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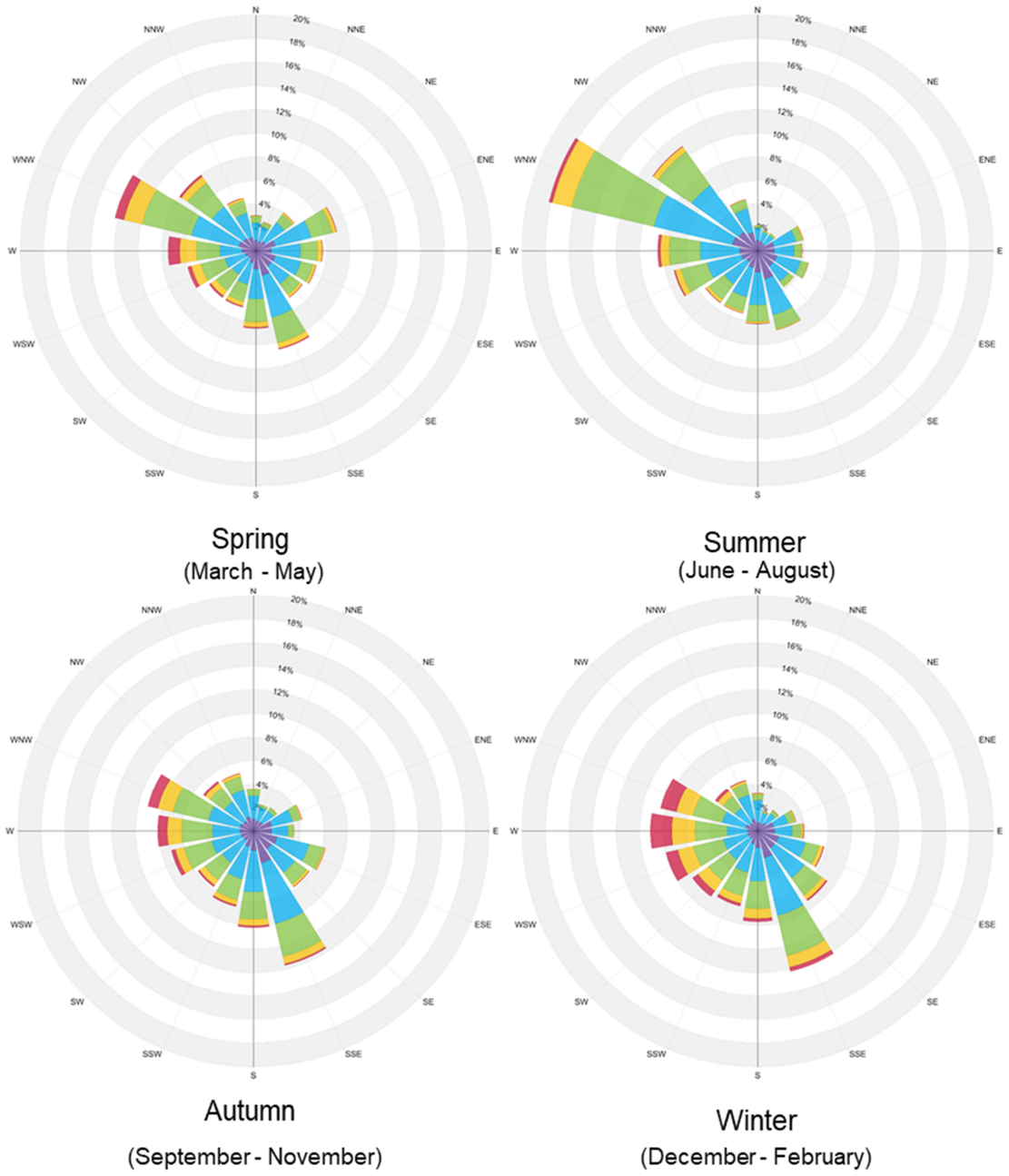

Figure 14.2
Seasonal Wind Data for Liverpool John Lennon Airport

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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

14.2.10.4 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
	Uncomfortable	>10 m/s	Winds of this magnitude are considered a nuisance for most activities, and wind mitigation is typically recommended.
	Walking	8-10 m/s	Relatively high wind speeds that can be tolerated if the objective is to walk, run or cycle without lingering.
	Standing	4-6 m/s	Gentle breezes suitable for main building entrances, pick-up/drop-off points and bus stops.
	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.

14.2.10.5 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 within the stadium's stands 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.

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 that access can be controlled to by gates that are proposed), 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 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 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.

A mix of winds suitable for sitting and standing use during the summer season could be considered acceptable for large mixed-use amenity spaces including both public realm and access-controlled areas as people could choose to sit at calmer areas and areas 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.

The football pitch at the centre of the stadium has been assessed as an amenity space as this is considered to be the most applicable criteria for such location. As such the football pitch would be considered suitable for the intended use if it has wind conditions suitable for sitting or standing use during the windiest season. The windiest season has been assessed as the football pitch is expected to be in use frequently during this season.

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.

It should be noted that entrances such as fire escapes and back of house entrances, that are not expected to be used on a frequent basis would be acceptable with strolling use wind conditions due to their infrequent usage.

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.

14.2.10.6 Strong Winds

The assessments undertaken also provides 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

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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 development such as the proposed development with heavy footfall expected on match days 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.

14.2.11 Assessment Scenarios

The following configurations were tested in the wind tunnel:

- Configuration 1: Existing site conditions with existing surrounding buildings (Baseline) (tested on 25/09/2019);
- Configuration 2: Liverpool Waters approved scheme on-site and in surrounding area (Future Baseline) (tested on 10/10/2019);
- Configuration 3: Proposed development on-site (including proposed landscaping and design interventions) with existing surrounding buildings (tested on 03/10/2019); and
- Configuration 4: Proposed development on-site (including proposed landscaping and design interventions) with Liverpool Waters scheme in surrounding area (tested on 19/11/2019).

Landscaping was not included in Configurations 1 and 2 as there is currently no landscaping around Bramley Moore Dock; and the reserved matters details of landscaping have not yet been submitted by Peel for the Liverpool Waters Scheme and therefore cannot be modelled. Other than the Liverpool Waters (Nelson Dock) scheme, no other cumulative schemes are present within the 360 m radius study area and as such, the only scheme considered to have the potential to result in cumulative effects alongside the Bramley-Moore Dock proposals is the Liverpool Waters (Nelson Dock) scheme.

In total, 142 probe locations at the existing site were included on the wind tunnel model for Configuration 1, with a further 27 probe locations in the surrounding area. The number of locations measured was reduced to a total of 150 measurement locations, both on and off-site with the introduction of the Liverpool Waters (Nelson Dock) schemes in Configuration 2 as some of the cumulative buildings would be situated in the same position as 19 of the probes in the baseline scenario. With the proposed development in place, a total of 242 measurements locations were introduced dropping to 238 with the introduction of the cumulative scheme.

The layout and total number of receptor locations for the baseline assessment at the application site (i.e. inside the red boundary line for the application site) was informed by the ground floor plan of the proposed development to ensure a consistent comparison of measurement locations for the different assessment configurations.

The probe locations in each of the four configurations can be found on Figures 14.3 to 14.10

14.2.11.1 Configuration 1: Baseline

A total of 169 measurement locations were tested in this scenario, below is a table outlining the usage of each receptor in the baseline scenario.

Table 14.3
Intended Usage of Receptors in the baseline

INTENDED USE	PROBE LOCATION NUMBER
On-Site Receptors	
Thoroughfare	4, 7, 11, 14, 20, 22, 23, 26, 27, 32, 33, 34, 35, 36, 38, 45, 46, 49, 53, 54, 58, 59, 60, 61, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 89, 90, 113, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 207, 208, 209, 210, 211, 212, 226, 227, 228, 229, 230, 231, 232, 233, 234, 242, 251, 252, 253, 254, 255, 259, 260, 261, 262, 263, 265
Inaccessible Locations	37, 39, 40, 41, 42, 43, 44, 47, 48, 51, 52, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 138, 139, 140, 141, 142, 143, 144, 145
Off-Site Receptors	
Thoroughfare	1, 2, 3, 4, 5, 6, 8, 9, 10, 12, 13, 15, 16, 17, 18, 19, 21, 24, 25, 28, 29, 30, 31, 62, 204, 205, 206, 249, 250, 264
Inaccessible Locations	244, 245, 246, 247, 248

14.2.11.2 Configuration 2: Future Baseline

A total of 150 measurement locations were tested in this scenario, below is a table outlining the usage of each receptor in the future baseline scenario:

Table 14.4
Intended Usage of Receptors in the future baseline

INTENDED USE	PROBE LOCATION NUMBER
On-Site Receptors	
Thoroughfare	4, 7, 11, 14, 20, 22, 23, 26, 27, 32, 33, 34, 35, 36, 38, 53, 57, 58, 59, 60, 61, 64, 66, 68, 70, 72, 73, 74, 76, 78, 80, 82, 83, 85, 86, 87, 89, 90, 111, 113, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 130, 131, 132, 133, 135, 137, 207, 208, 211, 212, 228, 231, 232, 242, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 267
Inaccessible Locations	37, 39, 40, 41, 42, 43, 44, 47, 48, 51, 52, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 138, 139, 140, 141, 142, 143, 144, 145
Off-Site Receptors	
Thoroughfare	1, 2, 3, 4, 5, 6, 8, 9, 10, 12, 13, 15, 16, 17, 18, 19, 21, 24, 25, 28, 29, 30, 31, 204, 205, 206, 244, 245, 246, 247, 248, 264

14.2.11.3 Configuration 3

A total of 242 measurement locations were tested in this scenario, below is a table outlining the usage of each receptor in the scenario with the proposed development in the context of the existing surroundings.

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Table 14.5
Intended Usage of Receptors in Configuration 3

INTENDED USE	PROBE LOCATION NUMBER
On-Site Receptors	
Thoroughfare	7, 11, 14, 20, 22, 27, 32, 42, 58, 59, 60, 61, 63, 64, 65, 66, 68, 74, 76, 78, 80, 82, 83, 84, 85, 86, 87, 88, 89, 91, 92, 94, 95, 97, 100, 102, 103, 106, 109, 110, 111, 112, 113, 115, 116, 117, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 131, 132, 133, 134, 135, 136, 137, 207, 208, 209, 210, 211, 212, 215, 219, 221, 225, 226, 227, 228, 229, 230, 231, 232, 233, 243
Entrances	4, 23, 40, 43, 48, 50, 51, 55, 56, 70, 72, 213, 214, 216, 217, 218, 220, 222, 223, 224, 235
Ground Level Amenity – Mixed Use	26, 33, 34, 35, 36, 38, 39, 41, 44, 45, 47, 52, 53, 54, 57, 90, 93, 96, 101, 105, 108, 237, 242
Football Pitch	138, 139, 140, 141, 142, 143, 144, 145
Ground Level Amenity Area – Seating Areas	37, 46, 49, 67, 69, 71, 73, 75, 77, 79, 81, 104, 107, 118, 119, 130, 236, 238, 239, 240, 241
Seating in stands	146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163
Inaccessible Locations	99, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203
Off-Site Receptors	
Thoroughfare	1, 2, 3, 5, 6, 8, 9, 10, 12, 13, 15, 16, 17, 18, 19, 21, 24, 25, 28, 29, 30, 31, 62, 204, 205, 206

14.2.11.4 Configuration 4

A total of 238 measurement locations were tested in this scenario, below is a table outlining the usage of each receptor in the scenario with the proposed development in the context of the cumulative surroundings:

Table 14.6
Intended Usage of Receptors in Configuration 4

INTENDED USE	PROBE LOCATION NUMBER
On-Site Receptors	
Thoroughfare	7, 11, 14, 20, 22, 27, 32, 42, 58, 59, 60, 61, 63, 64, 65, 66, 68, 74, 76, 78, 80, 82, 83, 84, 85, 86, 87, 88, 89, 91, 92, 94, 95, 97, 100, 102, 103, 106, 109, 110, 111, 112, 113, 115, 116, 117, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 131, 132, 133, 134, 135, 136, 137, 207, 208, 209, 210, 211, 212, 215, 219, 221, 226, 227, 228, 229, 230, 231, 232, 233, 242, 243
Entrances	4, 23, 40, 43, 48, 50, 51, 55, 56, 70, 72, 98, 213, 214, 216, 217, 218, 220, 222, 223, 224, 235
Ground Level Amenity – Mixed Use	26, 33, 34, 35, 36, 39, 41, 44, 45, 47, 52, 53, 54, 57, 90, 93, 96, 101, 105, 108, 237
Football Pitch	138, 139, 141, 142, 144, 145
Ground Level Amenity – Seating Areas	37, 46, 49, 67, 69, 71, 73, 75, 77, 79, 81, 104, 107, 118, 119, 130, 236, 238, 239, 240, 241
Seating in stands	146, 147, 148, 149, 150, 152, 153, 154, 155, 156, 157, 158, 159, 161, 162, 163
Inaccessible Locations	164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203
Off-Site Receptors	
Thoroughfare	1, 2, 3, 5, 6, 8, 9, 10, 12, 13, 15, 16, 17, 18, 19, 21, 24, 25, 28, 29, 30, 31, 204, 205, 206, 244, 245, 246, 247, 248

Note: Probe locations 99, 140, 143, 151, 160 and 225 were removed from Configuration 4 due to a limitation with the number of measurement locations that can assessed in any single test.

14.2.11.5 Inaccessible areas

A number of inaccessible locations have been identified around the application site across all four configurations tested. In the baseline and future baseline scenarios these locations would exist within Bramley-Moore Dock and are therefore considered to be water and inaccessible to pedestrians.

In Configurations 3 and 4, with the proposed development in place, there would be a single location (probe location 99) in the water channel to the west of the stadium which would be considered inaccessible for the same reasons as above. There would also be a number of locations at elevated levels around the stadium which would only be accessible to maintenance workers and as such are considered inaccessible to pedestrians and assessed accordingly.

14.2.11.6 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 probe location numbers that fall within each of these areas are shown in Table 14.7 below

Table 14.7
Off-Site Receptor Locations

OFF SITE AREA	PROBE LOCATION NUMBER
UU WwTW	1, 2, 3, 5, 6, 8, 9, 10, 12, 13, 15, 16, 17, 18, 19, 21, 24, 25, 28, 29, 30, 31
Regent Road	204, 205, 206
Nelson Dock	244, 245, 246, 247, 248

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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 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 they are acquiring from Peel for the proposed stadium scheme. As consequence of this, 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 larger 'river-walk' extending through the Liverpool Waters site, would be subject to separate assessment (by Peel as land owners). The current proposed stadium scheme does however facilitate future access to this area.

14.2.11.7 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 RWDI's experience of assessing wind in the built environment.

14.2.12 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 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 building on the western side of Nelson Dock (plot E-06) has been reduced in length to reflect the redline boundary of the proposed development.
- The two proposed building 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 Ports on 23 August 2019 and they raised no objections.

14.2.13 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 14.8 and 14.9

Table 14.8
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 all adverse effects are considered a significant effect and would therefore require mitigation; beneficial effects are not considered significant.

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.

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Table 14.9
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.

14.2.13.1 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.

14.2.13.2 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.

14.2.13.3 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.

14.2.13.4 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).

14.2.13.5 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.

14.2.14 Assumptions and Limitations

The wind tunnel 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. A photograph of the wind tunnel model is shown in Figure 14.1; more photographs are included within Technical Appendix 14.1: Pedestrian Level Wind Microclimate Report. The scheme model has been constructed based on the design information supplied by the Applicant's Architect (MEIS) and Landscape Architect (Plan-It) Design Team.

The conditions for the application site during construction have not been directly assessed by the wind tunnel 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.

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14.3 BASELINE CONDITIONS

14.3.1 Existing Baseline (Configuration 1)

The baseline wind tunnel test results are shown graphically in Figures 14.11 and 14.12 for the windiest and summer seasons, respectively, and in Figure 16.13 for the annual safety results. 169 locations have been tested in the Baseline scenario. The results are provided in full in Tables 14.10, 14.11 and 14.12 below:

Table 14.10
Wind Comfort Conditions for Windiest Season

KEY RECEPTORS	PROBE NUMBER	REQUIRED COMFORT CONDITIONS	MEASURED CONDITIONS	FURTHER INFORMATION
On-Site Receptors				
Thoroughfares	208	N/A	Standing	Section 6.1 of Appendix 14.1
Thoroughfares	23, 26, 27, 32, 33, 38, 45, 46, 49, 53, 54, 58, 59, 60, 61, 63, 68, 78, 80, 90, 116, 117, 118, 124, 126, 127, 207, 211, 251, 252, 259	N/A	Strolling	Section 6.1 of Appendix 14.1
Thoroughfares	4, 7, 11, 14, 20, 22, 34, 35, 36, 64, 65, 66, 67, 69, 70, 72, 73, 74, 75, 76, 77, 79, 81, 84, 85, 86, 87, 89, 113, 119, 120, 121, 122, 123, 125, 128, 129, 130, 131, 132, 133, 134, 209, 210, 212, 228, 229, 230, 231, 232, 233, 234, 253, 254, 260, 261, 262, 263, 265	N/A	Walking	Section 6.1 of Appendix 14.1
Thoroughfares	71, 82, 83, 226, 227, 255	N/A	Uncomfortable	Section 6.1 of Appendix 14.1
Inaccessible Areas	37, 52	N/A	Standing	Section 6.1 of Appendix 14.1
Inaccessible Areas	40, 41, 44, 93, 94, 96, 97, 99, 101, 102, 104, 106, 107, 138,	N/A	Strolling	Section 6.1 of Appendix 14.1
Inaccessible Areas	39, 42, 43, 47, 48, 51, 92, 95, 98, 100, 103, 106, 108, 139, 140, 141, 142, 143, 144	N/A	Walking	Section 6.1 of Appendix 14.1
Inaccessible Areas	145	N/A	Uncomfortable	Section 6.1 of Appendix 14.1
Off-Site Receptors				
UU WwTW				
Thoroughfares	21, 24, 25, 28, 31	N/A	Strolling	Section 6.1 of Appendix 14.1
Thoroughfares	1, 2, 3, 5, 6, 8, 9, 10, 13, 15, 16, 17, 18, 19, 29, 30	N/A	Walking	Section 6.1 of Appendix 14.1
Thoroughfares	12	N/A	Uncomfortable	Section 6.1 of Appendix 14.1
Regent Road				Section 6.1 of Appendix 14.1
Thoroughfares	205	N/A	Standing	Section 6.1 of Appendix 14.1

WIND MICROCLIMATE

KEY RECEPTORS	PROBE NUMBER	REQUIRED COMFORT CONDITIONS	MEASURED CONDITIONS	FURTHER INFORMATION
Thoroughfares	204	N/A	Strolling	Section 6.1 of Appendix 14.1
Thoroughfares	206	N/A	Walking	Section 6.1 of Appendix 14.1
Nelson Dock				
Thoroughfares	62	N/A	Strolling	Section 6.1 of Appendix 14.1
Thoroughfares	249, 250, 264	N/A	Walking	Section 6.1 of Appendix 14.1
Inaccessible Areas	246	N/A	Strolling	Section 6.1 of Appendix 14.1
Inaccessible Areas	244, 245, 247, 248	N/A	Walking	Section 6.1 of Appendix 14.1

Table 14.11
Annual Safety Exceedances

PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM
On-Site Receptors		
4	S15	9.8
7	S15	8.4
11	S15	21.2
12	S20	4.4
14	S15	10.6
20	S15	5.6
22	S15	5.7
23	Pass	N/A
26	Pass	N/A
27	Pass	N/A
32	Pass	N/A
33	Pass	N/A
34	S15	8.5
35	S15	18.4
36	S15	3.2
37	Pass	N/A
38	Pass	N/A

WIND MICROCLIMATE

PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM
39	S15	2.3
40	Pass	N/A
41	Pass	N/A
42	Pass	N/A
43	S15	10.7
44	Pass	N/A
45	Pass	N/A
46	Pass	N/A
47	S15	13.7
48	S15	10.6
49	Pass	N/A
51	S15	5.7
52	Pass	N/A
53	Pass	N/A
54	Pass	N/A
58	Pass	N/A
59	Pass	N/A
60	S15	5.2
61	Pass	N/A
63	S15	3.9
64	S15	9.3
65	S15	8.8
66	S15	10.3
67	S15	23.3
68	S15	5.4
69	S15	25.7
70	S15	15.1
71	S20	4.1
72	S20	2.6
73	S15	25.8
74	S20	3.7
75	S15	14.7
76	S15	15.8
77	S15	8.1

WIND MICROCLIMATE

PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM
78	S15	7.4
79	S15	10.7
80	Pass	N/A
81	S15	27.7
82	S20	11.5
83	S20	17.5
84	S15	24
85	S15	5.5
86	S15	2.3
87	S15	21.9
88	S15	14.4
89	S15	4.8
90	Pass	N/A
92	S15	3.9
93	Pass	N/A
94	Pass	N/A
95	Pass	N/A
96	Pass	N/A
97	Pass	N/A
98	S15	2.5
99	Pass	N/A
100	Pass	N/A
101	Pass	N/A
102	Pass	N/A
103	S15	4.1
104	Pass	N/A
105	Pass	N/A
106	S15	7.5
107	Pass	N/A
108	S15	4.5
113	S15	6.4
116	Pass	N/A
117	Pass	N/A
118	Pass	N/A

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PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM
119	Pass	N/A
120	Pass	N/A
121	S15	11.6
122	S15	5.6
123	Pass	N/A
124	Pass	N/A
125	Pass	N/A
126	Pass	N/A
127	Pass	N/A
128	Pass	N/A
129	S15	6.7
130	S15	4.8
131	S15	9.8
132	Pass	N/A
133	S15	13.6
134	S15	5.3
138	Pass	N/A
139	S15	6.4
140	S15	11.6
141	S15	7
142	S15	3.4
143	S15	13
144	S15	13
145	S15	17.1
207	Pass	N/A
208	Pass	N/A
209	S20	2.9
210	S15	12.9
211	S15	4.3
212	S15	23
226	S15	25.4
227	S15	23.4
228	S15	8
229	S15	9.6

WIND MICROCLIMATE

PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM
230	S15	11
231	S15	4.6
232	S15	2.8
233	S15	8.8
234	S15	3.3
242	Pass	N/A
251	Pass	N/A
252	S15	3.1
253	S15	16.1
254	S15	29.8
255	S20	4.9
259	S15	4.4
260	S20	2.8
261	S15	25.8
262	S15	18
263	S15	4.5
265	S15	3.7
Off-Site Receptors		
1	S15	3
2	S15	9.9
3	S15	4.5
5	S15	14.6
6	S15	6.4
8	S15	3.3
9	S15	18.6
10	S15	12.9
12	S20	4.4
13	S15	19.7
15	S15	28.6
16	S15	17
17	S15	14.4
18	S15	4.6
19	S15	6
21	Pass	N/A

WIND MICROCLIMATE

PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM
24	Pass	N/A
25	Pass	N/A
28	Pass	N/A
29	S15	2.8
30	S15	7.2
31	Pass	N/A
62	Pass	N/A
114	S15	3.1
204	Pass	N/A
205	Pass	N/A
206	S15	14.4
244	S15	15.8
245	S15	7.5
246	S15	2.9
247	S15	16.9
248	S15	10.4
249	S15	4.9
250	S15	3.5
264	S15	6.6

Table 14.12

Description of Wind Conditions around application site

LOCATIONS	DESCRIPTION
On-site Receptors	
Thoroughfares	There would be 33 thoroughfare locations on-site with strolling use wind conditions or calmer with the remaining 66 thoroughfare locations having walking use wind conditions or wind conditions uncomfortable for all pedestrian use. There would also be 65 locations on-site with exceedances of the 15m/s safety threshold for up to 29.8 hours per year, with eight locations also having exceedances of the 20m/s safety threshold for up to 17.5 hours per year.
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	Five of the 23 locations probed to the north of the application site would have strolling use wind conditions (probe locations 21, 24, 25, 28, and 31). Seventeen of the remaining 23 locations would have walking use wind conditions with a single location (probe location 12) having uncomfortable wind conditions for all pedestrian use. Likewise, seventeen of the 23 off-site locations would have strong winds exceeding the 15m/s safety threshold for up to 28.6 hours per year while a single location (probe location 12) would have strong winds exceeding the 20m/s safety threshold for 4.4 hours per year.
Regent Road	A single thoroughfare location would have unsuitable wind comfort conditions of the three locations probed on Regent Road, with walking use conditions being measured at probe location 206. Probe location 205 would have strolling use conditions and probe location 204 would have standing use conditions. Probe location 206 would also have strong winds exceeding the 15m/s safety threshold for 14.4 hours per year.
Nelson Dock	Of the four accessible locations probed in Nelson Dock, three would have walking use wind conditions (probe locations 249, 250, and 264) and the remaining one would have strolling use wind conditions (probe location 62). All three locations with walking use wind conditions would have exceedances of the 15m/s safety threshold for up to 6.6 hours per year.

WIND MICROCLIMATE

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

The future baseline wind tunnel test results are shown graphically in Figures 14.14 and 14.15 for the windiest and summer seasons, respectively, and in Figure 14.16 for the annual safety results. The wind microclimate in this scenario is windier than required at most of the 150 locations tested (similar to Configuration 1). A comparison of the wind safety results between the baseline and the future baseline are presented in Figure 14.36. Only probes that would be accessible in both scenarios are presented in this Figure as to ensure a valid comparison.

- Probe locations which are white indicate locations that have safe wind conditions in both the baseline and future baseline;
- Probe locations which are grey indicate probes which have an exceedance of the 15m/s safety threshold in both the baseline and future baseline;
- Probe locations which are black would have an exceedance of the 20m/s safety threshold in both the baseline and the future baseline;
- Probes coloured yellow indicate locations which would have an exceedance of the 15m/s safety threshold in the baseline but safe wind conditions in the future baseline;
- Probes coloured green indicate locations which would have an exceedance of the 20m/s safety threshold in the baseline and safe wind conditions in the future baseline;
- Blue coloured probes would have an exceedance of the 20m/s safety threshold in the baseline but there would be a reduction in the occurrence of strong winds in the future baseline to the extent that the location would only have an exceedance of the 15m/s safety threshold;
- Probes coloured orange would indicate locations which have safe wind conditions in the baseline but would have an exceedance of the 15m/s safety threshold in the future baseline;
- Red coloured probes are locations which would have safe wind conditions in the baseline but would have an exceedance of the 20m/s safety threshold in the future baseline;
- Purple coloured probes are locations which would have an exceedance of the 15m/s safety threshold in the baseline but with an increase in strong winds in the future baseline to the extent that there is also an exceedance of the 20m/s safety threshold.

