Environmental Statement Volume II: Appendices – Wind Microclimate

Appendix 7.1 Detailed Wind Microclimate Methodology

BURO HAPPOLD

Unlocking potential for a better built environment

WIND MICROCLIMATE DETAILED METHODOLOGY

Robert Street

March 2026

GIA No: **20931**

gia
CHARTERED SURVEYORS

DATE / REF
MARCH 2026
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CFD METHODOLOGY

The CFD was performed using OpenFOAM.

Meshed using a hybrid mesh of hexahedral, polyhedral, tetrahedral and prismatic elements:

On site building edge length: 0.05m - 0.25m

Surrounding context edge length: 0.25m - 1m

Prismatic cells were used in the boundary layer region, with 4 layers of cells growing with an expansion ratio of 1.15 and aspect ratios between 0.1 and 0.4.

The total mesh size was between 96 and 115 million cells. Mesh detail is shown in Figure 1 and Figure 2.

Buildings within 400m of the site were included.

The domain was 5000mx5000m, with a blockage ratio of 0.5%

The blockage ratio uses a "test section" of 600mx200m (within which detail is captured).

Run using the SST turbulence model with high Re wall functions to ensure mesh suitability.

The simulations were steady state and isothermal.

2nd order discretisation schemes were used.

Convergence was measured as the residuals of the continuity, x-velocity, y-velocity, z-velocity, k and omega equations all falling by at least 2 orders of magnitude, and by measured static pressure on the site buildings varying by less than 1% over the final 100 iterations.

The wind speed is corrected into a "gust-equivalent" mean. The gust-equivalent mean is calculated using an empirical relationship between the gust and mean ratios recorded at over 13,000 data points from wind tunnel tests. This method is found to give a significant correlation improvement over the more traditional methods based on the CFD turbulent kinetic energy field.

