



Monarchs Quay Phase 1b

Wind Microclimate

March 2018

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Executive Summary

An experience-based desk study has been carried out to assess the likely impact of the proposed Monarchs Quay Phase 1b 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 comprises modest structures with respect to wind effects. However, the shelter from the most frequent strong winds from the west-north-west, created by existing buildings, is limited and winds passing over the existing buildings are expected to impact at pedestrian level within the site. In addition, the proposed development introduces sensitive pedestrian activities. The proposed landscaping scheme has therefore been purposely developed to help alleviate wind flows across the site and locally protect recreational areas.

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 alongside the site are expected to be suitable for pedestrian access to, and passage through or past, the proposed development.

The main entrance to Building 4 is expected require localised protection through the introduction of either a side screen at the building corner or tree planting along the northwest elevation. Subject to this, the main pedestrian entrances to the proposed development are expected to have suitable conditions for pedestrian ingress/egress

The Building 4 podium-top courtyard is expected to have acceptable conditions for planned activities, comprising a mix of outdoor seating within the sheltered pockets along the building front and general recreational uses (such as children's play for example) across the more open space. Conditions along the waterfront area around Building 4 are expected to be similar to existing site conditions and at least tolerable for associated recreational uses.

The proposed development is not expected to have any significant impact on the pedestrian level wind conditions within the surrounding area and no significant cumulative effects with the future surrounding developments are expected.

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

1. Introduction

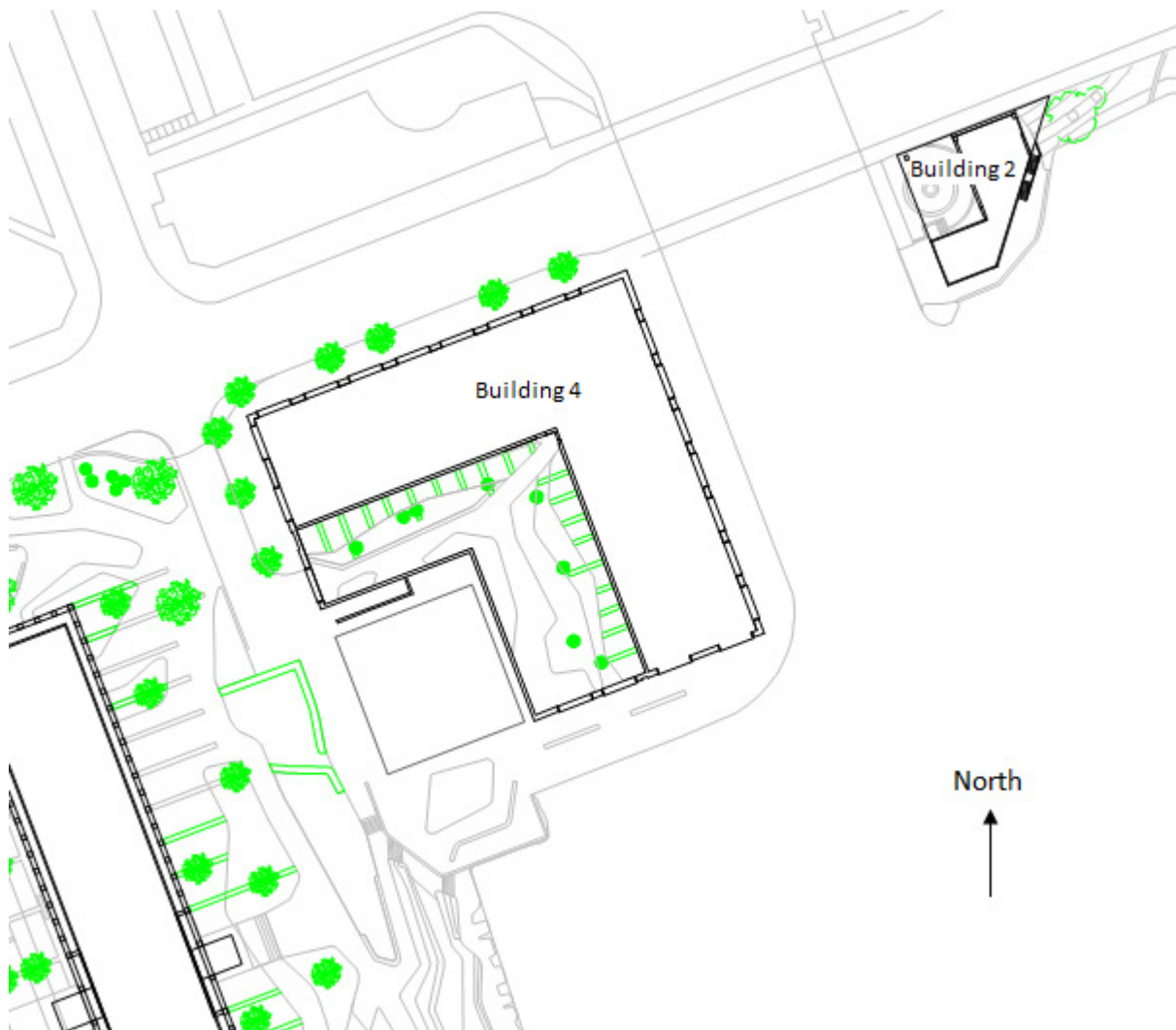
Urban Microclimate Ltd. has been commissioned by YPG Developments Ltd. to assess the likely impact of the proposed Monarchs Quay Phase 1b development in Liverpool, on the pedestrian level wind environment in and around the site.

