

ASSESSMENT INPUTS

The Proposed Development has the potential to introduce future site users to poor air quality. Dispersion modelling using ADMS Roads was therefore undertaken to predict NO₂ and PM concentrations across the site to consider site suitability for the proposed end-use.

The assessment was undertaken in accordance with the guidance contained within the DEFRA document LAQM (TG16)**Error! Bookmark not defined.** and the EPUK and IAQM guidance**Error! Bookmark not defined.**.

Dispersion Model

Dispersion modelling was undertaken using the ADMS-Roads dispersion model (version 5.0). 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 DEFRA.

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; and
- Monin-Obukhov length.

Traffic Flow Data

Baseline traffic data for all road links used in the assessment, including 24-hour Annual Average Daily Traffic (AADT) flows and fleet composition, was obtained from the Department for Transport (DfT). The DfT Matrix web tool enables the user to view and download traffic flows on every link of the A-road and motorway network in Great Britain for the years 1999 to 2019.

It should be noted that the DfT matrix is referenced in DEFRA guidance LAQM (TG16)**Error! Bookmark not defined.** as being a suitable source of data for air quality assessments and is therefore considered to provide a reasonable representation of traffic flows in the vicinity of the site.

Growth factors provided by the Trip End Model Presentation Program (TEMPO) software package were utilised to allow for conversion from the obtained 2019 traffic flow to 2025 which was used to represent the opening year scenario. Vehicle speeds were estimated based on the free flow potential of each link and local speed limits. Road widths were estimated from aerial photography and UK highway design standards.

A summary of the traffic data used in the verification scenario is provided in Table All 1.

Table All 1: 2019 Verification Traffic Data

Road Link		Road Width (m)	Canyon Height	24 Hour AADT Flow	HDV Pop (%)	Mean Vehicle Speed (km/hr)
L1	A56 (W)	12.5	0.0	34,299	3.0	40
L2	A56 (W) Slow Down (West)	11.5	0.0	17,150	3.0	20
L3	A56 (W) Slow Down (East)	9.5	0.0	17,150	3.0	10

Road Link		Road Width (m)	Canyon Height	24 Hour AADT Flow	HDV Pop (%)	Mean Vehicle Speed (km/hr)
L4	A56 Roundabout	11.3	0.0	14,574	3.7	10
L5	Regent Road (South)	10.5	0.0	35,616	3.0	55
L6	A57 (E)	7.0	0.0	27,986	4.7	55
L7	Regent Road (North)	10.5	0.0	35,616	3.0	55
L8	A57 (W)	7.3	0.0	24,299	6.9	55
L9	Regent Road Onslip	6.3	0.0	11,622	2.6	32
L10	Regent Road Offslip	7.5	0.0	7,271	2.5	32
L11	A56 Roundabout	16.0	0.0	15,320	4.2	12
L12	A56 Across Roundabout (East)	7.5	0.0	6,057	3.0	32
L13	A56 Across Roundabout (West)	7.5	0.0	6,057	3.0	32
L14	A56 Roundabout	11.0	0.0	15,320	4.2	12
L15	A56 Roundabout	11.0	0.0	17,029	3.6	36
L16	A56 roundabout (Manc Way)	11.0	0.0	17,029	3.6	36
L17	A56 Roundabout	13.0	0.0	17,711	2.6	15
L18	Chorlton Road Slow Down (North)	6.0	0.0	6,288	1.0	15
L19	Chorlton Road Slow Down (South)	6.2	0.0	6,288	1.0	25
L20	A56 Roundabout	12.2	0.0	14,574	3.7	15
L21	Chorlton Road (North)	6.0	0.0	6,288	1.0	40
L22	Chorlton Road (South)	6.3	0.0	6,288	1.0	40
L23	Manc Way East (up to slip roads)	9.5	0.0	38,686	4.0	60
L24	Manc Way West (up to slip roads)	9.5	0.0	38,686	4.0	60
L25	Manc Way Onslip	7.3	0.0	9,361	4.6	45
L26	Manc Way Offslip	7.3	0.0	9,992	2.9	50
L27	Manc Way Offslip Medlock Street	7.5	0.0	10,488	2.1	15
L28	Manc Way Onslip Princess Parkway	7.3	0.0	10,488	2.1	32
L29	Manc Way East (up to University)	8.0	0.0	38,686	4.0	55
L30	Manc Way West (up to University)	8.0	0.0	38,686	4.0	55
L31	Princess Parkway	10.7	0.0	25,412	2.0	50
L32	Princess Parkway	8.2	0.0	25,412	2.0	50
L33	Princess Parkway Onslip	7.3	0.0	12,706	2.0	25
L34	Medlock Street Offslip	7.6	0.0	7,825	1.0	25

