Epping Forest Final Report 2024

Monitoring Results from June 2023 - February 2024

Project number: 60707468

June 2024

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Quality information

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Revision	Revision date	Details	Authorized	Name	Position
V1	29 May 2024	Draft	ZA	Zadie Astill	Project Manager
V2	12 June 2024	Final	ZA	Zadie Astill	Project Manager

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1. Introduction

1.1 Overview

AECOM was commissioned by Epping Forest District Council (EFDC) in March 2023 to update the results from the 2018-2019 Epping Forest diffusion tube survey, using the same diffusion tube network used at that time. This network monitored nitrogen dioxide (NO_2) and ammonia (NH_3) concentrations at 13 transects in the vicinity of the Epping Forest Special Area of Conservation (SAC) / Site of Special Scientific Interest (SSSI). Monitoring was conducted along transects to provide information regarding the drop-off of pollutant concentrations with distance from the road.

The 2023-24 study included one background NO_2 and NH_3 monitoring location (T9_B3) in the Forest, sited well away from roads, and a co-located NO_2 monitoring site with an automatic monitoring station at the Prince of Wales (PoW) School in Enfield. Additionally, two passive NH_3 Adapted Low-cost Passive High-Absorption (ALPHA) samplers were set up, co-located with NH_3 diffusion tubes at one roadside location and the background location. The nine months of monitoring commenced on 7th June 2023, and the network was decommissioned on 7th March 2024.

This monitoring report presents the finalised results of the full monitoring survey.

1.2 Scope of the Survey

The purpose of the 2023-24 survey was to provide:

- monthly mean concentrations of oxides of nitrogen (NOx), as µg/m^3 of NO_2 at locations ranging from zero to 200 metres from the roadside within the SAC/SSSI, and at locations representative of background conditions within the SAC/SSSI;
- monthly mean concentrations of NH_3 at locations ranging from zero to 200 metres from the roadside within the SAC/SSSI, and at locations representative of background conditions within the SAC/SSSI; and
- provide a comparison of NO_X and NH_3 concentrations and trends relative to those found in the original 2018-19 survey.

The monthly mean values can be used to calculate long term mean concentration values, such as annual mean concentration values, that can be compared against relevant air quality standards for the protection of ecosystems. These standards are listed in Appendix B.

2. Monitoring Methodology

2.1 Locations

Much of the SAC/SSSI is densely wooded. The monitoring locations chosen at the time of the commencement of the baseline survey therefore reflected the practicalities of gaining safe access to those parts of the site at all times of the year. Care was taken to select monitoring locations which were safely accessible.

Details of each sampling location were recorded. Due to the nature of the study area, it was not possible to mount the diffusion tubes on stakes driven into the ground and so appropriate tree trunks or large branches were chosen to mount the tubes, subject to sufficient clearance around the tubes from smaller branches and/or summer leaves. Where possible, at roadside locations street furniture was used to mount the tubes. The height of the samplers was recorded, and a photograph of the sampling site saved to file.

The survey included two sampling positions representative of background air pollutant concentrations within the SAC/SSSI. The background locations were remote from any potentially significant local sources of the pollutants being sampled. Details of all locations used in the survey are presented in Appendix A.

The locations of the 13 transects situated perpendicular to major roads in the Forest were agreed with the City of London (CoL) Conservators and are consistent with the previous monitoring survey during 2018-2019.

Monitoring locations along the transects were spaced at approximate distances of 0m, 5m, 10m, 20m, 40m, 70m, 100m, 150m and 200m back from the kerb. Five transects (T1, T3, T4, T6, T8) included NO_2 and NH_3 monitoring sites along the full 200m, with triplicate tubes set up at 0m and either 20m or 40m. For the remaining transects (T2, T5, T7, T10, T11, T12, T13, T14), NO_2 monitoring sites were chosen using the same approximate spacing up to 40m from the kerb (0m, 5m, 10m, 20m, 40m), with one triplicate site at 0m. The 200m transect extent was selected as it is well documented that the contribution to NO_x and NO_2 from road traffic is unlikely to extend notably beyond this distance from the road. Similarly, the contribution to NH_3 concentrations from road traffic is unlikely to extend significantly beyond 40m from the road. Figure 6 to Figure 9 in Appendix A show the locations of the transects.