The assessment comprises an experience-based desk study and is based on details of the proposed development issued by Falconer Chester Hall Architects, in October 2017.

The proposed development comprises two buildings on the waterfront. Building 2 is a small 5-storey commercial building, whilst Building 4 comprises a 7-storey, 'L'-shaped, residential building with a podium-top courtyard space. The scheme considered is illustrated in Figures 1.1, below.

Figure 1.1a: Proposed Development Massing



Figure 1.1b: Proposed Siteplan and Landscaping Scheme

2. Methodology and Criteria

2.1. Policy and Guidelines

National Planning Policy and Guidelines

There are no national planning policies directly relating to wind microclimate issues. However, the NPPF emphasises the benefits of a high quality built environment. An example of this is presented in paragraph 58:

“...using streetscapes and buildings to create attractive and comfortable places to live, work and visit...”

The NPPG identifies the potential for a building's size and shape (particularly in the case of tall and large buildings) to affect the wind microclimate. Under the section addressing 'Design: How should buildings and the spaces between them be considered?', the NPPG states in Paragraph 025 ('Consider form') that:

“Some forms pose specific design challenges, for example how taller buildings meet the ground and how they affect local wind [...] patterns should be carefully considered.”

The NPPG goes on to state in Paragraph 026 ('Consider scale') that:

“Account should be taken of local climatic condition, including [...] wind”.

Local Planning Policy

Liverpool City Council's Local Plan is currently under development. The draft plan (September 2016) includes Policy UD5 New Buildings, which requires that:

“All new buildings should be designed to the highest design standards, based on a clear rationale, and aesthetic based on the characteristics of the area, and that design proposals for new buildings should demonstrate that:

a. The design has been considered from both a macro and a micro-scale, with adequate responses to issues of skyline impact, scale, relationship to existing structures, function, amenity, and its relationship to the public realm.

...

d. Orientation and micro-climate, overlooking and interface issues that may impact on existing structures or neighbouring plots have been considered.”

There are no apparent specific references to wind microclimate in the draft Core Strategy (2012) or the Liverpool Unitary Development Plan (adopted 2002).

Additional Standards and Guidance

The assessment of environmental wind flows 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 consequent 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.

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
4 m/s	C4	Long term Sitting	Reading a newspaper and eating and drinking.
6 m/s	C3	Standing or short term Sitting	Appropriate for bus stops, window shopping and building entrances.
8 m/s	C2	Walking and Strolling	General areas of walking and sightseeing.
10 m/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

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 from Liverpool Airport, approximately 11 km to the southeast of the site, were sourced 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

