



AIR QUALITY TECHNICAL ADDENDUM

FOR

CROWN STREET PRIMARY SCHOOL, PHASE 2, MANCHESTER

AQ73415r3

12/04/2022

Prepared For

Renaker Build Limited
1st Floor,
NQ Building 47 Bengal Street,
Manchester,
Lancashire,
M4 6BB

Prepared By

Rachael Harrison
Ensafé Consultants
Unit 9,
Orbital 24,
Oldham Street,
Denton,
Manchester,
M34 3SU

DISTRIBUTION LIST

Issued To	Title / Company / Location
Pete Mills	Renaker Build Limited

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Prepared By	Rachael Harrison	Rachael Harrison	Rachael Harrison	Rachael Harrison
Job Title	Air Quality Consultant	Air Quality Consultant	Air Quality Consultant	Air Quality Consultant
Signature				
Checked By	Matt O'Neill	Matt O'Neill	Matt O'Neill	Matt O'Neill
Job Title	Head of Air Quality	Head of Air Quality	Head of Air Quality	Head of Air Quality
Signature				
Authorised By	Matt O'Neill	Matt O'Neill	Matt O'Neill	Matt O'Neill
Job Title	Head of Air Quality	Head of Air Quality	Head of Air Quality	Head of Air Quality
Signature				
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1.0 AIR QUALITY NOTE

1.1 Background

Ensafe were commissioned by Renaker Build Limited to undertake an Air Quality Environmental Impacts Assessment (EIA), in support of a hybrid planning application for Crown Street Phase 2. Crown Street Phase 2 was approved under application 126668/FO/2020 on 3 August 2020. The hybrid planning permission established the principle of development for the outline phase, Phase C (education facility/school).

Air quality was scoped into the EIA submitted and approved as part of the hybrid planning permission (ref: 126668/FO/2020) - Chapter 6 (Air Quality) Environmental Statement Volume 1.

This technical note has been prepared to support the reserved matters application for Phase C (education facility) of Crown Street Phase 2. It is understood that a technical note is required outlining that the conclusions of the original EIA assessment remain valid.

In addition, future year emissions modelling has been undertaken for the Proposed Development 2024 opening year. This approach considers the predicted improvements in future air quality along the road network.

1.2 Changes to Background Concentrations and Monitoring Data

The following section provides a summary of changes to baseline conditions which may affect the validity of the previous impact assessment, as well as potential exposure to elevated pollutant concentrations during the occupation of the Proposed Development.

At the time of the assessment, 2019 monitoring data undertaken by MCC and SCC had not been released, as such 2018 monitoring data, alongside 2018 background and emission factors formed the baseline for this assessment.

Table 1 provides a comparison of predicted DEFRA background pollutant concentrations used within the previous assessment, against those predicted for 2019 (the latest ratified and published data unaffected by COVID-19).

Table 1 Comparison of Background Pollutant Concentrations

Pollutant	Predicted Background Concentration ($\mu\text{g}/\text{m}^3$)		
	2018	2019	Change
NO _x	36.21	33.65	-2.56
NO ₂	23.37	22.79	-0.58
PM ₁₀	12.71	13.16	+0.45
PM _{2.5}	8.42	8.54	+0.12

DEFRA 1km x 1km Grid Square – 383500, 397500

As indicated in Table 1, predicted NO₂ background concentrations have reduced since 2018 remain below the annual mean Air Quality Objectives (AQO), with a marginal increase for PM₁₀ and PM_{2.5} Concentrations. Subsequently, it is considered that there would be no worsening of current baseline conditions than those assessed within the previous submitted ES chapter.

Regarding MCC and Salford City Council (SCC) Air Quality monitoring data, a comparison of 2018 and 2019 monitoring results are provided in Table 2.

Table 2 Comparison of Monitored Pollutant Concentrations

ID	Type	NGR (m)		Annual Mean Concentration ($\mu\text{g}/\text{m}^3$)		
		X	Y	2018	2019	Change
MAN29A	Urban Traffic	384117	397505	58.80	55.40	-3.37
MAN77	Urban Centre	383602	397488	40.99	43.66	+2.67
MAN82	Urban Traffic	384233	397287	52.80	51.60	-0.37
SA59*	Urban Traffic	381822	397895	33.33	32.40	-0.87
SA60*	Urban Traffic	382445	397724	40.20	36.66	-3.57

*SCC Diffusion tube

Similar to background concentrations, the monitored data presented in Table 2 indicates that pollutant concentrations have undergone a net decrease within the study area since the completion of the previous assessment, with the exception of MAN77 which is considered least representative of the proposed development site, given its location within a street canyon, adjacent the rail lines.

The reductions to both background concentrations predicted by DEFRA and monitored NO_2 concentration undertaken by the MCC and SCC, would consequently lead to a reduction of baseline concentration and associated impacts.

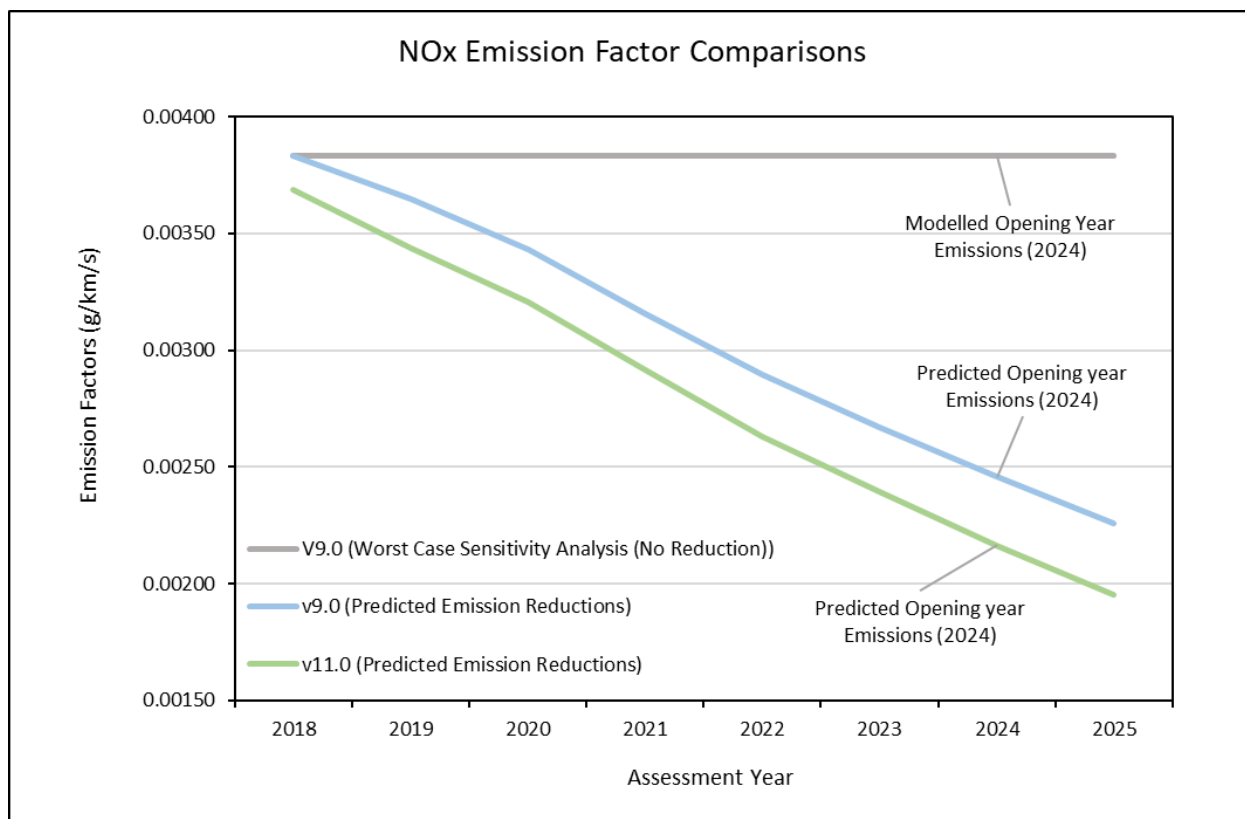
1.3 Change to Emission Factors

Air quality is predicted to improve in the future (due to the current shift towards a greater production and uptake of low emission vehicles, supported by national government targets). However, in order to provide a robust assessment, the previous assessment used 2018 emission factors within the dispersion model, to represent the anticipated future year of the development.

As such, the use of 2024 traffic data with 2018 emission factors obtained from Eft v9.0, within the previous assessment was considered to provide an absolute worst-case scenario, which significantly overestimates potential impacts. A sufficient level of confidence can therefore be placed upon the previous assessment conclusions regarding impact significance.

Since the previous AQA, EFTv11.0 was released which provides more realistic emission profile based on real world simulations. A comparison of NO_x emission factors obtained from v9.0 and v11.0 are provided in Graph 1.

Graph 1 NO_x Emission Factor Comparisons



* Factors based on 1,000 AADT (0% HDV) average speed of 50km/h.

As detailed in Graph 1, this worse case approach does not consider any future emission reductions and accounts for an 86% increase when compared to 2024 predictions provided by Eft v11.0.

Consideration of 2024 future year emissions across the Proposed Development site is outlined within Section 2.0.

2.0 FUTURE YEAR MODELLING SCENARIO

2.1 Operational Phase Assessment

Additional detailed dispersion modelling has been undertaken to quantify NO₂, PM₁₀ and PM_{2.5} concentrations across the site during the 2024 opening year. The following modelling scenarios were utilised during the assessment:

- 2019 as baseline year for verification purposes against latest ratified data;
- Opening year do-something (DS) (predicted traffic flows in 2024 should the proposals be completed, with 2024 emissions factors)

In light of expected emission improvements to the national vehicle fleet guided by government policy, it would be unrealistic not to assume a reduction to vehicle emission factors in future years, given the anticipated development year of 2024.

The 2024 scenario assumes an emission drop off based on assumptions provided by the Emission Factor Tool Kit (Eft v11.0) supported by the uptake of low emission vehicles and government incentives and targets concerning fleet proportions by 2030, as summarised within Graph 1.

2.1.1 Future Exposure

Annual mean NO₂, PM₁₀ and PM_{2.5} concentrations were predicted across the Proposed Development for the 2024 DS scenario at a height of 1.5m, 5.1m, 8.7m and 12.9m to represent exposure across the ground to third (roof) floor level, as shown in Figures 7 to 10 within Appendix A.

Nitrogen Dioxide (NO₂)

Predicted annual mean NO₂ concentrations across the Proposed Primary School Development site during the DS scenario are summarised in Table 3.

