Potato Wharf Blocks 3 & 4

Wind Microclimate

April 2015

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Contents

Executive Summary....1
1. Introduction....2
2. Methodology and Criteria....4
2.1. Policy and Guidelines....4
2.2. Assessment Criteria....5
2.3. Assessment Methodology....5
3. Assessment....7
3.1. Existing Site Conditions....7
3.2. Impact of Proposed Development....8
3.3. Mitigation Measures....11
3.4. Residual Effects....11
4. Conclusions....12
Appendix A – Wind Climate at Site....13

Executive Summary

An experience-based desk study has been carried out to assess the potential impact of the proposed Potato Wharf Blocks 3 and 4 development on pedestrian level wind conditions in and around the site. The assessment considers the proposed development massing and exposure in conjunction with long term wind climate statistics applicable to the site and provides an expert review of the likely suitability of wind conditions based on the industry standard Lawson criteria for pedestrian comfort and safety.

The proposed development is substantially sheltered from prevailing winds from the southerly sector and represent a modest obstruction to the stronger west-south-westerly winds.

As a result, the proposed development is not expected to have any significant impact on pedestrian level wind conditions with regards to pedestrian safety, and conditions in and around the site are expected to rate as safe for all users.

In terms of pedestrian comfort, with respect to wind force, thoroughfares within and immediately around the site are expected to be suitable for pedestrian access to, and passage through/past, the proposed development.

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

The landscaped courtyard is generally expected to enjoy suitable conditions for planned activities, though there may be potential to enhance conditions towards the north and south ends of the space to maximise the potential for outdoor seating.

The proposed development is not expected to have any significant impact on the pedestrian level wind conditions within the surrounding area.

On the basis of the above, the proposed development is considered compliant with Local Authority policies with regards to wind microclimate.

1. Introduction

Urban Microclimate Ltd. has been commissioned by Lend Lease Residential (North West) Ltd. to assess the potential impact of the proposed Potato Wharf Blocks 3 and 4 development in Manchester, on the pedestrian level wind environment in and around the site.

The assessment comprises an experience-based desk study and is based on details of the proposed development issued by Weedon Architects in April 2015.

The proposed development comprises two 8-storey, nominally rectangular, residential buildings, with a landscaped courtyard between. A railway viaduct crosses the southeast side of the site and car parking is proposed within the open spaces beneath. Within the immediate surrounding area, the recently completed Blocks 1 and 2 of the wider development are of similar height. These buildings lies to the northeast of the proposed blocks.

The scheme considered is illustrated in Figures 1.1, below.

Figure 1.1a: Proposed Massing (Viewed from West)

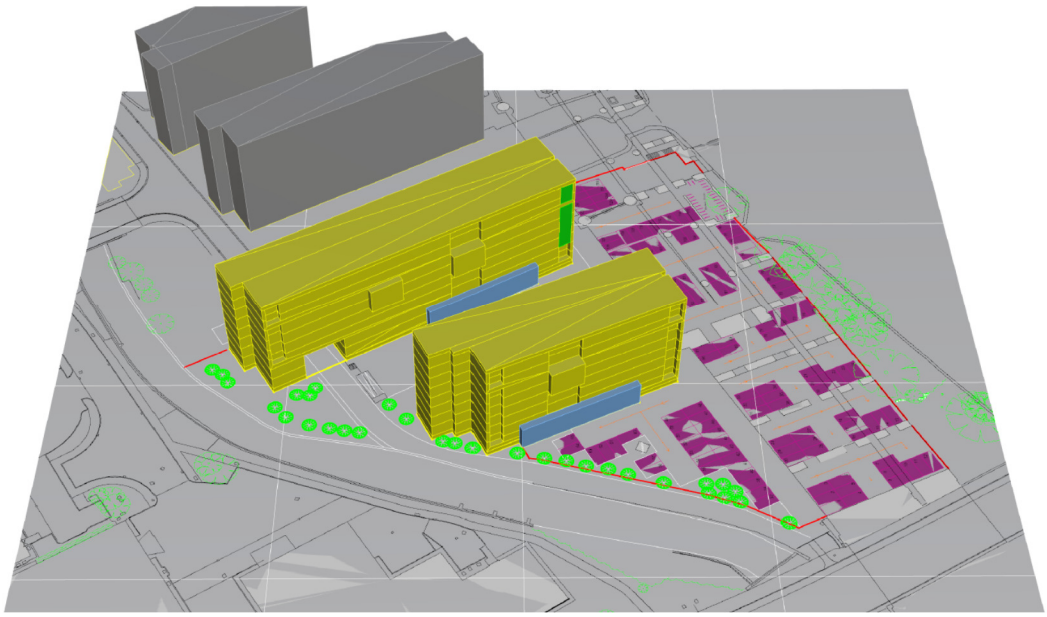


Figure 1.1b: Proposed Massing (Viewed from South)

