



ENVIRONMENTAL STATEMENT

VOLUME 2

CHAPTER 6 – AIR QUALITY



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APPENDIX 6.1 – ASSESSMENT INPUT DATA

Air Quality Environmental Impact Assessment

Appendix 6.1 - Assessment Input Data

Stakehill Development



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1.1 Introduction

- 1.1.1 The Proposed Development has the potential to cause air quality impacts as a result of vehicles travelling to and from the Site, as well as expose future residents to any existing air quality issues. In order to assess nitrogen dioxide (NO₂), particulate matter with an aerodynamic diameter of less than 10µm (PM₁₀) and particulate matter with an aerodynamic diameter of less than 2.5µm (PM_{2.5}) concentrations at sensitive locations, detailed dispersion modelling was undertaken in accordance with the following methodology.

1.2 Dispersion Model

- 1.2.1 Dispersion modelling was undertaken using the ADMS-Roads dispersion model (version 5.0.1.3). ADMS-Roads is developed by Cambridge Environmental Research Consultants (CERC) and is routinely used throughout the world for the prediction of pollutant dispersion from road sources. Modelling predictions from this software package are accepted within the UK by the Environment Agency and Department for Environment, Food and Rural Affairs (DEFRA).

- 1.2.2 The model requires input data that details the following parameters:

- Assessment area;
- Traffic flow data;
- Vehicle emission factors;
- Spatial co-ordinates of emissions;
- Street width;
- Meteorological data;
- Roughness length (z₀); and,
- Monin-Obukhov length.

- 1.2.3 Additional options can also be selected within the ADMS-Roads user interface in order to take account of site specific characteristics that may affect model outputs, such as canyons.

- 1.2.4 The relevant inputs are detailed in the following Sections.

1.3 Assessment Area

- 1.3.1 The assessment area was defined based on the site location and anticipated vehicle trip distribution from the Proposed Development. Ambient concentrations were predicted over National Grid Reference (NGR): 388540, 407740 to 389690, 408880. One Cartesian grid was used within the model to produce data suitable for contour plotting using the Surfer software package.
- 1.3.2 Reference should be made to Figure 1.1 in **Chapter 1** – Air Quality for a map of the assessment area.

1.4 Traffic Flow Data

- 1.4.1 Traffic data for use in the assessment, including 24-hour Annual Average Daily Traffic (AADT) flows and fleet composition as Heavy Duty Vehicle (HDV) proportion, was provided by WSP, the Transport Consultants for the project.
- 1.4.2 A summary of the traffic flow data is provided in Table A1.1.1.

Table A1.1.1 Traffic Data

Link		24-hour AADT Flow			HDV Prop. of Fleet (%)		
		Verif.	2040 DM	2040 DS	Verif.	2040 DM	2040 DS
L1	A627M Southbound (SB)	29,300	33,404	33,428	4.09	4.09	5.00
L2	Slip road off Junction 20 onto M62 Eastbound (EB)	3,238	4,098	4,103	5.54	5.54	5.54
L3	M62 EB	12,952	16,391	16,411	5.54	5.54	5.54
L4	M62 Westbound (WB)	14,592	22,440	22,462	7.73	7.73	7.73
L5	Slip road off M62 WB onto Junction 20	3,648	5,610	5,616	7.73	7.73	7.73
L6	Slip road onto A627M SB	39,098	54,468	54,540	5.03	5.03	5.03
L7	Slip road off A627M Northbound (NB)	40,003	64,778	64,844	4.60	4.60	5.00
L8	Slip road onto M62 WB	8,954	14,351	14,357	5.65	5.65	5.65
L9	M62 WB, west of Junction 20	35,816	57,403	57,428	5.65	5.65	5.65

