Silvertown Tunnel Scheme Air Quality Baseline Monitoring Report

Third Year of Monitoring, 2023
The Silvertown Tunnel Order 2018 No. 574

Transport for London

Project number: 60636520

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Quality information

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1.2 It is noted that air pollution concentrations during 2020 and 2021 were influenced by changes in travel behaviour and traffic flows as a result of the Covid-19 pandemic and national lockdowns as well the more recent fuel crisis situation in late 2021. The overall indications in London are that traffic flows are back to pre-pandemic levels, so 2023 concentrations are unlikely to be influenced as much as the proceeding years by atypical traffic conditions.

Silvertown Tunnel Monitoring

1.3 This report presents the results of the third year of nitrogen dioxide (NO_2) monitoring for 2023 for TfL's Silvertown Tunnel Scheme. Monitoring was conducted using low-cost diffusion tubes at 38 locations and at three continuous monitoring sites to provide reference standard data. These locations are shown in Appendix A.

1.4 The monitoring is required to meet the commitments TfL made as part of the Development Consent Order (DCO) [2] and Monitoring and Mitigation Strategy (MMS) [3] to conduct pre and post Scheme monitoring to compare concentrations.

1.5 In line with the MMS, this report presents NO_2 concentrations, in comparison to the Air Quality Strategy (AQS) Objective Values. Data from both Scheme and local authority monitoring sites that are likely to reflect potential impacts from the tunnel are provided. This report does not provide information on $PM_{2.5}$ or describe results against thresholds outside of the AQS as this is not part of the MMS and DCO requirements for the Scheme.

1.6 The headline results at the continuous monitoring sites show that measured NO_2 concentrations in 2023 complied with the AQS Objective values at the locations close to the Scheme (see Table 1-1).

Table 1-1. Summary of 2023 NO_2 Concentrations at Continuous Monitoring Sites

Statistic	Tunnel Avenue (TL4)	Hoola Tower (TL5)	Britannia Gate (TL6)	AQS Objective
Annual Mean NO_2 (µg/m^3)	26.4	21.3	21.7	40
Number of 1-hour mean NO_2 concentrations exceeding objective value of 200 µg/m^3	0	0	0	18
Data Capture Rate showing proportion of valid measurements (%)	92.9	89.6	89.9	-

1.7 2023 annual mean concentrations at monitoring sites: TL4, TL5 and TL6 declined from 2022 by 6.0 µg/m^3 (18.5%), 1.5 µg/m^3 (6.6%) and 2.9 µg/m^3 (11.8%) respectively.

[1] https://www.london.gov.uk/sites/default/files/london_health_burden_of_current_air_pollution_and_future_health_benefits_of_mayoral_air_quality_policies_january2020.pdf
[2] https://infrastructure.planninginspectorate.gov.uk/projects/london/silvertown-tunnel/
[3] TR010021-001726-8.84 Monitoring and Mitigation Strategy R2 .pdf (planninginspectorate.gov.uk)

1.8 Of the 38 diffusion tube monitoring sites, the annual mean NO_2 concentrations complied with the AQS objectives at all sites in 2023.

1.9 Across all diffusion tube sites, there was an average reduction in concentration by 6.7% with reductions at 37 of the 38 sites and an increase at one site (DT20 Lower Road).

2. Introduction

Air quality in London

2.1 Tackling air pollution across the capital is a key focus for the Greater London Authority (GLA) and Transport for London (TfL). The Mayor of London has adopted a number of policies to improve air pollution. In recent years, these have included the expansion of the Ultra Low Emission Zone (ULEZ) to outer London, and progressive improvements to the TfL bus fleet, all of which has met or exceeded Euro VI standards since 2021 and which now includes over 1,700 zero emission vehicles. Partly as a result of the Mayor's policies, London's air quality is now on track to meet UK legal limits by 2025 – 184 years earlier than previous projected.

2.2 Levels of air pollution are measured at more than 100 continuous monitoring and 1000's of diffusion tube sites across London to determine compliance against the UK's Air Quality Strategy (AQS) Objective Values 2010 (see Table 3-1). The World Health Organisation (WHO)[4] has developed their own guidelines for outdoor ambient air quality which are more stringent than the UK Air Quality Objectives (AQO). However, the WHO guidelines have not been adopted into UK legislation. The Silvertown DCO sets out the legal requirements and commitments regarding the appropriate air quality thresholds which the scheme was assessed against and will be reassessed in the refreshed assessment and reported in the Environmental Compliance Assessment.

2.3 A combination of Mayoral policies and ongoing reductions in background pollution has resulted in improvements in measured air quality levels across London. Trends are presented and discussed in the ULEZ 2021 inner London expansion one year report[5] and in the ULEZ six month report on the impacts of the 2023 outer London expansion[6].

2.4 The latest air quality report for London[7] for the period 2016-2024 identified the following key trends:

- Preliminary figures indicate that average annual concentrations of NO_2 in London dropped to the lowest levels ever recorded in 2023, lower even than the first year of COVID-19 lockdowns;
- Since the Mayor took office in 2016, monitoring from the expansive network of reference grade air quality monitors across London shows that NO_2 concentrations have reduced London-wide, with average roadside reductions of 65%, 53% and 45% at central, inner, and outer monitoring locations, respectively since 2016. Across London as a whole, average annual roadside NO_2 concentrations have been reduced by nearly half (49%) since 2016;
- The average roadside concentration across all active sites exceeded the annual mean objective value of 40 µg/m^3 from 2016 to 2019 in central, inner and outer London. Since 2020, the average across all active sites has been below the objective; and
- Whilst significant reductions in NO_2 concentrations have been recorded, none of the major roads or educational establishments in London met the WHO annual mean air quality guideline (AQG) of 10 µg/m^3 for NO_2, and this is predicted to still be the case by 2025 and 2030. Further action will be necessary if London is to meet its target of achieving the new WHO AQGs as soon as possible.

Monitoring Overview

2.5 The Silvertown Tunnel Scheme (the "Scheme") involves the construction of a 1.4 km twin-bore road tunnel under the Thames which will be the first in London in over 30 years. The new

[4] World Health Organization (WHO) 2021. https://apps.who.int/iris/bitstream/handle/10665/345329/9789240034228-eng.pdf?sequence=1&isAllowed=y
[5] https://www.london.gov.uk/programmes-strategies/environment-and-climate-change/environment-and-climate-change-publications/inner-london-ultra-low-emission-zone-expansion-one-year-report
[6] https://www.london.gov.uk/sites/default/files/2024-07/London-wide%20ULEZ%20Six%20Month%20Report.pdf
[7] https://www.london.gov.uk/programmes-strategies/environment-and-climate-change/environment-and-climate-change-publications/air-quality-london-2016-2024

modern tunnel, combined with a user charge applied at both the new and existing Blackwall Tunnel and a network of zero-emissions buses, will help reduce congestion, improve reliability and create a more resilient cross river road network in East London.

2.6 The Scheme will help:

- Effectively eliminate delays and queues at the Blackwall Tunnel, with journey times up to 20 minutes faster;
- Reduce the environmental impact of traffic congestion on some of London's most polluted roads; and
- Provide more opportunities to cross the river by public transport with a network of zero-emission buses offering new routes and better access to more destinations.

2.7 The Scheme was subject to a full Environmental Impact Assessment (EIA) at the DCO stage which was rigorously tested at the examination. However, it was determined that there was some uncertainty associated with NO_2 effects that required further monitoring closer to the Scheme opening date. Following the outcomes of the Environmental Statement (ES) and as part of the DCO [8], the Monitoring and Mitigation Strategy (MMS)[9] was developed. The MMS set out the requirements for further air quality monitoring relating to pre and post Scheme opening and baseline monitoring has been used in the refreshed assessment of Scheme impacts which was completed to:

- Set the User Charges;
- Define the requirement for and form of localised mitigation for residual effects; and
- Specify the bus network through the Silvertown Tunnel that will operate on opening.

2.8 For this process TfL updated the relevant transport and environmental models, re-ran the models, and developed its proposals for each element in conformity with the commitments, policies and procedures set out in the relevant certified documents and any DCO requirements.

2.9 TfL has implemented a series of air quality monitoring programmes for the Scheme, this included wider NO_2 monitoring for the ES in 2015/2016 and NO_2 monitoring in 2019 around the Hoola Tower close to the northern tunnel portal. The ES concluded that other pollutants (including particulates) complied with the relevant AQS Objectives, therefore this report presents the baseline monitoring as set out in the MMS where only NO_2 monitoring is required.

2.10 This report presents the results of the third year of NO_2 monitoring for 2023, in the context of the AQS Objective Values. Data from Scheme specific monitoring sites and selected local authority roadside monitoring sites close to the tunnel openings are reported.

Monitoring Requirements

2.11 The MMS states that NO_2 monitors should be sited as below:

a) where the Scheme is forecast to bring about a change in air quality in excess of 0.4 $\mu g/m^3$ where annual mean concentrations are above the national air quality objective value;

b) where the Scheme could lead to traffic diverting to alternative routes which were not foreseen in the original assessment; and

c) to ensure the monitoring locations are representative of relevant exposure at sensitive receptors.

2.12 The MMS also included a map of proposed air quality monitoring locations which were chosen based on the outcomes of the ES and the criteria set out in paragraph 2.10. Based on the above requirements and using the proposed monitoring locations, TfL had a number of meetings with Silvertown Tunnel Implementation Group (STIG) representatives for the five local authorities where the monitoring locations were proposed, to agree the monitoring locations.

[8] Silvertown Tunnel | National Infrastructure Planning (planninginspectorate.gov.uk)
[9] TR010021-001726-8.84 Monitoring and Mitigation Strategy R2 .pdf (planninginspectorate.gov.uk)

Following the agreement with STIG representatives, 38 triplicate passive diffusion tubes were installed across London Borough (LB) of Newham, Royal Borough (RB) of Greenwich, LB Tower Hamlets, LB Lewisham and LB Southwark, to provide information on NO_2 levels across the wider road network that may be affected by changes in traffic levels associated with the Scheme. The location of these diffusion tube sites is shown in Figure A1 in Appendix A.

2.13 In addition, three continuous monitoring sites (CMS) with NO_x analysers were installed close to the tunnel openings at roadside locations where Scheme impacts are likely to be greatest. The CMS were installed at Tunnel Avenue (TL4) in RB Greenwich, Hoola Tower (TL5) and Britannia Gate (TL6) both in LB Newham. The locations of these monitors are shown in Figure A2 in Appendix A.

2.14 In line with the MMS and DCO requirements, NO_2 will be monitored for three year's pre-Scheme opening and for a minimum of three year's post-Scheme opening in 2025 to provide data to inform baseline conditions and Scheme impacts.

2.15 As there are a number of existing local authority monitoring sites located close to the tunnel openings, data from selected sites in this area has also been included within this report to provide a fuller coverage of the baseline conditions. The locations of these selected sites are given in Figure A3 in Appendix A.

2.16 This report provides the results of the third full year of air quality baseline monitoring undertaken between 1st January 2023 and 31st December 2023. The report describes the monitoring locations and presents the results in the context of the relevant UK AQS objectives. Any exceedances of these objectives are highlighted and a comparison with data from the first two years of monitoring is given.

2.17 Monitoring of construction dust and particulates is being carried out separately to the monitoring presented in this report. The construction air quality monitoring programme is managed by Riverlinx Construction Joint Venture who are contracted to complete the design and construction of the Silvertown Tunnel.

3. Air Quality Objectives

3.1 Table 3-1 sets out the UK AQS Objectives that are of relevance to the air quality monitoring programme.

3.2 The table defines the averaging period and an associated Objective that should not be exceeded. For short-term Objectives there may be an allowable number of exceedances. For example, the UK AQS Objective for 1-hour NO_2 concentrations is an hourly mean NO_2 concentration of 200 µg/m^3 to be exceeded 18 times or fewer per year. This is equivalent to the 99.79th percentile of hourly mean NO_2 concentrations.

Table 3-1. Air Quality Objectives and Guidelines

Pollutant	Averaging Period	AQS Objective (µg/m^3)	Not to be Exceeded More Than
Nitrogen dioxide (NO_2)	Annual	40	-
	1-hour	200	18 hours (99.79th percentile)

4. Air Quality Monitoring Locations

Scheme Continuous Monitoring Stations (CMS)

4.1 Details of the CMS are shown in Table 4-1, along with a link to the relevant webpages of the London Air Quality Network (LAQN), where additional information about each site can be found and monitoring data can be downloaded. The monitoring site IDs are consistent with those in the LAQN for other existing TfL CMSs (TL1-3 are existing monitors in the network).

4.2 Tunnel Avenue, Greenwich (TL4) is in the Royal Borough of Greenwich alongside the A102 Blackwall Tunnel southern approach near to the location of the southern portal for the proposed Silvertown Tunnel. Hoola Tower (TL5) is located at the northern end of the proposed tunnel opening close to Hoola West Tower and Britannia Gate (TL6) is located at the northern end of the proposed tunnel opening on Silvertown Way. Both TL5 and TL6 are located in the London Borough of Newham. The locations of these monitoring stations are shown in Figure A2 in Appendix A.

4.3 Monitoring began at site TL4 and TL6 in December 2020 and in March 2021 at TL5 due to additional work required to provide power to the monitor.

4.4 All three stations are reference standard equipped with chemiluminescence analysers for the measurement of NO_x and NO_2.

Scheme Diffusion Tube Monitoring Locations

4.5 The diffusion tubes were installed in December 2020 at roadside sites close to the tunnel openings, on the approaching road links and on key routes north and south of the River Thames. Monitoring is conducted within the boroughs of Newham, Tower Hamlets, Lewisham, Greenwich and Southwark. Three of the diffusion tube sites are co-located with the three CMS; TL4, TL5 and TL6.

4.6 The Scheme ES[10] concluded that the greatest potential air quality impact would be at residential properties at the Hoola Tower, Tidal Basin Road in Newham. An additional six diffusion tube locations were therefore placed around the Hoola Tower building to further understand the potential air quality concentrations and impacts in this specific area.

4.7 A total of 38 diffusion locations were agreed with STIG, with triplicate diffusion tubes sited at each location. Details of the sites are in Table 4-2 and their locations are shown in Figure A1 in Appendix A. The tubes were prepared and analysed by Staffordshire Highways Laboratory, using the 20% triethanolamine (TEA) in water method of analysis. The methods used for the preparation and analysis of passive diffusion tubes match those used in the Scheme specific monitoring reported in the ES.

Local Authority Monitoring Locations

4.8 There are a number of local authority run air quality monitoring sites around the tunnel openings. These include CMSs, diffusion tubes and low-cost sensors through Breathe London. NO_2 concentrations from representative roadside sites within 2 km of the tunnel have been included in this report to provide additional baseline data, in addition to a nearby urban background site. These locations are situated in Greenwich, Newham and Tower Hamlets, as shown in Table 4-3.

[10] TR010021-000472-Transport for London - Chapter 6 Air Quality.pdf (planninginspectorate.gov.uk)

Table 4-1. Scheme Continuous Monitoring Station Site Details

Site ID	Site Address, London Borough	Site Type	X (m)	Y (m)	Height (m)	Distance to Kerb (m)	Distance to Relevant exposure (m)	Distance to Tunnel Portal (m)	LAQN Website Link
TL4	Tunnel Avenue, Greenwich	Roadside	539223	179250	1.3	13.0	260	30	TL4
TL5	Hoola Tower, Newham	Roadside	539936	180732	1.5	2.6	10	115	TL5
TL6	Britannia Gate, Newham	Roadside	540339	180263	1.4	5.8	7	700	TL6

Table 4-2. Scheme Diffusion Tube Site Details

Site ID	Site Address, London Borough	Site Type	X (m)	Y (m)	Height (m)	Distance to Kerb (m)	Distance to Relevant exposure (m)	Distance to Tunnel Portal (km)
DT1	3 Washington Close, Tower Hamlets	Roadside	538028	182780	3.0	0.9	2.3	2.7
DT2	Tynne Court on A12 Blackwall Tunnel, Tower Hamlets	Roadside	538101	182040	2.5	0.5	5.5	2.1
DT3	Douglas Road, Newham Way, Newham	Roadside	540302	181769	2.8	3.9	5.4	1.1
DT4	1041 Newham Way, Newham	Roadside	542221	182127	2.3	3.3	11.2	2.8
DT5	Strait Road / 3 Campion Close, Newham	Roadside	542911	180913	2.9	1.6	6.7	3.1
DT6	Hanameel Street / North Woolwich Road, Newham	Roadside	540635	180130	2.8	2.9	25.1	1.0
DT7	John Wilson Street / St Mary Street, Greenwich	Roadside	543181	179034	2.3	2.6	6	3.8
DT8	Southern Way, Greenwich	Roadside	539926	178964	2.5	12.0	8.6	0.7