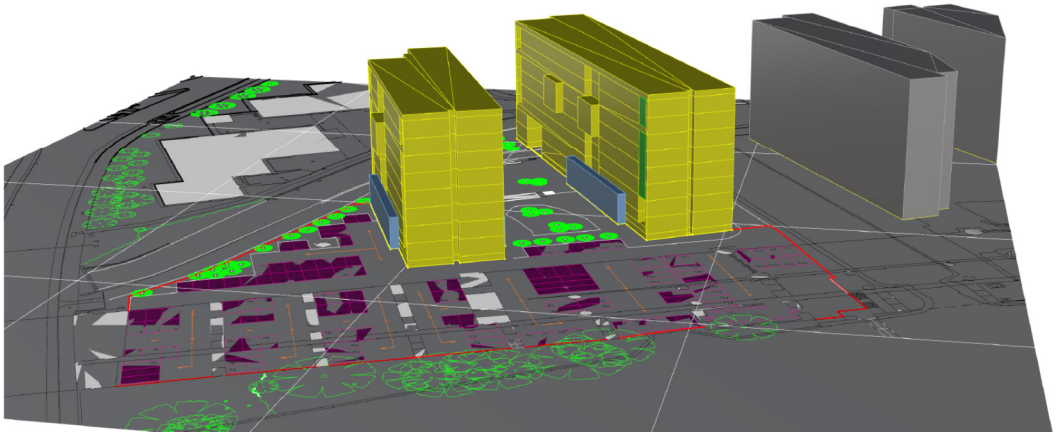
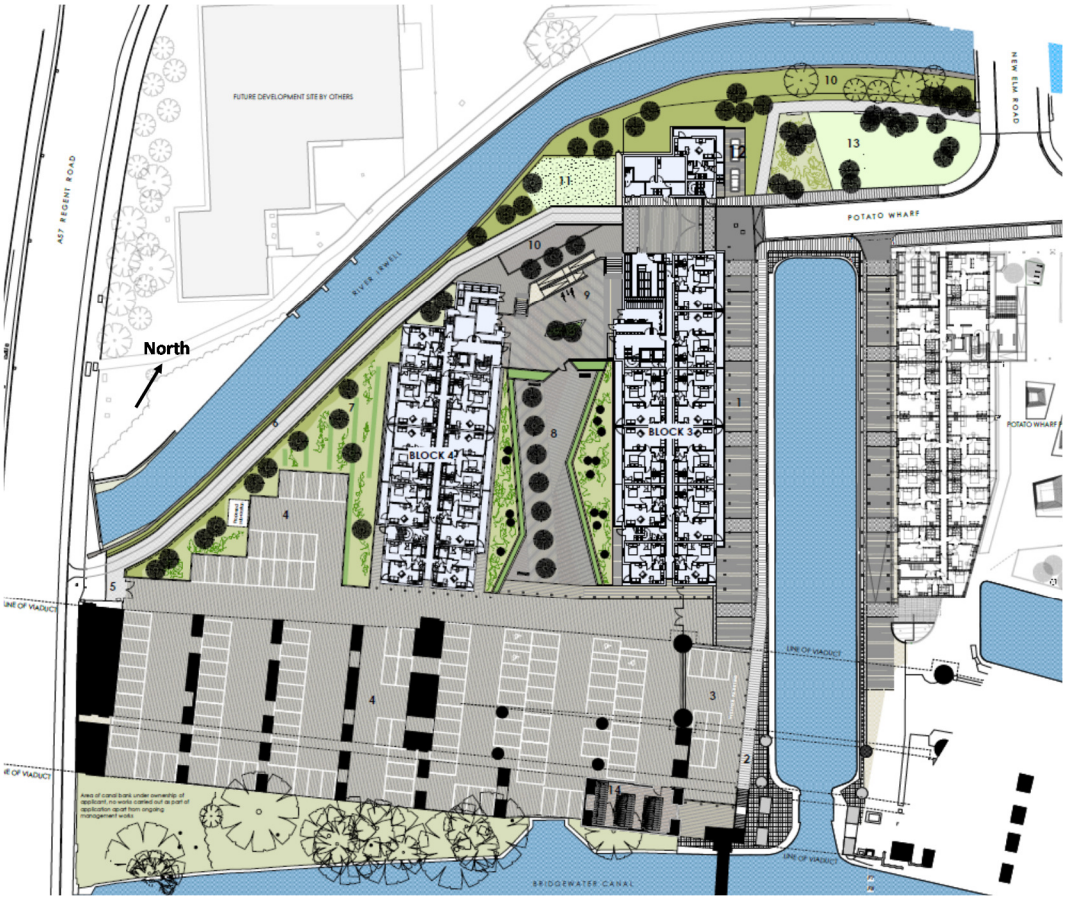


Figure 1.1c: Proposed Siteplan



2. Methodology and Criteria

2.1. Policy and Guidelines

National Planning Policy and Guidelines

There are no national codes of practice or legislative policies relating to the assessment of environmental wind flows in the built environment. The assessment of environmental wind flows also lies outside the scope of BS EN 1991-1-4:2005, the current European Standard for wind actions on structures, which focuses on wind loading issues. The impact of environmental wind on pedestrian spaces and the subsequent suitability of these spaces for planned usage are described by and compared against the industry standard Lawson criteria, which are recognised by Local Authorities as a suitable benchmark for wind assessments.