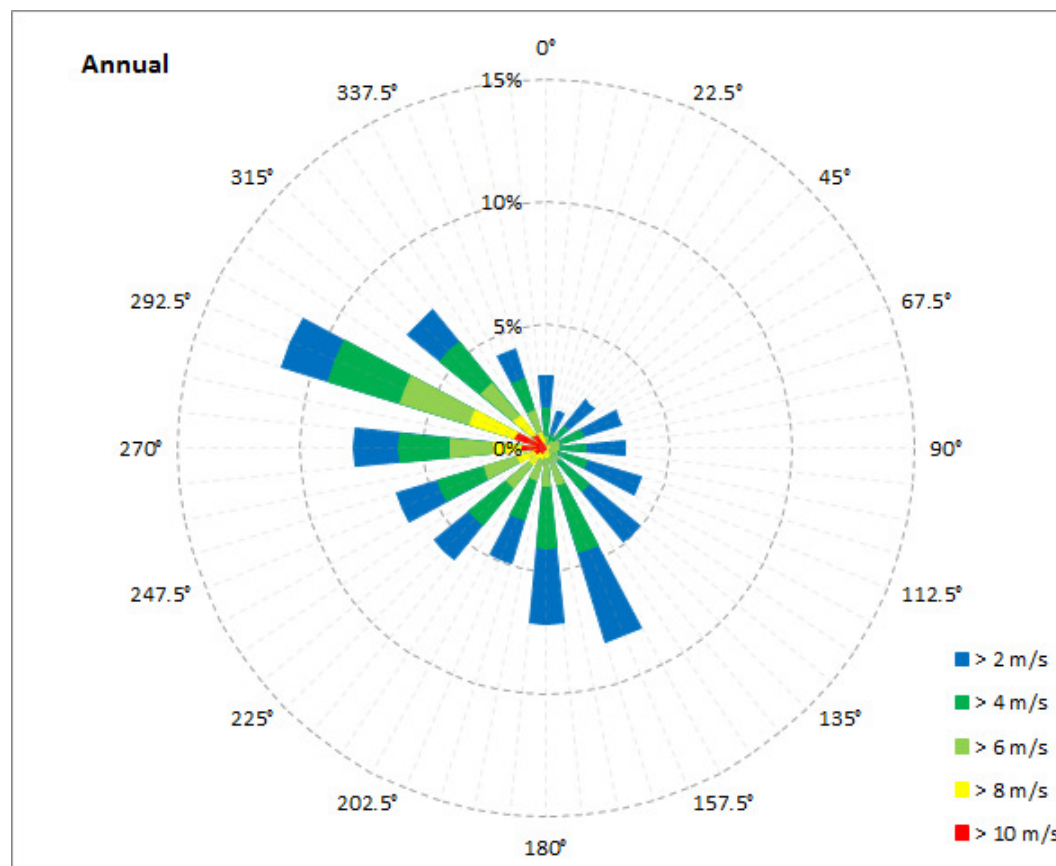
Suitability		Target Lawson comfort and safety criteria for specified seasons
Outdoor seating	For long periods of sitting, such as for an outdoor café or picnic area.	'Long term sitting' (C4) in at least summer.
Entrances, waiting areas	For pedestrian ingress/egress at entrances, or short periods of sitting 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 20 m, 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 20 m)



Based on the wind climate statistics, the most frequent strong winds blow from the west-north-west and west. Winds from the south-south-east are also common, but these winds are generally light. 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 location, 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 'leisurely strolling' during winter and comfortable for 'standing or short term sitting' during summer, with spring and autumn marginal between these ratings.

Existing Baseline

The existing site comprises open car parks and a waterfront walkway. The site does benefit from some shelter from the most frequent strong winds from the west-north-west, created by existing surrounding buildings. However, winds passing over the existing buildings are expected to reach pedestrian level within the site.

However, in the absence of any dominant structures creating accelerated winds, 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, with respect to wind force, conditions in and immediately around the existing site are expected to be suitable for at least leisurely strolling and access to cars. However, benches along the waterfront area are expected to be suitable, at best, for only short periods of sitting, such as for meeting point or viewing area, from spring to autumn.

Future Baseline

Monarchs Quay Phase 1a represents a modest structure with respect to wind effects. However, this development will be largely exposed to prevailing west-north-westerly and westerly winds and there is potential for channelling of these winds along the development's west elevation and around the building corners. In addition, this development introduces sensitive pedestrian activities, including outdoor seating areas, though the landscaping scheme has been purposely developed to help alleviate wind flows and locally protect key seating areas.