Site ID	Site Address, London Borough	Site Type	X (m)	Y (m)	Height (m)	Distance to Kerb (m)	Distance to Relevant exposure (m)	Distance to Tunnel Portal (km)
DT9	Westcombe Hill / Westerdale Road, Greenwich	Roadside	540257	178208	2.6	0.7	12.9	1.5
DT10	Sun-in-the-Sands, Greenwich	Roadside	540770	176945	2.4	10.3	2.4	2.8
DT11	311 Prince Regent Lane, Newham	Roadside	541098	181646	3.0	3.1	4.7	1.6
DT12	Robin Hood Lane, Tower Hamlets	Roadside	538357	180968	2.8	0.4	2.5	1.4
DT13	46 Ming Street, Tower Hamlets	Roadside	537347	180722	2.9	7.3	12.6	2.4
DT14	East Parkside, Greenwich	Roadside	539578	179536	2.5	>50	125.2	0.4
DT15	45 Siebert Road, Greenwich	Roadside	540423	177707	2.4	16.0	10.5	2.0
DT16	Switch House, Tower Hamlets	Roadside	538925	180938	2.9	0.6	20.8	0.8
DT17	East India Dock Road, Tower Hamlets	Roadside	538721	181180	2.9	1.2	7.3	1.1
DT18	13 College Approach, Greenwich	Roadside	538327	177780	2.7	1.0	0.8	1.7
DT19	8 Silvertown Way, Newham	Roadside	539498	181422	2.6	1.2	9	0.7
DT20	68 Lower Road, Southwark	Roadside	535253	179314	2.0	2.9	0	4.0
DT21	Evelyn Street, Lewisham	Roadside	537124	177699	2.7	3.5	9.1	2.6
DT22	85 Evelyn Street, Lewisham	Roadside	536220	178443	2.5	6.1	5.3	3.1
DT23	43 Rotherhithe Old Road, Southwark	Roadside	535676	178798	2.6	0.4	9.9	3.6
DT24	A2 Blackheath Hill, Greenwich	Roadside	538410	176743	2.8	2.6	4.6	2.6
DT25	Old Kent Road, Southwark	Roadside	534986	177422	2.6	10.0	21	4.6
DT26	Lower Road, Southwark	Roadside	535936	178720	2.6	8.0	7.3	3.3

Site ID	Site Address, London Borough	Site Type	X (m)	Y (m)	Height (m)	Distance to Kerb (m)	Distance to Relevant exposure (m)	Distance to Tunnel Portal (km)
DT27	1 Silvertown Way, Newham	Roadside	539642	181158	2.3	0.8	5.8	0.5
DT28	Lanrick Road, Tower Hamlets	Roadside	538961	181331	2.5	2.2	7.3	1.0
DT29	Deptford Church Street, Lewisham	Roadside	537398	177488	2.3	8.2	12.5	2.6
Hoola 1	Hoola Tower - 3 Tidal Basin Rd, Newham	Roadside	539905	180737	1.3	25.0	0	0.1
Hoola 2	Hoola Tower - 3 Tidal Basin Rd, Newham	Roadside	539907	180733	1.3	15.0	0	0.1
Hoola 3	Hoola Tower - 3 Tidal Basin Rd, Newham	Roadside	539909	180729	1.3	10.0	0	0.1
Hoola 5	Hoola Tower - 3 Tidal Basin Rd, Newham	Roadside	539915	180766	1.5	14.0	0	0.1
Hoola 6	Hoola Tower - 3 Tidal Basin Rd, Newham	Roadside	539938	180749	2.7	16.8	2.8	0.1
Hoola 10	Hoola Tower - 3 Tidal Basin Rd, Newham	Roadside	539922	180730	2.5	2.5	2.8	0.1
TL4	Tunnel Avenue*, Greenwich	Roadside	539223	179250	1.3	13.0	33.5	0.0
TL5	Hoola Tower - 3 Tidal Basin Rd*, Newham	Roadside	539936	180732	1.5	2.6	10.6	0.1
TL6	Britannia Gate / Silvertown Way*, Newham	Roadside	540339	180263	1.4	5.8	5.9	0.7

Table 4-3. Relevant Local Authority Site Details

Site ID	Site Address, London Borough	Site Type	X (m)	Y (m)	Height (m)	Distance to Kerb (m)	Distance to Relevant exposure (m)	Distance to Tunnel Portal (km)
TH004	Blackwall Tunnel Northern Approach, Tower Hamlets	Roadside	538290	181452	3	3	28.6	1.6
GN6	John Harrison Way, Greenwich	Roadside	539687	179123	3	3	23.7	4.6
GR8	Woolwich Flyover, Greenwich	Roadside	540208	178373	3	3	9.1	1.3
GW36(11)	Boord St, Greenwich	Roadside	539319	179235	2	30	11.9	8.1
GW50*	Woolwich Flyover, Greenwich	Roadside	540208	178373	2	3.5	6.8	1.3
GW51 (28)	Bugsbys Way, Greenwich	Roadside	539638	179024	2	2	41.4	4.6
GW61*	John Harrison Way, Greenwich	Roadside	539687	179123	2	3.5	23.7	4.6
NM3	Wren Close, Newham	Background	539889	181469	3	>50	15	7.4
10	Tant Avenue, Newham	Background	539747	181477	1.5	27.8	9.6	7.5
20	Canning Town Roundabout, Newham	Roadside	539456	181499	1.5	0.3	33.5	8.2
73	John Smith Mews, Tower Hamlets	Kerbside	538742	180756	2.3	0.5	12.3	1.0
85	Portree Street, Tower Hamlets	Kerbside	538890	181301	2.3	0.5	4.9	1.0
86	Newport Avenue, Tower Hamlets	Kerbside	538954	180872	2.6	0.5	15.5	8.1
Breathe London**	Silvertown Tunnel Access Corridor	Roadside	539517	181362	3	0.5	>50	7.4
Breathe London**	Blackwall Tunnel Approach	Roadside	538290	181452	3	3	28.6	1.6

Notes 1: *Co-located with CMS
Notes 2 **Breathe London -details estimated

5. Scheme Continuous Monitoring Results

Data Processing

5.1 All data have gone through a process of Quality Assurance/Quality Control (QA/QC) to ensure that monitoring data is fit for purpose. The CMS are calibrated every two weeks and calibration data is sent to the Environmental Research Group (ERG), who are responsible for data management, data validation and ratification as part of the LAQN. This ensures that the data collected and reported are reliable and consistent.

5.2 Data capture rates are used to determine the useability of the data. If data capture for the year is below 85% (as specified in Defra's Technical Guidance LAQM.TG(22)[11]), it is considered less precise. The automatic monitoring sites are also subject to 6 monthly external audits and servicing.

5.3 Full details of the QA/QC procedures are provided in Appendix C.

Tunnel Avenue (TL4), Greenwich

5.4 Table 5-1 summarises the results for the period 1st January 2023 to 31st December 2023 ('the monitoring period') for the TL4 CMS.

5.5 Data capture for the monitoring period was 92.9%. This is above the recommended 85% minimum data capture defined by The Department for Environment, Food and Rural Affairs (Defra) for data quality purposes. There were issues with the SIM card and communication towards the end of the year; hence there is no data available from 7th December 2023 onwards. This issue has now been resolved.

5.6 The annual mean NO_2 concentration was 26.4 µg/m^3. This achieves the annual mean NO_2 AQS Objective of 40 µg/m^3. Data from this site were not annualised as the data capture rate was above 75%.

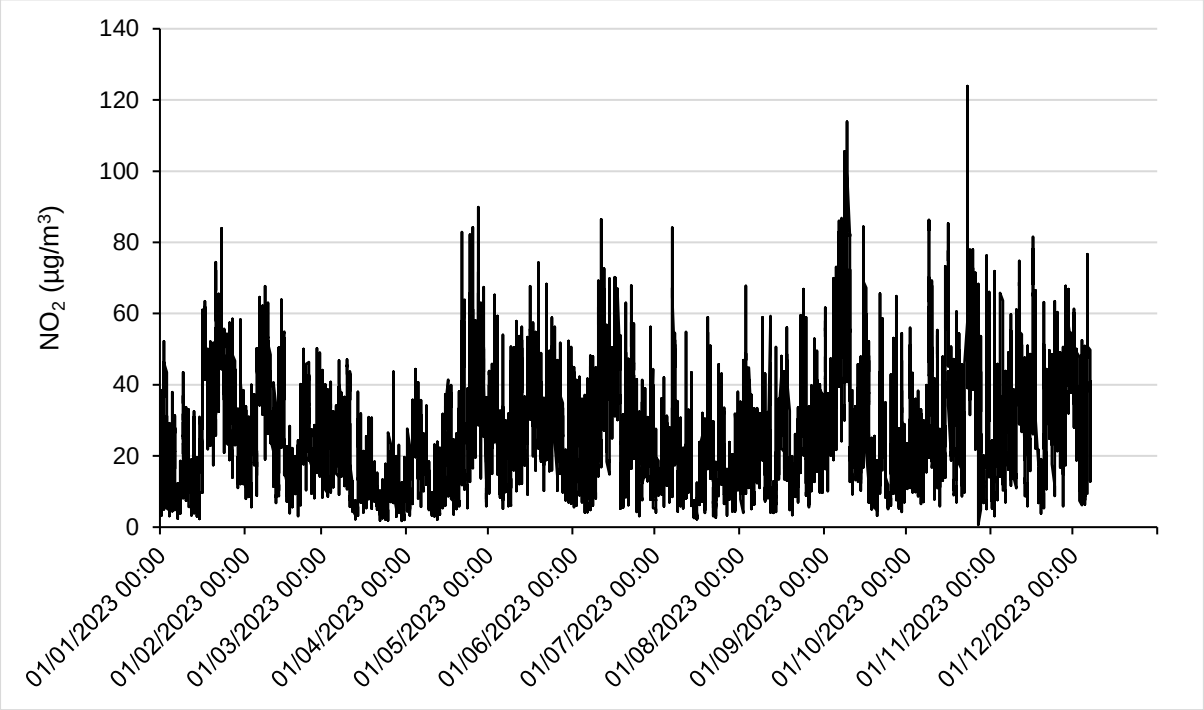
5.7 The maximum 1-hour mean NO_2 concentration was 123.9 µg/m^3, which meant that the 1-hour mean NO_2 AQS Objective value of 200 µg/m^3 was not exceeded during the monitoring period. This is within the 18 permitted hours of exceedance and therefore the 1-hour mean NO_2 AQS Objective was achieved.

Table 5-1. Tunnel Avenue (TL4) Air Quality Monitoring Results, 2023

Statistic	NO_x	NO	NO_2
Annual Mean (µg/m^3)	47.7	13.9	26.4
Number of 1-hour mean NO_2 concentrations exceeding objective value of 200 µg/m^3	-	-	0
Data Capture (%)	92.9	92.9	92.9

[11] https://laqm.defra.gov.uk/air-quality/featured/uk-regions-exc-london-technical-guidance/

Figure 5-1. Time Series Plot of 1-hour Mean NO_2 Concentrations at TL4 – Tunnel Avenue Greenwich, 1st January 2023 to 31st December 2023



5.8 Monitored hourly values clearly vary over the year, with higher peaks seen around September – October 2023, and lower concentrations observed during the spring period and towards the end of February. The seasonal variation observed at TL4 is similar to that observed at Newham's Wren Close urban background monitoring site (Figure 7-4) and across other roadside sites.

5.9 Between March and September 2023, there was construction and digging activities around TL4 as part of the Silvertown Tunnel Works which may have influenced concentrations.

Hoola Tower (TL5), Newham

5.10 Table 5-2 summarises the results for the period 1st January 2023 to 31st December 2023 ('the monitoring period') for the TL5 CMS.

5.11 Data capture for the annual monitoring period was 89.6%. This is above the recommended 85% minimum data capture defined by The Department for Environment, Food and Rural Affairs (Defra) for data quality purposes. There were periods where the monitor constantly reported flow faults between the 7th and the 14th of June as well as between the 9th and 11th of September, the faults were due to poor NOx and O_3 flows respectively and were each resolved following a call out by the equipment manufacturers. There were also issues with the SIM card and communication towards the end of the year; hence there is no data available from 7th December 2023 onwards. This issue has since been resolved.

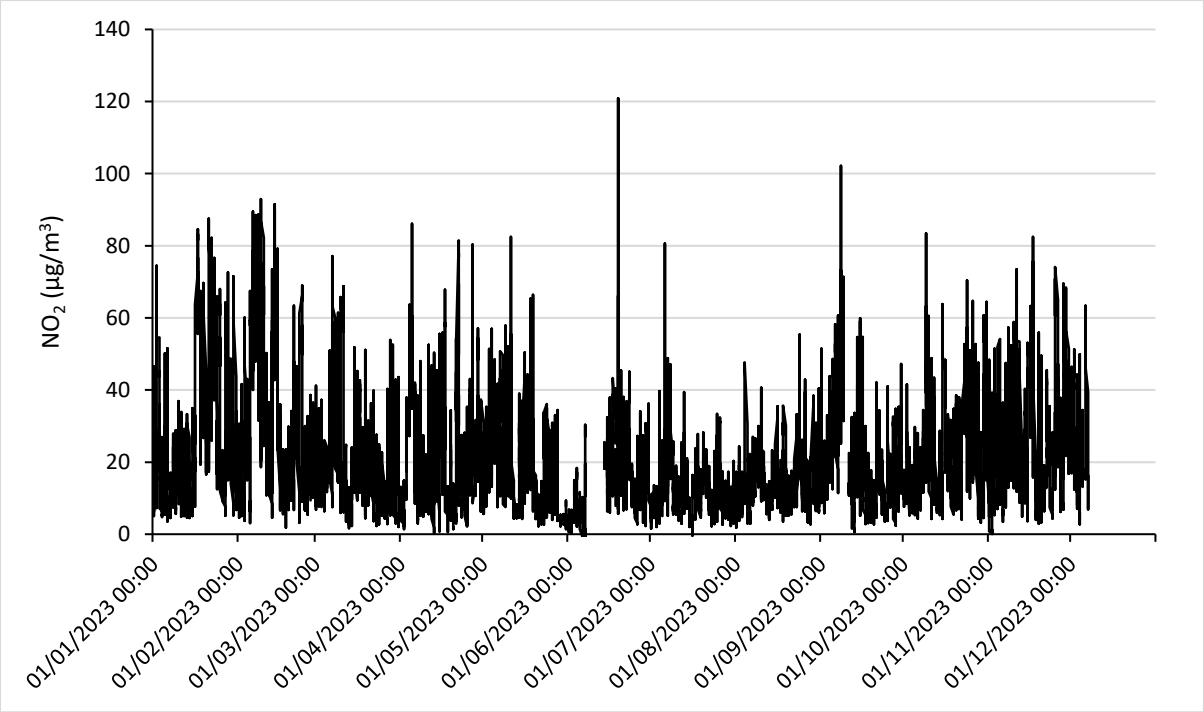
5.12 The annual mean NO_2 concentration was 21.3 µg/m^3. This achieves the annual mean NO_2 AQS Objective of 40 µg/m^3. Data from this site were not annualised as the data capture rate was above 75%.

5.13 The maximum 1-hour mean NO_2 concentration was 120.9 µg/m^3, which meant that the 1-hour mean NO_2 AQS Objective value of 200 µg/m^3 was not exceeded during the monitoring period. This is within the 18 permitted hours of exceedance and therefore the 1-hour mean NO_2 AQS Objective was achieved.

Table 5-2. Hoola Tower (TL5) Air Quality Monitoring Results, 2023

Statistic	NO_x	NO	NO_2
Annual Mean (µg/m^3)	32.5	7.3	21.3
Number of 1-hour mean NO_2 concentrations exceeding objective value of 200 µg/m^3	-	-	0
Data Capture (%)	89.6	89.6	89.6

Figure 5-2. Time Series Plot of 1-hour Mean NO_2 Concentrations at TL5 – Hoola Tower Newham, 1st January 2023 to 31st December 2023



5.14 Hourly values were highest in September – October and in the winter/summer periods, although these peaks are significantly lower. Lower concentrations observed during the spring period and towards the end of February. As indicated in Figure 7-4, the seasonal variation observed at TL5 follows a similar trend to that observed at Newham's Wren Close urban background monitoring site and other roadside sites.

5.15 It is noted that there are a number of idling delivery vehicles often parking immediately outside the monitoring unit observed during site visits which may be affecting concentrations. These delivery vehicles are associated with the residential properties in the Hoola Tower and are not related to the construction of the Scheme.

5.16 Other relevant issues noted during 2023 that could affect concentrations at this site included major construction works (as part of the Silvertown Tunnel works) along A1011 Silvertown Way resulting in partial road closures along the Silvertown Way flyover from April – December 2023. Traffic was diverted along Tidal Basin Road next to Hoola Tower. Slightly lower concentrations were observed in February and March prior to the start of construction works.

Britannia Gate (TL6), Newham

5.17 Table 5-3 summarises the results for the period 1st January 2023 to 31st December 2023 ('the monitoring period') for the TL6 CMS.

5.18 Data capture for the monitoring period was 89.9.%. This is above the recommended 85% minimum data capture defined by Defra for data quality purposes. There was a period where the monitor could not be connected to between 9th and the 16th of August due to issues with the monitor's modem, which was resolved by resetting the equipment. As well as this, between the 21st and 26th of September the monitor had crashed and was unavailable until a callout from the equipment manufacturer. There were also issues with needing to upgrade the SIM card towards the end of the year; hence there is no data available from 7th December 2023 onwards. The issue was resolved later in the month on the 29th December.