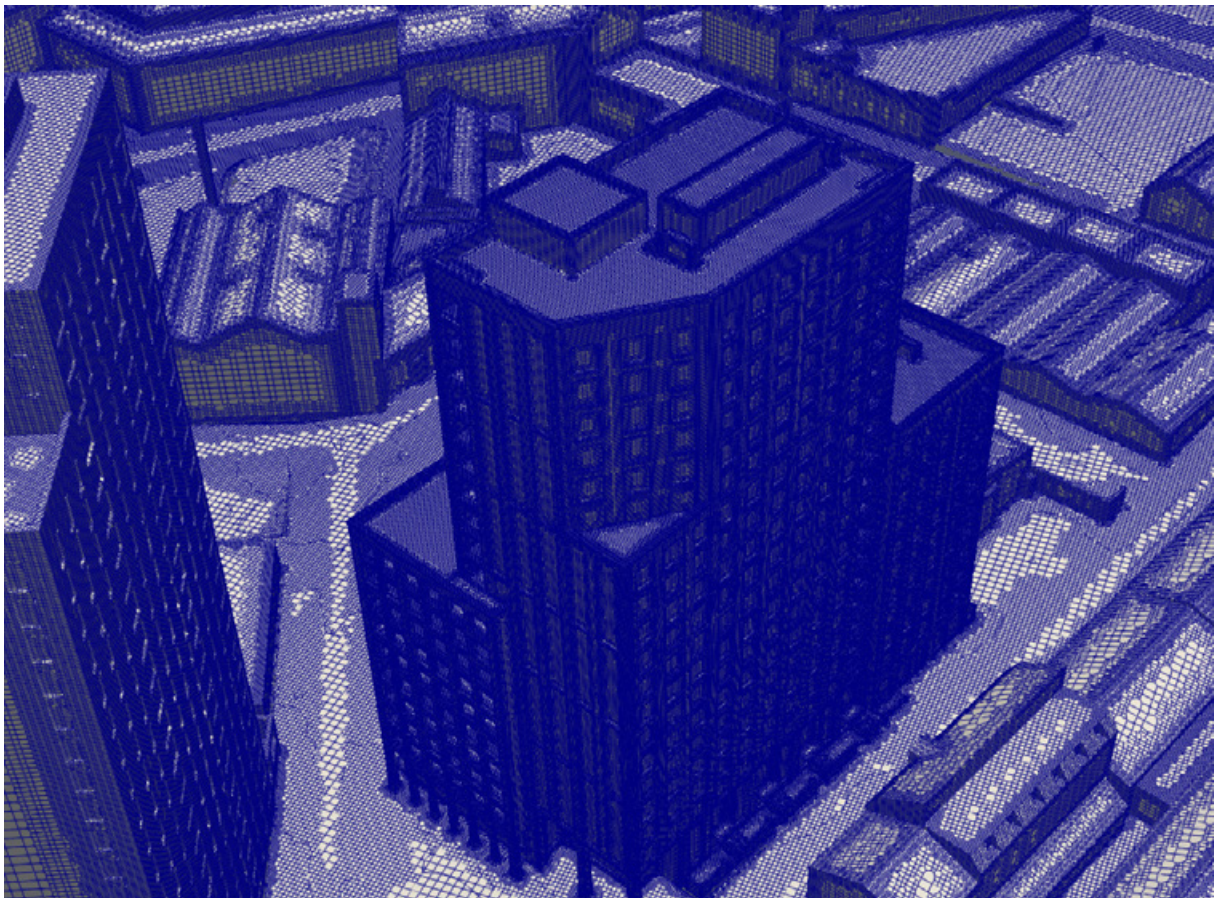


Fig. 01: Mesh Detail on Site

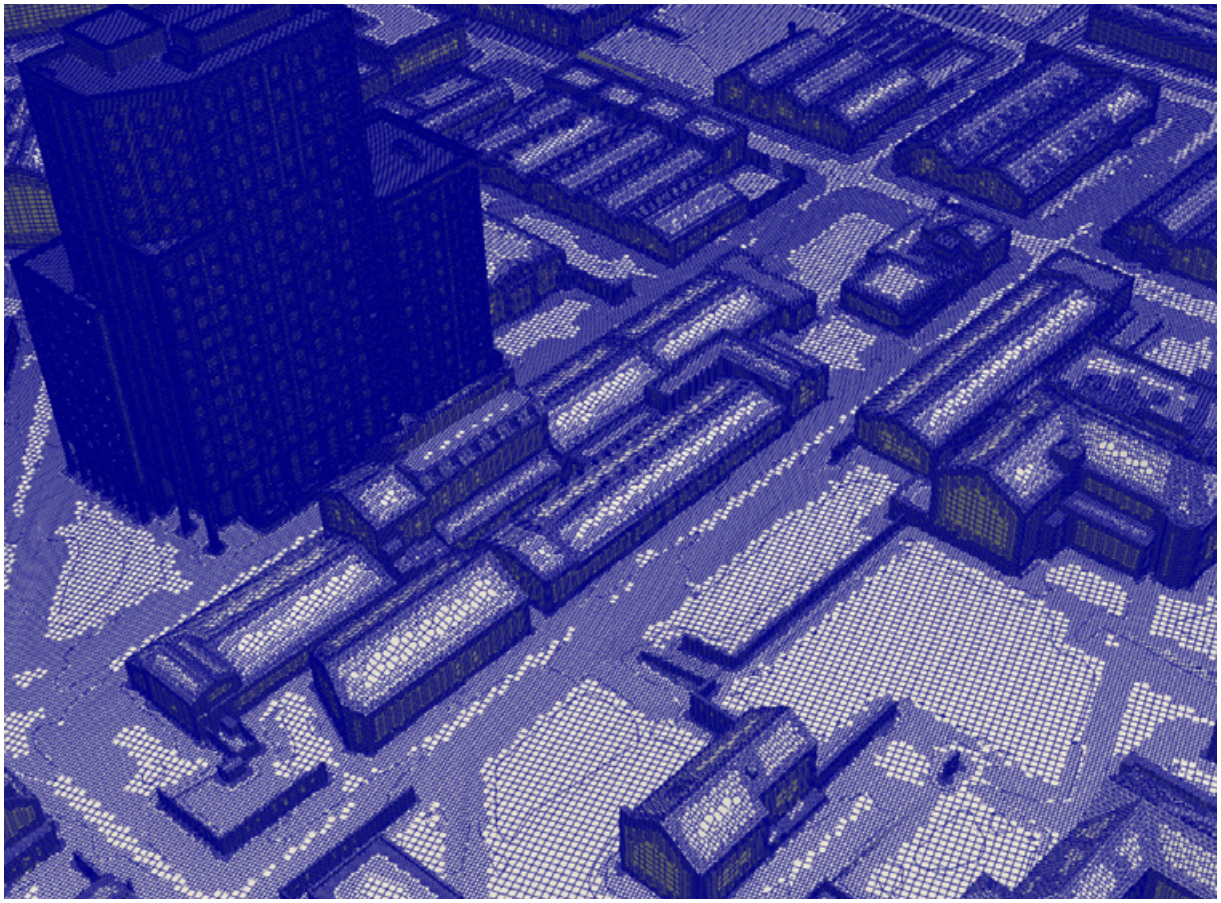


Fig. 02: Mesh Detail on Surrounds

SURROUNDS METHODOLOGY

The model used for the existing building on site is shown in brown in Figure 3.

The model used for the proposed development is shown in green in Figure 4.

All buildings within 400m radius were included in the surrounding context model.

The following scenarios were tested as part of the assessment:

Scenario 1: Baseline for site and surrounds (shown in Figure 5);

Scenario 2: Proposed development in baseline surrounds (shown in Figure 6); and

Scenario 3: Proposed development in cumulative surrounds (shown in Figure 7).

The following scheme was considered sufficiently advanced to be included within the baseline surrounds:

- Former Boddington Brewery Site (118831/FO/2018)

The following schemes were only included as part of the cumulative surrounds:

- 1 Lord Street (113914/FO/2016); and
- 1 Park Place (138302/FO/2023).