The results are provided in full in Tables 14.13, 14.14, and 14.15 below:

Table 14.13
Expected Wind Comfort Conditions

KEY RECEPTORS	PROBE NUMBER	REQUIRED COMFORT CONDITIONS	MEASURED CONDITIONS	FURTHER INFORMATION
On-site Receptors				
Thoroughfare	36	Strolling	Sitting	Section 6.2 of Appendix 14.1
Thoroughfare	34, 53, 58, 68, 70, 89, 111, 208, 251	Strolling	Standing	Section 6.2 of Appendix 14.1
Thoroughfare	4, 7, 22, 23, 26, 27, 35, 38, 60, 61, 64, 66, 74, 76, 78, 80, 82, 85, 113, 126, 133, 207, 211, 231, 207, 211, 212, 231, 242, 253, 257, 258, 259, 260, 261, 262, 263, 267	Strolling	Strolling	Section 6.2 of Appendix 14.1
Thoroughfare	11, 14, 20, 32, 33, 59, 72, 73, 83, 86, 87, 90, 124, 125, 127, 130, 137, 228, 232, 252, 254, 255	Strolling	Walking	Section 6.2 of Appendix 14.1
Thoroughfare	57, 115, 116, 177, 118, 119, 120, 121, 122, 123, 128, 131, 132, 135, 256	Strolling	Uncomfortable	Section 6.2 of Appendix 14.1
Inaccessible Areas	37, 40, 141	N/A	Standing	Section 6.2 of Appendix 14.1
Inaccessible Areas	39, 41, 42, 43, 47, 48, 51, 52, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 106, 140, 142, 143, 145	N/A	Strolling	Section 6.2 of Appendix 14.1
Inaccessible Areas	44, 102, 107, 108, 138, 139, 144	N/A	Walking	Section 6.2 of Appendix 14.1
Inaccessible Areas	103, 104, 105	N/A	Uncomfortable	Section 6.2 of Appendix 14.1
Off-Site Receptors				
UU WwTW				
Thoroughfare	2, 3, 6, 8, 9, 10, 25, 31, 114	Strolling	Strolling	Section 6.2 of Appendix 14.1
Thoroughfare	1, 5, 13, 15, 16, 17, 18, 19, 21, 24, 28, 29, 30	Strolling	Walking	Section 6.2 of Appendix 14.1
Thoroughfare	12	Strolling	Uncomfortable	Section 6.2 of Appendix 14.1

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KEY RECEPTORS	PROBE NUMBER	REQUIRED COMFORT CONDITIONS	MEASURED CONDITIONS	FURTHER INFORMATION
Regent Road				
Thoroughfare	204, 205, 206	Strolling	Standing	Section 6.2 of Appendix 14.1
Nelson Dock				
Thoroughfare	264	Strolling	Walking	Section 6.2 of Appendix 14.1
Thoroughfare	244. 245, 246, 247, 248	Strolling	Strolling	Section 6.2 of Appendix 14.1

Table 16.14
Expected Wind Safety Conditions

PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES MITIGATION?
On-Site Receptors			
4	Pass	N/A	N/A
7	Pass	N/A	N/A
11	S15	12.6	N/A
14	S15	11.2	N/A
20	S15	15.6	N/A
22	Pass	N/A	N/A
23	S15	4.2	N/A
26	S15	2.5	N/A
27	Pass	N/A	N/A
32	S15	9.7	N/A
33	S15	3.1	N/A
34	Pass	N/A	N/A
35	Pass	N/A	N/A
36	Pass	N/A	N/A
37	Pass	N/A	N/A
38	S15	5	N/A
39	Pass	N/A	N/A
40	Pass	N/A	N/A
41	Pass	N/A	N/A
42	Pass	N/A	N/A
43	S15	3.9	N/A
44	S20	2.5	N/A
47	Pass	N/A	N/A
48	Pass	N/A	N/A

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PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES MITIGATION?
51	S15	3.8	N/A
52	Pass	N/A	N/A
53	Pass	N/A	N/A
57	S20	10.4	N/A
58	Pass	N/A	N/A
59	S15	6.1	N/A
60	S15	3	N/A
61	S15	11.3	N/A
64	S15	6.5	N/A
66	S15	3.1	N/A
68	Pass	N/A	N/A
70	Pass	N/A	N/A
72	S15	9.6	N/A
73	S15	4.4	N/A
74	S15	9.3	N/A
76	S15	15.5	N/A
78	S15	4.7	N/A
80	Pass	N/A	N/A
82	S15	9.3	N/A
83	S15	8	N/A
85	S15	5.1	N/A
86	S15	10.1	N/A
87	S15	6.2	N/A
89	Pass	N/A	N/A
90	S15	9.6	N/A
92	S15	2.9	N/A
93	S15	8.7	N/A
94	Pass	N/A	N/A
95	Pass	N/A	N/A
96	S15	2.3	N/A
97	Pass	N/A	N/A
98	Pass	N/A	N/A
99	Pass	N/A	N/A
100	S15	6.9	N/A

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PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES MITIGATION?
101	Pass	N/A	N/A
102	S15	19.1	N/A
103	S20	12.1	N/A
104	S20	13.4	N/A
105	S20	32.4	N/A
106	S15	6.2	N/A
107	S15	35.6	N/A
108	S20	5.8	N/A
111	Pass	N/A	N/A
113	S15	4.7	N/A
115	S20	5.6	N/A
116	S20	6.4	N/A
117	S20	3.1	N/A
118	S20	5.8	N/A
119	S20	11.2	N/A
120	S20	24.9	N/A
121	S20	76.5	N/A
122	S20	3.9	N/A
123	S15	10.2	N/A
124	Pass	N/A	N/A
125	S15	4.5	N/A
126	S15	4.6	N/A
127	S15	8.2	N/A
128	S20	6.4	N/A
130	S15	6.6	N/A
131	S20	8	N/A
132	S20	6.3	N/A
133	Pass	N/A	N/A
135	S20	10.2	N/A
137	S15	4.8	N/A
138	S15	12.9	N/A
139	S15	10.3	N/A
142	S15	3.1	N/A
143	S15	4.3	N/A

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PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES MITIGATION?
144	S15	26.2	N/A
145	S15	9.6	N/A
207	S15	2.6	N/A
208	Pass	N/A	N/A
211	Pass	N/A	N/A
212	S15	3.8	N/A
228	S15	3.7	N/A
231	S15	4.9	N/A
232	S15	6	N/A
242	Pass	N/A	N/A
251	Pass	N/A	N/A
252	S15	19.8	N/A
253	Pass	N/A	N/A
254	S20	2.4	N/A
255	S15	26.8	N/A
256	S20	13.8	N/A
257	S15	20.9	N/A
258	S15	2.5	N/A
259	Pass	N/A	N/A
260	Pass	N/A	N/A
261	S15	11.2	N/A
262	S15	2.3	N/A
263	Pass	N/A	N/A
267	S15	5	N/A
Off-Site Receptors			
1	S15	22.9	N/A
2	S15	8	N/A
3	S15	5.9	N/A
5	S15	9.2	N/A
6	S15	5.5	N/A
8	S15	2.3	N/A
9	Pass	N/A	N/A
10	Pass	N/A	N/A
12	S20	3.1	N/A

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PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES MITIGATION?
13	S15	3.3	N/A
15	S15	17.6	N/A
16	S15	12.6	N/A
17	S15	12.3	N/A
18	S15	5.5	N/A
19	S15	6.9	N/A
21	Pass	N/A	N/A
24	Pass	N/A	N/A
25	Pass	N/A	N/A
28	S15	3.1	N/A
29	S15	4.8	N/A
30	S15	5.4	N/A
31	Pass	N/A	N/A
114	S15	9.3	N/A
204	Pass	N/A	N/A
205	Pass	N/A	N/A
206	Pass	N/A	N/A
244	Pass	N/A	N/A
245	Pass	N/A	N/A
246	Pass	N/A	N/A
247	Pass	N/A	N/A
248	S15	3.3	N/A
264	S15	8.1	N/A

Table 14.15

Description of Wind Conditions around application site

LOCATIONS	DESCRIPTION
On-Site Receptors	
Thoroughfares	There would be 37 locations, largely around the west of the site, which would have unsuitable wind conditions; 22 of these locations would have walking use wind conditions and 15 locations would have wind conditions uncomfortable for all pedestrian use. Of the remaining 45 thoroughfare locations on-site, one would have sitting use conditions (probe location 36), nine would have standing use conditions (probe locations 34, 53, 58, 68, 70, 89, 111, and 251) and the remaining 35 locations would have strolling use wind conditions. There would also be 58 locations which would have strong winds exceeding the 15m/s safety threshold for up to 26.8 hours per year and 15 locations would also have strong winds exceeding the 20m/s safety threshold for up to 76.5 hours per year. Of the probe locations which are in both the baseline and the future baseline: Eight probe locations (27, 53, 58, 80,124, 147 208, and 242) would have safe wind conditions in both configurations; 15 probe locations would have unsafe wind conditions in the baseline but safe wind conditions in the future baseline; 26 probe locations would have unsafe wind conditions in both configurations but would exceed the safety threshold for fewer hours in the future baseline per year; 15 probe locations would have unsafe wind conditions in both configurations but would exceed the safety threshold for more hours in the future baseline per year;

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LOCATIONS	DESCRIPTION
	19 probe locations would have safe wind conditions in the baseline but would have strong winds exceeding the safety threshold in the future baseline. For a further breakdown of wind safety conditions in the future baseline scenario, please refer to Table 16.13.
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 future baseline scenario, there would be seven of the 23 locations probed (probe locations 2, 3, 6, 8, 9, 10, 25, 31, and 114). Of the remaining 16 locations, 15 would have walking use wind conditions and one location (probe location 12) would have uncomfortable wind conditions for all pedestrian use. There would also be 17 locations which would have strong winds exceeding the safety threshold for up to 22.9 hours per year with one of these locations (probe location 12) having strong winds exceeding the 20m/s safety threshold for 3.1 hours per year. In comparison with the baseline conditions, probe locations 1, 5, 12, 13, 15, 16, 17,18, 19, 25, 29, 30, and 31 would have the same wind comfort conditions in the future baseline in the windiest season, probe locations 2, 3, 6, 8, 9, 10, 114 would have calmer wind comfort conditions in future baseline in the windiest season, and probe locations 21, 24, and 28 would have windier wind comfort conditions in future baseline in the windiest season. In comparison with the baseline, exceedance of the safety threshold at probe locations 1, 3, 18, 19, 29, and 114 would increase by up to 19.9 hours per year, whereas at probe locations 2, 5, 6, 8, 13, 15, 16, 17, and 30 exceedance of the safety threshold would decrease by up to 16.4 hours per annum. All of these locations would still have strong wind exceeding the 15m/s safety threshold. There would be a single probe location which would have strong winds exceeding the 20m/s safety threshold in the baseline (probe location 12) for 4.4 hours per annum and this exceedance would decrease to 3.1 hours per annum in the future baseline however the location would still have strong winds exceeding the 20m/s safety threshold. In the baseline, probe locations 9 and 10 would have strong winds exceeding the safety threshold for 18.6 and 12.9 hours respectively however would have safe wind conditions in the future baseline. Probe locations 21, 24, 25, and 31 would have safe wind conditions in both the baseline and the future baseline. A single location, probe location 28 would have safe wind conditions in the baseline scenario but would have strong winds exceeding the 15m/s safety threshold in the future baseline by 3.1 hours per annum.
Regent Road	All three locations probed on Regent Road (probe locations 204, 205 and 206) would have standing use wind conditions in the future baseline. All locations probed on Regents Road in the future baseline scenario would have safe wind conditions for pedestrian use. In comparison with the baseline, probe locations 204 and 206 would have calmer wind comfort conditions in the future baseline in the windiest season and probe location 205 would have the same wind comfort conditions in the future baseline in the windiest season. In the baseline probe location 206 has strong winds exceeding the 15m/s safety threshold for 14.4 hours per annum however in the future baseline this location would be safe for pedestrian use.
Nelson Dock	There would be six thoroughfare locations in Nelson Dock in the future baseline scenario (probe locations 244, 245, 246, 247, 248, and 264), five of these locations (probe locations 244, 245, 246, 247, and 248) would have strolling use wind conditions during the windiest season. The remaining location (probe location 264) would have walking use wind conditions. Two locations (probe locations 248 and 264) would also have strong winds exceeding the 15m/s safety threshold for 3.3 and 8.1 hours per year respectively.

The results of the Configurations 1 and 2 scenarios have been reported above. The following sections assess the proposed scheme on an individual basis (Configuration 3 – stadium without Liverpool Waters) and cumulative (Configuration 4 – stadium plus Liverpool Waters). Whilst it is uncertain about the timings of delivery of the approved Nelson Dock development within the wider Liverpool Waters scheme, it is extremely unlikely to be developed prior to the stadium opening (currently anticipated by the applicant as 2023).

14.4 POTENTIAL SIGNIFICANT IMPACTS

Table 14.16

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). 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), 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

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14.5 DESIGN INTERVENTIONS

A number of 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 14.17
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.	■ Chapter 3 of the Environmental Impact Assessment ■ Landscaping Masterplan Drawings (Ref: BMD01-PLA-L1-00-DR-L-0001; BMD01-PLA-L1-00-DR-L-1000; and BMD01-PLA-L1-00-DR-L-2000)
Two 50% porous gates covering the openings on the western façade of the car park massing at the west of the stadium, one at the north end and one and the south end	Unsafe and unsuitable wind conditions would be present underneath the car park massing built into the west of the stadium. The gates, along with other design interventions, would ensure the wind microclimate in this area is safe and suitable for the intended use.	■ Section 7 of Appendix 14.1 ■ Fig 35 of Appendix C of Appendix 14.1 ■ Chapter 3 of the Environmental Impact Assessment
A solid, floor-to-ceiling screen spanning the width of the car park massing at the west of the stadium located at the north side of the hospitality entrances at the western façade of the stadium	Unsafe and unsuitable wind conditions would be present at the underside of the car park massing at the west of the stadium. The floor-to-ceiling screen, along with other design interventions, would ensure the wind microclimate in this area is safe and suitable for the intended use.	■ Section 7 of Appendix 14.1 ■ Fig 36 of Appendix C of Appendix 14.1 ■ Chapter 3 of the Environmental Impact Assessment
Thirteen, 5m tall deciduous trees located on the south side (on-site) of the northern boundary fence running eastward (probe location 27 to probe location 34)	Unsafe and unsuitable wind conditions would be present at the north-west corner of The Hydraulic Engine House. The deciduous trees would ensure a safe and comfortable wind environment around the Hydraulic Engine House	■ Section 7 of Appendix 14.1 ■ Fig 37 of Appendix C of Appendix 14.1 ■ Chapter 3 of the Environmental Impact Assessment
Four, 3m tall, 10m deep, 50% porous baffles hung from the underside of the car park massing at the west of the stadium located 10m apart with the east most baffle being 26m from the southern edge of the car park massing	Unsafe and unsuitable wind conditions would be present at the underside of the car park massing at the west of the stadium. The baffles, along with other design interventions in this area, would ensure the wind microclimate in this area is safe and suitable for the intended use.	■ Section 7 of Appendix 14.1 ■ Fig 38 of Appendix C of Appendix 14.1 ■ Chapter 3 of the Environmental Impact Assessment
2m tall 50% porous balustrades at both sides of the south-western bridge	Unsafe and unsuitable wind conditions would be present at the south-west of the stadium. The increased balustrade height, along with other design interventions in this area, would ensure the wind conditions would be safe and suitable for the intended use.	■ Section 7 of Appendix 14.1 ■ Fig 43 of Appendix C of Appendix 14.1 ■ Chapter 3 of the Environmental Impact Assessment
The northern boundary wall made 50% porous running eastward from the eastern most column at the northern façade of the stadium	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.	■ Section 7 of Appendix 14.1 ■ Fig 39 of Appendix C of Appendix 14.1 ■ Chapter 3 of the Environmental Impact Assessment
A 2m tall 50% porous boundary fence at the south-west of the site	Unsafe and unsuitable wind conditions would be present at the south-west of site. A 50% porous boundary fence in this area would ensure the wind conditions would be safe and suitable for the intended use.	■ Section 7 of Appendix 14.1 ■ Fig 40 of Appendix C of Appendix 14.1 ■ Chapter 3 of the Environmental Impact Assessment
A 4m wide, floor-to-ceiling, 50% porous screen extending from the western façade of the stadium at the north end of the car park massing at the west of the stadium	Unsafe and unsuitable wind conditions would be present at the underside of the car park massing at the west of the stadium. The floor-to-ceiling screen, along with other design interventions, would ensure the wind microclimate in this area is safe and suitable for the intended use.	■ Section 7 of Appendix 14.1 ■ Fig 41 of Appendix C of Appendix 14.1 ■ Chapter 3 of the Environmental Impact Assessment
A 30% porous gate covering the entirety of the central entrance on the western façade of the car park massing at the west of the stadium	Unsafe and unsuitable wind conditions would be present at the underside of the car park massing at the west of the stadium. The gate, along with other design interventions, would ensure the wind microclimate in this area is safe and suitable for the intended use.	■ Section 7 of Appendix 14.1 ■ Fig 42 of Appendix C of Appendix 14.1

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DESIGN INTERVENTION	REASON FOR INTERVENTION	FURTHER INFORMATION
		■ Chapter 3 of the Environmental Impact Assessment
A 5m tall, 50% porous fence running from the eastern end of the south-west bridge to the western façade of the car park massing at the west of the stadium	Unsafe and unsuitable wind conditions would be present at the south-west of the stadium. The fence, along with other design interventions in this area, would ensure the wind conditions would be safe and suitable for the intended use.	■ Section 7 of Appendix 14.1 ■ Fig 43 of Appendix C of Appendix 14.1 ■ Chapter 3 of the Environmental Impact Assessment
Seventeen 7.5m wide, tapered baffles which are 9m tall the southern end and 6m tall at the northern end, spaced 10m apart running along the southern thoroughfare underneath the south stand	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.	■ Section 7 of Appendix 14.1 ■ Fig 44 of Appendix C of Appendix 14.1 ■ Chapter 3 of the Environmental Impact Assessment
Nine 6m tall 50% porous baffles of varying width (3-15m) and 6m ground clearance at the south-west corner of the stadium	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.	■ Section 7 of Appendix 14.1 ■ Fig 45 of Appendix C of Appendix 14.1 ■ Chapter 3 of the Environmental Impact Assessment
Six 6m tall 50% porous baffles of varying width (3-12m) and 6m ground clearance at the south-east corner of the stadium	Unsafe and unsuitable wind conditions would be present at the south-east corner 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.	■ Section 7 of Appendix 14.1 ■ Fig 46 of Appendix C of Appendix 14.1 ■ Chapter 3 of the Environmental Impact Assessment
Two 12m tall, varying width (9-15m), 50% porous screens at the south-west corner of the stadium	Unsafe and unsuitable wind conditions would be present at the south-west of the stadium. The screens, along with other design interventions in this area, would ensure the wind conditions would be safe and suitable for the intended use.	■ Section 7 of Appendix 14.1 ■ Fig 47 of Appendix C of Appendix 14.1 ■ Chapter 3 of the Environmental Impact Assessment
22, 10m wide, 3m tall, 50% porous baffles with 7m ground clearance at the north façade of the stadium	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.	■ Section 7 of Appendix 14.1 ■ Fig 48 of Appendix C of Appendix 14.1 ■ Chapter 3 of the Environmental Impact Assessment
2m tall, 50% porous fence running along the east side of the Mersey Wall at the west side of the proposed development.	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.	■ Section 7 of Appendix 14.1 ■ Fig 49 of Appendix C of Appendix 14.1 ■ Chapter 3 of the Environmental Impact Assessment

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 Figures 14.17 to 14.19 for the windiest and Figures 14.20 to 14.22 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 14.23 to 14.25. A comparison of the wind safety results between the baseline and Configuration 3 are presented in Figure 14.37. Only probes that would be accessible in both scenarios are presented in this Figure as to ensure a valid comparison.

- Probe locations which are white indicate locations that have safe wind conditions in both the baseline and Configuration 3;
- Probe locations which are grey indicate probes which have an exceedance of the 15m/s safety threshold in both the baseline and Configuration 3;
- Probe locations which are black would have an exceedance of the 20m/s safety threshold in both the baseline and Configuration 3;
- Probes coloured yellow indicate locations which would have an exceedance of the 15m/s safety threshold in the baseline put safe wind conditions in Configuration 3;
- Probes coloured green indicate locations which would have an exceedance of the 20m/s safety threshold in the baseline and safe wind conditions in Configuration 3;
- Blue coloured probes would have an exceedance of the 20m/s safety threshold in the baseline but there would be a reduction in the occurrence of strong winds in Configuration 3 to the extent that the location would only have an exceedance of the 15m/s safety threshold;
- Probes coloured orange would indicate locations which have safe wind conditions in the baseline but would have an exceedance of the 15m/s safety threshold in Configuration 3;

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- Red coloured probes are locations which would have safe wind conditions in the baseline but would have an exceedance of the 20m/s safety threshold in Configuration 3;
- Purple coloured probes are locations which would have an exceedance of the 15m/s safety threshold in the baseline but with an increase in strong winds in Configuration 3 to the extent that there is also an exceedance of the 20m/s safety threshold.

The results are provided in full in Tables 14.18, 14.19, and 14.20 below.

Table 14.18
Expected Wind Comfort Conditions

PHASE	RECEPTOR(S) AFFECTED	PROBE NUMBERS	MEASURED CONDITIONS	SIGNIFICANCE CRITERIA	MITIGATION PROPOSED?	FURTHER INFORMATION
On-site Receptors						
Operation	Thoroughfare	42, 78, 80, 97, 102, 103, 106, 109, 111, 219, 221, 225, 233	Sitting	Moderate Beneficial	No	Section 6.3 of Appendix 14.1
Operation	Thoroughfare	7, 11, 14, 20, 27, 32, 58, 59, 61, 64, 68, 74, 84, 85, 87, 88, 91, 92, 94, 110, 112, 120, 121, 122, 123, 124, 125, 126, 128, 129, 132, 133, 135, 136, 137, 208, 209, 210, 211, 215, 227, 228, 230, 231, 232, 243	Standing	Minor Beneficial	No	Section 6.3 of Appendix 14.1
Operation	Thoroughfare	22, 60, 63, 65, 66, 76, 82, 83, 86, 89, 113, 115, 116, 117, 127, 131, 134, 207, 212, 226, 229	Strolling	Negligible	No	Section 6.3 of Appendix 14.1
Operation	Entrances	4, 40, 43, 48, 50, 51, 55, 56, 214, 216, 217, 220, 222, 223, 224	Sitting	Minor Beneficial	No	Section 6.3 of Appendix 14.1
Operation	Entrances	23, 70, 72, 213, 218, 235	Standing	Negligible	No	Section 6.3 of Appendix 14.1
Operation	Entrances	98	Strolling	Minor Adverse	No	Section 6.3 of Appendix 14.1
Operation	Football Pitch	138, 139, 140, 142, 143, 144, 145	Sitting	Negligible	No	Section 6.3 of Appendix 14.1
Operation	Football Pitch	141	Standing	Negligible	No	Section 6.3 of Appendix 14.1
Operation	Ground Level Amenity Areas – Mixed Use	35, 36, 39, 41, 45, 47, 52, 57	Sitting	Negligible	No	Section 6.3 of Appendix 14.1
Operation	Ground Level Amenity Areas – Mixed Use	26, 33, 34, 38, 44, 53, 54, 105, 108, 242	Standing	Negligible	No	Section 6.3 of Appendix 14.1
Operation	Ground Level Amenity Areas – Mixed Use	96, 101, 237	Strolling	Minor Adverse	Yes	Section 6.3 of Appendix 14.1
Operation	Ground Level Amenity Areas – Mixed Use	90, 93	Walking	Moderate Adverse	Yes	Section 6.3 of Appendix 14.1
Operation	Ground Level Amenity - Seating	37, 69, 71, 73, 79, 81	Sitting	Negligible	No	Section 6.3 of Appendix 14.1
Operation	Ground Level Amenity - Seating	46, 49, 67, 75, 77, 118, 119, 130, 240	Standing	Minor Adverse	Yes	Section 6.3 of Appendix 14.1
Operation	Ground Level Amenity - Seating	104, 107, 238, 239, 241	Strolling	Moderate Adverse	Yes	Section 6.3 of Appendix 14.1
Operation	Ground Level Amenity - Seating	236	Walking	Major Adverse	Yes	Section 6.3 of Appendix 14.1
Operation	Seating in stands	146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163	Sitting	Negligible	No	Section 6.3 of Appendix 14.1
Operation	Inaccessible locations	164, 199, 201	Sitting	Negligible	No	Section 6.3 of Appendix 14.1
Operation	Inaccessible locations	168, 169, 170, 171, 176, 179, 180, 181, 182, 183, 184, 185, 186, 202	Standing	Negligible	No	Section 6.3 of Appendix 14.1

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PHASE	RECEPTOR(S) AFFECTED	PROBE NUMBERS	MEASURED CONDITIONS	SIGNIFICANCE CRITERIA	MITIGATION PROPOSED?	FURTHER INFORMATION
Operation	Inaccessible locations	165, 166, 167, 172, 173, 174, 190, 194, 195, 197, 198, 200	Strolling	Negligible	No	Section 6.3 of Appendix 14.1
Operation	Inaccessible locations	99, 175, 177, 178, 187, 189, 191, 196, 203	Walking	Negligible	No	Section 6.3 of Appendix 14.1
Operation	Inaccessible locations	188, 192, 193	Uncomfortable for all pedestrian use	Negligible	No	Section 6.3 of Appendix 14.1
Off-Site Receptors						
UU WwTW						
Operation	Thoroughfares	1, 2, 3, 114	Standing	Moderate Beneficial	No	Section 6.3 of Appendix 14.1
Operation	Thoroughfares	31	Standing	Negligible	No	Section 6.3 of Appendix 14.1
Operation	Thoroughfares	5, 8, 29	Strolling	Minor Beneficial	No	Section 6.3 of Appendix 14.1
Operation	Thoroughfares	6, 9, 10, 13, 16, 18, 30	Walking	Negligible	No	Section 6.3 of Appendix 14.1
Operation	Thoroughfares	21, 24, 25, 28	Walking	Minor Adverse	No	Section 6.3 of Appendix 14.1
Operation	Thoroughfares	12	Uncomfortable	Negligible	No	Section 6.3 of Appendix 14.1
Operation	Thoroughfares	15, 17, 19	Uncomfortable	Minor Adverse	No	Section 6.3 of Appendix 14.1
Regent Road						
Operation	Thoroughfares	205	Standing	Negligible	No	Section 6.3 of Appendix 14.1
Operation	Thoroughfares	206	Standing	Moderate Beneficial	No	Section 6.3 of Appendix 14.1
Operation	Thoroughfares	204	Strolling	Negligible	No	Section 6.3 of Appendix 14.1
Nelson Dock						
Operation	Thoroughfares	62	Strolling	Negligible	No	Section 6.3 of Appendix 14.1