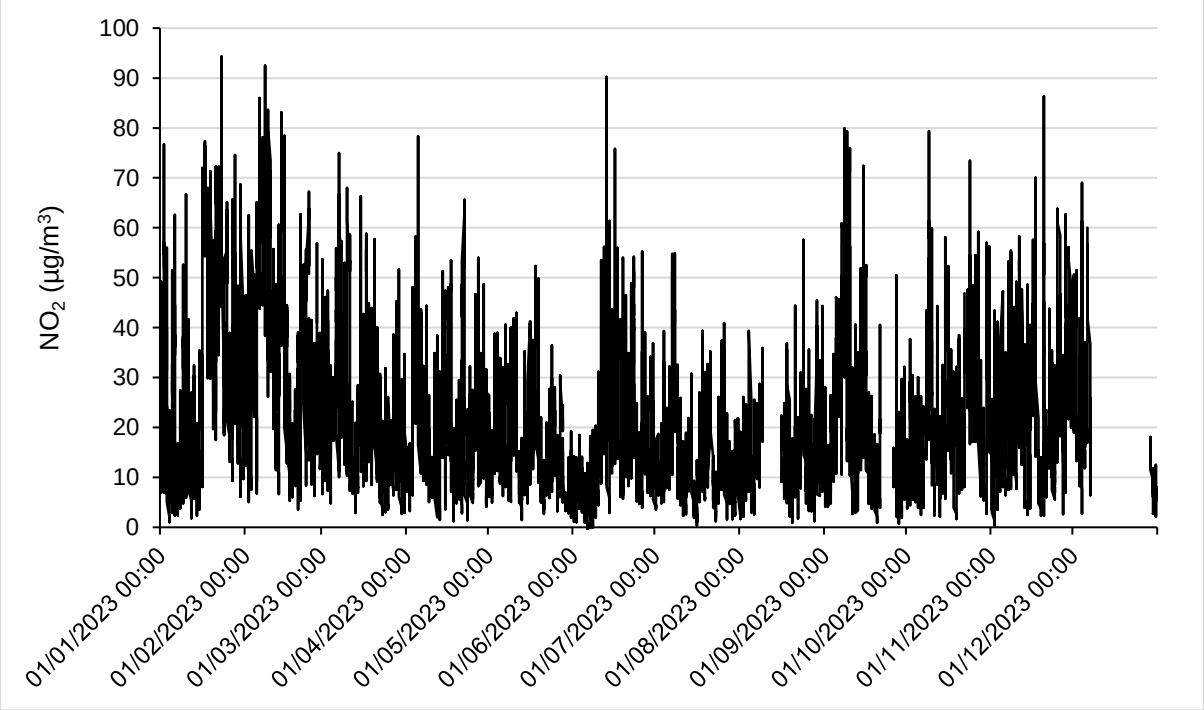
5.19 The annual mean NO_2 concentration was 21.7 µg/m^3. This achieves the annual mean NO_2 AQS Objective of 40 µg/m^3. Data from this site were not annualised as the data capture rate was above 75%. There were issues with the SIM card and communication towards the end of the year; hence there is no data available from 7th December 2023 to 29th December 2023.

5.20 The maximum 1-hour mean NO_2 concentration was 94.3 µg/m^3, which meant that the 1-hour mean NO_2 AQS Objective value of 200 µg/m^3 was not exceeded during the monitoring period. This is within the 18 permitted hours of exceedance and therefore the 1-hour mean NO_2 AQS Objective was achieved.

Table 5-3. Brittania Gate (TL6) Air Quality Monitoring Results, 2023

Statistic	NO_x	NO	NO_2
Annual Mean (µg/m^3)	36.9	9.9	21.7
Number of 1-hour mean NO_2 concentrations exceeding objective value of 200 µg/m^3	-	-	0
Data Capture (%)	89.9	89.9	89.9

Figure 5-3. Time Series Plot of 1-hour Mean NO_2 Concentrations at TL6 – Britannia Gate Newham, 1st January 2023 to 31st December 2023



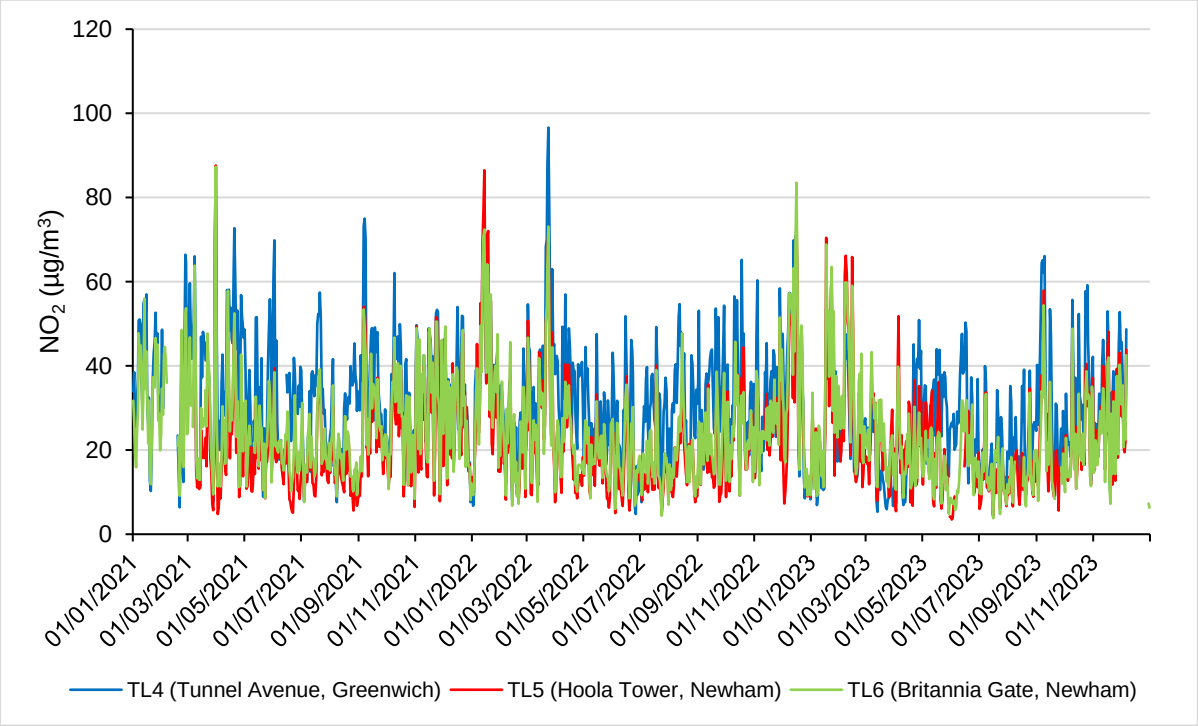
5.21 Hourly concentrations show a different patten to the other two CMS, with higher peak values spread throughout the year. Lower concentrations are only really observed during the summer from late May to early June and also at the beginning of August. It should be noted that there were major construction works (as part of the Silvertown Tunnel works) along the A1011 Silvertown Way from April 2023 onwards. This could explain the different trend in results at this site.

Three Year Trend

5.22 The trends observed in the monthly data are broadly consistent between 2021 and 2023 where concentrations generally increase in the autumn and winter and decrease in the spring and summer months. However, a peak was observed in March – April 2022 which was not present in 2021 or 2023.

5.23 The annual average concentrations observed at TL4, TL5 and TL6 decreased from 2021 to 2023 by 23.0%, 2.3% and 17.8% respectively.

Figure 5-4. Daily Mean NO_2 Concentrations at the Continuous Monitoring Sites, 2021- 2023



6. Scheme Diffusion Tube Monitoring Results

Data Processing

6.1 Diffusion tube data is processed by Staffordshire Highways Laboratory using a preparation method of 20% TEA in water. In line with Defra guidance, data have been adjusted using a factor based on the difference between diffusion tube readings and readings from a continuous reference monitor, called a bias adjustment factor. Two factors have been calculated, one based on co-located tubes with the three continuous monitoring sites and a second using data from the national basis factor database which is based on multiple co-location studies for the laboratory.

6.2 Full details of the QA/QC procedure are provided in Appendix C.

Summary

6.3 The results of the diffusion tube monitoring survey for the period 3rd January 2023 to 9th January 2024 are summarised in Table 6-1. The data report has been adjusted using the 2023 national bias adjustment factor as this approach is more conservative than using a locally derived factor.

6.4 The complete monthly diffusion tube data including local and nationally adjusted results for the monitoring period can be found in Appendix B.

Table 6-1. Scheme Diffusion Tube Monitoring Results

Site	Raw Annual Mean NO_2 Concentration ($\mu g/m^3$)	Triplicate Data Capture Rate (%)	National Bias Adjusted 2023 Annual Mean NO_2 Concentration ($\mu g/m^3$)	National Bias Adjusted 2022 Annual Mean NO_2 Concentration ($\mu g/m^3$)	Percentage Change from 2022 to 2023
DT1	25.6	100.0%	22.0	24.3	-9.5%
DT2	37.7	83.3%	32.4	34.8	-6.9%
DT3	46.4	100.0%	39.9	**41.4**	-3.6%
DT4	32.6	100.0%	28.0	30.8	-9.0%
DT5	23.9	100.0%	20.6	21.9	-6.1%
DT6	28.7	100.0%	24.7	26.9	-8.4%
DT7	31.5	91.7%	27.1	28.4	-4.8%
DT8	31.9	100.0%	27.4	29.4	-6.6%
DT9	39.9	100.0%	34.3	34.9	-1.7%
DT10	28.2	100.0%	24.3	26.5	-8.4%
DT11	36.7	100.0%	31.6	34.4	-8.2%
DT12	40.3	100.0%	34.6	36.8	-6.0%

Site	Raw Annual Mean NO_2 Concentration (µg/m^3)	Triplicate Data Capture Rate (%)	National Bias Adjusted 2023 Annual Mean NO_2 Concentration (µg/m^3)	National Bias Adjusted 2022 Annual Mean NO_2 Concentration (µg/m^3)	Percentage Change from 2022 to 2023
DT13	25.7	83.3%	22.1	25.8	-14.3%
DT14	26.9	91.7%	23.1	23.6	-2.2%
DT15	27.1	100.0%	23.3	26.8	-13.2%
DT16	30.1	100.0%	25.9	27.5	-5.9%
DT17	42.9	100.0%	36.9	38.9	-5.1%
DT18	37.3	100.0%	32.1	35.3	-9.2%
DT19	35.5	100.0%	30.5	35.8	-14.7%
DT20	30.6	100.0%	26.3	26.1	+0.8%
DT21	26.7	100.0%	23.0	30.3	-24.1%
DT22	30.1	66.7%	24.8	27.0	-7.9%
DT23	39.4	100.0%	33.8	35.8	-5.4%
DT24	43.8	100.0%	37.7	**41.1**	-8.4%
DT25	26.9	100.0%	23.2	24.3	-4.5%
DT26	26.4	100.0%	22.7	23.6	-4.0%
DT27	34.1	100.0%	29.3	32.0	-8.4%
DT28	36.0	100.0%	31.0	31.6	-1.9%
DT29	25.7	100.0%	22.1	22.5	-1.8%
TL4	33.3	75.0%	28.6	31.1	-8.2%
TL5	30.4	83.3%	26.1	25.8	-4.8%
TL6	27.0	100.0%	23.2	25.5	-9.0%

*Notes: Concentrations in **bold** denote exceedances of the annual mean AQS objective value. Concentrations at site DT22 have been annualised due to low data capture.*

6.5 Throughout the monitoring period, any relevant local site-specific issues identified are recorded to assist in analysing trends. Issues noted during 2023 are outlined below:

- January & February 2023 – Power generator located next to DT19 which is likely to have affected the results. Concentrations do appear higher during these periods.
- March 2023- September 2023 - Construction and digging around TL4 (Tunnel Avenue) as part of the Tunnel Works.

- April- December 2023 - Major construction works (as part of the Tunnel works) along A1011 Silvertown Way resulting in partial road closures along the Silvertown Way Flyover. Diffusion tubes at TL6 (Britannia Gate) did see a noticeable drop in concentrations throughout the period.
- October 2023- Screen installed between TL4 (Tunnel Avenue) and Blackwall Tunnel Southern Approach to allow access to public footpath without entering the construction site. Lower concentrations observed for the rest of the year.
- November 2023 – Planters with trees removed between the TL6 monitor and the road; and
- December 2023 – Construction and digging in close proximity to DT18.

6.6 All of the diffusion tube monitoring locations except DT22 recorded a data capture of 75% or greater in 2023 and therefore did not require annualisation. DT22 only had a data capture of 66.7% and therefore annualization of the data was carried out. Details on these can be found in Appendix C.

6.7 There were no exceedances of the annual mean objective in 2023 at any of the diffusion tube sites.

6.8 Due to the long exposure periods needed for diffusion tube sampling, it is not possible to make direct comparisons against the 1-hour mean NO_2 AQS Objective. As a proxy, Defra suggests using an annual mean NO_2 concentration of 60 µg/m^3 for diffusion tube measurements to determine the likelihood of the short-term AQS Objective being achieved or exceeded[12]. There were no diffusion tube sites where the annual mean NO_2 concentration exceeded 60 µg/m^3 and therefore the 1-hour mean NO_2 AQS Objective is expected to have been met.

6.9 The highest average monthly NO_2 concentrations were monitored during the winter months with another peak in September, as is consistent with the trend observed in the continuous monitoring data. The lowest concentrations occurred between March and May 2023, with a smaller dip in concentrations visible in June.

Additional Monitoring at the Hoola Tower

6.10 In addition to the monitoring locations specified within the MMS, a number of additional NO_2 diffusion tubes were located around the Hoola West Tower, located on Tidal Basin Road in Newham.

6.11 There is the potential for increases in NO_2 concentrations due to the Scheme at this location given the Hoola Towers' proximity to tunnel portal and changes in road network with the Scheme. Data from these supplementary locations provide additional information on NO_2 concentrations around the Tower.

Table 6-2. Scheme Diffusion Tube Monitoring Results at Hoola Tower

Site	Raw Period Mean NO_2 Concentration (µg/m^3)	Data Capture Rate (%)	National Bias Adjusted Annual Mean 2023 NO_2 Concentration (µg/m^3)	National Bias Adjusted Annual Mean 2022 NO_2 Concentration (µg/m^3)	Percentage Change from 2022 to 2023
Hoola 1	28.9	100.0%	24.9	25.1	-0.6%
Hoola 2	29.6	100.0%	25.4	26.3	-3.1%
Hoola 3	29.1	91.7%	25.0	25.7	-3.0%
Hoola 5	30.8	100.0%	26.5	27.9	-5.0%
Hoola 6	32.9	75.0%	28.3	29.1	-3.0%

[12] Microsoft Word - TG_NO2 relationship_report_draft1.doc (defra.gov.uk)

Site	Raw Period Mean NO_2 Concentration ($\mu g/m^3$)	Data Capture Rate (%)	National Bias Adjusted Annual Mean 2023 NO_2 Concentration ($\mu g/m^3$)	National Bias Adjusted Annual Mean 2022 NO_2 Concentration ($\mu g/m^3$)	Percentage Change from 2022 to 2023
Hoola 10	29.6	100.0%	25.5	27.3	-6.5%

6.12 Throughout the monitoring period, any relevant local site-specific issues identified are recorded to assist in analysing trends. Issues noted during 2023 are outlined below:

- April- December 2023- Major construction works (as part of the Tunnel works) along A1011 Silvertown Way resulting in partial road closures along the Silvertown Way Flyover. Traffic was diverted along Tidal Basin Road next to Hoola Tower. No discernible difference between results pre and during the construction works.
- October 2023- The lamppost where Hoola 10 was situated was taken down as part of the A1011 Silvertown Way roadworks. Diffusion tube installed at same location but lower height (≈ 1.0m); noticeable increase in concentrations for the rest of the year.

6.13 The data show that the measured 2023 concentrations at all diffusion tube sites around the Hoola Tower are below the AQS objective value at all sites.

6.14 In 2023, NO_2 concentrations were highest at Hoola 6, located to the east of the West Tower. The concentration measured at Hoola 10 located close to Tidal Basin Road were similar to the value for the tube at TL5, co-located with the continuous monitoring site. Hoola 10 is slightly further west than TL5 and is located approximately 30 m closer to the A1011/Silvertown Way. Generally, concentrations at TL5 were slightly higher in the winter than at Hoola 10 whilst the concentrations at Hoola 10 were slightly higher during the summer.

Comparison to 2022

6.15 Annual mean NO_2 concentrations at 37 of the 38 diffusion tube monitoring locations decreased from 2022 to 2023, whilst concentrations at one site; DT20 Lower Road slightly increased (see Table 6-1 and Table 6-2). This small increase was likely due to increased emissions associated with traffic congestion at the temporary traffic lights which were installed for several months to allow for construction of the new cycle lane for Cycleway 4. It is noted that this tube is located next to a local authority continuous monitor (SKA) and levels at this site also increased.

6.16 Two diffusion tube monitoring sites exceeded the AQS objective in 2022: DT3 and DT24. The concentration at DT3 decreased from 41.4 $\mu g/m^3$ in 2022 to 39.9 $\mu g/m^3$ in 2023 to a level below the objective. DT24 also decreased, from 41.1 $\mu g/m^3$ to 37.7 $\mu g/m^3$ in 2023 which is also below the AQS objective.

6.17 The average reduction in annual mean NO_2 concentrations across all sites from 2022 to 2023 was 6.7% (2.0 $\mu g/m^3$).

7. Local Authority Monitoring Results

Selected Continuous Monitoring Results

Blackwall (TH004), Tower Hamlets

7.1 Table 7-1 summarises the 2023 results for the TH004 CMS. Hourly data are provided in Figure 7-1.

7.2 Data for the monitoring period has been fully ratified. Data capture for the monitoring period was 98.5%, above the recommended 85% minimum data capture defined by Defra for data quality purposes.