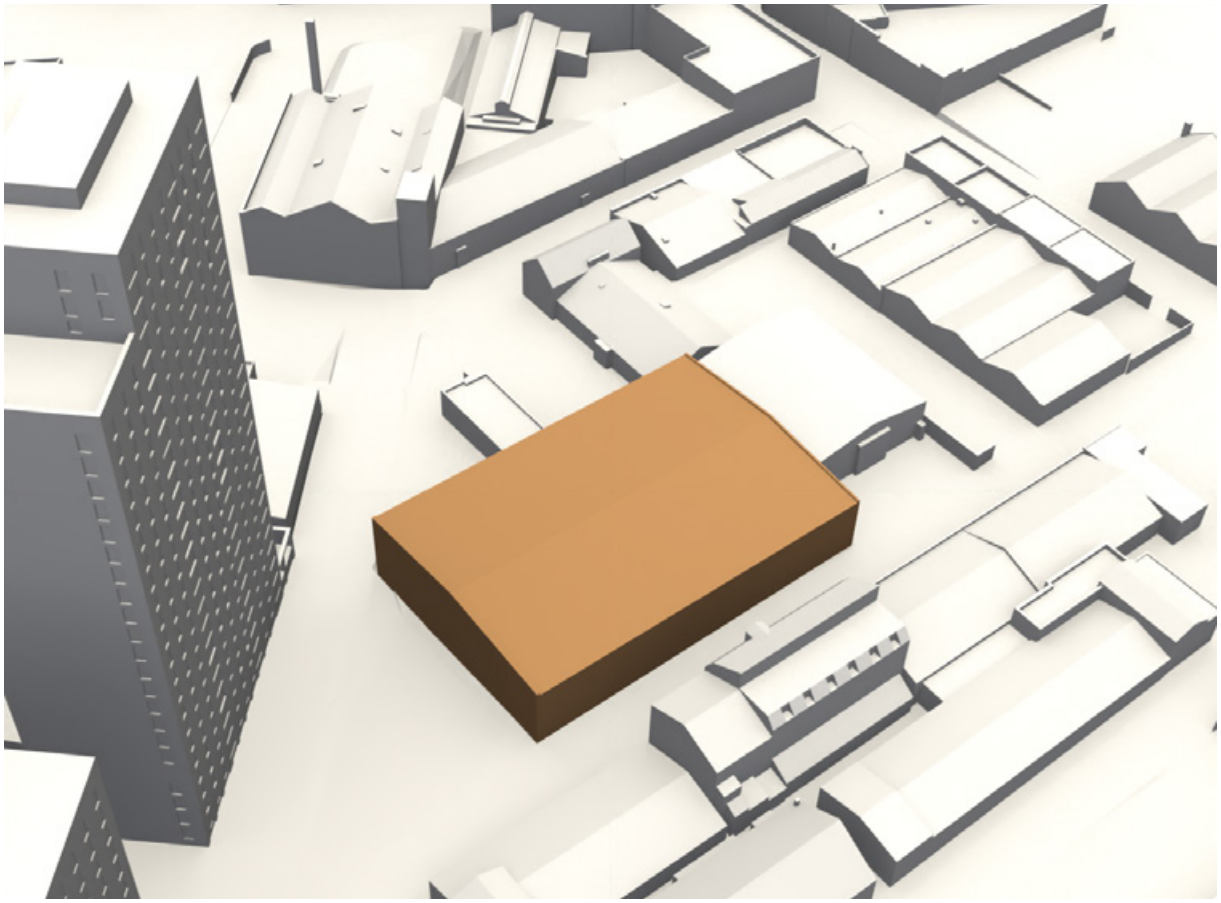


Fig. 03: Existing Building on Site

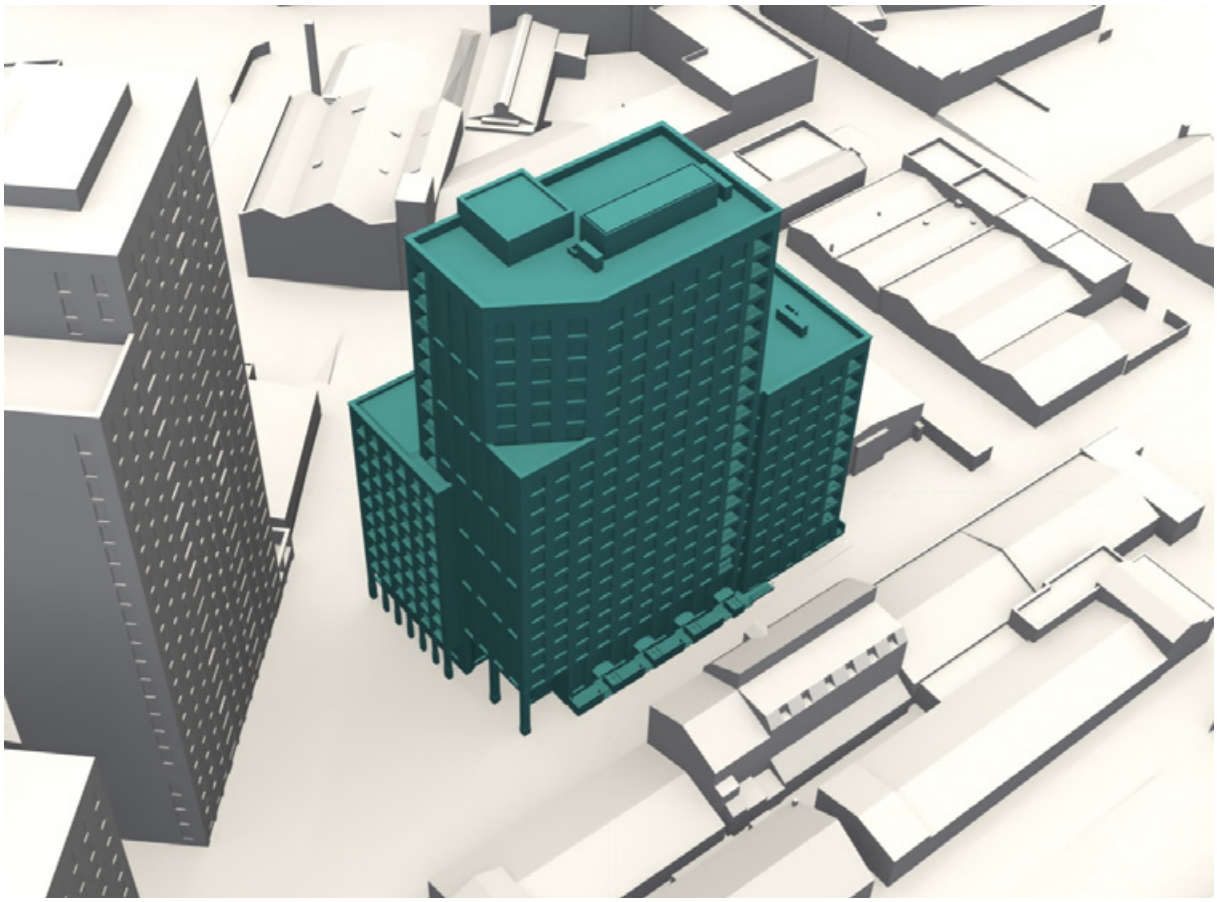


Fig. 04: Proposed Development as Tested



Fig. 05: Scenario 1 (Existing Site with Existing Surrounds)