Local Planning Policy

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

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

The Guide to Development in Manchester, Supplementary Planning Document and Planning Guidance (adopted April 2007), includes:

Section 2. Design, Paragraph 2.40 (Hard landscaped areas within the public realm should be attractive):

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

Section 12. The City Centre, Paragraph 12.8 (Development Quality):

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

It should be noted that the proposed development is not considered a "Tall Building" and the neighbouring, existing, Blocks 1 and 2 are of similar height.

2.2. Assessment Criteria

Details of the Lawson criteria for pedestrian comfort are presented in Table 2.1 and are based on the exceedance of threshold wind speeds, considering mean-hourly and gust-equivalent-mean values, occurring less than 5% of the time. The thresholds represent upper bounds of acceptability for a range of common activities. The value of 5% has been established as giving a reasonable allowance for extreme and relatively infrequent winds that are acceptable within each category.

Table 2.1: Lawson Criteria for Pedestrian Comfort

Threshold Mean-hourly Wind Speed Exceeded < 5% of the Time	**Comfort Rating / Activity**		**Qualifying Comments**
4m/s	C4	Long term Sitting	Reading a newspaper and eating and drinking
6m/s	C3	Standing or short term Sitting	Appropriate for bus stops, window shopping and building entrances
8m/s	C2	Walking and Strolling	General areas of walking and sightseeing
10m/s	C1	Business walking	Local areas around tall buildings where people are not likely to linger

Details of the Lawson criteria for pedestrian safety, or distress, are presented in Table 2.2 and are based on the exceedance of the threshold wind speeds, considering mean-hourly and gust-equivalent-mean values, occurring once per annum. These thresholds represent wind speeds with the potential to destabilise the less able or more susceptible members of the public (including elderly, cyclists and children) and able-bodied users.

Table 2.2: Lawson Criteria for Pedestrian Safety or Distress

Threshold mean-hourly wind speed exceeded once a year	**Safety Rating**		**Qualifying Comments**
15 m/s	S2	Unsuitable for general public.	Less able and cyclists find conditions physically difficult.
20 m/s	S1	Unsuitable for able-bodied.	Able-bodied persons find conditions difficult. Physically impossible to remain standing during gusts.

2.3. Assessment Methodology

With reference to the policies and guidelines outlined in Section 2.1, the proposed development is not considered a tall building. Nevertheless, an experience-based desk study has been carried out to provide a qualitative assessment of the likely effects of the proposed development on the pedestrian level wind environment. The study considers the proposed development massing and exposure in conjunction with long term wind climate statistics applicable to the site, and draws on extensive experience in the assessment of wind flows, gained from wind tunnel testing of similarly massed schemes within similar urban settings. These detailed studies were based on the aforementioned Lawson criteria for pedestrian comfort and safety.

Long-term wind frequency statistics were sourced from Manchester Airport, approximately 13.5 km to the south of the site, for the period 2001 to 2012. Historical data is used as standard practice due, in part, to lack of certainty in potential future changes in wind patterns, though any changes are expected to be minor.

The data was corrected to apply directly at the site, taking account of differences in upwind terrain and altitude between the weather centre and the site, based on the widely accepted Deaves and Harris log law wind model of the atmospheric boundary layer and BS EN 1991-1-4:2005.

The pedestrian level wind environment assessment is summarised in terms of suitability for various activities, based on expected seasonal comfort and safety ratings in accordance with the above criteria. The assessment takes full account of seasonal variations in wind conditions and pedestrian activities. Thus conditions for recreational activities focus on summer, but also consider spring and autumn. Recreational activities do not consider winter comfort ratings as it is anticipated that users would not demand suitable conditions 95% of the time in winter, but would instead be satisfied to use the amenity spaces on occasions when conditions, including precipitation and temperature, permit. Conditions for pedestrian thoroughfare, access or waiting (for example at bus stops) consider all seasons, with winter being predominantly the critical season due to generally higher wind speeds in the winter months.

The activities considered, and their relation to the comfort criteria detailed above, are shown in Table 2.3. The table is ordered in terms of decreasing sensitivity to wind speeds. Conditions considered suitable for the more sensitive activities would also be suitable for the subsequent, less sensitive, uses.