Table 14.19
Expected Wind Safety Conditions

PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES MITIGATION?
On-Site Receptors			
4	Pass	N/A	No
7	Pass	N/A	No
11	Pass	N/A	No
14	Pass	N/A	No
20	Pass	N/A	No
22	Pass	N/A	No
23	Pass	N/A	No
26	Pass	N/A	No
27	Pass	N/A	No
32	Pass	N/A	No

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PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES MITIGATION?
33	Pass	N/A	No
34	Pass	N/A	No
35	Pass	N/A	No
36	Pass	N/A	No
37	Pass	N/A	No
38	Pass	N/A	No
39	Pass	N/A	No
40	Pass	N/A	No
41	Pass	N/A	No
42	Pass	N/A	No
43	Pass	N/A	No
44	Pass	N/A	No
45	Pass	N/A	No
46	Pass	N/A	No
47	Pass	N/A	No
48	Pass	N/A	No
49	Pass	N/A	No
50	Pass	N/A	No
51	Pass	N/A	No
52	Pass	N/A	No
53	Pass	N/A	No
54	Pass	N/A	No
55	Pass	N/A	No
56	Pass	N/A	No
57	Pass	N/A	No
58	Pass	N/A	No
59	Pass	N/A	No
60	Pass	N/A	No
61	Pass	N/A	No
63	Pass	N/A	No
64	Pass	N/A	No
65	Pass	N/A	No
66	Pass	N/A	No
67	Pass	N/A	No

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PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES MITIGATION?
68	Pass	N/A	No
69	Pass	N/A	No
70	Pass	N/A	No
71	Pass	N/A	No
72	Pass	N/A	No
73	Pass	N/A	No
74	Pass	N/A	No
75	Pass	N/A	No
76	Pass	N/A	No
77	Pass	N/A	No
78	Pass	N/A	No
79	Pass	N/A	No
80	Pass	N/A	No
81	Pass	N/A	No
82	Pass	N/A	No
83	Pass	N/A	No
84	Pass	N/A	No
85	Pass	N/A	No
86	Pass	N/A	No
87	Pass	N/A	No
88	Pass	N/A	No
89	Pass	N/A	No
90	S20	3.8	Yes
91	Pass	N/A	No
92	Pass	N/A	No
93	S15	34.9	Yes
94	Pass	N/A	No
95	Pass	N/A	No
96	S15	6.1	Yes
97	Pass	N/A	No
98	Pass	N/A	No
99	S15	3.4	Yes
100	Pass	N/A	No
101	Pass	N/A	No

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PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES MITIGATION?
102	Pass	N/A	No
103	Pass	N/A	No
104	Pass	N/A	No
105	Pass	N/A	No
106	Pass	N/A	No
107	S15	3.1	Yes
108	S15	6.9	Yes
109	Pass	N/A	No
110	Pass	N/A	No
111	Pass	N/A	No
112	Pass	N/A	No
113	Pass	N/A	No
115	Pass	N/A	No
116	Pass	N/A	No
117	Pass	N/A	No
118	Pass	N/A	No
119	Pass	N/A	No
120	Pass	N/A	No
121	Pass	N/A	No
122	Pass	N/A	No
123	Pass	N/A	No
124	Pass	N/A	No
125	Pass	N/A	No
126	Pass	N/A	No
127	Pass	N/A	No
128	Pass	N/A	No
129	Pass	N/A	No
130	Pass	N/A	No
131	Pass	N/A	No
132	Pass	N/A	No
133	Pass	N/A	No
134	Pass	N/A	No
135	Pass	N/A	No
136	Pass	N/A	No

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PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES MITIGATION?
137	Pass	N/A	No
138	Pass	N/A	No
139	Pass	N/A	No
140	Pass	N/A	No
141	Pass	N/A	No
142	Pass	N/A	No
143	Pass	N/A	No
144	Pass	N/A	No
145	Pass	N/A	No
146	Pass	N/A	No
147	Pass	N/A	No
148	Pass	N/A	No
149	Pass	N/A	No
150	Pass	N/A	No
151	Pass	N/A	No
152	Pass	N/A	No
153	Pass	N/A	No
154	Pass	N/A	No
155	Pass	N/A	No
156	Pass	N/A	No
157	Pass	N/A	No
158	Pass	N/A	No
159	Pass	N/A	No
160	Pass	N/A	No
161	Pass	N/A	No
162	Pass	N/A	No
163	Pass	N/A	No
164	Pass	N/A	No
165	Pass	N/A	No
166	Pass	N/A	No
167	Pass	N/A	No
168	Pass	N/A	No
169	Pass	N/A	No
170	Pass	N/A	No

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PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES MITIGATION?
171	Pass	N/A	No
172	Pass	N/A	No
173	Pass	N/A	No
174	S15	2.9	No
175	S15	11.4	No
176	Pass	N/A	No
177	S15	2.7	No
178	S15	9.9	No
179	Pass	N/A	No
180	Pass	N/A	No
181	Pass	N/A	No
182	Pass	N/A	No
183	Pass	N/A	No
184	Pass	N/A	No
185	Pass	N/A	No
186	Pass	N/A	No
187	S20	3.3	No
188	S20	3.1	No
189	S15	8.8	No
190	Pass	N/A	No
191	S15	8.7	No
192	S20	2.3	No
193	S15	20.6	No
194	Pass	N/A	No
195	Pass	N/A	No
196	S15	7.1	No
197	Pass	N/A	No
198	Pass	N/A	No
199	Pass	N/A	No
200	Pass	N/A	No
201	Pass	N/A	No
202	Pass	N/A	No
203	S20	4	No
207	Pass	N/A	No

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PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES MITIGATION?
208	Pass	N/A	No
209	Pass	N/A	No
210	Pass	N/A	No
211	Pass	N/A	No
212	Pass	N/A	No
213	Pass	N/A	No
214	Pass	N/A	No
215	Pass	N/A	No
216	Pass	N/A	No
217	Pass	N/A	No
218	Pass	N/A	No
219	Pass	N/A	No
220	Pass	N/A	No
221	Pass	N/A	No
222	Pass	N/A	No
223	Pass	N/A	No
224	Pass	N/A	No
225	Pass	N/A	No
226	Pass	N/A	No
227	Pass	N/A	No
228	Pass	N/A	No
229	Pass	N/A	No
230	Pass	N/A	No
231	Pass	N/A	No
232	Pass	N/A	No
233	Pass	N/A	No
235	Pass	N/A	No
236	S20	4	Yes
237	S15	11.4	Yes
238	S15	10.5	Yes
239	S15	8.4	Yes
240	Pass	N/A	No
241	S15	5.3	Yes
242	Pass	N/A	No

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PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES MITIGATION?
243	Pass	N/A	No
Off-Site Receptors			
1	Pass	N/A	No
2	Pass	N/A	No
3	Pass	N/A	No
5	Pass	N/A	No
6	S15	2.8	No
8	Pass	N/A	No
9	Pass	N/A	No
10	S15	4	No
12	S20	2.8	No
13	S15	13.6	No
15	S15	31.8	Yes
16	S15	37.8	Yes
17	S20	4.4	No
18	S15	28.9	Yes
19	S20	2.6	No
21	S15	10.6	Yes
24	S15	26	Yes
25	S15	11	Yes
28	S15	9.2	Yes
29	Pass	N/A	No
30	S15	3.1	No
31	Pass	N/A	No
62	Pass	N/A	No
114	Pass	N/A	No
204	Pass	N/A	No
205	Pass	N/A	No
206	Pass	N/A	No

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Table 14.20
Description of Wind Conditions around proposed development

LOCATIONS	DESCRIPTION
On-Site Receptors	
Thoroughfares	All thoroughfare locations on-site would have strolling use conditions or calmer making them suitable for the intended use and requiring no further mitigation or design interventions. These would represent negligible to moderate beneficial effects (not significant). There would also be no instances of strong winds exceeding the safety threshold at any thoroughfare locations on-site in Configuration 3. There are 58 probe locations that represent thoroughfare which is accessible to pedestrians in the baseline that would also be accessible to pedestrians with the proposed development in place (Configuration 3) of these 58 locations: 18 locations would have safe wind conditions in both the baseline and Configuration 3; 40locations would have strong winds exceeding the safety threshold in the baseline but would have safe wind conditions in Configuration 3. For a further breakdown of wind safety conditions in Configuration 3, please refer to Table 14.19.
Entrances	There would be a single entrance location to the amenity space at the west of the stadium (probe location 98) which would have strolling use conditions in the windiest season making it unsuitable for the intended use, representing a minor adverse effect (significant), and requiring mitigation measures. 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.
Football Pitch	Wind conditions on the football pitch (probe locations 138, 139, 140, 141, 142, 143, 144, and 145) would range from sitting use to standing use during the windiest season; therefore, the football pitch would be suitable for the intended use and requires no mitigation measures. These would represent negligible effects (not significant). There would be no instances of strong winds exceeding the safety threshold on the pitch.
Ground Level Amenity Areas – Mixed Use	There would be two dedicated ground level amenity areas with the proposed development in place; an area to the west of the stadium and the fan-zone to the east of the stadium. Both would have locations that would require suitable conditions for a mixed-use amenity space. There are sixteen probe locations (26, 33, 34, 35, 36, 38, 39, 41, 44, 45, 47, 52, 53, 54, 57 and 242) that would represent mixed-use amenity spaces in the fan-zone to the east of the stadium. Of these sixteen locations, seven probe locations (26, 33, 34, 38, 44, 53 and 54) would have standing use wind conditions during the summer season and the remaining nine probe locations (35, 36, 39, 41, 45, 47, 52, 57 and 242) would have sitting use wind conditions. As such all 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 to the east of the stadium would also have safe wind conditions throughout the year. There are fourteen probe locations which represent the space to the west of the stadium. Of these fourteen locations, seven locations would represent mixed-use amenity locations (probe locations 90, 93, 96, 101, 105, 108, 237). Two of these locations (probe locations 90 and 93) would have walking use wind conditions during the summer season, and three locations (probe locations 96, 101, and 237) would have strolling use wind conditions during the summer season. These wind conditions would be one (strolling use) to two (walking use) categories 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 (significant) to moderate adverse effects (significant). The remaining two locations (probe locations 105 and 108) 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 five mixed-use amenity locations within the amenity area to the west of the stadium (probe locations 90, 93, 96, 108, 237) with strong winds exceeding the 15m/s safety threshold for up to 34.9 hours per year and one of these locations (probe location 90) would also have strong winds exceeding the 20m/s safety threshold for 3.8 hours per year. As such this area would require mitigation measures to ensure safe wind conditions for pedestrians.
Ground Level Amenity Areas - Seating	There would be 21 designated seating locations at ground level around the proposed development with fourteen publicly accessible locations all year round and seven locations in the amenity space to the west of the stadium, where access can be controlled if required. Of the seven seating locations in the amenity space to the west of the stadium, where access can be controlled if required, a single location (probe location 236) would have walking use wind conditions in the summer season, and five locations (probe locations 104, 107, 238, 239, 241) would have strolling use wind conditions during the summer season. The single remaining location (probe location 240) would have standing use wind conditions during the summer season. These wind conditions would be one (standing use), two (strolling use) or three (walking use) categories windier than the required wind conditions of sitting use during the summer season. These would represent minor adverse effects (significant), moderate adverse effects (significant) and major adverse effects (significant) respectively. This area would require mitigation measures in order to ensure comfortable wind conditions for pedestrians. Five of the seating locations in the amenity space to the west of the stadium, where access can be controlled, would also have strong winds exceeding the 15m/s safety threshold for up to 10.5 hours per year and one of these locations would also have strong winds exceeding the 20m/s safety threshold for 4.0 hours per year. As such this area would require mitigation measures to ensure safe wind conditions for pedestrians. At the fourteen publicly accessible designated seating locations around the proposed development, eight locations (probe locations 46, 49, 67, 75, 77, 118, 119, 130) would have wind conditions suitable for standing use during the summer season making them unsuitable for the intended use and representing minor adverse effects (significant). These areas would require mitigation measures to ensure a comfortable wind environment for pedestrians. The remaining six locations (probe locations 37, 69, 71, 73, 79, 81) would have sitting use wind conditions during the summer season making them suitable for the intended use and representing negligible effects (not significant). All fourteen of the seating locations accessible to the public all year round would have safe wind conditions throughout the year.
Terrace Level Amenity Areas – Mixed Use	There would be terrace level amenity spaces at the western façade of the stadium on top of the car park massing, these locations have not been instrumented as they were introduced to the design after wind tunnel testing took place. As such they have not been quantitatively assessed however it is expected that due to the exposure of this area to the prevailing westerly winds, that these areas would have unsuitable wind comfort conditions in the summer season and potentially unsafe wind conditions throughout the year. Mitigation measures in the form of a monitoring system would be required to be implemented at these locations to ensure pedestrian safety and comfort. With the monitoring system in place it is expected that these areas would only be accessible to pedestrians which wind conditions are both safe and suitable for the intended use.

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LOCATIONS	DESCRIPTION
Seating in Stands	All seating areas located in the stands would have sitting use wind conditions throughout the year making them suitable for the intended use and requiring no mitigation measures or design interventions. These would represent negligible effects (not significant). Additionally, there would be no instances strong winds exceeding the safety threshold at these locations.
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.
Off-site Receptors	
UU WwTW	
Thoroughfares	There are 23 thoroughfare locations that have been probed off-site to the north of the stadium on the United Utilities Wastewater Treatment Works land. There are five locations (probe locations 1, 2, 3, 31, 114) which would have standing use wind conditions during the windiest season, four of these locations (probe location 1, 2, 3, and 114) would have walking use conditions in the baseline and as such would become suitable for the intended use with the proposed development in place representing a moderate beneficial effect (not significant). Probe location 31 would have strolling use wind conditions in the baseline making it suitable for the intended use and standing use wind conditions during the windiest season with the proposed development in place, also suitable for the intended use representing a negligible effect (not significant). There would be three locations (probe locations 5, 8, and 29) which would have strolling use wind conditions during the windiest season making these locations suitable for the intended use, all three of these locations have walking use wind conditions in the baseline representing a minor beneficial effect (not significant). There would be eleven locations (probe locations 6, 9, 10, 13, 16, 18, 21, 24, 25, 28, and 30) which would have walking use wind conditions during the windiest season with the proposed development in place making them unsuitable for the intended use. Seven of these locations would have the same conditions with the proposed development in place as in the baseline representing a negligible effect (not significant). Four of these locations would have strolling use wind conditions in the baseline, making them suitable for the intended use, and walking use conditions in Configuration 3, making them unsuitable for the intended use, this would represent a minor adverse effect (significant) and would require mitigation measures. There would also be four locations (probe locations 12, 15, 17 and 19) that would have wind conditions uncomfortable for all pedestrian use during the windiest season making them unsuitable for the intended use. One of these locations (probe location 12) would have the same wind conditions in the baseline representing a negligible effect (not significant). The other three locations (probe locations 15, 17 and 19) would have walking use wind conditions in the baseline and wind conditions uncomfortable for all pedestrian use during the windiest season in Configuration 3 representing a minor adverse effect (significant) and requiring mitigation measures. Of the 23 locations probed there would be 14 locations (probe locations 6, 10, 12, 13, 15, 16, 17, 18, 19, 21, 24, 25, 28, and 30) with strong winds exceeding the 15m/s safety threshold with three of these locations (probe locations 12, 17, and 19) also would have strong winds exceeding the 20m/s safety threshold. Five of these locations (probe locations 6, 10, 12, 13, and 30) would have fewer hours of exceedance of the safety threshold throughout the year with the proposed development in place than in the baseline, however, it is important to note that these locations would still be unsafe for pedestrian use. Seven of these locations (probe locations 15, 16, 18, 21, 24, 25, and 28) would have strong winds exceeding the 15m/s safety threshold in both the baseline and with the proposed development in place however the number of hours of exceedance per year would be made worse with the introduction of the proposed development, and therefore would require mitigation measures. The other two locations (probe locations 17 and 19) would not only have more hours of exceedance per year with the proposed development in place than in the baseline, they would also both have strong winds exceeding the 20m/s safety threshold for 4.4 and 2.6 hours per year, respectively, up from 0.7 hours and 0.2 hours per year in the baseline scenario. As wind conditions at these locations would be made worse with the introduction of the proposed development, these locations would also require mitigation measures to ensure a safe pedestrian environment. There would also be eight locations (probe locations 1, 2, 3, 5, 8, 9, 29, and 114) that would have unsafe wind conditions in the baseline scenario and would have safe wind conditions in Configuration 3, with the introduction of the proposed development. Overall the wind conditions of the area off-site to the north do not materially change from those recorded for the baseline scenario.
Regent Road	
Thoroughfares	All three of the locations probed (probe locations 204, 205 and 206) in Regent Road would have suitable wind conditions for the intended use with the proposed development in place. Two locations (probe locations 206 and 205) would have standing use wind conditions during the windiest season, representing a moderate beneficial effect (not significant) and a negligible effect (not significant), respectively. The single remaining location (probe location 204) would have strolling use wind conditions during the windiest season representing a negligible effect (not significant). There would also be no instances of exceedance of the 15m/s safety threshold at the thoroughfare locations on Regent Road with the proposed development in place.
Nelson Dock	
Thoroughfares	There would be a single location probed (probe location 62) in Nelson Dock in Configuration 3. This location would have strolling use wind conditions during the windiest season, representing a negligible effect (not significant), and making it suitable for the intended use and this location would also have no strong winds exceeding the safety threshold with the proposed development in place.

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 above design interventions. There would however be locations in and around the proposed development that would still require mitigation measures.

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

The proposed development with the cumulative scheme was tested in the presence of the design interventions, created in the context of the existing surroundings. The results of the tests undertaken for the ground and elevated levels of the proposed development are graphically shown in Figures 14.26 to 14.28 for the windiest season and Figures 14.29 to 14.31 for the summer season, respectively. The results for the annual safety exceedances are shown in Figures 14.32 to 14.34. A comparison of the wind safety results between the baseline and Configuration 4 are presented in Figure 14.38. Only probes that would be accessible in both scenarios are presented in this Figure as to ensure a valid comparison.

- Probe locations which are white indicate locations that have safe wind conditions in both the baseline and Configuration 4;
- Probe locations which are grey indicate probes which have an exceedance of the 15m/s safety threshold in both the baseline and Configuration 4;

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- Probes which are black would have an exceedance of the 20m/s safety threshold in both the baseline and Configuration 4;
- Probes coloured yellow indicate locations which would have an exceedance of the 15m/s safety threshold in the baseline put safe wind conditions in Configuration 4;
- Probes coloured green indicate locations which would have an exceedance of the 20m/s safety threshold in the baseline and safe wind conditions in Configuration 4;
- Blue coloured probes would have an exceedance of the 20m/s safety threshold in the baseline but there would be a reduction in the occurrence of strong winds in Configuration 4 to the extent that the location would only have an exceedance of the 15m/s safety threshold;
- Probes coloured orange would indicate locations which have safe wind conditions in the baseline but would have an exceedance of the 15m/s safety threshold in Configuration 4;
- Red coloured probes are locations which would have safe wind conditions in the baseline but would have an exceedance of the 20m/s safety threshold in Configuration 4;
- Purple coloured probes are locations which would have an exceedance of the 15m/s safety threshold in the baseline but with an increase in strong winds in Configuration 4 to the extent that there is also an exceedance of the 20m/s safety threshold.

These results are reported in Tables 14.21, 14.22 and 14.23 below.

Table 14.21
Expected Wind Comfort Conditions

PHASE	RECEPTOR(S) AFFECTED	PROBE NUMBERS	MEASURED CONDITIONS	SIGNIFICANCE CRITERIA	MITIGATION PROPOSED?	FURTHER INFORMATION
On-site Receptors						
Operation	Thoroughfare	27, 32, 42, 95, 97, 100, 102, 103, 106, 109, 111, 123, 126, 219, 221, 233	Sitting	Moderate Beneficial	No	Section 6.3 of Appendix 14.1
Operation	Thoroughfare	7, 11, 14, 22, 58, 59, 61, 64, 66, 68, 74, 76, 78, 80, 84, 86, 92, 94, 110, 112, 120, 121, 122, 124, 125, 127, 128, 129, 208, 209, 210, 215, 226, 227, 228, 229, 230, 231, 232	Standing	Minor Beneficial	No	Section 6.3 of Appendix 14.1
Operation	Thoroughfare	20, 60, 63, 65, 82, 83, 85, 87, 88, 91, 115, 116, 117, 135, 136, 137, 207, 212, 243	Strolling	Negligible	No	Section 6.3 of Appendix 14.1
Operation	Thoroughfare	113, 131, 132, 133, 134	Walking	Minor Adverse	No	Section 6.3 of Appendix 14.1
Operation	Entrances	4, 43, 48, 50, 51, 55, 56, 216, 217, 218, 222, 223, 235	Sitting	Minor Beneficial	No	Section 6.3 of Appendix 14.1
Operation	Entrances	23, 40, 70, 72, 213, 214, 220, 224	Standing	Negligible	No	Section 6.3 of Appendix 14.1
Operation	Entrances	98	Strolling	Minor Adverse	No	Section 6.3 of Appendix 14.1
Operation	Football Pitch	138, 139, 141, 142, 144, 145	Sitting	Negligible	No	Section 6.3 of Appendix 14.1
Operation	Ground Level Amenity Areas – Mixed Use	35, 36, 39, 41, 44, 45, 47, 52, 53, 54, 57	Sitting	Negligible	No	Section 6.3 of Appendix 14.1
Operation	Ground Level Amenity Areas – Mixed Use	26, 33, 34, 38, 105, 108	Standing	Negligible	No	Section 6.3 of Appendix 14.1
Operation	Ground Level Amenity Areas – Mixed Use	96, 101, 237	Strolling	Minor Adverse	Yes	Section 6.3 of Appendix 14.1
Operation	Ground Level Amenity Areas – Mixed Use	90, 93	Walking	Moderate Adverse	Yes	Section 6.3 of Appendix 14.1
Operation	Ground Level Amenity - Seating	37, 46, 69, 73, 75, 79, 81	Sitting	Negligible	No	Section 6.3 of Appendix 14.1
Operation	Ground Level Amenity - Seating	49, 67, 71, 77, 118, 119, 130, 240	Standing	Minor Adverse	Yes	Section 6.3 of Appendix 14.1

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PHASE	RECEPTOR(S) AFFECTED	PROBE NUMBERS	MEASURED CONDITIONS	SIGNIFICANCE CRITERIA	MITIGATION PROPOSED?	FURTHER INFORMATION
Operation	Ground Level Amenity - Seating	104, 107, 238, 239, 241	Strolling	Moderate Adverse	Yes	Section 6.3 of Appendix 14.1
Operation	Ground Level Amenity - Seating	236	Walking	Major Adverse	Yes	Section 6.3 of Appendix 14.1
Operation	Seating in stands	146, 147, 148, 149, 150, 152, 153, 154, 155, 156, 157, 158, 159, 161, 162, 163	Sitting	Negligible	No	Section 6.3 of Appendix 14.1
Operation	Inaccessible Areas	164, 199, 201	Sitting	Negligible	No	Section 6.3 of Appendix 14.1
Operation	Inaccessible Areas	168, 169, 170, 171, 172, 173, 176, 179, 180, 181, 182, 183, 184, 185, 186, 202	Standing	Negligible	No	Section 6.3 of Appendix 14.1
Operation	Inaccessible Areas	165, 166, 167, 174, 175, 177, 187, 190, 194, 195, 197, 198, 200	Strolling	Negligible	No	Section 6.3 of Appendix 14.1
Operation	Inaccessible Areas	178, 188, 189, 191, 193, 196, 203	Walking	Negligible	No	Section 6.3 of Appendix 14.1
Operation	Inaccessible Areas	192	Uncomfortable for all pedestrian use	Negligible	No	Section 6.3 of Appendix 14.1
Off-Site Receptors						
	UU WwTW					
Operation	Thoroughfares	2, 114	Standing	Moderate Beneficial	No	Section 6.3 of Appendix 14.1
Operation	Thoroughfares	31	Standing	Negligible	No	Section 6.3 of Appendix 14.1
Operation	Thoroughfares	1, 3, 5, 6, 8, 10, 17, 18, 29, 30	Strolling	Minor Beneficial	No	Section 6.3 of Appendix 14.1
Operation	Thoroughfares	24	Strolling	Negligible	No	Section 6.3 of Appendix 14.1
Operation	Thoroughfares	9, 13, 16	Walking	Negligible	No	Section 6.3 of Appendix 14.1
Operation	Thoroughfares	21, 25, 28	Walking	Minor Adverse	No	Section 6.3 of Appendix 14.1
Operation	Thoroughfares	12	Uncomfortable	Negligible	No	Section 6.3 of Appendix 14.1
Operation	Thoroughfares	15, 19	Uncomfortable	Minor Adverse	No	Section 6.3 of Appendix 14.1
	Regent Road					
Operation	Thoroughfares	204, 205	Standing	Negligible	No	Section 6.3 of Appendix 14.1
Operation	Thoroughfares	206	Standing	Moderate Beneficial	No	Section 6.3 of Appendix 14.1
	Nelson Dock					
Operation	Thoroughfares	248	Sitting	Negligible	No	Section 6.3 of Appendix 14.1
Operation	Thoroughfares	244, 245	Standing	Negligible	No	Section 6.3 of Appendix 14.1
Operation	Thoroughfares	246, 247	Strolling	Negligible	No	Section 6.3 of Appendix 14.1

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Table 14.22
Expected Wind Safety Conditions

PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES MITIGATION?
On-Site Receptors			
4	Pass	N/A	No
7	Pass	N/A	No
11	Pass	N/A	No
14	Pass	N/A	No
20	Pass	N/A	No
22	Pass	N/A	No
23	Pass	N/A	No
26	Pass	N/A	No
27	Pass	N/A	No
32	Pass	N/A	No
33	Pass	N/A	No
34	Pass	N/A	No
35	Pass	N/A	No
36	Pass	N/A	No
37	Pass	N/A	No
39	Pass	N/A	No
40	Pass	N/A	No
41	Pass	N/A	No
42	Pass	N/A	No
43	Pass	N/A	No
44	Pass	N/A	No
45	Pass	N/A	No
46	Pass	N/A	No
47	Pass	N/A	No
48	Pass	N/A	No
49	Pass	N/A	No
50	Pass	N/A	No
51	Pass	N/A	No
52	Pass	N/A	No
53	Pass	N/A	No
54	Pass	N/A	No