Road Link		Road Width (m)	Canyon Height	24 Hour AADT Flow	HDV Pop (%)	Mean Vehicle Speed (km/hr)
L35	Medlock Street Slow Down	14.5	0.0	15,650	1.0	25
L36	Medlock Street (River Street to Little Peter Street)	14.6	0.0	16,235	1.0	40
L37	Albion Street	14.9	0.0	16,235	1.0	35
L38	Medlock Street Slow Down	14.7	0.0	16,235	1.0	15
L39	River Street	9.5	0.0	1,776	0.0	32
L40	City Road East/Great Jackson Street	8.2	0.0	5,127	1.9	20
L41	City Road East/Great Jackson Street (Street Canyon Section)	17.8	23.5	5,127	1.9	35
L42	City Road East/Great Jackson Street	8.2	0.0	5,127	1.9	35
L43	City Road East Slow Down	9.1	0.0	3,402	1.1	30
L44	Great Jackson Street to Bridgewater Viaduct	5.6	0.0	1,701	1.1	15
L45	Bridgewater Viaduct to Great Jackson Street	4.5	0.0	1,701	1.1	15
L46	Garwood Street	8.6	0.0	1,272	0.0	32
L47	Garwood Street Onslip	5.5	0.0	636	0.0	25
L48	Garwood Street Offslip	5.5	0.0	636	0.0	15
L49	Chester Road East (West of Great Jackson Street)	7.3	0.0	6,057	3.0	40
L50	Chester Road East (West of Great Jackson Street)	7.3	0.0	12,113	3.0	40
L51	Chester Road East (A56 Roundabout Exit)	3.8	0.0	6,057	3.0	20
L52	Chester Road East (West of Great Jackson Street)	7.5	0.0	6,057	3.0	25
L53	Chester Road East (West of Great Jackson Street)	10.8	0.0	12,113	3.0	20
L54	Chester Road East (A56 Roundabout Approach)	5.6	0.0	6,057	3.0	20
L55	Chester Road East (Great Jackson Street to Old Deansgate) Eastbound	7.3	0.0	11,562	3.0	32
L56	Chester Road East (Great Jackson Street to Old Deansgate) Westbound	6.3	0.0	11,562	3.0	32
L57	A56 Bridgewater Viaduct	10.8	0.0	18,371	3.0	32
L58	Old Deansgate Slow Down	9.3	0.0	1,992	2.4	40
L59	Old Deansgate	6.5	0.0	1,992	2.4	40
L60	Little Peter Street	6.1	0.0	1,611	0.0	15

Road Link		Road Width (m)	Canyon Height	24 Hour AADT Flow	HDV Pop (%)	Mean Vehicle Speed (km/hr)
L61	Whitworth Street West - Slow Down	11.5	0.0	9,152	1.0	15
L62	Whitworth Street West	11.5	0.0	9,152	1.0	48
L63	Whitworth Street East - Slow Down	10.5	0.0	11,797	1.0	15
L64	Whitworth Street East	10.5	0.0	11,797	1.0	48
L65	Deansgate	12.0	0.0	16,939	3.0	48
L66	Albion Street	15.6	0.0	16,029	3.0	35
L67	Hewitt Street	5.0	0.0	515	0.0	15
L68	Hewitt Street	5.1	0.0	515	0.0	30
L69	Melborne Street	6.5	0.0	131	0.0	32
L70	Regent Road (West) Slow	11.1	0.0	19,641	4.3	15
L71	Regent Road (West) Slow	7.3	0.0	19,641	4.3	20
L72	Regent Road (East) Slow	7.0	0.0	19,641	4.3	20
L73	Regent Road (East) Slow	9.8	0.0	19,641	4.3	15
L74	Regent Road (West) Slow	7.0	0.0	19,641	4.3	32
L75	Regent Road (West) Slow	10.0	0.0	19,641	2.1	15
L76	Regent Road (East) Slow	7.2	0.0	19,641	2.1	32
L77	Regent Road (East) Slow	7.3	0.0	19,641	2.1	15
L78	Regent Road (West) Speed Up	7.1	0.0	20,767	2.0	15
L79	Regent Road (West)	7.5	0.0	20,767	2.0	32
L80	Regent Road (East) Slow Down	9.5	0.0	20,767	2.0	15
L81	Regent Road (East)	7.5	0.0	20,767	2.0	35
L82	Liverpool Road Slow Down	10.3	0.0	5,372	3.4	15
L83	Water Street/Liverpool Street	8.2	0.0	5,372	3.4	40
L84	Water Street Slow Down	15.6	0.0	5,372	3.4	15
L85	Trinity Way (North)	8.3	0.0	10,803	1.1	40
L86	Trinity Way (South)	8.3	0.0	10,803	1.1	40
L87	Oldfield Road (North) Slow Down	13.1	0.0	9,755	2.3	15
L88	Oldfield Road (North)	9.9	0.0	9,755	2.3	40
L89	Oldfield Road (South) Slow Down	12.4	0.0	7,085	2.7	15
L90	Oldfield Road (South)	8.2	0.0	7,085	2.7	40
L91	Ordsall Lane (South)	8.7	0.0	11,421	1.8	32
L92	Ordsall Lane (South) Slow Down	13.2	0.0	11,421	1.8	10
L93	Regent Road onto Ordsall Lane	4.0	0.0	3,807	1.8	10

