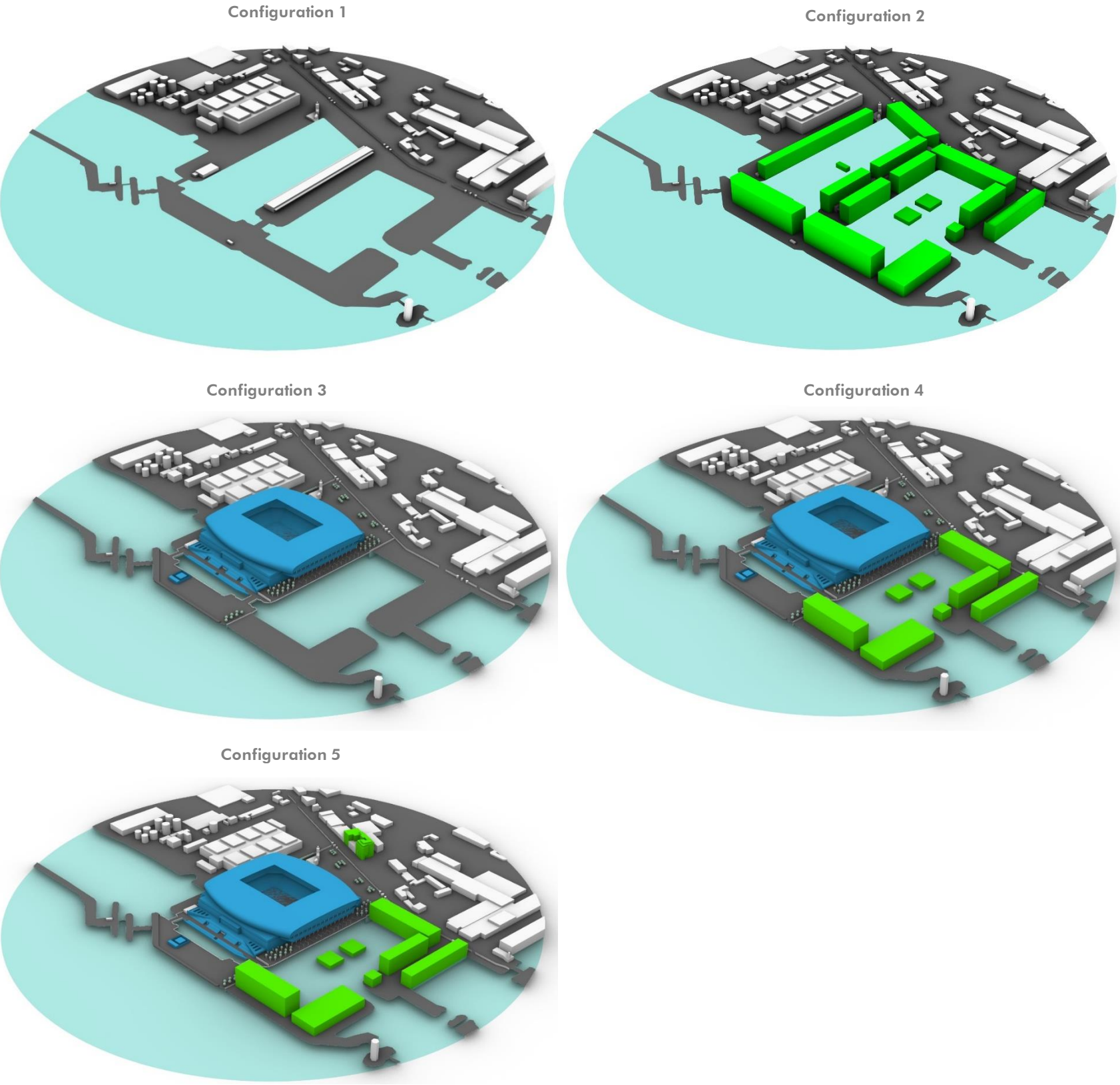


Figure 14.1
Configurations tested C1, C2, C3, C4 and C5.

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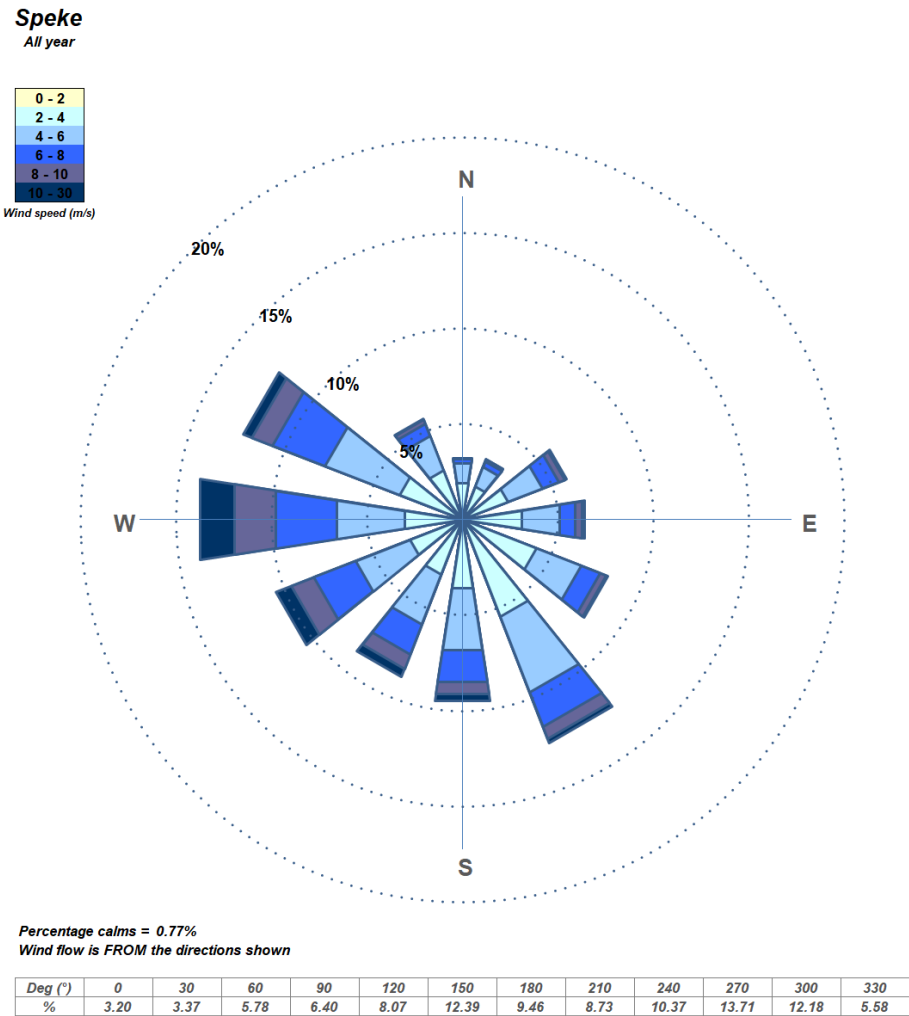


Figure 14.2
Annual Wind Data for Liverpool John Lennon Airport.

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The meteorological station data, as summarised in Table 14.1, is adjusted to the application site conditions using the software package BREVe3.2 to model the effects of terrain roughness on the wind speed characteristics.

Table 14.1

Site Meteorological Data Adjustment

DEGREES	0°	30°	60°	90°	120°	150°
Mean Factor	1.38	1.42	1.42	1.39	1.39	1.41
DEGREES	180°	210°	240°	270°	300°	330°
Mean Factor	1.43	1.41	1.45	1.54	1.58	1.57

14.2.9.4 Pedestrian Wind Comfort

The assessment of wind conditions requires a ‘standard’ against which to benchmark the microclimate. The Lawson Comfort Criteria (9) have been established for some thirty years and have been widely used on building developments across the United Kingdom (UK).

Lawson devised a scale for assessing the suitability of wind conditions in the built environment. The Lawson Comfort Criteria (set out in Table 14.2) define a range of pedestrian activities from sitting through to more transient activities such walking along a thoroughfare, and for each activity define a threshold wind speed and frequency of occurrence beyond which the wind environment would be unsuitable for the stated activity.

The criteria reflect the fact that sedentary activity, such as sitting, requires a low wind speed whereas for more transient activity (such as walking) pedestrians would tolerate stronger winds.

If the wind conditions exceed the threshold then the conditions are unacceptable for the stated activity. If the wind conditions are below the threshold then they are described as tolerable (or suitable) for the stated activity.

Table 14.2

Lawson Comfort Criteria

COLOUR	COMFORT CATEGORY	WIND SPEED	DESCRIPTOR
Red	Uncomfortable	> 10 m/s	Winds of this magnitude are considered a nuisance for most activities, and wind mitigation is typically recommended.
Pink	Walking	8-10 m/s	Relatively high wind speeds that can be tolerated if the objective is to walk, run or cycle without lingering.

COLOUR	COMFORT CATEGORY	WIND SPEED	DESCRIPTOR
Yellow	Strolling	6-8 m/s	Moderate breezes that would be appropriate for strolling along a city/town centre street, plaza or park.
Blue	Standing	4-6 m/s	Gentle breezes suitable for main building entrances, pick-up/drop-off points and bus stops.
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.

14.2.9.5 Target Wind Conditions

For a stadium project, such as the proposed development, the desired wind microclimate would typically need to have areas suitable for sitting, standing and strolling use.

Wind conditions classified as acceptable for walking, although not desirable for general thoroughfare use, could be acceptable for designated pedestrian pathways around the outside of the stadium when pedestrians are not expected to linger, in other words, where pedestrians would be expected to be ‘walking with purpose’.

The assessment considers the summer season for certain usages and the windiest season for others, as identified below. For this project, the windiest season would typically be the winter season based on the meteorological data for the area.

Amenity Areas

The target conditions in seating areas is a wind microclimate that is suitable for sitting or standing in the windiest season. This is because these areas are expected to be frequently used in the winter time whilst the stadium is used for football matches and pedestrians are expected to be generally more active than most designated seating areas during these matches when these locations will be in use.

The above comfort criteria are to be achieved for the dedicated seating areas, both within the public realm and in access-controlled amenity areas (e.g. the area to the west of the stadium where access can be controlled by proposed gates). Where the western stepped terrace meets the adjacent water channel, there are three openings that provide access to the covered plaza area underneath (with associated access to the west stand turnstile and hospitality entrances). Gates (porous) are proposed to control access / egress through these three openings. There are also two openings to the north and south of the western terrace to enable access through to the covered plaza and the associated west stand entrances. Two gates are proposed at the north western and south western extents of the terrace area to prevent access / circulation further west to the area immediately

adjoining the water channel (waters edge) or the west quay beyond the two north (proposed) and south (existing) isolation structures.

At ground level around the proposed development, wind conditions suitable for sitting use would be required during the summer season in order for these areas to be suitable for their intended use. The summer season is assessed for these locations as it is assumed that there is an expectation for these areas to be somewhat uncomfortable for sitting during the windiest season, winter for this project.

Amenity locations that would not have dedicated seating are designated as mixed-use amenity spaces. Winds suitable for sitting and standing use during the summer season would be considered acceptable for these mixed-use amenity locations, as people could choose to sit at calmer locations and locations with standing wind conditions could be used for more active pursuits.

Therefore, the assessment of amenity areas for the proposed development focusses on the summer season results.

Entrances

Near building entrances, a wind environment suitable for standing or calmer is desired, as pedestrians will transition from the calm indoors to the windier outdoors throughout the year. The assessment of building entrances therefore focuses on the windiest season results. The primary entrances that are expected to be used frequently by the public have been assessed for comfort. Secondary entrances, such as those used for fire escape, back of house, plant rooms, etc., have not been assessed given that they are not expected to be used on a frequent basis; strolling use wind conditions for these secondary entrances would be acceptable due to their infrequent usage.

There are also doors at the top of the western stepped terrace within the new glazed portal area that provide access directly to the Level One hospitality area within the west stand. These doors along the western terrace will remain closed during high winds but will be open to give access to the top of the west terrace for amenity and other entertainment events when the weather is suitable.

Thoroughfares

A pedestrian thoroughfare should be suitable for strolling during the windiest season. The assessment of pedestrian thoroughfares therefore focuses on the windiest season results.

Localised occurrence of walking conditions may be tolerable in areas with limited footfall, or service areas, as long as the strong wind criteria (described below) is not exceeded. Walking conditions would be tolerable on a thoroughfare only if there is no reason for a pedestrian to linger (as per the definitions in Table 14.2), such as in the middle of a road crossing. Otherwise, the target condition should be strolling.

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14.2.9.6 Strong Winds

The assessments undertaken also provide a notification of stronger winds as specified by Lawson, which are defined as wind speeds in excess of 15 m/s for more than 0.025% of the time (approximately two hours of the year). Strong winds are assessed on an annual basis; however, the greatest proportion of the total can generally be attributed to the windiest season (most commonly winter in the UK).

Exceedance of the 15 m/s threshold indicates a need for remedial measures and careful assessment of the expected use of that location if remedial measures are not developed as these wind speeds would represent a safety issue for vulnerable pedestrians and cyclists. Wind speeds that exceed 20 m/s for more than 0.025% of the time (approximately two hours of the year) represent a safety issue for all members of the population, which would require mitigation to provide an appropriate wind environment.

Strong winds are generally associated with areas which would be classified by the Lawson Comfort Criteria as being acceptable for 'walking' or as 'uncomfortable', however are occasionally concurrent with areas acceptable for 'strolling' use. In an urban environment such as the proposed development with heavy footfall expected on match days (potential maximum of 28 match-days subject to club progress in cup competitions) and the 4 non-football major events proposed per year (such as concerts or other sporting events) throughout the year, 'walking' and 'uncomfortable' conditions would not usually form part of the 'target' wind environment in terms of pedestrian comfort and would usually require mitigation to reduce the frequency of, or even eliminate, any strong winds.

14.2.10 Assessment Scenarios

The following configurations were tested in the CFD assessment:

- Configuration 1: Existing site conditions with existing surrounding buildings (Baseline);
- Configuration 2: Liverpool Waters approved scheme on-site and in surrounding area (Future Baseline);
- Configuration 3: Proposed development on-site (including proposed landscaping and design interventions) with existing surrounding buildings;
- Configuration 4: Proposed development on-site (including proposed landscaping and design interventions) with Liverpool Waters scheme in surrounding area; and
- Configuration 5: Proposed development on-site (including proposed landscaping and design interventions) with Liverpool Waters scheme and additional cumulative schemes in surrounding area (only one development was within the radius of the wind study)

Landscaping was not included in Configurations 1 and 2 as there is currently no landscaping around Bramley-Moore Dock (vacant dockland

with majority of buildings cleared); and the reserved matters details of landscaping in the relevant Nelson Dock area (as part of the approved parameters-based Liverpool Waters scheme) have not yet been submitted by Peel Land & Property and therefore cannot be modelled. Other than the approved Liverpool Waters (Nelson Dock) scheme and the proposed Bramley Hotel scheme at Regent Road/Blackstone Street (LPA ref. 20F/0217), no other cumulative schemes are present within the 360 m radius study area and have the potential to result in cumulative effects.

Composite comfort maps were produced for the summer and winter, along with annual safety maps, at pedestrian height, i.e. 1.5m above ground level. The maps include several thousand points spaced within the mesh grid.

14.2.10.1 The application site and immediate surrounding area falling within the radius of the model have been divided into areas, to allow the results of each configuration to be more easily reported and discussed in the chapter. Each area has been given a code (e.g. A, B, C, D1, D2 etc.) and the areas are shown on each of the comfort and safety maps. The intended usage of each area for each configuration is provided in the following tables.Configuration 1: Baseline

Table 14.3

Intended Usage of Receptors in the baseline

INTENDED USE	AREA
On-Site Receptors	
Thoroughfare	A, B, C, D1, D2, E, F1, F2, G, north of H1, north of H2, south of J1, south of J2, K, L, M, N1, all of N2 except southwest corner, east of O, all of P1 except northwest corner, P2
Inaccessible Locations	South of H1, south of H2, I1, I2, north of J1, north of J2, southwest of N2, west of O, northwest of P1
Off-Site Receptors	
Thoroughfare	UU1, UU2, UU3, UU4, RR1, RR2, RR3, RR4, ND1, ND2
Inaccessible Locations	Area in middle of Nelson Dock

14.2.10.2 Configuration 2: Future Baseline

Table 14.4

Intended Usage of Receptors in the future baseline

INTENDED USE	AREA
On-Site Receptors	
Thoroughfare	A, B, C, D1, D2, E, F1, F2, G, north of H1, north of H2, south of J1, south of J2, K, L, M, N1, all of N2 except southwest corner, east of O, all of P1 except northwest corner, P2
Inaccessible Locations	South of H1, south of H2, I1, I2, north of J1, north of J2, southwest of N2, west of O, northwest of P1
Off-Site Receptors	
Thoroughfare	UU1, UU2, UU3, UU4, RR1, RR2, RR3, RR4, ND1, ND2, Area immediately surrounding future Liverpool Waters buildings in the middle of Nelson Dock

14.2.10.3 Configuration 3

Table 14.5

Intended Usage of Receptors in Configuration 3

INTENDED USE	AREA
On-Site Receptors	
Thoroughfare	A, B, C, D1, D2, E, F1, F2, G, H2, I2, J2, K, L, M, N1, P2
Entrances	B, C, H2, I2, J2, L, N2, O, P1
Ground Level Amenity – Mixed Use	H1, I1, J1, N2, O, P1, Top of Western Terrace
Ground Level Amenity Area – Seating Areas	D1, F2, H1, I1, J1, K, L, M, N2, O, Top of Western Terrace
Off-Site Receptors	
Thoroughfare	UU1, UU2, UU3, UU4, RR1, RR2, RR3, RR4, ND1, ND2
Inaccessible Locations	Area in middle of Nelson Dock

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14.2.10.4 Configuration 4

Table 14.6
Intended Usage of Receptors in Configuration 4

INTENDED USE	AREA
On-Site Receptors	
Thoroughfare	A, B, C, D1, D2, E, F1, F2, G, H2, I2, J2, K, L, M, N1, P2
Entrances	B, C, H2, I2, J2, L, N2, O, P1
Ground Level Amenity – Mixed Use	H1, I1, J1, N2, O, P1, Top of Western Terrace
Ground Level Amenity – Seating Areas	D1, F2, H1, I1, J1, K, L, M, N2, O, Top of Western Terrace
Off-Site Receptors	
Thoroughfare	UU1, UU2, UU3, UU4, RR1, RR2, RR3, RR4, ND1, ND2, Area immediately surrounding proposed Liverpool Waters buildings in middle of Nelson Dock

14.2.10.5 Configuration 5

Table 14.7
Intended Usage of Receptors in Configuration 5

INTENDED USE	AREA
On-Site Receptors	
Thoroughfare	A, B, C, D1, D2, E, F1, F2, G, H2, I2, J2, K, L, M, N1, P2
Entrances	B, C, H2, I2, J2, L, N2, O, P1
Ground Level Amenity – Mixed Use	H1, I1, J1, N2, O, P1, Top of Western Terrace
Ground Level Amenity – Seating Areas	D1, F2, H1, I1, J1, K, L, M, N2, O, Top of Western Terrace
Off-Site Receptors	
Thoroughfare	UU1, UU2, UU3, UU4, RR1, RR2, RR3, RR4, ND1, ND2, Area immediately surrounding proposed Liverpool Waters buildings in middle of Nelson Dock

14.2.10.6 Inaccessible areas

A number of inaccessible locations have been identified around the application site across all five configurations tested. In the baseline and future baseline scenarios these locations include the existing waterbody covering Bramley-Moore Dock and the future proposed water channel within the proposed scheme; both would be inaccessible to pedestrians.

In Configurations 2, 4 and 5, there would be an area within the middle of the Nelson Dock waterbody (as per approved Liverpool Waters parameters plans) that could become accessible in order to provide access to the proposed structures. However, this area is inaccessible in Configurations 1 and 3.

14.2.10.7 Off-site Areas

Off-site receptors have been grouped into three areas:

- The United Utilities Wastewater Treatment Works site (to the north of the application site);
- Regent Road (to the east of the application site); and
- Nelson Dock (to the south of the application site).

The areas analysed within the comfort maps that fall within each of these off-site areas are shown in Table 16.7 below.

Table 14.8
Off-Site Receptor Locations

OFF SITE AREA	AREA
UU WwTW	UU1, UU2, UU3, UU4
Regent Road	RR1, RR2, RR3, RR4
Nelson Dock	ND1, ND2, Area immediately surrounding future buildings in middle of Nelson Dock

The western boundary of the application site is limited to the foot of the concrete crown wall, built on top of the River Mersey wall (this being in Peel Ports / The Mersey Docks & Harbour Company ownership). The wall has a crest level of 8.12m AOD along most of the application site and is approximately 1.5m higher than the adjacent ground level of Bramley-Moore Dock.

When the proposed stadium scheme is operational, this area will not be accessible to the public as the Applicant does not have access rights to the top of the River Mersey wall as it is outside of the land the Applicant is acquiring from Peel Land & Property for the proposed stadium scheme. As a consequence of this, fencing and gates are proposed at any stairwells which run up to the top of the wall. Therefore, receptor locations within the area on top of the wall have not been included within this wind assessment. Future access and use of the area on top of the wall, primarily as part of a proposed 'river-walk' extending through the Liverpool Waters site, would

be subject to separate assessment (by Peel Land & Property as land owners). The current proposed stadium scheme does however facilitate future access to this area.

14.2.10.8 Demolition and Construction Phase

The quantitative assessment of construction works effects on the wind microclimate around the proposed development falls outside the scope of this report. The potential microclimate effects during the demolition and construction works have therefore been assessed using the professional judgement of an experienced wind engineer, based on an assessment of the background wind climate at the application site and an understanding of the effects of wind in the built environment. This approach is taken assuming that the activity on-site during this time (i.e. construction activity) is less sensitive to wind conditions than when the proposed development is completed and occupied (which would include entrances and amenity space, for example) as workers would be less susceptible to uncomfortable winds than pedestrians.

It is also expected that construction works would also be subject to certain measures and controls related to working in windy conditions, that would further reduce risks to construction workers. Such measures and controls would be expected to include:

- Tower cranes, mobile cranes and platform hoists all have their specific wind speed limits, above which they cannot operate;
- Under windy conditions a task/work area specific risk assessment would be completed to determine whether or not works can continue.

A qualitative assessment of the wind microclimate during demolition / construction has therefore been undertaken and is based on professional judgement; informed by an assessment of the background wind microclimate in the area, the results of the tested configurations for the baseline and completed development scenarios, and Buro Happold's experience of assessing wind in the built environment.

14.2.11 Modelling of Liverpool Waters scheme

As the Liverpool Waters scheme is subject to an extant outline planning consent (ref. 19NM/1121 as most recent variation of original permission ref. 10O/2424), the scheme masterplan has been modelled in accordance with the consented maximum height and building footprint parameter plans.

The following assumptions have been made in regard to the modelling of the Liverpool Waters scheme (plot numbers as per latest approved parameter plans):

- The proposed buildings immediately around and within Bramley-Moore Dock (a 27m tall building to the north (plot E-15), a 28m tall building to the east (plot E-14), two 33m tall buildings to the south (plots E-11 and E-12), a 38m tall building to the west (plot E-13), and

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- 8m tall building at the centre of the dock (plot E-17)) have been removed.
- The proposed buildings on the northern extent of Nelson Dock (two 33m tall buildings (plots E-09 and E-10) and a 31m tall building (part of plot E-04)) have been removed.
 - The proposed 38m tall buildings on the western and east side of Nelson Dock (plot E-06) has been reduced in length to reflect the redline boundary of the proposed development.
 - The two proposed buildings at the centre of Nelson Dock would be 6m (plot E-07 and 7m (plot E-08) respectively.
 - The remaining buildings stay as proposed in the approved Liverpool Waters scheme.
 - It is assumed that the area around the buildings in Nelson Dock (plots E07 and E-08) in the cumulative scenarios (C2 and C4) would be a floating walkway and therefore is considered to be thoroughfare.

These assumptions were issued to Peel Land & Property, as landowner and promoter of the Liverpool Waters scheme, on 23 August 2019 and they raised no objections. This updated assessment was also submitted to Peel Land & Property in September 2020 prior to submission of the revised planning application.

14.2.12 Assessment of Effect Significance

The significance criteria used in the assessment of effects is based upon the relationship between the desired pedestrian use of a particular area of the proposed development, using the categories defined by the Lawson Comfort Criteria and the predicted wind conditions at that location within the proposed development. This allows for the assessment to take into account any change in pedestrian activity that might arise as a result of the proposed development.

A seven-point scale has been used within this assessment to assess the significance of effect, as shown in Tables 14.9 and 14.10.

Table 14.9
Significance Criteria for On-Site Measurement Locations

RECORDED WIND CONDITIONS	
RECEPTORS	SIGNIFICANCE OF EFFECT
Wind Conditions are 3 comfort categories calmer than desired	Major Beneficial
Wind Conditions are 2 comfort categories calmer than desired	Moderate Beneficial
Wind Conditions are 1 comfort category calmer than desired	Minor Beneficial
Wind Conditions are similar to those desired	Negligible
Wind Conditions are 1 comfort category windier than desired	Minor Adverse
Wind Conditions are 2 comfort categories windier than desired	Moderate Adverse
Wind Conditions are 3 comfort categories windier than desired	Major Adverse

The adopted scale for the significance criteria is a logical comparison of the measured wind environment with the desired wind environment. An adverse effect implies that a location has a wind environment that is unsuitable for its intended use. It should be noted that moderate and major adverse effects are considered significant effects and would therefore require mitigation; beneficial effects are not considered significant. Minor adverse effects may be improved with mitigation, but this is not considered a necessity.

The minor, moderate and major categories indicate the severity of the difference between the desired microclimate and the actual microclimate. As an example, if the desired wind conditions at a particular location are required to be suitable for standing, but the predicted wind conditions are suitable for strolling, the difference between the desired and predicted wind condition is one category windier than desired. In this case, the significance of the effect would be identified as minor adverse. Any adverse effect would be material to the planning decision process because it implies that a location, or area, has a wind microclimate that is unsuitable for the desired use of that area.

Table 14.10
Significance Criteria for Off-Site Measurement Locations

RECORDED WIND CONDITIONS	
RECEPTORS	SIGNIFICANCE OF EFFECT
OFF-SITE RECEPTORS WHERE WIND CONDITIONS ARE CURRENTLY SUITABLE FOR THE INTENDED USE (I.E. IN THE BASELINE)	
Wind Conditions are similar to those desired or calmer	Negligible
Wind Conditions are 1 comfort category windier than desired	Minor Adverse
Wind Conditions are 2 comfort categories windier than desired	Moderate Adverse
Wind Conditions are 3 comfort categories windier than desired	Major Adverse
OFF-SITE RECEPTORS WHERE WIND CONDITIONS ARE CURRENTLY NOT SUITABLE FOR THE INTENDED USE (I.E. IN THE BASELINE)	
Wind Conditions are 3 comfort categories calmer than desired	Major Beneficial
Wind Conditions are 2 comfort categories calmer than desired	Moderate Beneficial
Wind Conditions are 1 comfort category calmer than desired	Minor Beneficial
Wind Conditions are as in the baseline scenario	Negligible
Wind Conditions are 1 comfort category windier than desired	Minor Adverse
Wind Conditions are 2 comfort categories windier than desired	Moderate Adverse
Wind Conditions are 3 comfort categories windier than desired	Major Adverse

Any off-site locations would be deemed to have an adverse effect should conditions be windier than suitable by the criteria and is also windier than in the baseline scenario. If these conditions do not occur as a direct result of the introduction of the proposed development this effect would be considered negligible (not significant). If these conditions occur due to the introduction of the proposed development the effect would be considered adverse and significant. Any off-site locations would only be deemed to have a beneficial effect if the wind conditions have been improved relative to the criteria because of the introduction of the proposed development. This effect would be considered not significant.

14.2.12.1 Receptor Sensitivity

The Lawson Comfort Criteria inherently include a consideration of receptor sensitivity. For example, areas proposed for more sensitive pedestrian activities, such as sitting, are required to meet more stringent wind condition criteria to be considered suitable for their intended use than areas where less wind sensitive activities, such as walking, are proposed. As such, given that the assessment has been based on the Lawson Comfort criteria, it is considered that receptor sensitivity has been taken into account sufficiently in the assessment.

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14.2.12.2 Impact Magnitude

Although the proposed methodology does not specifically reference impact magnitude, like receptor sensitivity, it is considered that this is ingrained within the methodology. While the sensitivity of receptor is inherent in the Lawson comfort criteria scale itself, the degree to which the predicted conditions adhere to the conditions suitable for the intended use represents the magnitude of the impact.