7.3 The annual mean NO_2 concentration was 28.3 µg/m^3. This achieves the annual mean NO_2 AQS Objective of 40 µg/m^3.

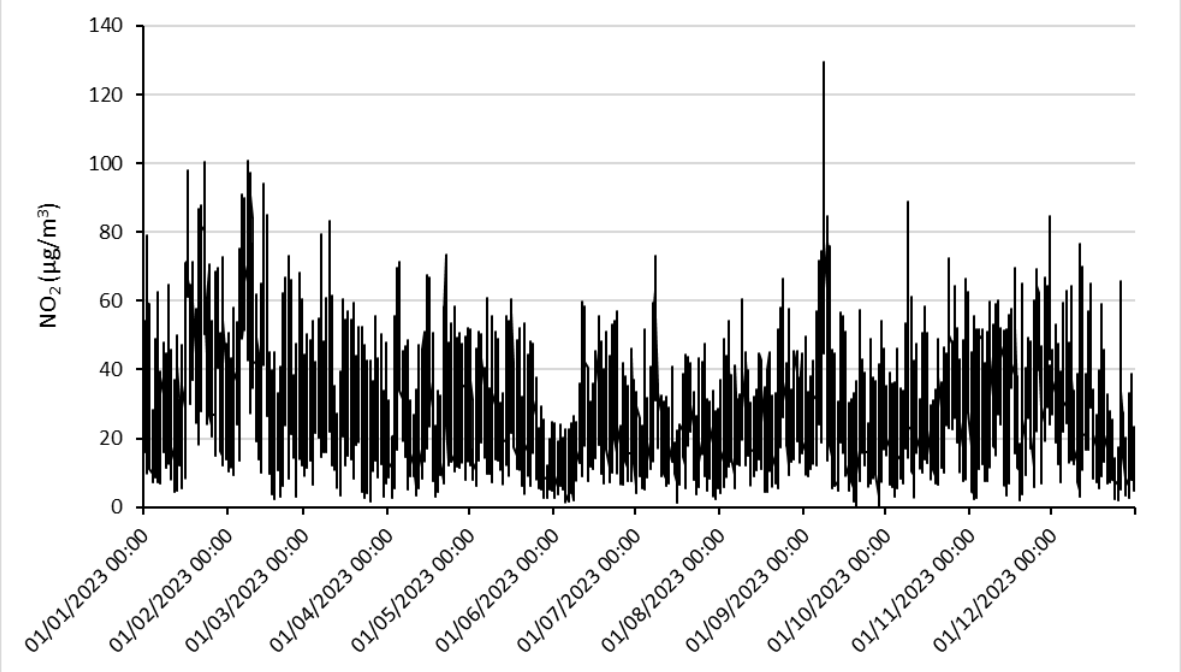
7.4 The 1-hour mean NO_2 AQS Objective value of 200 µg/m^3 was not exceeded on any occasions during the monitoring period. This is within the 18 permitted hours of exceedance and therefore the 1-hour mean NO_2 AQS Objective was achieved.

Table 7-1. Blackwall (TH004) Air Quality Monitoring Results, 2023

Statistic	NO_x	NO	NO_2
Annual Mean (µg/m^3)	57.5	19.0	28.3
Number of 1-hour mean NO_2 concentrations exceeding objective value of 200 µg/m^3	-	-	0
Data Capture (%)	98.4	98.9	98.5

Note: Data was sourced from Air Quality England[13]. Data for NOx and NO are not available.

Figure 7-1. Time Series Plot of 1-hour Mean NO_2 Concentrations at TH004 – Blackwall Tower Hamlets, 1st January 2023 to 31st December 2023



[13] https://www.airqualityengland.co.uk/site/data?site_id=TH004

7.5 Trends in annual mean concentrations over the last six years at TH004 are shown in Table 7-2. The measured data show that concentrations have declined by 44% over this period and have been below the annual mean objective from 2020.

Table 7-2. Annual mean NO_2 concentrations at Blackwall (TH004) between 2018 - 2023

Statistic	2018	2019	2020	2021	2022	2023	Percentage change
Annual Mean ($\mu g/m^3$)	**50.7**	**47.4**	38.6	37.4	36.5	28.3	-44%
Data Capture (%)	98.9	98.6	98.9	98.9	62.1	98.5	-

*Note: Concentrations in **bold** above the annual mean AQS objective value*

John Harrison Way (GN6), Greenwich

7.6 Table 7-3 summarises the 2023 results for the GN6 CMS. Hourly data are provided in Figure 7-2.

7.7 Data for the monitoring period has been fully ratified and the data capture for the monitoring period was 99.9%. This is above the recommended 85% minimum data capture defined by Defra for data quality purposes.

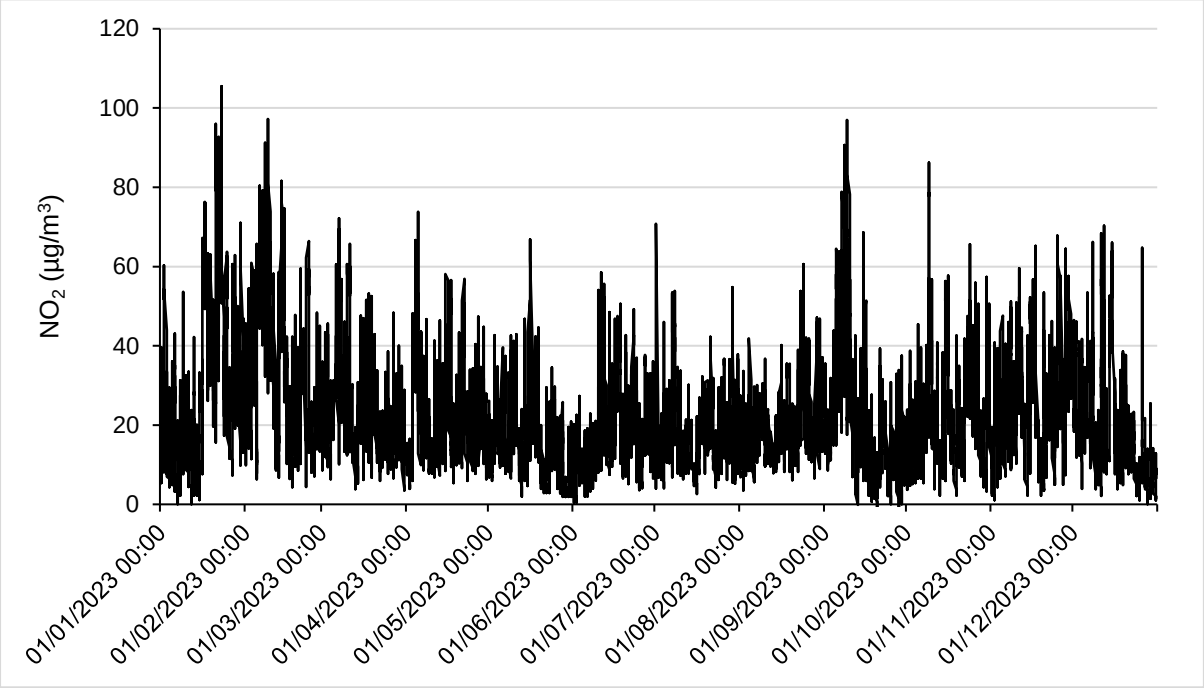
7.8 The annual mean NO_2 concentration was 22.2 $\mu g/m^3$. This achieves the annual mean NO_2 AQS Objective of 40 $\mu g/m^3$.

7.9 The 1-hour mean NO_2 AQS Objective value of 200 $\mu g/m^3$ was not exceeded on any occasions during the monitoring period. This is within the 18 permitted hours of exceedance and therefore the 1-hour mean NO_2 AQS Objective was achieved.

Table 7-3. John Harrison Way (GN6) Air Quality Monitoring Results, 2023

Statistic	NO_x	NO	NO_2
Annual Mean ($\mu g/m^3$)	35.1	8.4	22.2
Number of 1-hour mean NO_2 concentrations exceeding objective value of 200 $\mu g/m^3$	-	-	0
Data Capture (%)	99.9	99.9	99.9

Figure 7-2. Time Series Plot of 1-hour Mean NO_2 Concentrations at GN6 – John Harrison Way-Greenwich, 1st January 2023 to 31st December 2023



7.10 GN6 is located approximately 500 m southeast of AECOM's TL4 monitoring site. The sites are not positioned on the same road, with TL4 located on Tunnel Avenue off A102, and GN6 on John Harrison Way which is a smaller road. GN6 monitored an annual mean NO_2 concentration of 22.2 µg/m^3, whereas TL4 recorded a higher annual mean NO_2 concentration of 26.4 µg/m^3, likely to be because it is positioned nearer the A102.

7.11 Trends in annual mean concentrations over the last six years at GN6 are shown in Table 7-4. The measured data show that concentrations have declined by 34% over this period.

Table 7-4. Annual mean NO_2 concentrations at John Harrison Way (GN6) between 2018 - 2023

Statistic	2018	2019	2020	2021	2022	2023	Percentage change
Annual Mean (µg/m^3)	33.7	32.9	25.6	25.3	23.2	22.2	-34%
Data Capture (%)	43.0	100.0	100.0	97.3	90.5	99.9	-

Woolwich Flyover (GR8), Greenwich

7.12 Table 7-5 summarises the 2023 results for the GR8 CMS. Hourly data are provided in Figure 7-3.

7.13 Data for the monitoring period has been fully ratified and data capture for the monitoring period was 55.1% due to a loss of data between March and May and also from late September onwards. This is below the recommended 85% minimum data capture defined by Defra for data quality purposes.

7.14 The annual mean NO_2 concentration was 32.0 µg/m^3 which is below the annual mean NO_2 AQS Objective of 40 µg/m^3.

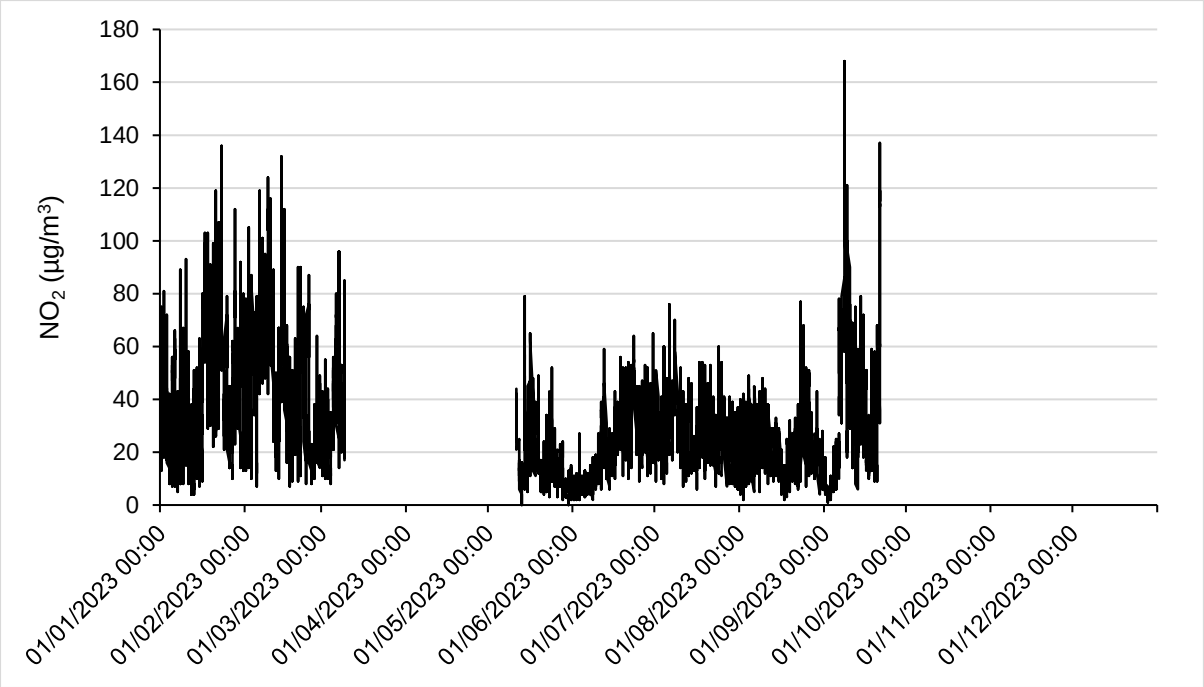
7.15 The 1-hour mean NO_2 AQS Objective value of 200 µg/m^3 was not exceeded on any occasions during the monitoring period. This is within the 18 permitted hours of exceedance and therefore the 1-hour mean NO_2 AQS Objective was achieved.

Table 7-5. Woolwich Flyover (GR8) Air Quality Monitoring Results, 2023

Statistic	NO_x	NO	NO_2
Annual Mean (µg/m^3)	76.3	28.8	32.0
Number of 1-hour mean NO_2 concentrations exceeding objective value of 200 µg/m^3	-	-	0
Data Capture (%)	55.1	55.1	55.1

Note: Data capture rate was low. Data have not been annualised.

Figure 7-3. Time Series Plot of 1-hour Mean NO_2 Concentrations at GR8 – Woolwich Flyover-Greenwich, 1st January 2023 to 31st December 2023



7.16 GR8 is located 1.3 km south of AECOM's TL4 monitoring site. GR8 monitored an annual mean NO_2 concentration of 32.0 µg/m^3, whereas TL4 recorded an annual mean NO_2 concentration of 26.4 µg/m^3. Both sites are roadside monitoring locations, however TL4 is positioned further back from the road (13 m from the kerb) compared to GR8 which is located 3 m from the nearest kerb.

7.17 Trends in annual mean concentrations over the last six years at GR8 are shown in Table 7-6. The measured data show that concentrations have declined by 43% over this period.

Table 7-6. Annual mean NO_2 concentrations at Woolwich Flyover (GR8) between 2018 - 2023

Statistic	2018	2019	2020	2021	2022	2023	Percentage change
Annual Mean (µg/m^3)	**56.7**	**52.3**	**43.2**	**40.3**	40.0	32.0	-43%
Data Capture (%)	95.6	99.7	98.4	100.0	97.9	55.1	-

*Note: Concentrations in **bold** above the annual mean AQS objective value*

Wren Close (NM3), Newham

7.18 Table 7-7 summarises the 2023 results for the NM3 urban background CMS. Hourly data are provided in Figure 7-4.

7.19 Data for the monitoring period has been fully ratified and data capture for the monitoring period was 98.4%. This is above the recommended 85% minimum data capture defined by Defra for data quality purposes.

7.20 The annual mean NO_2 concentration was 19.8 µg/m^3. This achieves the annual mean NO_2 AQS Objective of 40 µg/m^3.

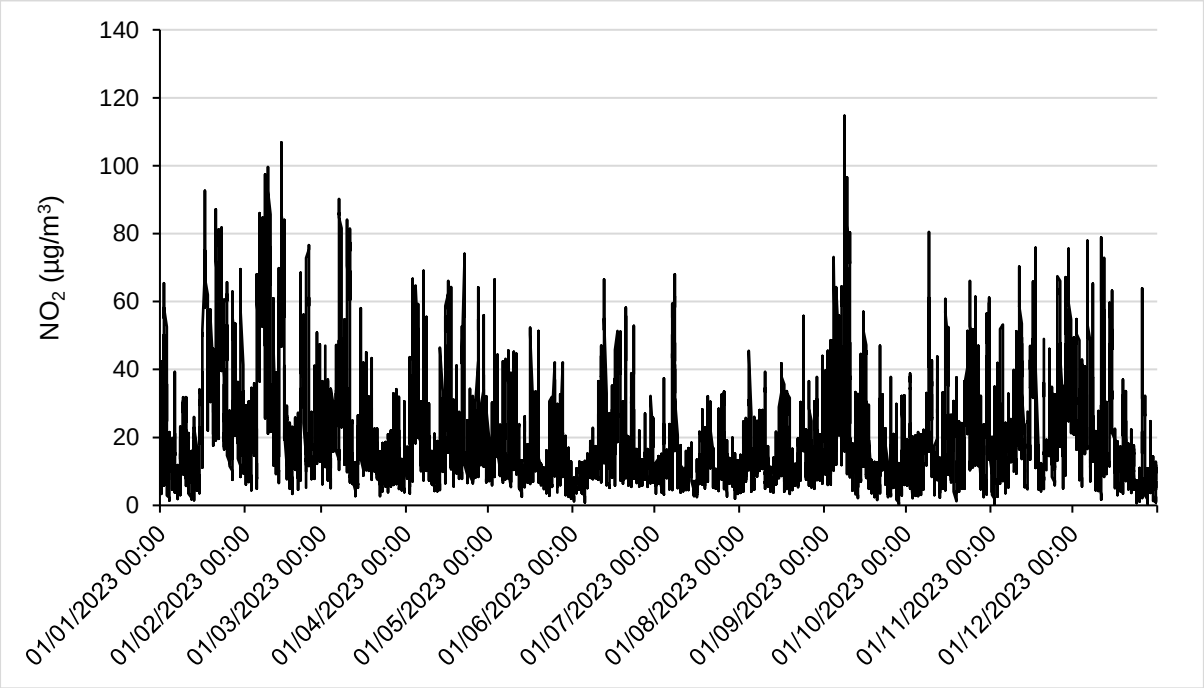
7.21 The 1-hour mean NO_2 AQS Objective value of 200 µg/m^3 was not exceeded on any occasions during the monitoring period. This is within the 18 permitted hours of exceedance and therefore the 1-hour mean NO_2 AQS Objective was achieved.

7.22 The trend in recorded NO_2 concentrations over the course of 2023 at Wren Close are similar those recorded at previously mentioned roadside sites. Concentrations increased in autumn and winter, with peak concentrations around September and February. Concentrations are lowest in the summer months and the end of March.

Table 7-7. Wren Close (NM3) Air Quality Monitoring Results, 2023

Statistic	NO_x	NO	NO_2
Annual Mean (µg/m^3)	25.8	3.9	19.8
Number of 1-hour mean NO_2 concentrations exceeding objective value of 200 µg/m^3	-	-	0
Data Capture (%)	98.4	98.4	98.4

Figure 7-4. Time Series Plot of 1-hour Mean NO_2 Concentrations at NM3 – Wren Close-Newham, 1st January 2023 to 31st December 2023



7.23 Trends in annual mean concentrations over the last six years at NM3 are shown in Table 7-8. The measured data show that concentrations have declined by 31% over this period.

Table 7-8. Annual mean NO_2 concentrations at Wren Close (NM3) between 2018 - 2023

Statistic	2018	2019	2020	2021	2022	2023	Percentage change
Annual Mean (µg/m^3)	28.5	28.0	20.3	20.7	21.8	19.8	-31%
Data Capture (%)	96.7	99.7	94.0	95.1	98.5	98.4	

Breathe London Sensors

7.24 There are two roadside Breathe London sensors located close to the northern portal of Blackwall Tunnel, within Tower Hamlets and Newham. One is co-located with TH004 at Blackwall Tunnel Northern Approach and one on Silvertown Way (Silvertown Town access corridor) close to the bus station.