Table 3: Modelling Results - Annual Mean NO₂ at Proposed Development

Floor Level	Predicted 2024 Annual Mean NO ₂ Concentration (µg/m ³)
Ground (1.5m)	27.5 – 33.7
First Floor (6.0m)	26.8 – 30.6
Second Floor (9.0m)	25.4 – 27.0
Roof Floor (12.3m)	23.7 – 23.8

The predicted concentrations shown in Table 3 indicate that there were no exceedances of the AQO across sensitive uses of the Proposed Development. As such, it is considered that annual mean NO₂ levels at the Proposed Development site should not be viewed as a constraint to development.

Predictions of 1-hour NO₂ concentrations were not produced as part of the dispersion modelling assessment. LAQM.(TG16)¹ states if annual mean NO₂ concentrations are below 60µg/m³ then it is unlikely that the 1-hour AQO will be exceeded. As such, based on the results in Table 3, it is not predicted that on-site concentrations will exceed the 1-hour mean AQO for NO₂.

Based on the results of the dispersion modelling assessment, the site is considered to be suitable for educational use without the implementation of mitigation techniques to protect future site users from elevated NO₂ concentrations.

Particulate Matter (PM₁₀ & PM_{2.5})

Predicted annual mean PM₁₀ and PM_{2.5} concentrations across the Proposed Development site during the DS scenario are summarised in Table 4.

Table 4: Modelling Results - Annual Mean PM₁₀ and PM_{2.5} at Proposed Development

Floor Level	Predicted 2024 Annual Mean Concentration (µg/m ³)	
	PM ₁₀	PM _{2.5}
Ground (1.5m)	15.5 – 17.8	9.7 – 11.0

The predicted concentrations shown in Table 4 indicate that there were no exceedances of the annual mean AQOs for PM₁₀ or PM_{2.5} throughout the modelling area. As such, it is considered that annual mean PM₁₀ or PM_{2.5} levels at the Proposed Development site should not be viewed as a constraint to development.

Background PM₁₀ and PM_{2.5} levels are likely to be lower at elevated heights due to increased distance from emission sources, such as roads. Therefore, predicted concentrations at heights above ground floor level are considered acceptable in regards to future exposure and have not been assessed further.

Based on the results of the dispersion modelling assessment, the site is considered to be suitable for proposed end use without the implementation of mitigation techniques to protect future site users from elevated PM₁₀ and PM_{2.5} concentrations.

2.1.2 Discussion

The following section provides a summary of the changes to 2018 emission scenario undertaken within the 2020 ES submission compared to the 2024 emission scenario.

Table 5 outlines the comparison of 2018 emissions and predicted 2024 emissions for the 2024 opening year of the Proposed Development. Exceedances are shown in **bold**.

Table 5: Modelling Results – Comparison of NO₂ Exposure Levels

Floor Level	Predicted 2024 Annual Mean NO ₂ Concentration (µg/m ³)		
	2018 Emissions	2024 Emissions	Change
Ground (1.5m)	37.6 – 47.5	27.5 – 33.7	(-) 10.1 – 13.8
First Floor (6.0m)	35.9 – 41.1	26.8 – 30.6	(-) 9.1 – 10.5
Second Floor (9.0m)	33.7 – 35.7	25.4 – 27.0	(-) 8.3 – 8.7
Roof Floor (12.3m)	31.9 – 32.4	23.7 – 23.8	(-) 8.2 – 8.6

Table 5 indicates that pollutant concentrations across the development site are anticipated to decrease when considering the 2024 future year emissions.

The reductions to anticipated vehicles emissions in 2024 would consequently lead to a reduction of concentration and associated impacts across the development site in the 2024 opening year scenario, when compared to the 2018 emissions factor scenario.

Further comparisons of the maximum predicted NO₂, PM₁₀ and PM_{2.5} concentrations across the site, against the national air quality objectives are outlined within **Table 6**.

It should be noted that ground floor concentrations have been utilised within this table, as these represent the maximum predicted exposure limits across the site during the respective scenarios.

Table 6: Comparison of NO₂ Exposure Levels against National Objectives

Pollutant	Air Quality Objectives	Maximum Predicted 2018 & 2024 Annual Mean NO ₂ Concentration (µg/m ³) at Ground Floor Level (1.5m)			
	Concentration (µg/m ³)	2018 Emissions	Below objective?	2024 Emissions	Below objective?
NO ₂	40	47.5	No	33.7	Yes
PM ₁₀	40	17.6	Yes	17.8	Yes
PM _{2.5}	25	-*	Yes	11.0	Yes

*PM_{2.5} was not assessed during the 2020 ES submission

As indicated within Table 6, there were exceedances in the annual mean AQO for NO₂ during the 2018 emissions scenario at sensitive locations across the proposed development. During the 2024 emissions scenario the pollutant levels are anticipated to improve, with concentration levels predicting to fall below the national objectives.

However, it should be noted that there is current uncertainty over NO₂ concentrations within the UK not reducing as previously expected due to the shifts towards a greater production and uptake of electric and hybrid vehicles. As such it is considered, that the use of 2024 traffic data, together with 2018 emission factors is considered to provide a worst-case, conservative scenario and therefore a sufficient level of confidence can be placed within the predicted emission levels.

3.0 MITIGATION MEASURES

Ensafe previously submitted a technical note (AQ107792c1) outlining the mitigation requirements for both the internal and external area of the proposed school for the 2018 emissions scenario, this was further detailed within the 2020 ES Chapter. The recommendations provided within these reports remain valid, however the further 2024 emissions modelling scenario outlined within Section 2.1.1, provides an alternative conclusion of the mitigation measures to be considered for the proposed development. These measures will ensure that future users are not exposed to elevated pollutant levels.

3.1 Onsite Mitigation Measure

3.1.1 Primary School Internal Areas

2018 Emissions Scenario

The inclusion of protective mitigation measures in the form of mechanical NO_x filtration would be required to all internal areas throughout the proposed primary school. Given the predicted spatial extents of annual mean NO₂ exceedances, the following recommended mitigation measures have been incorporated into the schools design, throughout internal ground and first floor sensitive use at the proposed development site.

The implementation of proven systems would ensure future pupils would not be exposed to unacceptable NO₂ concentrations. It is not possible to draw clean air from upper floors, and as such it would be necessary to incorporate specialised NO_x filtration units to all ventilation systems throughout the proposed school. Additionally, a high specification of air tightness on the windows and doors should be incorporated within the development to ensure internal areas are sufficiently ventilated by clean air from the mechanical NO_x filtration systems.

It has been confirmed by MEP Design, the appointed engineering consultants for the scheme, that Mechanical Ventilation with Heat Recovery (MVHR) with the addition of NO_x filtration units will be implemented throughout the design of the Proposed Development. This alongside a high specification of air tightness will ensure that the internal areas will be suitably ventilated via mechanical systems when the windows are shut. As such, the inclusion of these measures within the development design will reduce potential exposure of future site users to elevated pollutant concentrations.

2024 Emissions Scenario

Where the 2024 emissions scenario is to be referenced, the site falls below the annual mean objectives for NO₂. As such there is no direct requirement to mitigate against NO₂ level under current LAQM TG (16) guidance¹.

However, given the proposed educational use, it is recommended that MVHR systems and high specification of air tightness are maintained through the proposed building, with NO_x filtration units to be implemented on the ground floor level (1.5m) as a good practice measure. The MVHR system should draw air from roof level in order to provide future users with provision of 'fresh' air within internal areas.

However, if the MVHR cannot provide air drawn from a suitable location of 'fresh' air then the use of MVHR with NO_x 'filtration' should be considered throughout the building.

3.1.2 Primary School External Areas

In accordance with LAQM (TG16)¹ the 1 hour mean AQO is applicable to outdoor locations where members of the public might reasonably be expected to spend one hour or longer. In context of the proposed primary school this averaging period relates to external ground floor and roof level play areas in which pupils would be present during recreational times.

¹ Local Air Quality Management Technical Guidance 2016 LAQM.TG(16), DEFRA, 2021

1-hour NO₂ concentrations assessed during the 2020 ES Chapter are not predicted to exceed the relevant AQO of 200 µg/m³ at any location within the Phase II site. Subsequently, external ground and roof level play areas are considered to be suitable for proposed use without the implementation of mitigation measures to protect future users from elevated 1-hour mean NO₂ concentrations.

Additionally, as mentioned given the time between the 2019 baseline and 2024 future year, local air quality is predicted to improve during future years, due to improved vehicle emission standards associated with a shift towards 'greener' vehicle fleet compositions such as, electric vehicles (see Section 2.1.1).

3.2 Operational Phase Offsetting Measures

Although it considered that associated operational impacts remain unaffected from the previous assessment, there is still a requirement to secure a reduction in pollution concentrations associated with development generated road vehicle exhaust emissions.

No additional car parking provision is included as part the reserved matters proposals for Phase C, the education facility. Public parking is however to be provided within the detailed planning permission for Crown Street Phase 2.

Given the schools location within a City Centre is it anticipated that the majority of pupils will be from the local area and so walking will be a popular means of accessing the school, reducing the need for car parking in relation to the school. In the event that parking is required, visitors will have the ability to make use of the public car park that is being delivered as Phase D of the Crown Street Phase 2 proposals.

The following offsetting measures are therefore proposed as and will be implemented within the design and operation of the wider hybrid application;

- Electric charging provision of 10% is to be provided within the public parking spaces which form part of the under the outline planning application (126668/FO/2020)
- Cycle parking provision will be located within the public realm being delivered as part of Crown Street Phase 2
- Production and upkeep of Sustainable Travel Plans.

It is considered that the above measures are proportional to the nature and scale of the Proposed Development, and will secure a reduction in development associated road vehicle exhaust emissions.

4.0 CONCLUSION

An air quality assessment provided within the outline ES application in 2020 was undertaken to determine pollutant levels across the proposed school development during 2018 baseline data. Following submission, it has been requested by MCC that further assessment was undertaken as part of Reserved Matters application, to determine that air quality at the application site was not to exceed the levels previously assessed during the developments 2024 opening year.

A review of data used to undertake the previous assessment demonstrates that air quality during 2018 to 2024 has improved since the previous submission. Reductions in background concentrations predicted by DEFRA and monitored pollutant concentrations undertaken by the MCC indicate that the previous assessment was highly conservative in its consideration of pollutant concentrations in relation to the national Air Quality Objectives (AQO).

Furthermore, advancement to vehicle technologies since 2018, as well as real world monitoring have resulted in wholesale reduction to road vehicle emission factors. When comparing previous and current baseline scenarios (2018 and 2019, respectively) this indicated a reduction of 7% between 2018 and 2019 emission factors.