14.2.12.3 Significance

Any adverse effect is 'significant' because it implies that a location, or area, has a wind microclimate that is unsuitable for the desired use of that area. On this basis, effects that are adverse need mitigating. Beneficial effects that are minor, moderate or major in scale are not considered to be significant.

14.2.12.4 Strong Winds

Strong winds (affecting pedestrian safety) are not included within this scale of effect assessment but are reported separately as any strong wind exceedance is significant and cannot be scaled to major/moderate/minor. Where strong winds occur, mitigation is required (as per adverse effects related to pedestrian comfort).

14.2.12.5 Significance Descriptors

For wind, the duration of effects has been defined as follows:

- Short term: up to five years;
- Medium term: five to ten years; and
- Long term: more than ten years.

Effects during the construction works are direct, local and short-term (temporary) and reversible.

Effects once the proposed development is completed are direct, local and long-term and permanent. However, the construction process has been designed to be reversible in the future. As such, effects are considered reversible.

14.2.13 Assumptions and Limitations

The CFD model included the surrounding buildings, and all relevant features with regards to wind flow, up to a distance of 360 m from the centre of the application site. An image of the CFD model is shown in Figure 14.1; and the five configurations tested. The scheme model has been constructed based on the design information supplied by the Applicant's Architect (Pattern) and Landscape Architect (Plan-It).

The conditions for the application site during construction have not been directly assessed by the CFD tests. Instead, professional judgement has been used to assess conditions during construction, and experience would suggest that the wind microclimate at ground level would develop from the

existing site conditions to that of the fully proposed development as construction evolved.

The wind assessment is based upon historical meteorological data from Liverpool John Lennon Airport, which has been used for this assessment as it is a large and reliable dataset which is located near to the application site. This data has been adjusted to the terrain exposure of the application site. The selection of measurement locations covers both the ground and elevated levels across the application site in areas where wind acceleration could be expected and in areas designed for more sedentary pedestrian use. The assessment takes into account the wind conditions for all wind directions.

The frozen computer model of the scheme was issued by the architects, Pattern Design, to Buro Happold in May 2020, for the purposes of undertaking the wind microclimate assessments. Since the model was issued, minor changes have occurred with the proposed design comprising the omission of two rooflights on the raised western terrace. However, these design changes are considered to be minor and are not expected to affect the wind comfort and safety impact assessment results reported in this ES chapter.

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14.3 BASELINE CONDITIONS

14.3.1 Existing Baseline (Configuration 1)

The baseline CFD test results are shown graphically in Figures 14.3 and 14.4 for the windiest and summer seasons, respectively, and in Figure 14.5 for the annual safety results. The results are provided in full in Tables 14.11, 14.12 and 14.13 below.

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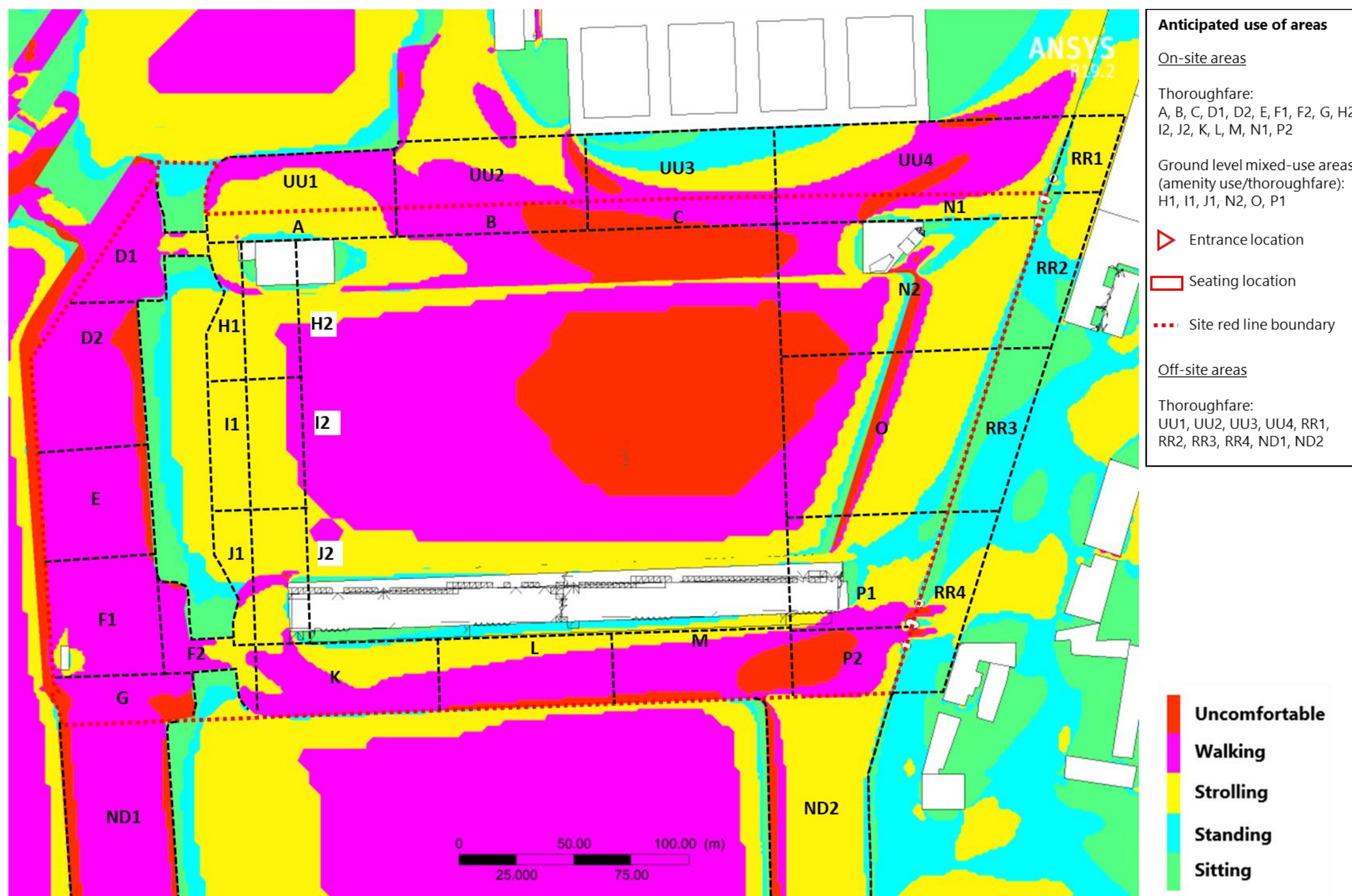


Figure 14.3
Configuration 1, Windiest season

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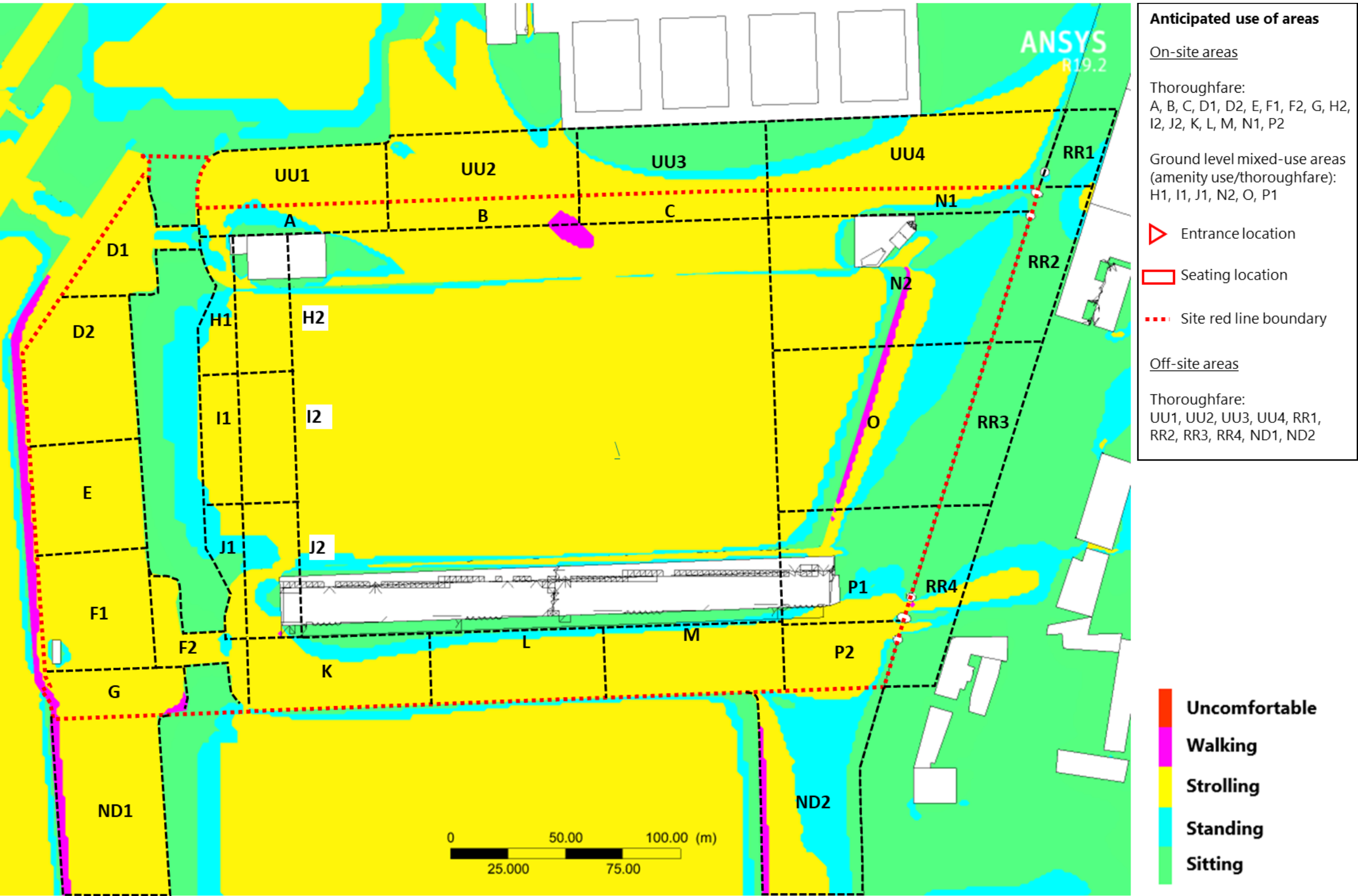


Figure 14.4
Configuration 1, Summer season

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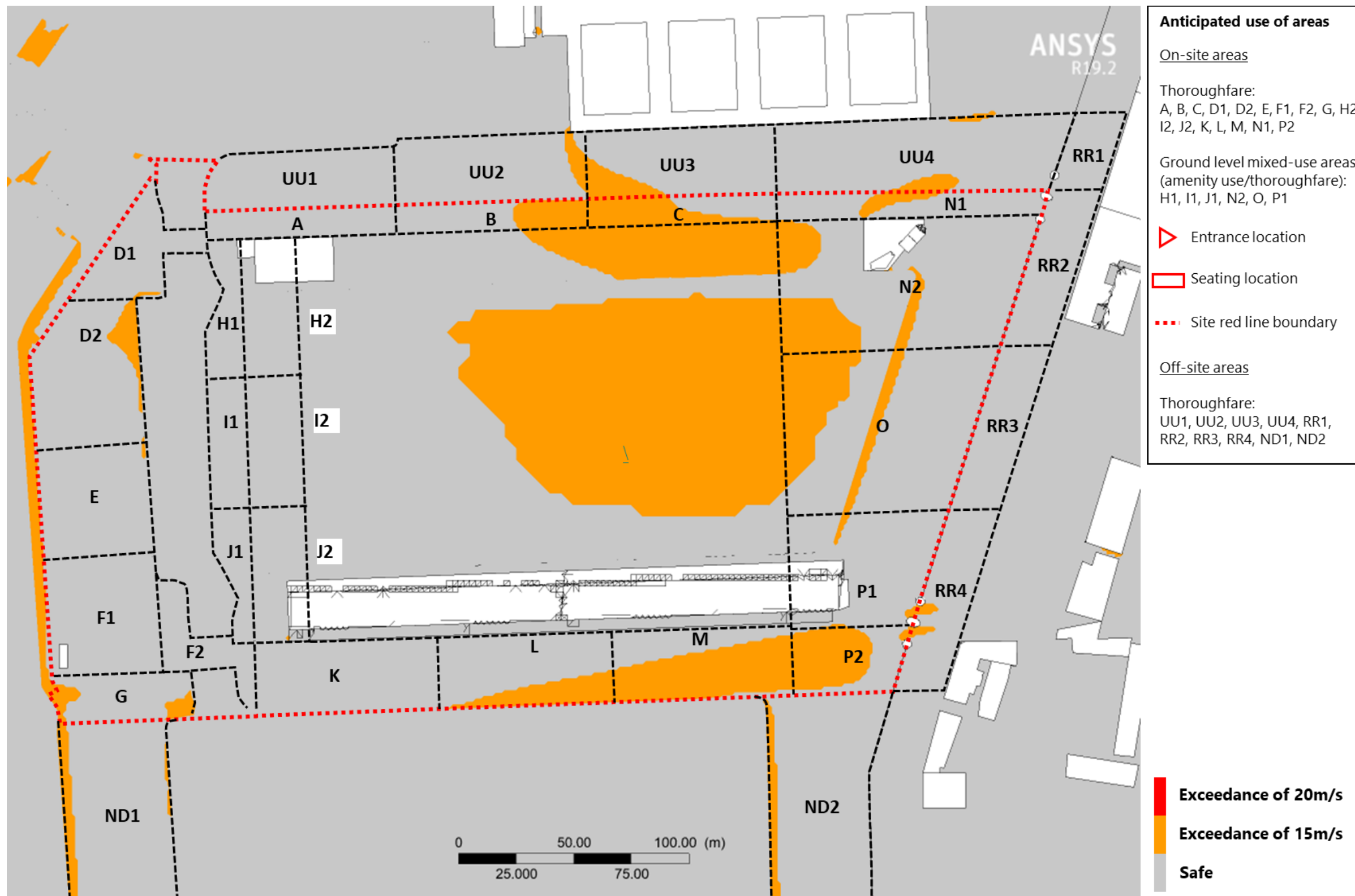
Table 14.11
Wind Comfort Conditions for Windiest Season

KEY RECEPTORS	AREA	MEASURED CONDITIONS	FURTHER INFORMATION
On-Site Receptors			
Thoroughfares	North side of H2 (green areas at west and south), South side of J2 (green area at southeast), N1 (green area at the south), N2 except for southwest corner (green area at north), East side of O (green area at the east), P1 except for northwest corner (green areas at northeast and in middle)	Sitting	N/A
Thoroughfares	A (blue area at south), North side of H1 (blue area at southwest), North side of H2 (blue area at west), South side of J2 (blue area at east), K (blue area at north), N1 (blue area at south), N2 except for southwest corner (blue areas at east and in middle), East side of O (blue area at east), P1 except for northwest corner (blue area at east)	Standing	N/A
Thoroughfares	A (yellow covers most of the area), D1 (yellow area at east), F1 (yellow area at west), F2 (yellow area to the east), North side of H1 (yellow part covering most of the area), North side of H2 (yellow area at southeast), South side of J1 (yellow part covering most of the area), South side of J2 (yellow part covering most of the area), K (yellow areas at northwest, west and north), L (yellow area at north), M (yellow area at north), N1 (yellow areas in middle, and at east), N2 except for southwest corner (yellow areas at east and west), East side of O (yellow area at east), P1 except for northwest corner (yellow areas at north, east and southwest), P2 (yellow area at the east)	Strolling	N/A
Thoroughfares	A (pink area at the east), B (pink covers most of the area), C (pink covers most of the area), D1 (pink covers most of the area), D2 (pink in middle covering most of the area), E (pink in middle covering most of the area), F1 (pink covering most of the area), F2 (pink areas at west and southeast), G (pink area in middle covering most of the area), North side of H1 (pink area at south), South side of J1 (pink area at east), South side of J2 (pink area in middle), K (pink areas at south, west and east), L (pink area at south), M (pink area at south), N1 (pink area at west), N2 except for southwest corner (pink areas in middle, at northwest corner and at south), East side of O (pink area at west), P1 except for northwest corner (pink area at south) P2 (pink covers most of the area)	Walking	N/A
Thoroughfares	B (red area at east), C (red area at southwest), D2 (red areas at east and west), E (red areas at east and west), F1 (red area at west), F2 (red area at north), G (red areas at east and southeast), South side of J2 (red area in middle), L (red area at south), M (red areas at east and south), N1 (red area in middle), N2 except for southwest corner (red areas at west and in middle), East side of O (red area at west), P1 except for northwest corner (red area at southeast), P2 (red area at west)	Uncomfortable	N/A
Inaccessible Areas	North side of J2 (green area at southeast corner), West side of O (green area at east edge), Northwest side of P1 (green area at east edge)	Sitting	N/A
Inaccessible Areas	North side of J1 (blue area at south), Southwest side of N2 (blue area at east edge), West side of O (blue area at east edge), Northwest side of P1 (blue area at east)	Standing	N/A
Inaccessible Areas	South side of H1 (yellow covers all area), South side of H2 (yellow covers most of the area), I1 (yellow covers all area), I2 (yellow area at west), North side of J1 (yellow covers most of the area), North side of J2 (yellow covers most of the area), Southwest side of N2 (yellow area along north and east edges), West side of O (yellow area in middle), Northwest side of P1 (yellow area in middle)	Strolling	N/A
Inaccessible Areas	South side of H2 (pink area at southeast), I2 (pink area at east), North side of J1 (pink area at southeast), North side of J2 (pink area at south), Southwest side of N2 (pink area in middle), West side of O (pink area in middle), Northwest side of P1 (pink area at northwest)	Walking	N/A
Inaccessible Areas	North side of J2 (red area in middle), Southwest side of N2 (red area at southwest), West side of O (red area at northwest)	Uncomfortable	N/A
Off-Site Receptors			
UU WwTW			
Thoroughfares	UU3 (green area at the north extending to west)	Sitting	N/A
Thoroughfares	UU3 (blue area in middle extending between east and west and at northwest), UU4 (blue area at the northwest corner)	Standing	N/A
Thoroughfares	UU1 (yellow area in middle and at south), UU2 (yellow area at north), UU3 (yellow area in the middle extending between east and west), UU4 (yellow areas at west, east and at southeast corner),	Strolling	N/A
Thoroughfares	UU1 (pink areas to north, east and west), UU2 (pink areas at south, east and west), UU3 (pink area at south), UU4 (pink area extending between northeast, middle and southwest)	Walking	N/A
Thoroughfares	UU2 (red area to east), UU3 (red area at west), UU4 (red areas at north and middle to the south)	Uncomfortable	N/A
Regent Road			
Thoroughfares	RR1 (green area at west edge), RR2 (green areas at northwest, south and east), RR3 (green areas at north and west), RR4 (green areas at west and at southeast)	Sitting	N/A
Thoroughfares	RR1 (blue area at the west), RR2 (blue area in middle), RR3 (blue areas in middle and at south), RR4 (blue areas at north, northeast, west and south),	Standing	N/A

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KEY RECEPTORS	AREA	MEASURED CONDITIONS	FURTHER INFORMATION
Thoroughfares	RR1 (yellow area covering most of RR1), RR2 (yellow area at northeast), RR4 (yellow area in middle and at east),	Strolling	N/A
Thoroughfares	RR4 (pink areas at west)	Walking	N/A
Thoroughfares	RR4 (red areas at west)	Uncomfortable	N/A
<u>Nelson Dock</u>			
Thoroughfares	N/A	Sitting	N/A
Thoroughfares	ND2 (blue area at east edge)	Standing	N/A
Thoroughfares	ND2 (yellow covers most of the area)	Strolling	N/A
Thoroughfares	ND1 (pink areas in middle), ND2 (pink area at west)	Walking	N/A
Thoroughfares	ND1 (red areas at east and west), ND2 (red area at west edge)	Uncomfortable	N/A
<u>Inaccessible Areas</u>			
Inaccessible	Area in middle of Nelson Dock	Walking	N/A

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Configuration 1, Pedestrian Safety Annual

Table 14.12

Annual Safety Exceedances

Figure 14.5

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RECEPTOR/AREA	SAFETY EXCEEDANCE WITHIN REGION
On-Site Receptors	
A	Pass
B	S15
C	S15
D1	S15
D2	S15
E	S15
F1	Pass
F2	Pass
G	S15
H1	Pass
H2	Pass
I1	Pass
I2	Pass
J1	Pass
J2	Pass
K	Pass
L	S15
M	S15
N1	S15
N2	S15
O	S15
P1	S15
P2	S15
Off-Site Receptors	
UU1	Pass
UU2	S15
UU3	S15
UU4	S15
RR1	Pass
RR2	Pass
RR3	Pass
RR4	S15
ND1	S15
ND2	S15

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RECEPTOR/AREA	SAFETY EXCEEDANCE WITHIN REGION
Area in middle of Nelson Dock	Pass

Table 14.13
Description of Wind Conditions around application site

LOCATIONS	DESCRIPTION
On-site Receptors	
Thoroughfares	The majority of the areas of thoroughfare have wind conditions suitable for walking with localised areas where conditions may feel uncomfortable for pedestrian use. Areas where conditions are suitable for strolling (with localised areas of acceleration) are located to the east, northwest and south of the site. There are several locations on-site with exceedances of the 15m/s safety threshold.
Inaccessible Areas	As pedestrians would be unable to access the inaccessible areas on-site, wind conditions would be considered acceptable regardless of the measured conditions.
Off-site Receptors	
UU WwTW	The majority of this area is suitable for strolling or walking with localised acceleration areas where conditions are uncomfortable (in the middle and to the east) Strong winds exceeding the 15m/s safety threshold are observed across this area.
Regent Road	The majority of this area is suitable for sitting or standing, with conditions more suitable for strolling in the north and south of this area. Localised areas of acceleration were observed towards the south, where conditions are uncomfortable. The safety threshold of 15m/s is exceeded in these areas of acceleration.
Nelson Dock	Conditions are generally suitable for walking in ND1 and strolling in ND2. Localised acceleration at the western edges of the site adjacent to the river Mersey and Nelson Dock result in uncomfortable conditions. Exceedances of the 15m/s safety threshold is observed at the western and eastern edges of ND1 and the western edge of ND2.

14.3.2 Future Baseline (Configuration 2 – Liverpool Waters Scheme on-site and at Nelson Dock)

The future baseline CFD results are shown graphically in Figures 14.6 and 14.7 for the windiest and summer seasons, respectively, and in Figure 14.8 for the annual safety results. The results are provided in full in Tables 14.14, 14.15 and 14.16 below. The wind microclimate in this scenario is windier than Configuration 1 , to the west of the site close to the corner of the buildings and/or where wind funnels between buildings.

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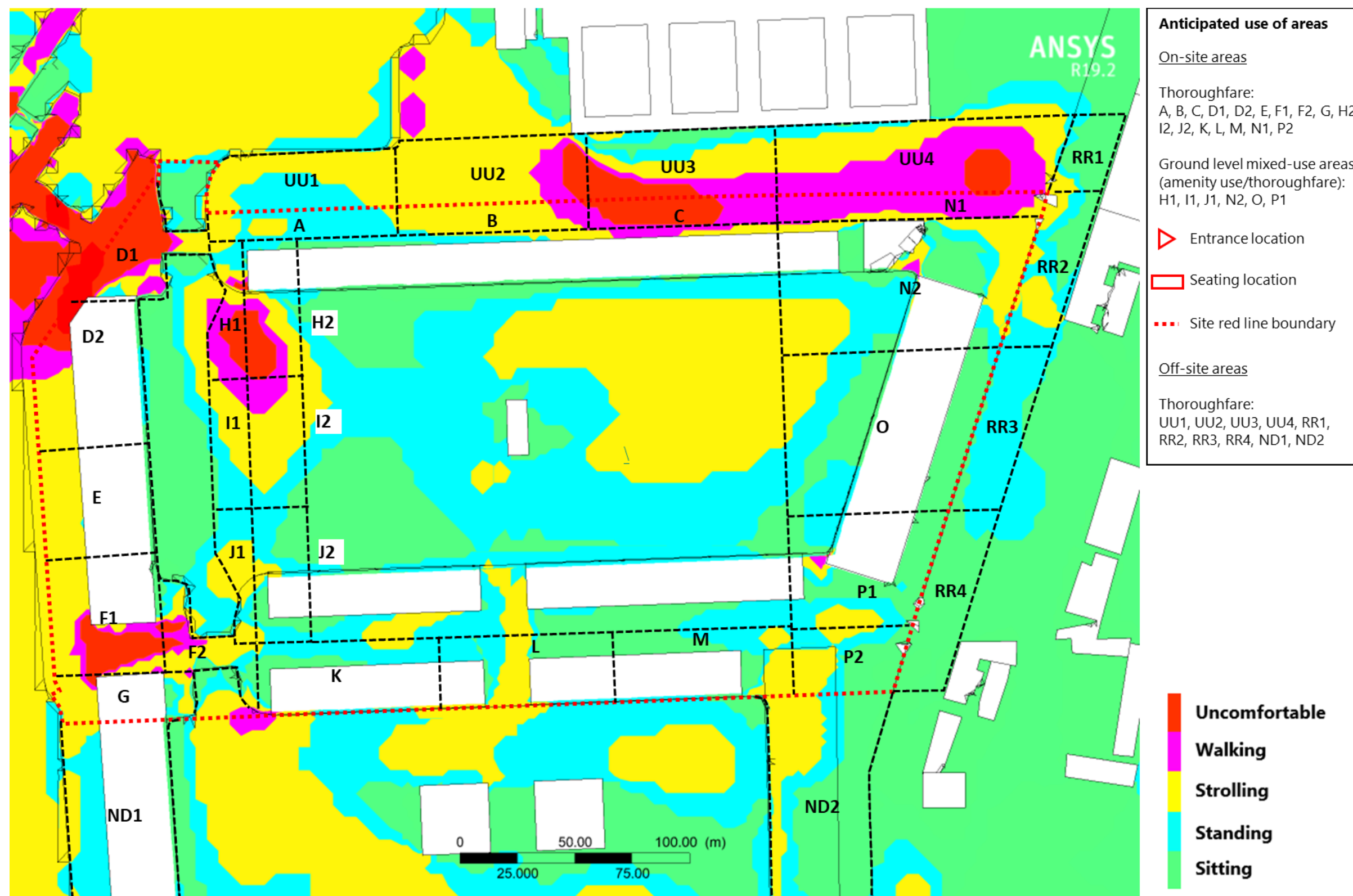


Figure 14.6
Configuration 2, Windiest season

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Figure 14.7

Configuration 2, Summer season

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Table 14.14
Expected Wind Comfort Conditions