Table 2.3: Suitability Assessment

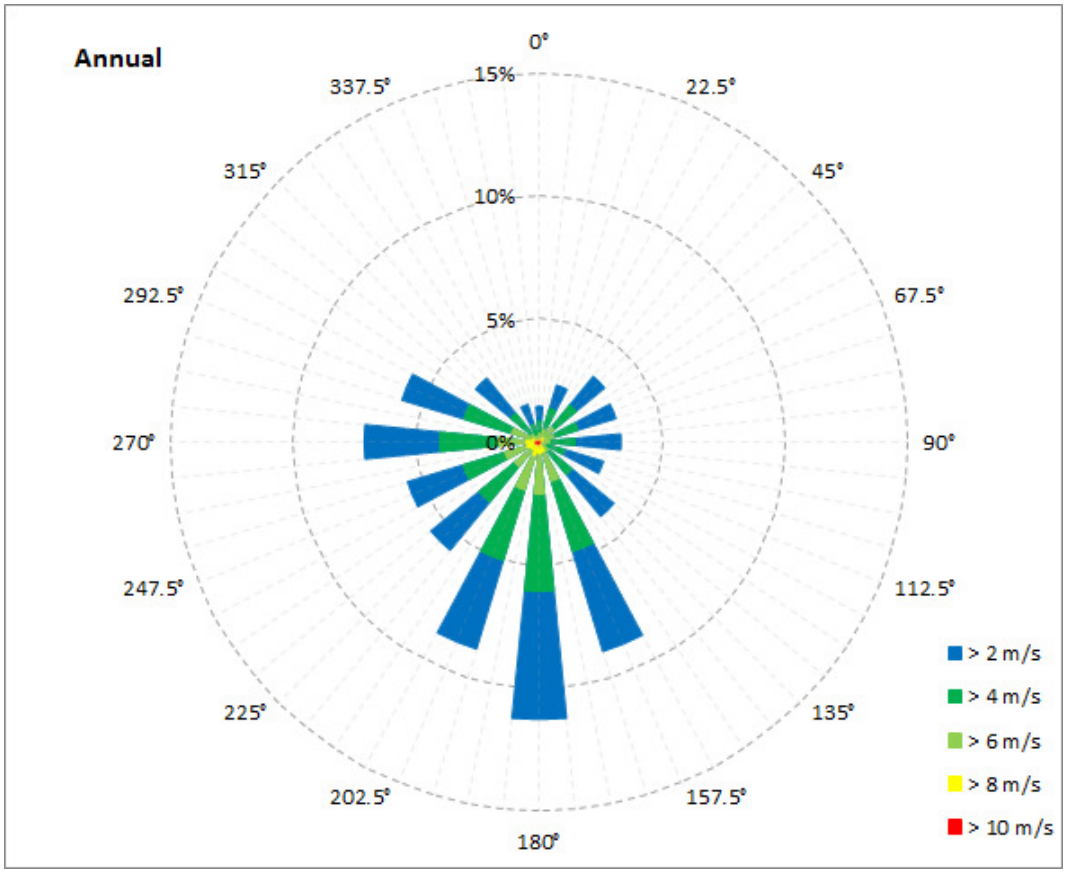
Suitability		**Target Lawson comfort and safety criteria for specified seasons**
Outdoor seating	For long periods of sitting, such as for an outdoor café or picnic area.	'Long term sitting' (C4) in at least summer.
Entrances, waiting areas	For pedestrian ingress/egress at entrances, or short periods of sitting or standing such as at a bus stop, taxi rank, meeting point, window shopping, etc.	'Standing or short term sitting' (C3) in all seasons.
General leisure (excluding seating areas)	For leisure uses excluding long periods of outdoor sitting, such as active leisure, general park spaces, children's play area, etc.	'Standing or short term sitting' (C3) from spring to autumn.
Thoroughfare	For pedestrian access to, and passage through, the Site and surrounding area.	'Business walking' / 'Walking or strolling' (C1/C2) in all seasons..
Unsuitable	Unsuitable for all activities.	Exceeds comfort criterion for 'Business walking' (C1) or safety criteria (S1/S2).

3. Assessment

3.1. Existing Site Conditions

The wind climate expected at the site is summarised in Figure 3.1 in terms of the annual wind speed and direction probability distributions at a reference height of 26m, corresponding to the approximate maximum roof height of the proposed development, relative to local ground level. Seasonal wind speed and direction probability distributions are presented in Appendix A.

Figure 3.1: Wind Climate at Site (at reference height of 26m)



Based on the wind climate statistics, winds from the southerly quadrant are prevalent. Light to moderate winds from the south and south-south-east are most common, whilst stronger winds more frequently blow from the south-south-west. Winds from the west-south-west also occur frequently, and extreme wind speeds (relevant to pedestrian safety) are most likely to blow from this direction. Northerly winds are generally light and rare, though cold north-easterly winds are common during spring. Wind speeds are generally higher during winter and lower during summer.

Applying these wind statistics at the site, an area free from localised building effects (either sheltering or acceleration) would be expected to experience pedestrian level wind conditions rated (in accordance with the Lawson criteria) as comfortable for 'standing or short term sitting' from autumn to spring and for 'long term sitting' in summer.

The site currently comprises a largely open industrial works, with the railway viaduct across the southeast side. The northern part of the viaduct bridges over a large open space in the east corner of the site, however the open spaces beneath the west and south parts of the viaduct are limited to the arches. Large mature trees and undergrowth also runs along the south side of the viaduct, with mid-rise building lying further to the south, across the Bridgewater Canal. As a result, channelling of prevailing southerly winds through the viaduct is not expected to be significant, and the site is expected to be largely sheltered from these winds. The site is more exposed to the winds from the west, including the most frequent extreme winds from the west-south-west. However, in the absence of a dominant structure no significant acceleration of these winds is expected.

Potato Wharf Blocks 1 and 2, across the canal basin to the northeast of the site, are similarly sheltered from prevailing southerly winds but are currently exposed to winds from the west. The modest height of the blocks is expected to limit the potential for downdraughts and subsequent channelling of the resulting pedestrian level winds along Block 2's western front and around the west and south corners.