Additional future year modelling using 2024 emission factors the predicted pollutant concentrations levels across the proposed development during the 2024 opening to below the relevant air quality objectives at proposed sensitive teaching areas within the Proposed Development.

Based on the above, Air Quality impacts associated with the Proposed Development will be below those previously predicted within the outline application ES, and a worst-case scenario has been robustly assessed throughout all elements of the assessment.

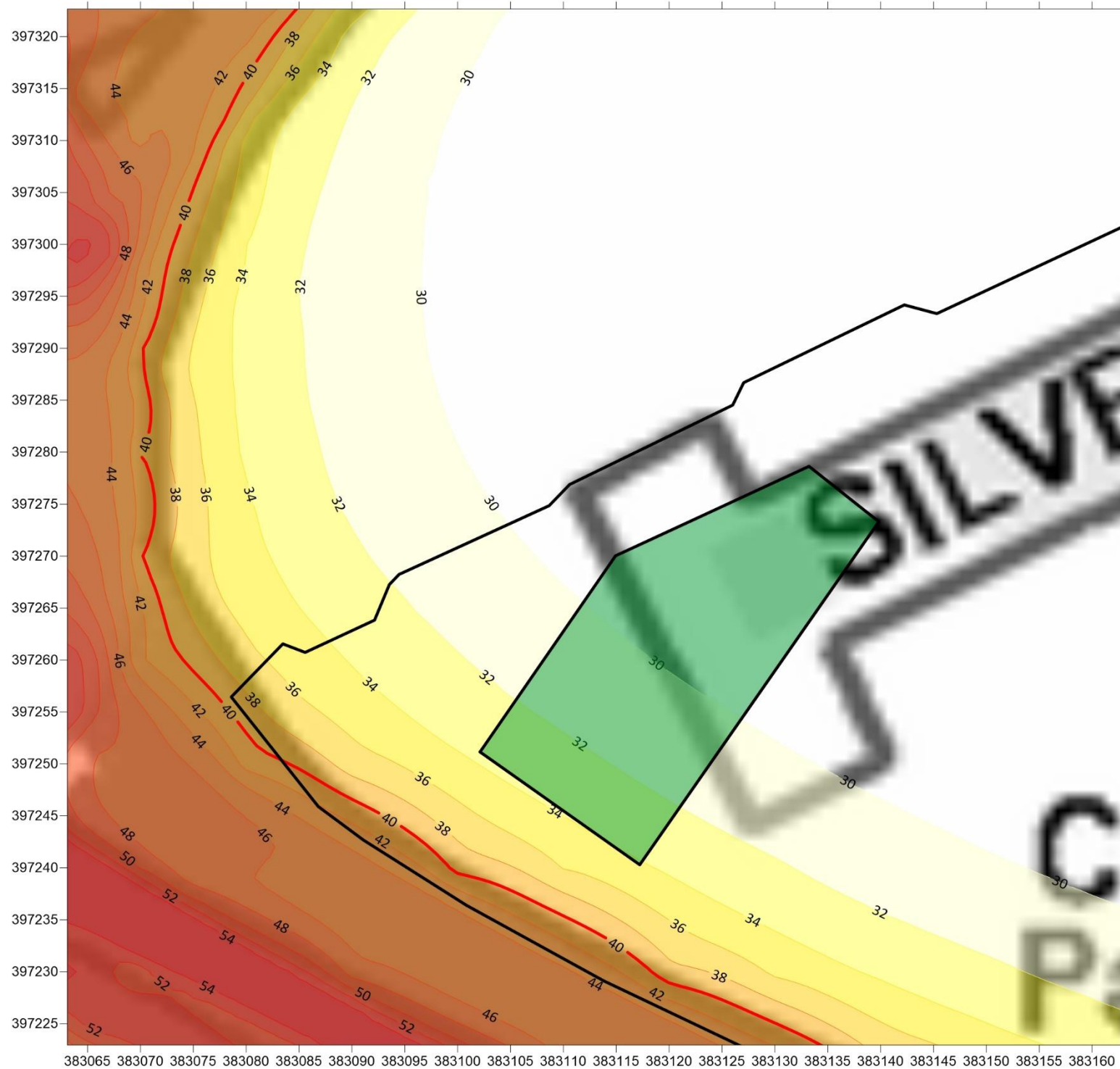
It is recommended that mechanical ventilation with NO_x filters are to be installed within sensitive teaching spaces of the development as good practice. As air quality improves it is considered that the reliance on NO_x filtration will be reduced at the Proposed Development site.

Outdoor teaching and amenity spaces are not predicted to exceed the annual or 1 hour mean for NO₂ and therefore are considered suitable for the proposed end use without the implementation of restricted play periods or protective mitigation techniques to protect future amenity.

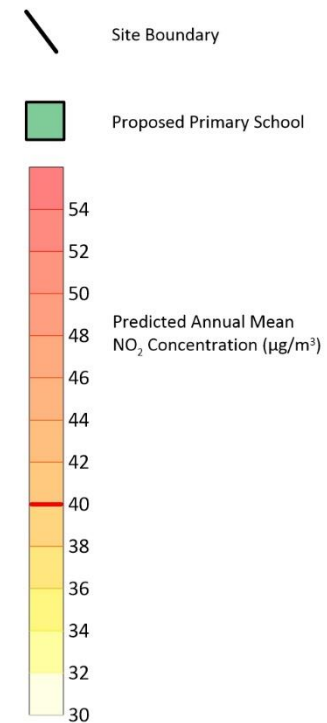
It is therefore considered that no further assessment is necessary, and furthermore Air Quality should not be viewed as a constraint to planning approval.



APPENDIX A - FIGURES



Legend



Title

Figure 1
Predicted Annual Mean NO₂
Concentrations (µg/m³) 2024

Ground Floor (z = 1.5m)

Project

Crown Street Primary School, Manchester

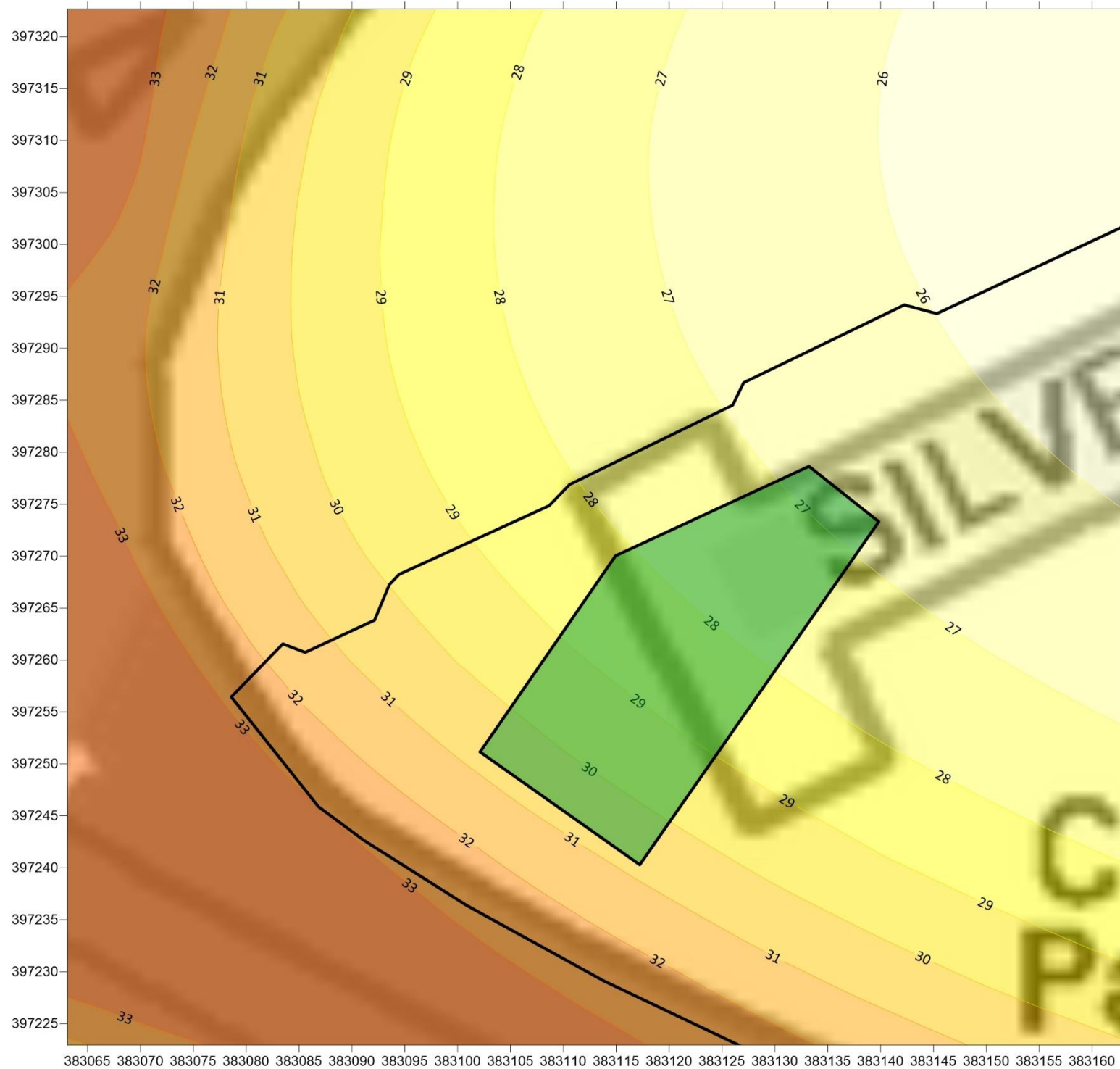
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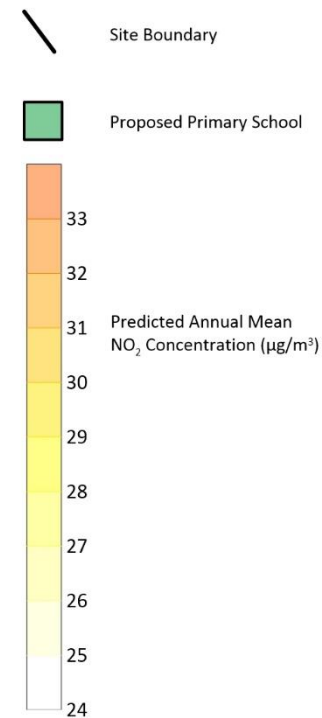
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Manchester, M34 3SU
Tel – 0161 523 4640
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Legend



Title

Figure 2
Predicted Annual Mean NO₂
Concentrations (µg/m³) 2024

First Floor (z= 5.1m)