Link		24-hour AADT Flow			HDV Prop. of Fleet (%)		
		Verif.	2040 DM	2040 DS	Verif.	2040 DM	2040 DS
L10	M62 EB, west of Junction 20	26,383	35,725	35,751	5.26	5.26	5.26
L11	Slip road off M62 EB onto Junction 20	6,596	8,931	8,938	5.26	5.26	5.26
L12	A627M NB	22,412	28,085	28,107	4.86	4.86	5.00
L13	M62 WB, between Junction 20	18,903	29,941	29,959	6.25	6.23	6.23
L14	M62 EB, between Junction 20	14,750	19,543	19,561	5.36	5.35	5.35
L15	A627M SB, south of Junction 20	39,098	54,468	54,540	5.03	5.03	5.03
L16	A627M NB, south of Junction 20	40,003	64,778	64,844	4.60	4.60	5.00
L17	Slip road off A627M SB onto Slattocks Interchange	9,774	13,617	13,635	5.03	5.03	5.03
L18	Slip road onto A627M SB, south of Slattocks Interchange	6,932	8,358	8,367	4.18	4.18	5.00
L19	Slip road off A627M NB, south of Slattocks Interchange	7,855	9,272	9,284	3.53	3.53	5.00
L20	A627M WB Slow, west of Slattocks Interchange	17,422	27,736	27,900	4.87	4.87	5.00
L21	A627M EB Slow, west of Slattocks Interchange	13,323	26,643	26,798	5.23	5.23	5.23
L22	Slip road onto A627M NB, north of Slattocks Interchange	10,001	16,194	16,211	4.60	4.60	5.00
L23	A627M SB, between Slattocks Interchange	25,059	32,962	33,003	4.68	4.71	5.02
L24	A627M NB, between Slattocks Interchange	26,783	38,200	38,243	4.13	4.21	5.00
L25	A627M SB, south of Slattocks Interchange	27,726	33,431	33,470	4.18	4.18	5.00
L26	A627M NB, south of Slattocks Interchange	31,420	37,089	37,136	3.53	3.53	5.00
L27	A627M WB, west of Slattocks Interchange	17,422	27,736	27,900	4.87	4.87	5.00
L28	A627M EB, west of Slattocks Interchange	13,323	26,643	26,798	5.23	5.23	5.23
L29	Bentley Avenue SP	371	10,815	11,614	4.18	4.18	5.00
L30	Bentley Avenue	371	10,815	11,614	4.18	4.18	5.00

Link		24-hour AADT Flow			HDV Prop. of Fleet (%)		
		Verif.	2040 DM	2040 DS	Verif.	2040 DM	2040 DS
L31	Whitbrook Way NB, SP	7,441	11,238	11,386	6.91	6.91	6.91
L32	Whitbrook Way NB	7,441	11,238	11,386	6.91	6.91	6.91
L33	Whitbrook Way SB, SP	8,069	9,346	9,553	7.47	7.47	7.47
L34	Whitbrook Way SB	8,069	9,346	9,553	7.47	7.47	7.47
L35	A664 SP towards Slattocks Roundabout	31,184	38,029	38,687	2.03	2.03	5.00
L36	A664 towards Slattocks Roundabout	31,184	38,029	38,687	2.03	2.03	5.00
L37	Rochdale Road, between The Close and Cardinal High School	31,184	38,029	38,687	2.03	2.03	5.00
L38	Rochdale Road	16,422	23,163	23,799	2.03	2.03	5.00
L39	Rochdale Road SP	16,422	23,163	23,799	2.03	2.03	5.00
L40	Hollin Lane SP	6,489	12,715	12,792	2.03	2.03	5.00
L41	Hollin Lane	6,489	12,715	12,792	2.03	2.03	5.00
L42	Long Street SP, towards Hollin Lane	19,056	25,542	26,102	2.03	2.03	5.00
L43	Long Street	19,056	25,542	26,102	2.03	2.03	5.00
L44	Long Street Canyon	19,056	25,542	26,102	2.03	2.03	5.00
L45	Long Street SP	19,056	25,542	26,102	2.03	2.03	5.00
L46	Rochdale Road SP, north of Slattocks Roundabout	17,145	29,738	29,913	2.80	2.80	5.00
L47	Rochdale Road, north of Slattocks Roundabout	17,145	29,738	29,913	2.80	2.80	5.00
L48	A627M WB SP, east of Slattocks Roundabout	17,422	27,736	27,900	4.87	4.87	5.00
L49	A627M EB SP, east of Slattocks Roundabout	13,323	26,643	26,798	5.23	5.23	5.23
R1	Junction 20	19,156	26,716	26,741	7.73	7.73	7.73
R2	Slattocks Interchange	10,884	16,970	17,033	3.53	3.53	5.00
R3	Slattocks Roundabout	13,565	21,935	22,264	7.47	7.47	7.47