Fig. 06: Scenario 2 (Proposed Development with Existing Surrounds)

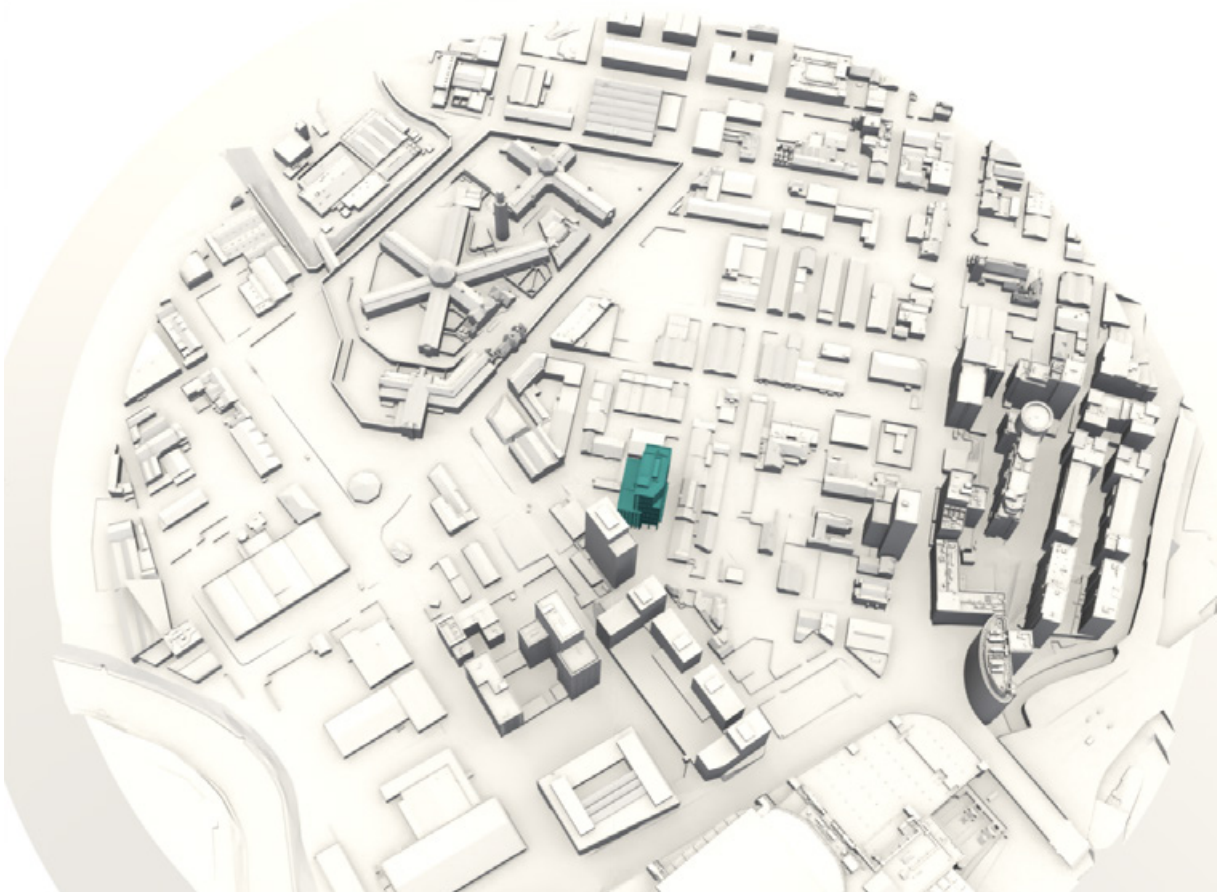


Fig. 07: Scenario 3 (Proposed Development with Cumulative Surrounds)

WIND CLIMATE METHODOLOGY

The simulations were performed form 18 wind directions, spaced such that no single direction contributed more than 10% of the annual winds.