Project

Crown Street Primary School, Manchester

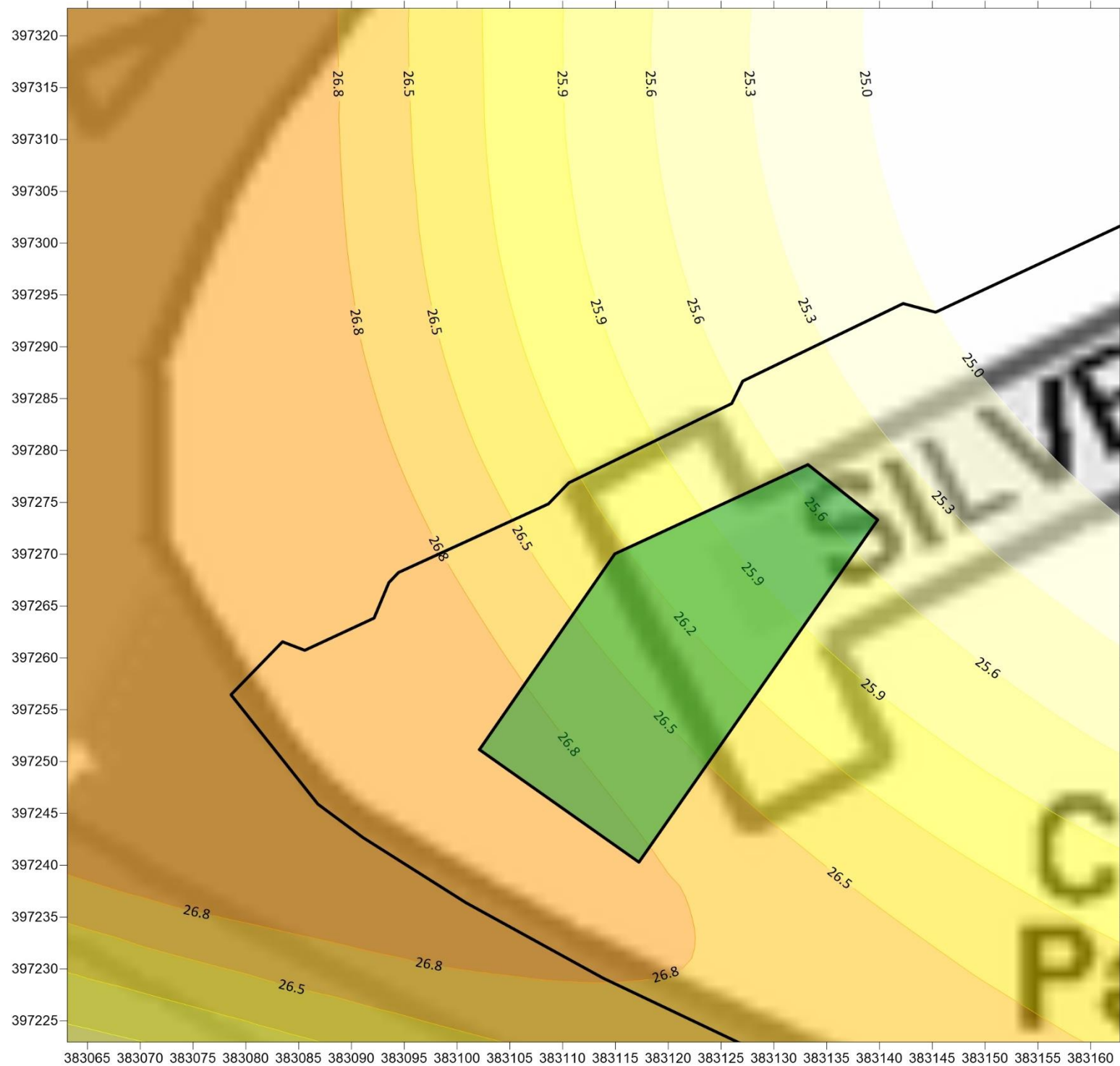
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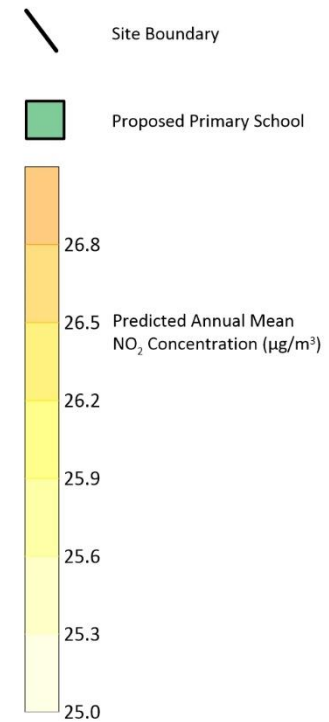
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Legend



Title

Figure 3
Predicted Annual Mean NO₂
Concentrations (µg/m³) 2024
Second Floor (z= 8.7m)

Project

Crown Street Primary School, Manchester

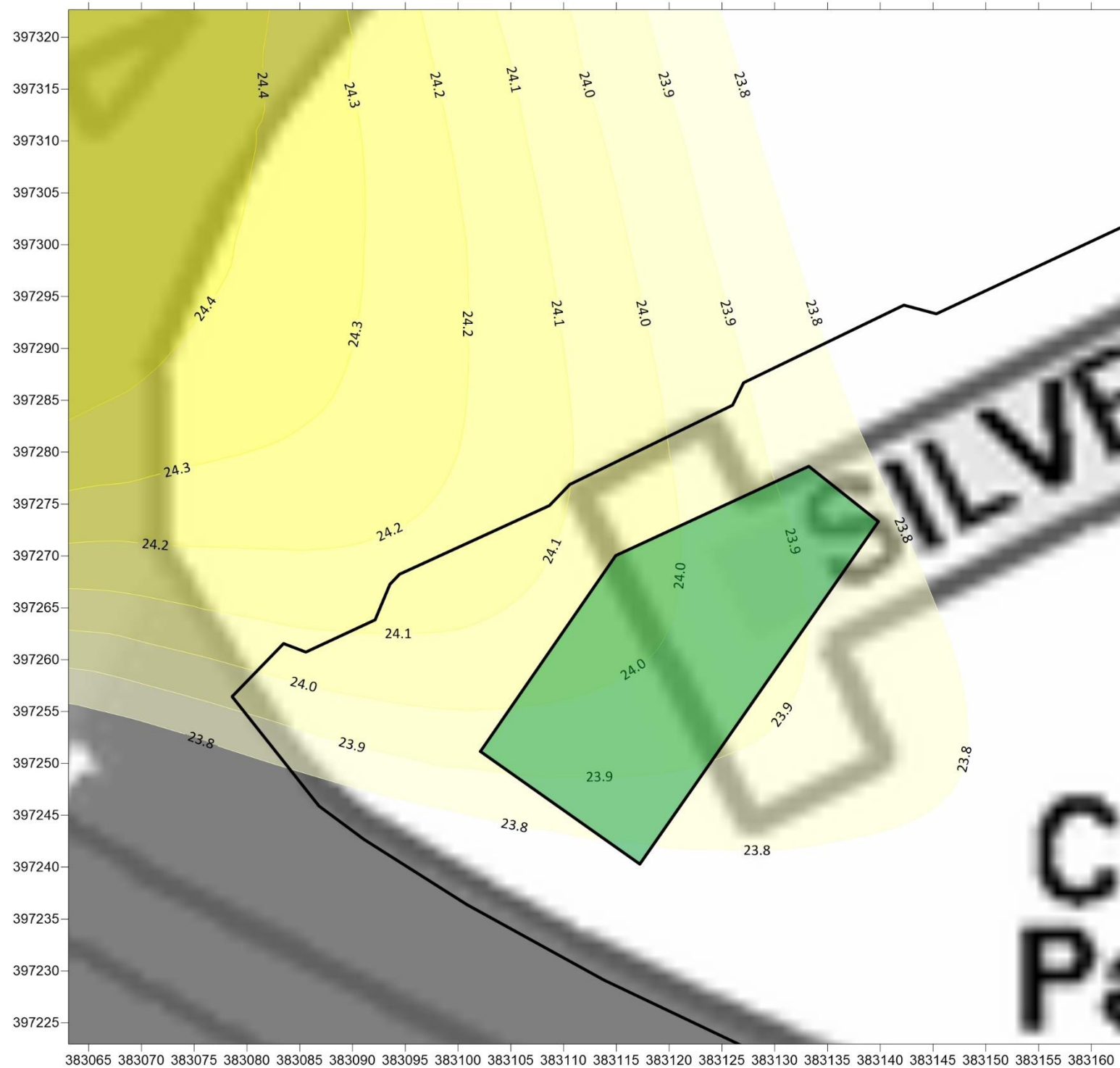
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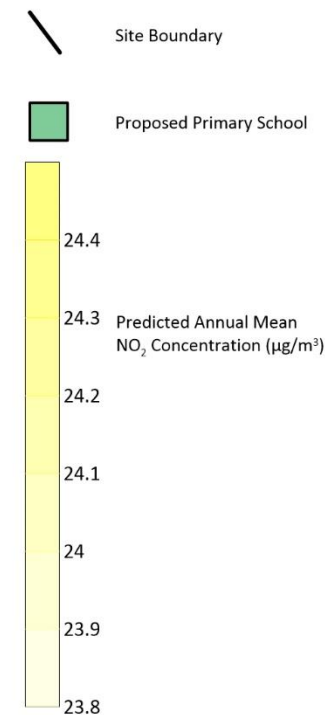
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Title

Figure 4
Predicted Annual Mean NO₂
Concentrations (µg/m³) 2024
Roof Level (z=12.9m)

