Technical Note – Great Northern Air Quality Monitoring

TO: Adam Linard

FROM: Sian Grimsley & Tom Reade

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FILE REF:

PROJECT: Great Northern

SUBJECT: Air Quality Monitoring Summary

Hilson Moran was appointed by GNW Developments Ltd to conduct a diffusion tube monitoring survey in support of the Proposed Development at Great Northern, Manchester.

The monitoring survey was conducted in order to help validate and support the results of the air quality dispersion modelling presented in the Air Quality Environmental Statement Chapter as part of the planning application.

Monitoring Methodology

An NO_2 diffusion tube monitoring survey was undertaken in support of the Proposed Development at Great Northern, Manchester. The monitoring was conducted over a sixth-month period between the 6th of June to the 5th of December 2022 at 11 roadside locations. The diffusion tubes were located on the road network surrounding the Site where development-generated traffic is likely to travel.

As the monitoring survey did not extend to a period of twelve months, there was a requirement in accordance with LAQM.TG(22) to calibrate and annualise the monitoring data collected to be representative of a single year in order to compare the pollutant concentrations with the annual mean AQS objective for NO_2 (40µg/m³).

Ratification of the data was based on calibration factors derived from local calibration reports, along with a visual review of the monitoring data and comparison with nearby urban background monitoring sites that fall within Defra's Automatic Urban and Rural Network (AURN). The urban background sites selected include:

- Manchester Piccadilly; and,
- Salford Eccles.

Period and annual means have been calculated for each of the onsite monitoring locations, as appropriate. The period means have been adjusted to provide estimates of the annual mean concentrations at each onsite monitoring location using the data obtained from the two Defra operated AURN sites summarised above. This has been done in accordance with the guidance set out in LAQM.TG(22).

Monitoring Results

The results have been annualised using the data presented in **Table 1.1**.

Table 1.1 Annualised Data for Monitoring Period

Site	2022 Annual Mean (µg/m³)	Period Mean (µg/m³)	Ratio
Manchester Piccadilly	29.00	24.80	1.17
Salford Eccles	21.50	18.00	1.20
Average			1.18
Date Capture >75% in all cases			

A summary of the monitoring results is presented in **Table 1.2** below.

Table 1.2 Air Quality Monitoring Results

Location	Period Mean (µg/m³)	Data Capture (%)	Annualised Mean Estimate (µg/m³)
Watson Street	37.30	33	**40.14**
Peter Street (corner of Southmill Street)	38.20	83	**41.10**
Peter Street (junction at Deansgate)	33.40	42	35.93
Great Bridgewater Street	**62.20**	58	**66.96**
Great Bridgewater Street (junction at Deansgate)	37.50	17	**40.43**
Deansgate	37.90	75	**40.79**
Quay Street	37.40	83	**40.28**
Liverpool Street	34.30	83	36.92
Lower Mosley Street	33.40	83	35.98
Bridgewater Street (east of Lower Mosley Street)	35.40	8	38.14
Oxford Street	35.90	58	38.70
Oxford Street Automatic Monitor	**49.20**	67	**53.01**
*Following ratification and adjustment using locally derived bias adjustment factor (0.84). **Bold indicates exceedance of the Annual Mean AQS Objective (40µg/m³).**			

NO_2 diffusion tube monitoring was undertaken at 11 locations between the 9th of June 2022 and 5th of December 2022.

Data capture ranged from 8% - 83%. Monitoring locations At Peter Street (corner of Southmill Street), Quay Street, Liverpool Street and Lower Mosely Street had the highest data capture. The locations with the lowest data captures were Bridgewater Street (east of Lower Mosley Street), Great Bridgewater Street and Watson Street.

At all locations throughout the monitoring period tubes were recorded as missing at the time of collection. Missing monitoring tubes throughout a programme of air quality monitoring is common in busy central areas, hence why multiple locations of installation were selected. The loss of monitoring devices is most likely due to interference from the public and/or building maintenance teams undertaking work in the area which could result in damage to the tubes and monitoring fixtures.

The low data capture across several monitoring locations is not a cause for concern within this report as the purpose of this monitoring survey was to validate the dispersion modelling outputs presented in the Air Quality ES Chapter and submitted to planning, as summarised in the section below.

The period mean concentrations at the Site were compliant with the AQS objective of 40µg/m³ at both Manchester Piccadilly and Salford Eccles.