As a result, conditions in and immediately around the existing site are expected to rate as safe for all users, in accordance with the Lawson criteria for pedestrian safety.

In terms of pedestrian comfort, conditions are expected to be generally suitable for short periods of standing or sitting and at least suitable for leisurely strolling, and are thus expected to be suitable for current pedestrian activities.

3.2. Impact of Proposed Development

Demolition and Construction

The existing structures on the site to be demolished are not considered significant with respect to wind effects.

In addition, the massing and spacing relative to Potato Wharf Block 2 is such that potential short terms effects where partially completed buildings may exacerbate downdraughts from existing downwind buildings are not expected to be significant. Potential wind effects from the partially completed development are therefore expected to be less than from the completed development considered below.

Pedestrian activities within the site will also be different during construction and will include restrictions on pedestrian movements in some areas for health and safety reasons. Pedestrian perception of conditions both within the site and in the surrounding area is also likely to be affected by expectations of conditions around a building site, with pedestrians more likely to tolerate adverse conditions as they can appreciate it as a temporary situation.

Overall, conditions are likely to be generally suitable for interim pedestrian activities and the proposed development is not expected to have any significant effect on wind conditions within the site or surrounding area during construction.

Operation

Upon completion, the proposed development will be partially sheltered at lower levels from prevailing southerly winds by the railway viaduct, the mature trees and the existing buildings beyond to the south. The blocks are also well orientated with respect to these winds, limiting the potential for downdraughts from higher levels and subsequent funnelling of winds through the landscaped courtyard between the blocks, though there is some potential for these winds to affect the southern end of the courtyard.

Block 4 and the north end of Block 3 are exposed to westerly winds, including the most frequent extreme winds from the west-south-west. As a result downdraughts from the westerly facades are expected to reach pedestrian level before channelling along the buildings and accelerating around the west and south corners. There is also potential for some funnelling of these winds through the Block 3 underpass.

The north end of Block 3 is also partially exposed to north-easterly winds, common in spring. Again there is potential for accelerated winds around the north corner and, to a lesser extent, through the underpass.

The severity of these effects is however expected to be substantially limited by the modest height of the proposed development and further alleviated by the soft landscaping proposals around the western corners.

The north end of the courtyard is exposed to north-westerly winds, though these winds are generally lighter and less frequent than south-westerly and southerly winds.

The pedestrian level wind environment in and around the site, resulting from the above effects, is presented in terms of suitability for pedestrian activities in Figure 3.2.

Pedestrian Safety

As discussed above, the proposed development is sheltered from prevailing southerly winds and presents a modest obstruction to the stronger west-south-westerly winds. As a result, pedestrian level wind conditions in and around the site are expected to remain rated as safe for all users.

The proposed development is thus considered to have no significant impact with respect to pedestrian safety.