KEY RECEPTORS	AREA	MEASURED CONDITIONS	FURTHER INFORMATION
On-site Receptors			
Thoroughfare	F2 (green areas at northwest, south and east), G (green area at east), North side of H2 (green area at northeast), South side of J1 (green area at east), South side of J2 (green area in middle), K (green areas in middle and at west), L (green areas at northeast and west), M (green areas at west and in middle), N2 except for southwest corner (green areas at west, in middle and at south), East side of O (green covers most of the area), P1 except for northwest corner (green covers most of the area), P2 (green areas at southeast and east)	Sitting	N/A
Thoroughfare	A (blue area at east), F2 (blue areas at east and northwest), G (blue area at east), North side of H1 (blue area in middle), North side of H2 (blue area at north), South side of J1 (blue area in middle), South side of J2 (blue areas at north and at south), K (blue area at north), L (blue area at west), M (blue area at north), N2 except for southwest corner (blue areas in middle and at south), East side of O (blue area at northeast), P1 except for northwest corner (blue areas at south and northwest), P2 (blue areas at west and north)	Standing	N/A
Thoroughfare	A (yellow areas at west and northeast), B (yellow covers most of the area), D1 (yellow areas at southeast and east), D2 (yellow area at south), E (yellow covers all area), F1 (yellow area at west and south), F2 (yellow area in middle), G (yellow area at the east and west), North side of H1 (yellow areas at north and south), North side of H2 (yellow area at west), South side of J1 (yellow areas at north and south), South side of J2 (yellow areas at northwest and southwest), K (yellow area at north), L (yellow area in middle), M (yellow area at east), N1 (yellow areas at north and southeast), N2 except for southwest corner (yellow areas at north, northeast and in middle), P1 except for northwest corner (yellow areas at south and northwest), P2 (yellow areas at west and north)	Strolling	N/A
Thoroughfare	B (pink area at east), C (pink areas at east and west), D1 (pink area at southeast), D2 (pink area in middle), F1 (pink areas in middle and at east), F2 (pink area at west), G (pink areas at northeast and west), North side of H1 (pink area at south), North side of H2 (pink area at west), N1 (pink covers most of the area), N2 except for southwest corner (pink area in middle), P1 except for northwest corner (pink area at northwest)	Walking	N/A
Thoroughfare	B (red area at northeast), C (red area in middle), D1 (red covers most of the area), D2 (red area at north), F1 (red areas in middle and at east), F2 (red area at west), G (red area at west), North side of H1 (red area at south), North side of H2 (red area at west)	Uncomfortable	N/A
Inaccessible Areas	South side of H2 (green area at east), I1 (green area at west), I2 (green area at southeast), North side of J1 (green area at northwest), North side of J2 (green area at east), Southwest side of N2 (green areas at northeast and southeast), West side of O (green area at east), Northwest side of P1 (green area at west)	Sitting	N/A
Inaccessible Areas	South side of H2 (blue area at northeast), I1 (blue areas at south and west), I2 (blue area at south), North side of J1 (blue area at north), North side of J2 (blue area in middle), Southwest side of N2 (blue area in middle), West side of O (blue area in middle), Northwest side of P1 (blue area at east)	Standing	N/A
Inaccessible Areas	South side of H1 (yellow areas at north and southwest), South side of H2 (yellow area in middle), I1 (yellow area in middle), I2 (yellow area in middle), North side of J1 (yellow area at south), North side of J2 (yellow area at southwest), Southwest side of N2 (yellow area at southwest), West side of O (yellow area at the northwest)	Strolling	N/A
Inaccessible Areas	South side of H1 (pink area in middle), South side of H2 (pink area in middle), I1 (pink area at north), I2 (pink area at north)	Walking	N/A
Inaccessible Areas	South side of H1 (red areas at east and in middle), South side of H2 (red area at west)	Uncomfortable	N/A
Off-Site Receptors			
UU WwTW			
Thoroughfare	UU3 (green area at north)	Sitting	N/A
Thoroughfare	UU1 (blue areas in middle and at south), UU3 (blue area at north), UU4 (blue areas at northwest and east)	Standing	N/A
Thoroughfare	UU1 (yellow areas in middle at north), UU2 (yellow covers most of the area), UU3 (yellow areas in middle and north), UU4 (yellow areas at north and east)	Strolling	N/A
Thoroughfare	UU2 (pink area at east), UU3 (pink area at east and middle), UU4 (pink area in middle)	Walking	N/A
Thoroughfare	UU2 (red area at east), UU3 (red area at southwest), UU4 (red area at east)	Uncomfortable	N/A
Regent Road			
Thoroughfare	RR1 (green covers most of the area), RR2 (green area at east), RR3 (green areas at east and west edges), RR4 (green covers most of area)	Sitting	N/A
Thoroughfare	RR1 (blue area at southwest), RR2 (blue areas at south and in middle), RR3 (blue covers most of the area), RR4 (blue area at north)	Standing	N/A
Thoroughfare	RR1 (yellow area at southwest), RR2 (yellow areas in middle)	Strolling	N/A
Thoroughfare	N/A	Walking	N/A

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KEY RECEPTORS	AREA	MEASURED CONDITIONS	FURTHER INFORMATION
Thoroughfare	N/A	Uncomfortable	N/A
<u>Nelson Dock</u>			
Thoroughfare	ND2 (green covers most of the area), Green areas immediately surrounding future Liverpool Waters buildings in middle of Nelson Dock	Sitting	N/A
Thoroughfare	ND1 (blue covers most of the area), ND2 (blue area in middle), Blue areas immediately surrounding future Liverpool Waters buildings in middle of Nelson Dock	Standing	N/A
Thoroughfare	ND1 (yellow areas at northwest and west), ND2 (yellow area at west), Yellow areas immediately surrounding future Liverpool Waters buildings in middle of Nelson Dock	Strolling	N/A
Thoroughfare	N/A	Walking	N/A
Thoroughfare	N/A	Uncomfortable	N/A

WIND MICROCLIMATE

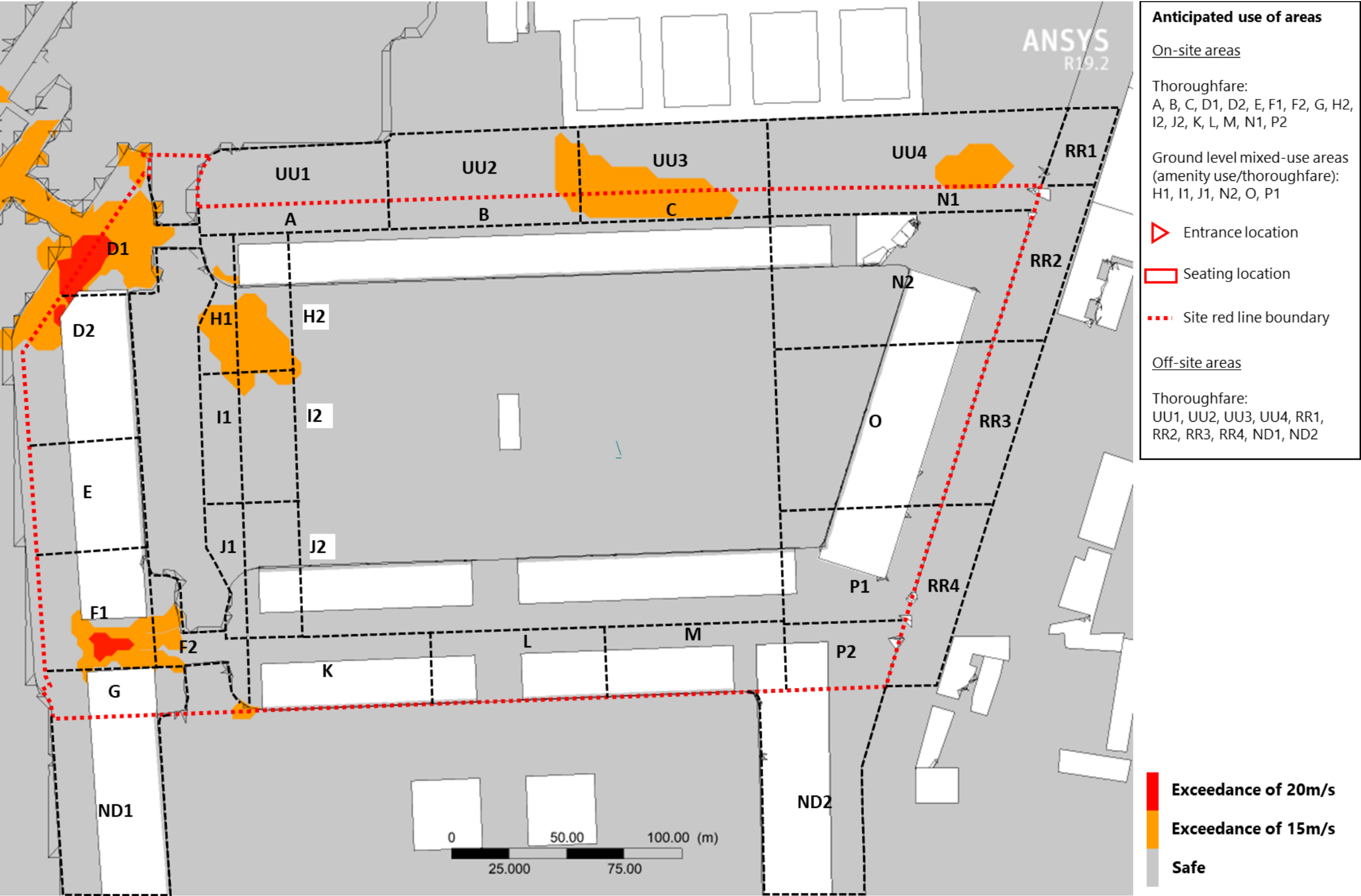


Figure 14.8
Configuration 2, Pedestrian Safety Annual.

WIND MICROCLIMATE

Table 14.15
Expected Wind Safety Conditions

AREA	SAFETY EXCEEDANCE WITHIN REGION
On-Site Receptors	
A	Pass
B	S15
C	S15
D1	S20
D2	S20
E	Pass
F1	S20
F2	S15
G	S15
H1	S15
H2	S15
I1	S15
I2	S15
J1	Pass
J2	Pass
K	Pass
L	Pass
M	Pass
N1	Pass
N2	Pass
O	Pass
P1	Pass
P2	Pass
Off-Site Receptors	
UU1	Pass
UU2	S15
UU3	S15
UU4	S15
RR1	Pass
RR2	Pass
RR3	Pass
RR4	Pass
ND1	Pass

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AREA	SAFETY EXCEEDANCE WITHIN REGION
ND2	Pass
Area immediately surrounding proposed Liverpool Waters buildings in middle of Nelson Dock	Pass

Table 14.16
Description of Wind Conditions around application site

LOCATIONS	DESCRIPTION
On-Site Receptors	
Thoroughfares	Most of the onsite locations with pedestrian access are suitable for strolling in the winter with few areas of localised acceleration at the northeast and west of the site, where conditions may feel uncomfortable for pedestrian use. Several locations have exceeded the safety threshold of 15 m/s and two exceeded the threshold of 20 m/s.
Inaccessible Areas	As pedestrians would be unable to access the inaccessible areas on-site, wind conditions would be considered acceptable regardless of the measured conditions.
Off-site Receptors	
UU WwTW	In the majority of this area, wind conditions are suitable for strolling in the winter with the exception of localised areas of acceleration in the middle and at the east of the area, where wind conditions would be suitable for walking or uncomfortable for pedestrian use. Exceedance of the 15 m/s threshold is observed across this area.
Regent Road	Wind conditions within all areas on Regent Road are suitable for strolling or better in winter, and at no location is the safety threshold exceeded.
Nelson Dock	Both ND1 and ND2 and the area immediately surrounding the proposed Liverpool Waters buildings in middle of Nelson Dock will have conditions suitable for strolling or better in the winter, with no safety threshold exceedance.

The results of Configurations 1 and 2 have been reported above. The following sections assess the proposed development on an individual basis (Configuration 3 – stadium without Liverpool Waters) and cumulatively (Configuration 4 – stadium plus Liverpool Waters, and Configuration 5 – stadium plus Liverpool Waters plus the proposed Bramley Hotel development (LPA ref. 20F/0217) at Regent Road/Blackstone Street). Whilst the timings of delivery of the approved Nelson Dock development within the wider Liverpool Waters scheme is uncertain, it is extremely unlikely to be developed prior to the stadium opening (currently anticipated by the applicant as 2023/2024).

14.4 POTENTIAL SIGNIFICANT IMPACTS

Table 14.17
Potential Significant Impacts of the Proposed Development

PHASE	DESCRIPTION	ADVERSE/BENEFICIAL
Construction	It is expected that the impact of the proposed development on wind conditions at the site and in the immediate surrounding area will increase gradually as the construction progresses from the baseline (Configuration 1) to reach a maximum equal to the impact caused by the operational development in situ (Configuration 3/4/5). Given that effects will be temporary and short-term, the construction phase effects have not been assessed further in this chapter.	Beneficial/Adverse depending on location
Operation	The proposed development (Configurations 3/4/5), once complete and operational, has the potential to cause adverse wind conditions that could result in unsafe conditions for pedestrians or make the pedestrian environment on site and in the surrounding area unsuitable for its intended use.	Beneficial/Adverse depending on location

14.5 DESIGN INTERVENTIONS

Design interventions were developed through a number of workshops to improve the wind microclimate around the proposed development, thereby generating safe and comfortable wind conditions for pedestrians in and around the site. The below table describes the design interventions that were developed. It should be noted that these design interventions were developed as a whole strategy, and all are required to achieve the wind conditions discussed in subsequent sections of this chapter.

Table 14.18
Design interventions implemented around the proposed development

DESIGN INTERVENTION	REASON FOR INTERVENTION	FURTHER INFORMATION
The inclusion of the proposed landscaping scheme	Unsafe and unsuitable wind conditions would be present around the proposed development. The proposed landscaping, along with other design interventions, would ensure the wind microclimate around the site is safe and suitable for the intended use.	<ul style="list-style-type: none">■ ES Chapter 3: Site Description & Development Proposals■ Design and Access Statement Addendum

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DESIGN INTERVENTION	REASON FOR INTERVENTION	FURTHER INFORMATION
<p>A new western terrace is proposed on the west stand elevation of the stadium. The terrace includes a large stepped area from ground level up to a large viewing platform/public realm area at first floor (podium) level. The terrace importantly provides a covered area which enables a safe ‘sheltered’ way to enter and leave the stadium in high wind events (general admission turnstiles and hospitality entrances located at ground floor level within the covered area). The covered area underneath the terrace is accessed via entrances located to the north and south at ground level.</p> <p>There are also three openings located along the stepped area at ground level facing out to the proposed Water Channel; these openings provide access to the covered area underneath and have porous gates to control access (for security but also during adverse weather conditions).</p> <p>At the top of the Western Terrace there are light wells (with appropriate security fencing surrounding) to provide daylight to the covered area below. There are also doors at the top of the Western Terrace that lead into the hospitality areas (Level One) within the proposed glazed portal of the west stand that could be used to provide added ‘spill out’ amenity space when the weather is appropriate.</p>	<p>Unsafe and unsuitable wind conditions would be present on the west elevation of the stadium at the top of the west terrace, the public realm areas along the proposed water channel and the west quay (primary parking area). The Western Terrace provides a sheltered/covered way to enter and leave the stadium during any adverse weather conditions. The proposed porous gates to the north and south of the terrace and in the three openings within the stepped area, along with other design interventions, would ensure the wind microclimate in this area is safe and suitable for the intended use.</p>	<ul style="list-style-type: none">■ Landscaping Masterplan Submission Drawings■ ES Chapter 3: Site Description & Development Proposals■ Design and Access Statement Addendum■ Proposed West Terrace Submission Drawing
<p>The north entrance to the Western Terrace covered area is surrounded by a wind mitigation structure that it is porous, and a large porous screen with associated gate running from the northern tip of the west terrace structure to the boundary fence with the adjoining United Utilities land to the north; this screen is to ultimately prevent general public access westwards to the public realm areas around the water channel and also the west quay (car parking area).</p> <p>A 4m high wind mitigation structure (including gate) is also proposed from the southern tip of the west terrace structure to the Nelson Dock balustrade to prevent general access to the public realm area on top of and in front of the terrace and the west quay (west of the water channel)</p>	<p>Unsafe and unsuitable wind conditions would be present at the underside of the Western Terrace at the west of the stadium. The enclosed space at the north entrance, along with other design interventions, would ensure the wind microclimate in this area is safe and suitable for the intended use.</p>	<ul style="list-style-type: none">■ ES Chapter 3: Site Description & Development Proposals■ Design and Access Statement Addendum
<p>Thirteen 5m high deciduous trees located on the south side (on-site) of the northern boundary fence running eastward (near to the Hydraulic Tower)</p>	<p>Unsafe and unsuitable wind conditions would be present at the north-west corner of The Hydraulic Tower. The deciduous trees would ensure a safe and comfortable wind environment around the Hydraulic Engine House</p>	<ul style="list-style-type: none">■ ES Chapter 3: Site Description & Development Proposals■ Design and Access Statement Addendum
<p>1.2m tall 50% porous balustrades running along the Water Channel and Nelson Dock at several locations around the site.</p>	<p>Unsafe and unsuitable wind conditions would be present at the south-west of the stadium. The balustrade height, along with other design interventions in this area, would ensure the wind conditions would be safe and suitable for the intended use.</p>	<ul style="list-style-type: none">■ ES Chapter 3: Site Description & Development Proposals■ Design and Access Statement Addendum
<p>The northern boundary fence to United Utilities made 50% porous running eastward from the eastern most column at the northern façade of the stadium</p>	<p>Unsafe and unsuitable wind conditions would be present at the north of the stadium. Changing the porosity of the boundary fence, along with other design interventions in this area, would ensure the wind conditions would be safe and suitable for the intended use.</p>	<ul style="list-style-type: none">■ ES Chapter 3: Site Description & Development Proposals■ Design and Access Statement Addendum
<p>A 2m tall 50% porous boundary fence at the south-east of the site</p>	<p>Unsafe and unsuitable wind conditions would be present at the south-east of site. A 50% porous boundary fence in this area would ensure the wind conditions would be safe and suitable for the intended use.</p>	<ul style="list-style-type: none">■ ES Chapter 3: Site Description & Development Proposals■ Design and Access Statement Addendum
<p>Wind screens along the south façade which are integrated into the entrance portals for the turnstiles and the ticket office (located at both ends of the doors) along this elevation of the stadium, consisting of 50% porous screen. There are also two wind screens at the southwest end of the south façade.</p>	<p>Unsafe and unsuitable wind conditions would be present at the south east and south west corners of the stadium. The wind screens, along with other design interventions, would ensure the wind microclimate in this area is safe and suitable for the intended use.</p>	<ul style="list-style-type: none">■ ES Chapter 3: Site Description & Development Proposals■ Design and Access Statement Addendum
<p>Fourteen 6.5m wide, tapered baffles which are 2 to 2.5m tall, spaced 10m apart running along the southern thoroughfare underneath the south stand</p>	<p>Unsafe and unsuitable wind conditions would be present at the south of the stadium. The baffles, along with other design interventions in this area, would ensure the wind conditions would be safe and suitable for the intended use.</p>	<ul style="list-style-type: none">■ ES Chapter 3: Site Description & Development Proposals■ Design and Access Statement Addendum

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DESIGN INTERVENTION	REASON FOR INTERVENTION	FURTHER INFORMATION
Fourteen trees with various heights with sets of 4 screens underneath, 0.5m wide which are 7m tall at the south-west corner of the stadium. All trees are assumed to be evergreen in line with the landscaping proposals.	Unsafe and unsuitable wind conditions would be present at the south-west of the stadium. The baffles, along with other design interventions in this area, would ensure the wind conditions would be safe and suitable for the intended use.	<ul style="list-style-type: none">■ ES Chapter 3: Site Description & Development Proposals■ Design and Access Statement Addendum
Sixteen trees with various heights with sets of 4 screens underneath, 0.5m wide which are 7m tall at the south-east corner of the stadium. All trees are evergreen in accordance with the landscaping proposals.	Unsafe and unsuitable wind conditions would be present at the south-east corner of the stadium. The wind screens and trees, along with other design interventions in this area, would ensure the wind conditions would be safe and suitable for the intended use.	<ul style="list-style-type: none">■ ES Chapter 3: Site Description & Development Proposals■ Design and Access Statement Addendum
18 no., 10m wide, 3m tall, 50% porous baffles with 7m ground clearance at the north façade of the stadium (located in between the stadium façade and the boundary fence with the United Utilities facility to the north)	Unsafe and unsuitable wind conditions would be present at the north of the stadium. The baffles, along with other design interventions in this area, would ensure the wind conditions would be safe and suitable for the intended use.	<ul style="list-style-type: none">■ ES Chapter 3: Site Description & Development Proposals■ Design and Access Statement Addendum
1.5 to 2.5m tall, hoarding fence panels running along the eastern face of the River Mersey Wall within the application site.	Unsafe and unsuitable wind conditions would be present at the west side of the proposed development. The fence, along with other design interventions in this area would ensure wind conditions would be safe and suitable for the intended use.	<ul style="list-style-type: none">■ ES Chapter 3: Site Description & Development Proposals■ Design and Access Statement Addendum

14.6 ASSESSMENT PRE-MITIGATION (INCLUDING DESIGN INTERVENTIONS)

14.6.1 Proposed Development Scenario (Configuration 3)

The results of the tests undertaken for the ground and elevated levels of the proposed development, are graphically shown in Figure 14.9 for the windiest and Figure 14.10 for the summer season respectively. The results for the annual safety exceedances with the proposed development, proposed landscaping and design interventions in place are shown in Figures 14.11. The results are provided in full in Tables 14.19, 14.20 and 14.21 below.

WIND MICROCLIMATE

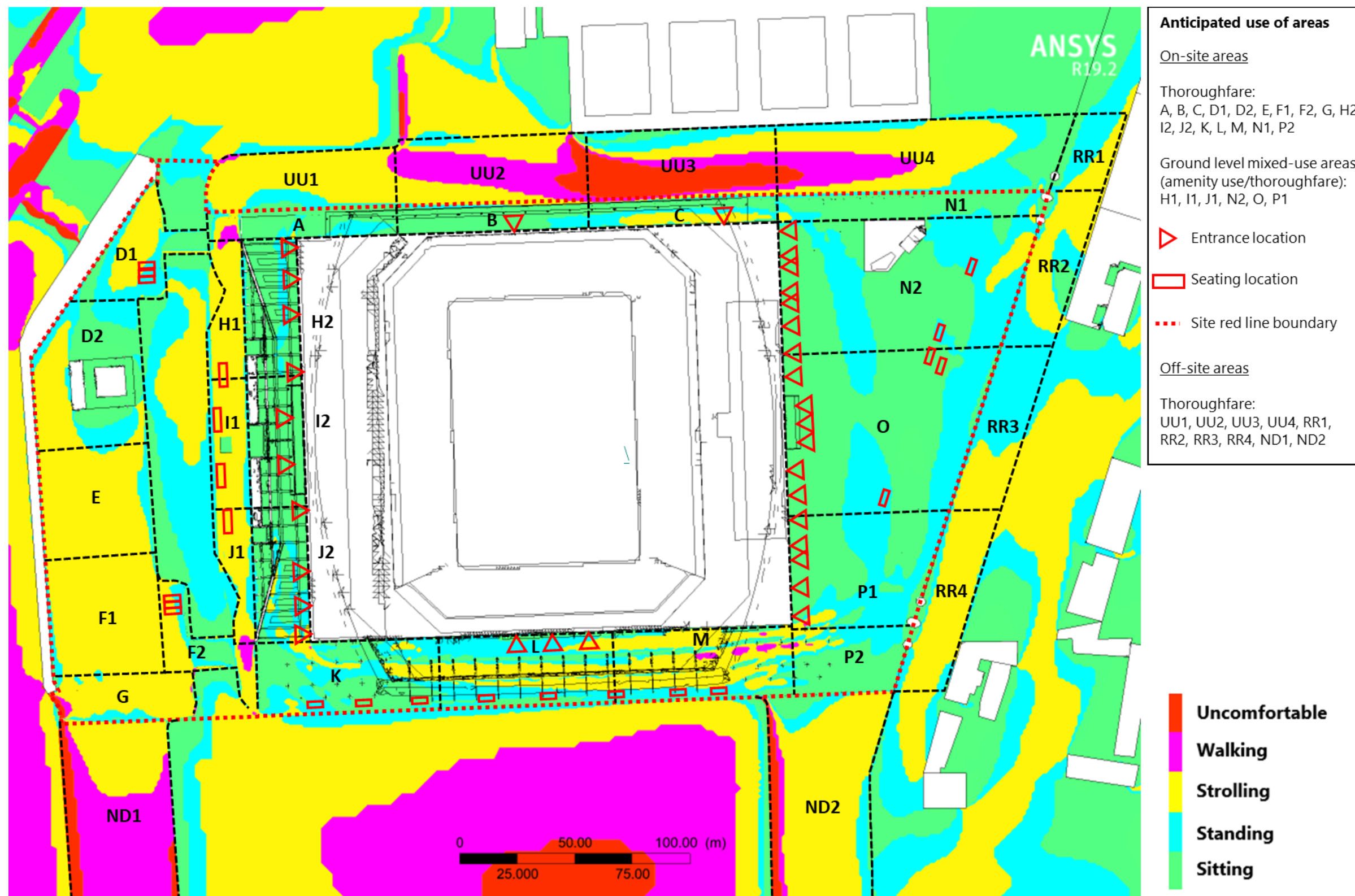


Figure 14.9a

Configuration 3, Windiest season. Conditions at ground level, and underneath the Western Terrace.

WIND MICROCLIMATE

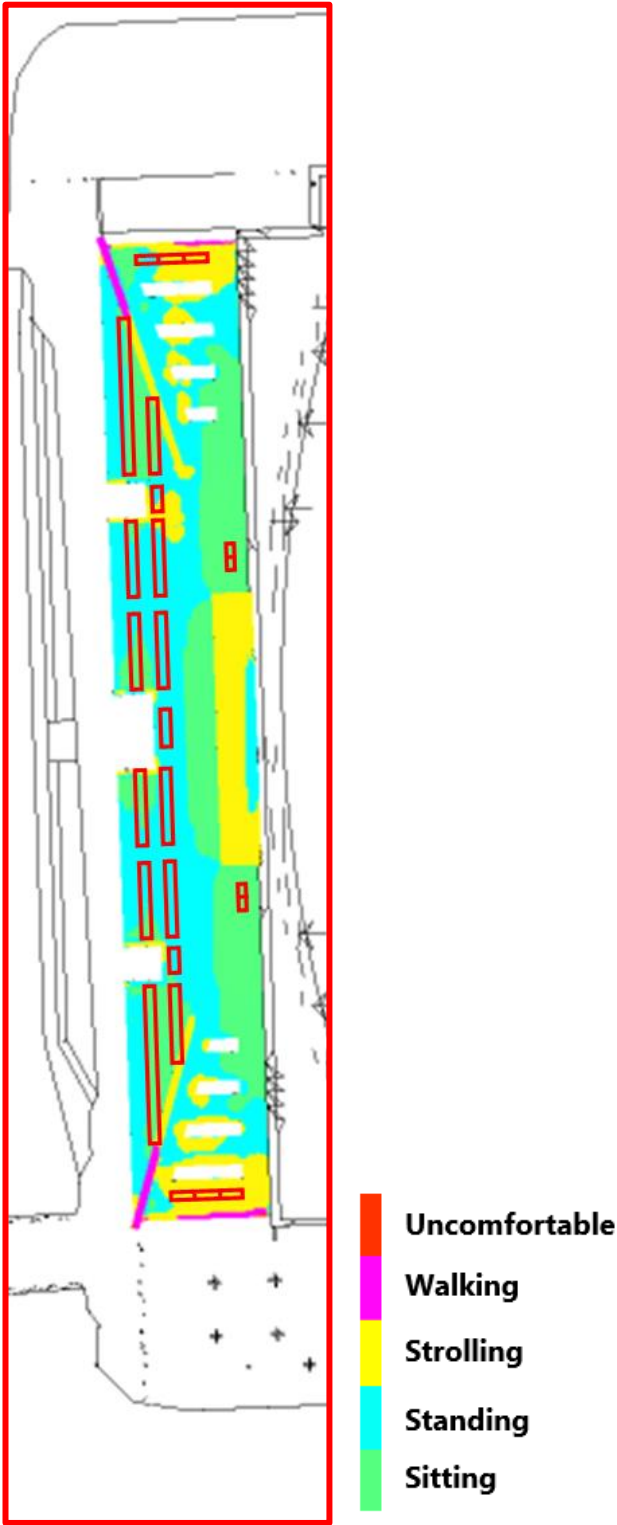


Figure 14.9b
Configuration 3, Windiest season. Conditions at the top of the Western Terrace.