2.2 Monitoring Details

The survey was undertaken by suitably qualified and trained staff. The results of the survey have been analysed and reviewed appropriately by air quality professionals.

There is no internationally recognised standard for the use of passive diffusion tubes (Palmes tubes) to sample NO_2 and NH_3. However, the method is widely used, especially in UK and European countries, as a method for informing decision making for the development control process.

The NO_2 diffusion tubes were prepared and analysed by Gradko International Ltd using a 20% triethanolamine (TEA) in water solution. Gradko also prepared and analysed the NH_3 tubes, using the UKAS-accredited ion chromatography method.

The triplicate tubes at each location for each month were assessed for their precision as part of the quality assurance and quality control (QA/QC) process for reporting these results. Over the monitoring period, consideration was given to discard any unreliable data, when factors such as tube contamination of water droplets, insects or spiders and their nests were identified, and also when results were found to be spuriously low or high, relative to other similar sites. The coefficient of variance (CV) of the triplicate tubes was also considered, with CV desirable to be kept less than 20%, which indicates good precision in the results. However, due to the variability in results, particularly with respect to NH_3, results were generally retained to preserve data capture, and most triplicate locations recorded CV of less than 30%.

2.3 Sampling Methodology

Baseline sampling for NO_2 and NH_3 was undertaken within the SAC/SSSI, during the period June 2023 to March 2024.

The diffusion tubes were stored in a refrigerator when not in use and care was taken during transfer to and from the sampling site to avoid exposure of the tubes to intense UV light or extreme temperatures.

The tubes were exposed on site for a period of approximately 4 weeks, consistent with the sampling advice provided by the Gradko. Following exposure, the tubes were collected and re-sealed before being returned to the laboratory for analysis.

Additional tubes were used as controls (travel blanks) during the survey. These tubes were not exposed to the air but were analysed. The controls serve to identify any potential issues with handling and use of the diffusion tubes.

The tubes were positioned at a height above local ground level of around 2m. Appropriate fixings were used to hold the tubes at a suitable distance away from obstructions and at the correct angle. Examples of the diffusion tube setup are shown in Figure 1.

The concentration of NO_x can be calculated from the NO_2 monitoring results by using the NO_x:NO_2 converter tool provided by Defra[1].

[1] Current version of the tool is version 8.1, https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc

Figure 1: Examples of Diffusion Tube Mounting in Epping Forest

3. NO_2 Monitoring Results

Appendix C presents the raw NO_2 monitoring data for each period of the monitoring survey.

A local bias adjustment factor was calculated using data from the triplicate diffusion tubes co-located with the Enfield PoW School continuous monitoring station and a spreadsheet tool provided by Defra to calculate precision and accuracy of diffusion tubes[2]. The local bias adjustment factor was calculated to be 0.89 and applied to the raw diffusion tube monitoring results. Further details of the bias adjustment factor calculation can be found in Appendix D.

For monitoring surveys of less than one year, or where there are gaps in the data, it is best practice to calculate annualisation factors, which are used to estimate annual mean concentrations from the monitored period mean concentrations. The annualisation calculation is described in Box 7.10 of Defra's technical guidance LAQM.TG22[3]. Location-specific annualisation factors were calculated for each tube location based on the differing periods of missing or excluded data. Further details of the calculation of annualisation factors can be found in

Table 1 shows the period mean NO_2 concentrations, 2023-equivalent annualised and bias-adjusted annual mean NO_2 concentrations, the background NO_2 and NO_X concentrations, and derived annual mean NO_X concentration. The annual mean NO_X concentration can be compared against the annual mean NO_X Critical Level for the protection of ecosystems, 30 $\mu g/m^3$.

The 2023-24 annual mean equivalent NO_2 concentrations ranged from 8.5 $\mu g/m^3$ at the background site T9_B3, to 31.3 $\mu g/m^3$ at the T3_N0 triplicate roadside site, located roadside near the Wake Arms Roundabout. This level is below the AQS objective value of 40 $\mu g/m^3$. Elevated NO_2 concentrations were also found at the roadside T2_N0 (24.7 $\mu g/m^3$) and T1_N0 (24.0 $\mu g/m^3$) locations.