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

In terms of pedestrian comfort, thoroughfares in and immediately around the site are expected to be suitable for at least leisurely strolling and main entrances to Monarchs Quay Phase 1a are expected to have suitable conditions for pedestrian ingress/egress.

Much of the café outdoor seating area on the northeast side of Monarchs Quay Phase 1a is expected to enjoy suitable conditions for long periods of outdoor sitting during summer, though the outer edges of these areas may be slightly windy for such activities and may benefit from additional shelter such as extended hedges or screens.

Within Monarchs Quay Phase 1a, the waterfront area benefits from drops in levels which provide a back to benches and provides some shelter to the seating from prevailing winds. Resulting conditions may be slightly windy for prolonged periods of sitting but are expected to be suitable for short periods of sittings from spring to autumn. These conditions are expected to be considered tolerable for a waterfront area, though the seating areas may again benefit from additional shelter such as tall shrubs on the ledges above the benches.

3.2. Impact of Proposed Development

Demolition and Construction

There are no existing buildings to be demolished. In addition, there are no immediate surrounding tall buildings where the partially completed development could potentially exacerbate downdraughts. 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, the proposed development is not expected to have any additional significant effects on wind conditions within the site or surrounding area during construction.

Operation

The completed proposed development comprises two modest structures with respect to wind effects. However, the shelter from the most frequent strong winds from the west-north-west, created by existing buildings, is limited and winds passing over the existing buildings are expected to impact at pedestrian level within the site. The southern parts of Buildings 2 and 4 are more sheltered from prevailing west-north-westerly and westerly winds, but the northwest and northeast corners are expected to be susceptible to these winds channelling around the corners.

In addition, the proposed development introduces a communal podium-top courtyard, with sensitive recreational uses, within Building 4.

As a result of these effects, and the general windiness of the waterfront area, the proposed landscaping scheme has been purposely developed to help alleviate potential strong winds and create locally sheltered areas within the Building 4 courtyard. In particular, the landscaping includes:

- substantial tree planting along the southwest and northwest elevations of Building 4; and
- 1.2m high hedging extending out from the courtyard elevations of the Building 4.

It is understood that the trees will be a mixture of pines and deciduous species with substantial retained solidity in winter (i.e. lots of branches), and will be planted semi-mature at heights of between 5.5 and 7 m.

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

Pedestrian Safety

As discussed above, the proposed development is modest in scale. 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 expected to have no significant impact with respect to pedestrian safety.

Pedestrian Comfort

Thoroughfares

In terms of pedestrian comfort, with respect to wind force, conditions on thoroughfares within and alongside the site are expected to be suitable for at least leisurely strolling and are thus likely to be considered suitable for pedestrian access to and passage past the development.

Building Entrances

The main entrance to Building 2 is expected to be susceptible to west-north-westerly winds channelling around the building's northeast corner. Resulting conditions are likely to be suitable for leisurely strolling but too windy for comfortable pedestrian ingress/egress.

The main residential entrance to Building 4 from Queens Wharf is located close to the building's northeast corner but is upwind of the main area of expected accelerated winds around the corner and is partially protect by the proposed tree planting. Similarly, the commercial entrance from Queens Wharf is partially protect by the proposed tree planting and is expected to be downwind of the main area of potential accelerated winds around the corner. Thus, whilst conditions in the immediate vicinity of these entrances may be too windy to linger comfortably, the entrances are expected to have acceptable conditions for pedestrian ingress/egress. The remaining entrances to Building 4 are located in more benign areas and are expected to enjoy suitable conditions for pedestrian ingress/egress.

Amenity Spaces

The Building 4 podium-top courtyard benefits from hedging extending out from the façade to create sheltered pockets. Resulting conditions along much of the Building frontage are expected to be suitable for recreational activities including long periods of outdoor sitting during summer. The remainder of the courtyard is expected to be suitable for general recreational activities, such as children's play for example. Overall, these conditions are expected to be considered acceptable for planned recreational uses.