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PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES MITIGATION?
55	Pass	N/A	No
56	Pass	N/A	No
57	Pass	N/A	No
58	Pass	N/A	No
59	Pass	N/A	No
60	Pass	N/A	No
61	Pass	N/A	No
63	Pass	N/A	No
64	Pass	N/A	No
65	Pass	N/A	No
66	Pass	N/A	No
67	Pass	N/A	No
68	Pass	N/A	No
69	Pass	N/A	No
70	Pass	N/A	No
71	Pass	N/A	No
72	Pass	N/A	No
73	Pass	N/A	No
74	Pass	N/A	No
75	Pass	N/A	No
76	Pass	N/A	No
77	Pass	N/A	No
78	Pass	N/A	No
79	Pass	N/A	No
80	Pass	N/A	No
81	Pass	N/A	No
82	Pass	N/A	No
83	Pass	N/A	No
84	Pass	N/A	No
85	Pass	N/A	No
86	Pass	N/A	No
87	Pass	N/A	No
88	Pass	N/A	No
90	S15	23.6	Yes

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PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES MITIGATION?
91	Pass	N/A	No
92	Pass	N/A	No
93	S15	23.4	Yes
94	Pass	N/A	No
95	Pass	N/A	No
96	S15	8.8	Yes
97	Pass	N/A	No
98	Pass	N/A	No
101	S15	3.2	Yes
102	Pass	N/A	No
103	Pass	N/A	No
104	Pass	N/A	No
105	Pass	N/A	No
106	Pass	N/A	No
107	Pass	N/A	No
108	Pass	N/A	No
109	Pass	N/A	No
110	Pass	N/A	No
111	Pass	N/A	No
112	Pass	N/A	No
113	S15	2.6	No
115	Pass	N/A	No
116	Pass	N/A	No
117	Pass	N/A	No
118	Pass	N/A	No
119	Pass	N/A	No
120	Pass	N/A	No
121	Pass	N/A	No
122	Pass	N/A	No
123	Pass	N/A	No
124	Pass	N/A	No
125	Pass	N/A	No
126	Pass	N/A	No
127	Pass	N/A	No

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PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES MITIGATION?
128	Pass	N/A	No
129	Pass	N/A	No
130	Pass	N/A	No
131	S15	6.4	No
132	S15	7.8	Yes
133	S15	3.3	No
134	S15	22.5	No
135	Pass	N/A	No
136	S15	9.6	No
137	Pass	N/A	No
138	Pass	N/A	No
139	Pass	N/A	No
141	Pass	N/A	No
144	Pass	N/A	No
145	Pass	N/A	No
147	Pass	N/A	No
148	Pass	N/A	No
149	Pass	N/A	No
150	Pass	N/A	No
152	Pass	N/A	No
153	Pass	N/A	No
154	Pass	N/A	No
156	Pass	N/A	No
157	Pass	N/A	No
158	Pass	N/A	No
159	Pass	N/A	No
161	Pass	N/A	No
162	Pass	N/A	No
163	Pass	N/A	No
164	Pass	N/A	No
165	Pass	N/A	No
166	Pass	N/A	No
167	Pass	N/A	No
168	Pass	N/A	No

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PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES MITIGATION?
169	Pass	N/A	No
170	Pass	N/A	No
171	Pass	N/A	No
172	Pass	N/A	No
173	Pass	N/A	No
174	Pass	N/A	No
175	Pass	N/A	No
176	Pass	N/A	No
177	Pass	N/A	No
178	S15	5.5	No
179	Pass	N/A	No
180	Pass	N/A	No
181	Pass	N/A	No
182	Pass	N/A	No
183	Pass	N/A	No
184	Pass	N/A	No
185	Pass	N/A	No
186	Pass	N/A	No
187	Pass	N/A	No
188	S15	10.9	No
189	S15	3.1	No
190	Pass	N/A	No
191	S15	4.2	No
192	S15	30.9	No
193	S15	5.1	No
194	Pass	N/A	No
195	Pass	N/A	No
196	S15	7.8	No
197	Pass	N/A	No
198	Pass	N/A	No
199	Pass	N/A	No
200	Pass	N/A	No
201	Pass	N/A	No
202	Pass	N/A	No

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PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES MITIGATION?
203	S20	4.2	No
207	Pass	N/A	No
208	Pass	N/A	No
209	Pass	N/A	No
210	Pass	N/A	No
212	Pass	N/A	No
213	Pass	N/A	No
214	Pass	N/A	No
215	Pass	N/A	No
216	Pass	N/A	No
217	Pass	N/A	No
218	Pass	N/A	No
219	Pass	N/A	No
220	Pass	N/A	No
221	Pass	N/A	No
222	Pass	N/A	No
223	Pass	N/A	No
224	Pass	N/A	No
226	Pass	N/A	No
227	Pass	N/A	No
228	Pass	N/A	No
229	Pass	N/A	No
230	Pass	N/A	No
232	Pass	N/A	No
233	Pass	N/A	No
234	Pass	N/A	No
235	Pass	N/A	No
236	S15	25.4	Yes
237	Pass	N/A	No
238	S15	17.2	Yes
239	S15	5.1	Yes
240	Pass	N/A	No
241	Pass	N/A	No

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PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES MITIGATION?
Off-Site Receptors			
1	Pass	N/A	No
2	Pass	N/A	No
3	Pass	N/A	No
5	Pass	N/A	No
6	S15	2.4	No
8	Pass	N/A	No
9	S15	2.8	No
10	S15	3.1	No
12	S15	32.5	No
13	S15	13.8	No
15	S15	39.1	Yes
16	S15	31.0	Yes
17	Pass	N/A	No
18	Pass	N/A	No
19	S20	5.8	Yes
21	S15	4.9	Yes
24	Pass	N/A	No
25	S15	3.7	Yes
28	S15	12.9	Yes
29	Pass	N/A	No
30	Pass	N/A	No
31	Pass	N/A	No
114	Pass	N/A	No
204	Pass	N/A	No
205	Pass	N/A	No
206	Pass	N/A	No
244	Pass	N/A	No
245	Pass	N/A	No
246	Pass	N/A	No
247	Pass	N/A	No
248	Pass	N/A	No

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Table 14.23
Description of Wind Conditions around proposed development

LOCATIONS	DESCRIPTION
On-Site Receptors	
Thoroughfares	In Configuration 4, there would be five thoroughfare locations (probe locations 113, 131, 132, 133 and 134) which would have walking use wind conditions during the windiest season, making them unsuitable for the intended use and representing minor adverse effect (significant). These locations would require mitigation measures to ensure a comfortable wind environment for pedestrians. Additionally, six thoroughfare locations (probe locations 113, 131, 132, 133, 134 and 136) would have strong winds exceeding the 15m/s safety threshold and as such these locations would require mitigation measures to ensure safe wind conditions for pedestrians. All other thoroughfare locations on-site would have strolling use conditions or calmer making them suitable for the intended use and requiring no mitigation. These would represent negligible to moderate beneficial effects (not significant). There would also be no instances of strong winds exceeding the safety threshold at any other thoroughfare locations on-site in Configuration 4. There are 56 probe locations that represent thoroughfares that are accessible to pedestrians in the baseline that would also be accessible to pedestrians with the proposed development in place (Configuration 4). Of these 56 locations: ■ 17 locations would have safe wind conditions in both the baseline and Configuration 4; ■ Four locations would have strong winds exceeding the safety threshold in both the baseline and Configuration 4; ■ 34 locations would have strong winds exceeding the safety threshold in the baseline but would have safe wind conditions in Configuration 4; ■ And a single location (probe location 132) would have safe wind conditions in the baseline and strong winds exceeding the safety threshold in Configuration 4. For a further breakdown of wind safety conditions in Configuration 4, please refer to Table 14.22.
Entrances	There would be a single entrance location to the amenity space at the west of the stadium (probe location 98) which would have strolling use conditions in the windiest season making it unsuitable for the intended use, representing a minor adverse effect (significant), and requiring mitigation measures. 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.
Football Pitch	Wind conditions on the football pitch (probe locations 138, 139, 141, 142, 144, and 145) would be suitable for sitting use during the windiest season; therefore, the football pitch would be suitable for the intended use and require no mitigation measures or design intervention. These would represent negligible effects (not significant). There would be no instances of strong winds exceeding the safety threshold on the pitch.
Ground Level Amenity Areas – Mixed Use	There would be two dedicated ground level amenity areas with the proposed development in place; an area to the west of the stadium and the fan-zone to the east of the stadium. Both would have locations that would require suitable conditions for a mixed-use amenity space. There are fourteen probe locations (26, 33, 34, 35, 36, 39, 41, 44, 45, 47, 52, 53, 54, 57) that would represent mixed-use amenity spaces in the fan-zone to the east of the stadium. Of these fourteen locations, three probe locations (26, 33 and 34) would have standing use wind conditions during the summer season and the remaining eleven probe locations (35, 36, 39, 41, 44, 45, 47, 52, 53, 54 and 57) would have sitting use wind conditions. As such all 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 to the east of the stadium would also have safe wind conditions throughout the year. There are fourteen probe locations which represent the space to the west of the stadium. Of these fourteen locations, seven locations would represent mixed-use amenity locations (probe locations 90, 93, 96, 101, 105, 108, 237). Two of these locations (probe locations 90 and 93) would have walking use wind conditions during the summer season, and three locations (probe locations 96, 101, and 237) would have strolling use wind conditions during the summer season. These wind conditions would be one (strolling use) to two (walking use) categories 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 (significant) to moderate adverse effects (significant). The remaining two locations (probe locations 105 and 108) 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 four mixed-use amenity locations within the amenity area to the west of the stadium (probe locations 90, 93, 96, and 101) with strong winds exceeding the 15m/s safety threshold for up to 23.6 hours per year. As such this area would require mitigation measures to ensure safe wind conditions for pedestrians.
Ground Level Amenity Areas - Seating	There would be 21 designated seating locations at ground level around the proposed development with fourteen publicly accessible locations all year round and seven locations in the amenity space to the west of the stadium, where access can be controlled. Of the seven seating locations in the amenity space to the west of the stadium, where access can be controlled, a single location (probe location 236) would have walking use wind conditions in the summer season, and five locations (probe locations 104, 107, 238, 239, 241) would have strolling use wind conditions during the summer season. The single remaining location (probe location 240) would have standing use wind conditions during the summer season. These wind conditions would be one (standing use), two (strolling use) or three (walking use) categories windier than the required wind conditions of sitting use during the summer season. These would represent minor adverse effects (significant), moderate adverse effects (significant) and major adverse effects (significant) respectively. This area would require mitigation measures in order to ensure comfortable wind conditions for pedestrians. Three of the seating locations in the amenity space to the west of the stadium, where access can be controlled, would also have strong winds exceeding the 15m/s safety threshold for up to 25.4 hours per year. As such this area would require mitigation measures to ensure safe wind conditions for pedestrians. At the fourteen publicly accessible designated seating locations around the proposed development, six locations (probe locations 46, 67, 71, 118, 119, 130) would have wind conditions suitable for standing use during the summer season making them unsuitable for the intended use and representing minor adverse effects (significant). These areas would require mitigation measures to ensure a comfortable wind environment for pedestrians. The remaining eight locations (probe locations 37, 46, 69, 73, 75, 77, 79, 81) would have sitting use wind conditions during the summer season making them suitable for the intended use and representing negligible effects (not significant). All fourteen of the seating locations accessible to the public all year round would have safe wind conditions throughout the year.

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LOCATIONS	DESCRIPTION
Terrace Level Amenity Areas – Mixed Use	There would be terrace level amenity spaces at the western façade of the stadium on top of the car park massing, these locations have not been probed as they were introduced to the design after wind tunnel testing took place. As such they have not been quantitatively assessed however it is expected that due to the exposure of this area to the prevailing westerly winds, that these areas would have unsuitable wind comfort conditions in the summer season and potentially unsafe wind conditions throughout the year. Mitigation measures in the form of a monitoring system are required be implemented at these locations to ensure pedestrian safety and comfort. With the monitoring system in place it is expected that these areas would only be accessible to pedestrians which wind conditions are both safe and suitable for the intended use.
Seating in Stands	All seating areas located in the stands would have sitting use wind conditions throughout the year making them suitable for the intended use and requiring no mitigation measures or design interventions. These would represent negligible effects (not significant). Additionally, there would be no instances of strong winds exceeding the safety threshold at these locations.
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.
Off-site Receptors	
UU WwTW	
Thoroughfares	There are 23 thoroughfare locations that have been probed off-site to the north of the stadium on the United Utilities Wastewater Treatment Works land. There are three locations (probe locations 2, 31 and 114) which would have standing use wind conditions during the windiest season, two of these locations (probe locations 2 and 114) would have walking use conditions in the baseline and as such would become suitable for the intended use with the proposed development in place representing a moderate beneficial effect (not significant). Probe location 31 would have strolling use wind conditions in the baseline making it suitable for the intended use and standing use wind conditions during the windiest season with the proposed development in place, also suitable for the intended use representing a negligible effect (not significant). There would be eleven locations (probe locations 1, 3, 5, 6, 8, 10, 17, 18, 24, 29 and 30) which would have strolling use wind conditions during the windiest season making these locations suitable for the intended use, ten of these locations (probe locations 1, 3, 5, 6, 8, 10, 17, 18, 29 and 30) have walking use wind conditions in the baseline representing a minor beneficial effect (not significant). There would be six locations (probe locations 9, 13, 16,21, 25 and 28) which would have walking use wind conditions during the windiest season with the proposed development in place making them unsuitable for the intended use. Three of these locations (probe locations 9, 13, and 16) would have the same conditions with the proposed development in place as in the baseline representing a negligible effect (not significant). Three of these locations (probe locations 21, 25 and 28) would have strolling use wind conditions in the baseline, making them suitable for the intended use, and walking use conditions in Configuration 4, making them unsuitable for the intended use, this would represent a minor adverse effect (significant) and would require mitigation measures to ensure a comfortable wind environment at these locations. There would also be three locations (probe locations 12, 15 and 19) that would have wind conditions uncomfortable for all pedestrian use during the windiest season making them unsuitable for the intended use. One of these locations (probe location 12) would have the same wind conditions in the baseline representing a negligible effect (not significant). The other two locations (probe locations 15 and 19) would have walking use wind conditions in the baseline and wind conditions uncomfortable for all pedestrian use during the windiest season in Configuration 4 representing a minor adverse effect (significant) and requiring mitigation measures to ensure a comfortable wind environment at these locations. Of the 23 locations probed there would be 11 locations (probe locations 6, 9, 10, 12, 13, 15, 16, 19, 21, 25 and 28) with strong winds exceeding the 15m/s safety threshold with one of these locations (probe location 19) also would have strong winds exceeding the 20m/s safety threshold. Four of these locations (probe locations 6, 9, 10 and 13) would have fewer hours of exceedance of the safety threshold throughout the year with the proposed development in place than in the baseline, however, it is important to note that these locations would still be unsafe for pedestrian use. A single location (probe location 12) which would have strong winds exceeding the 20m/s safety threshold in the baseline, but these would reduce in Configuration 4 where this location would not have strong winds exceeding the 20m/s safety threshold but would have strong winds exceeding the 15m/s safety for 32.5 hours per year. Two of these locations (probe locations 15 and 16) would have strong winds exceeding the 15m/s safety threshold in both the baseline and with the proposed development in place however the number of hours of exceedance per year would be made worse with the introduction of the proposed development, and therefore would require mitigation measures to ensure a safe pedestrian environment. A single location (probe location 19) would not only have more hours of exceedance per year with the proposed development in place than in the baseline, there would also be strong winds exceeding the 20m/s safety threshold for 5.8 hours per year up from 0.2 hours per year in the baseline scenario. There would also be three locations (probe locations 21, 25, and 28) which would have safe wind conditions in the baseline and strong winds exceeding the 15m/s safety threshold in Configuration 4 for up to 12.2 hours per year. As wind conditions at these locations would be made worse with the introduction of the proposed development, these locations would also require mitigation measures to ensure a safe pedestrian environment. There would also be ten locations (probe locations1, 2, 3, 5, 8, 17, 18, 29, 30 and 114) that would have unsafe wind conditions in the baseline scenario and would have safe wind conditions in Configuration 4, with the introduction of the proposed development.
Regent Road	
Thoroughfares	All three of the locations probed (probe locations 204, 205 and 206) in Regent Road would have suitable wind conditions for the intended use with the proposed development in place. All three locations (probe locations 204, 205 and 206) would have standing use wind conditions during the windiest season, representing two negligible effects (not significant) and a moderate beneficial effect (not significant), respectively. There would also be no instances of exceedance of the 15m/s safety threshold at the thoroughfare locations on Regent Road with the proposed development in place.
Nelson Dock	
Thoroughfares	There would be five locations probed (probe locations 244, 245, 246, 247, 248) in Nelson Dock in Configuration 4. Of these five locations, one location (probe location 248) would have sitting use wind conditions during the windiest season, two locations (probe locations 244 and 245) would have standing use wind conditions during the windiest season and two locations (probe locations 246 and 247) would have strolling use conditions during the windiest season. These locations would be suitable for the intended use and would therefore represent negligible effects (not significant). There would be no instances of strong winds exceeding the safety threshold at these locations in Configuration 4.

The proposed mitigation measures below which relate to the cumulative scenario would need to be further developed to address the changes in the wind conditions that are expected when the Liverpool Waters scheme is brought forward to the detailed design phase (via reserved matters submissions linked to the existing outline planning permission LPA ref. 11RM/1121 – variation of original permission ref. 10O/2424).

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14.7 MITIGATION & ENHANCEMENT MEASURES

Table 14.24
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 terrace level amenity areas at the western side of the stadium	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 terrace level amenity spaces. The triggers would be: 1. Forecast wind speeds above a certain threshold that would be determined through further analysis and wind tunnel assessments 2. Local wind speeds above a certain threshold that would be determined through further analysis and wind tunnel assessments If either of these trigger conditions are met, the terrace level amenity spaces would be closed to pedestrians. This monitoring strategy would require further wind tunnel testing in order to determine: 3. An appropriate location for anemometers 4. The appropriate wind speed threshold to close restricted areas Additionally, the design team will be required to develop a strategy: 5. To control how access will be restricted to this area 6. Define who will be monitoring the wind speeds 7. Define who will be responsible for closing/opening restricted areas With this system in place the terrace level amenity areas within the stadium will only be accessible 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.	Planning Condition	Sitting to Standing use	Negligible	-
Operation	Unsafe and uncomfortable wind conditions at receptors 90, 93, 96, 98, 101, 104, 105, 107, 108, 236, 237, 238, 239, 240, 241	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 level amenity space to the west of the stadium. The triggers would be: 1. Forecast wind speeds above a certain threshold that would be determined through further analysis and wind tunnel assessments 2. Local wind speeds above a certain threshold that would be determined through further analysis and wind tunnel assessments If either of these trigger conditions are met, the terrace level amenity spaces would be closed to pedestrians. This monitoring strategy would require further wind tunnel testing in order to determine: 3. An appropriate location for anemometers 4. The appropriate wind speed threshold to close restricted areas Additionally, the design team will be required to develop a strategy: 5. To control how access will be restricted to this area 6. Define who will be monitoring the wind speeds 7. Define who will be responsible for closing/opening restricted areas With this system in place the ground level amenity space to the west of the stadium will only be accessible when wind conditions are safe and suitable for sitting 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.	Planning Condition	Sitting 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 amenity area to the west of the proposed stadium as well as the terrace level amenity spaces at all sides of the stadium would only be accessible when the wind conditions are suitable for the intended use and safe for pedestrians. This monitoring process is outlined in table 14.24 above.

With the above design interventions and mitigation measures in place, the following residual effects would occur:

Table 14.25
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	42, 78, 80, 97, 102, 103, 106, 109, 111, 219, 221, 225, 233	Sitting Use	Moderate beneficial	Long-term	Direct	Permanent	Reversible
Operation	Thoroughfares	7, 11, 14, 20, 27, 32, 58, 59, 61, 64, 68, 74, 84, 85, 87, 88, 91, 92, 94, 110, 112, 120, 121, 122, 123, 124, 125, 126, 128, 129, 132, 133, 135, 136, 137, 208, 209, 210, 211, 215, 227, 228, 230, 231, 232, 243	Standing Use	Minor beneficial	Long-term	Direct	Permanent	Reversible
Operation	Thoroughfares	22, 60, 63, 65, 66, 76, 82, 83, 86, 89, 113, 115, 116, 117, 127, 131, 134, 207, 212, 226, 229	Strolling use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Entrances	4, 43, 48, 50, 51, 55, 56, 216, 217, 218, 222, 223, 235	Sitting use	Minor beneficial	Long-term	Direct	Permanent	Reversible
Operation	Entrances	23, 40, 70, 72, 213, 214, 220, 224	Standing use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Entrances – Controlled by Monitoring	98	Standing use or Sitting use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Football Pitch	138, 139, 140, 142, 143, 144, 145	Sitting use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Football Pitch	141	Standing use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Ground Level Amenity Areas – Mixed Use	35, 36, 39, 41, 44, 45, 47, 52, 53, 54, 57	Sitting use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Ground Level Amenity Areas – Mixed Use	26, 33, 34, 38, 105, 108	Standing use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Ground Level Amenity Areas- Mixed Use – Controlled by Monitoring	90, 93, 96, 101, 237	Sitting use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Ground Level Amenity Areas - Seating	37, 69, 71, 73, 79, 81	Sitting Use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Ground Level Amenity Areas - Seating	46, 49, 67, 75, 77, 118, 119, 130	Standing Use	Minor Adverse	Long-term	Direct	Permanent	Reversible
Operation	Ground Level Amenity Areas – Seating – Controlled by Monitoring	104, 107, 236, 238, 239, 240, 241	Sitting use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Terrace Level Amenity Areas – Mixed use – Controlled by Monitoring	N/A	Standing use or Sitting use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Seating in stands	146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163	Sitting use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Inaccessible locations	164, 199, 201	Sitting use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Inaccessible locations	168, 169, 170, 171, 176, 179, 180, 181, 182, 183, 184, 185, 186, 202	Standing use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Inaccessible locations	165, 166, 167, 172, 173, 174, 190, 194, 195, 197, 198, 200	Strolling use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Inaccessible locations	99, 175, 177, 178, 187, 189, 191, 196, 203	Walking use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Inaccessible locations	188, 192, 193	Uncomfortable for all pedestrian use	Negligible	Long-term	Direct	Permanent	Reversible

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PHASE	RECEPTOR	PROBE NUMBER	RESIDUAL EFFECT					
			EXPECTED CONDITIONS	SIGNIFICANCE CRITERIA	ST/MT/LT	D/IND	P/T	R/IRR
Off-Site Receptors								
UU WwTW								
Operation	Thoroughfares	1, 2, 3, 114	Standing use	Moderate beneficial	Long-term	Direct	Permanent	Reversible
Operation	Thoroughfares	31	Standing use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Thoroughfares	5, 8, 29	Strolling use	Minor beneficial	Long-term	Direct	Permanent	Reversible
Operation	Thoroughfares	6, 9, 10, 13, 16, 18, 30	Walking use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Thoroughfares	21, 24, 25, 28	Walking use	Minor Adverse	Long-term	Direct	Permanent	Reversible
Operation	Thoroughfares	12	Uncomfortable for all pedestrian use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Thoroughfares	15, 17, 19	Uncomfortable for all pedestrian use	Minor Adverse	Long-term	Direct	Permanent	Reversible
Regent Road								
Operation	Thoroughfares	206	Standing use	Moderate Beneficial	Long-term	Direct	Permanent	Reversible
Operation	Thoroughfares	205	Standing use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Thoroughfares	204	Strolling use	Negligible	Long-term	Direct	Permanent	Reversible
Nelson Dock								
Operation	Thoroughfares	62	Strolling use	Negligible	Long-term	Direct	Permanent	Reversible

Table 14.26
Expected Wind Safety Conditions

PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES FURTHER MITIGATION?*
On-Site Receptors			
4	Pass	N/A	No
7	Pass	N/A	No
11	Pass	N/A	No
14	Pass	N/A	No
20	Pass	N/A	No
22	Pass	N/A	No
23	Pass	N/A	No
26	Pass	N/A	No
27	Pass	N/A	No
32	Pass	N/A	No
33	Pass	N/A	No
34	Pass	N/A	No

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PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES FURTHER MITIGATION?*
35	Pass	N/A	No
36	Pass	N/A	No
37	Pass	N/A	No
38	Pass	N/A	No
39	Pass	N/A	No
40	Pass	N/A	No
41	Pass	N/A	No
42	Pass	N/A	No
43	Pass	N/A	No
44	Pass	N/A	No
45	Pass	N/A	No
46	Pass	N/A	No
47	Pass	N/A	No
48	Pass	N/A	No
49	Pass	N/A	No
50	Pass	N/A	No
51	Pass	N/A	No
52	Pass	N/A	No
53	Pass	N/A	No
54	Pass	N/A	No
55	Pass	N/A	No
56	Pass	N/A	No
57	Pass	N/A	No
58	Pass	N/A	No
59	Pass	N/A	No
60	Pass	N/A	No
61	Pass	N/A	No
63	Pass	N/A	No
64	Pass	N/A	No
65	Pass	N/A	No
66	Pass	N/A	No
67	Pass	N/A	No
68	Pass	N/A	No
69	Pass	N/A	No

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PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES FURTHER MITIGATION?*
70	Pass	N/A	No
71	Pass	N/A	No
72	Pass	N/A	No
73	Pass	N/A	No
74	Pass	N/A	No
75	Pass	N/A	No
76	Pass	N/A	No
77	Pass	N/A	No
78	Pass	N/A	No
79	Pass	N/A	No
80	Pass	N/A	No
81	Pass	N/A	No
82	Pass	N/A	No
83	Pass	N/A	No
84	Pass	N/A	No
85	Pass	N/A	No
86	Pass	N/A	No
87	Pass	N/A	No
88	Pass	N/A	No
89	Pass	N/A	No
90	S20	3.8	No
91	Pass	N/A	No
92	Pass	N/A	No
93	S15	34.9	No
94	Pass	N/A	No
95	Pass	N/A	No
96	S15	6.1	No
97	Pass	N/A	No
98	Pass	N/A	No
99	S15	3.4	No
100	Pass	N/A	No
101	Pass	N/A	No
102	Pass	N/A	No
103	Pass	N/A	No

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PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES FURTHER MITIGATION?*
104	Pass	N/A	No
105	Pass	N/A	No
106	Pass	N/A	No
107	S15	3.1	No
108	S15	6.9	No
109	Pass	N/A	No
110	Pass	N/A	No
111	Pass	N/A	No
112	Pass	N/A	No
113	Pass	N/A	No
115	Pass	N/A	No
116	Pass	N/A	No
117	Pass	N/A	No
118	Pass	N/A	No
119	Pass	N/A	No
120	Pass	N/A	No
121	Pass	N/A	No
122	Pass	N/A	No
123	Pass	N/A	No
124	Pass	N/A	No
125	Pass	N/A	No
126	Pass	N/A	No
127	Pass	N/A	No
128	Pass	N/A	No
129	Pass	N/A	No
130	Pass	N/A	No
131	Pass	N/A	No
132	Pass	N/A	No
133	Pass	N/A	No
134	Pass	N/A	No
135	Pass	N/A	No
136	Pass	N/A	No
137	Pass	N/A	No
138	Pass	N/A	No