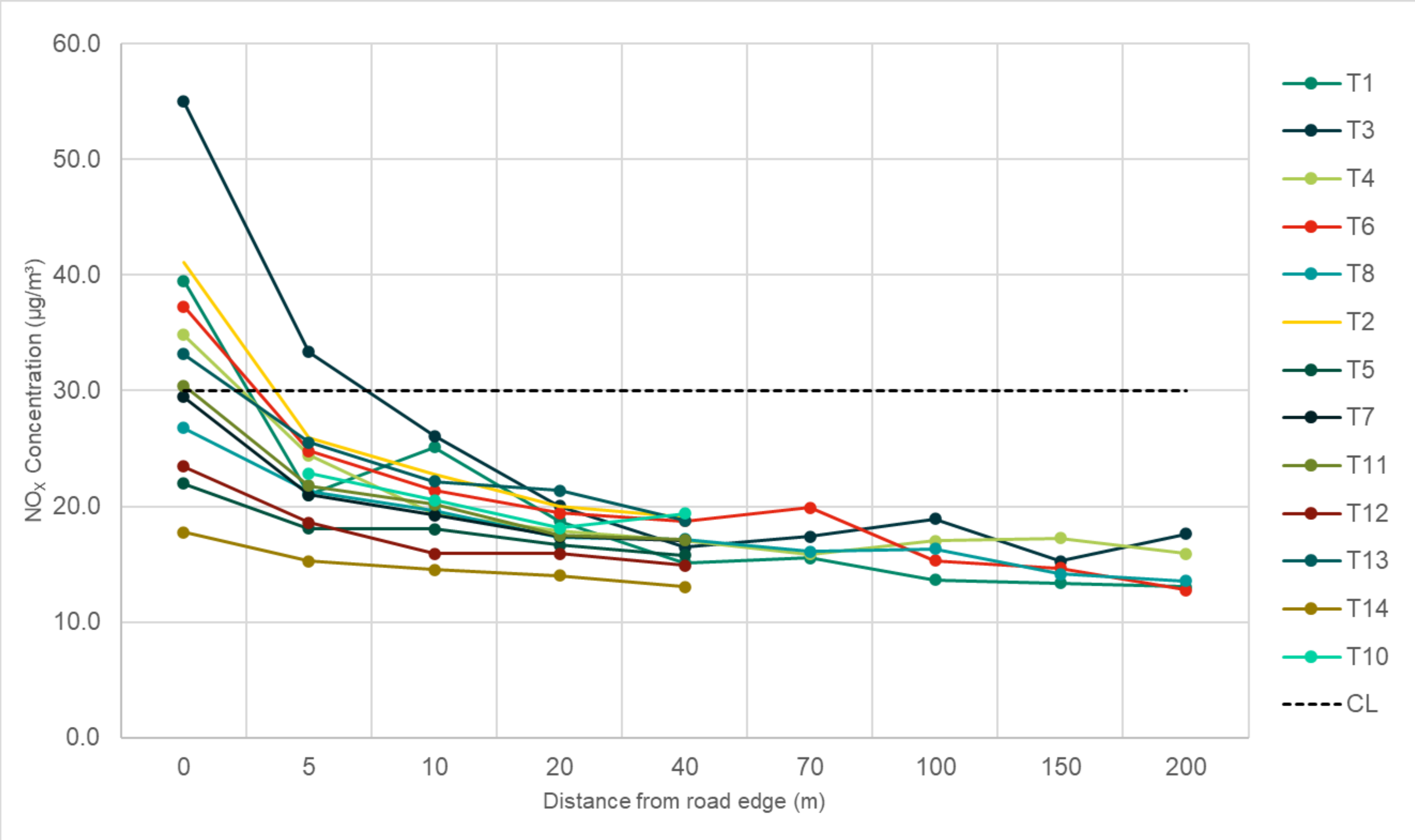
Although the background concentration (8.5 $\mu g/m^3$) was relatively low compared to the Defra mapped background concentration (12.6 $\mu g/m^3$) for the 1km x 1km grid square within which T9_B3 is located (542500, 197500), the concentrations at the more distant transect locations were often between 11-12 $\mu g/m^3$ and compare slightly more favourably. It should be noted that the most up to date currently available Defra mapped background concentrations are based on 2018 data and projections, and as such may not have accounted for potentially sharper than predicted decreases in background concentrations. Nevertheless, the measured NO_2 concentration at T9_B3 has been used as the background NO_2 concentration in Defra's NO_x to NO_2 calculator[4] to derive the annual mean NO_x concentrations for each monitoring location. The corresponding background NO_X concentration was calculated by multiplying the monitored T9_B3 NO_2 concentration by the ratio of the Defra mapped background NO_x:NO_2 concentrations for the 1km x 1km grid square within which T9_B3 is located (542500,197500); this gave a background NO_x concentration of 11.4 $\mu g/m^3$ for Epping Forest.