Project

Crown Street Primary School, Manchester

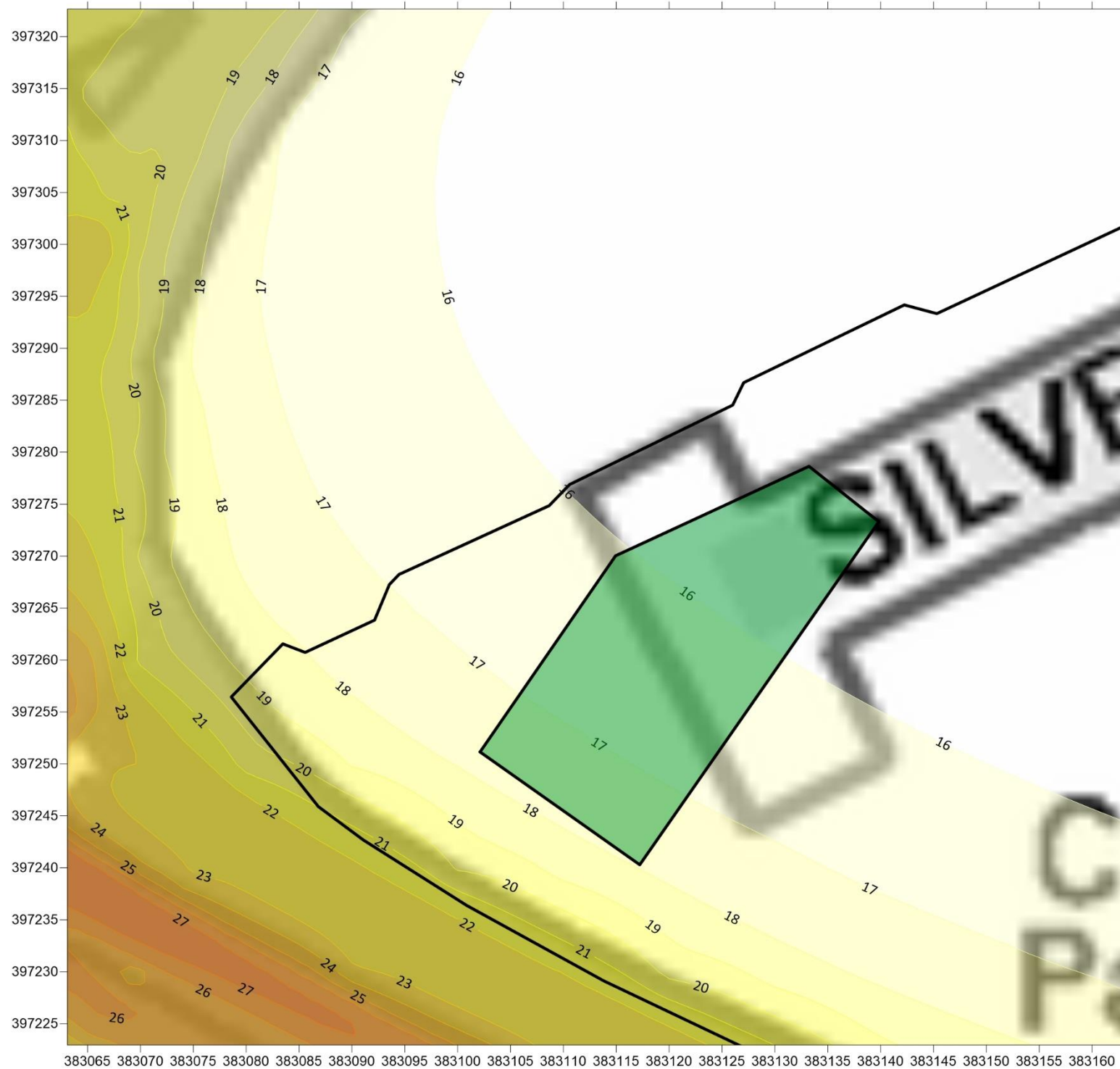
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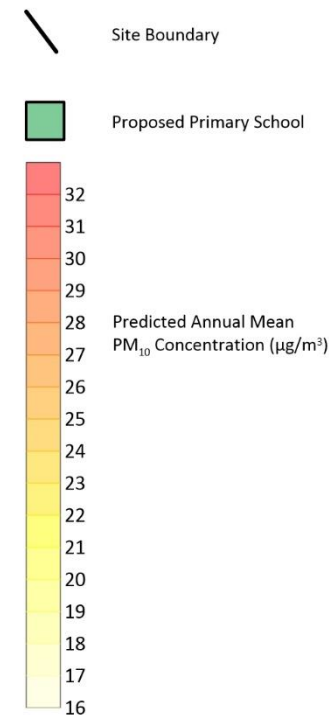
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Legend



Title

Figure 5
Predicted Annual Mean PM₁₀
Concentrations (µg/m³) 2024

Ground Level (z=1.5m)

Project

Crown Street Primary School, Manchester

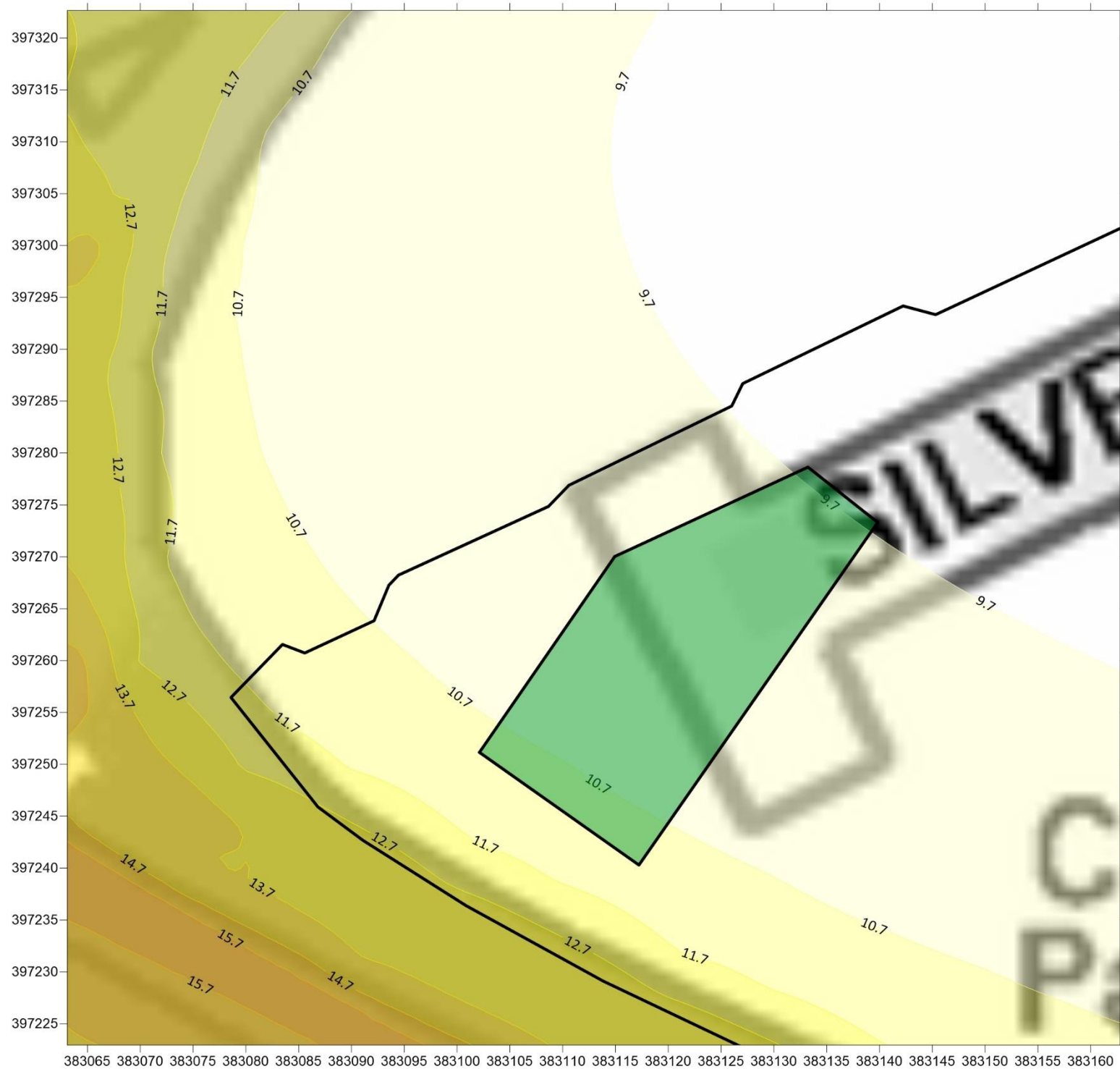
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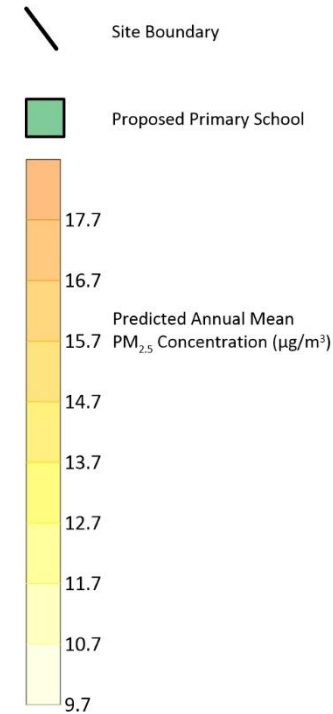
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Title

Figure 6
Predicted Annual Mean PM_{2.5}
Concentrations (µg/m³) 2024
Ground Level (z=1.5m)

Project

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Project Number

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APPENDIX B – ASSESSMENT INPUTS



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 pollutant 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.TG(16)¹, and the EPUK and IAQM guidance

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.

Assessment Area

Ambient concentrations were predicted over the Proposed Development site and surrounding highway network. One Cartesian grid was included in the model over the area at approximately NGR: 383040, 397130 and 383270, 397360 at height of 1.5m, to represent the proposed ground floor level for the 2024 opening year scenario.

Results were subsequently used to produce contour plots within the Surfer software package. Reference should be made to Figure 6 within Appendix A for a graphical representation of the verification inputs and operation phase DS extents, respectively.

Traffic Flow Data

A number of road links used in the assessment were not provided by Curtins and as such were obtained from a number of sources. Traffic data surrounding the Proposed Development was obtained from the agreed TfGM SATURN model provided by Vectos. This dataset fully accounts for planned growth in line with relevant committed developments and is considered to be a robust base upon to assess Proposed Development trips.

Data utilised in the verification process, including Regent Road, Trinity Way, Ordsall Lane and Oldfield Road were obtained from the Department for Transport (DfT).

It should be noted that the SATURN model and DfT matrix are suitable source of data for air quality assessments and are therefore considered to provide a reasonable representation of traffic flows in the vicinity of the site.

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. The DfT matrix is referenced in DEFRA guidance LAQM.TG(16) 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 2024 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 B1.