WIND MICROCLIMATE

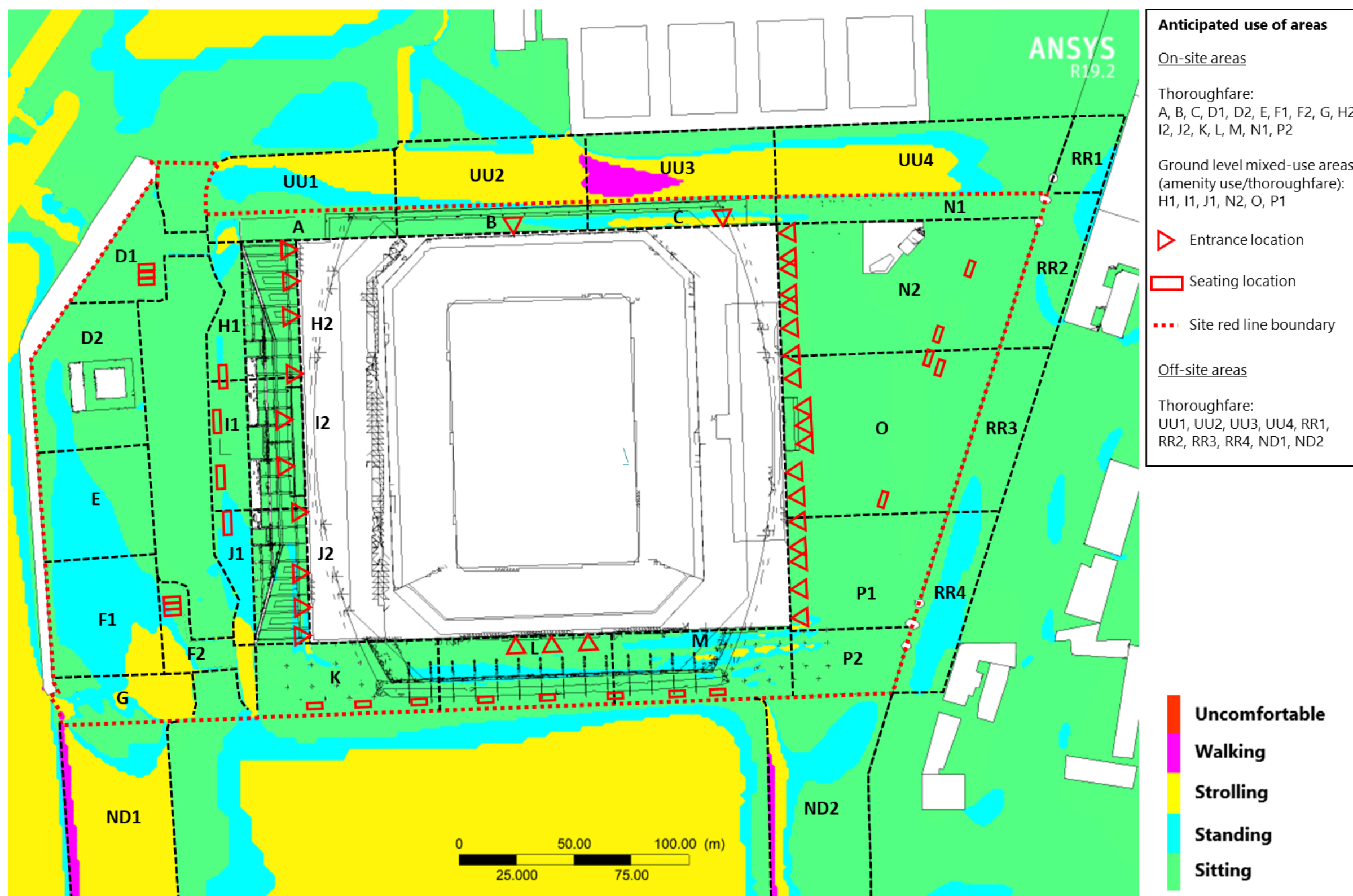


Figure 14.10a

Configuration 3, Summer season. Conditions at Ground level, and underneath the Western Terrace

WIND MICROCLIMATE

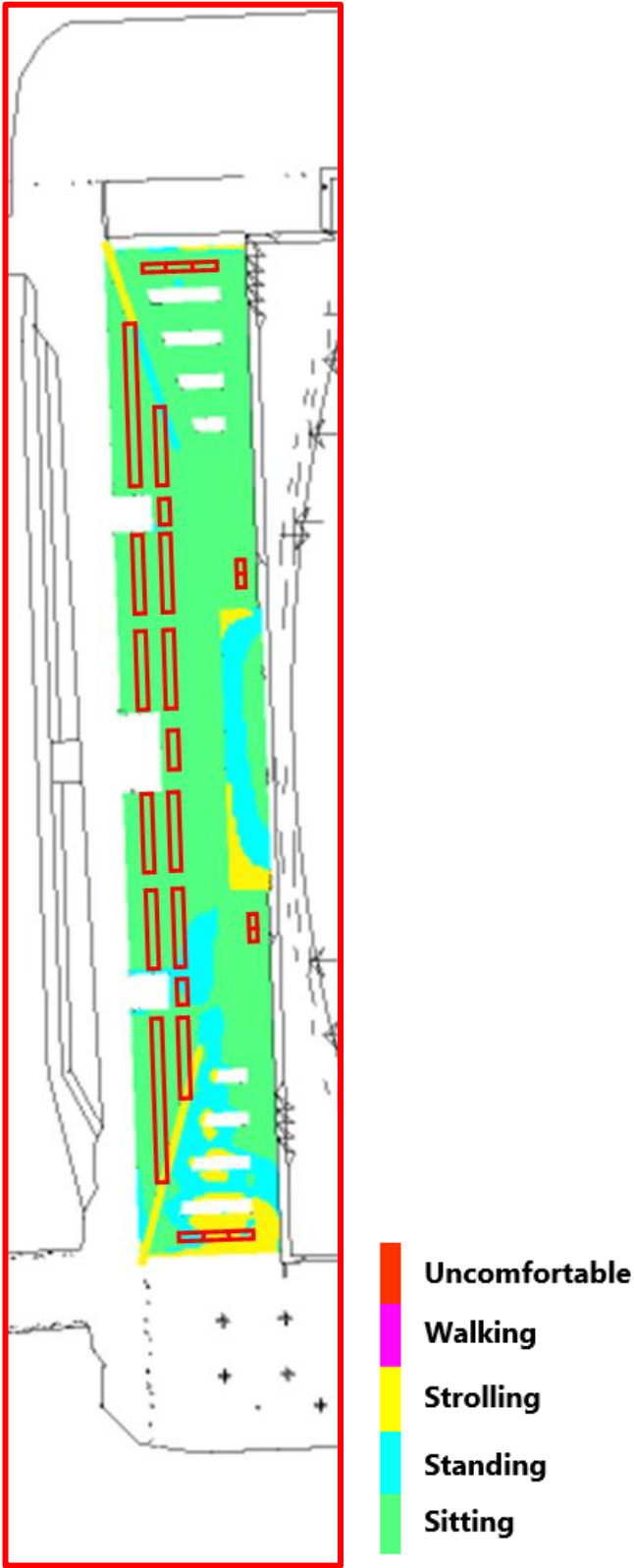


Figure 14.10b

Configuration 3, Summer season. Conditions at the top of the Western Terrace.

WIND MICROCLIMATE

Table 14.19a
Expected Wind Comfort Conditions – on-site receptors

PHASE	RECEPTOR(S) AFFECTED	LOCATIONS	MEASURED CONDITIONS	SIGNIFICANCE CRITERIA	MITIGATION PROPOSED?	FURTHER INFORMATION
Operation	Thoroughfare	A (green area in middle), B (everywhere except southeast), C (green area at north), D1 (green areas at east and southwest), D2 (green area in middle), F2 (green area at east), H2 (green area at east and west), I2, J2 (green areas in middle, east and west), K (green areas at north, south and west), L (green areas at north, middle and south), M (green areas at north, middle and east), N1 (everywhere except southwest, south and east), P2 (everywhere except north)	Sitting	Moderate Beneficial	No	N/A
Operation	Thoroughfare	A (blue areas at east and middle), B (blue area at southeast), C (blue area across middle, southeast and southwest), D1 (blue areas at west, middle and south), D2 (blue areas at north, south and northwest), E (blue area at east and north), F1 (blue areas at northeast and southwest), F2 (blue areas across middle), G (blue areas at north and south), H2 (blue area in middle), J2 (blue areas at north and south), K (blue areas at northeast, middle, southeast and southwest), L (blue areas at north and south), M (blue areas at west and south), N1 (blue areas at east, west and south), P2 (blue areas at north, northeast and west)	Standing	Minor Beneficial	No	N/A
Operation	Thoroughfare	A (yellow area at west), C (yellow area along south), D1 (yellow area across middle), D2 (yellow area at west and southeast), E (everywhere except east and north), F1 (everywhere except northeast and southwest), F2 (yellow areas at east and west), G (everywhere except small areas at north, south and southwest), J2 (yellow areas in middle and south), K (yellow areas at north, south and middle), L (yellow areas at northeast and across middle), M (yellow areas at north and across middle), N1 (yellow areas at southeast and southwest), P2 (yellow area at northwest)	Strolling	Negligible	No	N/A
Operation	Thoroughfare	A (pink area at southwest), F2 (pink area at east), G (pink area at southwest), M (pink areas across middle and east), P2 (pink area at northwest)	Walking	Minor adverse	No	N/A
Operation	Thoroughfare	G (red area at southwest)	Uncomfortable	Moderate adverse	Yes	N/A
Operation	Entrances	B, H2 (all except northern entrance), I2, J2 (northern two entrances), L, N2, O, P1	Sitting	Minor Beneficial	No	N/A
Operation	Entrances	H2 (northern entrance), J2 (second entrance from south)	Standing	Negligible	No	N/A
Operation	Entrances	C, J2 (southern entrance)	Strolling	Minor adverse	No	N/A
Operation	Ground Level Amenity Areas – Mixed Use	H1 (everywhere except north and small area towards south), I1 (everywhere except small area at south), J1 (small green areas at northeast and northwest), N2, O, P1 (everywhere except small area at southwest), Top of Western Terrace (everywhere except south and small area at north)	Sitting	Negligible	No	N/A
Operation	Ground Level Amenity Areas – Mixed Use	H1 (blue area at north and towards south), I1 (blue area at south), J1 (everywhere except south and small areas at northeast and northwest), P1 (blue area at southwest), Top of Western Terrace (blue areas at north and south)	Standing	Negligible	No	N/A
Operation	Ground Level Amenity Areas – Mixed Use	H1 (yellow area at north), J1 (yellow area at south), P1 (yellow area at southwest), Top of Western Terrace (yellow areas at north and south)	Strolling	Minor Adverse	No	N/A
Operation	Ground Level Amenity - Seating	D1, F2 (two northern-most seating locations), H1, I1, K, L, M, N2, O, Top of Western Terrace (all seating locations except one on the west side and three at the south)	Sitting	Negligible	No	N/A
Operation	Ground Level Amenity - Seating	F2 (southern-most seating location), J1, Top of Western Terrace (one seating location on the west side and one at the south)	Standing	Minor Adverse	No	N/A
Operation	Ground Level Amenity - Seating	Top of Western Terrace (two seating locations at the south)	Strolling	Moderate adverse	Yes	N/A

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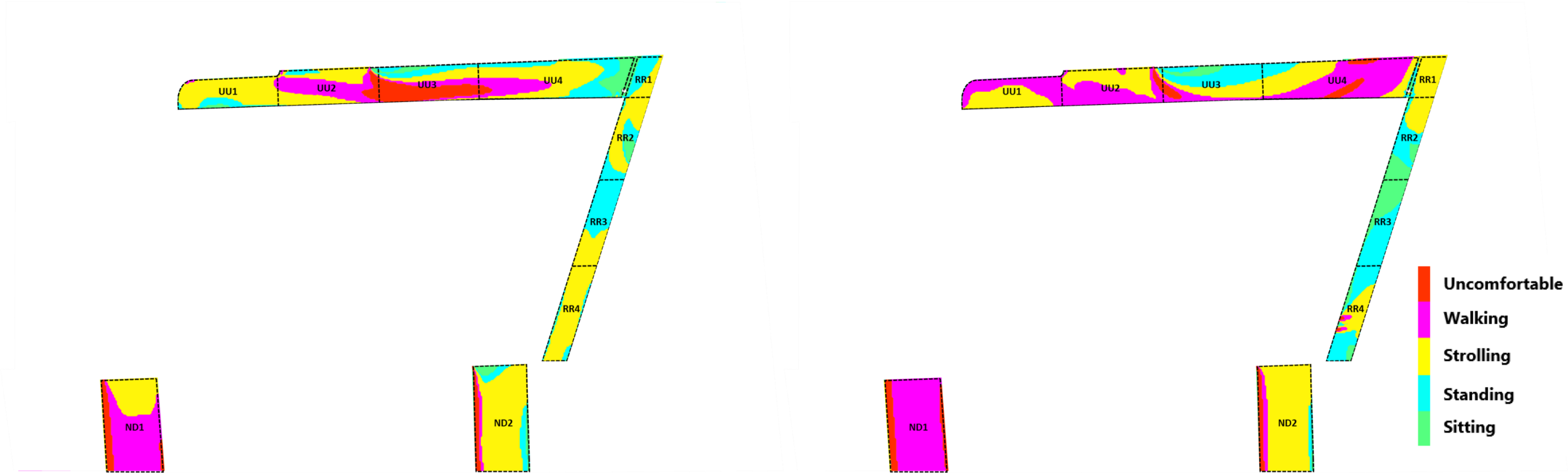


Figure 14.9c

Configuration 3, Windiest season. Conditions at the off-site areas – Configuration 3 (left) vs. Configuration 1 (baseline) (right).

Table 14.19b

Expected Wind Comfort Conditions – Off-site receptors

PHASE	RECEPTOR(S) AFFECTED	LOCATIONS	BASELINE CONDITIONS	MEASURED CONDITIONS	SIGNIFICANCE CRITERIA	MITIGATION PROPOSED?	FURTHER INFORMATION
<u>UU WwTW</u>							
Operation	Thoroughfares	UU1 (yellow area at south in Configuration 3 that is also yellow in Configuration 1)	Strolling	Strolling	Negligible	No	N/A
Operation	Thoroughfares	UU1 (blue area at south in Configuration 3 that is yellow in Configuration 1)	Strolling	Standing	Negligible	No	N/A
Operation	Thoroughfares	UU1 (green area at south in Configuration 3 that is yellow in Configuration 1)	Strolling	Sitting	Negligible	No	N/A
Operation	Thoroughfares	UU1 (yellow area across north, east and west in Configuration 3 that is pink in Configuration 1)	Walking	Strolling	Minor beneficial	No	N/A

WIND MICROCLIMATE

PHASE	RECEPTOR(S) AFFECTED	LOCATIONS	BASELINE CONDITIONS	MEASURED CONDITIONS	SIGNIFICANCE CRITERIA	MITIGATION PROPOSED?	FURTHER INFORMATION
Operation	Thoroughfares	UU1 (pink area at northwest and east in Configuration 3 that is pink in Configuration 1)	Walking	Walking	Negligible	No	N/A
Operation	Thoroughfares	UU2 (green area at northeast in Configuration 3 that is blue in Configuration 1)	Standing	Sitting	Negligible	No	N/A
Operation	Thoroughfares	UU2 (blue area at north in Configuration 3 that is yellow in Configuration 1)	Strolling	Standing	Negligible	No	N/A
Operation	Thoroughfares	UU2 (yellow area across north in Configuration 3 that is yellow in Configuration 1)	Strolling	Strolling	Negligible	No	N/A
Operation	Thoroughfares	UU2 (pink area across middle in Configuration 3 that is yellow in Configuration 1)	Strolling	Walking	Minor adverse	No	N/A
Operation	Thoroughfares	UU2 (red area at east in Configuration 3 that is yellow in Configuration 1)	Strolling	Uncomfortable	Moderate adverse	Yes	N/A
Operation	Thoroughfares	UU2 (red area at northeast in Configuration 3 that is yellow in Configuration 1)	Strolling	Uncomfortable	Moderate adverse	Yes	N/A
Operation	Thoroughfares	UU2 (yellow area at southwest in Configuration 3 that is pink in Configuration 1)	Walking	Strolling	Minor beneficial	No	N/A
Operation	Thoroughfares	UU2 (pink area across middle in Configuration 3 that is pink in Configuration 1)	Walking	Walking	Negligible	No	N/A
Operation	Thoroughfares	UU2 (red area at east in Configuration 3 that is pink in Configuration 1)	Walking	Uncomfortable	Moderate adverse	Yes	N/A
Operation	Thoroughfares	UU2 (yellow area at north in Configuration 3 that is pink in Configuration 1)	Walking	Strolling	Minor beneficial	No	N/A
Operation	Thoroughfares	UU2 (red area at east in Configuration 3 that is red in Configuration 1)	Uncomfortable	Uncomfortable	Negligible	No	N/A
Operation	Thoroughfares	UU3 (green area at north in Configuration 3 that is green in Configuration 1)	Sitting	Sitting	Negligible	No	N/A
Operation	Thoroughfares	UU3 (blue area at north in Configuration 3 that is green in Configuration 1)	Sitting	Standing	Negligible	No	N/A
Operation	Thoroughfares	UU3 (blue area towards north in Configuration 3 that is green in Configuration 1)	Sitting	Standing	Negligible	No	N/A
Operation	Thoroughfares	UU3 (green area at north in Configuration 3 that is blue in Configuration 1)	Standing	Sitting	Negligible	No	N/A
Operation	Thoroughfares	UU3 (blue area at north in Configuration 3 that is blue in Configuration 1)	Standing	Standing	Negligible	No	N/A
Operation	Thoroughfares	UU3 (blue area towards north in Configuration 3 that is blue in Configuration 1)	Standing	Standing	Negligible	No	N/A
Operation	Thoroughfares	UU3 (yellow area at middle in Configuration 3 that is blue in Configuration 1)	Standing	Strolling	Negligible	No	N/A
Operation	Thoroughfares	UU3 (pink area at middle in Configuration 3 that is blue in Configuration 1)	Standing	Walking	Minor adverse	No	N/A
Operation	Thoroughfares	UU3 (pink area at middle in Configuration 3 that is yellow in Configuration 1)	Strolling	Walking	Minor adverse	No	N/A
Operation	Thoroughfares	UU3 (red area at south in Configuration 3 that is yellow in Configuration 1)	Strolling	Uncomfortable	Moderate adverse	Yes	N/A
Operation	Thoroughfares	UU3 (yellow area at southeast in Configuration 3 that is pink in Configuration 1)	Walking	Strolling	Minor beneficial	No	N/A
Operation	Thoroughfares	UU3 (pink area at southeast in Configuration 3 that is pink in Configuration 1)	Walking	Walking	Negligible	No	N/A

WIND MICROCLIMATE

PHASE	RECEPTOR(S) AFFECTED	LOCATIONS	BASELINE CONDITIONS	MEASURED CONDITIONS	SIGNIFICANCE CRITERIA	MITIGATION PROPOSED?	FURTHER INFORMATION
Operation	Thoroughfares	UU3 (red area at southwest in Configuration 3 that is pink in Configuration 1)	Walking	Uncomfortable	Moderate adverse	Yes	N/A
Operation	Thoroughfares	UU3 (red area at southwest in Configuration 3 that is red in Configuration 1)	Uncomfortable	Uncomfortable	Negligible	No	N/A
Operation	Thoroughfares	UU4 (blue area at northwest in Configuration 3 that is blue in Configuration 1)	Standing	Standing	Negligible	No	N/A
Operation	Thoroughfares	UU4 (yellow area at west in Configuration 3 that is blue in Configuration 1)	Standing	Strolling	Negligible	No	N/A
Operation	Thoroughfares	UU4 (blue area at northwest in Configuration 3 that is yellow in Configuration 1)	Strolling	Standing	Negligible	No	N/A
Operation	Thoroughfares	UU4 (yellow area at west in Configuration 3 that is yellow in Configuration 1)	Strolling	Strolling	Negligible	No	N/A
Operation	Thoroughfares	UU4 (pink area at west in Configuration 3 that is yellow in Configuration 1)	Strolling	Walking	Minor adverse	No	N/A
Operation	Thoroughfares	UU4 (red area at southwest in Configuration 3 that is yellow in Configuration 1)	Strolling	Uncomfortable	Moderate adverse	Yes	N/A
Operation	Thoroughfares	UU4 (green area at southeast in Configuration 3 that is yellow in Configuration 1)	Strolling	Sitting	Negligible	No	N/A
Operation	Thoroughfares	UU4 (blue area at southeast in Configuration 3 that is yellow in Configuration 1)	Strolling	Standing	Negligible	No	N/A
Operation	Thoroughfares	UU4 (green area at east in Configuration 3 that is pink in Configuration 1)	Walking	Sitting	Moderate beneficial	No	N/A
Operation	Thoroughfares	UU4 (blue area at east in Configuration 3 that is pink in Configuration 1)	Walking	Standing	Minor beneficial	No	N/A
Operation	Thoroughfares	UU4 (yellow area across middle in Configuration 3 that is pink in Configuration 1)	Walking	Strolling	Minor beneficial	No	N/A
Operation	Thoroughfares	UU4 (pink area across middle in Configuration 3 that is pink in Configuration 1)	Walking	Walking	Negligible	No	N/A
Operation	Thoroughfares	UU4 (yellow area at north in Configuration 3 that is red in Configuration 1)	Uncomfortable	Strolling	Minor beneficial	No	N/A
Operation	Thoroughfares	UU4 (yellow area at middle in Configuration 3 that is red in Configuration 1)	Uncomfortable	Strolling	Minor beneficial	No	N/A
<u>Regent Road</u>							
Operation	Thoroughfares	RR1 (blue area at southwest in Configuration 3 that is blue in Configuration 1)	Standing	Standing	Negligible	No	N/A
Operation	Thoroughfares	RR1 (blue area at northwest in Configuration 3 that is yellow in Configuration 1)	Strolling	Standing	Negligible	No	N/A
Operation	Thoroughfares	RR1 (yellow area at southeast and east in Configuration 3 that is yellow in Configuration 1)	Strolling	Strolling	Negligible	No	N/A
Operation	Thoroughfares	RR2 (green area at middle in Configuration 3 that is green in Configuration 1)	Sitting	Sitting	Negligible	No	N/A
Operation	Thoroughfares	RR2 (blue area at south in Configuration 3 that is green in Configuration 1)	Sitting	Standing	Negligible	No	N/A
Operation	Thoroughfares	RR2 (yellow area at south in Configuration 3 that is green in Configuration 1)	Sitting	Strolling	Negligible	No	N/A

WIND MICROCLIMATE

PHASE	RECEPTOR(S) AFFECTED	LOCATIONS	BASELINE CONDITIONS	MEASURED CONDITIONS	SIGNIFICANCE CRITERIA	MITIGATION PROPOSED?	FURTHER INFORMATION
Operation	Thoroughfares	RR2 (blue area in middle in Configuration 3 that is blue in Configuration 1)	Standing	Standing	Negligible	No	N/A
Operation	Thoroughfares	RR2 (yellow area in middle in Configuration 3 that is blue in Configuration 1)	Standing	Strolling	Negligible	No	N/A
Operation	Thoroughfares	RR2 (blue area in middle in Configuration 3 that is yellow in Configuration 1)	Strolling	Standing	Negligible	No	N/A
Operation	Thoroughfares	RR2 (yellow area at north in Configuration 3 that is yellow in Configuration 1)	Strolling	Strolling	Negligible	No	N/A
Operation	Thoroughfares	RR3 (blue area at north in Configuration 3 that is green in Configuration 1)	Sitting	Standing	Negligible	No	N/A
Operation	Thoroughfares	RR3 (yellow area at south in Configuration 3 that is green in Configuration 1)	Sitting	Strolling	Negligible	No	N/A
Operation	Thoroughfares	RR3 (blue area at middle in Configuration 3 that is blue in Configuration 1)	Standing	Standing	Negligible	No	N/A
Operation	Thoroughfares	RR3 (yellow area at south in Configuration 3 that is blue in Configuration 1)	Standing	Strolling	Negligible	No	N/A
Operation	Thoroughfares	RR4 (blue area at west in Configuration 3 that is green in Configuration 1)	Sitting	Standing	Negligible	No	N/A
Operation	Thoroughfares	RR4 (yellow area at west in Configuration 3 that is green in Configuration 1)	Sitting	Strolling	Negligible	No	N/A
Operation	Thoroughfares	RR4 (blue area at southeast in Configuration 3 that is green in Configuration 1)	Sitting	Standing	Negligible	No	N/A
Operation	Thoroughfares	RR4 (yellow area at southeast in Configuration 3 that is green in Configuration 1)	Sitting	Strolling	Negligible	No	N/A
Operation	Thoroughfares	RR4 (yellow area at north in Configuration 3 that is blue in Configuration 1)	Standing	Strolling	Negligible	No	N/A
Operation	Thoroughfares	RR4 (blue area at southwest in Configuration 3 that is blue in Configuration 1)	Standing	Standing	Negligible	No	N/A
Operation	Thoroughfares	RR4 (yellow area at south in Configuration 3 that is blue in Configuration 1)	Standing	Strolling	Negligible	No	N/A
Operation	Thoroughfares	RR4 (blue area in east in Configuration 3 that is yellow in Configuration 1)	Strolling	Standing	Negligible	No	N/A
Operation	Thoroughfares	RR4 (yellow area in middle in Configuration 3 that is yellow in Configuration 1)	Strolling	Strolling	Negligible	No	N/A
Operation	Thoroughfares	RR4 (blue area at west in Configuration 3 that is pink in Configuration 1)	Walking	Standing	Minor beneficial	No	N/A
Operation	Thoroughfares	RR4 (yellow area in middle in Configuration 3 that is pink in Configuration 1)	Walking	Strolling	Minor beneficial	No	N/A
Operation	Thoroughfares	RR4 (blue area at west in Configuration 3 that is red in Configuration 1)	Uncomfortable	Standing	Minor beneficial	No	N/A
Operation	Thoroughfares	RR4 (yellow area at west in Configuration 3 that is red in Configuration 1)	Uncomfortable	Strolling	Minor beneficial	No	N/A
Nelson Dock							
Operation	Thoroughfares	ND1 (yellow area at north in Configuration 3 that is pink in Configuration 1)	Walking	Strolling	Minor beneficial	No	N/A
Operation	Thoroughfares	ND1 (pink area in middle in Configuration 3 that is pink in Configuration 1)	Walking	Walking	Negligible	No	N/A
Operation	Thoroughfares	ND1 (pink area at northwest in Configuration 3 that is red in Configuration 1)	Uncomfortable	Walking	Minor adverse	No	N/A
Operation	Thoroughfares	ND1 (red area at west in Configuration 3 that is red in Configuration 1)	Uncomfortable	Uncomfortable	Negligible	No	N/A

WIND MICROCLIMATE

PHASE	RECEPTOR(S) AFFECTED	LOCATIONS	BASELINE CONDITIONS	MEASURED CONDITIONS	SIGNIFICANCE CRITERIA	MITIGATION PROPOSED?	FURTHER INFORMATION
Operation	Thoroughfares	ND1 (pink area at east in Configuration 3 that is red in Configuration 1)	Uncomfortable	Walking	Negligible	No	N/A
Operation	Thoroughfares	ND1 (red area at east in Configuration 3 that is red in Configuration 1)	Uncomfortable	Uncomfortable	Negligible	No	N/A
Operation	Thoroughfares	ND2 (green area at east in Configuration 3 that is blue in Configuration 1)	Standing	Sitting	Negligible	No	N/A
Operation	Thoroughfares	ND2 (blue area at east in Configuration 3 that is blue in Configuration 1)	Standing	Standing	Negligible	No	N/A
Operation	Thoroughfares	ND2 (green area at north in Configuration 3 that is yellow in Configuration 1)	Strolling	Sitting	Negligible	No	N/A
Operation	Thoroughfares	ND2 (blue area at north and east in Configuration 3 that is yellow in Configuration 1)	Strolling	Standing	Negligible	No	N/A
Operation	Thoroughfares	ND2 (yellow area in middle in Configuration 3 that is yellow in Configuration 1)	Strolling	Strolling	Negligible	No	N/A
Operation	Thoroughfares	ND2 (yellow area at west in Configuration 3 that is pink in Configuration 1)	Walking	Strolling	Minor beneficial	No	N/A
Operation	Thoroughfares	ND2 (pink area at west in Configuration 3 that is pink in Configuration 1)	Walking	Walking	Negligible	No	N/A
Operation	Thoroughfares	ND2 (pink area at northwest in Configuration 3 that is red in Configuration 1)	Uncomfortable	Walking	Minor adverse	No	N/A
Operation	Thoroughfares	ND2 (red area at west in Configuration 3 that is red in Configuration 1)	Uncomfortable	Uncomfortable	Negligible	No	N/A
<u>Inaccessible Areas</u>							
Operation	Inaccessible	Area in middle of Nelson Dock (pink area in Configuration 3 that is pink in Configuration 1)	Walking	Walking	Negligible	No	N/A
Operation	Inaccessible	Area in middle of Nelson Dock (red area in Configuration 3 that is pink in Configuration 1)	Walking	Uncomfortable	Negligible	No	N/A