Figure 2 presents the derived NO_X monitoring results from the transect locations, with measured concentrations plotted against increasing distance from the nearest road. There is a general trend for NO_X (and by extension NO_2) concentrations to decrease with distance away from the road, to a background level at distances between 40-100m from the road and beyond.

The Critical Level of 30 $\mu g/m^3$ of NO_x as an annual mean is set in the EU Ambient Air Quality Directive, and transposed into UK law by the Air Quality Standards Regulations 2010 for the protection of vegetation. The results of the 2023-24 monitoring survey indicate that concentrations of NO_x achieve this Critical Level at most of the monitoring sites, except for a number of roadside sites and the T3_N5 site 5m from the road. This is in contrast to the 2018-19 survey, where most monitoring sites exceeded the Critical Level.

[2] Defra's Precision Accuracy Bias spreadsheet: https://laqm.defra.gov.uk/air-quality/air-quality-assessment/local-bias
[3] Defra, Local Air Quality Management Technical Guidance LAQM.TG(22), 2022.
[4] Defra's NOx to NO_2 calculator v8.1 https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc

Figure 2: 2023 Annual Mean Equivalent NOx Concentrations with Distance from the Road



Note: "CL" denotes the NOx Critical Level, or annual mean air quality objective of 30 µg/m³ for the protection of vegetation. Distance from road edge is not presented to scale, in order to visualise the concentrations nearer the road more clearly.

Table 1: Epping Forest 2023-24 NO_2 Diffusion Tube Concentrations and Derived NOx Concentrations

Monitoring Transect	Diffusion Tube Location	Distance from Road (m)	NO_2 Period Mean (µg/m^3)	Local Bias Adjustment Factor	Annualisation Factor	Bias Adjusted NO_2 2023 Annual Mean Equivalent (µg/m^3)	Background NO_2 (µg/m^3)	Background NO_X (µg/m^3)	Derived Road NO_X (µg/m^3)	Derived Total NO_X (µg/m^3)
T1	T1_N0 (Tri)	0	26.9	0.89	1.00	24.0	8.5	11.4	28.1	**39.5**
T1	T1_N5	5	18.5	0.89	0.88	14.5	8.5	11.4	9.6	21.0
T1	T1_N10	10	18.8	0.89	1.00	16.7	8.5	11.4	13.8	25.1
T1	T1_N20	20	16.1	0.89	0.93	13.3	8.5	11.4	7.4	18.7
T1	T1_N40	40	12.8	0.89	1.00	11.4	8.5	11.4	3.7	15.1
T1	T1_N70	70	14.1	0.89	0.93	11.6	8.5	11.4	4.2	15.5
T1	T1_N100	100	11.9	0.89	1.00	10.6	8.5	11.4	2.3	13.6
T1	T1_N150	150	12.6	0.89	0.93	10.4	8.5	11.4	2.0	13.4
T1	T1_N200	200	12.4	0.89	0.93	10.2	8.5	11.4	1.7	13.0
T2	T2_N0 (Tri)	0	30.0	0.89	0.93	24.7	8.5	11.4	29.7	**41.1**
T2	T2_N5	5	19.5	0.89	0.99	17.1	8.5	11.4	14.6	25.9
T2	T2_N10	10	17.4	0.89	1.00	15.5	8.5	11.4	11.4	22.8
T2	T2_N20	20	15.7	0.89	1.00	14.0	8.5	11.4	8.6	20.0
T2	T2_N40	40	15.2	0.89	1.00	13.5	8.5	11.4	7.7	19.1
T3	T3_N0 (Tri)	0	35.1	0.89	1.00	31.3	8.5	11.4	43.6	**55.0**
T3	T3_N5	5	23.5	0.89	1.00	20.9	8.5	11.4	22.0	**33.4**
T3	T3_N10	10	19.3	0.89	1.00	17.2	8.5	11.4	14.7	26.1
T3	T3_N20 (Tri)	20	16.0	0.89	0.99	14.0	8.5	11.4	8.6	20.0
T3	T3_N40	40	13.9	0.89	0.98	12.1	8.5	11.4	5.1	16.5
T3	T3_N70	70	14.2	0.89	1.00	12.6	8.5	11.4	6.0	17.4
T3	T3_N100	100	15.1	0.89	1.00	13.4	8.5	11.4	7.5	18.9
T3	T3_N150	150	13.6	0.89	0.95	11.5	8.5	11.4	3.9	15.3
T3	T3_N200	200	14.3	0.89	1.00	12.7	8.5	11.4	6.2	17.6