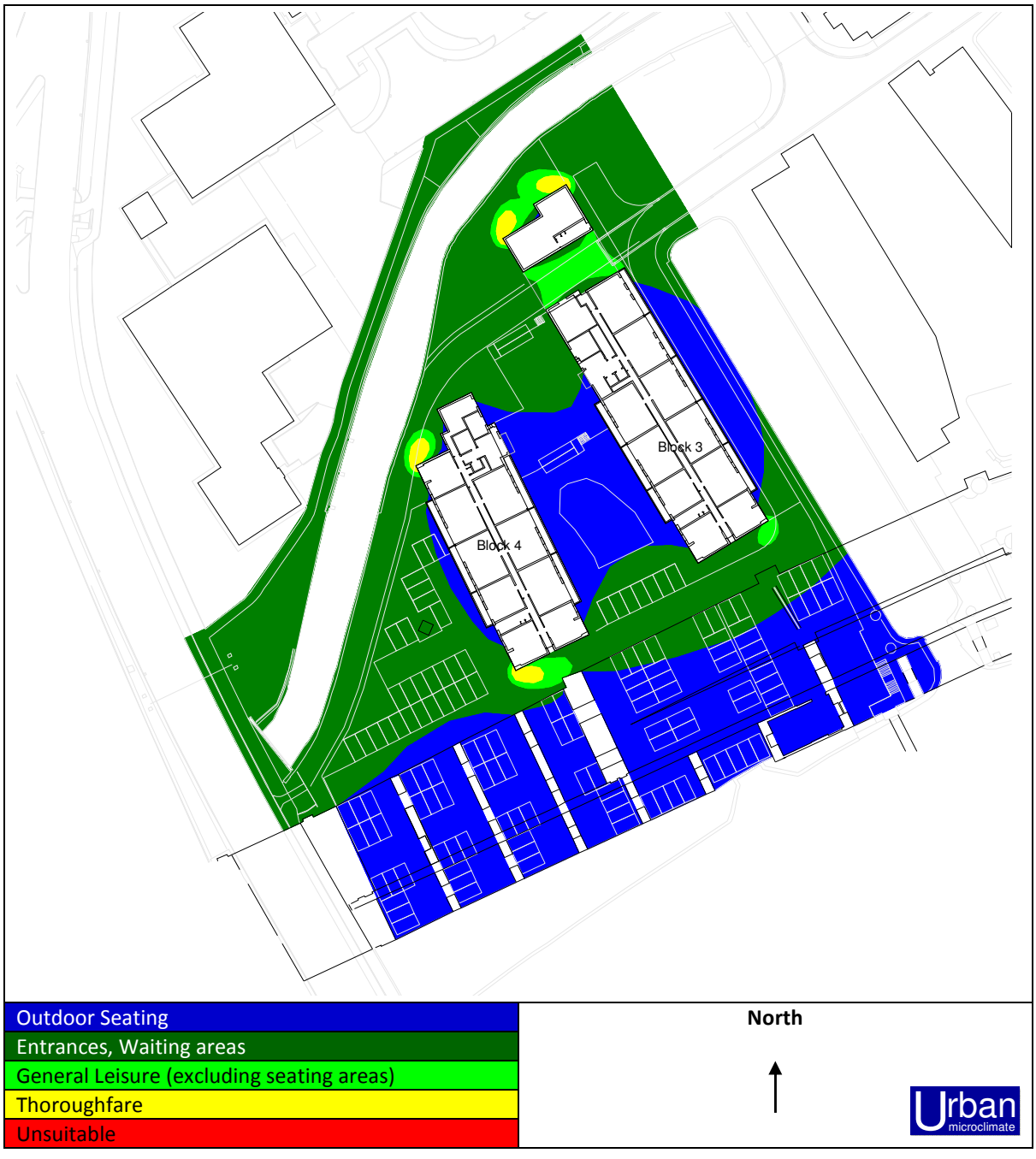
Pedestrian Comfort

In terms of pedestrian comfort, with respect to wind force, wind conditions are expected to be suitable for at least leisurely strolling and are thus considered suitable for pedestrian access to and passage through the development.

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

The landscaped courtyard between Blocks 3 and 4 is sheltered from the more frequent stronger winds from the south-south-west and west-south-west. As a result, the main central area is expected to enjoy suitable conditions for recreational activities, including outdoor seating during at least summer. These conditions would be suitable for picnics for example. The areas towards each end of the courtyard may be slightly windy for prolonged periods of outdoor sitting, but are expected to be suitable for pedestrian access and for short periods of standing or sitting such as for a meeting point for example. Given the large space expected to enjoy suitable conditions for outdoor seating this effect is not considered significant, though seating in these areas would likely benefit from additional soft landscaping to provide shelter from winds entering the ends of the courtyard.

Figure 3.2: Suitability Assessment



The proposed development is expected to shelter the existing Potato Wharf Block 2 from west-south-westerly winds. However, as existing conditions are expected to be suitable for current activities, this effect would not be considered significant.

The proposed development is also not expected to have any significant effect on the suitability of wind conditions elsewhere within the surrounding area. Surrounding thoroughfares, immediately adjacent to the site are expected to remain suitable for at least leisurely strolling, with much of the space, including the riverside, further suitable for short periods of standing or sitting.

3.3. Mitigation Measures

Conditions are expected to be suitable for planned pedestrian activities and no mitigation measures are considered to be required.

The north and, to a lesser extent, the south ends of the landscaped courtyard may benefit from additional soft landscaping around any seating in these areas. However, the affected area is relatively small and the main central space is expected to enjoy suitable conditions for outdoor seating, and this would therefore be considered an enhancement rather than mitigation.

3.4. Residual Effects

As no mitigation measures are expected to be required, the residual effects are as discussed above for the proposed development.

4. Conclusions

Existing Site Conditions

Pedestrian level wind conditions in and immediately around the existing site are expected to rate as safe for all users and are expected to be generally comfortable for current pedestrian activities.

Impact of Proposed Development

The proposed development is not expected to have any significant impact on wind conditions with regards to pedestrian safety.

In terms of pedestrian comfort, thoroughfares within and around the site are expected to be suitable for pedestrian access to, and passage through/past, the proposed development.

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

The landscaped courtyard is generally expected to enjoy suitable conditions for planned activities, though there may be potential to enhance conditions towards the north and south ends of the space to maximise the potential for outdoor seating.

The proposed development is not expected to have any significant impact on the pedestrian level wind conditions within the surrounding area.

On the basis of the above, the proposed development is considered compliant with Local Authority policies with regards to wind microclimate.

Appendix A – Wind Climate at Site

Figure A.1: Autumn Wind Speed and Direction Distribution (at ref height of 26m)