The directions simulated were 0°,30°,60°,90°,120°,150°,170°,180°,190°,200°,210°,220°, 240°, 260°, 270°, 280°, 300°, 330°.

Seasonal wind roses for Manchester International Airport are shown in Figure 8.

Target wind profiles for the site, from each wind direction, were generated using sectoral analysis of the terrain surrounding the site and the local weather stations with ESDU 2010 Item01008 'Computer program for wind speeds and turbulent properties: flat or hilly sites in terrain with roughness changes'. The target wind profiles, compared to the wind speeds measured from the CFD model are shown in Figure 9.

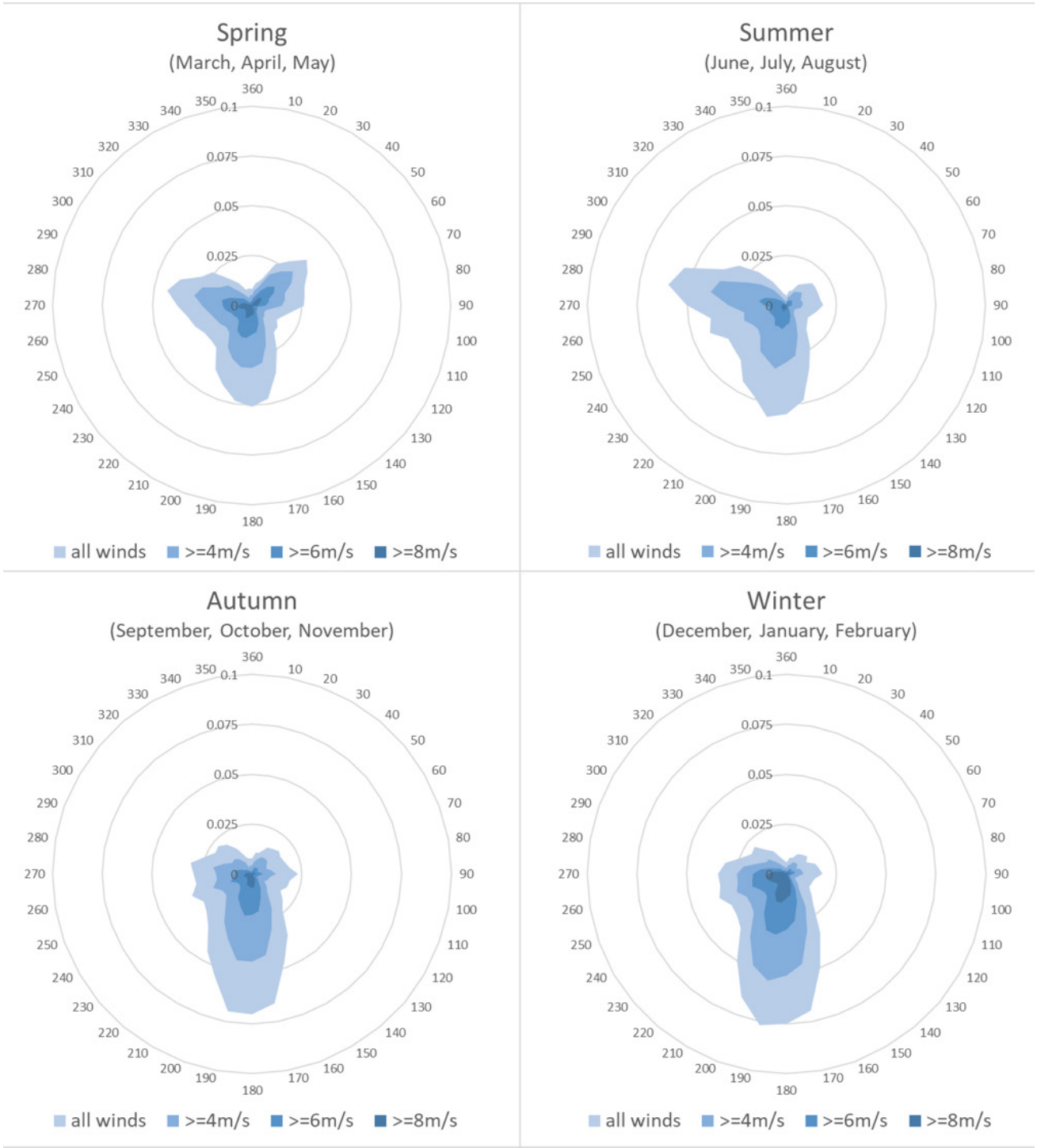


Fig. 08: Seasonal Wind Roses for Manchester International Airport (1990-2020)