- 1.4.3 Reference should be made to Figure 1.1 in **Chapter 1** – Air Quality for a graphical representation of the road link locations.
- 1.4.4 Road widths were estimated from aerial photography and UK highway design standards. Vehicle speeds were provided by the Transport Consultants for the project. For slip roads, roundabouts and slow phases, aerial photography was used to estimate the vehicle speeds. A summary of the link parameters is provided in Table A1.1.2.

Table A1.1.2 Road Width and Vehicle Speed

Link		Road Width (m)	Average Vehicle Speed (km/h)
L1	A627M SB	7.6	113
L2	Slip road off Junction 20 onto M62 EB	6.3	64
L3	M62 EB	11.2	113
L4	M62 WB	11.3	113
L5	Slip road off M62 WB onto Junction 20	7.6	64
L6	Slip road onto A627M SB	7.5	64
L7	Slip road off A627M NB	10.9	64
L8	Slip road onto M62 WB	7.3	64
L9	M62 WB, west of Junction 20	14.8	113
L10	M62 EB, west of Junction 20	13.6	113
L11	Slip road off M62 EB onto Junction 20	9.8	64
L12	A627M NB	7.2	113
L13	M62 WB, between Junction 20	10.9	113
L14	M62 EB, between Junction 20	10.8	113
L15	A627M SB, south of Junction 20	10.8	113
L16	A627M NB, south of Junction 20	10.6	113
L17	Slip road off A627M SB onto Slattocks Interchange	7.5	64
L18	Slip road onto A627M SB, south of Slattocks Interchange	6.5	64
L19	Slip road off A627M NB, south of Slattocks Interchange	6.3	64

Link		Road Width (m)	Average Vehicle Speed (km/h)
L20	A627M WB Slow, west of Slattocks Interchange	7.1	20
L21	A627M EB Slow, west of Slattocks Interchange	7.2	20
L22	Slip road onto A627M NB, north of Slattocks Interchange	7.3	64
L23	A627M SB, between Slattocks Interchange	7.3	113
L24	A627M NB, between Slattocks Interchange	7.5	113
L25	A627M SB, south of Slattocks Interchange	7.5	113
L26	A627M NB, south of Slattocks Interchange	7.2	113
L27	A627M WB, west of Slattocks Interchange	7.3	113
L28	A627M EB, west of Slattocks Interchange	7.0	113
L29	Bentley Avenue SP	8.5	20
L30	Bentley Avenue	7.8	48
L31	Whitbrook Way NB, SP	8.2	20
L32	Whitbrook Way NB	7.0	48
L33	Whitbrook Way SB, SP	6.1	20
L34	Whitbrook Way SB	6.9	48
L35	A664 SP towards Slattocks Roundabout	11.6	20
L36	A664 towards Slattocks Roundabout	7.0	48
L37	Rochdale Road, between The Close and Cardinal High School	6.9	30
L38	Rochdale Road	8.3	48
L39	Rochdale Road SP	11.4	20
L40	Hollin Lane SP	9.3	20
L41	Hollin Lane	7.3	48
L42	Long Street SP, towards Hollin Lane	11.1	20
L43	Long Street	10.6	48
L44	Long Street Canyon	10.0	48
L45	Long Street SP	12.1	20