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PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES FURTHER MITIGATION?*
139	Pass	N/A	No
140	Pass	N/A	No
141	Pass	N/A	No
142	Pass	N/A	No
143	Pass	N/A	No
144	Pass	N/A	No
145	Pass	N/A	No
146	Pass	N/A	No
147	Pass	N/A	No
148	Pass	N/A	No
149	Pass	N/A	No
150	Pass	N/A	No
151	Pass	N/A	No
152	Pass	N/A	No
153	Pass	N/A	No
154	Pass	N/A	No
155	Pass	N/A	No
156	Pass	N/A	No
157	Pass	N/A	No
158	Pass	N/A	No
159	Pass	N/A	No
160	Pass	N/A	No
161	Pass	N/A	No
162	Pass	N/A	No
163	Pass	N/A	No
164	Pass	N/A	No
165	Pass	N/A	No
166	Pass	N/A	No
167	Pass	N/A	No
168	Pass	N/A	No
169	Pass	N/A	No
170	Pass	N/A	No
171	Pass	N/A	No
172	Pass	N/A	No

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PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES FURTHER MITIGATION?*
173	Pass	N/A	No
174	S15	2.9	No
175	S15	11.4	No
176	Pass	N/A	No
177	S15	2.7	No
178	S15	9.9	No
179	Pass	N/A	No
180	Pass	N/A	No
181	Pass	N/A	No
182	Pass	N/A	No
183	Pass	N/A	No
184	Pass	N/A	No
185	Pass	N/A	No
186	Pass	N/A	No
187	S20	3.3	No
188	S20	3.1	No
189	S15	8.8	No
190	Pass	N/A	No
191	S15	8.7	No
192	S20	2.3	No
193	S15	20.6	No
194	Pass	N/A	No
195	Pass	N/A	No
196	S15	7.1	No
197	Pass	N/A	No
198	Pass	N/A	No
199	Pass	N/A	No
200	Pass	N/A	No
201	Pass	N/A	No
202	Pass	N/A	No
203	S20	4	No
207	Pass	N/A	No
208	Pass	N/A	No
209	Pass	N/A	No

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PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES FURTHER MITIGATION?*
210	Pass	N/A	No
211	Pass	N/A	No
212	Pass	N/A	No
213	Pass	N/A	No
214	Pass	N/A	No
215	Pass	N/A	No
216	Pass	N/A	No
217	Pass	N/A	No
218	Pass	N/A	No
219	Pass	N/A	No
220	Pass	N/A	No
221	Pass	N/A	No
222	Pass	N/A	No
223	Pass	N/A	No
224	Pass	N/A	No
225	Pass	N/A	No
226	Pass	N/A	No
227	Pass	N/A	No
228	Pass	N/A	No
229	Pass	N/A	No
230	Pass	N/A	No
231	Pass	N/A	No
232	Pass	N/A	No
233	Pass	N/A	No
235	Pass	N/A	No
236	S20	4	No
237	S15	11.4	No
238	S15	10.5	No
239	S15	8.4	No
240	Pass	N/A	No
241	S15	5.3	No
242	Pass	N/A	No
243	Pass	N/A	No

WIND MICROCLIMATE

PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES FURTHER MITIGATION?*
Off-Site Receptors			
1	Pass	N/A	No
2	Pass	N/A	No
3	Pass	N/A	No
5	Pass	N/A	No
6	S15	2.8	No
8	Pass	N/A	No
9	Pass	N/A	No
10	S15	4	No
12	S20	2.8	No
13	S15	13.6	No
15	S15	31.8	Yes
16	S15	37.8	Yes
17	S20	4.4	No
18	S15	28.9	Yes
19	S20	2.6	No
21	S15	10.6	Yes
24	S15	26	Yes
25	S15	11	Yes
28	S15	9.2	Yes
29	Pass	N/A	No
30	S15	3.1	No
31	Pass	N/A	No
62	Pass	N/A	No
114	Pass	N/A	No
204	Pass	N/A	No
205	Pass	N/A	No
206	Pass	N/A	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.*

WIND MICROCLIMATE

14.8.2 Proposed Development + Liverpool Waters 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 cumulative scheme, in this case the Liverpool Waters Masterplan, in situ. The mitigation measures in Table 14.23 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:

Table 14.27
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	27, 32, 42, 95, 97, 100, 102, 103, 106, 109, 111, 123, 126, 219, 221, 233	Sitting use	Moderate Beneficial	Long-term	Direct	Permanent	Reversible
Operation	Thoroughfares	7, 11, 14, 22, 58, 59, 61, 64, 66, 68, 74, 76, 78, 80, 84, 86, 92, 94, 110, 112, 120, 121, 122, 124, 125, 127, 128, 129, 208, 209, 210, 215, 226, 227, 228, 229, 230, 231, 232	Standing use	Minor Beneficial	Long-term	Direct	Permanent	Reversible
Operation	Thoroughfares	20, 60, 63, 65,82, 83, 85, 87, 88, 91, 115, 116, 117, 135, 136, 137, 207, 212, 243	Strolling use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Thoroughfares	113, 131, 132, 133, 134	Walking use	Minor Adverse	Long-term	Direct	Permanent	Reversible
Operation	Entrances	4, 43, 48, 50, 51, 55, 56, 216, 217, 218, 222, 223, 235	Sitting use	Minor Beneficial	Long-term	Direct	Permanent	Reversible
Operation	Entrances	23, 40, 70, 72, 213, 214, 220, 224	Standing use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Entrances – Controlled by Monitoring	98	Sitting use or Standing use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Football Pitch	138, 139, 141, 142, 144, 145	Sitting use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Ground Level Amenity Areas – Mixed Use	35, 36, 39, 41, 44, 45, 47, 52, 53, 54, 57	Sitting use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Ground Level Amenity Areas – Mixed Use	26, 33, 34	Standing use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Ground Level Amenity Areas - Mixed Use – Controlled by Monitoring	90, 93, 96, 101, 237	Sitting use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Ground Level Amenity Areas – Seating	37, 46, 69, 73, 75, 77, 79, 81	Sitting use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Ground Level Amenity Areas – Seating	49, 67, 71, 118, 119, 130	Standing use	Minor Adverse	Long-term	Direct	Permanent	Reversible
Operation	Ground Level Amenity Areas – Seating – Controlled by Monitoring	104, 107, 236, 238, 239, 240, 241	Sitting use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Terrace Level Amenity Areas – Mixed use – Controlled by Monitoring	N/A	Sitting use or Standing use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Seating in stands	146, 147, 148, 149, 150, 152, 153, 154, 155, 156, 157, 158, 159, 161, 162, 163	Sitting use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Inaccessible locations	164, 199, 201	Sitting use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Inaccessible locations	168, 169, 170, 171, 172, 173, 176, 179, 180, 181, 182, 183, 184, 185, 186, 202	Standing use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Inaccessible locations	165, 166, 167, 174, 175, 177, 187, 190, 194, 195, 197, 200	Strolling use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Inaccessible locations	178, 188, 189, 191, 193, 196, 198, 203	Walking use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Inaccessible locations	192	Unsuitable for all pedestrian use	Negligible	Long-term	Direct	Permanent	Reversible

WIND MICROCLIMATE

PHASE	RECEPTOR	PROBE NUMBER	RESIDUAL EFFECT EXPECTED CONDITIONS	SIGNIFICANCE CRITERIA	ST/MT/LT	D/IND	P/T	R/IRR
Off-Site Receptors								
UU WwTw								
Operation	Thoroughfares	2, 114	Standing use	Moderate Beneficial	Long-term	Direct	Permanent	Reversible
Operation	Thoroughfares	31	Standing use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Thoroughfares	1, 3, 5, 6, 8, 10, 17, 18, 29, 30	Strolling use	Minor Beneficial	Long-term	Direct	Permanent	Reversible
Operation	Thoroughfares	24	Strolling use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Thoroughfares	9, 13, 16	Walking use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Thoroughfares	21, 25, 28	Walking use	Minor Adverse	Long-term	Direct	Permanent	Reversible
Operation	Thoroughfares	12	Uncomfortable for all pedestrian use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Thoroughfares	15, 19	Uncomfortable for all pedestrian use	Minor Adverse	Long-term	Direct	Permanent	Reversible
Regent Road								
Operation	Thoroughfares	206	Standing use	Moderate Beneficial	Long-term	Direct	Permanent	Reversible
Operation	Thoroughfares	204, 205	Standing use	Negligible	Long-term	Direct	Permanent	Reversible
Nelson Dock								
Operation	Thoroughfares	248	Sitting use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Thoroughfares	244, 245	Standing use	Negligible	Long-term	Direct	Permanent	Reversible
Operation	Thoroughfares	246, 247	Strolling use	Negligible	Long-term	Direct	Permanent	Reversible

Table 14.28
Expected Wind Safety Conditions

PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES FURTHER MITIGATION?*
On-Site Receptors			
4	Pass	N/A	No
7	Pass	N/A	No
11	Pass	N/A	No
14	Pass	N/A	No
20	Pass	N/A	No
22	Pass	N/A	No
23	Pass	N/A	No
26	Pass	N/A	No
27	Pass	N/A	No
32	Pass	N/A	No
33	Pass	N/A	No
34	Pass	N/A	No

WIND MICROCLIMATE

PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES FURTHER MITIGATION?*
35	Pass	N/A	No
36	Pass	N/A	No
37	Pass	N/A	No
39	Pass	N/A	No
40	Pass	N/A	No
41	Pass	N/A	No
42	Pass	N/A	No
43	Pass	N/A	No
44	Pass	N/A	No
45	Pass	N/A	No
46	Pass	N/A	No
47	Pass	N/A	No
48	Pass	N/A	No
49	Pass	N/A	No
50	Pass	N/A	No
51	Pass	N/A	No
52	Pass	N/A	No
53	Pass	N/A	No
54	Pass	N/A	No
55	Pass	N/A	No
56	Pass	N/A	No
57	Pass	N/A	No
58	Pass	N/A	No
59	Pass	N/A	No
60	Pass	N/A	No
61	Pass	N/A	No
63	Pass	N/A	No
64	Pass	N/A	No
65	Pass	N/A	No
66	Pass	N/A	No
67	Pass	N/A	No
68	Pass	N/A	No
69	Pass	N/A	No
70	Pass	N/A	No

WIND MICROCLIMATE

PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES FURTHER MITIGATION?*
71	Pass	N/A	No
72	Pass	N/A	No
73	Pass	N/A	No
74	Pass	N/A	No
75	Pass	N/A	No
76	Pass	N/A	No
77	Pass	N/A	No
78	Pass	N/A	No
79	Pass	N/A	No
80	Pass	N/A	No
81	Pass	N/A	No
82	Pass	N/A	No
83	Pass	N/A	No
84	Pass	N/A	No
85	Pass	N/A	No
86	Pass	N/A	No
87	Pass	N/A	No
88	Pass	N/A	No
90	S15	23.6	No
91	Pass	N/A	No
92	Pass	N/A	No
93	S15	23.4	No
94	Pass	N/A	No
95	Pass	N/A	No
96	S15	8.8	No
97	Pass	N/A	No
98	Pass	N/A	No
101	S15	3.2	No
102	Pass	N/A	No
103	Pass	N/A	No
104	Pass	N/A	No
105	Pass	N/A	No
106	Pass	N/A	No
107	Pass	N/A	No

WIND MICROCLIMATE

PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES FURTHER MITIGATION?*
108	Pass	N/A	No
109	Pass	N/A	No
110	Pass	N/A	No
111	Pass	N/A	No
112	Pass	N/A	No
113	S15	2.6	No
115	Pass	N/A	No
116	Pass	N/A	No
117	Pass	N/A	No
118	Pass	N/A	No
119	Pass	N/A	No
120	Pass	N/A	No
121	Pass	N/A	No
122	Pass	N/A	No
123	Pass	N/A	No
124	Pass	N/A	No
125	Pass	N/A	No
126	Pass	N/A	No
127	Pass	N/A	No
128	Pass	N/A	No
129	Pass	N/A	No
130	Pass	N/A	No
131	S15	6.4	No
132	S15	7.8	Yes
133	S15	3.3	No
134	S15	22.5	No
135	Pass	N/A	No
136	S15	9.6	No
137	Pass	N/A	No
138	Pass	N/A	No
139	Pass	N/A	No
141	Pass	N/A	No
144	Pass	N/A	No
145	Pass	N/A	No

WIND MICROCLIMATE

PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES FURTHER MITIGATION?*
147	Pass	N/A	No
148	Pass	N/A	No
149	Pass	N/A	No
150	Pass	N/A	No
152	Pass	N/A	No
153	Pass	N/A	No
154	Pass	N/A	No
156	Pass	N/A	No
157	Pass	N/A	No
158	Pass	N/A	No
159	Pass	N/A	No
161	Pass	N/A	No
162	Pass	N/A	No
163	Pass	N/A	No
164	Pass	N/A	No
166	Pass	N/A	No
167	Pass	N/A	No
168	Pass	N/A	No
169	Pass	N/A	No
170	Pass	N/A	No
171	Pass	N/A	No
172	Pass	N/A	No
173	Pass	N/A	No
174	Pass	N/A	No
175	Pass	N/A	No
176	Pass	N/A	No
177	Pass	N/A	No
178	S15	5.5	No
179	Pass	N/A	No
180	Pass	N/A	No
181	Pass	N/A	No
182	Pass	N/A	No
183	Pass	N/A	No
184	Pass	N/A	No

WIND MICROCLIMATE

PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES FURTHER MITIGATION?*
185	Pass	N/A	No
186	Pass	N/A	No
187	Pass	N/A	No
188	S15	10.9	No
189	S15	3.1	No
190	Pass	N/A	No
191	S15	4.2	No
192	S15	30.9	No
193	S15	5.1	No
194	Pass	N/A	No
195	Pass	N/A	No
196	S15	7.8	No
197	Pass	N/A	No
198	Pass	N/A	No
199	Pass	N/A	No
200	Pass	N/A	No
201	Pass	N/A	No
202	Pass	N/A	No
203	S20	4.2	No
207	Pass	N/A	No
208	Pass	N/A	No
209	Pass	N/A	No
210	Pass	N/A	No
212	Pass	N/A	No
213	Pass	N/A	No
214	Pass	N/A	No
215	Pass	N/A	No
216	Pass	N/A	No
217	Pass	N/A	No
218	Pass	N/A	No
219	Pass	N/A	No
220	Pass	N/A	No
221	Pass	N/A	No
222	Pass	N/A	No

WIND MICROCLIMATE

PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES FURTHER MITIGATION?*
223	Pass	N/A	No
224	Pass	N/A	No
226	Pass	N/A	No
227	Pass	N/A	No
228	Pass	N/A	No
229	Pass	N/A	No
230	Pass	N/A	No
232	Pass	N/A	No
233	Pass	N/A	No
234	Pass	N/A	No
235	Pass	N/A	No
236	S15	25.4	No
237	Pass	N/A	No
238	S15	17.2	No
239	S15	5.1	No
240	Pass	N/A	No
241	Pass	N/A	No
Off-Site Receptors			
1	Pass	N/A	No
2	Pass	N/A	No
3	Pass	N/A	No
5	Pass	N/A	No
6	S15	2.4	No
8	Pass	N/A	No
9	S15	2.8	No
10	S15	3.1	No
12	S15	32.5	No
13	S15	13.8	No
15	S15	39.1	Yes
16	S15	31.0	Yes
17	Pass	N/A	No
18	Pass	N/A	No
19	S20	5.8	Yes
21	S15	4.9	Yes

WIND MICROCLIMATE

PROBE NUMBER	SAFE EXCEEDANCE	HOURS OF EXCEEDANCE PER ANNUM	REQUIRES FURTHER MITIGATION?*
24	Pass	N/A	No
25	S15	3.7	Yes
28	S15	12.9	Yes
29	Pass	N/A	No
30	Pass	N/A	No
31	Pass	N/A	No
114	Pass	N/A	No
204	Pass	N/A	No
205	Pass	N/A	No
206	Pass	N/A	No
244	Pass	N/A	No
245	Pass	N/A	No
246	Pass	N/A	No
247	Pass	N/A	No
248	Pass	N/A	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. The cumulative effects of the two schemes have already been reported in sections 14.7 and 14.8 of this chapter.

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14. Wind Microclimate

Appendix 14.1

PEDESTRIAN LEVEL WIND MICROCLIMATE REPORT

FINAL REPORT

THE PEOPLE'S PROJECT

LIVERPOOL, UK

PEDESTRIAN LEVEL WIND MICROCLIMATE ASSESSMENT

RWDI #1801412 PLW - REV D

3RD JANUARY 2020

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1 EXECUTIVE SUMMARY

The objective of this study was to provide a ground, stands, pitch and concourse level wind microclimate assessment, based on a series of wind tunnel tests, for the proposed The People's Project development in Liverpool, UK.

The document presents a description of the methodology used and summary of results for four configurations tested in the wind tunnel, namely:

- Configuration 1: Existing site conditions with existing surrounding buildings (Baseline) (tested on 25/09/2019);
- Configuration 2: Liverpool Waters approved scheme on-site and in surrounding area (Future Baseline) (tested 10/10/2019);
- Configuration 3: Proposed development on-site (including proposed landscaping and design interventions) with existing surrounding buildings (tested 03/10/2019); and
- Configuration 4: Proposed development on-site (including proposed landscaping and design interventions) with Liverpool Waters scheme in surrounding area (tested on 19/11/2019).

Local wind conditions derived from the meteorological data collected at Liverpool John Lennon airport indicate prevailing winds from the west throughout the year. There is a secondary peak from the south-east during the autumn and winter season. Liverpool is noted to have a particularly windy environment compared to other large cities in the UK such as London. This generally windy background environment means that even a modest increase in wind speeds (caused by the aerodynamic performance of a building) could create uncomfortable or unsafe wind conditions.

Baseline (Configuration 1)

In the baseline scenario (Configuration 1), wind conditions around the site are not suitable for the intended use with conditions ranging from suitable for standing use to uncomfortable for all pedestrian use in the windiest season. There are a large number of safety exceedances, both on and off-site, with the windiest areas being at the south side of the existing building, to the west of the site by the river, and off-site to the north of the site around the south side of the United Utilities Wastewater Treatment Works building.

Future Baseline (Configuration 2)

In the future baseline scenario (Configuration 2) with the Liverpool Waters Scheme (modelled from the 1868-03-SK-003-03-Qualitative Visual Assessment Model.skp 3D model supplied to RWDI on 13/08/2019) built out there would be large areas of the site, particularly to the north-west, where wind conditions would be unsuitable for the intended use with wind conditions overall remain similar to those of the baseline scenario. The future baseline scenario would improve comfort conditions at eight locations off-site such that they would become suitable for intended use, whilst making conditions at three locations windier such that they would no longer be suitable for the intended use.

The majority of on-site and off-site locations would also have safety exceedances in the future baseline scenario with particularly large exceedances at the north-west corner of the site and the south-west corner of the site where wind is being channelled in between cumulative buildings. The future baseline would also improve safety conditions at two locations off-site to the north such that they would become safe for pedestrian use, whilst a single location would have windier conditions such that it became unsafe for vulnerable pedestrian use.

Proposed development on-site (including proposed landscaping and design interventions) with existing surrounding buildings (Configuration 3)

With the introduction of the proposed development, a number of design interventions were developed through iterative wind tunnel testing to generate a calmer and safer wind microclimate around the site than that in the baseline, the following measures were developed:

- The proposed landscaping scheme;
- Two 50% porous gates covering the openings on the western façade of the car park massing at the west of the stadium, one at the north end and one at the south end;
- A solid, floor-to-ceiling screen spanning the width of the car park massing at the west of the stadium located at the north side of the VIP entrances at the western façade of the stadium;
- Thirteen, 5m tall deciduous trees located on the south side (on-site) of the northern boundary fence running eastward (probe location 27 to probe location 34);
- Four, 3m tall, 10m deep, 50% porous baffles hung from the underside of the car park massing at the west of the stadium located 10m apart with the east most baffle being 26m from the southern edge of the car park massing;
- 2m tall 50% porous balustrades at both sides of the south-western bridge;
- The northern boundary wall made 50% porous running eastward from the eastern most column at the northern façade of the stadium;
- A 2m tall 50% porous boundary fence at the south-west of the site;
- A 4m wide, floor-to-ceiling, 50% porous screen extending from the western façade of the stadium at the north end of the car park massing at the west of the stadium;
- A 30% porous gate covering the entirety of the central entrance on the western façade of the car park massing at the west of the stadium;
- A 5m tall, 50% porous fence running from the western end of the south-west bridge to the western façade of the car park massing at the west of the stadium;
- Seventeen 7.5m wide, tapered baffles which are 9m tall the southern end and 6m tall at the northern end, spaced 10m apart running along the southern thoroughfare;
- Nine 6m tall 50% porous baffles of varying width (3-15m) and 6m ground clearance at the south-west corner of the stadium;
- Six 6m tall 50% porous baffles of varying width (3-12m) and 6m ground clearance at the south-east corner of the stadium;
- Two 12m tall, varying width (9-15m), 50% porous screens at the south-west corner of the stadium;
- 22, 10m wide, 3m tall, 50% porous baffles with 7m ground clearance at the north façade of the stadium; and
- A 2m tall, 50% porous fence running along the east side of the Mersey Wall at the west side of the proposed development.

With the addition of all of these design interventions and the proposed development in place (Configuration 3), the conditions at ground level around the site would be generally calmer than the wind conditions in the baseline and the wind conditions on the pitch and in the seating areas of the stands would be suitable for the intended use. All entrances and thoroughfare locations on-site except, for a single entrance location associated with the western ground level amenity space, would have suitable wind comfort conditions.

There would be terrace level amenity areas at the west of the stadium that would be expected to have unsuitable wind conditions in the summer season as well as potentially unsafe conditions. Additionally, there would be a ground level amenity area to the west of the stadium that contains a mixture of seating and mixed-use areas. Wind conditions in these amenity areas would range from standing to walking use during the summer season making the areas unsuitable for the intended use. These areas would require mitigation measures to ensure a comfortable and safe wind environment for pedestrians which would come in the form of a robust monitoring process, which will involve monitoring of both the local wind environment and daily meteorological conditions to restrict access to these locations from pedestrians when wind conditions would be unsuitable.

Likewise, there would be fourteen seating areas located at ground level around the proposed development, six of which would have sitting use wind conditions during the summer season and would be suitable for the intended use. The other eight locations would have standing use conditions in the summer season and such would require mitigation measures to ensure a suitable wind comfort environment for pedestrians.

Off-site, wind conditions would improve to the north-west of the proposed development however conditions would become marginally windier to the north-east of the proposed development. Overall the wind conditions of the area off-site to the north do not materially change.

There would be 37 locations with exceedances of the safety threshold in Configuration 3, with 14 of these locations being off-site to the north of the proposed development, 10 locations would be within the ground level amenity space at the west of the stadium and the remaining 13 locations being inaccessible to pedestrians and therefore not of concern. The locations on-site at which would be accessible and would have exceedances of the safety threshold would require mitigation measures to ensure that wind conditions are safe for pedestrians.

There would be four fewer instances of safety exceedance off-site to the north of the proposed development (with design intervention in situ) than in the baseline; however, two locations that have exceedances of the 15m/s safety threshold in the baseline would have exceedances of the 20m/s safety threshold with the proposed development in place. This would not represent a material change in wind safety conditions in this area however the locations with exceedances of the safety threshold made windier by the proposed development would require mitigation measures.

Proposed development on-site (including proposed landscaping and design interventions) with Liverpool Waters scheme in surrounding area (Configuration 4)

The design interventions developed for the proposed development within the context of the existing surrounds were carried forward and tested in the context of the cumulative scheme (Configuration 4).

With the cumulative scheme in place, wind conditions for the majority of the proposed development do not materially change however there would be four thoroughfare locations at the south-west of the site that

would have unsuitable wind comfort conditions and five thoroughfare locations at the south-west of the site would have strong winds exceeding the safety threshold due to the introduction of the cumulative scheme.

Likewise, wind conditions off-site would not materially change with the introduction of the cumulative scheme.

2 INTRODUCTION

RWDI was retained by Buro Happold to conduct a pedestrian level wind microclimate assessment of the proposed The People's Project development (referred to hereafter as the proposed development) in Liverpool, UK. This document presents the background, objectives and a summary of results and recommendations from RWDI's assessment.

3 BACKGROUND AND APPROACH

Wind tunnel tests were conducted on a 1:300 scale model of the proposed development in Liverpool, UK. The investigation quantifies the wind conditions within and around the site, by comparing the measured wind speed and frequency of occurrence with the well-established Lawson Comfort Criteria. Meteorological data from the meteorological station at Liverpool John Lennon Airport has been analysed and adjusted to the local site conditions by modelling the effect of terrain roughness on the wind speeds approaching the site.

Measurements were taken at up to 242 locations for 36 directions at 10° intervals. The measurements covered ground and elevated level locations along the building façades and at corners, thoroughfares, within open amenity spaces and on pedestrian routes within and around the site.

Analysis was conducted on a seasonal basis, but the report focuses on the windiest season results (generally winter in the UK), when the proposed development is expected to be most frequently used and those for the summer season.

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

- Configuration 1: Existing site conditions with existing surrounding buildings (Baseline) (tested on 25/09/2019);
- Configuration 2: Liverpool Waters approved scheme on-site and in surrounding area (Future Baseline) (tested 10/10/2019);
- Configuration 3: Proposed development on-site (including proposed landscaping and design interventions) with existing surrounding buildings (tested 03/10/2019); and
- Configuration 4: Proposed development on-site (including proposed landscaping and design interventions) with Liverpool Waters scheme in surrounding area (tested on 19/11/2019).

3.1 Site Description and Surroundings

BMD (Bramley-Moore Dock) is currently accessed through two gated openings in the Grade II listed dock wall from Regent Road (ref. 1072979), at the southeast and northeast corners of the site. This is a granite boundary wall with turreted double gate entrances, a flanking pair of round towers and a larger central tower incorporating a watchman's hut. These accesses allow vehicular and pedestrian access. The site predominantly comprises a dock waterbody, surrounded by a Grade II Listed dock retaining wall (Ref. 1072980) and hardstanding.

The retaining walls of the dock are authentic to the time of their construction or reconstruction and many original ground surfaces and ancillary structures and objects survive in situ around the docks. The eastern end of BMD is splayed, following the dock road, to maximise waterspace and is bounded to the east by the Regent Road dock wall. The Hydraulic Engine House, built in 1883, is Grade II Listed (Ref. 1072981) and is situated in the northeast corner of the site. It was used for providing hydraulic power to operate the dock gates. A two-storey brick structure sits at the western end of the north wharf and a shed structure sits on the southern wharf. Both structures are unlisted.