Table B1: 2019 Verification Traffic Data

Road Link		Road Width (m)	24 Hour AADT Flow	HDV Pop (%)	Mean Vehicle Speed (km/hr)	Data Source
L1	A56 (W)	12.5	33,055	3.0	40	Curtins
L2	A56 (W) Slow Down (West)	11.5	16,527	3.0	20	Curtins
L3	A56 (W) Slow Down (East)	9.5	16,527	3.0	10	Curtins
L4	A56 Roundabout	11.3	14,574	3.7	10	SATURN
L5	Regent Road Speed Up(South)	11.4	26,067	4.0	15	Vectos
L6	Regent Road (South)	10.5	33,445	3.1	55	Vectos
L7	A57 (E)	7.0	26,756	3.1	55	Vectos
L8	Regent Road Slow Down (North)	16.4	33,445	3.1	15	Vectos
L9	Regent Road (North)	10.5	33,445	3.1	55	Vectos
L10	A57 (W)	7.3	26,756	3.1	55	Vectos
L11	Regent Road Onslip	6.3	6,689	3.1	32	Vectos
L12	Regent Road Offslip	7.5	6,689	3.1	32	Vectos
L13	A56 Roundabout	16.0	15,320	4.2	12	SATURN
L14	A56 Across Roundabout (East)	7.5	8,264	3.0	32	Curtins
L15	A56 Across Roundabout (West)	7.5	5,837	3.0	32	Curtins
L16	A56 Roundabout	11.0	15,320	4.2	12	SATURN
L17	A56 Roundabout	11.0	17,029	3.6	36	SATURN
L18	A56 roundabout (Manc Way)	11.0	17,029	3.6	36	SATURN
L19	A56 Roundabout	13.0	17,711	2.6	15	SATURN
L20	Chorlton Road Slow Down (North)	6.0	6,060	1.0	15	Curtins
L21	Chorlton Road Slow Down (South)	6.2	6,060	1.0	25	Curtins
L22	A56 Roundabout	12.2	14,574	3.7	15	SATURN
L23	Chorlton Road (North)	6.0	6,060	1.0	40	Curtins
L24	Chorlton Road (South)	6.3	6,060	1.0	40	Curtins

Road Link		Road Width (m)	24 Hour AADT Flow	HDV Pop (%)	Mean Vehicle Speed (km/hr)	Data Source
L25	Manc Way East (up to slip roads)	9.5	37,282	4.0	60	Curtins
L26	Manc Way West (up to slip roads)	9.5	37,282	4.0	60	Curtins
L27	Manc Way Onslip	7.3	9,361	4.6	45	SATURN
L28	Manc Way Offslip	7.3	9,992	2.9	50	SATURN
L29	Manc Way Offslip Medlock Street	7.5	10,488	2.1	15	SATURN
L30	Manc Way Onslip Princess Parkway	7.3	10,488	2.1	32	SATURN
L31	Manc Way East (up to University)	8.0	37,282	4.0	55	Curtins
L32	Manc Way West (up to University)	8.0	37,282	4.0	55	Curtins
L33	Princess Parkway	10.7	24,490	2.0	50	Curtins
L34	Princess Parkway	8.2	24,490	2.0	50	Curtins
L35	Princess Parkway Onslip	7.3	12,245	2.0	25	Curtins
L36	Medlock Street Offslip	7.6	7,541	1.0	25	Curtins
L37	Medlock Street Slow Down	14.5	15,082	1.0	25	Curtins
L38	Medlock Street (River Street to Little Peter Street)	14.6	15,522	1.0	40	Curtins
L39	Albion Street	14.9	15,522	1.0	35	Curtins
L40	Medlock Street Slow Down	14.7	15,522	1.0	15	Curtins
L41	River Street	9.5	1,711	0.0	32	Curtins
L42	City Road East/Great Jackson Street	8.2	2,050	1.0	20	Curtins
L43	City Road East/Great Jackson Street (Street Canyon Section)	17.8	2,050	1.0	35	Curtins
L44	City Road East/Great Jackson Street	8.2	2,050	1.0	35	Curtins
L45	City Road East Slow Down	9.1	3,504	1.0	30	Curtins
L46	Great Jackson Street to Bridgewater Viaduct	5.6	1,752	1.0	15	Curtins
L47	Bridgewater Viaduct to Great Jackson Street	4.5	1,752	1.0	15	Curtins
L48	Garwood Street	8.6	1,226	0.0	32	Curtins
L49	Garwood Street Onslip	5.5	613	0.0	25	Curtins
L50	Garwood Street Offslip	5.5	613	0.0	15	Curtins
L51	Chester Road East (West of Great Jackson Street)	7.3	5,837	3.0	40	Curtins
L52	Chester Road East (West of Great Jackson Street)	7.3	11,674	3.0	40	Curtins
L53	Chester Road East (A56 Roundabout Exit)	3.8	5,837	3.0	20	Curtins
L54	Chester Road East (West of Great Jackson Street)	7.5	5,837	3.0	25	Curtins
L55	Chester Road East (West of Great Jackson Street)	10.8	11,674	3.0	20	Curtins
L56	Chester Road East (A56 Roundabout Approach)	5.6	5,837	3.0	20	Curtins

Road Link		Road Width (m)	24 Hour AADT Flow	HDV Pop (%)	Mean Vehicle Speed (km/hr)	Data Source
L57	Chester Road East (Great Jackson Street to Old Deansgate) Eastbound	7.3	11,143	3.0	32	Curtins
L58	Chester Road East (Great Jackson Street to Old Deansgate) Westbound	6.3	11,143	3.0	32	Curtins
L59	A56 Bridgewater Viaduct	10.8	17,704	3.0	32	Curtins
L60	Old Deansgate Slow Down	9.3	4,593	1.0	40	Curtins
L61	Old Deansgate	6.5	4,593	1.0	40	Curtins
L62	Little Peter Street	6.1	1,553	0.0	15	Curtins
L63	Whitworth Street West - Slow Down	11.5	11,369	1.0	15	Curtins
L64	Whitworth Street West	11.5	11,369	1.0	48	Curtins
L65	Whitworth Street East - Slow Down	10.5	8,820	1.0	15	Curtins
L66	Whitworth Street East	10.5	8,820	1.0	48	Curtins
L67	Deansgate	12.0	16,325	3.0	48	Curtins
L68	Albion Street	15.6	15,448	3.0	35	Curtins
L69	Hewitt Street	5.0	496	0.0	15	Curtins
L70	Hewitt Street	5.1	496	0.0	30	Curtins
L71	Melborne Street	6.5	127	0.0	32	Curtins
L72	Regent Road (West) Slow	11.1	33,445	3.5	15	Vectos
L73	Regent Road (West) Slow	10.2	26,067	4.0	20	Vectos
L74	Regent Road (West) Slow	7.3	26,067	4.0	20	Vectos
L75	Regent Road (East) Slow	19.0	26,067	4.0	15	Vectos
L76	Regent Road (East) Slow	9.8	26,067	4.0	15	Vectos
L77	Regent Road (East) Slow	9.8	26,067	4.0	15	Vectos
L78	Regent Road (West) Slow	7.0	26,067	4.0	32	Vectos
L79	Regent Road (West) Slow	10.0	26,067	4.0	15	Vectos
L80	Regent Road (East) Slow	7.2	26,067	4.0	32	Vectos
L81	Regent Road (East) Slow	7.3	26,067	4.0	15	Vectos
L82	Regent Road (West) Speed Up	7.1	26,067	4.0	15	Vectos
L83	Regent Road (West)	7.5	26,067	4.0	32	Vectos
L84	Regent Road (East) Slow Down	9.5	26,067	4.0	15	Vectos
L85	Regent Road (East)	7.5	26,067	4.0	35	Vectos
L86	Liverpool Road Slow Down	10.3	5,551	2	15	DfT
L87	Water Street/Liverpool Street	8.2	5,551	2.1	40	Vectos
L88	Water Street Slow Down	15.6	6,375	2.0	15	Vectos

Road Link		Road Width (m)	24 Hour AADT Flow	HDV Pop (%)	Mean Vehicle Speed (km/hr)	Data Source
L89	Trinity Way Northbound	8.3	13,066	3.1	20	Vectos
L90	Trinity Way Northbound	7.2	11,682	3.1	40	Vectos
L91	Trinity Way Southbound	8.3	11,682	3.1	20	Vectos
L92	Trinity Way Southbound	7.9	13,066	3.1	40	Vectos
L93	Trinity Way onto Regent Road	10.8	6,533	3.1	15	Vectos
L94	Trinity Way onto Egerton Street	7.1	6,533	3.1	15	Vectos
L95	Oldfield Road (North) Slow Down	13.1	9,755	2.3	15	DfT
L96	Oldfield Road (North)	9.9	9,755	2.3	40	DfT
L97	Oldfield Road (South) Slow Down	12.4	7,085	2.7	15	DfT
L98	Oldfield Road (South)	8.2	7,085	2.7	40	DfT
L99	Ordsall Lane (South)	8.7	11,421	1.8	32	DfT
L100	Ordsall Lane (South) Slow Down	13.2	11,421	1.8	10	DfT
L101	Regent Road onto Ordsall Lane	4.0	3,807	1.8	10	DfT
L102	Ordsall Lane onto Regent Road	4.1	3,807	1.8	10	DfT
L103	Ordsall Lane/Regent Road Junction	15.0	3,807	1.8	10	DfT
L104	Ordsall Lane (North) Slow Down	18.3	9,083	1.8	10	DfT
L105	Ordsall Lane (North)	10.3	9,083	1.8	32	DfT
L106	A34 Irwell Street - South of Chapel Street - Northbound	7.7	15,171	2.7	25	DfT
L107	A34 Irwell Street - South of Chapel Street (Junction Slowdown) Northbound	11.2	15,171	2.7	15	DfT
L108	Trinity Way Northbound - Chapel Street Junction	9.1	15,171	2.7	40	DfT
L109	Trinity Way Northbound - Between New Bridge Street and Bloom Street	8.2	15,171	2.7	40	DfT
L110	A34 Irwell Street - South of Chapel Street - Southbound (Junction Slowdown)	7.8	15,171	2.7	15	DfT
L111	A34 Irwell Street - South of Chapel Street - Southbound	6.7	15,171	2.7	25	DfT
L112	Trinity Way Southbound - Chapel Street Junction	9.6	15,171	2.7	40	DfT
L113	Trinity Way Southbound - Between New Bridge Street and Bloom Street	8.0	15,171	2.7	40	DfT
L114	A6 Chapel Street Eastbound (Junction Slowdown) - West of A34	8.9	8,713	9.4	15	DfT
L115	A6 Chapel Street Eastbound - West of A34	7.0	8,713	9.4	25	DfT
L116	A6 Chapel Street Westbound (Junction Slowdown) - West of A34	8.0	8,713	9.4	15	DfT
L117	A6 Chapel Street Westbound - West of A34	6.9	8,713	9.4	25	DfT
L118	Chapel Street East of Adelphi Street	15.4	17,425	9.4	25	DfT

Road Link		Road Width (m)	24 Hour AADT Flow	HDV Pop (%)	Mean Vehicle Speed (km/hr)	Data Source
L119	A6 West of A5066 Westbound, Speed Up	8.0	12,341	7.3	20	DfT
L120	A6 West of A5066 Westbound	7.0	12,341	7.3	40	DfT
L121	A6 Eastbound East of Albion Way	7.7	12,341	7.3	30	DfT
L122	A6 Eastbound East of Albion Way Slowdown at A5066	8.0	12,341	7.3	15	DfT
L123	Water Street	7.1	5,551	2.1	20	Vectos

Reference should be made to Figure 6 within Appendix A for a graphical representation of the road link locations used within the verification assessment. The road width and mean vehicle speed shown in Table B1 remained the same for the 2024 scenarios.