The waterfront area around Building 4 is expected to be suitable for short periods of sittings, such as for a meeting point or viewing for example, from spring to autumn, but, with the exception of midway along the building's northeast frontage, may be slightly windy for prolonged periods of outdoor sitting. These conditions are expected to be considered

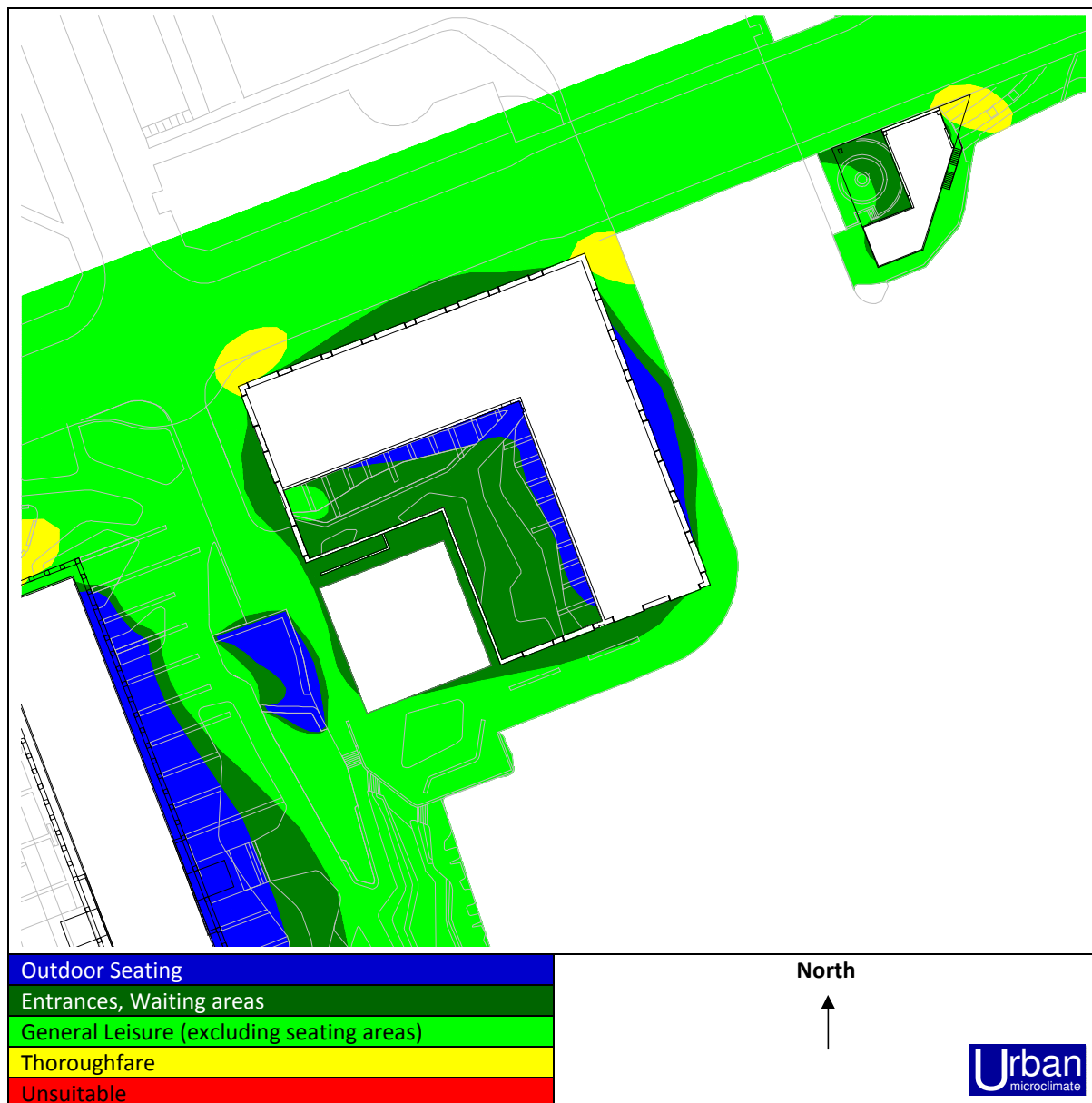
tolerable for a waterfront area. However, both the wind conditions and the likely usage is not expected to significantly change from baseline conditions.

Surrounding Area

The proposed development is not expected to materially affect the suitability of wind conditions for planned activities within the Monarchs Quay Phase 1a development. Conditions within Monarchs Quay Phase 1a are therefore expected to be as discussed above for the Future Baseline.