The water connection between BMD and Nelson Dock has been filled with an isolation structure. The dock comprises hard-standing to the perimeter of the dock water body and existing surface water drainage discharges into the River Mersey.

The site was previously used for aggregate storage and distribution, operated by Mersey Sands. However, the lease for this use expired in August 2019. The site remains occupied by Svitzer, which operates their tug boat services, until their lease expires in December 2019 and Cataclean, until their lease expires in December 2019. BMD lies within the UNESCO WHS Liverpool – Maritime Mercantile City (LMMC) designation (Ref. 1000104) and the Stanley Dock Conservation Area. Beyond the immediate bounds of the site, the surroundings are predominantly low rise to the north, east, and south of the site, with open water directly to the west of the site. The surrounding area to the north, east and south is characterised by 'suburban' terrain which results in a relatively turbulent wind environment with a lower mean wind speed (compared to an equivalent site in open terrain), however there is open water to the west of the site which will result in higher wind speeds at lower levels than those typically seen in suburban environments.

3.2 The Proposed Development

Application for Full Planning Permission for the demolition of non-listed structures; part-demolition of listed structures (Regent Road wall); remediation; infill of the Bramley-Moore Dock; engineering works; and alterations to the dock walls to accommodate the development of a 52,000 seated capacity stadium (Use Class D2) predominantly for football use with the ability to host other events, including up to 4 non-football events at full capacity per year; with ancillary offices (Use Class B1a); Club Shop and retail concessions (Use Class A1); museum and conference facilities (Use Class D1); food and drink concessions (internal and external to the stadium) (Use Classes A3 / A4 / A5); betting shop concessions (Sui Generis); and associated infrastructure including: electric substation, creation of a water channel, bridge links, outside broadcast compound, photo-voltaic canopy, storage areas/compound, security booth, external concourse / fan zone including performance stage, vehicular and pedestrian access and circulation areas, hard and soft landscaping (including lighting, public art and boundary treatments) and vehicle parking (external at grade and multi-storey parking).

Application for Full Planning Permission for the proposed change of use of the Hydraulic Tower structure to an exhibition/culture centre (Use Class D1) with ancillary food and drink use (Use Class A3).

Figure 1: Aerial view of The People's Project Site (approximate location highlighted yellow)

The wind tunnel model in the Configuration 2 scenario is shown in Figure 2. Further photographs of the various test configurations are included in Appendix A.

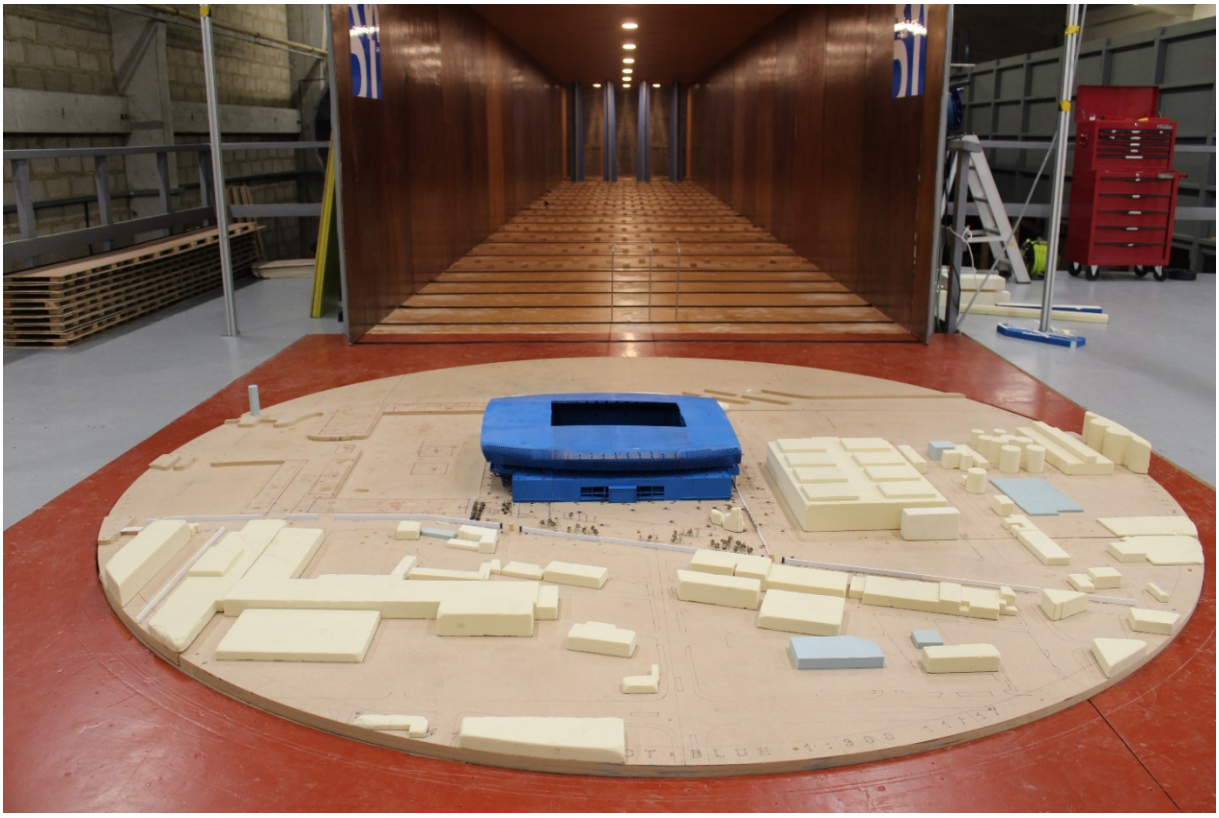


Figure 2: Image of the proposed development (blue) with existing surrounds (view from east)

4 METHODOLOGY AND ASSESSMENT CRITERIA

Wind tunnel testing is a well-established and robust means of assessing the pedestrian wind microclimate of the proposed development, allowing wind conditions at the site to be quantified and classified in accordance with the established Lawson Comfort Criteria. Testing is undertaken using a 1:300 scale model of the proposed development with existing and consented surrounding buildings and terrain covering a 360 metre (m) radius centred on the site.

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

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

4.1 Simulation of Atmospheric Winds

The wind is gusty, which is to say it is a turbulent flow. As this turbulence varies depending upon the site, it is necessary to reflect site specific conditions in the wind tunnel test. Additionally, as the fluid in the atmospheric boundary layer is viscous, mean wind speed will increase with height as the layers within the atmospheric boundary layer shear against each other. Modelling these effects is achieved by a combination of spires and floor roughness elements to create a naturally-grown boundary layer that is representative of urban or open country conditions, as appropriate. The detailed proximity model around the site is used to fine-tune the flow and create conditions similar to those expected at full scale.

4.2 Measurement Technique

Wind speed measurements were made using Irwin probes. For pedestrian comfort studies, both the mean wind speed and the peak wind speed are measured at each location at a scaled height of 1.5m above ground level. The typical equivalent full-scale time period for measuring the mean wind speed is around 90 minutes, whereas the peak wind speed is taken as the wind speed exceeded for 1% of the time.

Wind speeds at each location were measured for 36 wind directions in 10° intervals, with 0° representing a wind blowing from the north and 90° a wind blowing from the east.

4.3 Scaling

The length scale of the model was 1:300 and the velocity scale was approximately 1:2 for strong winds. Consequently, the time scale for the tests was 1:150, or in other words 1 second in the wind tunnel is equivalent to 150 seconds at full scale. The sampling frequency for the data acquisition equipment is therefore adjusted for the time scale.

4.4 Meteorological Data

Approximately 30 years of meteorological data derived from the meteorological station at Liverpool John Lennon Airport is presented in Appendix B as wind roses by season (Figure 62). The radial axis indicates the percentage hours per season that the wind speed exceeds the particular velocity range. The seasons are defined as spring (March, April and May), summer (June, July and August), autumn (September, October and November) and winter (December, January and February). The data has been corrected to standard conditions of 10m above open flat level country terrain, over which pedestrian level wind speeds are greatest. The meteorological station data is then adjusted to the site conditions using the methodology implemented in the BREVe 3.2 software package. Low to medium rise inner city environments increase the turbulence within the atmospheric boundary layer which reduces the mean wind speed, requiring terrain roughness factors to be specified and applied to the meteorological data to account for the variations in terrain surrounding the Site.

The meteorological data indicate that the prevailing wind direction is from the west throughout the year, with a secondary peak of winds from the south-east during the autumn and winter seasons. Liverpool is noted to have a particularly windy environment compared to other large cities in the UK such as London. This generally windy background environment means that even a modest increase in wind speeds (caused by the aerodynamic performance of a building) could create uncomfortable or unsafe wind conditions.

The combination of meteorological data, site altitude and velocity ratios permit the percentage of time that wind speeds are exceeded at ground level on the site to be evaluated. The locations can then be assessed using the Lawson Comfort Criteria, as described below.

4.5 Pedestrian Comfort

The assessment of the wind conditions requires a standard against which the measurements can be compared. This report uses the Lawson Comfort Criteria, which have been established for over thirty years. The comfort criteria, which seek to define the reaction of an average pedestrian to the wind, are described in Table 1. If the measured wind conditions exceed the threshold, then they are unacceptable for the stated pedestrian activity and the expectation is that there may be complaints of nuisance or people will not use the area for its intended purpose.

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

The criteria are derived for open air conditions and assume that pedestrians will be suitably dressed for the season. Thermal comfort is not part of the assessment.

The coloured key in Table 1 corresponds to the presentation of wind tunnel test results described in the Section 5 of this report.

Table 1: LDDC Criteria (based on the Lawson Comfort Criteria)

Key	Comfort Category	Threshold	Description
	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
	Standing	4 – 6 m/s	Gentle breezes acceptable for main building entrances, pick-up/drop-off points and bus stops
	Strolling	6 – 8 m/s	Moderate breezes that would be appropriate for strolling along a city/town centre street, plaza or park
	Walking	8-10 m/s	Relatively high speeds that can be tolerated if one's objective is to walk, run or cycle without lingering.
	Uncomfortable	>10 m/s	Winds of this magnitude are considered a nuisance for most activities, and wind mitigation is typically recommended

4.6 Strong Winds

The criteria also specify a strong wind threshold when winds exceed 15m/s for more than 0.025% of the time (approximately 2.2 hours per year). Exceedance of this threshold indicates a need for remedial measures and careful assessment of the expected use of that location.

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

5 RESULTS

5.1 Details of Analysis

To account for the difference in height and terrain roughness between meteorological conditions at the meteorological station and the site, it is necessary to apply adjustment factors to the wind tunnel velocity ratios. Adjustment factors (mean factors) were computed for wind directions from 0° through to 360°. The reference height in the wind tunnel was at the equivalent full-scale height of 120 meters. Table 2 presents the mean factors for the site.

Table 2: Mean factors at 120m above ground level

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

5.2 'Target' Wind Conditions

Generally, for a stadium development such as this, the target conditions are:

- Strolling during the windiest season on pedestrian thoroughfares;
- Standing/entrance conditions at main entrances, drop off areas or taxi ranks, and bus stops throughout the year (although it should be noted that back of house entrances and fire escapes, which are used less frequently, would tolerate windier conditions suitable for strolling use); and
- Sitting or standing conditions at the seating locations in the stands during the windiest season as these locations are expected to be more active than 'regular' seating areas.
- Sitting or standing conditions at large mixed-use amenity areas during the summer season when these areas are more likely to be frequently used by pedestrians.
- The football pitch at the centre of the stadium is assessed as a ground level amenity space and therefore would be required to have standing or sitting use conditions throughout the year as it would be expected to see use during the windiest season.
- Dedicated seating areas around the Proposed Development would be required to have sitting use wind conditions during the summer season as there as it assumed that there is an expectation for these areas to be somewhat uncomfortable for sitting during the windiest season, winter for this project.

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

5.3 Performance against the Lawson Comfort Criteria

The wind microclimate within and around the Site has been assessed and classified using the Lawson comfort Criteria defined in Table 1. The results of the assessment for each configuration are described below and presented graphically in Figures 11 to 34.

5.3.1 Configuration 1: Existing site conditions with existing surrounding buildings (Baseline) (tested on 25/09/2019)

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

- Figure 11: Windiest Season: Ground Level
- Figure 12: Summer Season: Ground Level
- Figure 13: Annual Safety: Ground Level

5.3.2 Configuration 2: Liverpool Waters approved scheme on-site and in surrounding area (Future Baseline) (tested 10/10/2019)

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

- Figure 14: Windiest Season: Ground Level
- Figure 15: Summer Season: Ground Level
- Figure 16: Annual Safety: Ground Level

5.3.3 Configuration 3: Proposed development on-site (including proposed landscaping and design interventions) with existing surrounding buildings (tested 03/10/2019)

The wind microclimate results for Configuration 3 are in the following figures:

- Figure 17: Windiest Season: Ground Level
- Figure 18: Windiest Season: Isometric Views from the North-East and North-West
- Figure 19: Windiest Season: Isometric Views form the South-East and South-West
- Figure 20: Summer Season: Ground Level
- Figure 21: Summer Season: Isometric Views from the North-East and North-West
- Figure 22: Summer Season: Isometric Views form the South-East and South-West
- Figure 23: Annual Safety: Ground Level
- Figure 24: Annual Safety: Isometric Views from the North-East and North-West
- Figure 25: Annual Safety: Isometric Views form the South-East and South-West

5.3.4 Configuration 4: Proposed development on-site (including proposed landscaping and design interventions) with Liverpool Waters scheme in surrounding area (tested on 19/11/2019)

The wind microclimate results for Configuration 4 are in the following figures:

- Figure 26: Windiest Season: Ground Level
- Figure 27: Windiest Season: Isometric Views from the North-East and North-West
- Figure 28: Windiest Season: Isometric Views form the South-East and South-West
- Figure 29: Summer Season: Ground Level
- Figure 30: Summer Season: Isometric Views from the North-East and North-West
- Figure 31: Summer Season: Isometric Views form the South-East and South-West
- Figure 32: Annual Safety: Ground Level
- Figure 33: Annual Safety: Isometric Views from the North-East and North-West
- Figure 34: Annual Safety: Isometric Views form the South-East and South-West

5.4 Expected Usage

The wind microclimate within and around the proposed development has been assessed and classified using the Lawson Comfort Criteria defined in Table 1. Expected usage of each location around the proposed development in the context of the existing surrounds is shown in Table 3 below.

Table 3: Expected Receptor Usage

Receptor	Receptor Reference (Probe Measurement Number)
On-Site	
Thoroughfares	7, 11, 14, 20, 22, 27, 32, 42, 58, 59, 60, 61, 63, 64, 65, 66, 68, 74, 76, 78, 80, 82, 83, 84, 85, 86, 87, 88, 89, 91, 92, 94, 95, 97, 100, 102, 103, 106, 109, 110, 111, 112, 113, 115, 116, 117, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 131, 132, 133, 134, 134, 135, 136, 137, 207, 208, 209, 210, 211, 212, 215, 219, 221, 225, 226, 227, 228, 229, 230, 231, 232, 233
Entrances	4, 23, 40, 43, 48, 50, 51, 55, 56, 70, 72, 98, 213, 214, 216, 217, 218, 229, 222, 223, 224, 235
Ground Level Amenity – Mixed Use	26, 33, 34, 35, 36, 38, 39, 41, 44, 45, 47, 52, 53, 54, 57, 90, 93, 96, 101, 105, 108, 237, 242
Ground Level Amenity - Seating	37, 46, 49, 67, 69, 71, 73, 75, 77, 79, 81, 104, 107, 118, 119, 130, 236, 238, 239, 240, 241
Football Pitch	138, 139, 140, 141, 142, 143, 144, 145
Seating in Stands	146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162,163
Inaccessible Locations	99, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203

	Off-Site
Thoroughfares	1, 2, 3, 5, 6, 8, 9, 10, 12, 13, 15, 16, 17, 18, 19, 21, 24, 25, 28, 29, 30, 31, 62, 114, 204, 205, 206

5.5 Occurrence of Strong Winds

Strong winds exceeding 15m/s and 20m/s for more than 0.025% of the time (2.2 hours per year) are listed in Table 4 in Appendix C.

6 DISCUSSION

6.1 Configuration 1: Existing site conditions with existing surrounding buildings (Baseline) (tested on 25/09/2019)

6.1.1 Pedestrian Comfort (Figures 11-13)

In the existing scenario (Configuration 1), the existing site is currently only used by a tug boat service operator however wind conditions are mostly unsuitable for the intended use. There are 41 locations probed on-site that would be inaccessible as they are currently located in Bramley-Moore Dock.

Thoroughfare (Figure 11)

There are currently only 32 thoroughfare locations on-site which have strolling use or calmer wind conditions and therefore would be suitable for the intended use. However, the majority of thoroughfare locations (60 locations) on-site have walking use conditions, one category windier than required, and six locations with wind conditions unsuitable for any pedestrian activity.

Off-Site (Figure 11)

Off-site there would only be seven locations of the 30 thoroughfare locations which have strolling or calmer use wind conditions and the remaining 23 would have walking use or windier conditions making them unsuitable for their intended use.

6.1.2 Strong Winds (Figure 13)

Currently there are safety exceedances of the 15m/s safety threshold at 66 of the 98 accessible locations on-site, with eight of these locations also having exceedances of the 20m/s safety threshold. Off-site, 22 of the 30 locations would have exceedances of the 15m/s safety threshold with one of these locations at the south-west corner of the Liverpool Wastewater Treatment Works building having strong winds exceeding the 20m/s safety threshold.

6.2 Configuration 2: Liverpool Waters approved scheme on-site and in surrounding area (Future Baseline) (tested 10/10/2019)

6.2.1 Pedestrian Comfort (Figures 14-16)

With the cumulative scheme (Configuration 2) in place, wind conditions around the site would not largely change; with areas to the east of the site becoming slightly calmer due to the additional shelter provided by the cumulative scheme which would make wind conditions up to three categories calmer in this area. In contrast, areas to the north-west and south-west of the site would become windier due to channelling between the cumulative developments and corner acceleration around the cumulative buildings making wind conditions one or two categories winder at a number of locations. A large portion of the site would still have wind conditions unsuitable for the intended use. The inaccessible locations within the Bramley-Moore Dock would remain in this configuration.

Thoroughfares (Figure 14)

On-site there would be 45 locations which would have strolling use wind conditions or calmer, with nine locations, mainly to the east of the site, having standing use conditions and a single location also at the east of the site having sitting use conditions during the windiest season. There would also be 37 locations on-site with unsuitable wind conditions during the windiest with 15 locations having wind conditions uncomfortable for all pedestrian activity and the remaining 22 locations would have walking use conditions.

In comparison with the baseline, the wind conditions present on-site in the future baseline are marginally calmer due to the sheltering afforded to the east of the site from the increased massing.

Off-Site (Figure 14)

Off-site there would only be 17 locations of the 32 locations that would have strolling use wind conditions or better with three of these locations, at the south-east of the site, with standing use conditions during the windiest season. The remaining 15 locations off-site would have wind conditions suitable for walking use with the exception of one location at the south-west corner of the Liverpool Wastewater Treatment Works building which would have uncomfortable wind conditions for all pedestrian use in the windiest season.

6.2.2 Strong Winds (Figure 16)

With the cumulative schemes in place, there would be 58 instances of exceedance of the 15m/s safety threshold at accessible locations on-site, 15 of which would also have exceedances of the 20m/s safety threshold. Off-site, there would be 19 locations of the 32 locations which would have exceedances of the 15m/s safety threshold with only a single location at the south-west corner of the Liverpool Wastewater Treatment Works building with an exceedance of the 20m/s safety threshold.

6.3 Configuration 3: Proposed development on-site (including proposed landscaping and design interventions) with existing surrounding buildings (tested 03/10/2019)

6.3.1 Pedestrian Comfort (Figures 17-25)

Configuration 3 consists of the proposed development with the proposed landscaping and design interventions implemented in the context of the existing surrounding buildings. The following design interventions have been developed through iterative wind tunnel testing to improve the wind microclimate around the proposed development:

- Two 50% porous gates covering the openings on the western façade of the car park massing at the west of the stadium, one at the north end and one at the south end;
- A solid, floor-to-ceiling screen spanning the width of the car park massing at the west of the stadium located at the north side of the VIP entrances at the western façade of the stadium;
- Thirteen, 5m tall deciduous trees located on the south side (on-site) of the northern boundary fence running eastward (probe location 27 to probe location 34);
- Four, 3m tall, 10m deep, 50% porous baffles hung from the underside of the car park massing at the west of the stadium located 10m apart with the east most baffle being 26m from the southern edge of the car park massing;
- 2m tall 50% porous balustrades at both sides of the south-western bridge;
- The northern boundary wall made 50% porous running eastward from the eastern most column at the northern façade of the stadium;
- A 2m tall 50% porous boundary fence at the south-west of the site;
- A 4m wide, floor-to-ceiling, 50% porous screen extending from the western façade of the stadium at the north end of the car park massing at the west of the stadium;
- A 30% porous gate covering the entirety of the central entrance on the western façade of the car park massing at the west of the stadium;
- A 5m tall, 50% porous fence running from the western end of the south-west bridge to the western façade of the car park massing at the west of the stadium;
- Seventeen 7.5m wide, tapered baffles which are 9m tall the southern end and 6m tall at the northern end, spaced 10m apart running along the southern thoroughfare;
- Nine 6m tall 50% porous baffles of varying width (3-15m) and 6m ground clearance at the south-west corner of the stadium;
- Six 6m tall 50% porous baffles of varying width (3-12m) and 6m ground clearance at the south-east corner of the stadium;
- Two 12m tall, varying width (9-15m), 50% porous screens at the south-west corner of the stadium;
- 22, 10m wide, 3m tall, 50% porous baffles with 7m ground clearance at the north façade of the stadium; and
- A 2m tall, 50% porous fence running along the east side of the Mersey Wall at the west side of the proposed development.

With these measures in place the wind environment on-site would be much calmer than in the baseline however uncomfortable and unsafe wind conditions would persist off-site to the north of the proposed development.

Thoroughfares (Figure 17)

All thoroughfare locations on-site would have wind conditions suitable for sitting use to strolling use making them suitable for the intended use and requiring no further mitigation measures.

Entrances (Figure 17)

There would be a single entrance location, to the amenity space at the west of the stadium which would have strolling use conditions during the windiest season making it unsuitable for the intended use. The mitigation measures developed for this amenity space, discussed in Section 7 below, would be expected to ensure that this location would only be in use when wind conditions would be suitable for the intended use.

All other entrance locations on-site would have wind conditions suitable for sitting or standing use making them suitable for their intended use and requiring no mitigation measures.

Football Pitch (Figure 20)

The wind conditions on the football pitch at the centre of the proposed development would be suitable for the intended use during the windiest and summer seasons and therefore would require no mitigation measures.

Ground Level Amenity (Figure 20)

There would be two large ground level amenity spaces on-site, one to the west of the stadium between the western façade of the car park massing and the eastern edge of the water channel, and the other to the east of the stadium in the fan plaza. Both of these amenity spaces would have a number of designated seating locations as well as a numbered of mixed-use areas. There would also be a number of designated seating locations around the proposed development to the south of the stadium and to the west of the site, across the water channel from the stadium. At designated seating locations, sitting use conditions would be required during the summer season to make them suitable for the intended use however at mixed-use locations standing use wind conditions would be considered suitable.

At the amenity space to the west of the stadium, wind conditions would range from standing to walking use wind conditions at both the designated seating locations and the mixed-use locations making this area unsuitable for the intended use. The mitigation measures outlined in Section 7 of this report would be expected to ensure that this area is only accessible when wind conditions would be safe and suitable for pedestrian use.

To the east of the stadium, in the fan plaza, wind conditions in the mixed-use locations would range from sitting use conditions to standing use conditions during the summer season which would make the mixed-use amenity spaces suitable for the intended use and would require no mitigation. The designated seating areas would also have wind conditions ranging from sitting use to standing use during the summer season and as such two of the three locations (the two most southerly) would be unsuitable for the intended use and require mitigation measures to ensure a comfortable wind environment for pedestrians.

At the remaining designated seating areas around the proposed development, three locations on the southern thoroughfare the locations to the north-east and south-east of the surface level car park (across the water channel from the stadium) would have standing use wind conditions making them unsuitable for the intended use and also requiring mitigation measures. The remaining five seating locations would have sitting wind comfort conditions throughout the summer season and as such would be suitable for the intended use.

Seating in the Stands (Figures 21 and 22)

All seating locations within the stands would have sitting use wind conditions throughout the year and as such would be suitable for the intended use requiring no mitigation.

Terrace Amenity (Figures 21 and 22)

There would be terrace level amenity locations at the west of the stadium on top of the new car park massing. These terraces were introduced to the design of the stadium after the wind tunnel testing had taken place, as such they have been assessed qualitatively.

The terrace level amenity locations at the west of the stadium are expected to experience wind conditions that would be both unsuitable and potentially unsafe for pedestrian use during the summer season and as such mitigation measures would be required. The mitigation measures outlined in Section 7 of this report would be expected to ensure these areas are only accessible to pedestrians when wind conditions would be suitable for the intended use and safe for pedestrians.

Off-Site (Figure 17)

Wind comfort conditions off-site to the north of site would not change materially with the introduction of the proposed development as wind conditions would range from standing use to uncomfortable for all pedestrian use. 15 locations of the 27 off-site locations would have unsuitable wind conditions with four of those locations having wind conditions uncomfortable for all pedestrian use and the remaining 11 having walking use wind conditions. Therefore, there would be 12 locations off-site which would have strolling use or calmer wind conditions meaning they would be suitable for the intended use.

6.3.2 Strong Winds (Figures 23-25)

With the proposed development, proposed landscaping and design interventions in place (Configuration 3), there would be 10 accessible (and 13 inaccessible) locations on-site which would have unsafe wind conditions exceeding the 15m/s safety threshold, with two of these accessible locations with exceedances of the 20m/s safety threshold also. These locations are confined to the ground level amenity area to the west of the stadium. With the mitigation measures discussed in Section 7 below implemented, it is expected that these areas would only be accessible when wind conditions are safe for pedestrian use.

Therefore, with the mitigation measure discussed below in place, there would be no locations on-site which would be accessible to pedestrians which would have strong winds exceeding the safety threshold.

Off-site there would be 14 locations with exceedances of the 15m/s safety threshold, four fewer than in the baseline, located off-site to the north of the proposed development. Three of these locations would also have exceedances of the 20m/s safety threshold, which is one more than the baseline. The locations with windier safety conditions than in the baseline (probe locations 15, 16, 17, 18, 19, 21, 24, 25, and 28) would require further mitigation measures.

All other locations off-site would have safe wind conditions for pedestrian use.