7.25 Both sites had high data capture rates for 2023, and annual mean NO_2 concentrations were 28.9 µg/m^3 at Blackwall Tunnel which were similar to the concentration the TH004 reference monitor (28.3 µg/m^3) and 24.1 µg/m^3 at Silvertown Way. The nearest Scheme diffusion tubes to the Silvertown Way sensor are DT19 and DT27 on the other side of the road. 2023 concentrations measured by the two tube sites were higher at 30.5 µg/m^3 and 29.3 µg/m^3 respectively.

Selected Diffusion Tube Monitoring Results

7.26 Selected results from local authority diffusion tube monitoring surveys at roadside locations for the years 2017 - 2023 are summarised in Table 7-9. Data have been extracted from the latest Air Quality Annual Status Reports (ASRs) for Newham[14], Greenwich[15] and Tower Hamlets[16].

7.27 Of the selected results, the AQS objective was not exceeded at any sites in 2023.

Table 7-9. Selected Local Authority Diffusion Tube Monitoring Results, 2017-2023

Site	Site Name and Local Authority	Distance to Road (m)	Bias Adjusted Annual Mean NO_2 Concentration ($\mu g/m^3$)							Percentage change
			2017	2018	2019	2020	2021	2022	2023	
GW36(11)	Boord Street, Greenwich	30.0	**56.4**	**46.9**	**49.3**	**41.0**	30.5	23.0	23.9	-58%
GW50	Woolwich Flyover, Greenwich	3.0	**69.5**	**54.3**	**53.2**	**49.0**	**41.0**	36.0	38.7	-44%
GW51 (28)	Bugby's Way, Greenwich	2.0	**43.6**	37.0	39.0	30.0	29.0	26.0	27.0	-38%
GW61	John Harrison Way, Greenwich	3.0	28.1	31.9	32.8	26.0	23.0	23.0	25.0	-11%
NHM-10	Tant Avenue E16, Newham	30.0	30.0	27.0	24.4	20.4	16.1	20.1	17.5	-42%
NHM-20	Canning Town Round about, Newham	0.3	**56.0**	**58.0**	35.3	32.7	28.8	33.4	27.2	-51%
73	John Smith Mews, Tower Hamlets	0.5	**40.0**	32.0	31.0	24.6	26.0	22.3	21.6	-46%
85	Portree Street, Tower Hamlets	0.5	**48.0**	**45.0**	38.0	34.3	33.5	31.6	29.7	-38%

[14] London Borough of Newham (2024). Air Quality Annual Status Report for 2023. Available at: https://www.newham.gov.uk/public-health-safety/air-quality-newham/2
[15] Royal Borough of Greenwich (2024). Air Quality Annual Status Report for 2023. Available at: https://www.royalgreenwich.gov.uk/downloads/download/1466/air_quality_annual_status_report
[16] London Borough of Tower Hamlets (2024). Monitoring data available at https://www.towerhamlets.gov.uk/lgnl/environment_and_waste/environmental_health/pollution/air_quality/Advanced_information_on_air_quality/Monitoring.aspx

Site	Site Name and Local Authority	Distance to Road (m)	Bias Adjusted Annual Mean NO_2 Concentration ($\mu g/m^3$)							Percentage change
			2017	2018	2019	2020	2021	2022	2023	
86	Newport Avenue, Tower Hamlets	0.5	33.0	30.0	28.0	21.7	24.6	22.5	21.4	-35%

*Note: Concentrations in **bold** denote exceedances of the annual mean AQS objective value and those **bold and underlined** are at risk of exceedance of the hourly mean objective. Concentrations in 2020 have been affected by the Covid-19 pandemic including lockdowns, and must be interpreted with caution.*

7.28 The measured concentrations at the selected local authority sites close to the Scheme have decreased since 2017 by between 11-58%.

7.29 Several of AECOM's Scheme-specific monitoring locations are situated in close proximity to local authority managed sites. A comparison against these sites shows concentrations are similar which provides confidence in the results reported for the Scheme as outlined below.

- AECOM's site DT19 is positioned on the A1011 Silvertown Way, 90 m south of Newham's monitoring site NHM-20. In 2023, DT19 monitored an annual mean NO_2 concentration of 30.5 $\mu g/m^3$, which is slightly higher than the 2023 concentration monitored at Newham's site NHM-20 of 27.2 $\mu g/m^3$.
- Tower Hamlets' site 86 is located 60 m south of AECOM's site DT16, on Newport Avenue. In 2023, DT16 monitored an annual mean NO_2 concentration of 25.9 $\mu g/m^3$, which is slightly higher than the 2023 annual mean NO_2 concentration 21.4 $\mu g/m^3$ monitored by Tower Hamlets' site 86.
- AECOM's site DT28 is located on Lanrick Road, approximately 70 m from Tower Hamlets' site 85. In 2023, the monitored concentration at DT28 was 31.0 $\mu g/m^3$, which is similar to the 2023 concentration of 29.7 $\mu g/m^3$ monitored at Tower Hamlets' site 85.

8. Summary

Overview

8.1 Transport for London (TfL) is conducting air quality monitoring to assess the environmental impact of the Silvertown Tunnel Scheme. Monitoring was conducted at 38 NO_2 diffusion tube locations and three NOx continuous monitoring sites (TL4, TL5 and TL6). The results of the monitoring reported here represent the third year of baseline NO_2 monitoring results for 2023.

8.2 An annual report will be produced for each year of monitoring to determine the baseline trends pre-Scheme opening and Scheme impacts post-opening.

8.3 There are three local authority roadside CMSs in the vicinity of the Scheme:

- TH004 Blackwall (Tower Hamlets);
- GN6 John Harrison Way (Greenwich); and
- GR8 Woolwich Flyover (Greenwich).

8.4 In 2023, there were no exceedances of the annual mean objective for NO_2 at these local authority monitoring sites.

8.5 The annual mean NO_2 concentrations at all three scheme continuous monitoring sites complied with the AQS objective in 2022 with a maximum concentration 26.4 µg/m^3 recorded at TL4 (Tunnel Avenue), this was a reduction of 6.0% compared to 2022.

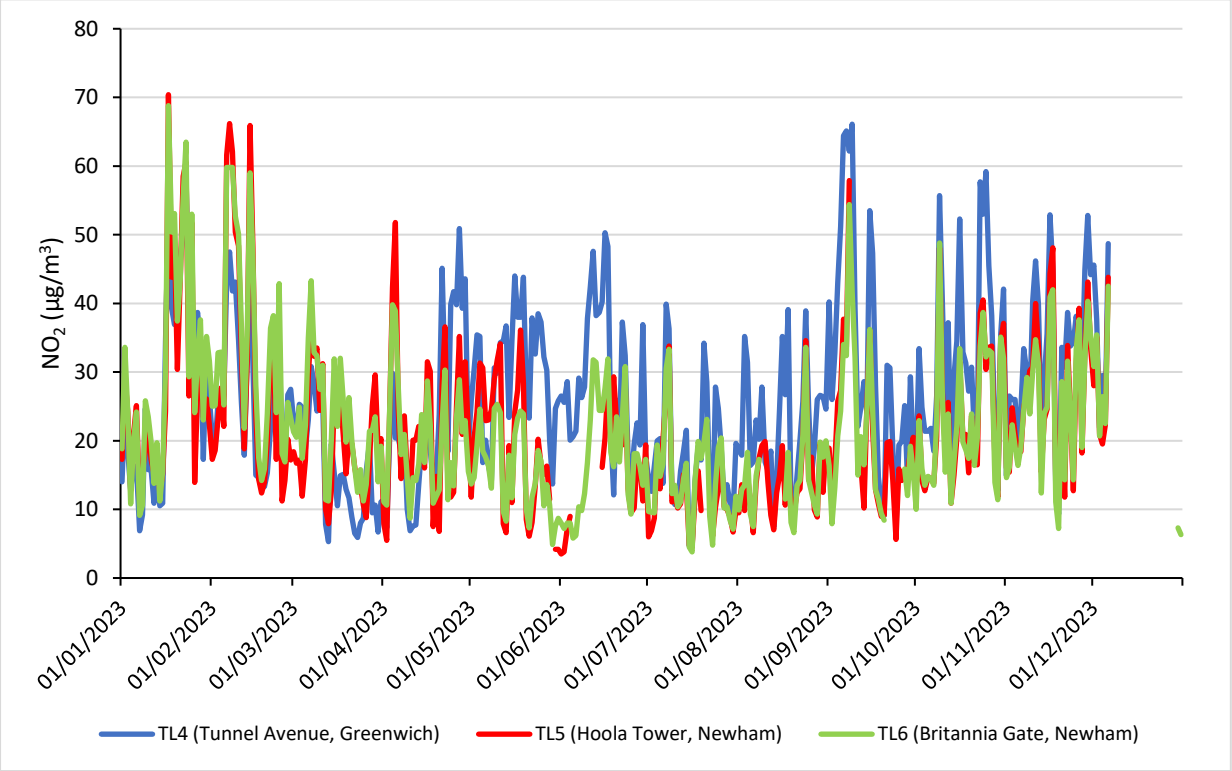
8.6 Average daily concentrations follow a similar trend to the local authority sites at TL4 and TL5, as evident in Figure 8-1. The trends at both these sites observed in the monthly data were broadly consistent between 2022 and 2023, concentrations generally increase in the autumn and winter and decrease in the spring and summer months. It is thought that the different trend seen at TL6 could have been influenced by the major roadworks along Silvertown Way for most of the year as concentrations were mainly consistent throughout the year with lower concentrations primarily from late May to early June. The annual average concentrations observed at TL4, TL5 and TL6 declined from 2022 to 2023 by 6.0%, 1.5% and 2.9% respectively.

8.7 The results of the diffusion tube monitoring survey during 2023 indicate that annual mean NO_2 concentrations comply with the AQS objective at all of the 38 monitoring sites, including those sites in the vicinity of the tunnel. A maximum concentration of 39.9 µg/m^3 was recorded at DT3 (Douglas Road, Newham Way), this was a small reduction of 3.6% compared to 2022.

8.8 The concentrations at 37 out of 38 scheme diffusion tube monitoring locations reduced from 2022 to 2023 whilst concentrations at one site increased. Overall, across all sites, there was a reduction in concentrations by 2.0 µg/m^3 (6.7%) from 2022, and a reduction of two exceedances of the AQS objective to no exceedances in 2023.

8.9 It is expected that annual mean NO_2 concentrations will continue to decline due to continued vehicle fleet improvements as a result of London wide measures such as the ULEZ and wider interventions including electrification of the vehicle fleet.

Figure 8-1. Daily Mean NO_2 Concentrations at CMS's, 2023

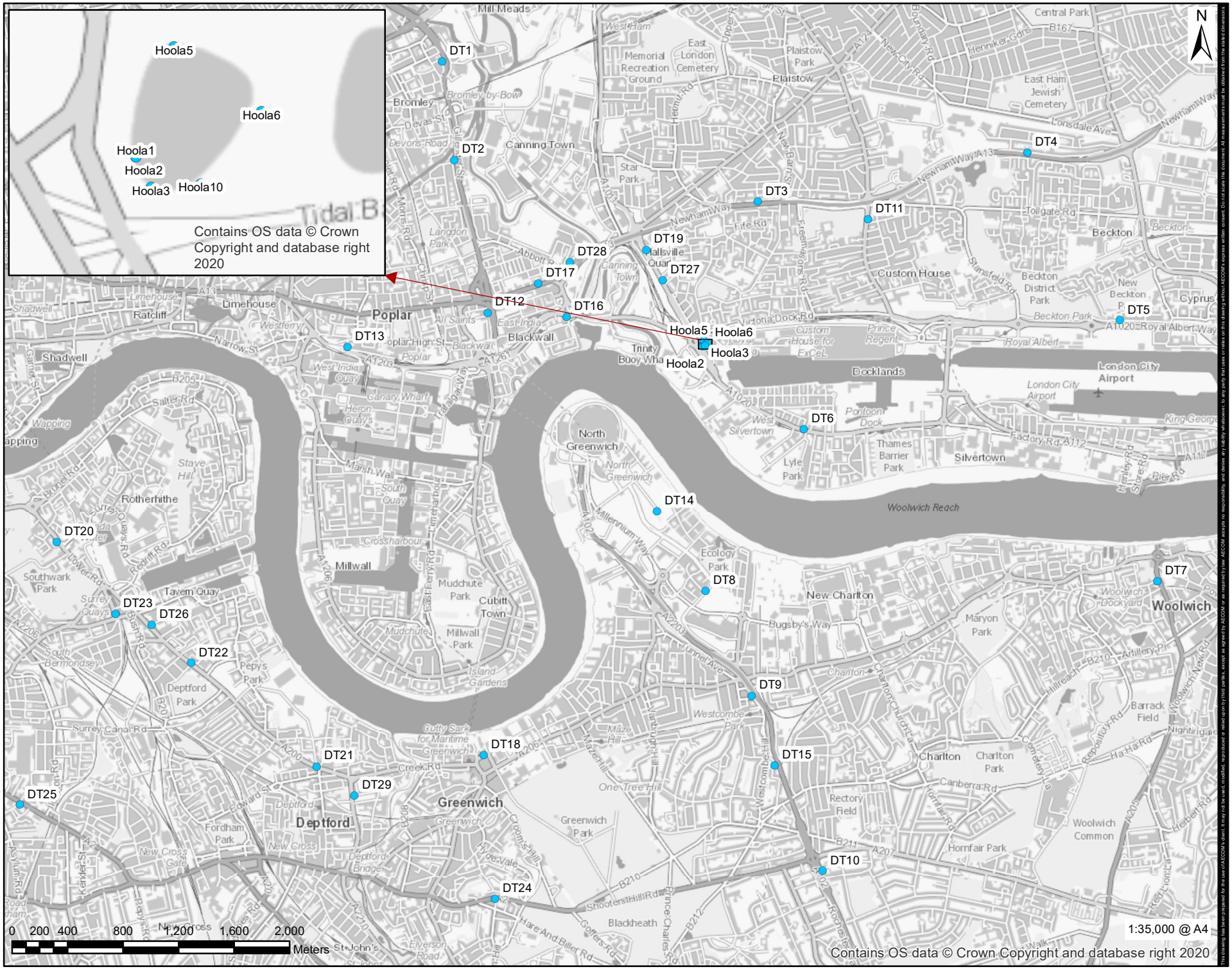


Next Steps

8.10 An annual monitoring report will be produced for the fourth baseline year summarising yearly concentrations, and analysis will be undertaken to determine yearly trends in concentrations across sites.

8.11 Post-opening after 2025, additional analysis will be undertaken with the aim of isolating the impacts of the Scheme, which may include the use of statistical analysis, removal of seasonal and meteorological influences, consideration of wider London data and trend interpretation.

Appendix A Monitoring Locations



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LEGEND
- Scheme Diffusion Tube Monitoring Location

NOTES
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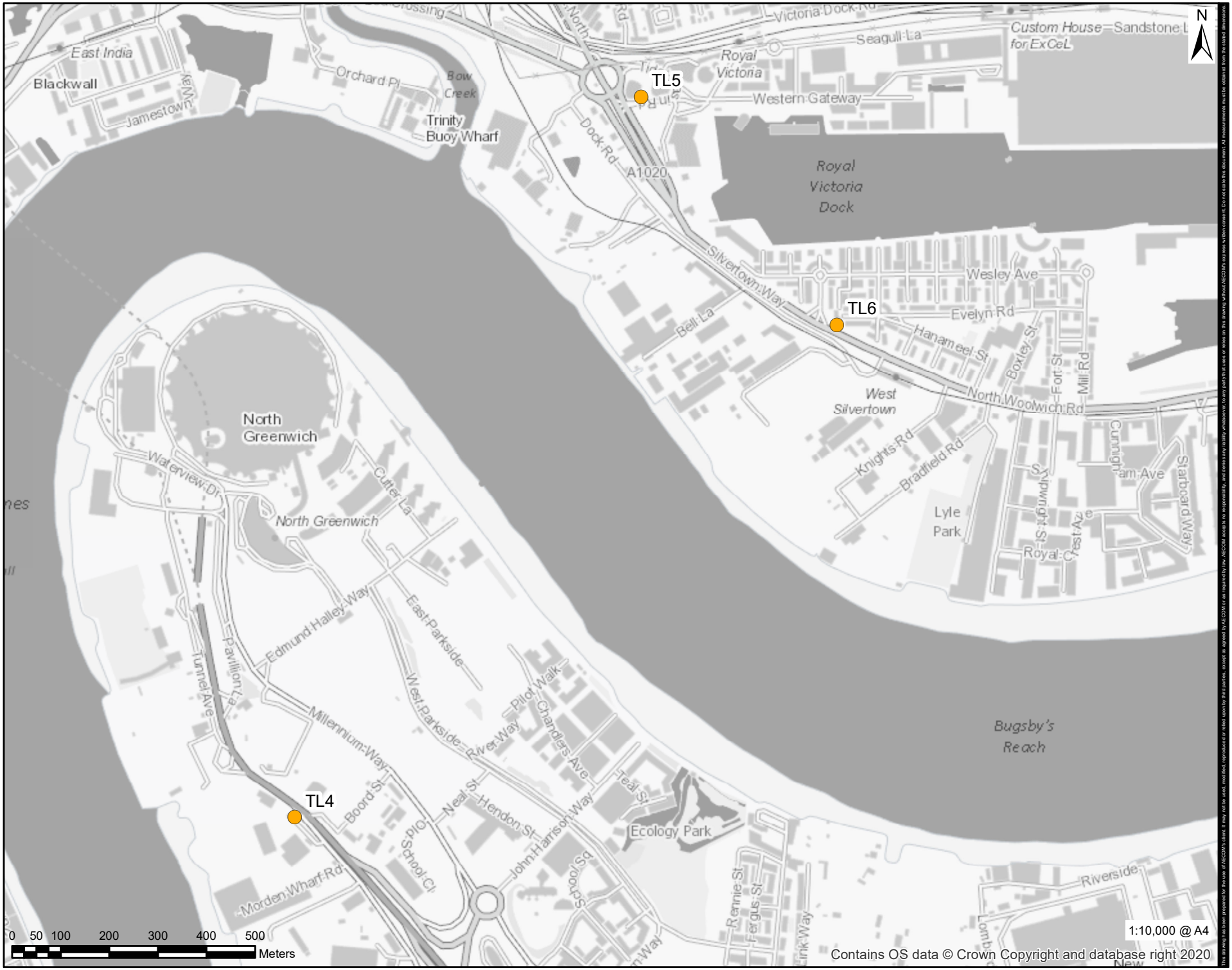
ISSUE PURPOSE
FINAL