Road Link		Road Width (m)	Canyon Height	24 Hour AADT Flow	HDV Pop (%)	Mean Vehicle Speed (km/hr)
L94	Ordsall Lane onto Regent Road	4.1	0.0	3,807	1.8	10
L95	Ordsall Lane/Regent Road Junction	15.0	0.0	3,807	1.8	10
L96	Ordsall Lane (North) Slow Down	18.3	0.0	9,083	1.8	10
L97	Ordsall Lane (North)	10.3	0.0	9,083	1.8	32

Reference should be made to Figure 6 within Appendix 7.2 for a graphical representation of the road link locations used within the verification assessment. The road width, canyon height and mean vehicle speed shown in Table All.1 remained the same for the 2025 scenarios.

In order to consider a robust assessment, a TEMPRO traffic growth factor was applied to the baseline traffic data to obtain traffic flows for the development future opening year, and development traffic added to each relevant road link. A summary of the 2025 traffic data is shown in **Table All 2**.

Table All 2: 2025Traffic Data

Road Link		Development Opening Year	
		24 Hr AADT Flow	HDV Prop (%)
L1	A56 (W)	34,324	3.0
L2	A56 (W) Slow Down (West)	17,162	3.0
L3	A56 (W) Slow Down (East)	17,162	3.0
L4	A56 Roundabout	16,172	3.7
L5	Regent Road (South)	34,745	3.0
L6	A57 (E)	30,980	4.6
L7	Regent Road (North)	34,745	3.0
L8	A57 (W)	26,934	6.8
L9	Regent Road Onslip	12,843	2.6
L10	Regent Road Offslip	8,069	2.5
L11	A56 Roundabout	16,901	4.2
L12	A56 Across Roundabout (East)	6,784	3.0
L13	A56 Across Roundabout (West)	6,650	3.0
L14	A56 Roundabout	16,813	4.2
L15	A56 Roundabout	18,689	3.6
L16	A56 roundabout (Manc Way)	18,689	3.6
L17	A56 Roundabout	19,437	2.6
L18	Chorlton Road Slow Down (North)	6,328	1.0
L19	Chorlton Road Slow Down (South)	6,328	1.0
L20	A56 Roundabout	15,994	3.7
L21	Chorlton Road (North)	6,328	1.0