WIND MICROCLIMATE

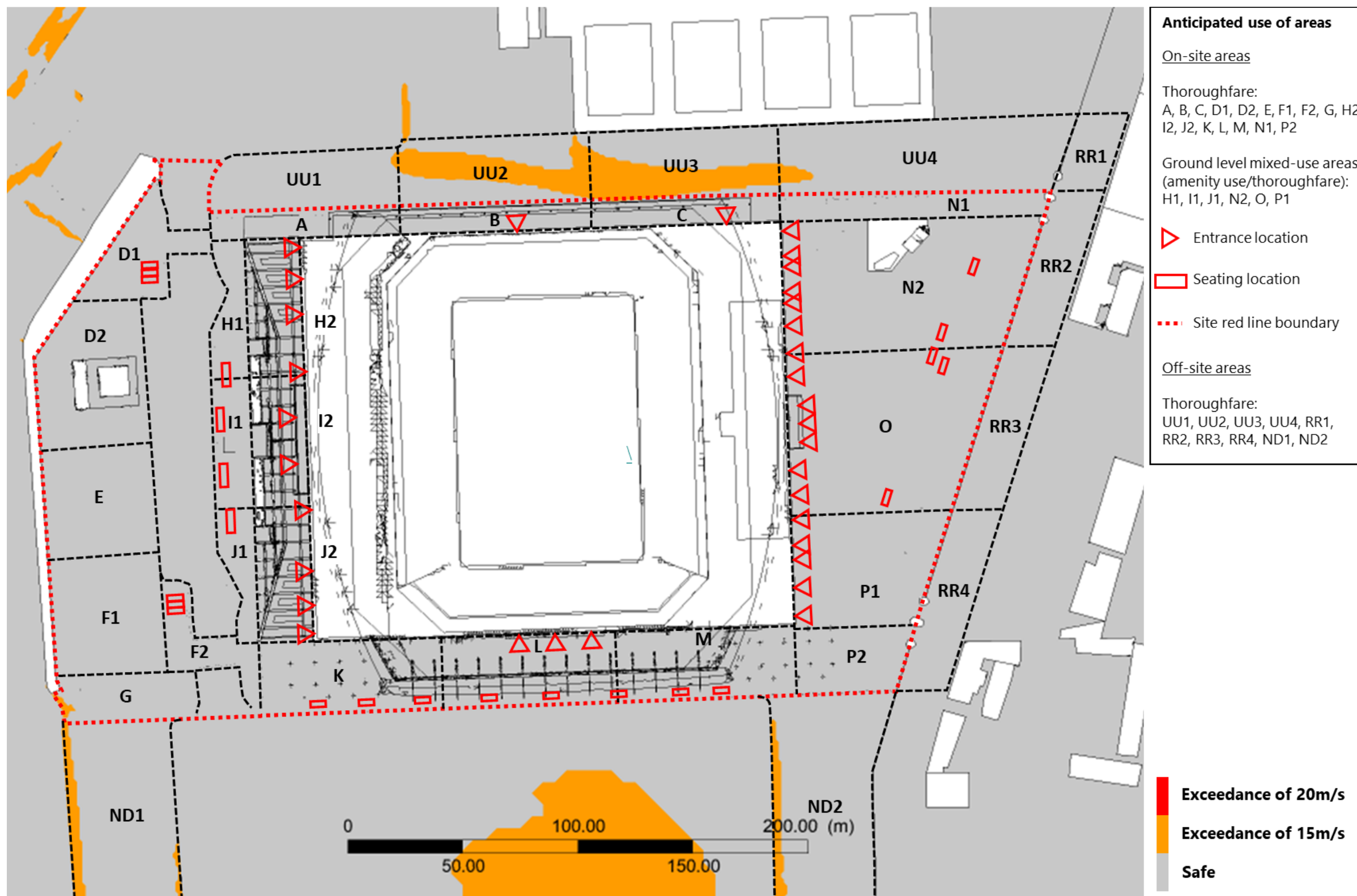


Figure 14.11a

Configuration 3, Pedestrian Safety Annual. Conditions at ground level, and underneath the Western Terrace

WIND MICROCLIMATE

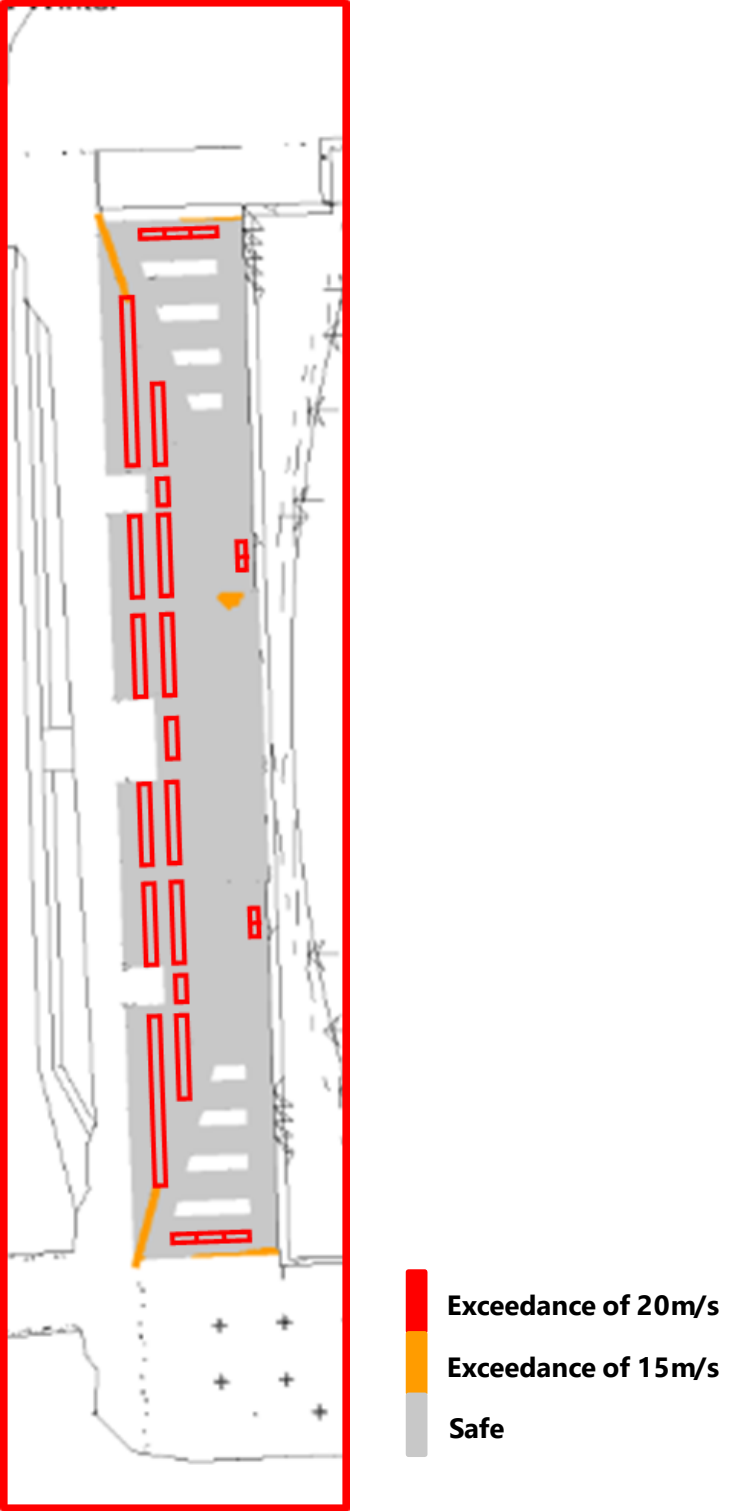


Figure 14.11b
Configuration 3, Pedestrian Safety Annual. Conditions at the top of the Western Terrace

WIND MICROCLIMATE

Table 14.20
Expected Wind Safety Conditions

AREA	SAFETY EXCEEDANCE WITHIN REGION	REQUIRES MITIGATION?
On-Site Receptors		
A	Pass	No
B	Pass	No
C	Pass	No
D1	Pass	No
D2	Pass	No
E	Pass	No
F1	Pass	No
F2	Pass	No
G	S15	Yes
H1	Pass	No
H2	Pass	No
I1	Pass	No
I2	Pass	No
J1	Pass	No
J2	Pass	No
K	Pass	No
L	Pass	No
M	Pass	No
N1	Pass	No
N2	Pass	No
O	Pass	No
P1	Pass	No
P2	Pass	No
Top of Western Terrace	S15	Yes
Off-Site Receptors		
UU1	S15	Yes
UU2	S15	Yes
UU3	S15	Yes
UU4	S15	Yes
RR1	Pass	No
RR2	Pass	No

WIND MICROCLIMATE

AREA	SAFETY EXCEEDANCE WITHIN REGION	REQUIRES MITIGATION?
RR3	Pass	No
RR4	Pass	No
ND1	S15	Yes
ND2	S15	Yes
Area in middle of Nelson Dock	S15	No

WIND MICROCLIMATE

Table 14.21
Description of Wind Conditions around proposed development

LOCATIONS	DESCRIPTION
On-Site Receptors	
Thoroughfares	<p>All thoroughfare locations on-site would have walking, strolling use conditions or calmer making them suitable for the intended use and requiring no further mitigation. This represents a negligible to moderate beneficial effect (not significant). Further discussion is provided below:</p> <ul style="list-style-type: none">■ The covered area under the Western Terrace shows conditions for strolling to standing use even during the windiest season.■ The ground level public realm area in front of the Western Terrace adjacent to the Water Channel shows conditions suitable for sitting and standing in summer, making it suitable for its intended use. Some small, localised areas more suitable for strolling are shown at the very north and south of this area. This is a minor adverse effect and the area will still be suitable for the activity.■ The Northern Concourse (between the stadium façade and the United Utilities land to the north) shows wind speeds suitable for a range of pedestrian activities, ranging from sitting to strolling during summer and the windiest season. A small area to the very west of the Northern Concourse is shown to be suitable for walking during the windiest season. However, this area is beyond the wind mitigation gate proposed from the northernmost extent of the west terrace to the boundary with the United Utilities site to the north and would therefore not be accessible to the general public during high-speed winds. Access beyond the proposed gate would be strictly controlled and managed by the club for those parking or working on the west quay.■ The Southern Concourse shows wind speeds suitable for strolling in the windiest season with no safety issues in this area. However, there are a few small areas around the southeast corner; located in between the trees and screens, where conditions are suitable for walking, this is a minor adverse effect and the area will still be suitable for the activity, however it will feel windy at times.■ The Western Quayside to the west of the proposed water channel shows conditions suitable for strolling in the windiest season but much lower wind speeds mostly suitable for sitting or standing in summer. There is a small area at the southwest shown to be uncomfortable for pedestrian use in the winter, however this area is very small and near the edge of the River Mersey where pedestrians would expect windier conditions. Access beyond the proposed gate would be strictly controlled and managed by the club for those parking or working on the west quay..■ The Fan Zone Plaza to the east of the proposed stadium shows conditions suitable for sitting and standing in the windiest season, with some very small areas suitable for strolling or walking. The area is still suitable for the activity however it will feel windy at times, particularly during the winter. Wind speeds are much lower during the summer, with conditions suitable for sitting, and some very small localised areas suitable for standing or walking. This is a minor adverse effect and the area will still be suitable for the activity.■ Conditions at the top of the Western Terrace will be suitable for sitting and standing in the summer, with some small areas suitable for strolling (a minor adverse effect). In winter, conditions are likely to be similar, with some small areas to the north and south feeling windier at times. Minor areas of unsafe conditions are found in this area. However, this area will be closed to pedestrians during high-speed winds. The doors from the Level One hospitality areas within the west stand which open out on to the terrace would not open during adverse conditions.■ There would also be no instances of strong winds exceeding the safety threshold, with the exception of the small areas noted at the top of the Western Terrace.
Entrances	<p>The new entrances at ground level (level 00) leading into the space underneath the Western Terrace are suitable for the location of a door, no safety issues are found. Access doors from the L01 hospitality areas at the top of the Western Terrace leading to the enclosed podium areas are likely to be unsuitable during high wind events, these doors will be in use only when the weather permits. The turnstiles located along the south elevation are suitable and no safety issues were found. The north elevation shows at the northeast corner turnstiles where conditions are suitable for strolling, a minor adverse effect. The west elevation shows turnstiles (at the southwest corner of the building under the covered area) where conditions are suitable for strolling, a minor adverse effect. All turnstiles and entrances along the east elevation are suitable for winter and summer and no safety issues were found.</p> <p>All other entrance locations on-site would have suitable wind conditions for their intended use. These would represent negligible to minor beneficial effects (not significant). There would be no instances of strong winds exceeding the safety threshold at any entrance locations on-site in Configuration 3.</p>
Ground Level and Terrace Level Amenity Areas – Mixed Use	<p>There would be two dedicated ground level amenity areas with the proposed development in place; an area to the west of the stadium (comprising the top of the west terrace, the area around the water channel in front of the west terrace and the west quay) and the Fan Zone Plaza to the east of the stadium. Both areas have locations that would require suitable conditions for a mixed-use amenity space.</p> <p>The east of the stadium presents conditions suitable for mixed-use amenity spaces in the Fan Zone Plaza. Some very small localised areas are more suitable for strolling, which represents a minor adverse effect. As such, the vast majority of these locations would be suitable for the intended use and these would represent a negligible effect (not significant). All the mixed-use amenity locations in the Fan Zone Plaza to the east of the stadium would also have safe wind conditions throughout the year.</p> <p>To the west of the stadium, the Western Terrace presents four zones that cover a large area representing mixed-use amenity locations, the water edge at the bottom of the stairs, the stairs, the top of the Western Area (L01) and the Quay Side.</p> <p>At the bottom of the stairs along the water edge (water channel), there are two locations to the southwest and northwest, where conditions are unsuitable and they will be uncomfortable during winter. The steps leading to the top of the Western Terrace will have strolling use wind conditions during the summer and winter season. These wind conditions would be one category windier than the required wind conditions of a mixture of sitting and standing use conditions for a large amenity space such as this. As such, this area would require mitigation measures to ensure comfortable wind conditions for pedestrians. These would represent minor adverse effects (not significant). The remaining spaces would have wind conditions suitable for standing use during the summer season making them suitable for the intended use and representing negligible effects (not significant). There would be locations within the amenity area to the west of the stadium (top of) Western Terrace with strong winds exceeding the safety threshold. As such this area would require mitigation measures to ensure safe wind conditions for pedestrians. These areas are at the top and along the steps and leading into the top of the Western Terrace areas. The Quay area present conditions suitable for strolling in winter, wind conditions increase to walking towards the south section of the Quay.</p>
Ground Level Amenity Areas - Seating	<p>Almost all seating bench locations throughout the ground level public realm area are seen to have wind conditions suitable for sitting in the summer, making them suitable for their intended activity. One bench location in the Western Terrace area, adjacent to the Water Channel, and two locations in the Western Quayside, have conditions suitable for standing, which is a minor adverse effect. However, being adjacent to the water, pedestrians would be more likely to expect windier conditions in this area.</p> <p>In the area at the top of the Western Terrace, almost all bench locations are shown to have conditions suitable for sitting. One location in the south of this area and one location on the steps have conditions more suitable for standing, a minor adverse effect. Two locations at the south of this area have conditions more suitable for strolling, which is a moderate adverse effect. However, this area is closed to pedestrians during high-speed winds (as per the management measures associated with closure of the gates across the three proposed openings in the terrace and the two gates at either end of the west terrace structure to prevent access to the top of the structure, the public realm areas around the water channel in front of the structure and the west quayside).</p>

WIND MICROCLIMATE

All of the seating locations would have safe wind conditions throughout the year.

Inaccessible locations	As pedestrians would be unable to access the inaccessible areas on-site, wind conditions would be considered acceptable regardless of the measured conditions.
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Off-site Receptors

UU WwTW	
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Thoroughfares	<p>In this area, conditions are broadly similar to the baseline, in the windiest season. In area UU1, a large area suitable for walking in the baseline has been made smaller in Configuration 3. Conditions in area UU2 are similar to the baseline. In UU3, the area that is uncomfortable for all pedestrian activities has been made larger in Configuration 3. In area UU4, the area suitable for walking has been made smaller. As conditions have been made worse in some areas and better in others, conditions are considered broadly similar to the baseline overall, when considering the UU WwTW area as a whole.</p> <p>The areas of safety exceedance are moved around slightly within this area, but overall, the conditions are similar to the baseline condition.</p> <p>Overall, the wind conditions of the area off-site to the north do not materially change from those recorded for the baseline scenario.</p>
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Regent Road	
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Thoroughfares	<p>There is a slight increase along Regent Road from standing to strolling in the windiest season in area RR3 when compared to the baseline condition. However, this area would have suitable wind conditions for the intended use with the proposed development in place, representing a minor adverse effect (not significant). Wind speeds reduce towards the north of Regent Road, in area RR1, bringing conditions from strolling to standing, a negligible effect (not significant). In area RR2, conditions are similar to the baseline, representing a negligible effect. In area RR4, some areas suitable for standing in the baseline are suitable for strolling in Configuration 3, however some small areas that are uncomfortable for all pedestrian activities in the baseline are now suitable for strolling in Configuration 3. As some areas have increased in wind speed and some have decreased, overall, the wind conditions in this area do not materially change from those recorded for the baseline scenario. There are two small areas of safety exceedance towards the south of Regent Road in the baseline, which are removed in Configuration 3.</p>
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Nelson Dock	
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Thoroughfares	<p>Conditions at Nelson Dock in Configuration 3 are less windy when compared to those of the baseline. Area ND1 now has an area suitable for strolling during the windiest season, representing a minor beneficial to negligible effect (not significant), and making it more suitable for the intended use. Conditions in area ND2 are similar to those in the baseline, with a slight reduction in wind speed at the north of this area, resulting in conditions suitable for standing/sitting, representing a minor beneficial to negligible effect (not significant). The areas of safety exceedance in area ND2 are similar to those in the baseline, however in area ND1, the area of safety exceedance has reduced slightly in Configuration 3.</p>
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Overall, with the proposed development and associated design interventions in place, the wind microclimate around the site is greatly improved from the baseline scenario with many areas of the proposed development being made calmer through the introduction of the design interventions. There would however be locations in and around the proposed development that would still require mitigation measures, which are set out later in this chapter.

14.6.2 Proposed Development + Liverpool Waters (Nelson Dock) Scenario (Configuration 4)

The design interventions identified above that would be required to mitigate unsafe and unsuitable wind conditions around the proposed development in the context of the existing scenario were carried forward and tested with the approved development parameters for Nelson Dock (as per the latest approved Liverpool Waters Masterplan (LPA ref. 19NM/1121 as non-material amendment to original outline permission ref. 10O/2424) in situ).

The results of the tests undertaken for this configuration, are graphically shown in Figure 14.12 for the windiest and Figure 14.13 for the summer season respectively. The results for the annual safety exceedances are shown in Figure 14.14. The results are provided in full in Tables 14.22, 14.23 and 14.24 below.

WIND MICROCLIMATE

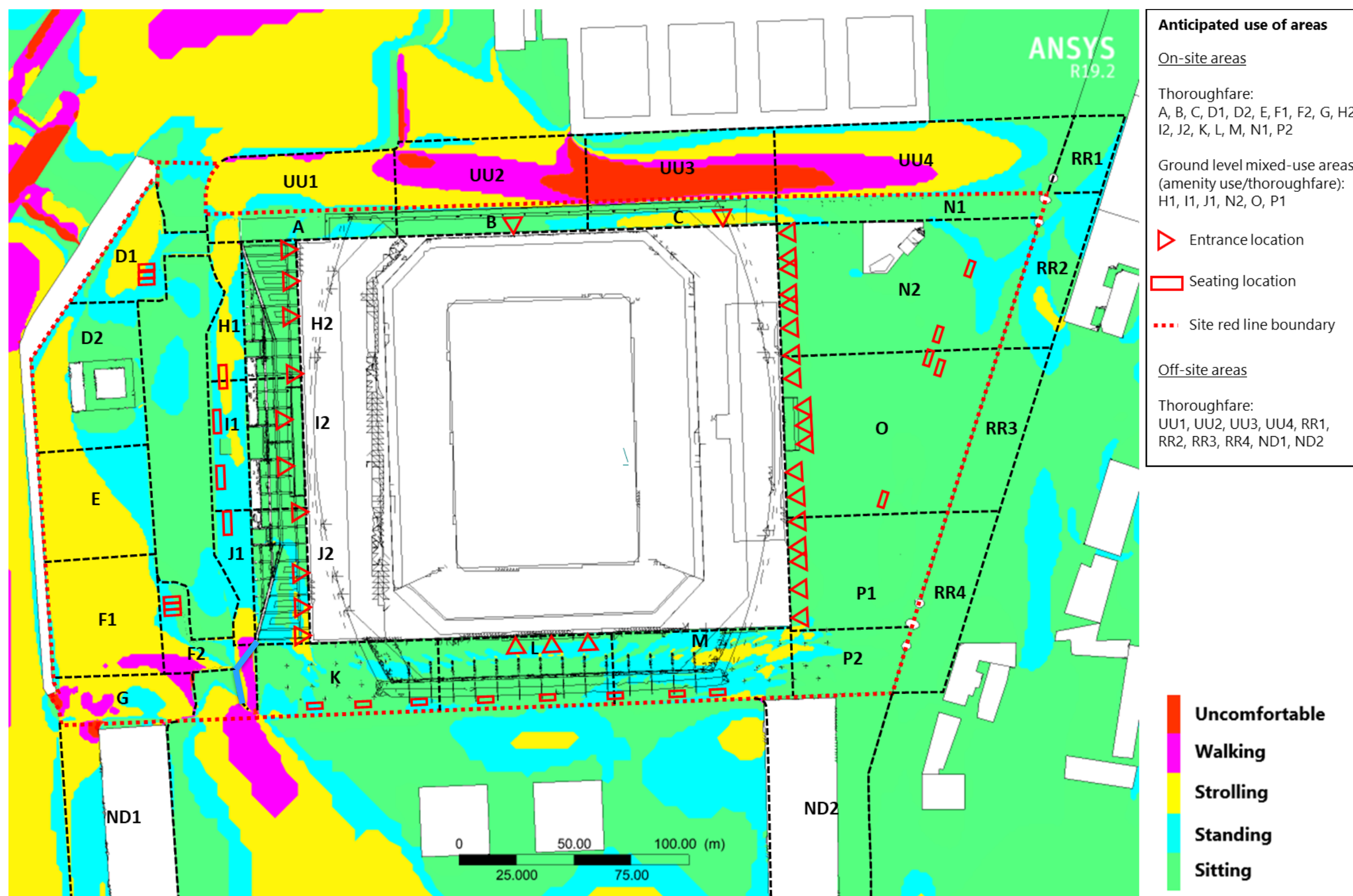


Figure 14.12a Configuration 4, Windiest season. Conditions at ground level, and underneath the Western Terrace

WIND MICROCLIMATE

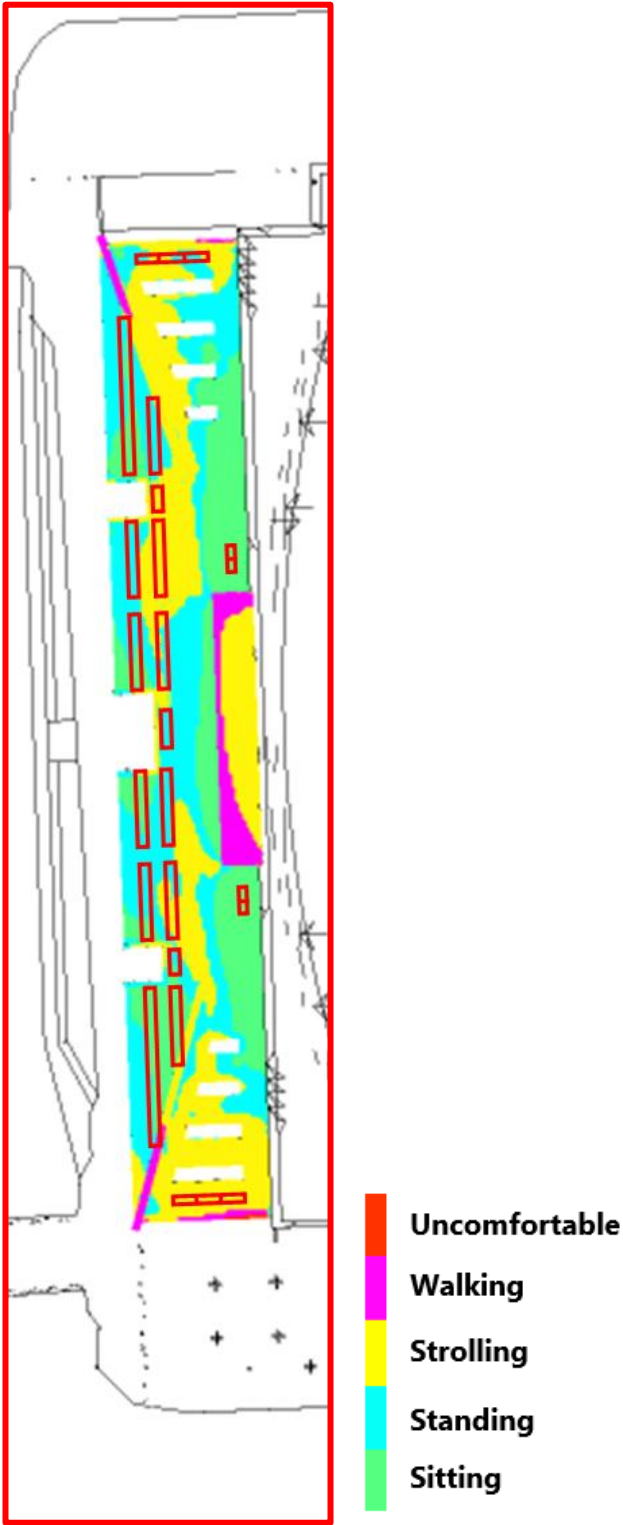


Figure 14.12b Configuration 4, Windiest season. Conditions at the top of the Western Terrace

WIND MICROCLIMATE

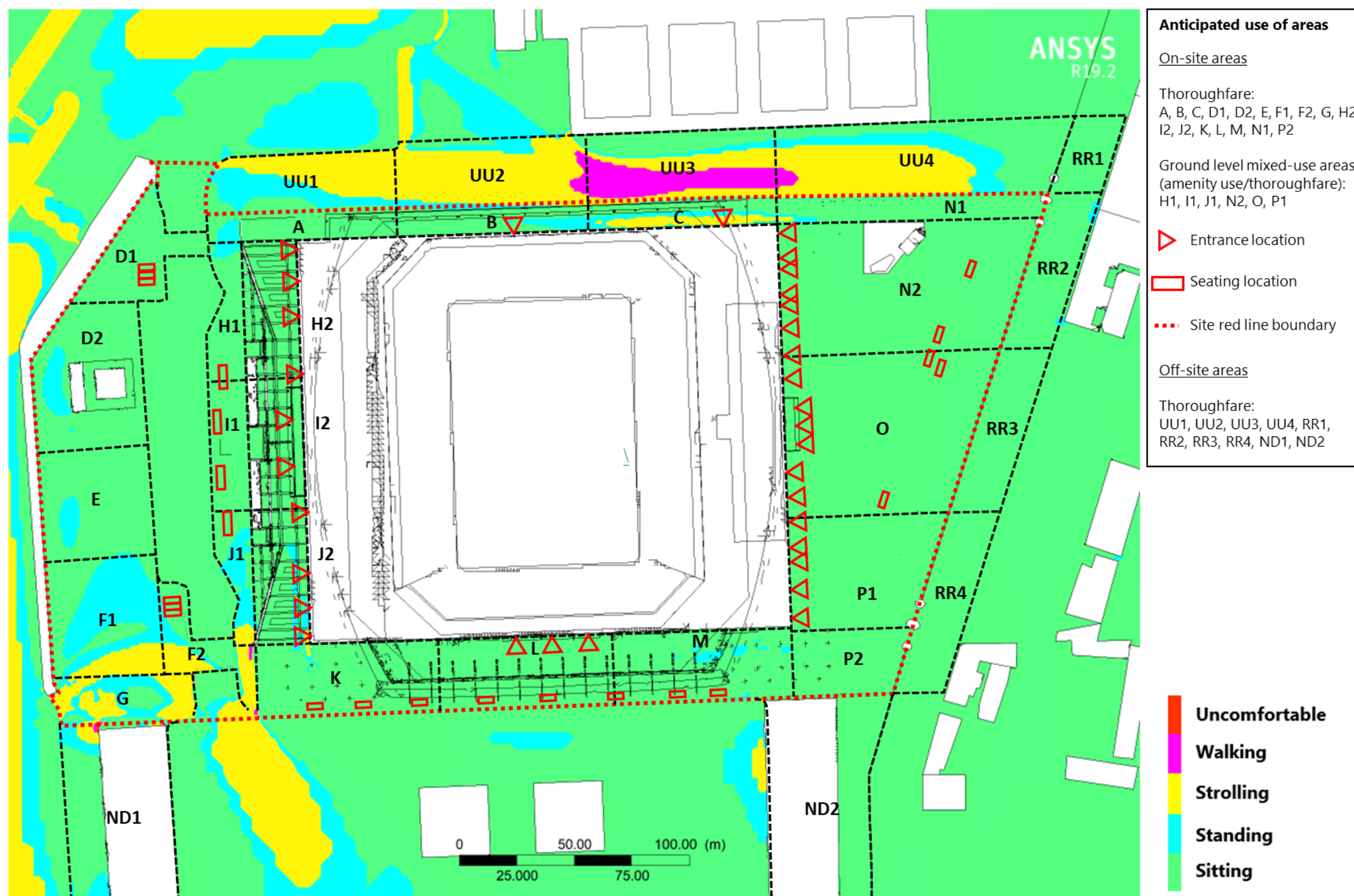


Figure 14.13a

Configuration 4, Summer season. Conditions at ground level, and underneath the Western Terrace