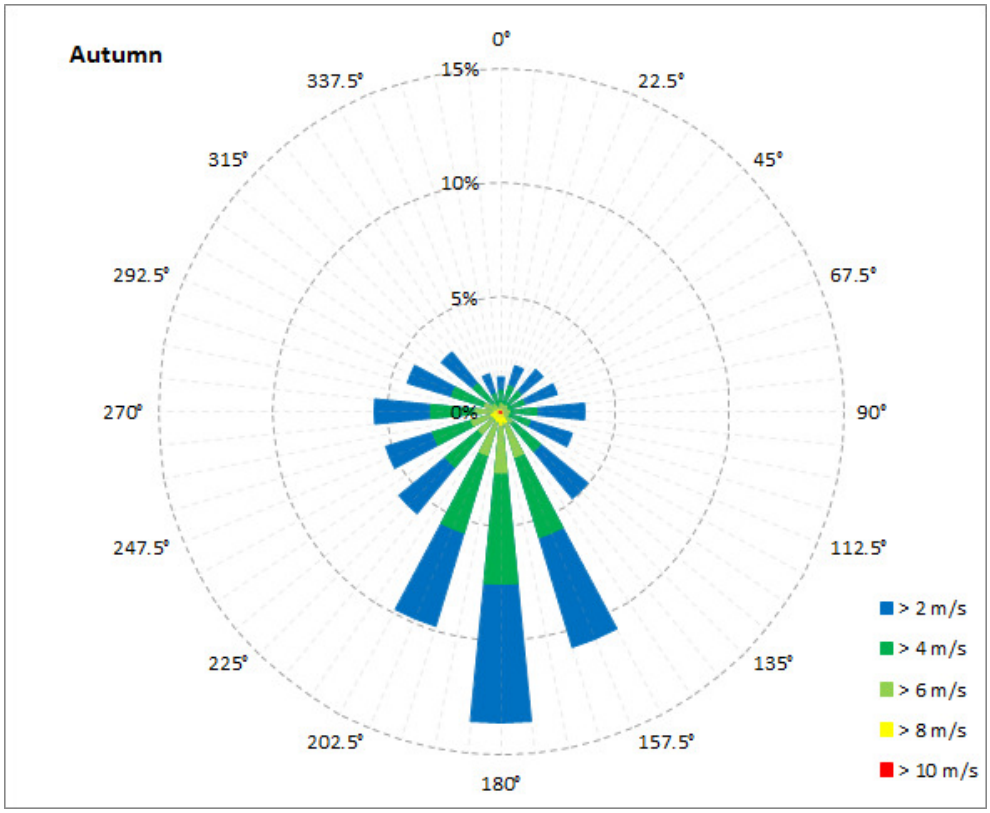


Figure A.2: Winter Wind Speed and Direction Distribution (at ref height of 26m)

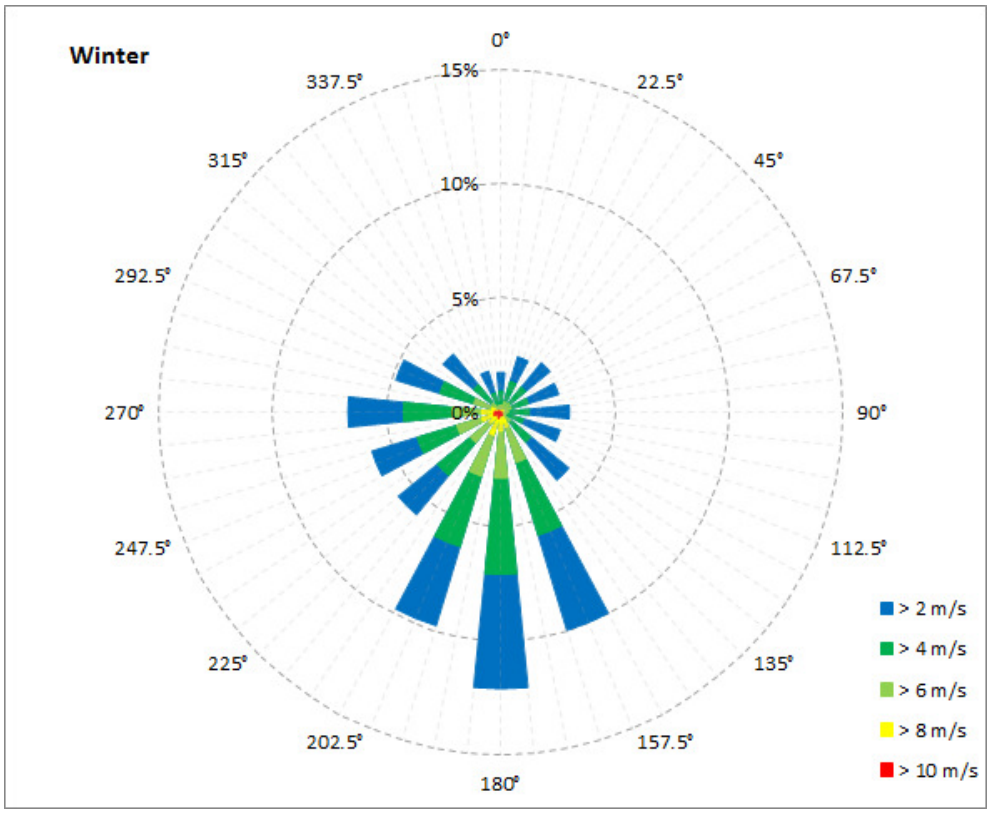


Figure A.3: Spring Wind Speed and Direction Distribution (at ref height of 26m)