L22	Chorlton Road (South)	6,328	1.0
L23	Manc Way East (up to slip roads)	38,222	4.0
L24	Manc Way West (up to slip roads)	38,222	4.0
L25	Manc Way Onslip	10,540	4.5
L26	Manc Way Offslip	11,232	2.8
L27	Manc Way Offslip Medlock Street	11,777	2.0
L28	Manc Way Onslip Princess Parkway	12,121	2.0
L29	Manc Way East (up to University)	37,956	4.0
L30	Manc Way West (up to University)	37,948	4.0
L31	Princess Parkway	24,464	2.0
L32	Princess Parkway	24,464	2.0
L33	Princess Parkway Onslip	12,232	2.0
L34	Medlock Street Offslip	8,335	1.0
L35	Medlock Street Slow Down	16,669	1.0
L36	Medlock Street (River Street to Little Peter Street)	16,919	1.0
L37	Albion Street	16,919	1.0
L38	Medlock Street Slow Down	16,919	1.0
L39	River Street	1,911	0.0
L40	City Road East/Great Jackson Street	6,071	1.7
L41	City Road East/Great Jackson Street (Street Canyon Section)	6,071	1.7
L42	City Road East/Great Jackson Street	6,071	1.7
L43	City Road East Slow Down	4,178	1.0
L44	Great Jackson Street to Bridgewater Viaduct	2,089	1.0
L45	Bridgewater Viaduct to Great Jackson Street	2,089	1.0
L46	Garwood Street	2,587	0.0
L47	Garwood Street Onslip	1,293	0.0
L48	Garwood Street Offslip	1,293	0.0
L49	Chester Road East (West of Great Jackson Street)	6,650	3.0
L50	Chester Road East (West of Great Jackson Street)	13,301	3.0
L51	Chester Road East (A56 Roundabout Exit)	6,650	3.0
L52	Chester Road East (West of Great Jackson Street)	6,650	3.0
L53	Chester Road East (West of Great Jackson Street)	13,301	3.0
L54	Chester Road East (A56 Roundabout Approach)	6,650	3.0
L55	Chester Road East (Great Jackson Street to Old Deansgate) Eastbound	12,157	3.0
L56	Chester Road East (Great Jackson Street to Old Deansgate) Westbound	12,157	3.0
L57	A56 Bridgewater Viaduct	17,833	3.0
L58	Old Deansgate Slow Down	2,187	2.4

L59	Old Deansgate	2,187	2.4
L60	Little Peter Street	1,548	0.0
L61	Whitworth Street West - Slow Down	9,165	1.0
L62	Whitworth Street West	9,165	1.0
L63	Whitworth Street East - Slow Down	11,380	1.0
L64	Whitworth Street East	11,513	1.0
L65	Deansgate	16,568	3.0
L66	Albion Street	15,240	3.0
L67	Hewitt Street	490	0.0
L68	Hewitt Street	490	0.0
L69	Melborne Street	120	0.0
L70	Regent Road (West) Slow	20,949	4.3
L71	Regent Road (West) Slow	20,949	4.3
L72	Regent Road (East) Slow	20,949	4.3
L73	Regent Road (East) Slow	20,949	4.3
L74	Regent Road (West) Slow	20,949	4.3
L75	Regent Road (West) Slow	20,949	2.1
L76	Regent Road (East) Slow	20,949	2.1
L77	Regent Road (East) Slow	20,949	2.1
L78	Regent Road (West) Speed Up	22,150	2.0
L79	Regent Road (West)	22,150	2.0
L80	Regent Road (East) Slow Down	22,150	2.0
L81	Regent Road (East)	22,150	2.0
L82	Liverpool Road Slow Down	5,730	3.4
L83	Water Street/Liverpool Street	5,730	3.4
L84	Water Street Slow Down	5,730	3.4
L85	Trinity Way (North)	11,522	1.1
L86	Trinity Way (South)	11,522	1.1
L87	Oldfield Road (North) Slow Down	10,405	2.3
L88	Oldfield Road (North)	10,405	2.3
L89	Oldfield Road (South) Slow Down	7,557	2.7
L90	Oldfield Road (South)	7,557	2.7
L91	Ordsall Lane (South)	12,182	1.8
L92	Ordsall Lane (South) Slow Down	12,182	1.8
L93	Regent Road onto Ordsall Lane	4,061	1.8
L94	Ordsall Lane onto Regent Road	4,061	1.8
L95	Ordsall Lane/Regent Road Junction	4,061	1.8
L96	Ordsall Lane (North) Slow Down	9,687	1.8
L97	Ordsall Lane (North)	9,687	1.8

Reference should be made to Figure 6 within Appendix 7.2 for a graphical representation of the road link locations used within the operation phase assessment.

Emission Factors

Emission factors for each link were calculated using the relevant traffic flows and the Emissions Factor Toolkit (version 10.1) released in August 2020, which incorporates updated COPERT 5.3 vehicle emissions factors for NO_x and PM and EURO 6 vehicle fleet sub-categories.

There is current uncertainty over NO₂ concentrations within the UK, with roadside levels not reducing as previously expected due to the implementation of new vehicle emission standards. Therefore, 2019 emission factors have been utilised for the prediction of pollution levels for all scenarios in preference to the development opening year in order to provide a robust assessment.