Link		Road Width (m)	Average Vehicle Speed (km/h)
L46	Rochdale Road SP, north of Slattocks Roundabout	13.5	20
L47	Rochdale Road, north of Slattocks Roundabout	9.2	48
L48	A627M WB SP, east of Slattocks Roundabout	7.4	20
L49	A627M EB SP, east of Slattocks Roundabout	7.1	20
R1	Junction 20	9.1	20
R2	Slattocks Interchange	9.3	20
R3	Slattocks Roundabout	8.7	20

1.5 **Canyons**

1.5.1 Where buildings or walls surround roads, pollutant dispersion patterns are altered which can lead to high pollutant concentrations. These street canyons can significantly influence air quality along a road and therefore it is important to take consideration of their effects when undertaking dispersion modelling.

1.5.2 The release of ADMS-Roads version 4.0.1.0 in December 2015 incorporated a number of new features including an advanced street canyon module, which have been retained in version 5.0.1.3. Advanced street canyon modelling allows a number of parameters to be included in the dispersion model in order to predict pollutant dispersion patterns which better reflect air flow within complex urban geometries.

1.5.3 Canyons have five principal effects on dispersion which can influence pollutant concentrations. These are:

- Pollutants are channelled along street canyons;
- Pollutants are dispersed across street canyons by circulating flow at road height;
- Pollutants are trapped in recirculation regions;
- Pollutants leave the canyon through gaps between buildings - as if there were no canyon; and,
- Pollutants leave the canyon from the canyon top.

- 1.5.4 The combined modelling of these effects will result in concentration patterns unique to each canyon. The parameters used in the assessment are outlined in Table A1.1.3.

Table A1.1.3 Canyon Parameters

Link	Parameter (m)					
	Canyon Width to Left	Average Height of Buildings to Left	Building Length Left	Canyon Width to Right	Average Height of Buildings to Right	Building Length Right
L44	9.6	11.5	67.2	7.4	8.5	76.3

- 1.5.5 A choice of two modes is provided for use in the advanced canyon module. Standard mode assumes that each road is part of a continuous network of roads with similar canyon properties. Network mode analyses the road network to determine transport of pollutants between adjoining street canyons, allows for varying concentrations along the canyon and accounts for transport of pollutants out of the end of a canyon. Network mode is considered most accurate for detailed local analysis and as such was selected for use in the model.

1.6 Emission Factors

- 1.6.1 The emission factors were calculated using the relevant traffic flows and the Emissions Factor Toolkit (version 12.0.1). This has been produced by DEFRA and incorporates COPERT 5.6 vehicle emission factors and fleet information.
- 1.6.2 There is current uncertainty over NO₂ concentrations within the UK, with the implementation of new vehicle emission standards not resulting in the previously expected reduction in roadside levels. Therefore, 2023 NO₂ and PM₁₀ emission factors were utilised in preference to the development opening year in order to provide robust model outputs. As predictions for 2023 were verified, it is considered the results are a robust indication of worst case concentrations for the future year. 2040 emission factors were used for PM_{2.5} to represent the likely conditions in development opening year and the achievement date for the Concentration Target.

1.7 Meteorological Data

1.7.1 Meteorological data used in the assessment was taken from Manchester Airport meteorological station over the period 1st January 2023 to 31st December 2023 (inclusive). Manchester Airport is located at NGR: 381792, 384116, which is approximately 25km south-west of the development. It is anticipated that conditions would be reasonably similar over a distance of this magnitude. The data was therefore considered suitable for an assessment of this nature.

1.7.2 All meteorological records used in the assessment were provided by Atmospheric Dispersion Modelling (ADM) Ltd, which is an established distributor of data within the UK. Reference should be made to Figure A1.1.1 in for a wind rose of the utilised meteorological data.

1.8 Roughness Length

1.8.1 The z_0 is a modelling parameter applied to allow consideration of surface height roughness elements. A z_0 of 0.5m was used to describe the modelling extents. This is considered appropriate for the morphology of the area and is suggested within ADMS-Roads as being suitable for 'parkland, open suburbia'.