Monitoring Transect	Diffusion Tube Location	Distance from Road (m)	NO_2 Period Mean (µg/m³)	Local Bias Adjustment Factor	Annualisation Factor	Bias Adjusted NO_2 2023 Annual Mean Equivalent (µg/m³)	Background NO_2 (µg/m³)	Background NO_X (µg/m³)	Derived Road NO_X (µg/m³)	Derived Total NO_X (µg/m³)
T4	T4_N0 (Tri)	0	25.4	0.89	0.96	21.7	8.5	11.4	23.5	**34.8**
T4	T4_N5	5	18.4	0.89	1.00	16.3	8.5	11.4	13.1	24.4
T4	T4_N10	10	15.3	0.89	1.00	13.6	8.5	11.4	7.9	19.3
T4	T4_N20 (Tri)	20	14.4	0.89	1.00	12.9	8.5	11.4	6.5	17.8
T4	T4_N40	40	14.0	0.89	1.00	12.4	8.5	11.4	5.7	17.1
T4	T4_N70	70	13.2	0.89	1.00	11.8	8.5	11.4	4.5	15.9
T4	T4_N100	100	13.9	0.89	1.00	12.4	8.5	11.4	5.6	17.0
T4	T4_N150	150	14.8	0.89	0.96	12.5	8.5	11.4	5.9	17.3
T4	T4_N200	200	13.3	0.89	1.00	11.8	8.5	11.4	4.5	15.9
T5	T5_N0 (Tri)	0	17.6	0.89	0.96	15.1	8.5	11.4	10.6	22.0
T5	T5_N5	5	15.7	0.89	0.93	13.0	8.5	11.4	6.7	18.1
T5	T5_N10	10	14.5	0.89	1.00	12.9	8.5	11.4	6.6	18.0
T5	T5_N20	20	13.7	0.89	1.00	12.2	8.5	11.4	5.3	16.6
T5	T5_N40	40	13.7	0.89	0.96	11.7	8.5	11.4	4.4	15.8
T6	T6_N0 (Tri)	0	25.7	0.89	1.00	22.9	8.5	11.4	25.9	**37.3**
T6	T6_N5	5	18.9	0.89	0.99	16.5	8.5	11.4	13.4	24.8
T6	T6_N10	10	16.8	0.89	0.99	14.7	8.5	11.4	10.0	21.4
T6	T6_N20 (Tri)	20	16.6	0.89	0.93	13.7	8.5	11.4	8.0	19.4
T6	T6_N40	40	15.0	0.89	1.00	13.3	8.5	11.4	7.3	18.7
T6	T6_N70	70	15.6	0.89	1.00	14.0	8.5	11.4	8.5	19.9
T6	T6_N100	100	13.4	0.89	0.96	11.5	8.5	11.4	3.9	15.3
T6	T6_N150	150	13.0	0.89	0.96	11.1	8.5	11.4	3.3	14.7
T6	T6_N200	200	11.0	0.89	1.03	10.1	8.5	11.4	1.4	12.8
T7	T7_N0 (Tri)	0	21.3	0.89	1.00	18.9	8.5	11.4	18.1	29.4