6.4 Configuration 4: Proposed development on-site (including proposed landscaping and design interventions) with Liverpool Waters scheme in surrounding area (tested on 19/11/2019)

6.4.1 Pedestrian Comfort (Figures 26-34)

The design interventions developed in the context of the existing surrounds were carried forward and tested in the context of the cumulative scheme. With the proposed development, cumulative scheme, proposed landscaping and design interventions in place (Configuration 4), wind conditions around the majority of the site would not change materially, however an additional five thoroughfare locations would get windier such that they become unsuitable for the intended use and six locations would have strong winds exceeding the safety threshold.

Thoroughfares (Figure 26)

With the introduction of the cumulative scheme and mitigation measures, there would be four thoroughfare locations at the south-west of the site which would have walking use wind conditions and would therefore be unsuitable for the intended use. There would also be a single thoroughfare location to the north of the amenity space at the west of the stadium which would have walking use wind conditions. These five locations would require mitigation measures to ensure a comfortable wind environment for pedestrians, if the cumulative scheme is built out to the maximum parameter massing.

All other thoroughfare locations on-site would have wind conditions suitable for sitting use to strolling use making them suitable for the intended use and requiring no mitigation measures.

Entrances (Figure 26)

There would be a single entrance location, to the amenity space at the west of the stadium which would have strolling use conditions during the windiest season making it unsuitable for the intended use. The mitigation measures developed for this amenity space, discussed in Section 7 below, would be expected to ensure that this location would only be in use when wind conditions would be suitable for the intended use.

All other entrance locations on-site would have wind conditions suitable for sitting or standing use making them suitable for their intended use and requiring no mitigation measures.

Football Pitch (Figure 29)

The wind conditions on the football pitch at the centre of the proposed development would be suitable for the intended use during the windiest and summer seasons and therefore would require no mitigation measures.

Ground Level Amenity (Figure 29)

At the amenity space to the west of the stadium, wind conditions would range from standing to walking use wind conditions at both the designated seating locations and the mixed-use locations making this area unsuitable for the intended use. The mitigation measures outlined in Section 7 of this report would be expected to ensure that this area is only accessible when wind conditions would be safe and suitable for pedestrian use.

To the east of the stadium, in the fan plaza, wind conditions in the mixed-use locations would range from sitting use conditions to standing use conditions during the summer season which would make the mixed-use amenity spaces suitable for the intended use and would require no mitigation. The designated seating areas would also have wind conditions ranging from sitting use to standing use during the summer season and as such one of the three locations (the most southerly) would be unsuitable for the intended use and require mitigation measures to ensure a comfortable wind environment for pedestrians.

At the remaining designated seating areas around the proposed development, two locations on the southern thoroughfare the locations to the north-east and south-east of the surface level car park (across the water channel from the stadium) would have standing use wind conditions making them unsuitable for the intended use and also requiring mitigation measures. The remaining six seating locations would have sitting wind comfort conditions throughout the summer season and as such would be suitable for the intended use.

Seating in the Stands (Figures 30 and 31)

All seating locations within the stands would have sitting use wind conditions throughout the year and as such would be suitable for the intended use requiring no mitigation.

Terrace Amenity (Figures 30 and 31)

The terrace level amenity locations at the west of the stadium are expected to experience wind conditions that would be both unsuitable and potentially unsafe for pedestrian use during the summer season and as such mitigation measures would be required. The mitigation measures outlined in Section 7 of this report would be expected to ensure these areas are only accessible to pedestrians when wind conditions would be suitable for the intended use and safe for pedestrians.

Off-Site (Figure 26)

Wind comfort conditions off-site to the north of site would not change materially with the introduction of the cumulative scheme as wind conditions would continue to range from standing use to uncomfortable for all pedestrian use. Nine locations off-site of the 32 locations off-site would have unsuitable wind conditions with three of those locations having wind conditions uncomfortable for all pedestrian use and the remaining six having walking use wind conditions. Therefore, there would be 23 locations off-site which would have strolling use or calmer wind conditions meaning they would be suitable for the intended use.

6.4.2 Strong Winds (Figures 24-26)

With the cumulative scheme and mitigation measures in place (Configuration 4), there would be 13 accessible locations on-site which would have unsafe wind conditions exceeding the 15m/s safety threshold.

Seven of these locations would be at the ground level amenity area to the west of the stadium. With the mitigation measures discussed in Section 7 below implemented, it is expected that these areas would only be accessible when wind conditions are safe for pedestrian use.

There would, however, be six locations on site with exceedances of the 15m/s safety threshold that would be accessible to pedestrians all year round and would therefore require mitigation measures to ensure a comfortable and safe wind environment. Five locations at the south-west corner of the site, in the outside broadcasting compound would have unsafe wind conditions, exceeding the 15m/s safety threshold. There would also be a thoroughfare location to the north of the amenity space at the west side of the stadium which would have strong winds exceeding the 15m/s safety threshold. It should be noted that these issues only occur with the cumulative scheme in place and given that the Liverpool Waters Masterplan was modelled to the currently consented outline planning maximum parameter massing models, when the cumulative scheme and the developments associated with it are brought forward to detailed design the wind conditions are expected to change. It is therefore recommended that the mitigation measures developed for the proposed development be re-examined and further refined when the cumulative scheme is brought forward to detailed design.

Off-site there would be 11 locations with exceedances of the 15m/s safety threshold, seven fewer than in the baseline, located off-site to the north of the proposed development. One of these locations would also have exceedances of the 20m/s safety threshold. The locations with windier safety conditions than in the baseline (probe locations 15, 16, 19, 21, 25, 28) would require mitigation measures.

All other locations off-site would have safe wind conditions for pedestrian use.

7 DESIGN INTERVENTIONS AND MITIGATION MEASURES

In the context of Configuration 3, with the existing surrounding buildings, the following design interventions were developed to improve the wind microclimate around the proposed development (shown in Figures 47 to 61 of Appendix A):

- Two 50% porous gates covering the openings on the western façade of the car park massing at the west of the stadium, one at the north end and one at the south end;
- A solid, floor-to-ceiling screen spanning the width of the car park massing at the west of the stadium located at the north side of the VIP entrances at the western façade of the stadium;
- Thirteen, 5m tall deciduous trees located on the south side (on-site) of the northern boundary fence running eastward (probe location 27 to probe location 34);
- Four, 3m tall, 10m deep, 50% porous baffles hung from the underside of the car park massing at the west of the stadium located 10m apart with the east most baffle being 26m from the southern edge of the car park massing;
- 2m tall 50% porous balustrades at both sides of the south-western bridge;
- The northern boundary wall made 50% porous running eastward from the eastern most column at the northern façade of the stadium;
- A 2m tall 50% porous boundary fence at the south-west of the site;
- A 4m wide, floor-to-ceiling, 50% porous screen extending from the western façade of the stadium at the north end of the car park massing at the west of the stadium;
- A 30% porous gate covering the entirety of the central entrance on the western façade of the car park massing at the west of the stadium;
- A 5m tall, 50% porous fence running from the western end of the south-west bridge to the western façade of the car park massing at the west of the stadium;
- Seventeen 7.5m wide, tapered baffles which are 9m tall the southern end and 6m tall at the northern end, spaced 10m apart running along the southern thoroughfare;
- Nine 6m tall 50% porous baffles of varying width (3-15m) and 6m ground clearance at the south-west corner of the stadium;
- Six 6m tall 50% porous baffles of varying width (3-12m) and 6m ground clearance at the south-east corner of the stadium;
- Two 12m tall, varying width (9-15m), 50% porous screens at the south-west corner of the stadium;
- 22, 10m wide, 3m tall, 50% porous baffles with 7m ground clearance at the north façade of the stadium; and
- A 2m tall, 50% porous fence running along the east side of the Mersey Wall at the west side of the proposed development.

With these design interventions in place, there would still be amenity locations at the ground floor level on-Site that would have unsafe and unsuitable wind conditions.

For the amenity space to the west of the stadium and the terrace level amenity space at the west of the stadium above the car park massing, a robust monitoring system will be installed which will monitor both local wind conditions and daily meteorological data to only allow access to pedestrians when wind conditions would be both suitable for the intended use, in this case a sitting use wind conditions for the ground level area and a mixture of sitting use and standing use conditions for terrace level areas, and safe for pedestrian use.

For the remaining amenity locations on-site and the thoroughfare locations off-site, no mitigation measures have been developed. As such there would be locations on-site with unsuitable wind comfort conditions and off-site there would be locations with unsuitable and unsafe wind conditions which are caused, or made windier, due to the introduction of the proposed development.

In the context of Configuration 4 and the cumulative surrounding buildings, the above design interventions were carried over however no additional mitigation measures have been developed.

The monitoring system developed for the amenity spaces at the west of the stadium would still be required to be in place and should be re-examined as and when the elements of the cumulative scheme are brought forward to detail design.

Additionally, there would be five thoroughfare locations on-site which would have unsuitable wind comfort conditions, and six thoroughfare locations which would have unsafe wind conditions and would be accessible to the public all year round. There would also be six designated seating locations around the proposed development that would have unsuitable wind comfort conditions in the summer season for their intended pedestrian use.

8 CONCLUSION

In conclusion:

1. The meteorological data for the application site indicates prevailing winds from the west throughout the year. There is a secondary peak from the south-east during the autumn and winter season. Liverpool is noted to have a particularly windy environment compared to other large cities in the UK such as London. This generally windy background environment means that even a modest increase in wind speeds (caused by the aerodynamic performance of a building) could create uncomfortable or unsafe wind conditions.

Baseline (Configuration 1)

2. In the baseline scenario (Configuration 1), wind conditions around the Site are not suitable for the intended use with conditions ranging from suitable for standing use to uncomfortable for all pedestrian use in the windiest season.

3. There are 88 instances of exceedance of the strong wind threshold (winds exceeding 15m/s for more than 0.025% of the time (approximately 2.2 hours per year)), of the 128 locations accessible pedestrians in Configuration 1.

Future Baseline (Configuration 2)

4. In the future baseline scenario (Configuration 2), wind conditions in and around the Site would not materially change from those in the baseline with wind conditions ranging from suitable for sitting use to uncomfortable for all pedestrian use in the windiest season.

5. There would be 75 instances of exceedance of the strong wind threshold out of the 114 locations accessible to pedestrians in Configuration 2.

Proposed development on-site (including proposed landscaping and design interventions) with existing surrounding buildings (Configuration 3)

6. With the proposed development, proposed landscaping and design interventions, introduced to the existing site (Configuration 3), wind conditions on-site would be considerably calmer than in the baseline.

7. There would still be a number of locations with uncomfortable and unsafe wind conditions at the ground level amenity space to the west of the stadium. Unsuitable and potentially unsafe winds are expected at the terrace level amenity space at the west of the stadium above the car park massing as well. As such, the following mitigation measures would be expected to ensure that these areas would only be accessible when winds are safe and comfortable for the intended pedestrian use:

    - A robust monitoring system, which will monitor both local wind conditions and daily meteorological data to only allow access to pedestrians when wind conditions would be both suitable for the intended use and safe, controlling access to the ground level amenity space to the west of the stadium.

- A robust monitoring system, which will monitor both local wind conditions and daily meteorological data to only allow access to pedestrians when wind conditions would be both suitable for the intended use and safe, controlling access to the terrace level amenity space at west of the stadium above the new car park massing.

8. On-site, wind conditions would range from suitable for sitting to strolling use during the windiest season in locations that are not access controlled. With the monitoring system in place, all thoroughfares and entrances would be suitable for intended use.

9. There would be designated seating areas in the fan plaza to the east of the stadium, along the southern thoroughfare, and across the water channel from the stadium which would have unsuitable wind conditions during the summer season for their intended use and would require mitigation measures to ensure a comfortable wind environment for pedestrians.

10. All other amenity and designated seating locations would only be accessible when wind conditions would be suitable for the intended use during the summer season.

11. Off-site, wind conditions would not materially change from those in the baseline with conditions ranging from suitable for standing use to uncomfortable for all pedestrian use during the windiest season.

12. There would be 10 accessible locations on-site, with winds exceeding the strong wind threshold (winds exceeding 15m/s for more than 0.025% of the time (approximately 2.2 hours per year)) throughout the year however these locations are all within access-controlled areas and as such no locations on-site would be accessible when strong winds exceed the 15m/s safety threshold.

13. Off-site, there would be 14 locations with wind exceeding the strong wind threshold, six of which would be made materially windier by the introduction of the proposed development. These winds would have the potential to be a safety concern for pedestrians and therefore would require mitigation.

Proposed development on-site (including proposed landscaping and design interventions) with Liverpool Waters scheme in surrounding area (Configuration 4)

14. The design interventions developed in the context of the existing surrounds would be carried over into the context of the cumulative surrounds as would the monitoring systems. With the cumulative scheme in place (Configuration 4) wind conditions for the majority of the site would not materially change however there would be five locations on site that would have unsuitable wind conditions and six that would have unsafe wind conditions.

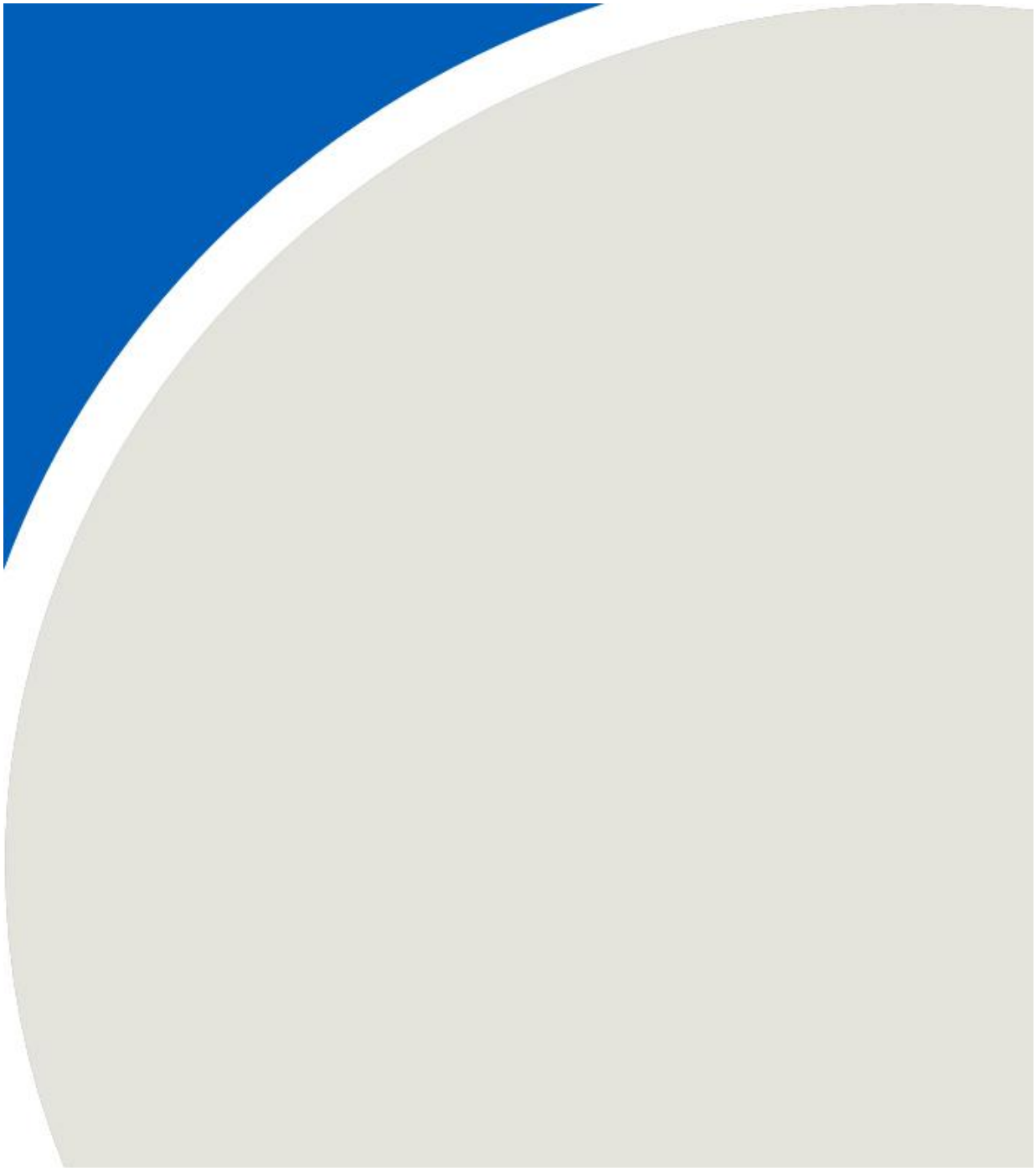
15. There would be four thoroughfare locations at the south-west of the site which would have walking use wind conditions during the windiest season and would therefore be unsuitable for the intended use. There would also be a thoroughfare location to the north of the amenity space to the west of the stadium that would have walking use conditions and would also be unsuitable for the intended use. These five locations would require further mitigation measures to ensure a comfortable wind environment for pedestrians, if the cumulative scheme is built out to the maximum parameter massing. All other thoroughfare and entrance locations would be suitable for intended use.

16. There would still be designated seating areas in the fan plaza to the east of the stadium, along the southern thoroughfare, and across the water channel from the stadium which would have unsuitable wind conditions during the summer season for their intended use and would require mitigation measures to ensure a comfortable wind environment for pedestrians. All other amenity and designated seating locations would be suitable for the intended use.

17. There would be six locations on site, with the cumulative scheme in place, with exceedances of the 15m/s safety threshold that would be accessible to pedestrians all year round. There would be five locations at the south-west corner of the site, and one to the north of the amenity space to the west of the stadium. The locations would require mitigation measures to ensure a safe pedestrian environment.

18. Off-site wind comfort conditions would not materially change from Configuration 3 and locations which are made windier due to the introduction of the proposed development would still require mitigation to ensure a safe and comfortable pedestrian environment.

FIGURES



LEGEND:

SENSOR LOCATION:

- Grade Level
- Podium Level
- Balcony/Roof Level

0 30 60m

Measurement Locations - Ground Floor

Configuration 1: Baseline

The People's Project, Bramley-Moore Dock, Liverpool- UK

True North

Project #1801412

Drawn by:	JLF	Figure:	3
Approx. Scale @A3:	1:1500		
Date Revised:	Nov. 27, 2019		

LEGEND:

SENSOR LOCATION:

- Grade Level
- Podium Level
- Balcony/Roof Level

0 30 60m

Measurement Locations - Ground Floor
Configuration 2: Future Baseline

The People's Project, Bramley-Moore Dock, Liverpool- UK

True North

Project #1801412

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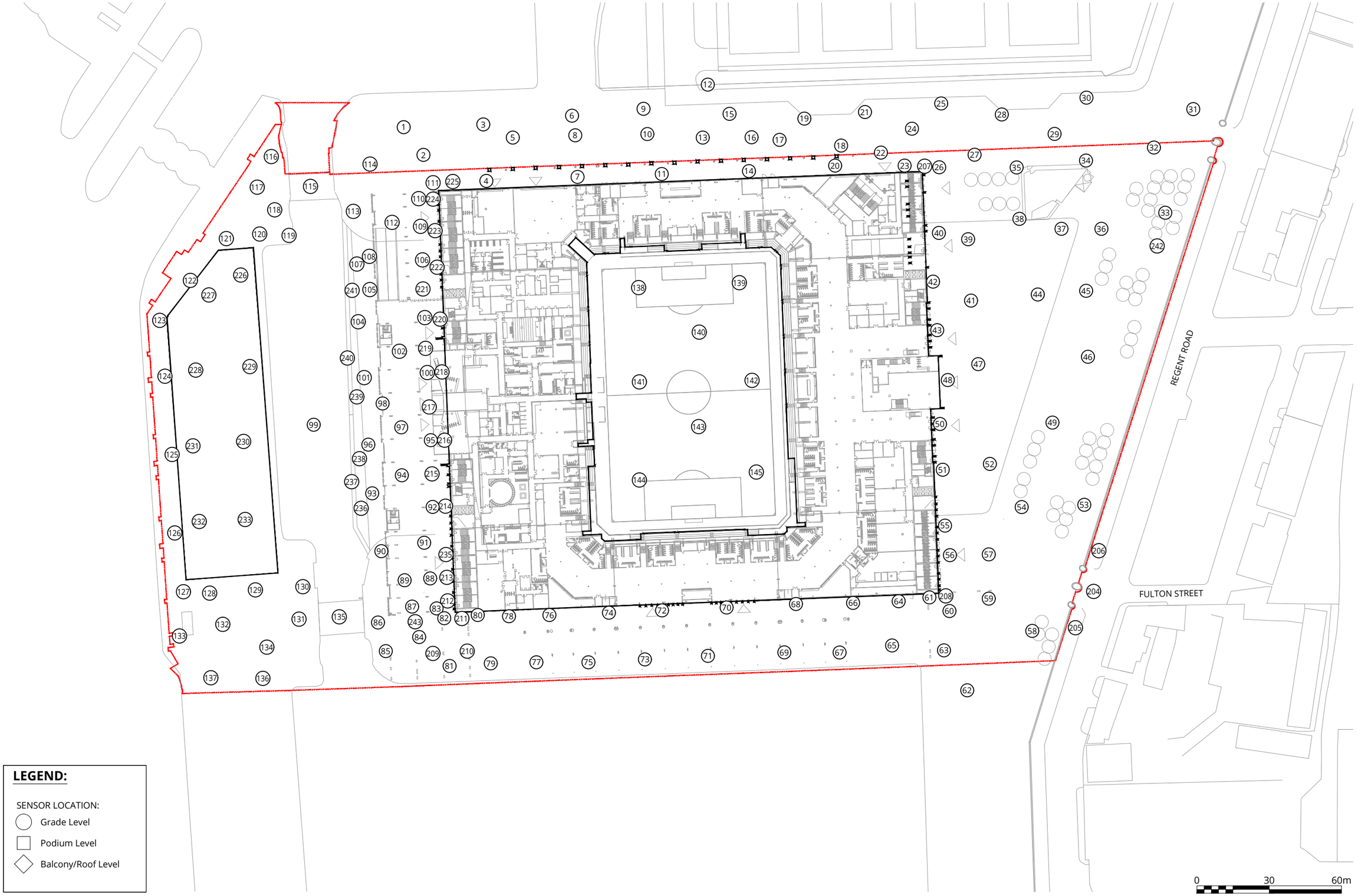
Date Revised:	Nov. 27, 2019		



LEGEND:

SENSOR LOCATION:

- Grade Level
- Podium Level
- Balcony/Roof Level

Measurement Locations - Ground Floor

Configuration 3: Proposed Development with Existing Surrounding Buildings, Proposed Landscaping and Design Interventions

The People's Project, Bramley-Moore Dock, Liverpool- UK

True North

Project #1801412

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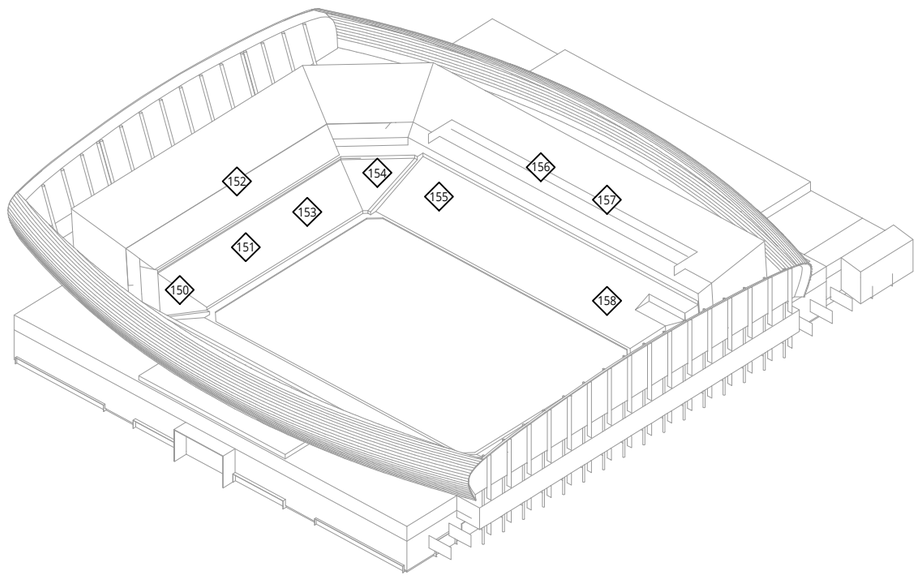

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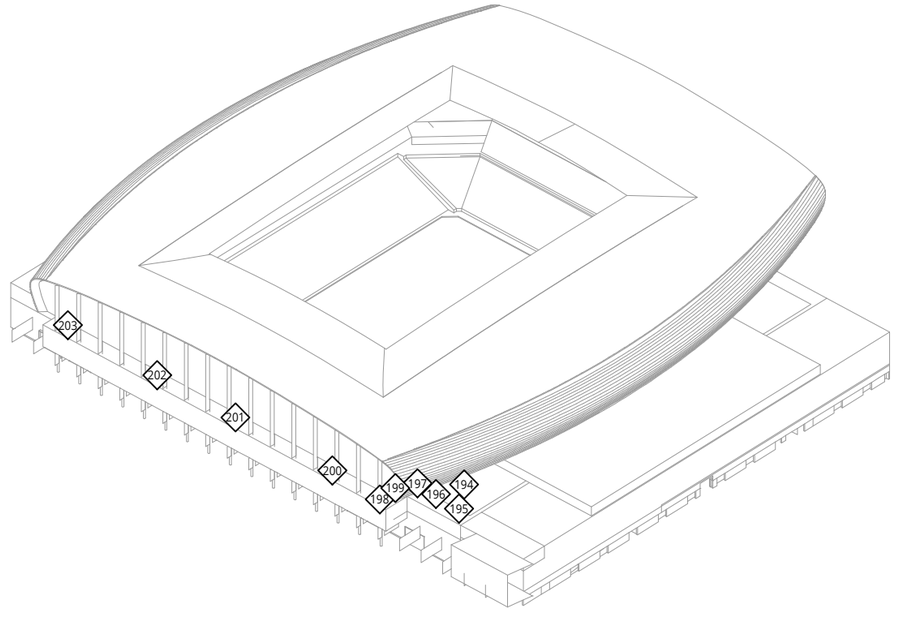