1.8.2 A z_0 of 0.2m was used to describe the meteorological site. This is considered appropriate for the morphology of the area and is suggested within ADMS-Roads as being suitable for 'agricultural areas (min)'.

1.9 Monin-Obukhov Length

1.9.1 A minimum Monin-Obukhov length of 30m was used to describe the modelling extents and meteorological site. This value is considered appropriate for the nature of both areas and is suggested within ADMS-Roads as being suitable for 'mixed urban/industrial'.

1.10 Background Concentrations

1.10.1 Annual mean NO₂, PM₁₀ and PM_{2.5} background concentrations were taken from the DEFRA mapping study for the grid square containing the RO4ANO monitoring position, NGR: 387500, 406500. These are shown in Table A1.1.4

Table A1.1.4 Background Pollutant Concentration

Pollutant	Predicted 2023 Background Concentration ($\mu\text{g}/\text{m}^3$)
NO ₂	14.81
PM ₁₀	12.31

1.10.2 The values shown in Table A1.1.4 were chosen to represent concentrations throughout the dispersion modelling extents without the contribution from road vehicles as they were higher than the DEFRA background for the grid squares containing the site, as shown in Table A1.2.4 in Appendix 1.2 – Supporting Information.

1.10.3 Similarly to emission factors, background NO₂ and PM₁₀ concentrations from 2023 were utilised in preference to the opening year. This provided a robust assessment and is likely to overestimate pollutant concentrations during the operation of the proposal.

1.10.4 Background concentrations from the grid square containing the RO4ANO monitor for 2040 were used for PM_{2.5}. This was used to allow comparison against the Concentration Target.

1.11 NO_x to NO₂ Conversion

1.11.1 Predicted annual mean oxides of nitrogen (NO_x) concentrations were converted to NO₂ concentrations using the spreadsheet (version 8.1) provided by DEFRA, which is the method detailed within DEFRA guidance¹.

1.12 Verification

1.12.1 The predicted results from a dispersion model may differ from measured concentrations for a large number of reasons, including:

- Estimates of background concentrations;
- Uncertainties in source activity data such as traffic flows and emission factors;
- Variations in meteorological conditions;
- Overall model limitations; and,
- Uncertainties associated with monitoring data, including locations.

¹ Local Air Quality Management Technical Guidance (TG22), DEFRA, 2022.

- 1.12.2 Model verification is the process by which these and other uncertainties are investigated and where possible minimised. In reality, the differences between modelled and monitored results are likely to be a combination of all of these aspects.
- 1.12.3 For the purpose of the assessment model verification was undertaken for 2023 using traffic data, meteorological data and monitoring results from this year.
- 1.12.4 Monitoring of NO₂ concentrations was undertaken at three locations within the vicinity of roads included within the model during 2023. The results were obtained and the road contribution to total NO_x concentration calculated following the methodology contained within DEFRA guidance². The monitored annual mean NO₂ concentrations and calculated road NO_x concentrations are summarised in Table A1.1.5.

Table A1.1.5 Verification - Monitoring Result

Monitoring Location	Monitored NO ₂ Concentration (µg/m ³)	Calculated Road NO _x Concentration (µg/m ³)
RO2ANO	27.6	30.22
RO3ANO	16.4	3.42
RO4ANO	23.0	18.57

- 1.12.5 The annual mean road NO_x concentrations predicted from the dispersion model and the 2023 road NO_x concentrations calculated from the monitoring result are summarised in Table A1.1.6.