A summary of the 2024 traffic data is shown in Table B2.

Table B2: 2024 Traffic Data

Road Link		DS Scenario	
		24 Hr AADT Flow	HDV Prop (%)
L1	A56 (W)	36,416	3.0
L2	A56 (W) Slow Down (West)	18,208	3.0
L3	A56 (W) Slow Down (East)	18,208	3.0
L4	A56 Roundabout	16,118	3.7
L5	Regent Road Speed Up(South)	26,676	4.0
L6	Regent Road (South)	34,335	3.5
L7	A57 (E)	27,468	3.5
L8	Regent Road Slow Down (North)	34,335	3.5
L9	Regent Road (North)	34,335	3.1
L10	A57 (W)	27,468	3.0
L11	Regent Road Onslip	6,867	3.5
L12	Regent Road Offslip	6,867	3.5
L13	A56 Roundabout	17,187	4.1
L14	A56 Across Roundabout (East)	9,262	3.0
L15	A56 Across Roundabout (West)	7,395	3.0
L16	A56 Roundabout	17,029	4.1
L17	A56 Roundabout	18,962	3.5
L18	A56 roundabout (Manc Way)	18,832	3.5
L19	A56 Roundabout	19,627	2.5
L20	Chorlton Road Slow Down (North)	6,596	1.0
L21	Chorlton Road Slow Down (South)	6,596	1.0

Road Link		DS Scenario	
		24 Hr AADT Flow	HDV Prop (%)
L22	A56 Roundabout	16,182	3.7
L23	Chorlton Road (North)	6,596	1.0
L24	Chorlton Road (South)	6,596	1.0
L25	Manc Way East (up to slip roads)	40,610	4.0
L26	Manc Way West (up to slip roads)	40,610	4.0
L27	Manc Way Onslip	10,420	4.6
L28	Manc Way Offslip	11,020	2.8
L29	Manc Way Offslip Medlock Street	11,542	2.1
L30	Manc Way Onslip Princess Parkway	11,542	2.1
L31	Manc Way East (up to University)	40,610	4.0
L32	Manc Way West (up to University)	40,610	4.0
L33	Princess Parkway	26,661	2.0
L34	Princess Parkway	26,661	2.0
L35	Princess Parkway Onslip	13,331	2.0
L36	Medlock Street Offslip	8,345	1.0
L37	Medlock Street Slow Down	16,690	1.0
L38	Medlock Street (River Street to Little Peter Street)	17,310	1.0
L39	Albion Street	17,310	1.0
L40	Medlock Street Slow Down	17,310	1.0
L41	River Street	1,894	0.0
L42	City Road East/Great Jackson Street	2,713	1.0
L43	City Road East/Great Jackson Street (Street Canyon Section)	2,713	1.0
L44	City Road East/Great Jackson Street	2,713	1.0
L45	City Road East Slow Down	5,735	1.0
L46	Great Jackson Street to Bridgewater Viaduct	2,868	1.0
L47	Bridgewater Viaduct to Great Jackson Street	2,868	1.0
L48	Garwood Street	1,517	0.0
L49	Garwood Street Onslip	758	0.0
L50	Garwood Street Offslip	758	0.0
L51	Chester Road East (West of Great Jackson Street)	7,282	3.0
L52	Chester Road East (West of Great Jackson Street)	14,564	3.0
L53	Chester Road East (A56 Roundabout Exit)	7,282	3.0
L54	Chester Road East (West of Great Jackson Street)	7,282	3.0
L55	Chester Road East (West of Great Jackson Street)	14,564	3.0
L56	Chester Road East (A56 Roundabout Approach)	7,282	3.0

Road Link		DS Scenario	
		24 Hr AADT Flow	HDV Prop (%)
L57	Chester Road East (Great Jackson Street to Old Deansgate) Eastbound	13,499	3.0
L58	Chester Road East (Great Jackson Street to Old Deansgate) Westbound	13,499	3.0
L59	A56 Bridgewater Viaduct	19,485	3.0
L60	Old Deansgate Slow Down	7,959	1.0
L61	Old Deansgate	7,959	1.0
L62	Little Peter Street	1,690	0.0
L63	Whitworth Street West - Slow Down	12,370	1.0
L64	Whitworth Street West	12,370	1.0
L65	Whitworth Street East - Slow Down	9,720	1.0
L66	Whitworth Street East	9,720	1.0
L67	Deansgate	17,984	3.0
L68	Albion Street	16,931	3.0
L69	Hewitt Street	540	0.0
L70	Hewitt Street	540	0.0
L71	Melborne Street	1,843	0.0
L72	Regent Road (West) Slow	34,335	3.5
L73	Regent Road (West) Slow	26,676	4.0
L74	Regent Road (West) Slow	26,676	4.0
L75	Regent Road (East) Slow	26,676	4.0
L76	Regent Road (East) Slow	26,676	4.0
L77	Regent Road (East) Slow	26,676	4.0
L78	Regent Road (West) Slow	26,676	4.0
L79	Regent Road (West) Slow	26,676	4.0
L80	Regent Road (East) Slow	26,676	4.0
L81	Regent Road (East) Slow	26,676	4.0
L82	Regent Road (West) Speed Up	26,676	4.0
L83	Regent Road (West)	26,676	4.0
L84	Regent Road (East) Slow Down	26,676	4.0
L85	Regent Road (East)	26,676	4.0
L86	Liverpool Road Slow Down	7,895	2.4
L87	Water Street/Liverpool Street	8,094	2.5
L88	Water Street Slow Down	9,160	2.5
L89	Trinity Way Northbound	14,595	3.1

Road Link		DS Scenario	
		24 Hr AADT Flow	HDV Prop (%)
L90	Trinity Way Northbound	11,774	3.1
L91	Trinity Way Southbound	11,774	3.1
L92	Trinity Way Southbound	14,595	3.1
L93	Trinity Way onto Regent Road	7,298	3.1
L94	Trinity Way onto Egerton Street	7,298	3.1
L95	Oldfield Road (North) Slow Down	10,227	2.3
L96	Oldfield Road (North)	10,227	2.3
L97	Oldfield Road (South) Slow Down	7,428	2.7
L98	Oldfield Road (South)	7,428	2.7
L99	Ordsall Lane (South)	11,974	1.8
L100	Ordsall Lane (South) Slow Down	11,974	1.8
L101	Regent Road onto Ordsall Lane	3,991	1.8
L102	Ordsall Lane onto Regent Road	3,991	1.8
L103	Ordsall Lane/Regent Road Junction	3,991	1.8
L104	Ordsall Lane (North) Slow Down	9,522	1.8
L105	Ordsall Lane (North)	9,522	1.8
L106	A34 Irwell Street - South of Chapel Street - Northbound	16,007	2.7
L107	A34 Irwell Street - South of Chapel Street (Junction Slowdown) Northbound	16,007	2.7
L108	Trinity Way Northbound - Chapel Street Junction	16,007	2.7
L109	Trinity Way Northbound - Between New Bridge Street and Bloom Street	16,007	2.7
L110	A34 Irwell Street - South of Chapel Street - Southbound (Junction Slowdown)	16,007	2.7
L111	A34 Irwell Street - South of Chapel Street - Southbound	16,007	2.7
L112	Trinity Way Southbound - Chapel Street Junction	16,007	2.7
L113	Trinity Way Southbound - Between New Bridge Street and Bloom Street	16,007	2.7
L114	A6 Chapel Street Eastbound (Junction Slowdown) - West of A34	9,134	9.4
L115	A6 Chapel Street Eastbound - West of A34	9,134	9.4
L116	A6 Chapel Street Westbound (Junction Slowdown) - West of A34	9,134	9.4
L117	A6 Chapel Street Westbound - West of A34	9,134	9.4
L118	Chapel Street East of Adelphi Street	18,269	9.4
L119	A6 West of A5066 Westbound, Speed Up	12,939	7.3
L120	A6 West of A5066 Westbound	12,939	7.3
L121	A6 Eastbound East of Albion Way	12,939	7.3

Road Link		DS Scenario	
		24 Hr AADT Flow	HDV Prop (%)
L122	A6 Eastbound East of Albion Way Slowdown at A5066	12,939	7.3
L123	Water Street	7,895	2.4

Reference should be made to Figure 6 within Appendix A 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 11.0) released in November 2021, which incorporates updated COPERT 5.3 vehicle emissions factors for NO_x, PM₁₀ and PM_{2.5} and EURO 6 vehicle fleet sub-categories.

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.TG(16)¹

Meteorological Data

Meteorological data used in this assessment was taken from Manchester Ringway meteorological station over the period 1st January 2019 to 31st December 2019 (inclusive). Manchester Ringway meteorological station is located at approximate NGR: 381745, 383960, which is approximately 17km south-west of the proposed development.

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 3 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 Ringway meteorological station are summarised in Table B3.

Table B3: Utilised Roughness Lengths

Scenario	Roughness Length (m)	ADMS Description
Verification and Operational phase (DS scenario)	1.0	Cities and Woodlands
Meteorological Station	0.3	Agricultural Areas (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 B4.

Table B4: Utilised Monin-Obukhov Lengths

Scenario	Monin-Obukhov Length (m)	ADMS Description
Verification and Operational phase (DS and DM scenario) and Meteorological Station	30	Cities and Large Town or Mixed Urban/Industrial

This Monin-Obukhov value is considered appropriate for the morphology of the assessment area.

Background Concentrations

The 2024 annual mean background concentrations detailed in Table B5, was used in the dispersion modelling assessment to represent annual mean pollutant levels at the Proposed Development site and local monitoring sites.

Table B5 displays the specific background concentrations as predicted by DEFRA, utilised to represent the condition at the monitoring locations used within the verification process.

Table B5: Predicted Background Pollutant Concentrations

Pollutant	Predicted Annual Mean Background Concentration ($\mu\text{g}/\text{m}^3$)			
	Total Predicted 2019 Background	Predicted Background with A-Roads Removed	Total Predicted 2024 Background	Predicted Background with A-Roads Removed
NO ₂	39.95	33.56	31.29	27.09
NO _x	26.07	22.52	21.29	18.80
Pollutant	Predicted Annual Mean Background Concentration ($\mu\text{g}/\text{m}^3$)			
PM ₁₀	13.47		12.69	
PM _{2.5}	8.69		8.13	

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 undertakes periodic monitoring of NO₂ concentrations at 4 roadside monitoring location within the assessment extents. 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.TG(16). The monitored annual mean NO_x concentration and calculated road NO_x concentration are summarised in Table B6.