PROJECT NUMBER
60636520

SHEET TITLE
Location of Scheme Diffusion Tubes

SHEET NUMBER
Figure A1

Filename: \\na.aecomnet.com\fs\EMEA\Croydon-UKCRD1\DCS\Projects\EGE\60636520_SilvertownTMMS\400_Technical\438_Air Quality Modelling\GIS\Report Figures\Scheme_DT.mxd
Revision: 1 Drawn: AG Checked: PF Approved: AS Date: 24/03/2022



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LEGEND
Scheme Continuous Monitor

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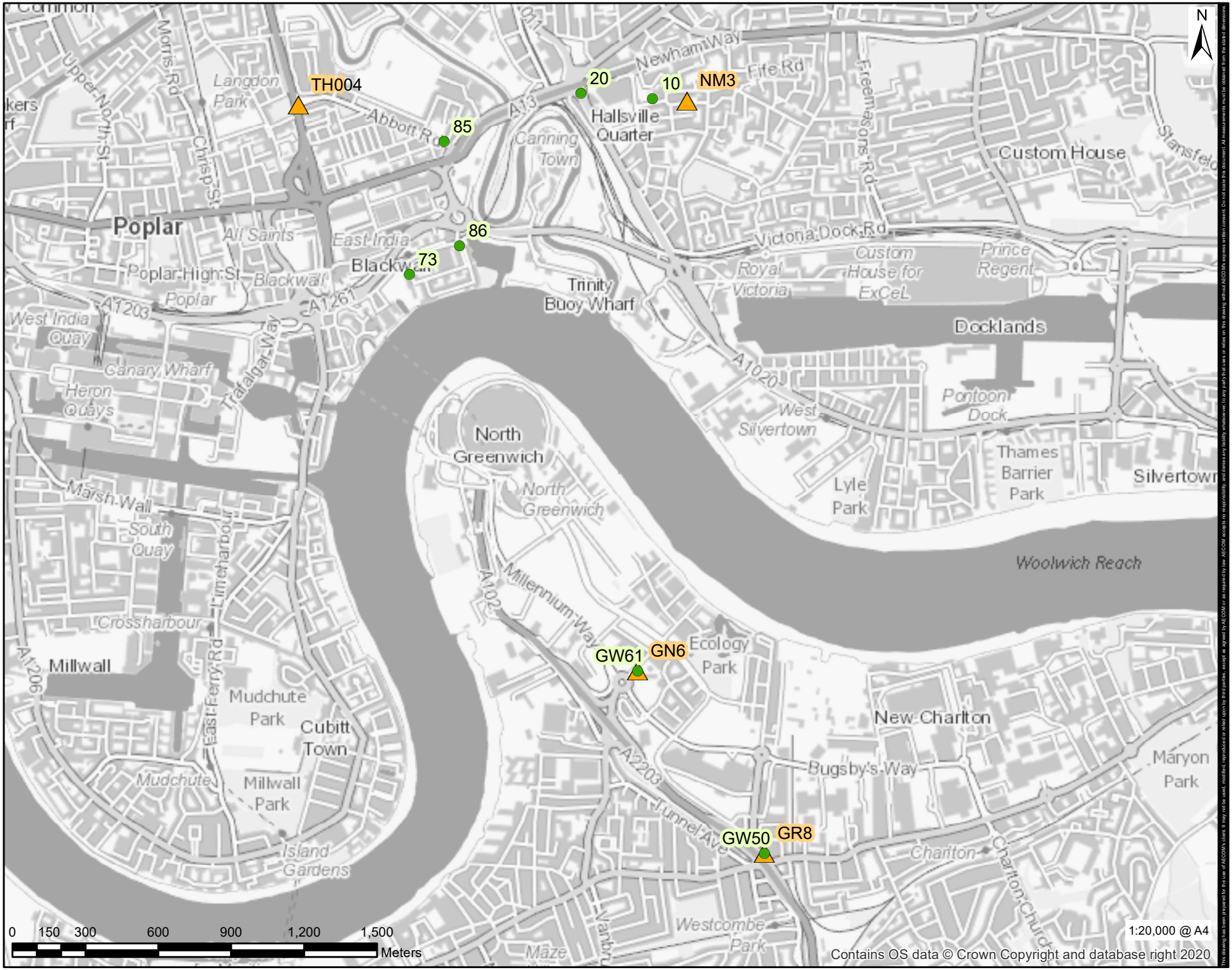
ISSUE PURPOSE
FINAL

PROJECT NUMBER
60636520

SHEET TITLE
Location of Scheme Continuous Monitors

SHEET NUMBER
Figure A2

Filename: \\na.aecomnet.com\ifs\EMEA\Croydon-UKCRD1\DCS\Projects\EGE\60636520_SilvertownTMMS\400_Technical\438_Air Quality Modelling\GIS\Report Figures\Scheme_CMS.mxd
Revision: 1 Drawn: AG Checked: PF Approved: AS Date: 20/06/2022



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LEGEND
- Selected Local Authority Automatic Monitoring Location
- Selected Local Authority Diffusion Tube Monitoring Location

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ISSUE PURPOSE
FINAL

PROJECT NUMBER
60636520

SHEET TITLE
Selected Local Authority Monitoring Locations

SHEET NUMBER
Figure A3

Filename: \\na.aecomnet.com\lfs\EMEA\Croydon-UKCRD1\DCS\Projects\EGE\60636520_SilvertownTMMS\400_Technical\438_Air Quality Modelling\GIS\Report Figures\LA_Selected DT.mxd
Revision: 1 Drawn: AG Checked: PF Approved: AS Date: 20/06/2022

Appendix B Monthly Diffusion Tube Data

Site Ref	NO_2 Concentration (µg/m^3)												2023 Raw Mean	2023 Raw Triplicate Mean	2023 Local Adjusted Mean	2023 National Adjusted Mean	2022 Local Adjusted Mean	2022 National Adjusted Mean
	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec						
DT1a	29.8	36.0	25.4	26.0	19.5	19.3	19.7	24.2	26.8	**44.2**	31.3	23.2	27.1					
DT1b	29.5	34.4	26.7	26.2	20.4	18.8	19.1	23.0	25.9	28.7	32.6	21.9	25.6	25.6	19.3	22.0	23.5	24.3
DT1c	30.0	34.4	25.8	25.0	18.9	18.0	17.5	22.3	27.2	29.6	30.7	23.9	25.3					
DT2a	-	36.5	-	35.7	29.3	28.5	34.6	35.7	**42.8**	**42.1**	**43.4**	34.8	36.3					
DT2b	-	37.6	-	36.2	32.0	29.3	35.3	**39.5**	**41.8**	**46.1**	**46.2**	36.4	38.0	**37.7**	28.4	32.4	33.6	34.8
DT2c	-	39.2	-	35.3	32.5	30.9	34.2	38.3	**41.5**	28.5	**56.0**	35.6	37.2					
DT3a	**55.4**	**55.8**	-	**46.2**	**40.5**	37.5	38.5	**46.5**	**53.4**	**49.8**	**52.3**	38.3	**46.7**					
DT3b	**50.3**	**55.4**	**43.6**	**51.1**	36.9	38.9	35.6	**50.0**	**54.5**	**52.6**	-	-	**46.9**	**46.4**	35.0	39.9	**40.0**	**41.4**
DT3c	**46.9**	**54.7**	**45.9**	**44.4**	**42.4**	37.0	**40.0**	**44.7**	**50.0**	**54.9**	**51.9**	39.5	**46.0**					
DT4a	33.1	**44.7**	28.4	32.1	24.6	27.9	-	-	39.0	38.6	37.0	28.4	33.4					
DT4b	34.6	**42.1**	27.3	30.9	24.2	26.3	-	-	38.3	36.9	35.8	27.5	32.4	32.6	24.5	28.0	29.7	30.8
DT4c	37.9	**39.6**	29.3	33.2	24.7	28.8	27.7	32.0	39.4	37.5	37.7	28.0	33.0					
DT5a	30.9	33.3	22.1	20.9	17.8	16.4	17.9	22.0	27.5	27.9	28.5	22.4	24.0					
DT5b	28.4	36.2	21.3	21.5	17.5	18.1	16.4	21.8	25.7	28.7	29.0	20.6	23.8	23.9	18.0	20.6	21.2	21.9
DT5c	28.6	33.7	22.9	21.9	17.4	18.3	19.5	22.5	23.5	29.2	28.7	22.7	24.1					
DT6a	34.3	**43.4**	28.0	27.9	22.9	22.6	26.8	27.6	32.3	33.5	-	-	29.9					
DT6b	34.7	**41.7**	-	28.2	22.5	22.7	26.3	26.9	32.0	33.6	-	24.6	29.3	28.7	21.6	24.7	26.0	26.9
DT6c	**68.5**	**42.3**	-	26.3	22.1	24.0	26.4	26.5	31.4	32.3	27.0	16.5	27.5					
DT7a	38.5	**40.5**	30.9	32.0	30.8	28.9	23.1	30.5	30.8	-	39.3	24.5	31.8					
DT7b	35.3	**43.0**	31.3	30.9	29.2	25.8	23.7	31.8	-	-	37.8	24.7	31.4	31.5	23.7	27.1	27.5	28.4
DT7c	36.2	**42.4**	29.9	33.1	31.3	27.7	22.6	30.6	-	-	34.2	25.7	31.4					
DT8a	**39.5**	**41.8**	30.4	32.9	24.3	26.3	26.2	30.8	34.4	35.6	36.5	27.5	32.2	31.9	24.0	27.4	28.4	29.4

Site Ref	NO_2 Concentration (µg/m^3)												2023 Raw Mean	2023 Raw Triplicate Mean	2023 Local Adjusted Mean	2023 National Adjusted Mean	2022 Local Adjusted Mean	2022 National Adjusted Mean
	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec						
DT8b	36.7	39.3	28.2	31.8	27.8	26.1	25.0	32.7	35.9	36.9	32.6	27.6	31.7					
DT8c	37.7	**40.3**	30.5	31.3	25.6	26.9	24.7	30.9	34.0	36.1	37.1	26.1	31.8					
DT9a	**42.3**	**48.1**	38.1	**40.9**	39.0	35.5	34.6	**45.0**	**43.5**	**43.2**	**39.8**	31.7	**40.1**					
DT9b	**42.8**	**50.8**	37.2	**39.7**	**45.6**	35.3	33.6	**43.5**	**41.4**	**40.9**	**43.1**	31.3	**42.6**	39.9	30.1	34.3	33.7	34.9
DT9c	**41.8**	**50.7**	37.4	**40.9**	38.2	35.0	32.5	**42.8**	**40.6**	**41.0**	**43.6**	32.9	**39.8**					
DT10a	38.2	38.5	26.8	26.6	22.2	20.1	22.8	28.7	28.7	29.5	34.7	-	28.8					
DT10b	36.1	39.2	27.9	23.0	20.9	20.0	23.3	27.6	27.9	29.0	34.9	24.1	27.8	28.2	21.2	24.3	25.6	26.5
DT10c	37.6	36.3	27.8	25.8	21.3	20.9	22.7	27.6	28.6	30.1	34.5	26.3	28.3					
DT11a	**42.6**	**45.4**	32.9	35.5	37.5	31.5	29.9	35.7	39.3	**40.2**	36.6	29.2	36.4					
DT11b	**43.3**	**45.9**	35.3	33.9	38.3	31.7	30.5	35.1	**39.9**	**39.7**	38.6	29.5	36.8	36.7	27.7	31.6	33.2	34.4
DT11c	**44.6**	**47.7**	33.9	35.6	37.8	31.9	31.1	34.6	**39.5**	39.1	38.4	29.3	37.0					
DT12a	**45.0**	**47.8**	**40.0**	**41.1**	32.8	35.5	33.0	**39.5**	**47.6**	**42.9**	**43.1**	35.7	**40.3**					
DT12b	**44.8**	**50.4**	39.4	39.0	35.1	34.2	34.1	**41.5**	**43.4**	**41.8**	**42.2**	36.5	**40.2**	**40.3**	30.3	34.6	35.6	36.8
DT12c	**45.7**	**47.8**	**41.9**	38.4	32.6	35.5	36.2	38.8	**44.6**	**42.9**	**43.2**	35.3	**40.2**					
DT13a	-	-	25.2	16.9	18.8	-	-	19.0	30.0	-	-	**47.2**	22.0					
DT13b	-	37.3	25.8	26.0	17.7	-	21.0	-	29.7	-	-	23.5	25.9	25.7	19.3	22.1	24.9	25.8
DT13c	-	35.0	25.5	24.9	18.3	23.2	-	16.1	29.7	-	31.5	23.1	25.3					
DT14a	**40.0**	**40.0**	24.5	-	17.9	20.5	20.2	24.7	26.5	31.0	33.2	23.0	27.4					
DT14b	38.2	36.0	-	-	17.2	19.7	20.0	23.7	27.1	31.5	32.2	24.2	27.0	26.9	20.3	23.1	22.8	23.6
DT14c	39.2	37.3	23.1	-	17.9	19.7	20.3	24.5	27.1	29.5	30.8	23.1	26.6					
DT15a	33.2	**39.9**	26.7	28.2	30.6	30.1	17.2	27.5	26.6	29.4	31.5	-	29.2					
DT15b	34.5	39.7	27.7	30.2	31.4	28.4	17.5	27.8	25.9	26.5	34.1	-	29.4	27.1	20.4	23.3	25.9	26.8
DT15c	34.2	37.4	28.8	31.2	33.2	29.6	17.7	28.3	27.9	27.7	31.0	0.9	27.3					
DT16a	35.6	**45.0**	29.0	25.0	24.2	26.6	24.3	28.7	30.0	33.2	38.4	25.9	30.5	30.1	22.7	25.9	26.6	27.5

Site Ref	NO_2 Concentration (µg/m^3)												2023 Raw Mean	2023 Raw Triplicate Mean	2023 Local Adjusted Mean	2023 National Adjusted Mean	2022 Local Adjusted Mean	2022 National Adjusted Mean
	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec						
DT16b	32.4	**41.1**	28.6	25.0	22.0	25.5	24.5	29.9	30.9	32.1	35.9	21.6	29.1					
DT16c	34.3	**43.9**	28.6	28.1	21.3	27.5	24.5	29.7	31.0	33.1	37.5	27.9	30.6					
DT17a	**45.8**	**55.7**	36.9	39.1	38.4	**41.1**	37.5	**42.7**	**50.3**	**47.0**	**44.7**	38.3	**43.1**					
DT17b	**46.2**	**51.7**	38.6	**39.9**	37.8	**39.5**	34.9	**43.3**	**48.9**	**45.4**	**46.6**	35.8	**42.4**	**42.9**	32.3	36.9	37.6	38.9
DT17c	**51.1**	**57.5**	**40.8**	37.0	36.9	**40.4**	37.3	**41.5**	**50.2**	**44.8**	**44.6**	36.8	**43.2**					
DT18a	**44.5**	**46.9**	34.5	35.3	31.5	35.1	32.0	38.6	**43.1**	**40.2**	**41.9**	28.2	37.7					
DT18b	**40.3**	**49.0**	33.5	32.9	33.0	35.9	29.8	38.9	**41.6**	38.3	**39.6**	31.7	37.0	37.3	28.1	32.1	34.1	35.3
DT18c	**43.4**	**49.8**	34.4	32.8	31.2	33.9	31.1	-	**42.5**	**40.8**	37.5	29.3	37.0					
DT19a	**44.8**	**45.1**	33.8	36.5	32.2	35.7	25.3	33.4	37.5	38.3	-	26.5	35.4					
DT19b	**47.5**	**50.1**	32.9	31.2	33.9	35.8	27.1	34.6	35.5	35.4	36.4	25.2	35.5	35.5	26.7	30.5	34.5	35.8
DT19c	**46.6**	**46.3**	32.5	31.7	34.7	34.9	26.7	32.3	38.6	38.9	-	26.4	35.4					
DT20a	32.1	**40.9**	28.2	31.0	27.6	26.2	22.5	29.9	33.0	35.6	35.0	25.2	30.6					
DT20b	33.4	**40.5**	26.7	29.8	26.1	25.6	22.9	29.1	32.8	36.1	33.2	25.8	30.2	30.6	23.1	26.3	25.2	26.1
DT20c	39.5	**40.3**	29.8	29.8	25.4	26.0	22.1	30.1	34.0	36.7	35.9	24.2	31.2					
DT21a	32.1	37.3	23.1	26.9	18.7	22.6	18.9	23.5	32.1	32.5	32.1	23.6	27.0					
DT21b	23.3	36.2	24.2	25.6	18.4	21.0	19.9	25.5	30.3	33.1	32.8	21.6	26.2	26.7	20.1	23.0	29.3	30.3
DT21c	32.6	33.0	24.1	23.9	19.8	20.4	19.1	25.6	31.5	37.7	32.9	22.1	26.9					
DT22a	33.7	-	26.6	-	26.5	-	-	-	31.8	31.1	-	22.8	28.8					
DT22b	35.4	-	26.6	-	-	-	-	-	30.5	32.3	35.9	24.3	30.8	30.1	21.7[(1)]	24.8[(1)]	26.1	27.0
DT22c	36.8	-	26.8	30.0	-	-	-	-	31.7	31.8	-	22.9	30.0					
DT23a	**43.7**	**45.4**	32.7	**43.3**	**39.9**	**41.4**	29.9	**41.7**	**46.0**	**42.6**	**40.6**	26.7	**39.5**					
DT23b	**42.5**	**48.1**	35.4	**42.2**	39.4	**40.3**	30.5	**40.1**	**41.4**	**42.7**	**43.4**	28.6	**39.6**	39.4	29.6	33.8	34.5	25.8
DT23c	**40.2**	**46.9**	33.5	39.1	37.8	**42.2**	32.4	39.7	**44.4**	**41.7**	**42.5**	27.9	39.0					
DT24a	**50.5**	**40.9**	**40.7**	**42.2**	33.4	**42.7**	**42.6**	**47.3**	**52.8**	**49.4**	**43.3**	36.2	**43.5**	**43.8**	33.0	37.7	39.7	**41.1**