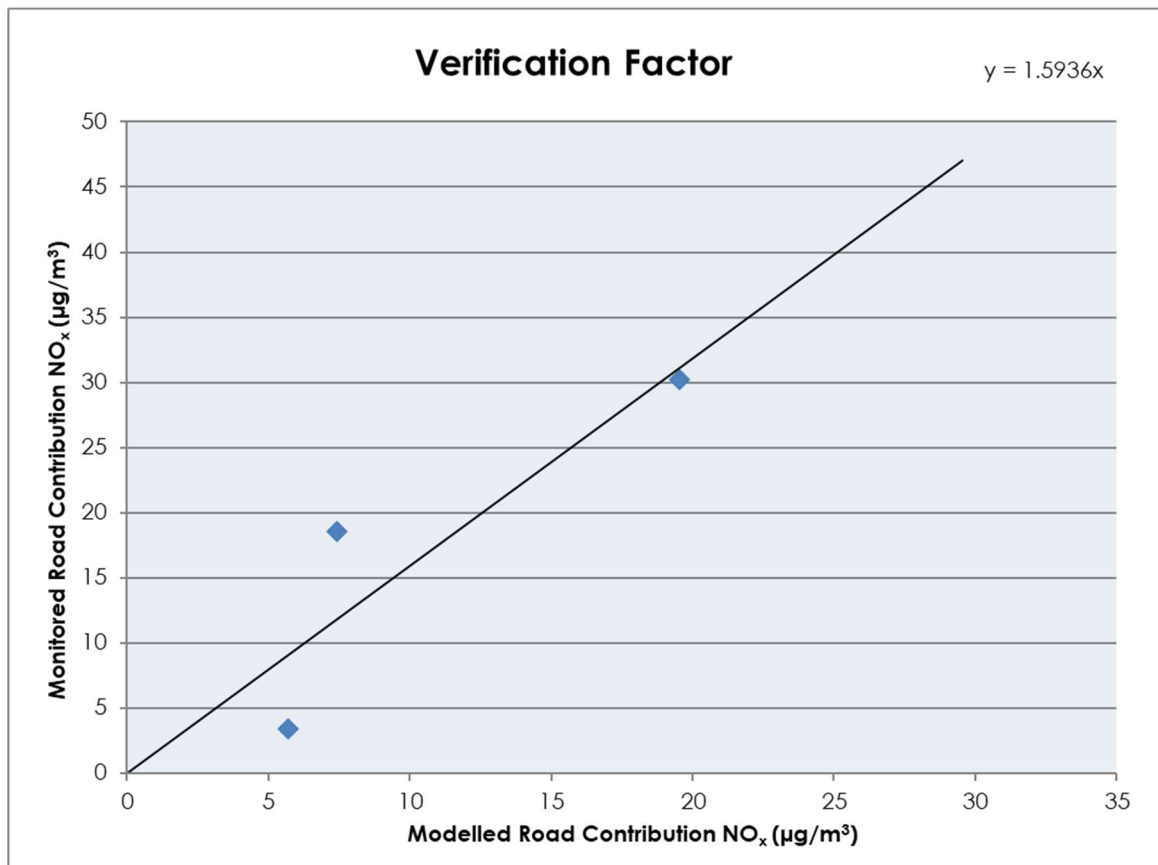
Table A1.1.6 Verification - Modelling Result

Monitoring Location	Calculated Road NO _x Concentration (µg/m ³)	Modelled Road NO _x Concentration (µg/m ³)
RO2ANO	30.22	19.53
RO3ANO	3.42	5.71
RO4ANO	18.57	7.41

² Local Air Quality Management Technical Guidance (TG22), DEFRA, 2022.

1.12.6 The monitored and modelled road NO_x concentrations were compared to calculate the associated ratio. This indicated a verification factor of 1.5936 was required to be applied to all modelling results, as shown in Graph 1.