The remaining surrounding thoroughfares are expected to remain suitable for at least leisurely strolling and access to cars, and there are no further sensitive building entrances or recreational uses in the immediate vicinity of the site.

Figure 3.2: Suitability Assessment



3.3. Cumulative Effects

The introduction of The Keel Phase 2, to the south, is not expected to significantly affect wind conditions within the site. Similarly, the proposed development is not expected to significantly affect wind conditions within The Keel Phase 2.

Potential cumulative effects are therefore considered insignificant.

3.4. Mitigation Measures

The main entrance to Building 2 would benefit from a side screen extending out from the building's northeast corner to locally shelter the entrance from winds channelling around the corner, or substantial tree planting along northwest elevation of the building.

3.5. Residual Effects

With the introduction of mitigation measures around the entrance to Building 2, all pedestrian entrances to the proposed development would be expected to enjoy suitable conditions for pedestrian ingress/egress.

No further mitigation measures are proposed, and the residual effects are therefore as discussed above for the proposed development.

4. Conclusions

Existing Site Conditions

Pedestrian level wind conditions in and around the existing site are expected to rate as safe for all users and are expected to be comfortable for at least leisurely strolling along thoroughfares and for access to parked vehicles. Waterfront benches are expected to be suitable, at best, for short periods of sitting from spring to autumn.

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 alongside the site are expected to be suitable for pedestrian access to, and passage past, the proposed development.

The main entrance to Building 4 is expected require localised protection through the introduction of either a side screen at the building corner or tree planting along the northwest elevation. Subject to this, the main pedestrian entrances to the proposed development are expected to have suitable conditions for pedestrian ingress/egress

The Building 4 podium-top courtyard is expected to have acceptable conditions for planned activities, comprising a mix of outdoor seating within the sheltered pockets along the building front and general recreational uses (such as children's play for example) across the more open space. Conditions along the waterfront area around Building 4 are expected to be similar to existing site conditions and at least tolerable for associated recreational uses.

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

No significant cumulative effects with the future surrounding developments are expected.

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 20 m)

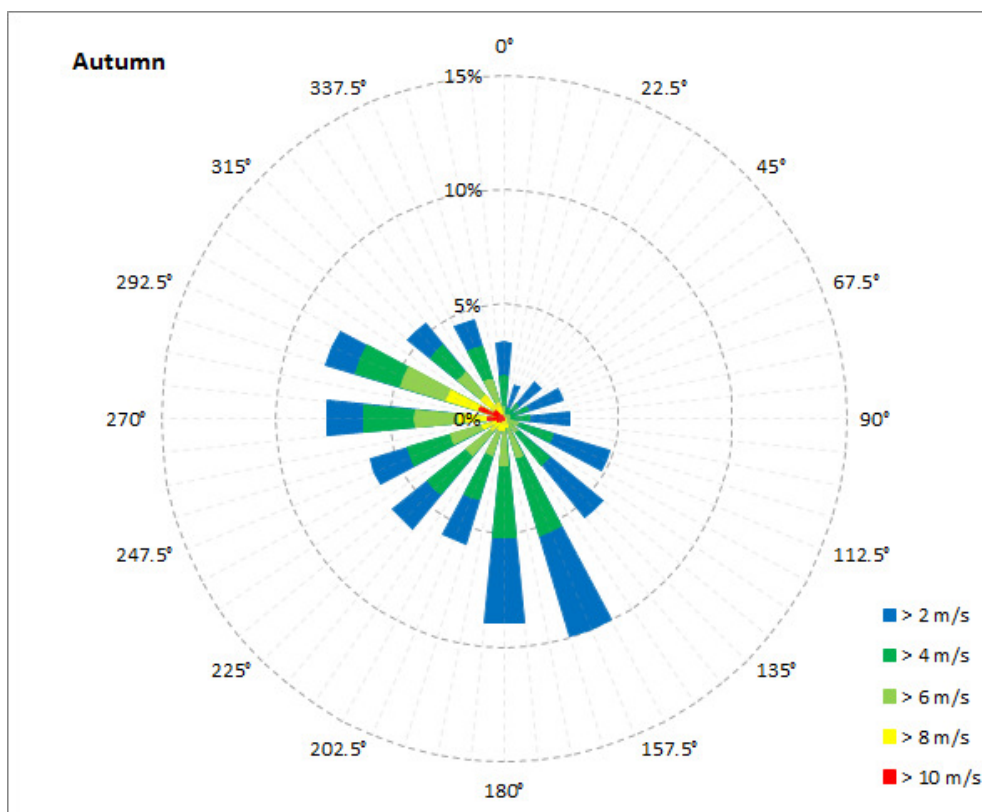


Figure A.2: Winter Wind Speed and Direction Distribution (at ref height of 20 m)