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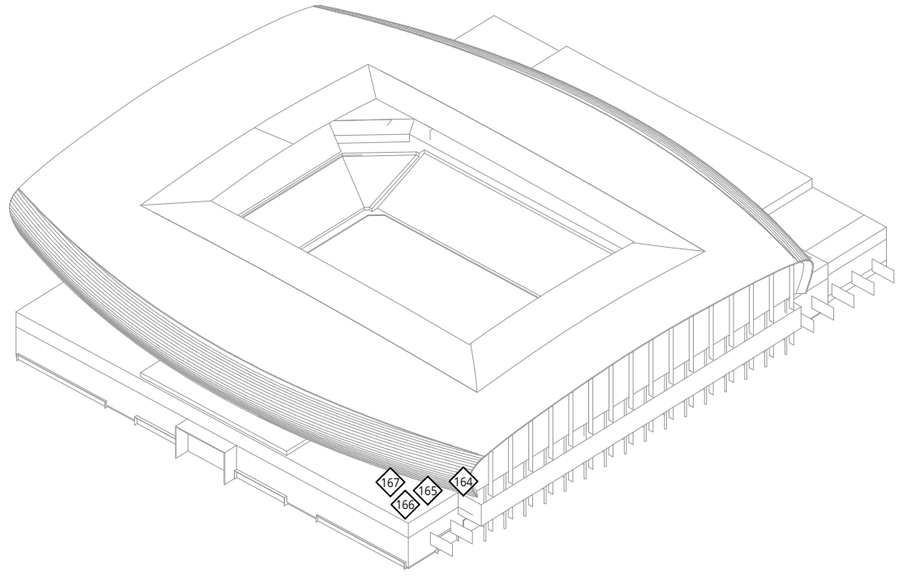

NORTH / EAST

LEGEND:

SENSOR LOCATION:

- Grade Level
- Podium Level
- Balcony/Roof Level

0 40 80m

Measurement Locations - Isometric Views

Configuration 3: Proposed Development with Existing Surrounding Buildings, Proposed Landscaping and Design Interventions

The People's Project, Bramley-Moore Dock, Liverpool- UK

Project #1801412

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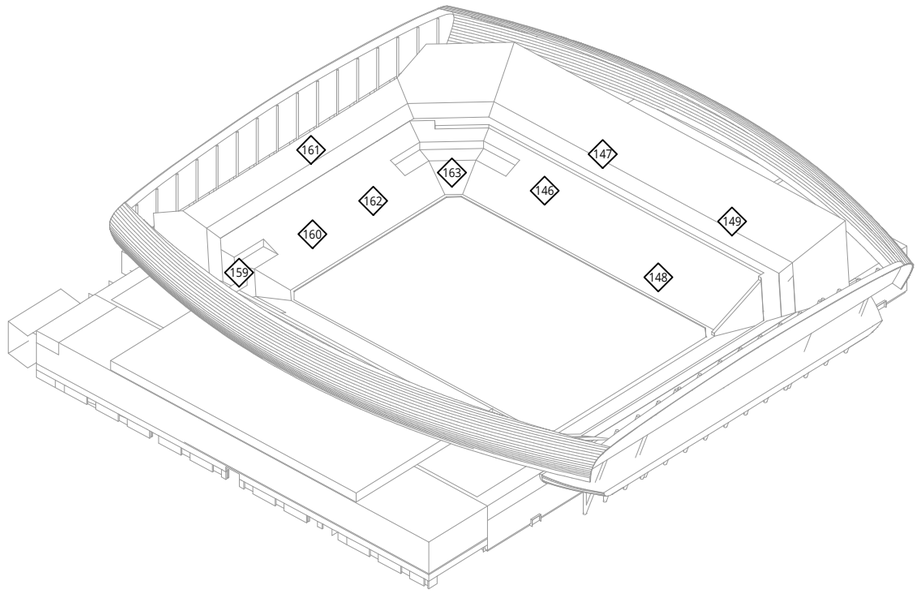

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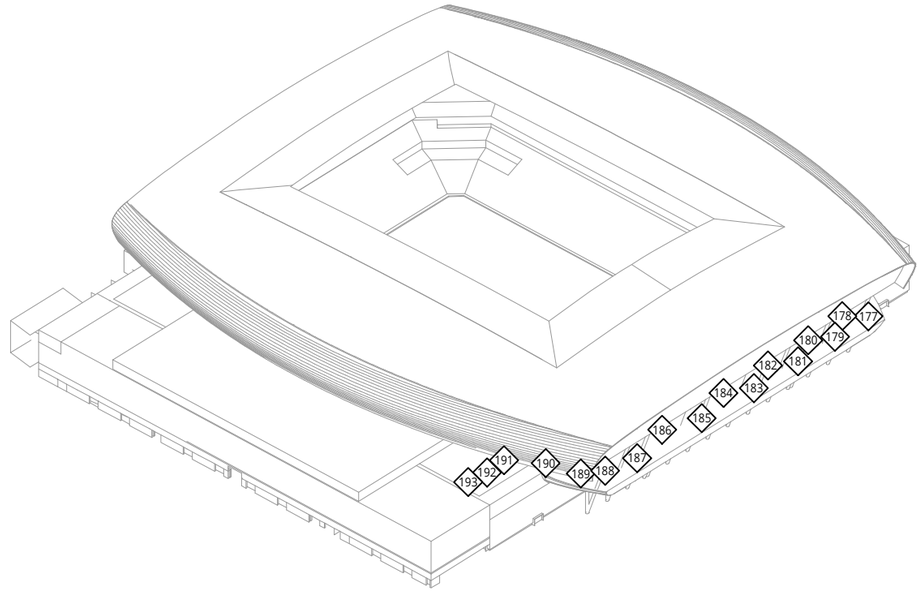

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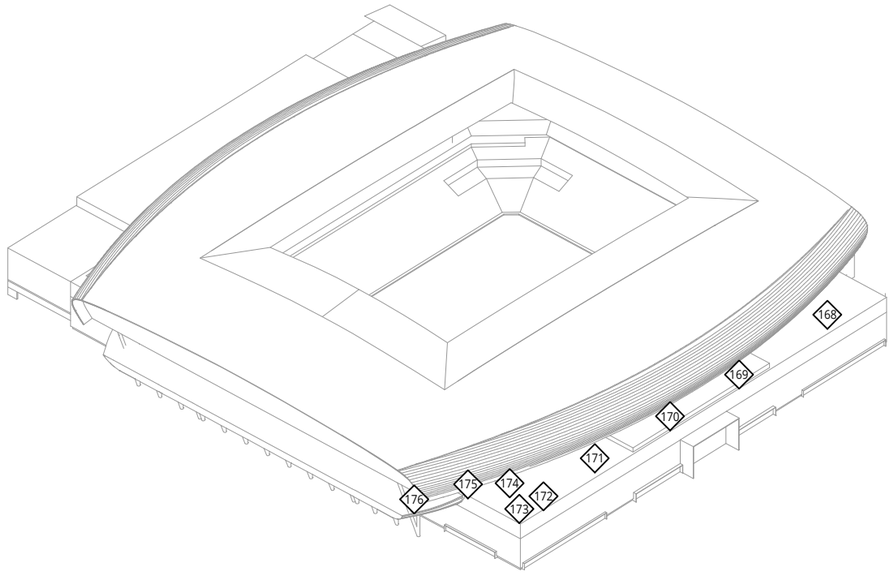

SOUTH / EAST

LEGEND:

SENSOR LOCATION:

- Grade Level
- Podium Level
- Balcony/Roof Level

0 40 80m

Measurement Locations - Isometric Views

Configuration 3: Proposed Development with Existing Surrounding Buildings, Proposed Landscaping and Design Interventions

The People's Project, Bramley-Moore Dock, Liverpool- UK

Project #1801412

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Approx. Scale @A3:	1:2000		
Date Revised:	Nov. 27, 2019		

LEGEND:

SENSOR LOCATION:

- Grade Level
- Podium Level
- Balcony/Roof Level

0 30 60m

Measurement Locations - Ground Floor

Configuration 4: Proposed Development with Cumulative Surrounding Buildings, Proposed Landscaping and Design Interventions

The People's Project, Bramley-Moore Dock, Liverpool- UK

True North

Project #1801412

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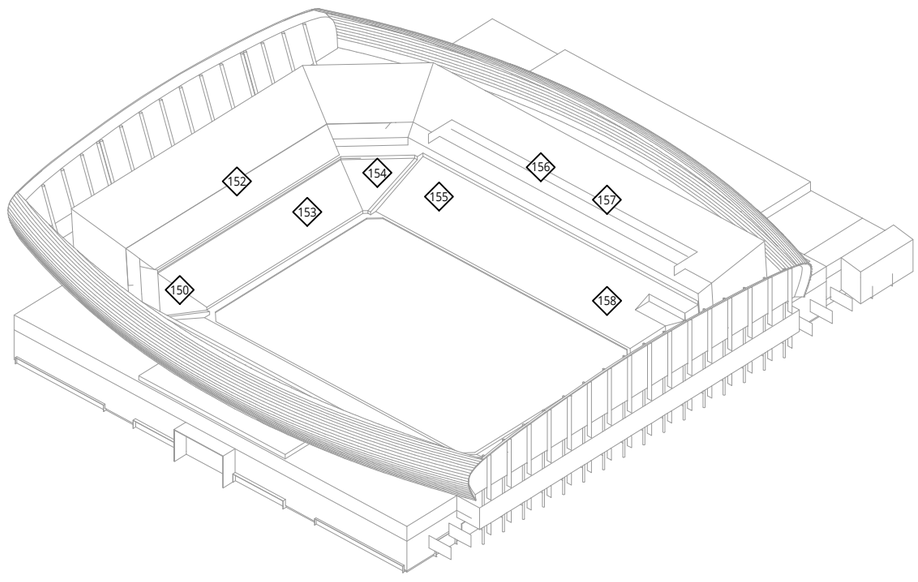

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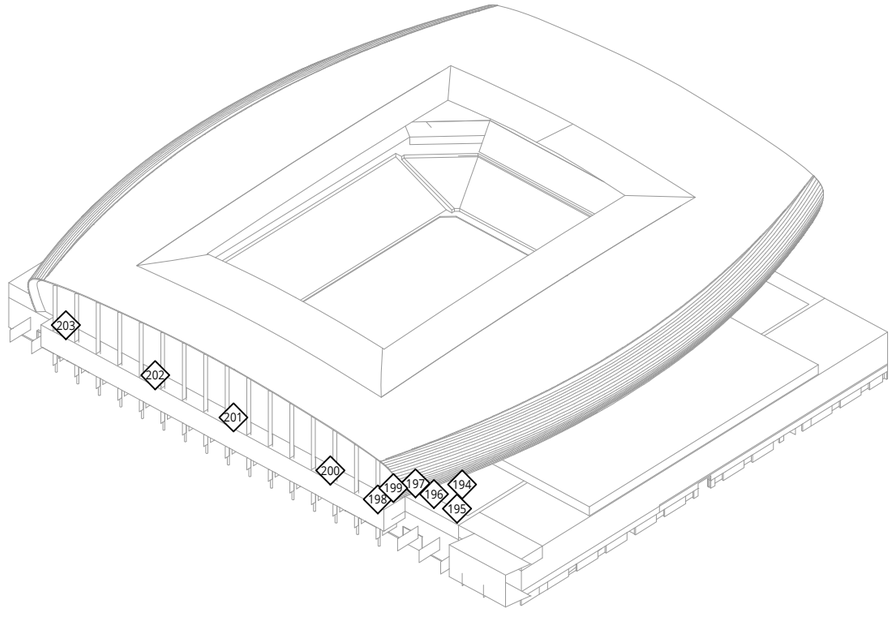
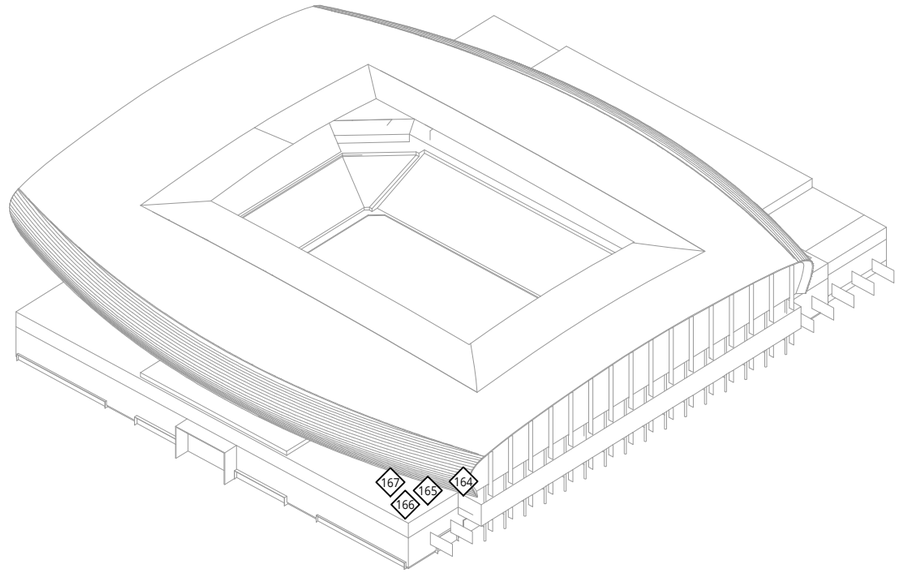


NORTH / WEST



NORTH / EAST

LEGEND:

SENSOR LOCATION:

- Grade Level
- Podium Level
- Balcony/Roof Level

0 40 80m

Measurement Locations - Isometric Views

Configuration 4: Proposed Development with Cumulative Surrounding Buildings, Proposed Landscaping and Design Interventions

The People's Project, Bramley-Moore Dock, Liverpool- UK

Project #1801412

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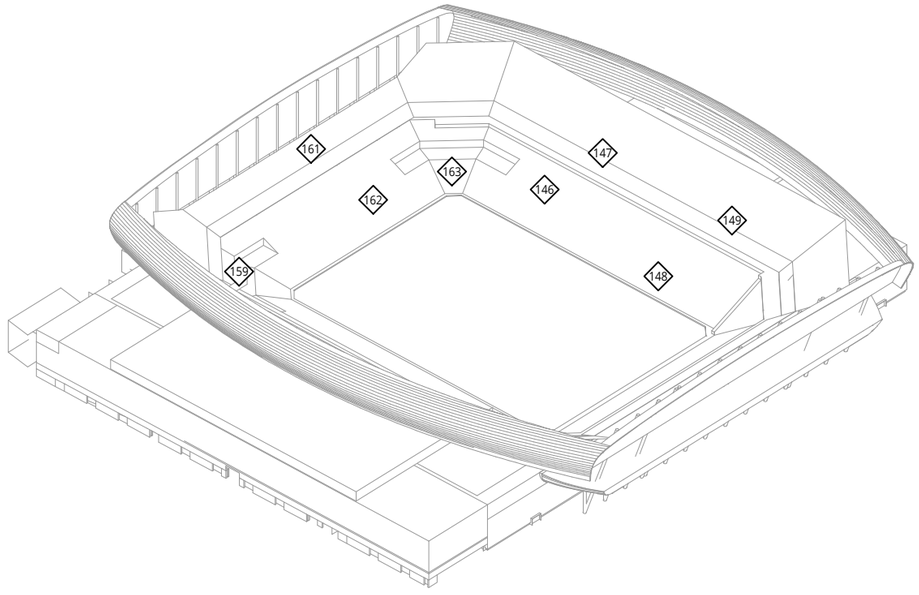

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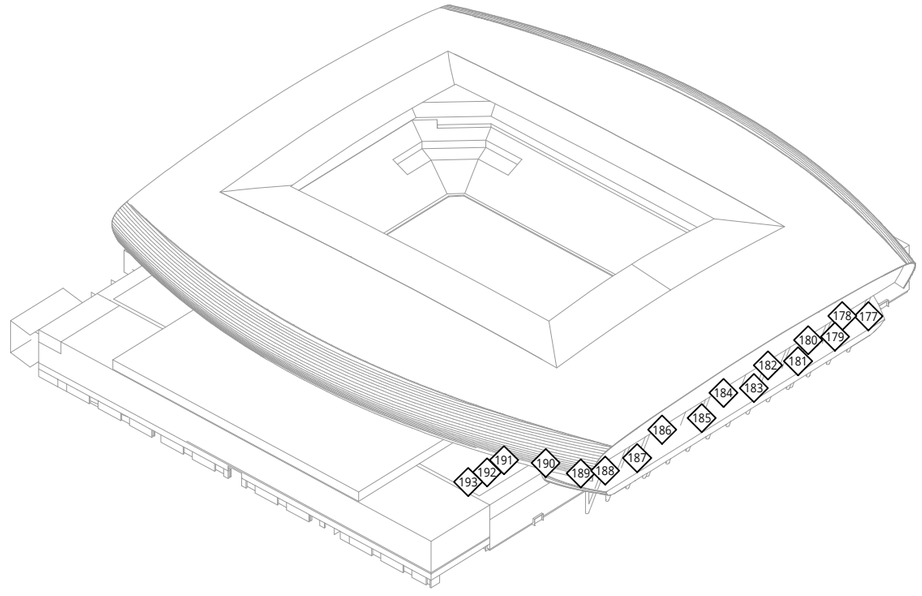

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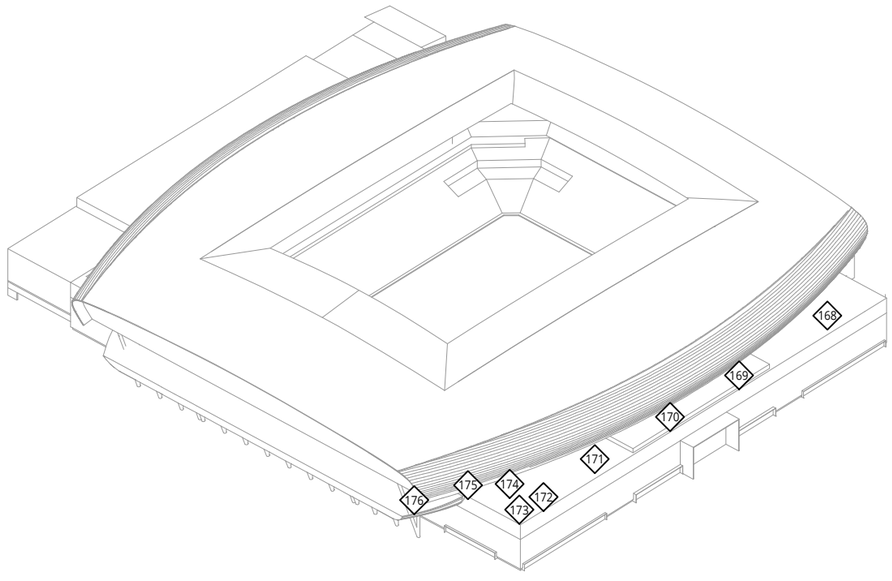

SOUTH / EAST

LEGEND:

SENSOR LOCATION:

- Grade Level
- Podium Level
- Balcony/Roof Level

0 40 80m

Measurement Locations - Isometric Views

Configuration 4: Proposed Development with Cumulative Surrounding Buildings, Proposed Landscaping and Design Interventions

The People's Project, Bramley-Moore Dock, Liverpool- UK

Project #1801412

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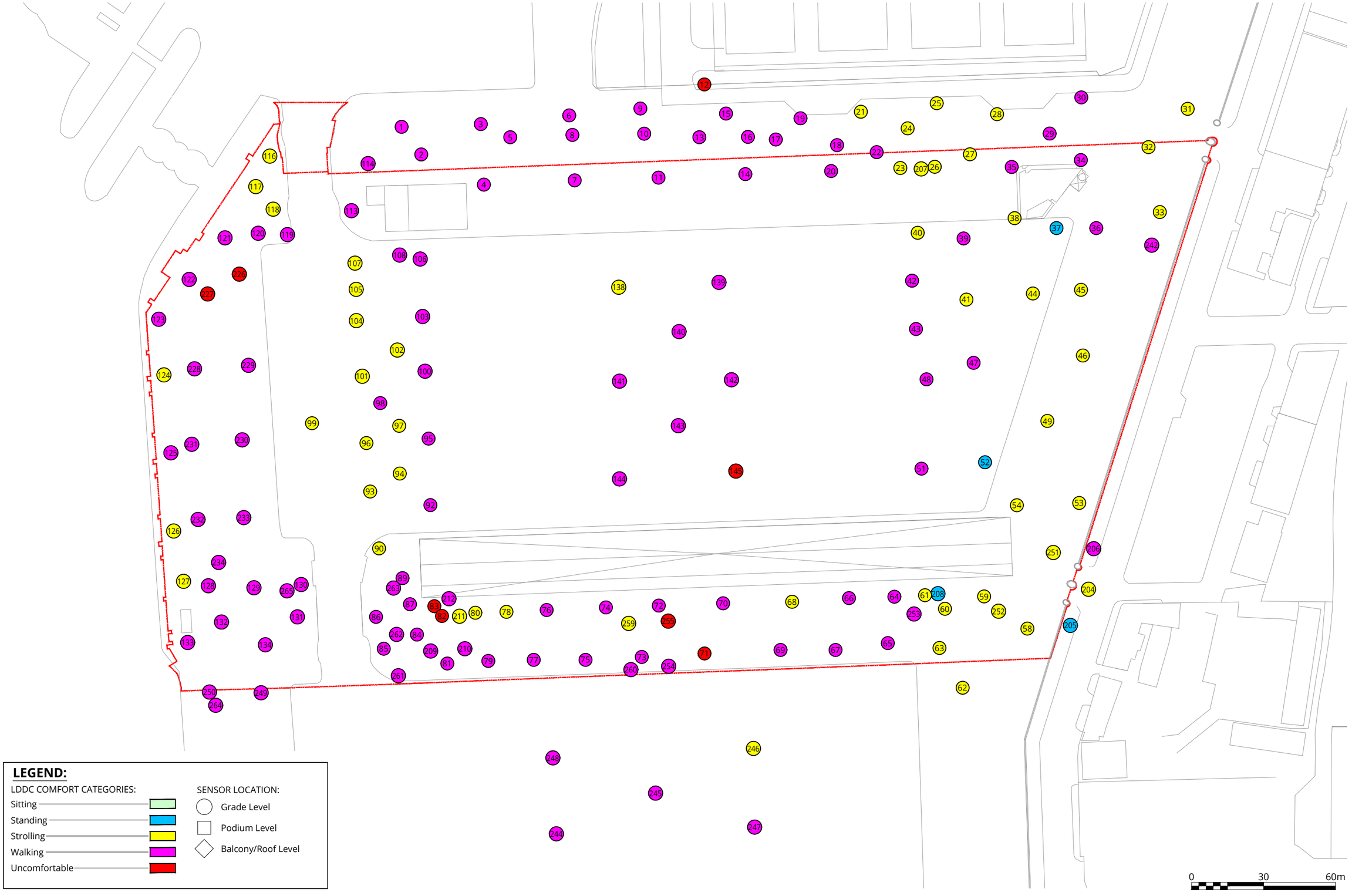
Approx. Scale @A3: 1:2000

Date Revised: Nov. 27, 2019



Pedestrian Wind Comfort Conditions - Ground Floor
Configuration 1: Baseline
Windiest Season

The People's Project, Bramley-Moore Dock, Liverpool- UK

True North

Project #1801412

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Approx. Scale @A3:	1:1500		
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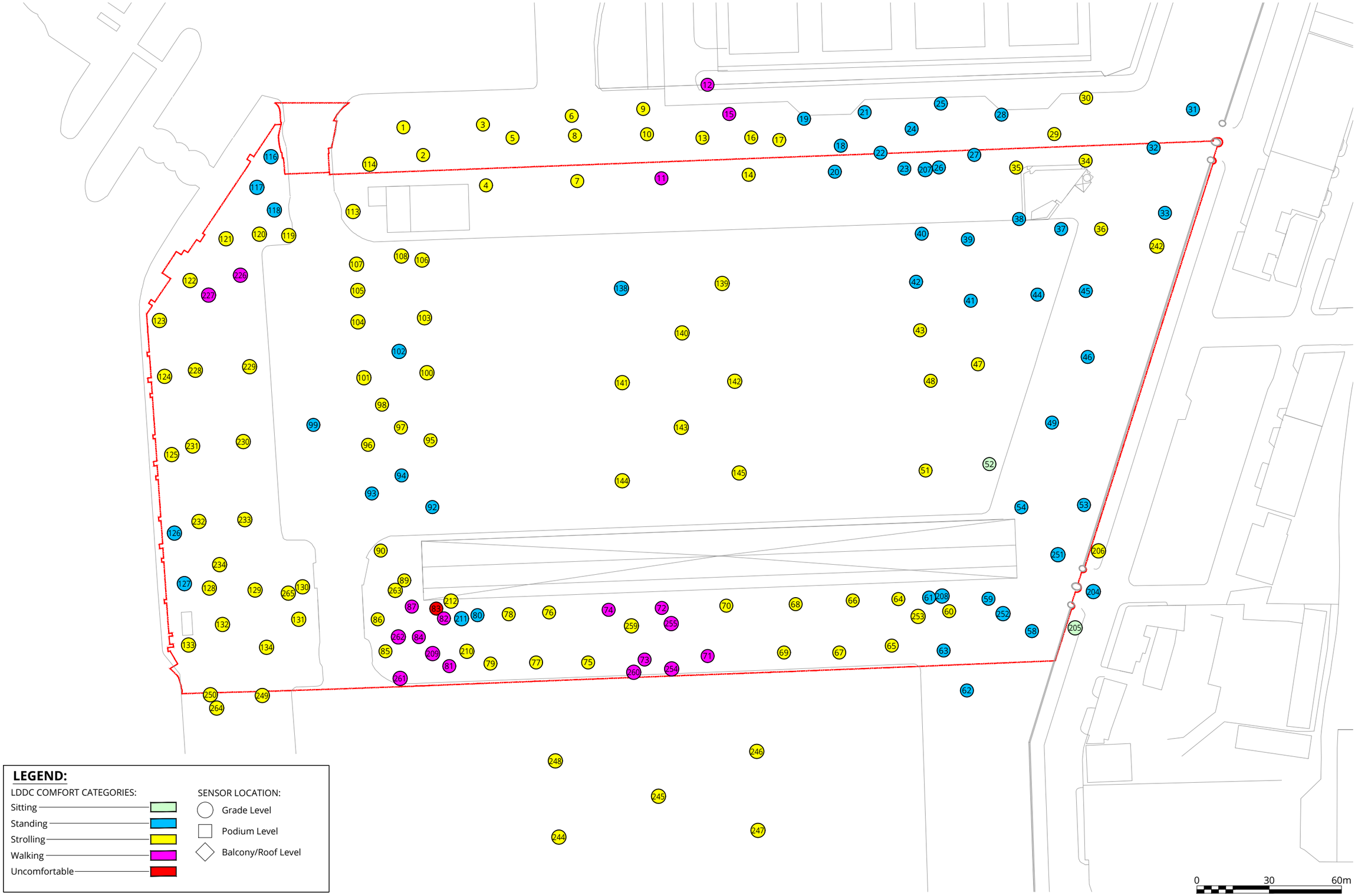

Pedestrian Wind Comfort Conditions - Ground Floor
Configuration 1: Baseline
Summer Season

The People's Project, Bramley-Moore Dock, Liverpool- UK

True North

Project #1801412

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Approx. Scale @A3: 1:1500
Date Revised: Nov. 27, 2019