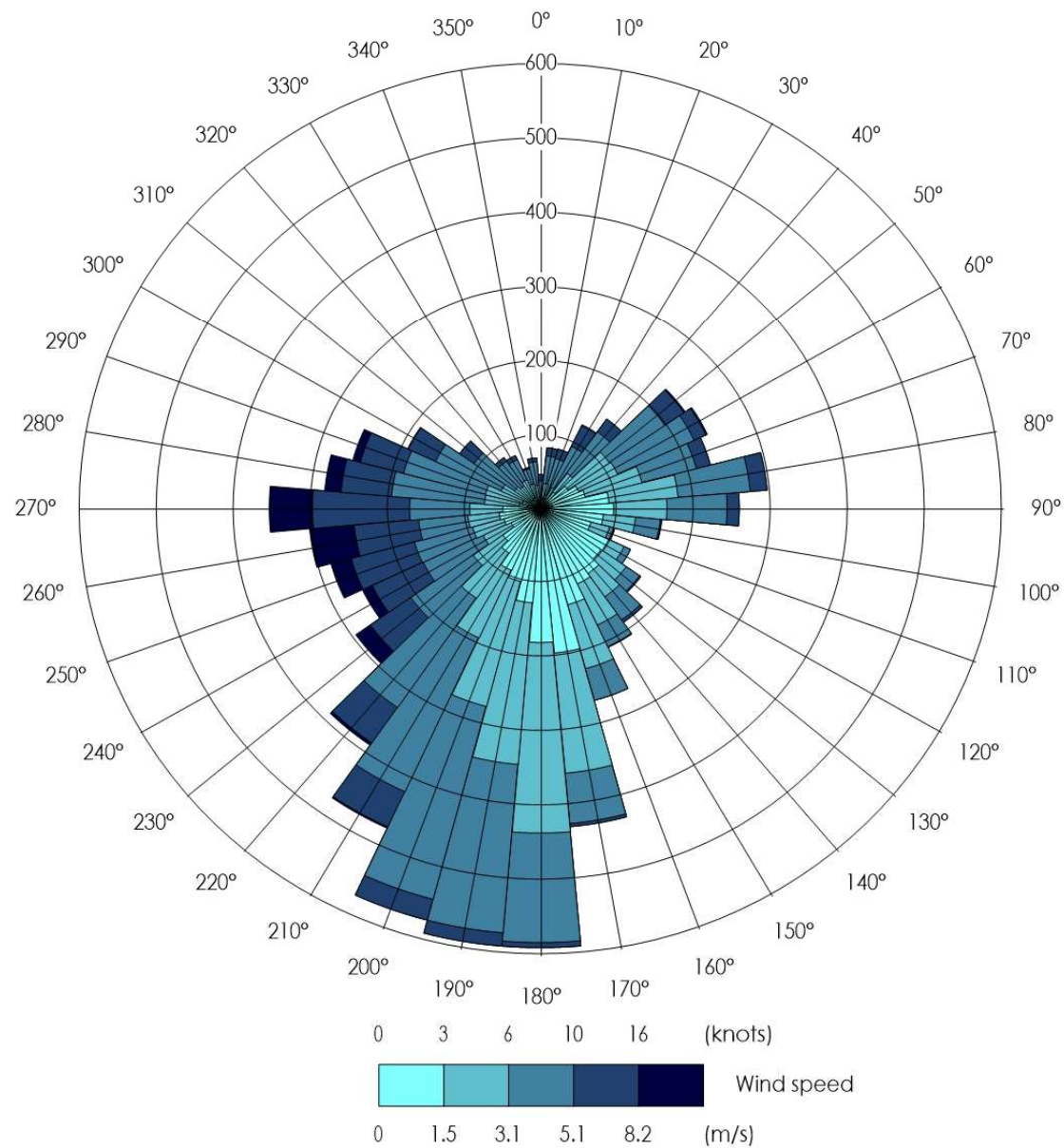
Graph 1 NO_x Verification Factor



1.12.7 Monitoring of PM₁₀ and PM_{2.5} concentrations is not undertaken within the assessment extents. The NO_x verification factor was therefore used to adjust PM₁₀ and PM_{2.5} model predictions in lieu of more accurate data in accordance with DEFRA guidance³.

³ Local Air Quality Management Technical Guidance (TG22), DEFRA, 2022.

Figures



Legend

Title
Figure A1.1 - Wind Rose of 2023
Manchester Airport Meteorological
Data

Project
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