Monitoring Transect	Diffusion Tube Location	Distance from Road (m)	NO_2 Period Mean (µg/m^3)	Local Bias Adjustment Factor	Annualisation Factor	Bias Adjusted NO_2 2023 Annual Mean Equivalent (µg/m^3)	Background NO_2 (µg/m^3)	Background NO_X (µg/m^3)	Derived Road NO_X (µg/m^3)	Derived Total NO_X (µg/m^3)
T7	T7_N5	5	16.3	0.89	1.00	14.5	8.5	11.4	9.6	21.0
T7	T7_N10	10	15.3	0.89	1.00	13.6	8.5	11.4	7.9	19.2
T7	T7_N20	20	14.2	0.89	1.00	12.6	8.5	11.4	6.0	17.4
T7	T7_N40	40	14.0	0.89	1.00	12.4	8.5	11.4	5.7	17.1
T8	T8_N0 (Tri)	0	19.7	0.89	1.00	17.6	8.5	11.4	15.4	26.8
T8	T8_N5	5	16.5	0.89	1.00	14.7	8.5	11.4	9.9	21.3
T8	T8_N10	10	15.5	0.89	1.00	13.8	8.5	11.4	8.3	19.7
T8	T8_N20 (Tri)	20	14.1	0.89	1.00	12.6	8.5	11.4	6.0	17.3
T8	T8_N40	40	14.0	0.89	1.00	12.5	8.5	11.4	5.8	17.2
T8	T8_N70	70	13.4	0.89	1.00	11.9	8.5	11.4	4.7	16.1
T8	T8_N100	100	13.5	0.89	1.00	12.0	8.5	11.4	5.0	16.3
T8	T8_N150	150	12.2	0.89	1.00	10.9	8.5	11.4	2.8	14.2
T8	T8_N200	200	12.3	0.89	0.96	10.5	8.5	11.4	2.2	13.5
T10	T10_N5 (Tri)	5	17.4	0.89	1.00	15.5	8.5	11.4	11.5	22.8
T10	T10_N10	10	16.3	0.89	0.99	14.3	8.5	11.4	9.1	20.5
T10	T10_N20	20	14.8	0.89	0.99	13.0	8.5	11.4	6.8	18.1
T10	T10_N40	40	15.4	0.89	1.00	13.7	8.5	11.4	8.0	19.4
T11	T11_N0 (Tri)	0	21.8	0.89	1.00	19.4	8.5	11.4	19.0	**30.4**
T11	T11_N5	5	17.5	0.89	0.96	15.0	8.5	11.4	10.4	21.8
T11	T11_N10	10	15.8	0.89	1.00	14.1	8.5	11.4	8.8	20.2
T11	T11_N20	20	14.8	0.89	0.96	12.7	8.5	11.4	6.1	17.5
T11	T11_N40	40	14.2	0.89	0.99	12.4	8.5	11.4	5.7	17.1
T12	T12_N0 (Tri)	0	17.8	0.89	1.00	15.8	8.5	11.4	12.1	23.5
T12	T12_N5	5	14.9	0.89	1.00	13.2	8.5	11.4	7.2	18.6