Site Ref	NO_2 Concentration (µg/m^3)												2023 Raw Mean	2023 Raw Triplicate Mean	2023 Local Adjusted Mean	2023 National Adjusted Mean	2022 Local Adjusted Mean	2022 National Adjusted Mean
	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec						
DT24b	**46.9**	**51.0**	**41.1**	**40.7**	32.7	**41.3**	**43.6**	**48.8**	**49.2**	**46.0**	**45.1**	35.5	**43.5**					
DT24c	**49.0**	**52.2**	39.3	**40.7**	32.8	-	**41.3**	**49.3**	**52.2**	**46.5**	**41.1**	36.0	**43.7**					
DT25a	34.6	31.9	25.2	25.4	26.9	25.8	17.8	26.1	25.2	26.8	33.9	22.3	26.8					
DT25b	34.3	34.1	23.8	26.0	25.3	25.7	17.4	26.4	24.8	28.4	30.6	22.5	26.6	26.9	20.3	23.2	23.4	24.3
DT25c	35.7	35.2	24.6	26.9	25.1	26.6	17.5	27.4	25.7	28.4	34.0	21.8	27.4					
DT26a	34.4	36.2	23.6	26.0	18.0	20.6	19.9	25.6	28.8	29.8	31.9	22.0	26.4					
DT26b	37.0	35.0	33.1	23.5	18.0	20.2	19.9	25.0	28.8	28.6	31.3	21.7	26.8	26.4	19.9	22.7	22.8	23.6
DT26c	34.1	37.2	22.8	24.5	18.4	21.6	18.8	24.3	27.5	28.8	31.3	21.3	25.9					
DT27a	**42.5**	**41.2**	33.2	33.2	31.7	32.7	25.8	33.6	33.3	35.6	**39.8**	-	34.8					
DT27b	**39.5**	**42.7**	32.2	30.7	31.8	31.6	26.1	32.6	33.2	35.8	38.0	39.4	34.5	34.1	25.7	29.3	30.9	32.0
DT27c	39.0	**43.8**	-	33.4	28.6	33.1	22.1	31.6	-	35.8	36.3	27.4	33.1					
DT28a	**39.7**	**42.4**	33.8	35.8	26.6	34.0	30.3	36.5	**44.2**	**41.7**	38.8	30.7	36.2					
DT28b	**40.3**	**43.3**	32.7	36.6	24.0	33.7	29.0	36.2	**43.2**	**41.6**	38.4	30.7	35.8	36.0	27.1	31.0	30.5	31.6
DT28c	**39.6**	**46.1**	33.9	37.3	27.3	31.5	30.3	35.3	**44.7**	**41.7**	33.7	31.5	36.1					
DT29a	32.0	32.2	25.4	23.3	19.7	20.0	20.2	24.9	27.5	30.2	31.9	21.1	25.7					
DT29b	30.3	33.3	23.0	22.0	20.6	20.6	21.0	25.5	27.7	28.5	32.3	21.1	25.5	25.7	19.4	22.1	21.8	22.5
DT29c	32.8	32.8	24.9	23.2	19.6	20.7	20.0	26.0	27.9	29.8	32.6	21.5	26.0					
Hoola 1a	38.1	34.8	24.6	27.9	23.5	21.4	21.7	27.3	35.6	32.9	32.3	24.1	28.7					
Hoola 1b	34.9	36.9	-	26.2	23.6	23.9	21.7	28.1	34.0	35.8	34.4	26.4	29.6	28.9	21.8	24.9	24.2	25.1
Hoola 1c	35.7	41.1	25.6	25.8	21.8	22.4	21.9	26.8	30.7	36.1	32.5	26.5	28.9					
Hoola 2a	**40.8**	37.6	28.1	-	21.5	24.3	22.3	26.5	32.6	< 1.2	-	I/S	29.2					
Hoola 2b	36.5	38.5	13.3	26.9	22.2	22.4	20.9	26.7	34.9	36.9	36.8	28.4	28.7	29.6	22.3	25.4	25.4	26.3
Hoola 2c	**42.3**	38.8	27.0	26.5	23.3	23.3	22.5	26.4	I/S	35.5	35.3	25.9	29.7					
Hoola 3a	36.1	37.9	24.7	29.7	20.0	22.4	24.8	26.4	31.7	38.8	-	25.9	28.9	29.1	21.9	25.0	24.9	25.7

Site Ref	NO_2 Concentration (µg/m^3)												2023 Raw Mean	2023 Raw Triplicate Mean	2023 Local Adjusted Mean	2023 National Adjusted Mean	2022 Local Adjusted Mean	2022 National Adjusted Mean
	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec						
Hoola 3b	32.8	**41.1**	28.3	-	14.6	23.2	24.7	27.8	36.1	35.2	-	27.8	34.1					
Hoola 3c	32.5	39.7	25.9	28.9	19.8	23.8	21.9	25.3	33.5	36.0	-	-	28.7					
Hoola 5a	-	**40.2**	-	26.2	21.3	23.0	26.6	28.5	**41.4**	37.9	38.5	29.1	31.3					
Hoola 5b	38.1	**48.7**	-	-	21.0	23.3	23.0	25.5	32.8	-	-	-	30.3	30.8	23.2	26.5	27.0	27.9
Hoola 5c	-	**39.8**	28.1	26.3	24.3	24.0	22.6	27.5	-	33.7	38.8	I/S	29.5					
Hoola 6a	-	**-**	31.7	-	26.1	26.8	24.1	27.4	33.8	**39.5**	**39.9**	32.5	31.3					
Hoola 6b	-	**-**	31.0	-	24.7	28.7	27.1	29.7	33.0	**40.1**	**46.4**	-	32.6	32.9	24.7	28.3	28.1	29.1
Hoola 6c	-	**-**	36.7	-	24.1	27.2	28.5	28.2	36.9	**41.5**	**49.2**	37.3	34.4					
Hoola 10a	37.8	38.3	27.2	28.5	23.0	28.7	23.1	27.1	19.3	36.4	36.7	28.4	29.5					
Hoola 10b	**39.6**	**40.2**	27.3	28.8	26.5	28.0	22.2	28.9	< 1.2	34.2	35.1	25.1	30.5	29.6	22.3	25.5	26.3	27.3
Hoola 10c	27.5	38.4	27.3	30.5	28.3	27.6	22.2	28.0	-	33.6	-	-	29.5					
TL4a	**39.5**	39.6	29.0	-	35.1	-	29.4	34.0	-	30.1	34.4	24.4	32.8					
TL4b	**40.8**	**41.7**	29.5	-	37.1	-	26.9	33.5	-	31.7	36.5	24.1	33.5	33.3	25.0	28.6	30.1	31.1
TL4c	38.3	**42.9**	29.8	-	36.9	-	26.9	34.1	-	29.6	37.3	24.7	33.4					
TL5a	**42.9**	-	26.8	29.3	26.6	-	22.1	24.0	33.2	37.5	37.7	27.7	30.8					
TL5b	38.9	-	-	27.9	22.9	-	19.4	26.0	37.5	37.0	32.1	33.5	30.6	30.4	22.9	26.1	26.5[(1)]	25.8[(1)]
TL5c	34.9	-	-	32.7	26.0	-	19.3	25.5	30.5	37.3	38.8	29.1	30.5					
TL6a	34.8	39.0	25.8	23.4	20.3	24.8	20.9	23.9	29.3	31.8	31.4	24.9	27.5					
TL6b	34.6	**40.3**	24.5	22.5	19.9	24.7	22.7	24.7	27.2	29.8	23.1	21.9	26.3	27.0	20.3	23.2	24.6	24.6
TL6c	33.8	38.7	23.9	23.7	20.2	22.5	24.0	23.1	28.5	32.6	29.7	23.6	27.0					

Note: Concentrations in bold above the annual mean AQS objective value and concentrations in bold and underlined are at risk of exceedance of the hourly mean objective value. [(1)] Data has been annualised. Missing tubes shown by -.

Appendix C Data Quality Assurance

C.1 Scheme Continuous Monitoring Sites

The equipment used at the three CMS are Teledyne API T200 chemiluminescence NO_x analysers. Calibrations of these continuous monitors are carried out with certified calibration gases for each analyser. Routine calibrations are undertaken manually every 2 weeks by AECOM for TL4, TL5 and TL6.

The QA/QC procedures followed by AECOM reflect those used in the UK Automatic Urban and Rural Network (AURN) and those outlined in the Technical Guidance; LAQM.TG(22).

The calibration data are sent to ERG, who are responsible for data management, data validation and ratification. Independent site audits are carried out annually and includes UKAS accredited on-site gas cylinder certification and on-site testing of sampling system efficiency.

LAQM.TG(22) specifies a 85% data capture threshold for assessing compliance with limit and guidance values. If the 85% threshold is not achieved, the data are still useful, but less precise than required for formal assessment.

C.2 Scheme Diffusion Tube Sites

Diffusion tubes for NO_2 are provided by Staffordshire Highways Laboratory using a preparation method of 20% TEA in water. This method conforms to the guidelines set out in Defra's 'Diffusion Tubes for Ambient NO_2 Monitoring: Practical Guidance' document.

Staffordshire Highways Laboratory participates in the AIR-PT scheme. AIR is an independent analytical proficiency-testing (PT) scheme, operated by LGC Standards and supported by the Health and Safety Laboratory (HSL). The AIR-PT scheme started in April 2014, combining two long running PT schemes: LGC Standards STACKS PT scheme and HSL WASP PT scheme.

AIR NO_2 PT forms an integral part of the UK NO_2 Network's QA/QC and is a useful tool in assessing the analytical performance of those laboratories supplying diffusion tubes. Defra and the Devolved Administrations advise that diffusion tubes used for air quality assessments should be obtained from laboratories that have demonstrated satisfactory performance in the AIR-PT scheme. Staffordshire Laboratories have achieved this during 2023.

Diffusion Tube Annualisation

Diffusion tubes require annualisation if they record data capture of less than 75%, but greater than 25%. All of the diffusion tube monitoring locations except DT22 recorded data capture of greater than 75% in 2023 and therefore did not require annualisation. DT22 only had a data capture of 66.7% and therefore annualisation had to be carried out. Two Urban Background sites were used to calculate an Annualisation Bias Factor: London Hillingdon and London Westminster. An Annualisation Bias Factor of 0.96 was calculated and applied to the Raw Triplicate Mean value of 30.1 µg/m^3. An annualised mean of 28.9 µg/m^3 was calculated for DT22 before bias adjustment.

Diffusion Tube Bias Adjustment Factors.

The diffusion tube data have been corrected for bias using an adjustment factor. Bias represents the overall tendency of the diffusion tubes to under or over-read relative to the reference chemiluminescence analyser. LAQM.TG22 provides guidance with regard to the application of a bias adjustment factor to correct diffusion tube monitoring. Triplicate co-location studies can be used to determine a local bias factor based on the comparison of diffusion tube results with data taken from NO_x/NO_2 continuous analysers. Alternatively, the national database of diffusion tube co-location surveys provides bias factors for the relevant laboratory and preparation method.

A national bias adjustment factor was obtained from the national Diffusion Tube Bias Adjustment Factors Spreadsheet. The national bias adjustment factor for tubes prepared by Staffordshire Scientific Services using to 20% TEA in Water preparation method for 2023 is 0.86, as depicted in Table C.1 and Figure C.1.

Table C.1 2023 National Bias Adjustment Factor

Laboratory	Preparation Method	2023 Factor
Staffordshire Scientific Services	20% TEA in Water	**0.86**

Figure C.1 National Bias Adjustment Factor Derivation

National Diffusion Tube Bias Adjustment Factor Spreadsheet — Spreadsheet Version Number: 03/24

Follow the steps below in the correct order to show the results of relevant co-location studies
Data only apply to tubes exposed monthly and are not suitable for correcting individual short-term monitoring periods
Whenever presenting adjusted data, you should state the adjustment factor used and the version of the spreadsheet
This spreadsheet will be updated every few months: the factors may therefore be subject to change. This should not discourage their immediate use.

This spreadsheet will be updated at the end of June 2024
LAQM Helpdesk Website

The LAQM Helpdesk is operated on behalf of Defra and the Devolved Administrations by Bureau Veritas, in conjunction with contract partners AECOM and the National Physical Laboratory.

Spreadsheet maintained by the National Physical Laboratory. Original compiled by Air Quality Consultants Ltd.

Step 1: Select the Laboratory that Analyses Your Tubes from the Drop-Down List

If a laboratory is not shown, we have no data for this laboratory.

Step 2: Select a Preparation Method from the Drop-Down List

If a preparation method is not shown, we have no data for this method at this laboratory.

Step 3: Select a Year from the Drop-Down List

If a year is not shown, we have no data

Step 4: Where there is only one study for a chosen combination, you should use the adjustment factor shown with caution. Where there is more than one study, use the overall factor shown in blue at the foot of the final column.

If you have your own co-location study then see footnote. If uncertain what to do then contact the Local Air Quality Management Helpdesk at LAQMHelpdesk@bureauveritas.com or 0800 0327953

Analysed By	Method	Year	Site Type	Local Authority	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) (µg/m³)	Automatic Monitor Mean Conc. (Cm)	Bias (B)	Tube Precision	Bias Adjustment Factor (A) (Cm/Dm)
Staffordshire Scientific Services	20% TEA in water	2023	R	Wigan Council	12	26	21	21.2%	G	**0.82**
Staffordshire Scientific Services	20% TEA in water	2023	UB	Salford City Council	11	22	20	8.2%	G	**0.92**
Staffordshire Scientific Services	20% TEA in water	2023	UB	Salford City Council	12	13	12	4.7%	G	**0.96**
Staffordshire Scientific Services	20% TEA in water	2023	R	Salford City Council	12	39	33	15.2%	G	**0.87**
Staffordshire Scientific Services	20% TEA in water	2023	KS	Manchester City Council	12	48	43	11.7%	G	**0.90**
Staffordshire Scientific Services	20% TEA in water	2023	UC	Manchester City Council	12	28	27	6.0%	G	**0.94**
Staffordshire Scientific Services	20% TEA in water	2023	SI	Manchester City Council	12	17	15	12.1%	G	**0.89**
Staffordshire Scientific Services	20% TEA in water	2023	KS	Marylebone Road intercomparison	11	50	38	31.8%	G	**0.76**
Staffordshire Scientific Services	20% TEA in water	2023	R	Stoke-on-trent City Council	12	50	37	35.4%	G	**0.74**
Staffordshire Scientific Services	20% TEA in water	2023	R	Stoke-on-trent City Council	12	53	44	20.8%	G	**0.83**
Staffordshire Scientific Services	20% TEA in water	2023	UB	Stoke-on-trent City Council	12	21	18	16.6%	G	**0.86**
Staffordshire Scientific Services	20% TEA in water	2023		**Overall Factor (11 studies)**				Use		**0.86**

A local bias adjustment factor was also calculated from the average the triplicate co-location of diffusion tubes at the TL4, TL5 and TL6 continuous monitoring stations. This factor is slightly lower than the national bias adjustment factor.

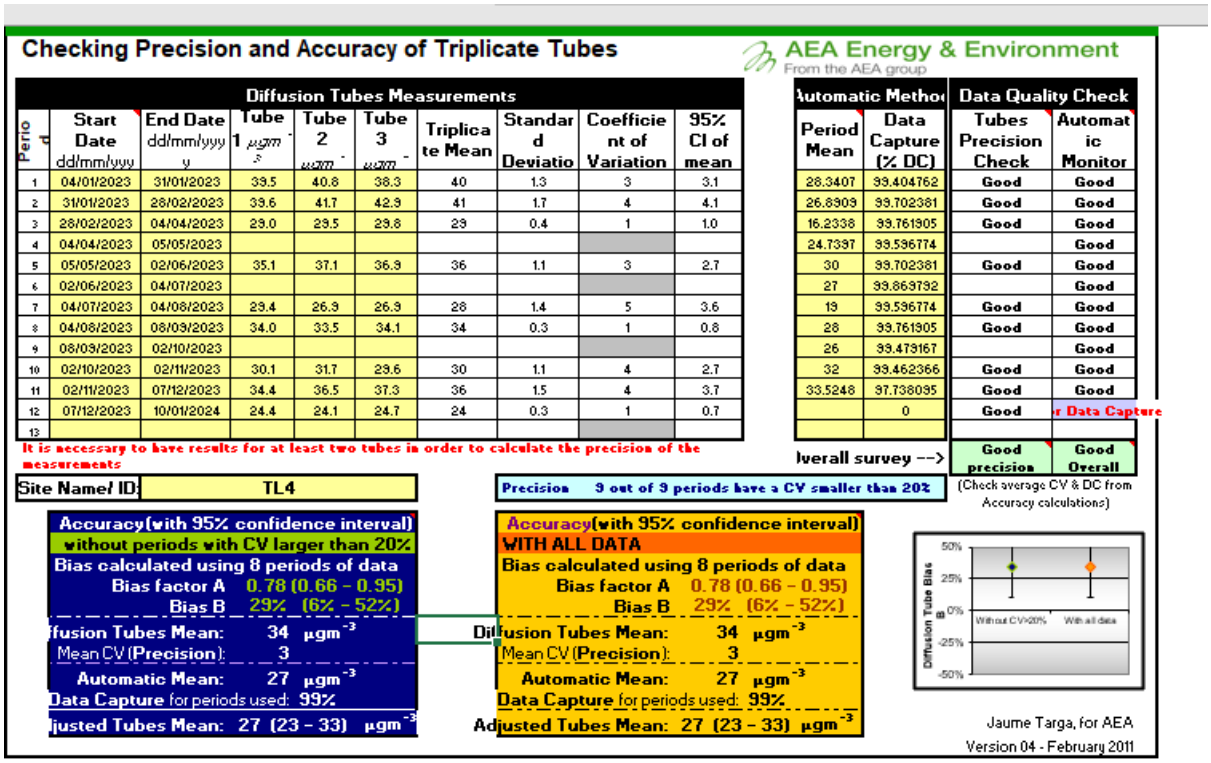
Calculation of the local bias adjustment factor is presented in Table C.2.