WIND MICROCLIMATE



Figure 14.13b

Configuration 4, Summer season. Conditioned at the top of the Western Terrace

WIND MICROCLIMATE

Table 14.22a
Expected Wind Comfort Conditions

PHASE	RECEPTOR(S) AFFECTED	AREAS	MEASURED CONDITIONS	SIGNIFICANCE CRITERIA	MITIGATION PROPOSED?	FURTHER INFORMATION
On-site Receptors						
Operation	Thoroughfare	A (green areas in middle and at east), B (green covers most of the area), C (green area at north), D1 (green areas at east and west), D2 (green area in middle), F2 (green area at north), G (green area at south), H2 (green covers all area), I2 (green covers all area), J2 (green covers most of the area), K (green covers most of the area), L (green covers most of the area), M (green areas at north and south), N1(green covers most of the area), P2 (green covers most of the area)	Sitting	Moderate Beneficial	No	N/A
Operation	Thoroughfare	A (blue area in at east and west), B (blue area at southeast), C (blue area at west), D1 (blue areas at west and east), D2 (blue areas at north and south), E (blue area at east), F1 (blue area at east), F2 (blue area at west), G (blue area in middle), J2 (blue area at south), K (blue areas at east and west), L (blue areas in middle), M (blue area in middle), N1 (blue area at southwest), P2 (blue area at northwest)	Standing	Minor Beneficial	No	N/A
Operation	Thoroughfare	A (yellow area at west), C (yellow area at south), D1 (yellow area in middle), D2 (yellow area at west), E (yellow covers most of the area), F1 (yellow covers most of the area), F2 (yellow areas at southwest and east), G (yellow covers most of the area), J2 (yellow area at south), K (yellow areas at north and south), M (yellow area at east), N1 (yellow area at southwest), P2 (yellow area at northwest)	Strolling	Negligible	No	N/A
Operation	Thoroughfare	F1 (pink area at southeast), F2 (pink area at southwest and east), G (pink areas at west and east)	Walking	Minor Adverse	No	N/A
Operation	Thoroughfare	F2 (red area at east), G (red area at east)	Uncomfortable	Moderate adverse	Yes	N/A
Operation	Entrances	B, H2, I2, J2 (northern two entrances), L, N2, O, P1	Sitting	Minor Beneficial	No	N/A
Operation	Entrances	J2 (second entrance from south)	Standing	Negligible	No	N/A
Operation	Entrances	C, J2 (southern entrance)	Strolling	Minor Adverse	No	N/A
Operation	Ground Level Amenity Areas – Mixed Use	H1 (green covers most of the area), I1 (green covers all area), J1 (green area at north), N2 (green covers all area), O (green covers all area), P1 (green covers all area), Top of Western Terrace (green covers most of the area)	Sitting	Negligible	No	N/A
Operation	Ground Level Amenity Areas – Mixed Use	H1 (blue area at north), J1 (blue covers most of the area), Top of Western Terrace (blue areas at north, middle and south)	Standing	Negligible	No	N/A
Operation	Ground Level Amenity Areas – Mixed Use	J1 (yellow area at south), Top of Western Terrace (yellow areas in middle, north and south)	Strolling	Minor Adverse	No	N/A
Operation	Ground Level Amenity - Seating	D1, F2, H1, I1, J1, K, L, M, N2, O, Top of Western Terrace (all seating locations except two on the steps at the west and three at the south)	Sitting	Negligible	No	N/A
Operation	Ground Level Amenity - Seating	Top of Western Terrace (two on the steps at the west and one at the south)	Standing	Minor Adverse	No	N/A
Operation	Ground Level Amenity - Seating	Top of Western Terrace (two southern seating locations)	Strolling	Moderate Adverse	Yes	N/A

WIND MICROCLIMATE

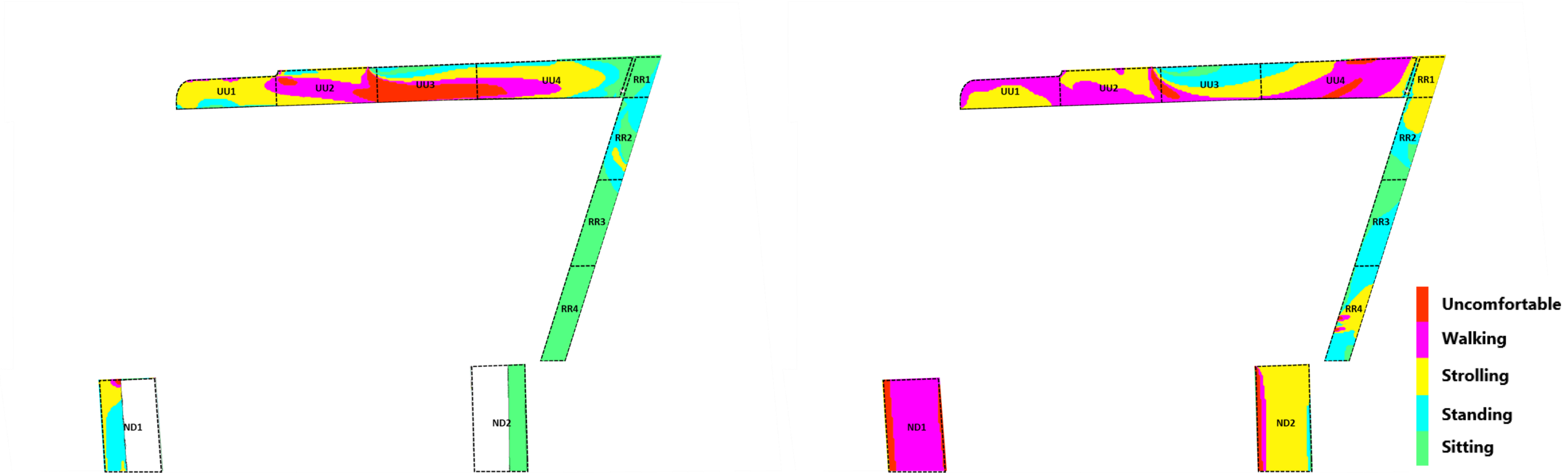


Figure 14.12c
Configuration 4, Windiest season. Conditions at the off-site areas – Configuration 4 (left) vs. Configuration 1 (Baseline) (right).

Table 14.22b
Expected Wind Comfort Conditions – Off-site receptors

PHASE	RECEPTOR(S) AFFECTED	LOCATIONS	BASELINE CONDITIONS	MEASURED CONDITIONS	SIGNIFICANCE CRITERIA	MITIGATION PROPOSED?	FURTHER INFORMATION
UU WwTW							
Operation	Thoroughfares	UU1 (yellow area in middle in Configuration 4 that is yellow in Configuration 1)	Strolling	Strolling	Negligible	No	N/A
Operation	Thoroughfares	UU1 (blue area at south in Configuration 4 that is yellow in Configuration 1)	Strolling	Standing	Negligible	No	N/A
Operation	Thoroughfares	UU1 (green area at south in Configuration 4 that is yellow in Configuration 1)	Strolling	Sitting	Negligible	No	N/A
Operation	Thoroughfares	UU1 (pink area at north and east in Configuration 4 that is pink in Configuration 1)	Walking	Walking	Negligible	No	N/A
Operation	Thoroughfares	UU2 (green area at northeast in Configuration 4 that is blue in Configuration 1)	Standing	Sitting	Negligible	No	N/A
Operation	Thoroughfares	UU2 (blue area at north in Configuration 4 that is yellow in Configuration 1)	Strolling	Standing	Negligible	No	N/A
Operation	Thoroughfares	UU2 (yellow area at north in Configuration 4 that is yellow in Configuration 1)	Strolling	Strolling	Negligible	No	N/A

WIND MICROCLIMATE

PHASE	RECEPTOR(S) AFFECTED	LOCATIONS	BASELINE CONDITIONS	MEASURED CONDITIONS	SIGNIFICANCE CRITERIA	MITIGATION PROPOSED?	FURTHER INFORMATION
Operation	Thoroughfares	UU2 (pink area across middle in Configuration 4 that is yellow in Configuration 1)	Strolling	Walking	Minor adverse	No	N/A
Operation	Thoroughfares	UU2 (red area at west in Configuration 4 that is yellow in Configuration 1)	Strolling	Uncomfortable	Moderate adverse	Yes	N/A
Operation	Thoroughfares	UU2 (yellow area at northeast in Configuration 4 that is yellow in Configuration 1)	Strolling	Strolling	Negligible	No	N/A
Operation	Thoroughfares	UU2 (red area at northeast in Configuration 4 that is yellow in Configuration 1)	Strolling	Uncomfortable	Moderate adverse	Yes	N/A
Operation	Thoroughfares	UU2 (pink area in middle in Configuration 4 that is pink in Configuration 1)	Walking	Walking	Negligible	No	N/A
Operation	Thoroughfares	UU2 (red area at west in Configuration 4 that is pink in Configuration 1)	Walking	Uncomfortable	Moderate adverse	Yes	N/A
Operation	Thoroughfares	UU2 (red area at east in Configuration 4 that is red in Configuration 1)	Uncomfortable	Uncomfortable	Negligible	No	N/A
Operation	Thoroughfares	UU3 (green area at north in Configuration 4 that is green in Configuration 1)	Sitting	Sitting	Negligible	No	N/A
Operation	Thoroughfares	UU3 (blue area at north in Configuration 4 that is green in Configuration 1)	Sitting	Standing	Negligible	No	N/A
Operation	Thoroughfares	UU3 (green area at north in Configuration 4 that is blue in Configuration 1)	Standing	Sitting	Negligible	No	N/A
Operation	Thoroughfares	UU3 (blue area at north in Configuration 4 that is blue in Configuration 1)	Standing	Standing	Negligible	No	N/A
Operation	Thoroughfares	UU3 (blue area towards north in Configuration 4 that is blue in Configuration 1)	Standing	Standing	Negligible	No	N/A
Operation	Thoroughfares	UU3 (yellow area at middle in Configuration 4 that is blue in Configuration 1)	Standing	Strolling	Negligible	No	N/A
Operation	Thoroughfares	UU3 (pink area at middle in Configuration 4 that is blue in Configuration 1)	Standing	Walking	Minor adverse	No	N/A
Operation	Thoroughfares	UU3 (pink area at middle in Configuration 4 that is yellow in Configuration 1)	Strolling	Walking	Minor adverse	No	N/A
Operation	Thoroughfares	UU3 (red area at south in Configuration 4 that is yellow in Configuration 1)	Strolling	Uncomfortable	Moderate adverse	Yes	N/A
Operation	Thoroughfares	UU3 (pink area at southeast in Configuration 4 that is pink in Configuration 1)	Walking	Walking	Negligible	No	N/A
Operation	Thoroughfares	UU3 (red area at southwest in Configuration 4 that is pink in Configuration 1)	Walking	Uncomfortable	Moderate adverse	Yes	N/A
Operation	Thoroughfares	UU3 (red area at southwest in Configuration 4 that is red in Configuration 1)	Uncomfortable	Uncomfortable	Negligible	No	N/A
Operation	Thoroughfares	UU4 (blue area at northwest in Configuration 4 that is blue in Configuration 1)	Standing	Standing	Negligible	No	N/A
Operation	Thoroughfares	UU4 (yellow area at northwest in Configuration 4 that is blue in Configuration 1)	Standing	Strolling	Negligible	No	N/A
Operation	Thoroughfares	UU4 (blue area at north in Configuration 4 that is yellow in Configuration 1)	Strolling	Standing	Negligible	No	N/A
Operation	Thoroughfares	UU4 (yellow area towards north in Configuration 4 that is yellow in Configuration 1)	Strolling	Strolling	Negligible	No	N/A
Operation	Thoroughfares	UU4 (pink area at middle in Configuration 4 that is yellow in Configuration 1)	Strolling	Walking	Minor adverse	No	N/A
Operation	Thoroughfares	UU4 (red area at southwest in Configuration 4 that is yellow in Configuration 1)	Strolling	Uncomfortable	Moderate adverse	Yes	N/A
Operation	Thoroughfares	UU4 (green area at east in Configuration 4 that is yellow in Configuration 1)	Strolling	Sitting	Negligible	No	N/A
Operation	Thoroughfares	UU4 (blue area at east in Configuration 4 that is yellow in Configuration 1)	Strolling	Standing	Negligible	No	N/A
Operation	Thoroughfares	UU4 (pink area across middle in Configuration 4 that is pink in Configuration 1)	Walking	Walking	Negligible	No	N/A
Operation	Thoroughfares	UU4 (red area at southwest in Configuration 4 that is pink in Configuration 1)	Walking	Uncomfortable	Moderate adverse	Yes	N/A
Operation	Thoroughfares	UU4 (pink area at middle in Configuration 4 that is red in Configuration 1)	Uncomfortable	Walking	Minor adverse	No	N/A
<u>Regent Road</u>							
Operation	Thoroughfares	RR1 (green area at southwest in Configuration 4 that is blue in Configuration 1)	Standing	Sitting	Negligible	No	N/A

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PHASE	RECEPTOR(S) AFFECTED	LOCATIONS	BASELINE CONDITIONS	MEASURED CONDITIONS	SIGNIFICANCE CRITERIA	MITIGATION PROPOSED?	FURTHER INFORMATION
Operation	Thoroughfares	RR1 (green area at north, west, middle and south in Configuration 4 that is yellow in Configuration 1)	Strolling	Sitting	Negligible	No	N/A
Operation	Thoroughfares	RR1 (blue area at southeast in Configuration 4 that is yellow in Configuration 1)	Strolling	Standing	Negligible	No	N/A
Operation	Thoroughfares	RR2 (green area at south in Configuration 4 that is green in Configuration 1)	Sitting	Sitting	Negligible	No	N/A
Operation	Thoroughfares	RR2 (blue area at south in Configuration 4 that is green in Configuration 1)	Sitting	Standing	Negligible	No	N/A
Operation	Thoroughfares	RR2 (yellow area at south in Configuration 4 that is green in Configuration 1)	Sitting	Strolling	Negligible	No	N/A
Operation	Thoroughfares	RR2 (green area in middle in Configuration 4 that is blue in Configuration 1)	Standing	Sitting	Negligible	No	N/A
Operation	Thoroughfares	RR2 (blue area in middle in Configuration 4 that is blue in Configuration 1)	Standing	Standing	Negligible	No	N/A
Operation	Thoroughfares	RR2 (yellow area in middle in Configuration 4 that is blue in Configuration 1)	Standing	Strolling	Negligible	No	N/A
Operation	Thoroughfares	RR2 (green areas at north in Configuration 4 that are yellow in Configuration 1)	Strolling	Sitting	Negligible	No	N/A
Operation	Thoroughfares	RR2 (blue area at north in Configuration 4 that is yellow in Configuration 1)	Strolling	Standing	Negligible	No	N/A
Operation	Thoroughfares	RR3 (green area at north in Configuration 4 that is green in Configuration 1)	Sitting	Sitting	Negligible	No	N/A
Operation	Thoroughfares	RR3 (blue area at northeast in Configuration 4 that is green in Configuration 1)	Sitting	Standing	Negligible	No	N/A
Operation	Thoroughfares	RR3 (green area at south in Configuration 4 that is blue in Configuration 1)	Standing	Sitting	Negligible	No	N/A
Operation	Thoroughfares	RR4 (green area at northwest in Configuration 4 that is green in Configuration 1)	Sitting	Sitting	Negligible	No	N/A
Operation	Thoroughfares	RR4 (green area at southeast in Configuration 4 that is green in Configuration 1)	Sitting	Sitting	Negligible	No	N/A
Operation	Thoroughfares	RR4 (green area at north in Configuration 4 that is blue in Configuration 1)	Standing	Sitting	Negligible	No	N/A
Operation	Thoroughfares	RR4 (green area at south in Configuration 4 that is blue in Configuration 1)	Standing	Sitting	Negligible	No	N/A
Operation	Thoroughfares	RR4 (green area in middle in Configuration 4 that is yellow in Configuration 1)	Strolling	Sitting	Negligible	No	N/A
Operation	Thoroughfares	RR4 (green areas at west in Configuration 4 that are pink in Configuration 1)	Walking	Sitting	Moderate beneficial	No	N/A
Operation	Thoroughfares	RR4 (green areas at west in Configuration 4 that are red in Configuration 1)	Uncomfortable	Sitting	Moderate beneficial	No	N/A
Nelson Dock							
Operation	Thoroughfares	ND1 (pink area at north in Configuration 4 that is pink in Configuration 1)	Walking	Walking	Negligible	No	N/A
Operation	Thoroughfares	ND1 (red area at north in Configuration 4 that is pink in Configuration 1)	Walking	Uncomfortable	Moderate adverse	Yes	N/A
Operation	Thoroughfares	ND1 (inaccessible area at east in Configuration 4 that is red in Configuration 1)	Uncomfortable	Inaccessible	N/A	No	N/A
Operation	Thoroughfares	ND2 (green area at east in Configuration 4 that is blue in Configuration 1)	Standing	Sitting	Negligible	No	N/A
Operation	Thoroughfares	ND2 (green area at east in Configuration 4 that is yellow in Configuration 1)	Strolling	Sitting	Negligible	No	N/A
Operation	Thoroughfares	ND2 (inaccessible area at west in Configuration 4 that is pink in Configuration 1)	Walking	Inaccessible	N/A	No	N/A
Operation	Thoroughfares	ND2 (inaccessible area at west in Configuration 4 that is red in Configuration 1)	Uncomfortable	Inaccessible	N/A	No	N/A
Operation	Thoroughfares	Area immediately surrounding the proposed Liverpool Waters buildings in middle of Nelson Dock (green areas in Configuration 4 that are pink in Configuration 1)	Walking	Sitting	Negligible	No	N/A
Operation	Thoroughfares	Area immediately surrounding the proposed Liverpool Waters buildings in middle of Nelson Dock (blue areas in Configuration 4 that are pink in Configuration 1)	Walking	Standing	Negligible	No	N/A
Operation	Thoroughfares	Area immediately surrounding the proposed Liverpool Waters buildings in middle of Nelson Dock (yellow areas in Configuration 4 that are pink in Configuration 1)	Walking	Strolling	Negligible	No	N/A

WIND MICROCLIMATE

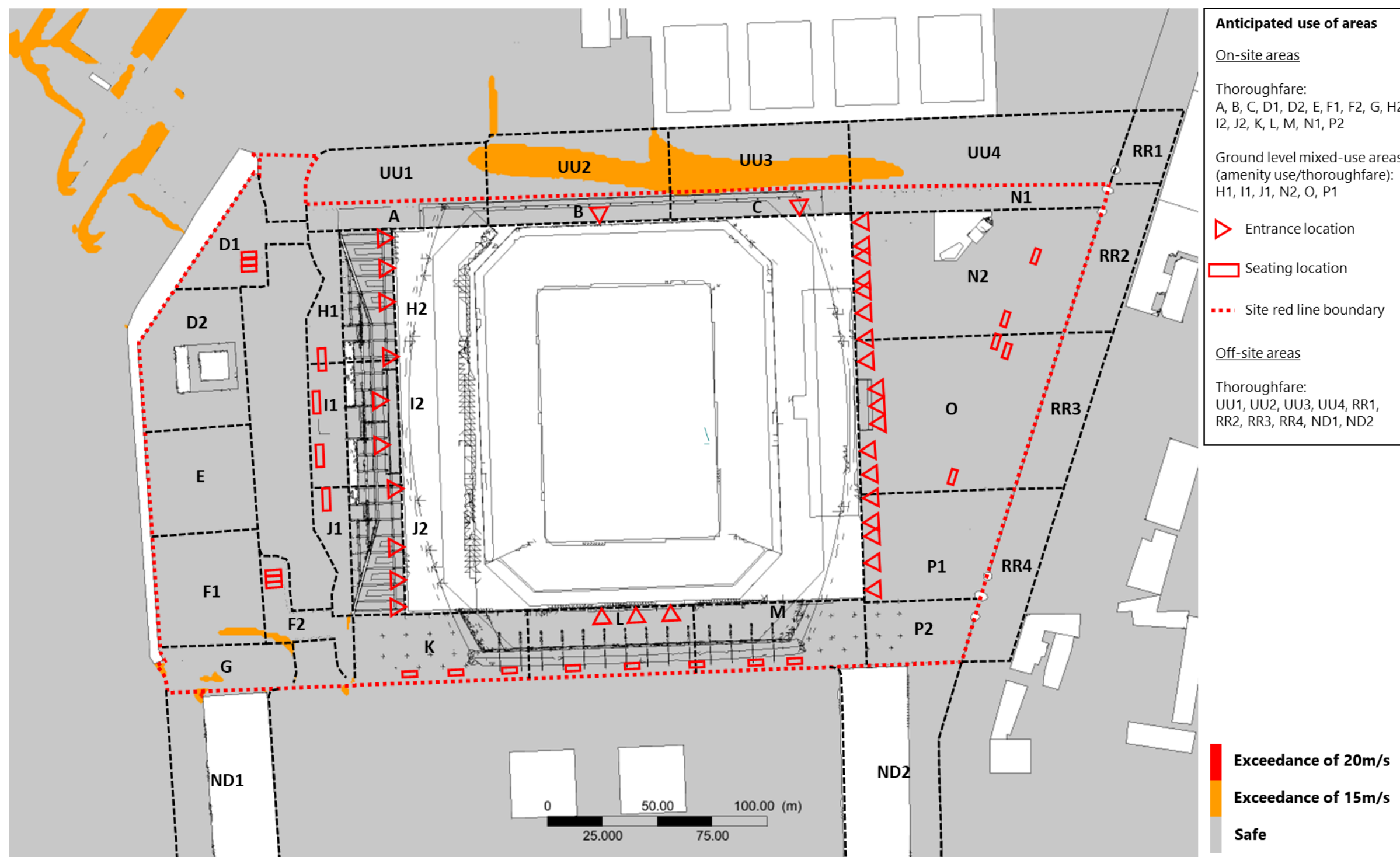


Figure 14.14a

Configuration 4, Pedestrian Safety Annual. Conditions at ground level, and underneath the Western Terrace

WIND MICROCLIMATE

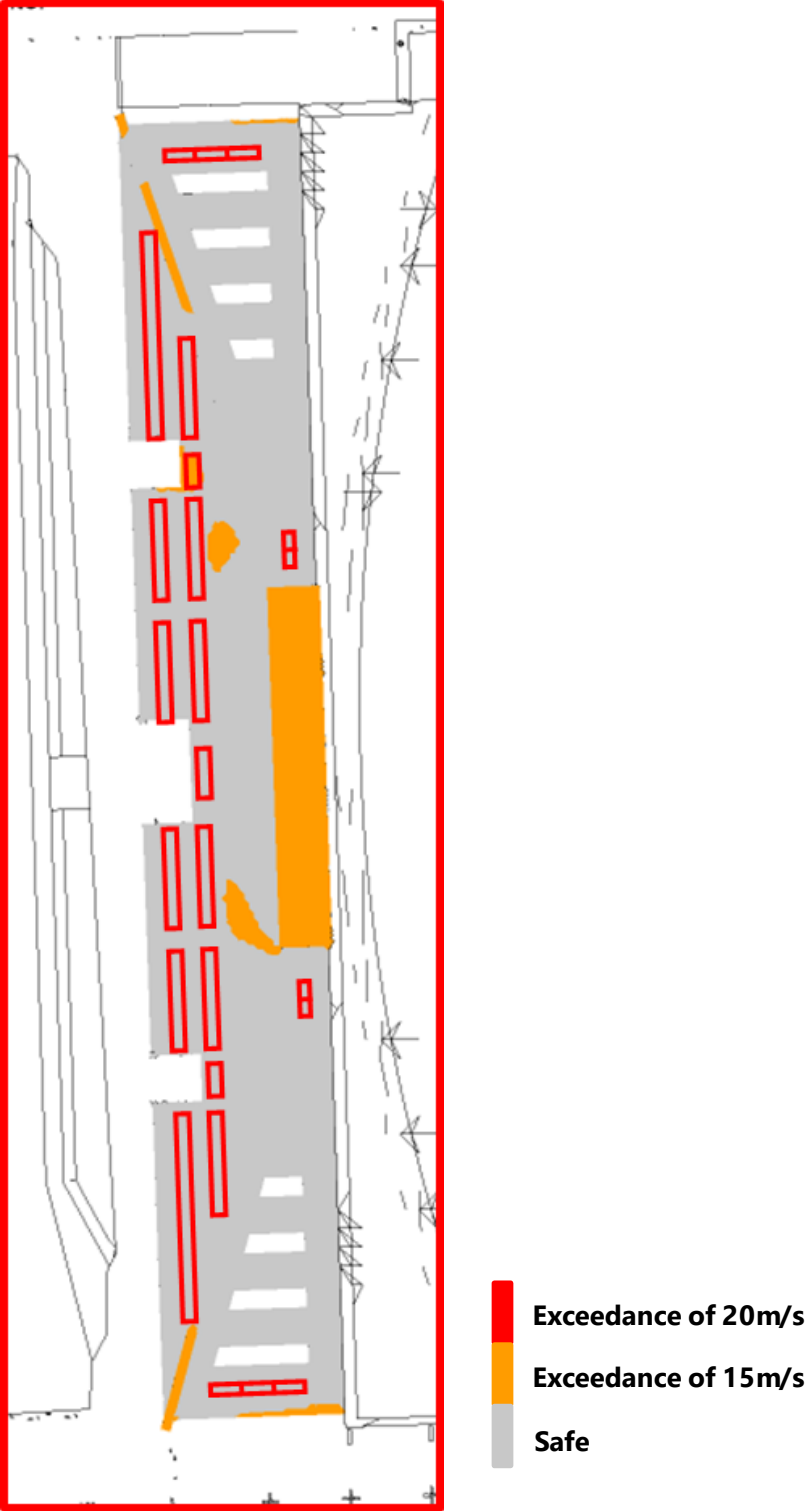


Figure 14.14b
Configuration 4, Pedestrian Safety Annual. Conditions at the top of the Western Terrace

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Table 14.23
Expected Wind Safety Conditions

AREA	SAFETY EXCEEDANCE WITHIN REGION	REQUIRES MITIGATION?
On-Site Receptors		
A	Pass	No
B	Pass	No
C	Pass	No
D1	Pass	No
D2	Pass	No
E	Pass	No
F1	S15	Yes
F2	S15	Yes
G	S15	Yes
H1	Pass	No
H2	Pass	No
I1	Pass	No
I2	Pass	No
J1	Pass	No
J2	Pass	No
K	Pass	No
L	Pass	No
M	Pass	No
N1	Pass	No
N2	Pass	No
O	Pass	No
P1	Pass	No
P2	Pass	No
Top of West Terrace	S15	Yes

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AREA	SAFETY EXCEEDANCE WITHIN REGION	REQUIRES MITIGATION?
Off-Site Receptors		
UU1	S15	Yes
UU2	S15	Yes
UU3	S15	Yes
UU4	S15	Yes
RR1	Pass	No
RR2	Pass	No
RR3	Pass	No
RR4	Pass	No
ND1	S20	Yes
ND2	Pass	No
Area immediately surrounding proposed Liverpool Waters buildings in middle of Nelson Dock	Pass	No

Table 14.24
Description of Wind Conditions around proposed development

LOCATIONS	DESCRIPTION
On-Site Receptors	
Thoroughfares	<p>Conditions in Configuration 4 are slightly calmer than those in Configuration 3 in the Fan Zone Plaza to the east of the stadium.</p> <p>In the Northern and Southern Concourse Areas, conditions are again calmer than those in Configuration 3.</p> <p>Along the Western Terrace there is a small wind speed reduction in the windiest season from Configuration 3 to Configuration 4, where conditions have improved from being suitable for strolling to standing. However, at the top of the Western terrace there is a slight increase in wind speeds in Configuration 4, which increases the areas of safety failures slightly, when compared with Configuration 3.</p> <p>The most significant change is to the southwest of the stadium at the Western Quayside/River Walk Gateway where wind speeds have increased in a small area around the F1, F2 and G sub-areas compared to Configuration 3.</p> <p>All thoroughfare locations on-site would have walking, strolling use conditions or calmer making them suitable for the intended use and requiring no further mitigation or design interventions. This represents a negligible to moderate beneficial effect (not significant).</p> <ul style="list-style-type: none">■ The covered area in the Western Terrace shows conditions for strolling to sitting use even during the windiest season.■ The public realm area in front of the Western Terrace adjacent to the Water Channel shows conditions suitable for sitting and standing in summer making it suitable for its intended use. Some small, localised areas more suitable for strolling are shown at the very south of this area. This is a minor adverse effect and the majority of the area will still be suitable for the intended activity.■ The Northern Concourse (between stadium façade and United Utilities site to the north) shows wind speeds suitable for a range of pedestrian activities, ranging from sitting to strolling during summer and the windiest season. A small area to the very west of the Northern Concourse, shown to be suitable for walking during the windiest season in Configuration 3, is now suitable for strolling.■ The Southern Concourse (between stadium façade and Nelson Dock to the south) shows wind speeds suitable for strolling or better in the windiest season with no safety issues in this area. There were a few small areas around the southeast corner where conditions were suitable for walking in the windiest season in Configuration 3, however these are now suitable for strolling.■ The Western Quayside to the west shows conditions suitable for strolling in the windiest season but much lower wind speeds mostly suitable for sitting or standing in summer. There is a small area at the southwest shown to be uncomfortable for pedestrian use in the winter, however this area is very small and near the water edge where pedestrians would expect windier conditions. <p>Some instances of strong winds exceeding the safety threshold are observed at the south of the Western Quayside and at the River Walk Gateway. The safety issues observed at the River Walk Gateway are caused by the buildings associated within the approved Nelson Dock development parameters as per the latest approved Liverpool Waters permission (LPA ref. 19NM/1121 — non-material amendment to original outline permission ref. 100/2424) to the south. As such this area would require mitigation measures to ensure safe wind conditions for pedestrians as and when the Nelson Dock scheme ultimately comes forward (via reserved matters associated with the extant outline permission or via a separate new outline/full planning application).</p>
Entrances	<p>The three new entrances that lead into the space underneath the Western Terrace at ground level (level 00) are suitable for entry, no safety issues are found.</p> <p>The doors associated with the Level One hospitality area within the west stand which open out on to the top of the Western Terrace are unsuitable during high wind events; the doors will therefore be closed during adverse wind conditions and only opened when the weather permits.</p> <p>The turnstile entrances located along the south stand elevation (located under the stadium façade) are suitable and no safety issues were found.</p>