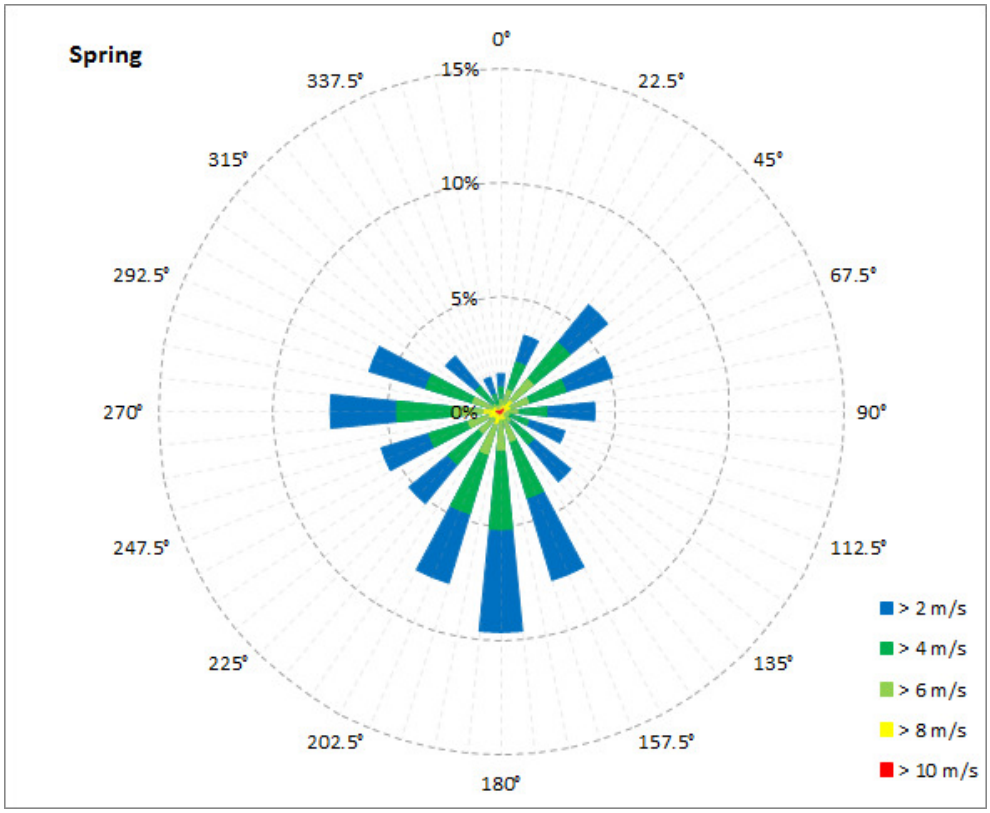
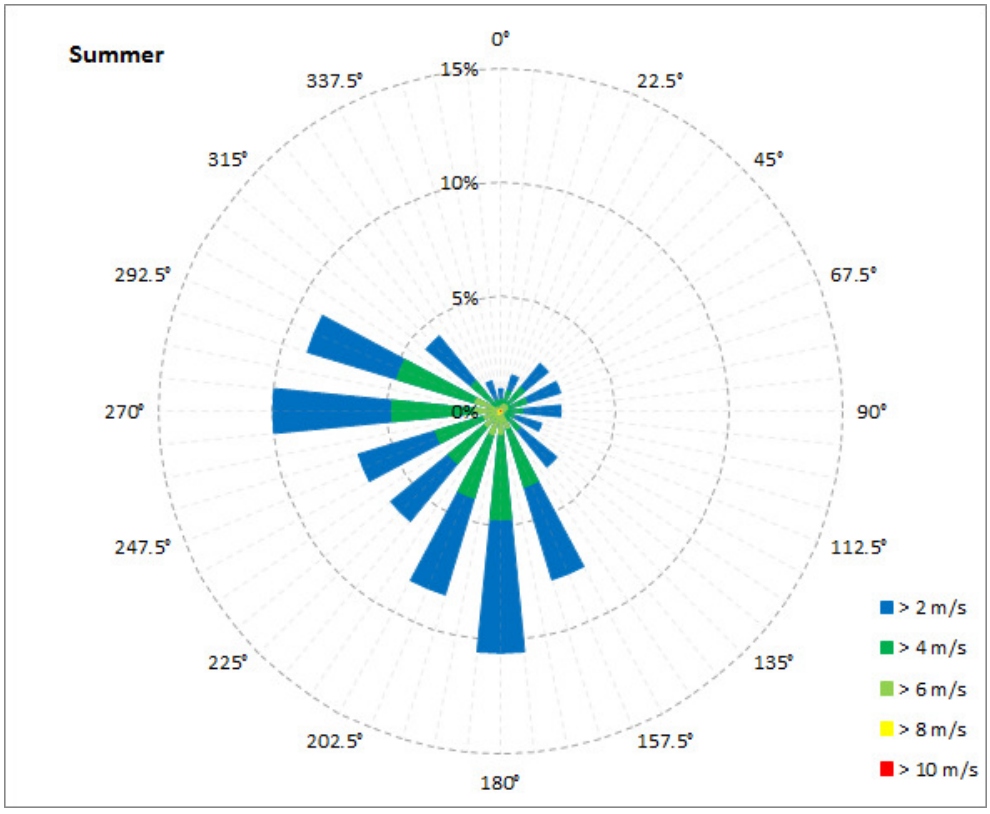


Figure A.4: Summer Wind Speed and Direction Distribution (at ref height of 26m)



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