NO_x to NO₂ Conversion

Predicted annual mean NO_x concentrations from the dispersion model were converted to NO₂ concentrations using the NO_x to NO₂ Calculator (v.8.1) provided by DEFRA, which is the method detailed within LAQM (TG16)**Error! Bookmark not defined..**

Meteorological Data

Meteorological data used in this assessment was taken from Manchester Airport meteorological station over the period 1st January 2019 to 31st December 2019 (inclusive). Manchester Airport meteorological station is located at approximate NGR: 381745, 383960 which is approximately 13.5km north west of the Proposed Development. Although there is a large distance between the application site and Manchester Airport the use of this data has prior approval from the Environmental Health Department at Manchester City Council and is therefore considered to provide a reasonable representation of conditions at the development site.

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 5 within Appendix 7.2 for a wind rose of utilised meteorological data.

Roughness Length

The specific roughness length (z_0) values used to represent conditions during the verification process, DS scenario, as well as conditions at the Manchester Airport meteorological station are summarised in Table AII 3.

Table AII 3: Utilised Roughness Lengths

Scenario	Roughness Length (m)	ADMS Description
Development Site	1.0	Cities, Woodlands
Manchester Airport	0.3	Agricultural (Max)

These values of z_0 are considered appropriate for the morphology of the assessment area.

Monin-Obukhov Length

The Monin-Obukhov length provides a measure of the stability of the atmosphere within certain urban or rural contexts. The specific length values used to represent conditions during the verification process, DS scenario, as well as conditions at the Manchester Ringway meteorological station are summarised in Table AII 4

Table AII 4: Utilised Monin-Obukhov Lengths

Scenario	Monin-Obukhov Length (m)	ADMS Description
Development Site	30	Cities and Large Towns

Manchester Airport	30	Mixed Urban Industrial
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This Monin-Obukhov value is considered appropriate for the morphology of the assessment area.

Background Concentrations

Background concentrations provided by DEFRA were used in the dispersion modelling assessment to represent existing annual mean NO₂, NO_x and PM₁₀ concentrations in the vicinity of the site. In order to avoid 'double-counting' of road vehicle exhaust emissions of NO₂ and NO_x, the proportion of the relevant background concentrations from A-roads was removed in accordance with the methodology outlined in DEFRA guidance LAQM.TG(16). This sector was considered to be the most representative of that being modelled within ADMS-Roads. The background concentrations before and following the adjustment are presented in Table All 5.

Table All 5: Background Pollutant Concentrations

Pollutant	Predicted Annual Mean Background Concentration (µg/m ³)	
	Total Predicted 2019 Background	Predicted Background with A-Roads Removed
NO _x	39.95	33.56
NO ₂	26.07	22.52
Pollutant	Predicted Annual Mean Background Concentration (µg/m ³)	
PM ₁₀	13.47	
PM _{2.5}	14.38	

Similar to emission factors, background concentrations for 2019 were utilised in preference to the development opening year of 2025. This provided a robust assessment and is likely to overestimate actual pollutant concentrations during the operation of the proposals.

Table All 6 displays the specific background concentrations as predicted by DEFRA, utilised to represent the condition at the monitoring locations used within the verification process. As above, In order to avoid 'double-counting' of road vehicle exhaust emissions of NO₂ and NO_x, the proportion of the relevant background concentrations from A-roads was removed in accordance with the methodology outlined in DEFRA guidance LAQM.TG(16).

Table All 6: Predicted Background Pollutant Concentrations for Diffusion Tubes

Monitoring Location	DEFRA Grid Square	Pollutant	2019 Predicted Background Concentration (µg/m ³)
MAN 77	383500, 397500	NO _x	33.56
		NO ₂	22.52
MAN 97, SA60, SA81	382500, 397500	NO _x	28.30
		NO ₂	19.64
SA59	381500, 397500	NO _x	27.19
		NO ₂	19.00

Similar to emission factors, background concentrations for 2019 were utilised in preference to predicted background concentrations for the development opening year (2025). This provided a robust assessment and is likely to overestimate actual pollutant concentrations during the operation of the proposals.

Verification

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.

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.

For the purpose of this assessment model verification was undertaken for 2019, using traffic data, meteorological data and monitoring results from this year. MCC and SCC undertake periodic monitoring of NO₂ concentrations at 5 suitable roadside monitoring location within the assessment extents. The dispersion model was run with the traffic input data previously detailed for 2019 to predict the NO_x concentration at the monitoring locations.

The road contribution to total NO_x concentration was calculated from the monitored NO₂ result for use in the verification process. This was undertaken following the methodology contained within DEFRA guidance LAQM (TG16)**Error! Bookmark not defined.** The monitored annual mean NO₂ concentration and calculated road NO_x concentration are summarised in Table All 7.