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	<p>The north elevation has an turnstiles where conditions are suitable for strolling, a minor adverse effect.</p> <p>The west elevation beneath the raised terrace has turnstiles at the southwest corner where conditions are suitable for strolling, a minor adverse effect.</p> <p>The entrance locations (turnstiles, hospitality entrance and club shop/offices entrance) along the east stand elevation are suitable for their intended use for winter and summer with no safety issues were found. All other entrance locations on-site would have suitable wind conditions for their intended use. These would represent negligible to minor beneficial effects (not significant). There would be no instances of strong winds exceeding the safety threshold at any entrance locations on-site in Configuration 4.</p>
Ground Level and Terrace Level Amenity Areas — Mixed Use	<p>There would be two dedicated ground level amenity areas with the proposed development in place; an area to the west of the stadium (comprising the top of the western terrace, the ground floor public realm area in front of the terrace next to the water channel and the west quayside) and the Fan Zone Plaza to the east of the stadium. Both would have locations that would require suitable conditions for a mixed-use amenity space.</p> <p>The Fan Zone Plaza to the east shows conditions suitable for sitting and standing in the windiest season, with some very small areas suitable for strolling, therefore the area is suitable for the activity. Wind speeds are much lower during the summer, with conditions suitable for sitting, and some very small localised areas suitable for standing or walking. This is a minor adverse effect and most of the area will still be suitable for the intended activity. There has been a small improvement in conditions to the eastern Fan Zone Plaza compared to Configuration 3. All the mixed-use amenity locations in the Fan Zone Plaza to the east of the stadium would also have safe wind conditions throughout the year.</p> <p>To the west of the stadium, the Western Terrace presents three zones that cover a large area representing mixed-use amenity locations. Within the ground floor public realm area in front of the stepped terrace next to the water channel to the south west there is a small area where conditions are unsuitable and they will be uncomfortable during winter. The steps leading to the top of the Western Terrace will mostly have sitting and standing use wind conditions during the summer and sitting, standing and strolling during the winter. These wind conditions would be one (strolling use) category windier than the required wind conditions of a mixture of sitting and standing use conditions for a large amenity space such as this. This would represent minor adverse effects (not significant). The remaining spaces would have wind conditions suitable for sitting and standing use during the summer season making them suitable for the intended use and representing negligible effects (not significant). There would be locations on top and along the steps of the Western Terrace with strong winds exceeding the safety threshold which would require mitigation measures to ensure safe wind conditions for pedestrians. There are also areas at the bottom of the steps and along the gate at the southwest corner that are unsafe and will require of mitigation. This is a moderate adverse effect (significant) that will require mitigation. .</p> <p>There is a small improvement at the Western Terrace water edge during winter also to the north of the water edge, however wind speeds have increase to the southwest of the water edge when compared to Configuration 3. At the top of the Western terrace the wind conditions are generally windier specially towards the north and southern edge of the top of the Western Terrace when compared with Configuration 3 however.</p>
Ground Level Amenity Areas - Seating	<p>All seating bench locations throughout the ground level public realm area are seen to have wind conditions suitable for sitting in the summer, making them suitable for their intended activity the effects are negligible when compare with configuration 3.</p> <p>In the area at the top of the Western Terrace, almost all bench locations are shown to have conditions suitable for sitting. One location at the south of this area and two locations on the steps have conditions more suitable for standing, a minor adverse effect. Two locations at the south of this area have conditions more suitable for strolling, which is a moderate adverse effect that will require mitigation.</p> <p>All of the seating locations would have safe wind conditions throughout the year, except for one on the steps towards the north.</p>
Inaccessible locations	<p>As pedestrians would be unable to access the inaccessible areas on-site (water channel), wind conditions would be considered acceptable regardless of the measured conditions.</p>

Off-site Receptors

<u>UU WwTW</u>	
Thoroughfares	<p>In this area, conditions are broadly similar to Configuration 3 and the baseline, in the windiest season. In area UU1, a large area suitable for walking in the baseline has been made smaller in Configuration 4. Conditions in area UU2 are similar to the baseline, with a slight increase in the uncomfortable areas. In UU3, the area that is uncomfortable for all pedestrian activities has been made larger in Configuration 4. In area UU4, the area suitable for walking has been made smaller. As conditions have been made worse in some areas and better in others, conditions are considered broadly similar to the baseline overall, when considering the UU WwTW area as a whole. .</p> <p>The areas of safety exceedance are moved around slightly within this area, but overall, the conditions are similar to the baseline condition.</p> <p>Overall, when considering this area in its entirety, the wind conditions do not materially change from those recorded for the baseline scenario.</p>
<u>Regent Road</u>	
Thoroughfares	<p>Conditions are calmer in Configuration 4 than in Configuration 3 in this area. Compared to the baseline, almost all areas along Regent Road have improved in Configuration 4, with most of this area now being suitable for sitting in the winter. Small areas suitable for standing and strolling are seen towards the north of the road in RR1 and RR2. Overall, these changes represent negligible to moderate beneficial effects.</p> <p>There are two small areas of safety exceedance towards the south of Regent Road in the baseline, which are removed in Configuration 4.</p>
<u>Nelson Dock</u>	
Thoroughfares	<p>Conditions at Nelson Dock are improved compared to Configuration 3 and the baseline. Conditions are now suitable for sitting on the eastern quayside, and mostly suitable for standing or strolling on the western quayside. There is a very small area that is now uncomfortable for all pedestrian activities on the west side, a moderate adverse effect, however this is a localised area adjacent to the façade of one of the future buildings on Nelson Dock (as per the latest Liverpool Waters approved parameters plan). Overall, Configuration 4 has resulted in a minor beneficial effect across this area.</p> <p>There is a small area exceeding the 20m/s safety threshold at the north-western corner of the future building on the western quay of Nelson Dock (as per the latest Liverpool Waters approved parameters plan); however this is a very small localised area adjacent to the façade of this building, and these conditions will depend on the final design of these future buildings and their landscape arrangement (to be formalised via reserved matters submissions against the original outline permission or via a new outline/full planning application). The overall area of safety exceedance in ND1 has reduced in size in Configuration 4, compared to the baseline.</p>

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14.6.3 Proposed Development + Liverpool Waters (Nelson Dock) + Additional Cumulative Developments Scenario (Configuration 5)

The design interventions have also been carried forward and tested within this cumulative scheme, which includes the proposed (development parameters-based) scheme on Nelson Dock as per the latest approved Liverpool Waters Masterplan (19NM/1 121 – latest non-material amendment to the original outline permission ref. 10O/2424) and the proposed Bramley Hotel development at Regent Road/Blackstone Street (LPA ref. 20F/0217), in situ. The results of the tests undertaken for this configuration, are graphically shown in Figure 14.1 5 for the windiest and Figure 14.1 6 for the summer season respectively. The results for the annual safety exceedances are shown in Figure 14.1 7. The results are provided in full in Tables 14.25, 14.26 and 14.27 below.

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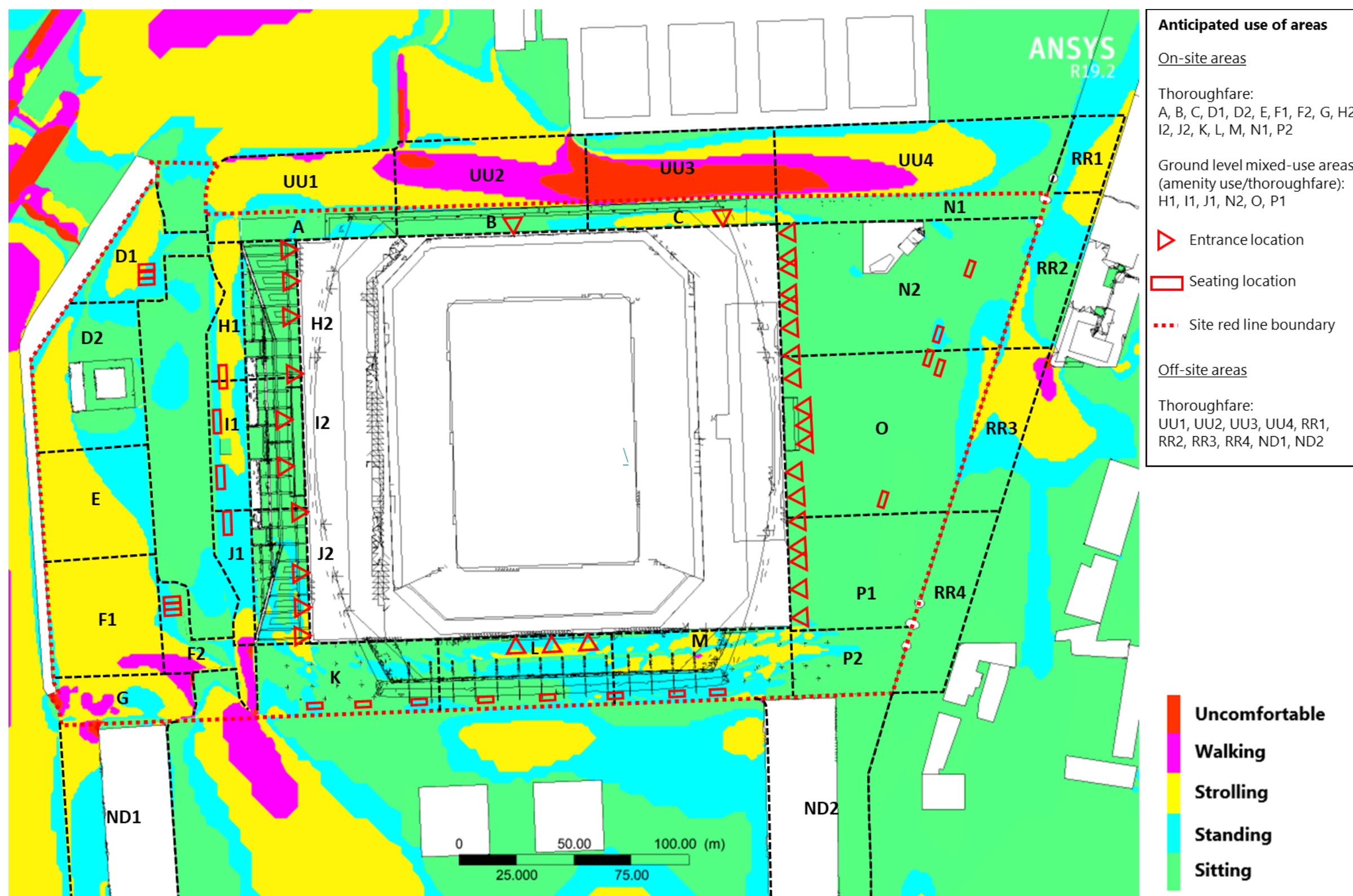


Figure 14.15a

Configuration 5, Windiest season. Conditions at ground level, and underneath the Western Terrace

WIND MICROCLIMATE

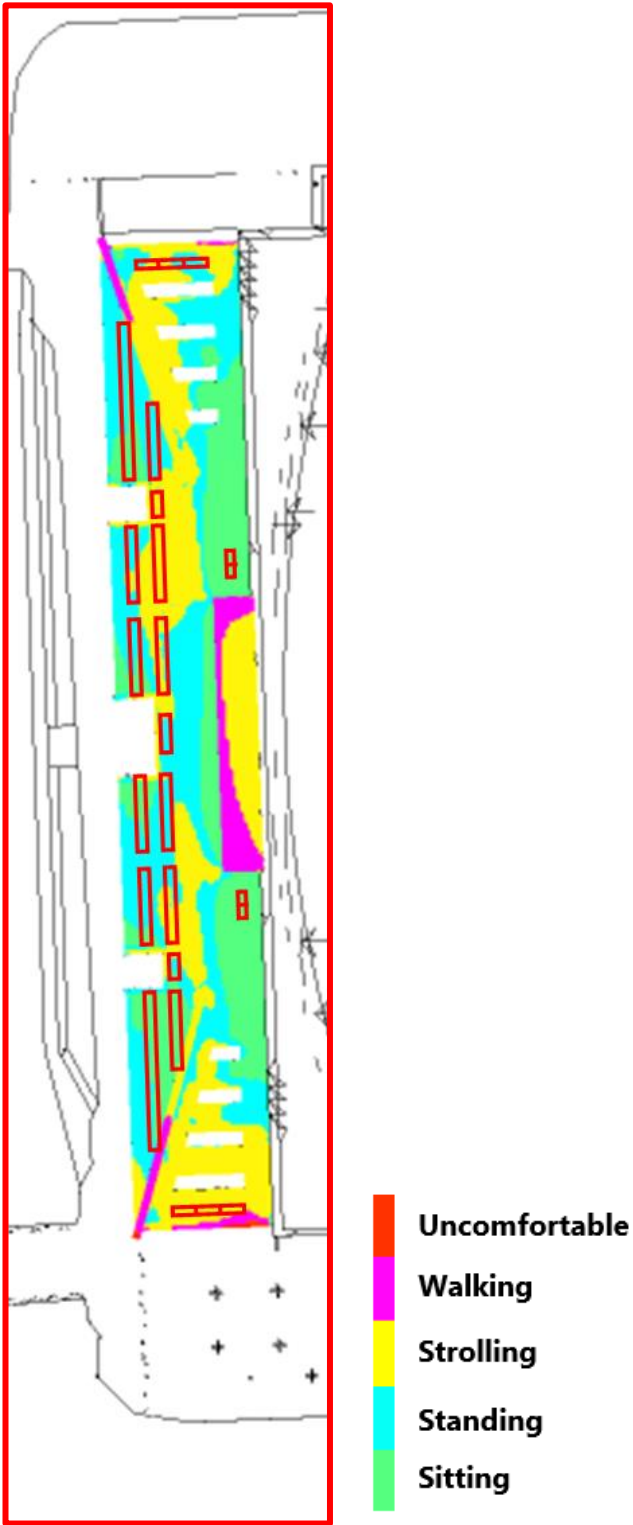


Figure 14.15b
Configuration 5, Windiest season. Conditions at the top of the Western Terrace

WIND MICROCLIMATE

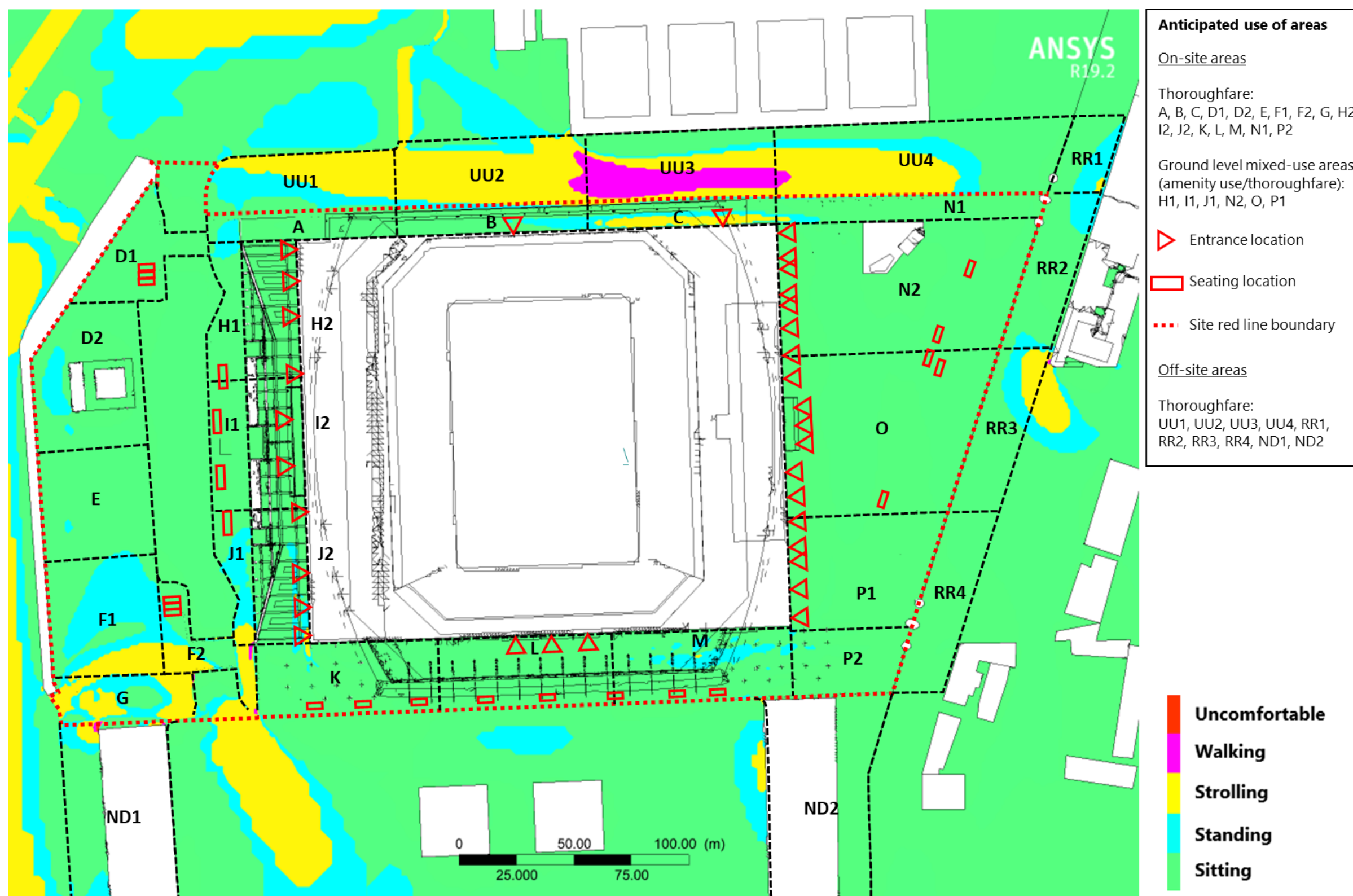


Figure 14.16a

Configuration 5, Summer season. Conditions at ground level, and underneath the Western Terrace

WIND MICROCLIMATE



Figure 14.16b

Configuration 5, Summer season. Conditions at the top of the Western Terrace

WIND MICROCLIMATE

Table 14.25a
Expected Wind Comfort Conditions- On-site Receptors

PHASE	RECEPTOR(S) AFFECTED	PROBE NUMBERS	MEASURED CONDITIONS	SIGNIFICANCE CRITERIA	MITIGATION PROPOSED?	FURTHER INFORMATION
On-site Receptors						
Operation	Thoroughfare	A (green areas in middle and at east), B (green covers most of the area), C (green area at north), D1 (green area at west), D2 (green area in middle), F2 (green area at north), G (green area at south), H2 (green covers all area), I2 (green covers all area), J2 (green covers most of the area), K (green covers most of the area), L (green area at north and south), M (green areas at north and southeast), N1 (green covers most of the area), P2 (green covers most of the area)	Sitting	Moderate Beneficial	No	N/A
Operation	Thoroughfare	A (blue area at east and west), B (blue area at southeast), C (blue area at west), D1 (blue areas at west and east), D2 (blue areas at north and south), E (blue area at east), F1 (blue area at east), F2 (blue area at west), G (blue area in middle), J2 (blue area at south), K (blue areas at east and west), L (blue areas in middle), M (blue area in middle), N1 (blue area at southwest), P2 (blue area at northwest)	Standing	Minor Beneficial	No	N/A
Operation	Thoroughfare	A (yellow area at west), C (yellow area at south), D1 (yellow area in middle), D2 (yellow area at west), E (yellow covers most of the area), F1 (yellow covers most of the area), F2 (yellow areas at southwest and east), G (yellow covers most of the area), J2 (yellow area at south), K (yellow areas at north and south), L (yellow areas in middle), M (yellow areas in middle and north), N1 (yellow area at southwest), P2 (yellow area at northwest)	Strolling	Negligible	No	N/A
Operation	Thoroughfare	F1 (pink area at southeast), F2 (pink area at southwest and east), G (pink areas at west and east), M (pink area in middle)	Walking	Minor Adverse	No	N/A
Operation	Thoroughfare	F2 (red area at east), G (red area at east)	Uncomfortable	Moderate adverse	Yes	N/A
Operation	Entrances	B, H2, I2, J2 (northern two entrances), N2, O, P1	Sitting	Minor Beneficial	No	N/A
Operation	Entrances	J2 (second entrance from south), L	Standing	Negligible	No	N/A
Operation	Entrances	C, J2 (southern entrance)	Strolling	Minor Adverse	No	N/A
Operation	Ground Level Amenity Areas —Mixed Use	H1 (green covers most of the area), I1 (green covers all area), J1 (green area at north), N2 (green covers all area), O (green covers all area), P1 (green covers all area), Top of Western Terrace (green covers most of the area)	Sitting	Negligible	No	N/A
Operation	Ground Level Amenity Areas —Mixed Use	H1 (blue area at north), J1 (blue covers most of the area), Top of Western Terrace (blue areas at north, middle and south)	Standing	Negligible	No	N/A
Operation	Ground Level Amenity Areas —Mixed Use	J1 (yellow area at south), Top of Western Terrace (yellow areas in middle, north and south)	Strolling	Minor Adverse	No	N/A
Operation	Ground Level Amenity - Seating	D1, F2, H1, I1, J1, K, L, M, N2, O, Top of Western Terrace (all seating locations except two on the steps at the west and three at the south)	Sitting	Negligible	No	N/A
Operation	Ground Level Amenity - Seating	Top of Western Terrace (two locations on the steps at the west and one at the south)	Standing	Minor Adverse	No	N/A
Operation	Ground Level Amenity - Seating	Top of Western Terrace (two southern seating locations)	Strolling	Moderate Adverse	Yes	N/A

WIND MICROCLIMATE

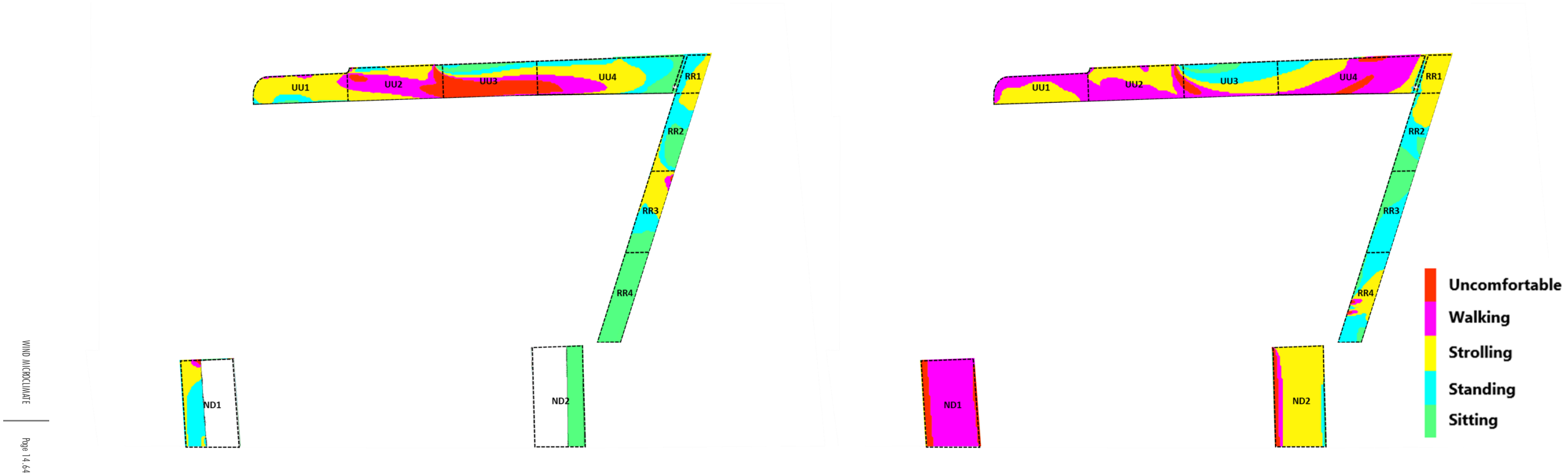


Figure 14.15c

Configuration 5, Windiest season. Conditions at the off-site areas – Configuration 5 (left) vs. Configuration 1 (right).