Table C.2 Local Bias Adjustment Factor Calculation

Continuous Monitor	Bias Adjustment Factor
TL4	0.78
TL5	0.68
TL6	0.80
Average	**0.75**

Figures C.2, C.3 and C.4 depict the derivation of the Local Bias factors for each of TL4, TL5 and TL6, respectively.

Figure C.2 Local Bias Adjustment Factor Calculation for TL4



Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements

Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 µgm⁻³	Tube 2 µgm⁻³	Tube 3 µgm⁻³	Triplicate Mean	Standard Deviation	Coefficient of Variation	95% CI of mean
1	04/01/2023	31/01/2023	39.5	40.8	38.3	40	1.3	3	3.1
2	31/01/2023	28/02/2023	39.6	41.7	42.3	41	1.7	4	4.1
3	28/02/2023	04/04/2023	29.0	29.5	29.8	29	0.4	1	1.0
4	04/04/2023	05/05/2023							
5	05/05/2023	02/06/2023	35.1	37.1	36.9	36	1.1	3	2.7
6	02/06/2023	04/07/2023							
7	04/07/2023	04/08/2023	29.4	26.9	26.9	28	1.4	5	3.6
8	04/08/2023	08/09/2023	34.0	33.5	34.1	34	0.3	1	0.8
9	08/09/2023	02/10/2023							
10	02/10/2023	02/11/2023	30.1	31.7	29.6	30	1.1	4	2.7
11	02/11/2023	07/12/2023	34.4	36.5	37.3	36	1.5	4	3.7
12	07/12/2023	10/01/2024	24.4	24.1	24.7	24	0.3	1	0.7
13									

Automatic Method		Data Quality Check	
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor
28.3407	99.404762	Good	Good
26.8909	99.702381	Good	Good
16.2338	99.761905	Good	Good
24.7397	99.536774		Good
30	99.702381	Good	Good
27	99.869792		Good
19	99.536774	Good	Good
28	99.761905	Good	Good
26	99.479167		Good
32	99.462366	Good	Good
33.5248	97.738095	Good	Good
	0	Good	r Data Capture
Overall survey -->		Good precision	Good Overall

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

Site Name/ ID: TL4

Precision 9 out of 9 periods have a CV smaller than 20%

(Check average CV & DC from Accuracy calculations)

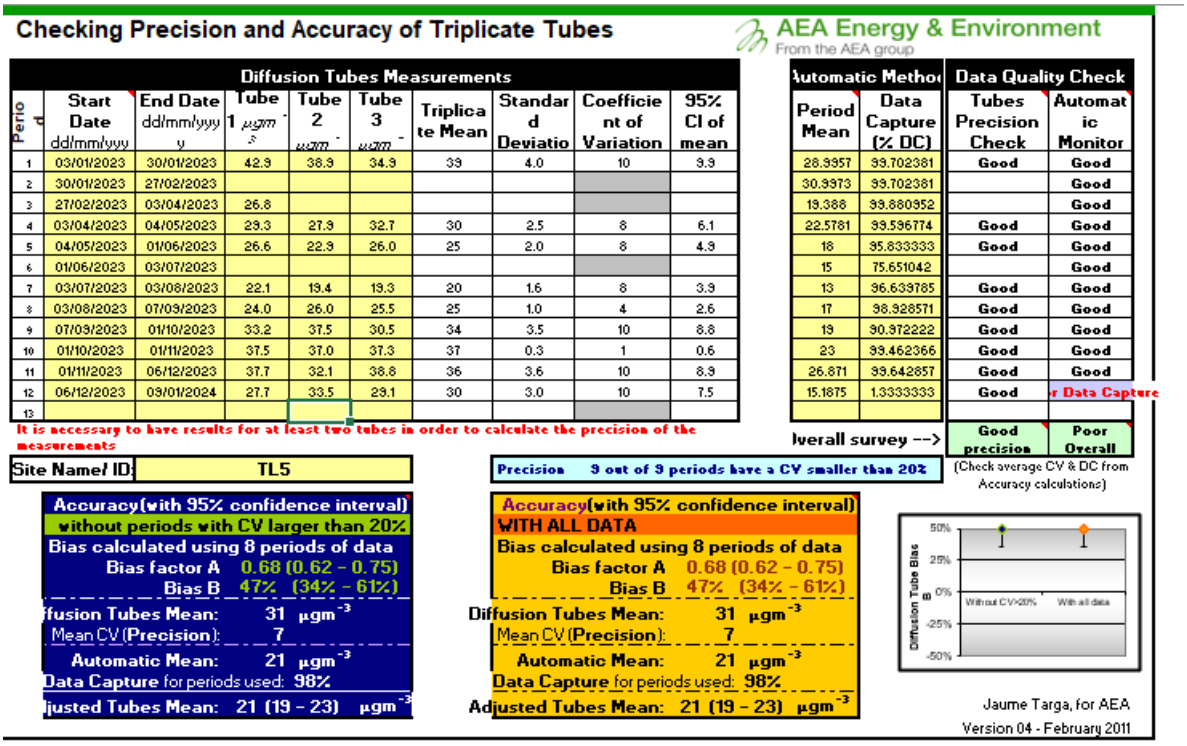
Accuracy(with 95% confidence interval) without periods with CV larger than 20%
Bias calculated using 8 periods of data
Bias factor A 0.78 (0.66 - 0.95)
Bias B 29% (6% - 52%)
Diffusion Tubes Mean: 34 µgm⁻³
Mean CV (Precision): 3
Automatic Mean: 27 µgm⁻³
Data Capture for periods used: 99%
Adjusted Tubes Mean: 27 (23 - 33) µgm⁻³

Accuracy(with 95% confidence interval) WITH ALL DATA
Bias calculated using 8 periods of data
Bias factor A 0.78 (0.66 - 0.95)
Bias B 29% (6% - 52%)
Diffusion Tubes Mean: 34 µgm⁻³
Mean CV (Precision): 3
Automatic Mean: 27 µgm⁻³
Data Capture for periods used: 99%
Adjusted Tubes Mean: 27 (23 - 33) µgm⁻³

Jaume Targa, for AEA
Version 04 - February 2011

If you have any enquiries about this spreadsheet please contact the LAQM Helpdesk at: LAQMHelpdesk@uk.bureauveritas.com

Figure C.3 Local Bias Adjustment Factor Calculation for TL5



Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements

Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 µgm⁻³	Tube 2 µgm⁻³	Tube 3 µgm⁻³	Triplicate Mean	Standard Deviation	Coefficient of Variation	95% CI of mean
1	03/01/2023	30/01/2023	42.9	38.9	34.9	39	4.0	10	9.9
2	30/01/2023	27/02/2023							
3	27/02/2023	03/04/2023	26.8						
4	03/04/2023	04/05/2023	29.3	27.9	32.7	30	2.5	8	6.1
5	04/05/2023	01/06/2023	26.6	22.9	26.0	25	2.0	8	4.9
6	01/06/2023	03/07/2023							
7	03/07/2023	03/08/2023	22.1	19.4	19.3	20	1.6	8	3.9
8	03/08/2023	07/09/2023	24.0	26.0	25.5	25	1.0	4	2.6
9	07/09/2023	01/10/2023	33.2	37.5	30.5	34	3.5	10	8.8
10	01/10/2023	01/11/2023	37.5	37.0	37.3	37	0.3	1	0.6
11	01/11/2023	06/12/2023	37.7	32.1	38.8	36	3.6	10	8.9
12	06/12/2023	09/01/2024	27.7	33.5	29.1	30	3.0	10	7.5
13									

Automatic Method		Data Quality Check	
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor
28.3957	99.702381	Good	Good
30.3973	99.702381		Good
19.388	99.880952		Good
22.5781	99.536774	Good	Good
18	95.833333	Good	Good
15	75.651042		Good
13	96.639785	Good	Good
17	98.928571	Good	Good
19	90.972222	Good	Good
23	99.462366	Good	Good
26.871	99.642857	Good	Good
15.1875	1.3333333	Good	r Data Capture
Overall survey -->		Good precision	Poor Overall

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

Site Name/ ID: TL5

Precision 9 out of 9 periods have a CV smaller than 20%

(Check average CV & DC from Accuracy calculations)

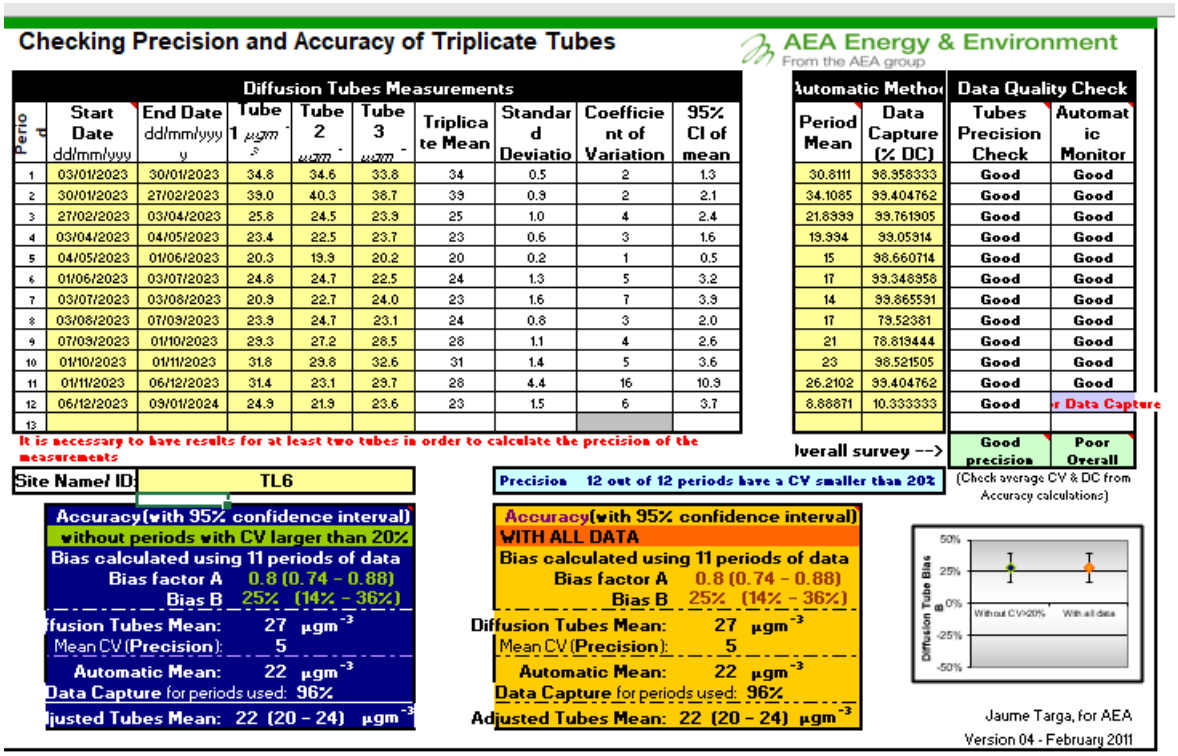
Accuracy(with 95% confidence interval) without periods with CV larger than 20%
Bias calculated using 8 periods of data
Bias factor A 0.68 (0.62 - 0.75)
Bias B 47% (34% - 61%)
Diffusion Tubes Mean: 31 µgm⁻³
Mean CV (Precision): 7
Automatic Mean: 21 µgm⁻³
Data Capture for periods used: 98%
Adjusted Tubes Mean: 21 (19 - 23) µgm⁻³

Accuracy(with 95% confidence interval) WITH ALL DATA
Bias calculated using 8 periods of data
Bias factor A 0.68 (0.62 - 0.75)
Bias B 47% (34% - 61%)
Diffusion Tubes Mean: 31 µgm⁻³
Mean CV (Precision): 7
Automatic Mean: 21 µgm⁻³
Data Capture for periods used: 98%
Adjusted Tubes Mean: 21 (19 - 23) µgm⁻³

Jaume Targa, for AEA
Version 04 - February 2011

If you have any enquiries about this spreadsheet please contact the LAQM Helpdesk at: LAQMHelpdesk@uk.bureauveritas.com

Figure C.4 Local Bias Adjustment Factor Calculation for TL6



Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements

Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 µgm⁻³	Tube 2 µgm⁻³	Tube 3 µgm⁻³	Triplicate Mean	Standard Deviation	Coefficient of Variation	95% CI of mean
1	03/01/2023	30/01/2023	34.8	34.6	33.8	34	0.5	2	1.3
2	30/01/2023	27/02/2023	39.0	40.3	38.7	39	0.9	2	2.1
3	27/02/2023	03/04/2023	25.8	24.5	23.9	25	1.0	4	2.4
4	03/04/2023	04/05/2023	23.4	22.5	23.7	23	0.6	3	1.6
5	04/05/2023	01/06/2023	20.3	19.9	20.2	20	0.2	1	0.5
6	01/06/2023	03/07/2023	24.8	24.7	22.5	24	1.3	5	3.2
7	03/07/2023	03/08/2023	20.9	22.7	24.0	23	1.6	7	3.9
8	03/08/2023	07/09/2023	23.9	24.7	23.1	24	0.8	3	2.0
9	07/09/2023	01/10/2023	29.3	27.2	28.5	28	1.1	4	2.6
10	01/10/2023	01/11/2023	31.8	29.8	32.6	31	1.4	5	3.6
11	01/11/2023	06/12/2023	31.4	23.1	29.7	28	4.4	16	10.9
12	06/12/2023	09/01/2024	24.9	21.9	23.6	23	1.5	6	3.7
13									

Automatic Metho / Data Quality Check

Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor
30.8111	98.958333	Good	Good
34.1085	99.404762	Good	Good
21.8333	99.761905	Good	Good
19.994	99.05914	Good	Good
15	98.660714	Good	Good
17	99.348958	Good	Good
14	99.865591	Good	Good
17	79.52381	Good	Good
21	78.819444	Good	Good
23	98.521505	Good	Good
26.2102	99.404762	Good	Good
8.88871	10.333333	Good	r Data Capture

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

Iverall survey -->

Good precision | Poor Overall

Site Name/ ID: TL6

Precision 12 out of 12 periods have a CV smaller than 20%

(Check average CV & DC from Accuracy calculations)

Accuracy (with 95% confidence interval) without periods with CV larger than 20%
Bias calculated using 11 periods of data
Bias factor A 0.8 (0.74 - 0.88)
Bias B 25% (14% - 36%)
ffusion Tubes Mean: 27 µgm⁻³
Mean CV (Precision): 5
Automatic Mean: 22 µgm⁻³
Data Capture for periods used: 96%
justed Tubes Mean: 22 (20 - 24) µgm⁻³

Accuracy (with 95% confidence interval) WITH ALL DATA
Bias calculated using 11 periods of data
Bias factor A 0.8 (0.74 - 0.88)
Bias B 25% (14% - 36%)
Diffusion Tubes Mean: 27 µgm⁻³
Mean CV (Precision): 5
Automatic Mean: 22 µgm⁻³
Data Capture for periods used: 96%
Adjusted Tubes Mean: 22 (20 - 24) µgm⁻³

Jaume Targa, for AEA
Version 04 - February 2011

If you have any enquiries about this spreadsheet please contact the LAQM Helpdesk at: LAQMHelpdesk@uk.bureauveritas.com

Royal Borough of Greenwich

Laboratory Details[17]

- Diffusion Tubes are prepared and analysed by UKAS accredited Gradko International Ltd
- Diffusion Tubes are prepared using 50% triethanolamine with acetone
- For details attaining to 'results' – precision, bias adjustment factors; and reference methods please refer to - 'London Wide Environment Program (LWEP) Nitrogen Dioxide diffusion tube survey report, 2020.

Bias Factor[18]

The Royal Borough of Greenwich has used the LWEP Bias Adjustment Factor for the last few years.

London Borough of Newham

Laboratory Details[19]

- Diffusion Tubes are prepared and analysed by UKAS accredited Gradko International Ltd
- Diffusion Tubes are prepared using 50% triethanolamine with acetone

Bias Factor[20]

A bias adjustment factor of 0.8 was applied to these tubes in both 2022 and 2021, derived from the LWEP.

London Borough of Tower Hamlets

Laboratory Details[21]

- Diffusion Tubes are prepared and analysed by UKAS accredited Socotec UK Ltd
- Diffusion Tubes are prepared using 50% triethanolamine with acetone

[17] 2023 data not yet available.
[18] 2023 data not yet available.
[19] 2023 data not yet available.
[20] 2023 data not yet available.
[21] 2023 data not yet available.

Bias Factor[22]

A bias adjustment factor of 0.76 was applied to these tubes in 2022, as derived from the national bias factor database. No local study was available.

[22] 2023 data not yet available.