Table All 7: Monitoring Results

Site ID	Monitored Road NO _x Concentration (µg/m ³)	Modelled Road NO _x Concentration (µg/m ³)	% Difference ((Monitored Modelled)/Monitored) * 100
MAN77	10.80	44.21	76%
MAN97	14.38	25.01	43%
SA81	39.52	56.61	30%
SA60	25.01	34.35	27%
SA59	9.23	26.63	65%

The monitored and modelled NO_x road contribution concentrations were graphed and the equation of the trend line based on the linear progression through zero was calculated, as shown in Graph 1. This indicated that a verification factor of **1.6099** was required to be applied to all NO_x modelling results, showing the model overestimated pollutant concentrations throughout the assessment extents.

Graph 1 - Verification Adjustment Factor

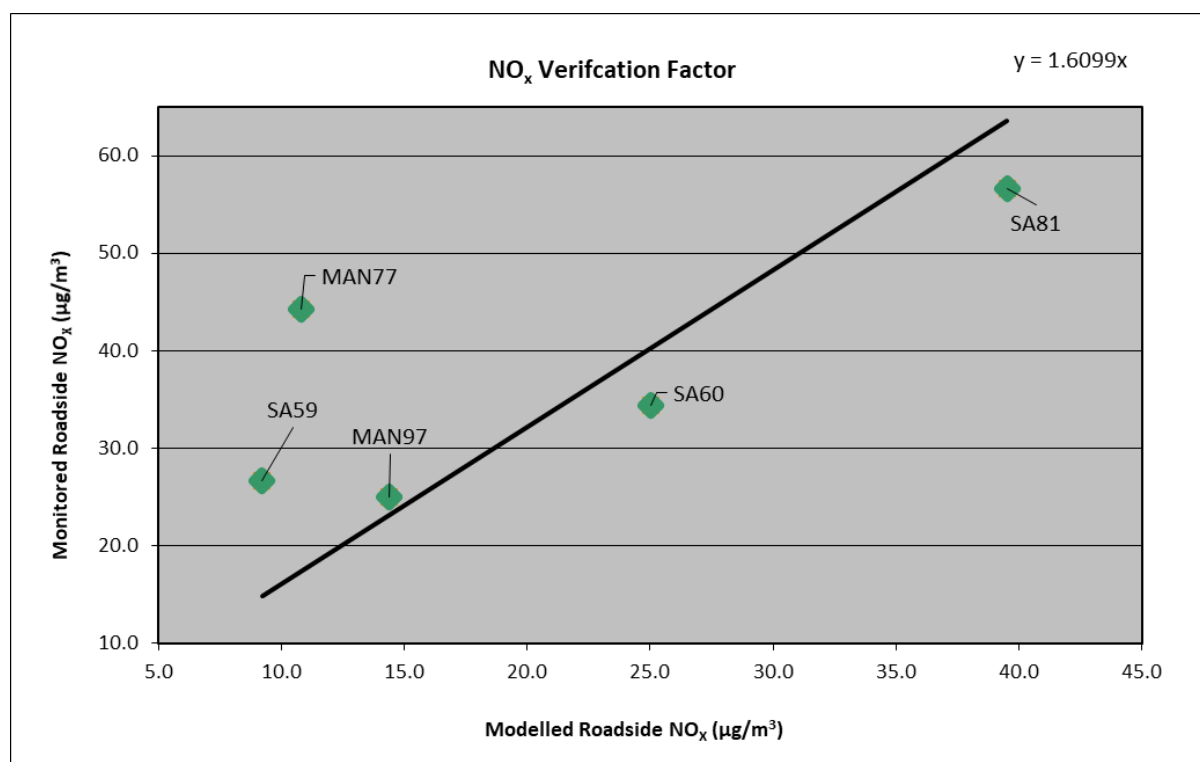


Table All 8 presents the monitored annual mean NO₂ concentrations and the adjusted modelled total NO₂ concentration based on the above verification factor.

Table All 8: Modelled Concentrations

Site ID	Monitored Road NO ₂ Concentration (µg/m³)	Adjusted Modelled Road NO ₂ Concentration (µg/m³)	% Difference ((Monitored Modelled)/Monitored) * 100
MAN77	43.66	31.33	28%
MAN97	32.29	31.39	3%
SA81	46.41	49.30	-6%
SA60	36.66	39.33	-7%
SA59	32.45	26.70	18%

As PM monitoring is not undertaken within the assessment extents, the NO_x adjustment factor of **1.6099** was utilised to adjust model predictions of PM in accordance with the guidance provided within LAQM (TG16)².