Consideration is given to the monitor locations where data capture was >75% across the six-month monitoring period. These locations include Peter Street - corner of Southmill Street (83%), Deansgate (75%), Quay Street (83%) and Liverpool Street (83%). Following annualization, the estimated annual mean NO_2 concentrations exceed the AQS objective of 40µg/m³ at Peter Street, Deansgate and Quay Street. The estimated annual mean NO2 concentration at Liverpool Street was compliant with the AQS objective.

Monitoring and Modelling

The ADMS-Urban dispersion model presented within the Air Quality ES Chapter underwent local model validation to determine how the model was performing at a local level by comparing the modelling results with local monitoring data. This verification process used local authority monitoring data from sites located in Central Manchester. These monitors included MA29ANO, MAN1, MA82NO/MA83NO/MA84NO, located along Oxford Street, circa 620m – 850m from the Site.

The verification factor calculated was **1.4**, which indicated that the model was under-predicting. Full details of the verification are presented within Appendix 8.8 of the submitted Air Quality ES Chapter.

To validate and support the modelling outputs presented within the ES Chapter, the model verification has been updated using the diffusion tube monitoring results presented above. As these monitoring locations are located along roads that are adjacent to the Site, they considered to be more representative than those used for model verification in the Air Quality ES Chapter. The monitoring results from locations where data capture was >75% and traffic data were available (Peter Street, Quay Street, Liverpool Street and Deansgate) were used to verify the 2019 baseline model. These monitors are all within 100m of the Site boundary.

The verification factor calculated was **0.72**, which indicated that the model was over-predicting. Full details of the verification factor are presented within the Appendix A attached to this note.

The revised verification factor indicates that the adjusted model outputs presented within the ES Chapter are an overestimation of pollutant concentrations at modelled receptors and are therefore the worst-case. Should the revised model verification factor be applied to the raw modelled outputs the total pollutant concentrations would be lower than those presented in the Air Quality ES Chapter.

Summary

Hilson Moran undertook a site-specific air quality survey for NO_2 to enable validation of the dispersion modelling results presented in the Air Quality ES Chapter.

The findings of the air quality monitoring survey are:

- A revised model verification factor of 0.72 was calculated indicating that the model is overpredicting pollutant concentrations.
- Utilising the updated, site-specific verification factor total pollutant concentrations at all modelled receptors are likely to be lower than those presented in the Air Quality ES Chapter.
- The submitted Air Quality ES Chapter presents a worst-case scenario and is considered to be robust.

Hilson Moran recommends that during the Stage 3 works, the air quality modelling results be updated.

Appendix A – Verification Details

The comparison of modelled concentrations with local monitored concentrations is a process termed 'verification'. Model verification investigates the discrepancies between modelled and measured concentrations. Discrepancies occur due to model uncertainties, such as:

- Estimates of background pollutant concentrations;
- Meteorological data uncertainties;
- Traffic data uncertainties;
- Model input parameters; and
- Overall limitations of the dispersion model.

NO_2 is produced in the atmosphere by the reaction of nitric oxide (NO) with ozone. Therefore, model verification for nitrogen oxides (NO_X = NO + NO_2) the primary pollutant is appropriate. This has been undertaken in accordance Chapter 7 of LAQM.TG(22).

The model has been run to predict the 2019 annual mean road-NO_X contribution at the monitoring locations given below. The model outputs of road-NO_X for each location have been compared with the 2019 'measured' road-NO_X, which was determined utilising the NO_X from NO_2 calculator and the NO_2 concentration data from diffusion tube monitoring survey conducted by Hilson Moran.

Details of the data used in the verification process is in the table below.

ID	2019 Monitored Total NO_2 ($\mu g/m^3$)	Background NO_2 ($\mu g/m^3$)	2019 Monitored Road Contribution NO_X ($\mu g/m^3$)	2019 Modelled Road Contribution NO_X ($\mu g/m^3$)	Ratio of monitored NO_X road contribution/modelled road contribution NO_X
Peter Street (2)	41.1	28.25	26.52	32.23	0.82
Deansgate (6)	40.79	28.25	25.84	36.59	0.70
Quay Street (7)	40.28	28.25	24.73	33.31	0.74
Liverpool Street (8)	36.92	28.25	17.55	30.01	0.58

The adjustment factor calculated is 0.72. This indicated that the model was under-predicting.