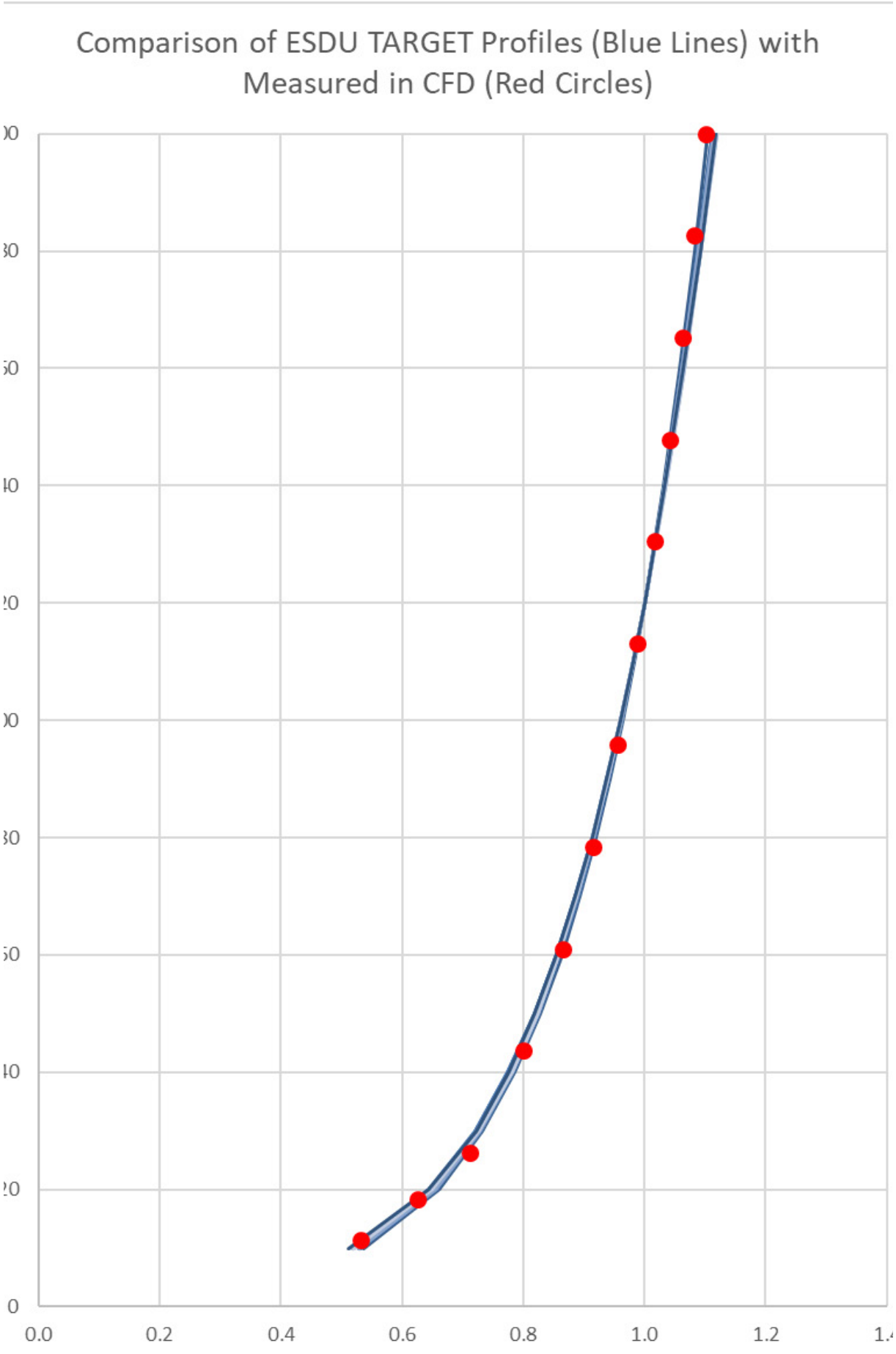


Fig. 09: Wind Profile for Robert Street

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