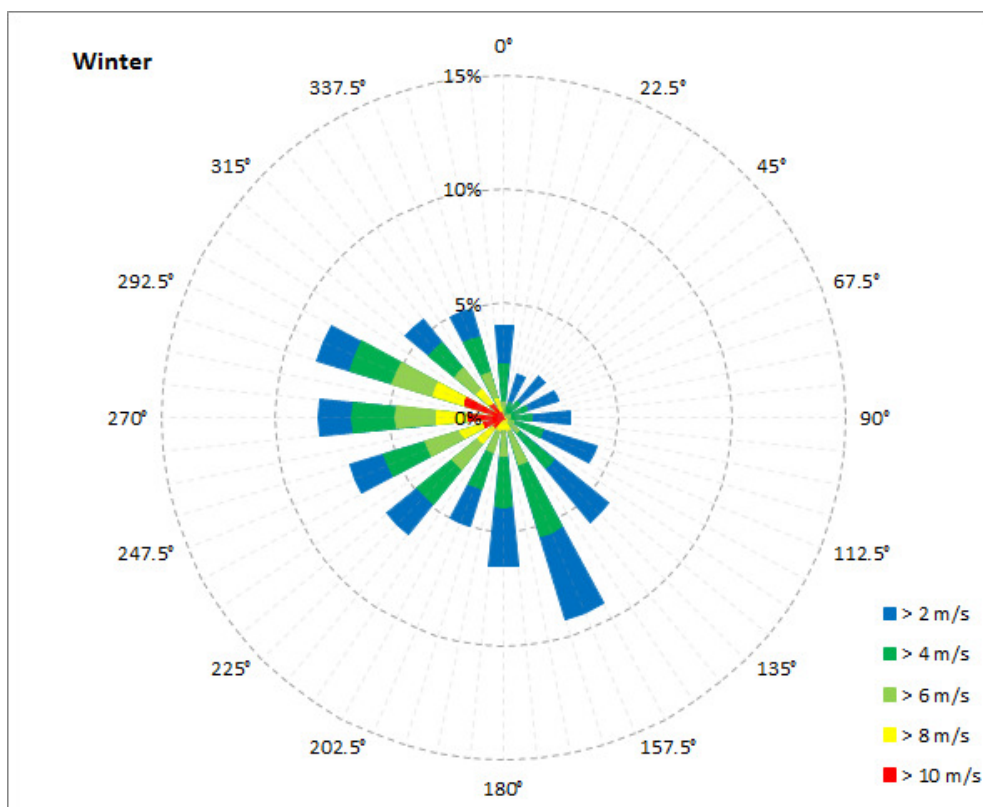
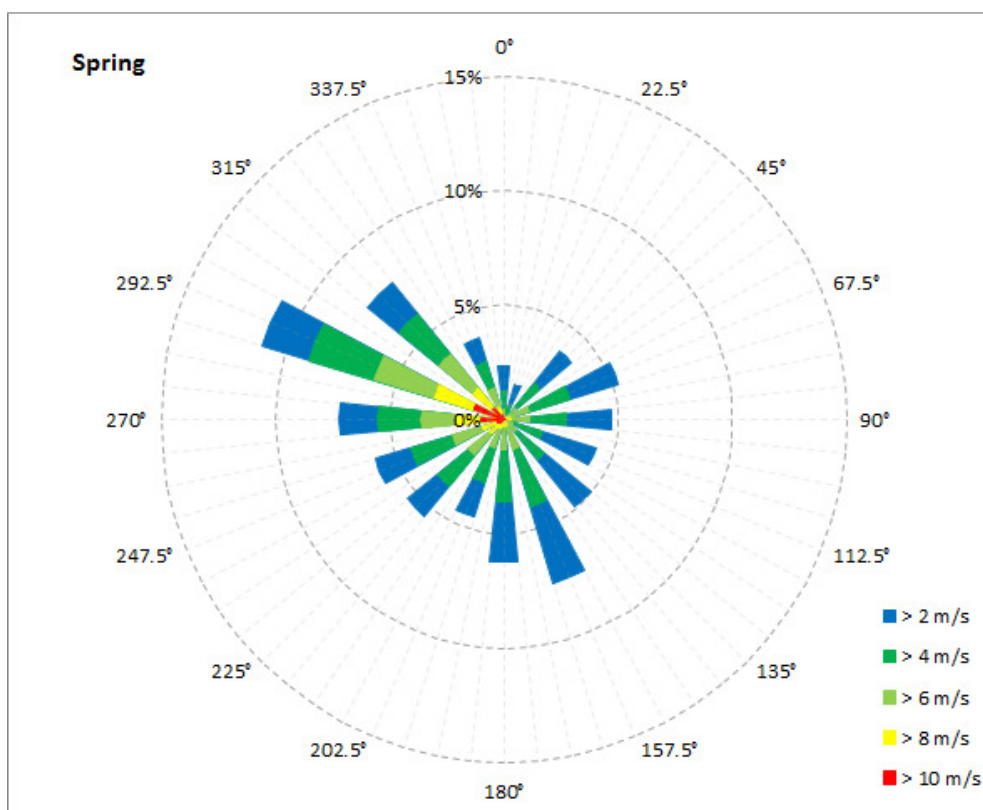
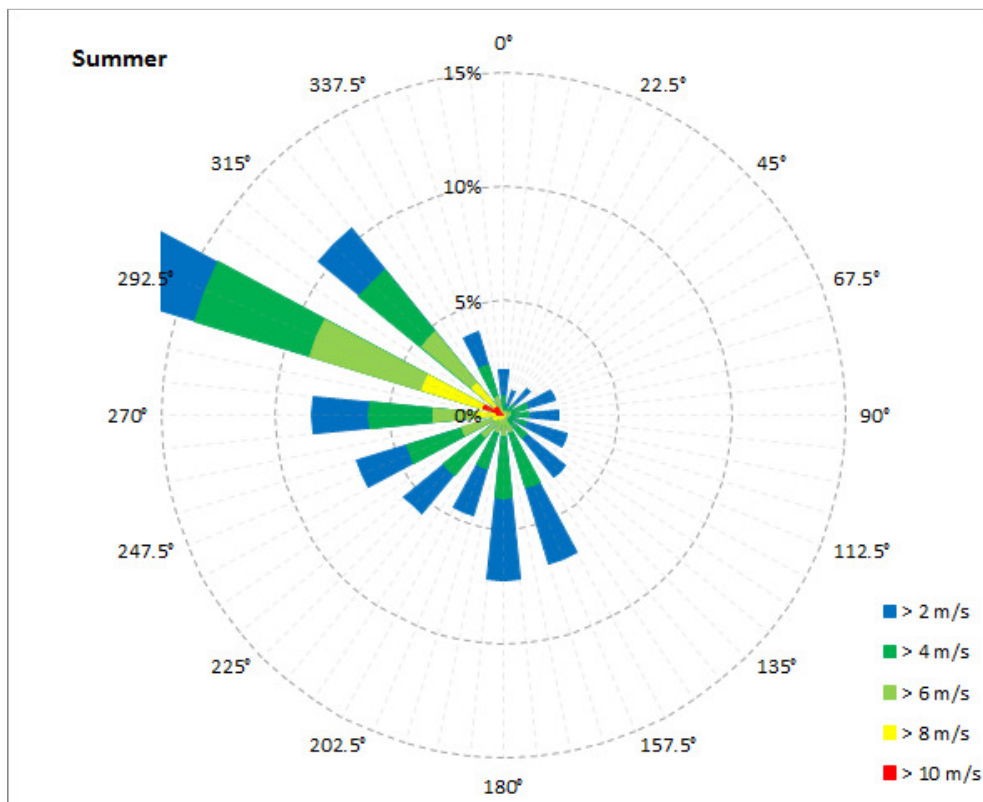


Figure A.3: Spring Wind Speed and Direction Distribution (at ref height of 20 m)**Figure A.4: Summer Wind Speed and Direction Distribution (at ref height of 20 m)**

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