Table 14.25b

Expected Wind Comfort Conditions – Off-site receptors

PHASE	RECEPTOR(S) AFFECTED	LOCATIONS	BASELINE CONDITIONS	MEASURED CONDITIONS	SIGNIFICANCE CRITERIA	MITIGATION PROPOSED?	FURTHER INFORMATION
UU WwTW							
Operation	Thoroughfares	UU1 (yellow area in middle in Configuration 5 that is yellow in Configuration 1)	Strolling	Strolling	Negligible	No	N/A
Operation	Thoroughfares	UU1 (blue area at south in Configuration 5 that is yellow in Configuration 1)	Strolling	Standing	Negligible	No	N/A
Operation	Thoroughfares	UU1 (green area at south in Configuration 5 that is yellow in Configuration 1)	Strolling	Sitting	Negligible	No	N/A
Operation	Thoroughfares	UU1 (pink area at north and east in Configuration 5 that is pink in Configuration 1)	Walking	Walking	Negligible	No	N/A
Operation	Thoroughfares	UU2 (green area at northeast in Configuration 5 that is blue in Configuration 1)	Standing	Sitting	Negligible	No	N/A
Operation	Thoroughfares	UU2 (blue area at north in Configuration 5 that is yellow in Configuration 1)	Strolling	Standing	Negligible	No	N/A
Operation	Thoroughfares	UU2 (yellow area at north in Configuration 5 that is yellow in Configuration 1)	Strolling	Strolling	Negligible	No	N/A
Operation	Thoroughfares	UU2 (pink area across middle in Configuration 5 that is yellow in Configuration 1)	Strolling	Walking	Minor adverse	No	N/A

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PHASE	RECEPTOR(S) AFFECTED	LOCATIONS	BASELINE CONDITIONS	MEASURED CONDITIONS	SIGNIFICANCE CRITERIA	MITIGATION PROPOSED?	FURTHER INFORMATION
Operation	Thoroughfares	UU2 (red area at west in Configuration 5 that is yellow in Configuration 1)	Strolling	Uncomfortable	Moderate adverse	Yes	N/A
Operation	Thoroughfares	UU2 (yellow area at northeast in Configuration 5 that is yellow in Configuration 1)	Strolling	Strolling	Negligible	No	N/A
Operation	Thoroughfares	UU2 (red area at northeast in Configuration 5 that is yellow in Configuration 1)	Strolling	Uncomfortable	Moderate adverse	Yes	N/A
Operation	Thoroughfares	UU2 (yellow area at southwest in Configuration 5 that is pink in Configuration 1)	Walking	Strolling	Minor beneficial	No	N/A
Operation	Thoroughfares	UU2 (pink area in middle in Configuration 5 that is pink in Configuration 1)	Walking	Walking	Negligible	No	N/A
Operation	Thoroughfares	UU2 (red area at west in Configuration 5 that is pink in Configuration 1)	Walking	Uncomfortable	Moderate adverse	Yes	N/A
Operation	Thoroughfares	UU2 (yellow area at north in Configuration 5 that is pink in Configuration 1)	Walking	Strolling	Minor beneficial	No	N/A
Operation	Thoroughfares	UU2 (red area at east in Configuration 5 that is red in Configuration 1)	Uncomfortable	Uncomfortable	Negligible	No	N/A
Operation	Thoroughfares	UU3 (green area at north in Configuration 5 that is green in Configuration 1)	Sitting	Sitting	Negligible	No	N/A
Operation	Thoroughfares	UU3 (blue area at north in Configuration 5 that is green in Configuration 1)	Sitting	Standing	Negligible	No	N/A
Operation	Thoroughfares	UU3 (green area at north in Configuration 5 that is blue in Configuration 1)	Standing	Sitting	Negligible	No	N/A
Operation	Thoroughfares	UU3 (blue area at north in Configuration 5 that is blue in Configuration 1)	Standing	Standing	Negligible	No	N/A
Operation	Thoroughfares	UU3 (blue area towards north in Configuration 5 that is blue in Configuration 1)	Standing	Standing	Negligible	No	N/A
Operation	Thoroughfares	UU3 (yellow area at middle in Configuration 5 that is blue in Configuration 1)	Standing	Strolling	Negligible	No	N/A
Operation	Thoroughfares	UU3 (pink area at middle in Configuration 5 that is blue in Configuration 1)	Standing	Walking	Minor adverse	No	N/A
Operation	Thoroughfares	UU3 (pink area at middle in Configuration 5 that is yellow in Configuration 1)	Strolling	Walking	Minor adverse	No	N/A
Operation	Thoroughfares	UU3 (red area at south in Configuration 5 that is yellow in Configuration 1)	Strolling	Uncomfortable	Moderate adverse	Yes	N/A
Operation	Thoroughfares	UU3 (pink area at southeast in Configuration 5 that is pink in Configuration 1)	Walking	Walking	Negligible	No	N/A
Operation	Thoroughfares	UU3 (red area at southwest in Configuration 5 that is pink in Configuration 1)	Walking	Uncomfortable	Moderate adverse	Yes	N/A
Operation	Thoroughfares	UU3 (red area at southwest in Configuration 5 that is red in Configuration 1)	Uncomfortable	Uncomfortable	Negligible	No	N/A
Operation	Thoroughfares	UU4 (blue area at northwest in Configuration 5 that is blue in Configuration 1)	Standing	Standing	Negligible	No	N/A
Operation	Thoroughfares	UU4 (yellow area at west in Configuration 5 that is blue in Configuration 1)	Standing	Strolling	Negligible	No	N/A
Operation	Thoroughfares	UU4 (blue area at north in Configuration 5 that is yellow in Configuration 1)	Strolling	Standing	Negligible	No	N/A
Operation	Thoroughfares	UU4 (yellow area towards north in Configuration 5 that is yellow in Configuration 1)	Strolling	Strolling	Negligible	No	N/A
Operation	Thoroughfares	UU4 (pink area at west in Configuration 5 that is yellow in Configuration 1)	Strolling	Walking	Minor adverse	No	N/A
Operation	Thoroughfares	UU4 (red area at southwest in Configuration 5 that is yellow in Configuration 1)	Strolling	Uncomfortable	Moderate adverse	Yes	N/A
Operation	Thoroughfares	UU4 (green area at east in Configuration 5 that is yellow in Configuration 1)	Strolling	Sitting	Negligible	No	N/A
Operation	Thoroughfares	UU4 (blue area towards east in Configuration 5 that is yellow in Configuration 1)	Strolling	Standing	Negligible	No	N/A
Operation	Thoroughfares	UU4 (green area at east in Configuration 5 that is pink in Configuration 1)	Walking	Sitting	Moderate beneficial	No	N/A
Operation	Thoroughfares	UU4 (pink area at south in Configuration 5 that is pink in Configuration 1)	Walking	Walking	Negligible	No	N/A
Operation	Thoroughfares	UU4 (red area at southwest in Configuration 5 that is pink in Configuration 1)	Walking	Uncomfortable	Moderate adverse	Yes	N/A
Operation	Thoroughfares	UU4 (pink area at south in Configuration 5 that is red in Configuration 1)	Uncomfortable	Walking	Minor adverse	No	N/A
Regent Road							

WIND MICROCLIMATE

PHASE	RECEPTOR(S) AFFECTED	LOCATIONS	BASELINE CONDITIONS	MEASURED CONDITIONS	SIGNIFICANCE CRITERIA	MITIGATION PROPOSED?	FURTHER INFORMATION
Operation	Thoroughfares	RR1 (blue area at southwest in Configuration 5 that is blue in Configuration 1)	Standing	Standing	Negligible	No	N/A
Operation	Thoroughfares	RR1 (blue area at north and west in Configuration 5 that is yellow in Configuration 1)	Strolling	Standing	Negligible	No	N/A
Operation	Thoroughfares	RR1 (yellow area at northeast, east and southeast in Configuration 5 that is yellow in Configuration 1)	Strolling	Strolling	Negligible	No	N/A
Operation	Thoroughfares	RR2 (green area at south in Configuration 5 that is green in Configuration 1)	Sitting	Sitting	Negligible	No	N/A
Operation	Thoroughfares	RR2 (blue area at south in Configuration 5 that is green in Configuration 1)	Sitting	Standing	Negligible	No	N/A
Operation	Thoroughfares	RR2 (yellow area at southwest in Configuration 5 that is green in Configuration 1)	Sitting	Strolling	Negligible	No	N/A
Operation	Thoroughfares	RR2 (green area in middle in Configuration 5 that is blue in Configuration 1)	Standing	Sitting	Negligible	No	N/A
Operation	Thoroughfares	RR2 (blue area in middle in Configuration 5 that is blue in Configuration 1)	Standing	Standing	Negligible	No	N/A
Operation	Thoroughfares	RR2 (blue area at north in Configuration 5 that is yellow in Configuration 1)	Strolling	Standing	Negligible	No	N/A
Operation	Thoroughfares	RR2 (yellow area at northeast in Configuration 5 that is yellow in Configuration 1)	Strolling	Strolling	Negligible	No	N/A
Operation	Thoroughfares	RR3 (yellow area at north in Configuration 5 that is green in Configuration 1)	Sitting	Strolling	Negligible	No	N/A
Operation	Thoroughfares	RR3 (pink area at northeast in Configuration 5 that is green in Configuration 1)	Sitting	Walking	Minor Adverse	No	N/A
Operation	Thoroughfares	RR3 (green area at south in Configuration 5 that is blue in Configuration 1)	Standing	Sitting	Negligible	No	N/A
Operation	Thoroughfares	RR3 (blue area at middle in Configuration 5 that is blue in Configuration 1)	Standing	Standing	Negligible	No	N/A
Operation	Thoroughfares	RR3 (yellow area at middle in Configuration 5 that is blue in Configuration 1)	Standing	Strolling	Negligible	No	N/A
Operation	Thoroughfares	RR4 (green area at northwest in Configuration 5 that is green in Configuration 1)	Sitting	Sitting	Negligible	No	N/A
Operation	Thoroughfares	RR4 (green area at southeast in Configuration 5 that is green in Configuration 1)	Sitting	Sitting	Negligible	No	N/A
Operation	Thoroughfares	RR4 (green area at north in Configuration 5 that is blue in Configuration 1)	Standing	Sitting	Negligible	No	N/A
Operation	Thoroughfares	RR4 (green area at south in Configuration 5 that is blue in Configuration 1)	Standing	Sitting	Negligible	No	N/A
Operation	Thoroughfares	RR4 (green area in middle in Configuration 5 that is yellow in Configuration 1)	Strolling	Sitting	Negligible	No	N/A
Operation	Thoroughfares	RR4 (green areas at west in Configuration 5 that are pink in Configuration 1)	Walking	Sitting	Moderate beneficial	No	N/A
Operation	Thoroughfares	RR4 (green areas at west in Configuration 5 that are red in Configuration 1)	Uncomfortable	Sitting	Moderate beneficial	No	N/A
Nelson Dock							
Operation	Thoroughfares	ND1 (pink area at north in Configuration 5 that is pink in Configuration 1)	Walking	Walking	Negligible	No	N/A
Operation	Thoroughfares	ND1 (red area at north in Configuration 5 that is pink in Configuration 1)	Walking	Uncomfortable	Moderate adverse	Yes	N/A
Operation	Thoroughfares	ND1 (inaccessible area at east in Configuration 5 that is red in Configuration 1)	Uncomfortable	Inaccessible	N/A	No	N/A
Operation	Thoroughfares	ND2 (green area at east in Configuration 5 that is blue in Configuration 1)	Standing	Sitting	Negligible	No	N/A
Operation	Thoroughfares	ND2 (green area at east in Configuration 5 that is yellow in Configuration 1)	Strolling	Sitting	Negligible	No	N/A
Operation	Thoroughfares	ND2 (inaccessible area at west in Configuration 5 that is pink in Configuration 1)	Walking	Inaccessible	N/A	No	N/A
Operation	Thoroughfares	ND2 (inaccessible area at west in Configuration 5 that is red in Configuration 1)	Uncomfortable	Inaccessible	N/A	No	N/A

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PHASE	RECEPTOR(S) AFFECTED	LOCATIONS	BASELINE CONDITIONS	MEASURED CONDITIONS	SIGNIFICANCE CRITERIA	MITIGATION PROPOSED?	FURTHER INFORMATION
Operation	Thoroughfares	Area immediately surrounding the proposed Liverpool Waters buildings in middle of Nelson Dock (green areas in Configuration 5 that are pink in Configuration 1)	Walking	Sitting	Negligible	No	N/A
Operation	Thoroughfares	Area immediately surrounding the proposed Liverpool Waters buildings in middle of Nelson Dock (blue areas in Configuration 5 that are pink in Configuration 1)	Walking	Standing	Negligible	No	N/A
Operation	Thoroughfares	Area immediately surrounding the proposed Liverpool Waters buildings in middle of Nelson Dock (yellow areas in Configuration 5 that are pink in Configuration 1)	Walking	Strolling	Negligible	No	N/A

WIND MICROCLIMATE

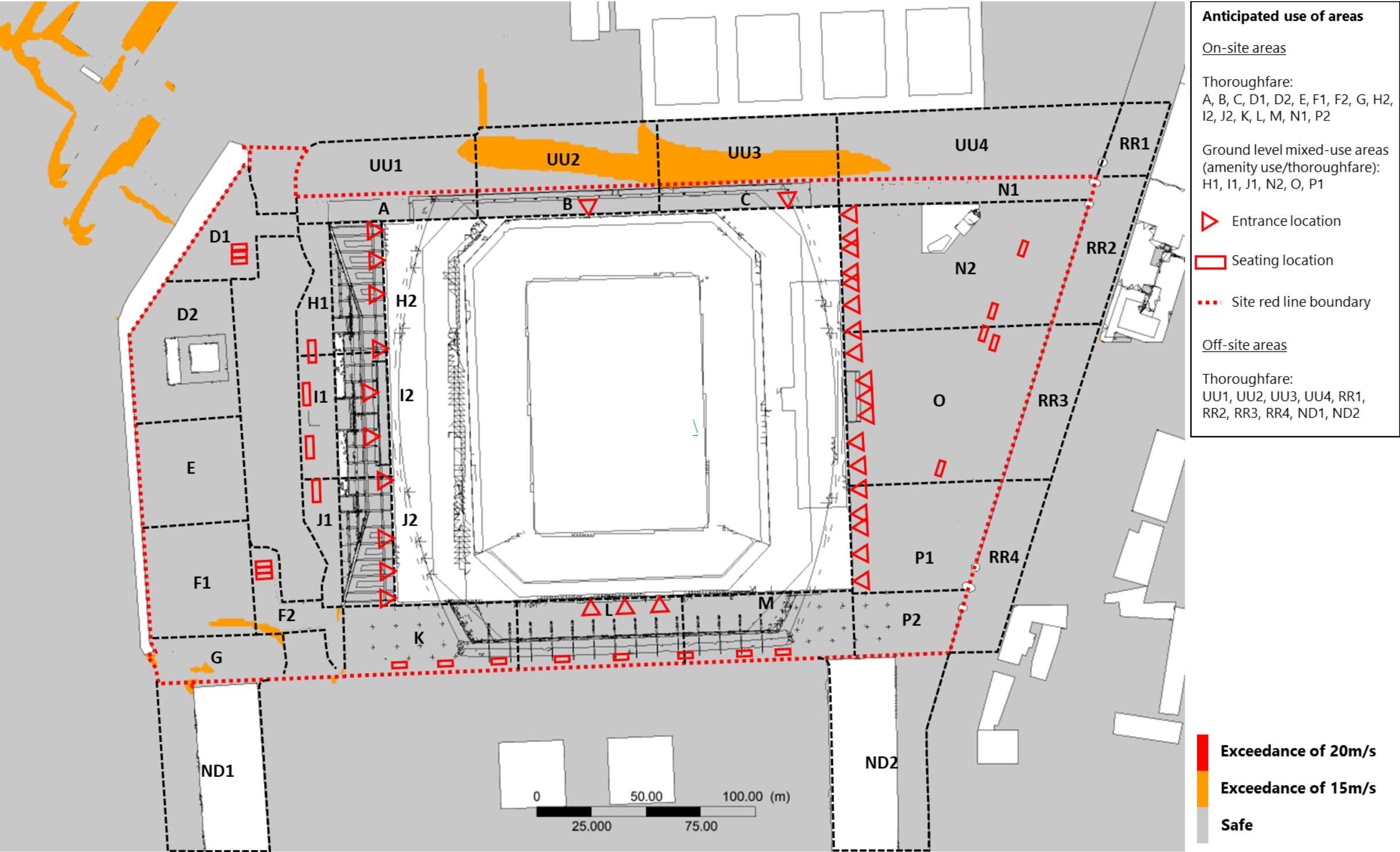


Figure 14.17a

Configuration 5, Pedestrian Safety Annual. Conditions at ground level, and underneath the Western Terrace

WIND MICROCLIMATE

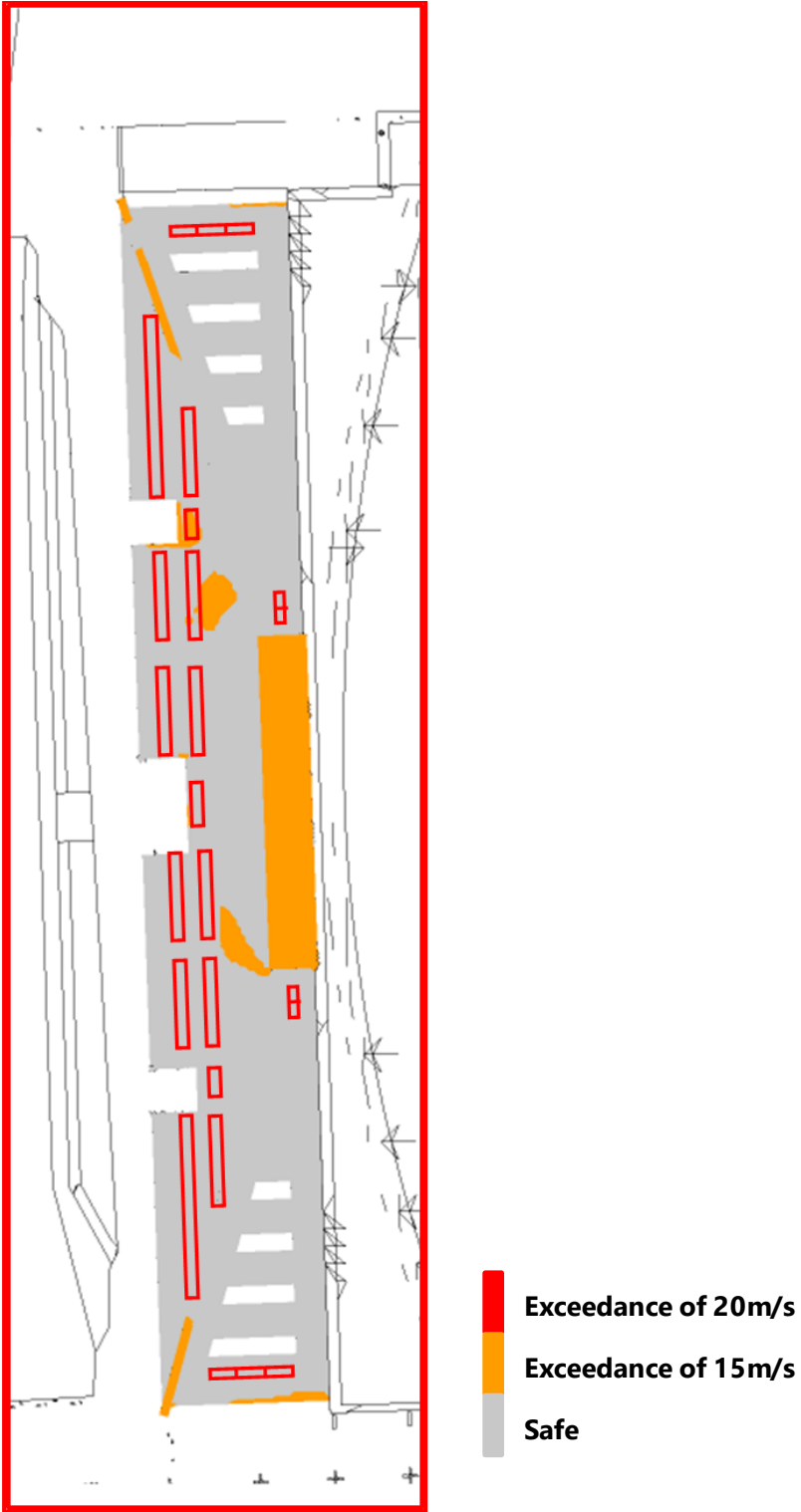


Figure 14.17b
Configuration 5, Pedestrian Safety Annual. Conditions at the top of the Western Terrace

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Table 14.26
Expected Wind Safety Conditions

AREA	SAFETY EXCEEDANCE WITHIN REGION	REQUIRES MITIGATION?
On-Site Receptors		
A	Pass	No
B	Pass	No
C	Pass	No
D1	Pass	No
D2	Pass	No
E	Pass	No
F1	S15	Yes
F2	S15	Yes
G	S15	Yes
H1	Pass	No
H2	Pass	No
I1	Pass	No
I2	Pass	No
J1	Pass	No
J2	Pass	No
K	Pass	No
L	Pass	No
M	Pass	No
N1	Pass	No
N2	Pass	No
O	Pass	No
P1	Pass	No
P2	Pass	No
Top of West Terrace	S15	Yes

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AREA	SAFETY EXCEEDANCE WITHIN REGION	REQUIRES MITIGATION?
Off-Site Receptors		
UU1	S15	Yes
UU2	S15	Yes
UU3	S15	Yes
UU4	S15	Yes
RR1	Pass	No
RR2	Pass	No
RR3	Pass	No
RR4	Pass	No
ND1	S20	Yes
ND2	Pass	No
Area immediately surrounding proposed Liverpool Waters buildings in middle of Nelson Dock	Pass	No

Table 14.27
Description of Wind Conditions around proposed development

LOCATIONS	DESCRIPTION
On-Site Receptors	
Thoroughfares	At the south of the stadium, there has been a very slight increase in wind speeds, compared to Configuration 4, where conditions were suitable for standing and are now suitable for strolling, with one very small area suitable for walking. The small area suitable for walking represents a minor adverse effect, however, conditions are still suitable for the intended activity for the majority of the area. Conditions everywhere else are broadly the same as those discussed for Configuration 4.
Entrances	The main (turnstile) entrances on the south façade of the stadium which were suitable for sitting in the windiest season in Configuration 4, are now suitable for standing in Configuration 5. However, conditions are still suitable for the intended activity. For all other entrance locations, conditions are the same as those discussed in Configuration 4
Ground Level and Terrace Level Amenity Areas — Mixed Use	Conditions are broadly the same as those discussed in Configuration 4.
Ground Level Amenity Areas — Seating	Conditions are the same as those discussed in Configuration 4.
Inaccessible locations	As pedestrians would be unable to access the inaccessible areas on-site (water channel), wind conditions would be considered acceptable regardless of the measured conditions.
Off-site Receptors	
UU WwTW	
Thoroughfares	Conditions are broadly the same as those discussed in Configuration 4.
Regent Road	
Thoroughfares	There is an increase in wind speeds along Regent Road, compared to Configuration 4, i.e. a very small area of wind acceleration at the southwest corner of the new proposed Bramley Hotel building. This is a moderate adverse effect (not significant). There is also some increase in wind speeds at the north and middle of Regent Road in Configuration 5, compared to Configuration 4. However, conditions are still suitable for strolling in these areas, and therefore the majority of Regent Road is suitable for its intended activity, except for the small area of acceleration mentioned at the southwest corner of the future proposed Bramley Hotel building (LPA ref. 20F/0217).
Nelson Dock	
Thoroughfares	Conditions are broadly the same as those discussed in Configuration 4.

WIND MICROCLIMATE

14.7 MITIGATION & ENHANCEMENT MEASURES

Table 14.28
Mitigation Measures Developed for Proposed Development

PHASE	POSSIBLE EFFECT BEING MITIGATED	MITIGATION MEASURE	HOW SECURED / TRIGGER	EXPECTED WIND CONDITIONS	RESIDUAL SIGNIFICANCE	FURTHER INFORMATION
Operation	Expected unsafe and uncomfortable wind conditions at ground level amenity areas at the western side of the stadium	<p>In the context of both the existing and cumulative surrounds, a robust monitoring process, which will involve an individual (or several) monitoring the wind conditions and when certain trigger conditions are met, mobilising to restrict access to the ground floor public realm areas and also the top of the western terrace area.</p> <p>The triggers would be:</p> <ol style="list-style-type: none">Forecast wind speeds above a certain threshold that would be determined through further analysisLocal wind speeds above a certain threshold that would be determined through further analysis <p>If either of these trigger conditions are met, the terrace level amenity spaces would be closed to pedestrians.</p> <p>This monitoring strategy would require in order to determine:</p> <ol style="list-style-type: none">An appropriate location for anemometersThe appropriate wind speed threshold to close restricted areas <p>Additionally, the applicant and its design team will be required to develop a strategy:</p> <ol style="list-style-type: none">To control how access will be restricted to this area (via the porous gates proposed within the three openings in the west terrace steps and the north and south entrances to west terrace)Define who will be monitoring the wind speedsDefine who will be responsible for closing/opening restricted areas <p>With this system in place the ground floor public realm areas (by the water channel in front of the west terrace steps), the top of the west terrace and the western quayside will only be accessible to unaccompanied general public when wind conditions are safe and suitable for sitting or standing use. In undertaking this piece of work, a good understanding of how many days in each year that these would need to be closed off for can be established.</p>	Planning Condition	Sitting to Standing use	Negligible	-

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14.8 ASSESSMENT POST-MITIGATION

14.8.1 Proposed Development Scenario (Configuration 3)

The above mitigation measures are expected to ensure that the ground level public realm areas to the west of the proposed stadium (in front of the west terrace by the water channel and the west quayside) as well as the top of the west terrace would only be accessible when the wind conditions are suitable for the intended use and safe for pedestrians and/or under strict supervision. This monitoring process is outlined in table 14.28 above.

With the above design interventions and mitigation measures in place, the following residual effects would occur (note, this table only shows the residual effects for areas that are affected by the mitigation measures. For all other locations, the residual effects remain as reported in section 14.6):

Table 14.29
Expected Wind Comfort Conditions

PHASE		RECEPTOR	LOCATIONS	EXPECTED CONDITIONS	RESIDUAL EFFECT				
					SIGNIFICANCE CRITERIA	ST/MT/LT	D/IND	P/T	R/IRR
On-Site Receptors									
Operation		Thoroughfares	G	Strolling use (with access to be managed when trigger conditions met)	Negligible	Long-term	Direct	Permanent	Irreversible
Operation		Ground Level Amenity Areas- Mixed Use — Controlled by Monitoring	Top of Western Terrace	Sitting use (with access to be restricted when trigger conditions met)	Negligible	Long-term	Direct	Permanent	Irreversible
Operation		Ground Level Amenity Areas — Seating — Controlled by Monitoring	Top of Western Terrace	Sitting use (with access to be restricted when trigger conditions met)	Negligible	Long-term	Direct	Permanent	Irreversible
Inaccessible Areas									
Operation		Inaccessible	Area in middle of Nelson Dock	Uncomfortable for all pedestrian use	Negligible	Long-term	Direct	Permanent	Irreversible

Table 14.30
Expected Wind Safety Conditions

AREA	SAFETY EXCEEDANCE WITHIN REGION	REQUIRES FURTHER MITIGATION?*
On-Site Receptors		
G	Pass	No
Top of Western Terrace	Pass	No

*A yes indicates that even with the design interventions and mitigation measures, outlined in this report in place, that the corresponding locations would require further mitigation measures. A no indicates that the location would be safe for pedestrian use.

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14.8.2 Proposed Development + Liverpool Waters Scenario (Configuration 4)

The mitigation measures in Table 14.28 are expected to ensure that the ground level amenity area to the west of the stadium as well as the terrace level amenity spaces at the west side of the stadium would only be accessible when the wind conditions are suitable for the intended use and safe for pedestrians and/or under strict supervision.

With the above design interventions and mitigation measures in place, the following residual effects would occur (note, this table shows the residual effects for areas that are affected by the mitigation measures. For all other locations, the residual effects remain as reported in section 14.6):

Table 14.31
Expected Wind Comfort Conditions

PHASE	RECEPTOR	PROBE NUMBER	RESIDUAL EFFECT EXPECTED CONDITIONS	SIGNIFICANCE CRITERIA	ST/MT/LT	D/IND	P/T	R/IRR
On-Site Receptors								
Operation	Thoroughfares	F1, F2, G	Strolling use (with access to be managed when trigger conditions met)	Negligible	Long-term	Direct	Permanent	Irreversible
Operation	Ground Level Amenity Areas - Mixed Use — Controlled by Monitoring	Top of Western Terrace	Sitting use (with access to be restricted when trigger conditions met)	Negligible	Long-term	Direct	Permanent	Irreversible
Operation	Ground Level Amenity Areas — Seating — Controlled by Monitoring	Top of Western Terrace	Sitting use (with access to be restricted when trigger conditions met)	Negligible	Long-term	Direct	Permanent	Irreversible

Table 14.32
Expected Wind Safety Conditions

AREA	SAFETY EXCEEDANCE WITHIN REGION	REQUIRES FURTHER MITIGATION?*
On-Site Receptors		
F1	Pass	No
F2	Pass	No
G	Pass	No
Top of Western Terrace	Pass	No

*a yes indicates that even with the design interventions and mitigation measures, outlined in this report in place, that the corresponding locations would require further mitigation measures. A no indicates that the location would be safe for pedestrian use.

14.8.3 Proposed Development + Liverpool Waters + Additional Cumulative Developments Scenario (Configuration 5)

The mitigation measures in Table 14.28 are expected to ensure that the ground level amenity area to the west of the stadium as well as the terrace level amenity spaces at the west side of the stadium would only be accessible when the wind conditions are suitable for the intended use and safe for pedestrians.

With the above design interventions and mitigation measures in place, the following residual effects would occur (note, this table only shows the residual effects for areas that are affected by the mitigation measures. For all other locations, the residual effects remain as reported in section 14.6):

Table 14.33
Expected Wind Comfort Conditions

PHASE	RECEPTOR	AREA	RESIDUAL EFFECT EXPECTED CONDITIONS	SIGNIFICANCE CRITERIA	ST/MT/LT	D/IND	P/T	R/IRR
On-Site Receptors								
Operation	Thoroughfares	F1, F2, G	Strolling use (with access to be restricted when trigger conditions met)	Negligible	Long-term	Direct	Permanent	Irreversible

WIND MICROCLIMATE

PHASE	RECEPTOR	AREA	RESIDUAL EFFECT EXPECTED CONDITIONS	SIGNIFICANCE CRITERIA	ST/MT/LT	D/IND	P/T	R/IRR
Operation	Ground Level Amenity Areas - Mixed Use – Controlled by Monitoring	Top of Western Terrace	Sitting use (with access to be restricted when trigger conditions met)	Negligible	Long-term	Direct	Permanent	Irreversible
Operation	Ground Level Amenity Areas – Seating – Controlled by Monitoring	Top of Western Terrace	Sitting use (with access to be restricted when trigger conditions met)	Negligible	Long-term	Direct	Permanent	Irreversible

Table 14.34

Expected Wind Safety Conditions

AREA	SAFETY EXCEEDANCE WITHIN REGION	REQUIRES FURTHER MITIGATION?*
On-Site Receptors		
F1	Pass	No
F2	Pass	No
G	Pass	No
Top of Western Terrace	Pass	No

*a yes indicates that even with the design interventions and mitigation measures, outlined in this report in place, that the corresponding probe locations would require further mitigation measures. A no indicates that the location would be safe for pedestrian use.

14.9 WIND MICROCLIMATE: INTER-DEVELOPMENT CUMULATIVE SCHEME EFFECTS

The only committed development with potential to result in cumulative effects alongside the proposed development at Bramley Moore Dock is the Liverpool Waters scheme and the proposed Hotel development at Blackstone Street (LPA ref. 20F/0217) to the east of the application site beyond Regent Road. The cumulative effects of the two schemes have already been reported in sections 14.6.2 and 14.6.3 of this chapter.

14.10 WORKS CITED

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