It should be noted that diffusion tube location MAN 77 has been excluded from the model verification as a result of localised conditions, due to its location within a canyon, adjacent to rail lines. Therefore, the diffusion tube was deemed unrepresentative of the Proposed Development site.

Table B6: NO_x Concentrations

Site ID	Monitored Road NO _x Concentration (µg/m ³)	Modelled Road NO _x Concentration (µg/m ³)	% Difference ((Monitored - Modelled)/Monitored) * 100
MAN97	25.07	14.22	43%
SA59	26.63	12.58	53%
SA60	34.35	31.45	8%
SA81	56.62	54.19	4%

*SA60 and SA81 were not included within the verification process due to suitable correlation with monitored NO_x concentration prior to adjustment.

According to LAQM.TG(16), no adjustment is necessary where the results of the model all lie within 10% of the monitored concentrations or provide systematic overpredictions (SA060 and SA81). Subsequently, specific monitors have not been included within the calculation of the NO_x adjustment factor.

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 **1.9183** was required to be applied to all NO_x modelling results, showing the model overestimated pollutant concentrations throughout the assessment extents.

An adjustment factor of 1 has been applied where modelled concentrations are observed within 10% of monitored NO_x concentrations, or in cases where systematic overpredictions occur. This method ensures that over adjustment is avoided at locations where the initial modelling provides suitable correlation to monitored concentrations.

Graph 1 is provided below.

Graph 1 - Verification Adjustment Factor

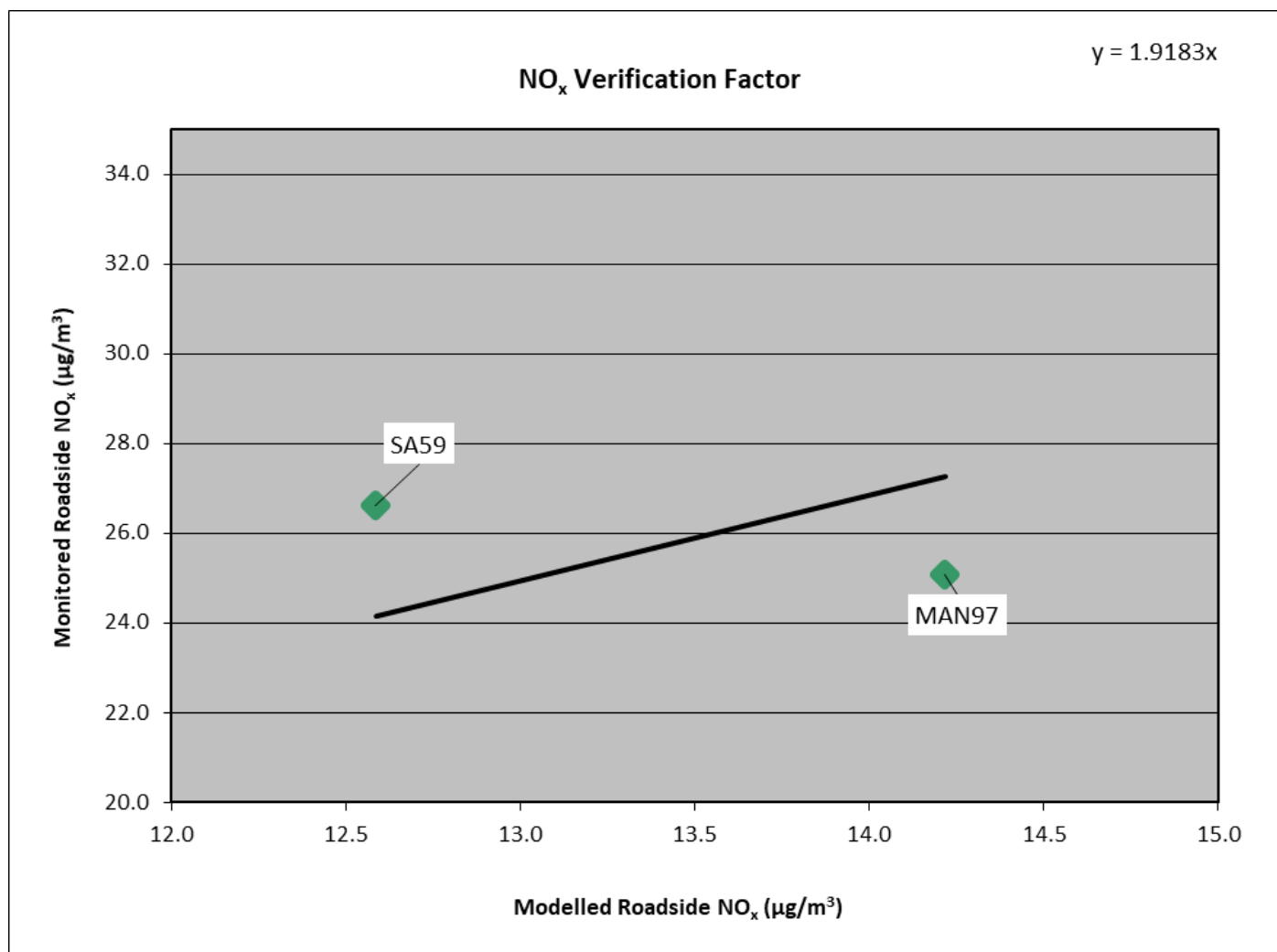


Table B7 presents the monitored annual mean NO₂ concentrations and the adjusted modelled total NO₂ concentration based on the above verification factor. Exceedances of the annual mean NO₂ AQO are highlighted in **bold**.

Table B7: NO₂ Concentrations

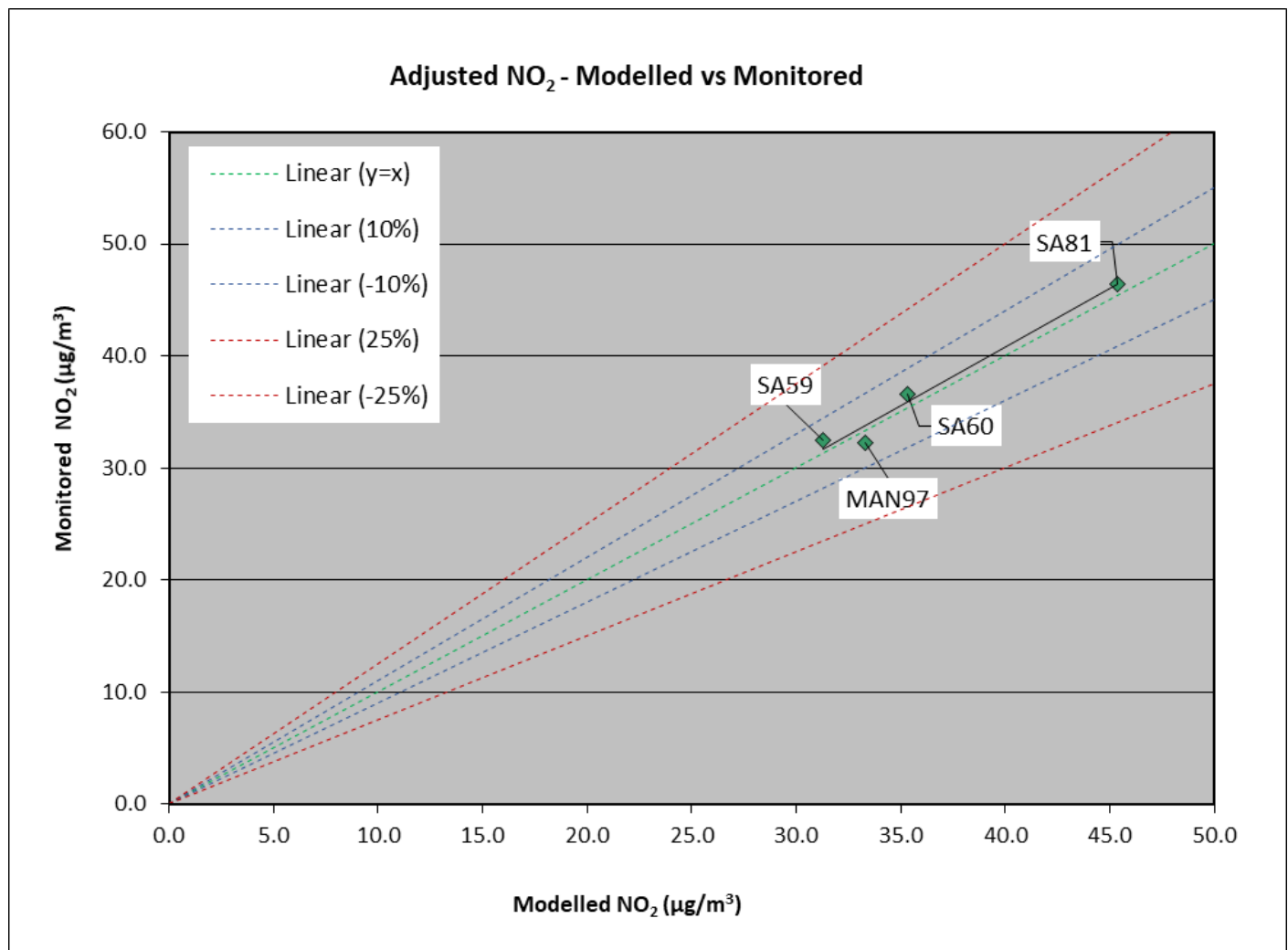
Site ID	Monitored Road NO ₂ Concentration (µg/m³)	Adjusted Modelled Road NO ₂ Concentration (µg/m³)	% Difference ((Monitored - Modelled)/Monitored) * 100
MAN97	32.29	33.33	-3%
SA59	32.45	31.26	4%
SA60*	36.66	35.32	4%
SA81*	46.41	45.39	2%

* Adjustment factor of 1.0 applied

As demonstrated in Table B7, the percentage difference between modelled and monitored concentrations is deemed acceptable and is less than 25% in all cases, and less than 10% at all locations. This reduces uncertainties in the model predictions and provide a robust representation of pollutant concentrations in accordance with the guidance suggested in LAQM.TG(16)¹.

A graphical representation of the adjusted NO₂ concentrations is provided within Graph 2.

Graph 2 – Modelled vs Monitored NO₂



As PM₁₀ and PM_{2.5} monitoring is not undertaken within the assessment extents, the NO_x adjustment factor of **1.9183** was utilised to adjust model predictions of PM₁₀ and PM_{2.5} in accordance with the guidance provided within LAQM.TG(16)².