Monitoring Transect	Diffusion Tube Location	Distance from Road (m)	NO_2 Period Mean (µg/m^3)	Local Bias Adjustment Factor	Annualisation Factor	Bias Adjusted NO_2 2023 Annual Mean Equivalent (µg/m^3)	Background NO_2 (µg/m^3)	Background NO_X (µg/m^3)	Derived Road NO_X (µg/m^3)	Derived Total NO_X (µg/m^3)
T12	T12_N10	10	13.3	0.89	1.00	11.8	8.5	11.4	4.5	15.9
T12	T12_N20	20	13.3	0.89	1.00	11.8	8.5	11.4	4.6	15.9
T12	T12_N40	40	12.7	0.89	1.00	11.3	8.5	11.4	3.5	14.9
T13	T13_N0 (Tri)	0	23.4	0.89	1.00	20.8	8.5	11.4	21.8	**33.1**
T13	T13_N5	5	18.2	0.89	1.04	16.9	8.5	11.4	14.2	25.5
T13	T13_N10	10	17.3	0.89	0.98	15.1	8.5	11.4	10.8	22.1
T13	T13_N20	20	17.6	0.89	0.94	14.7	8.5	11.4	10.0	21.4
T13	T13_N40	40	14.4	0.89	1.04	13.3	8.5	11.4	7.4	18.8
T14	T14_N0 (Tri)	0	14.4	0.89	1.00	12.8	8.5	11.4	6.4	17.8
T14	T14_N5	5	12.9	0.89	1.00	11.5	8.5	11.4	3.9	15.3
T14	T14_N10	10	12.6	0.89	0.99	11.0	8.5	11.4	3.1	14.5
T14	T14_N20	20	12.1	0.89	1.00	10.8	8.5	11.4	2.6	14.0
T14	T14_N40	40	11.5	0.89	1.00	10.2	8.5	11.4	1.7	13.1
T9_B3	T9_B3 (Tri)	> 200	9.5	0.89	1.00	8.4	8.5	11.4	-	-
PoW	PoW (Tri)	-	16.6	0.89	1.00	14.8	8.5	11.4	10.1	21.5

Note: Total NO_X concentrations marked in bold signify exceedances of the annual mean NO_X Critical Level for the protection of vegetation.

4. NH_3 Monitoring Results

In the 2023-24 survey, two Adapted Low-cost Passive High-Absorption (ALPHA) passive samplers (each are comprised of triplicate absorbers) were set up as co-location sites with the NH_3 diffusion tubes. One was set up at the roadside T3_A0 location along transect T3, which is the worst-case monitoring location in the survey, and the other at the T9_B3 background location, ensuring that a wide range of conditions are captured. These co-locations allowed for a bias adjustment factor for the NH_3 diffusion tube concentrations to be calculated, with details presented in Appendix F. The bias adjustment factor was calculated to be 0.57, indicating that the diffusion tubes overestimate NH_3 concentrations by just over 40% compared to the ALPHA samplers. This factor is very similar to that obtained from the three month co-location study at the UK Eutrophying and Acidifying Pollutant (UKEAP) London Cromwell Road ALPHA sampling location undertaken for the 2018-19 survey (0.59) and provides further confidence and robustness in the results.

Location-specific annualisation factors were calculated for each tube location to estimate annual mean concentrations from the monitored period mean concentrations. These were calculated using data for 2023 from four nearby UKEAP background NH_3 monitoring locations. Further details of the calculation of the annualisation factors can be found in Appendix F.

Table 2 presents the raw monthly NH_3 diffusion tube results, and period mean NH_3 concentrations from the nine months of NH_3 monitoring.

The 2023 annual mean equivalent NH_3 concentrations range from 0.8 µg/m^3 at the T8_A150 location 150m from the road, to 2.8 µg/m^3 at the T3_A0 triplicate roadside location. Elevated NH_3 concentrations were also found at the T6_A0 (2.5 µg/m^3) and T4_A0 (2.4 µg/m^3) roadside locations. There is a general trend for NH_3 concentrations to decrease with distance away from the road, to background levels at around 40-70m from the road and beyond, with most NH_3 concentrations at these distances around approx. 1 µg/m^3. The background site T9_B3 monitored 1.3 µg/m^3, which agrees relatively well with other monitoring locations furthest from the roads.

Figure 3 presents the monitoring results from the transect locations, with measured concentrations plotted against increasing distance from the nearest road. The same trend was broadly seen for all transects; peaks in concentrations are recorded at the roadside locations, with concentrations decreasing with distance away from the road, tending towards background levels at 40-70m from the road edge and beyond.

The critical level of 1 µg/m^3 of NH_3 as an annual mean is set by the Convention on Long-Range Transboundary Air Pollution (CLRTAP) for the protection of lichen and bryophytes. The results of the monitoring survey indicate that concentrations of NH_3 exceed this critical level at most of the monitoring sites with the exception of a couple of transects at between 100m and 150m from the road. The critical level is also exceeded at the T9_B3 background site, which is greater than 200m from trafficked roads.

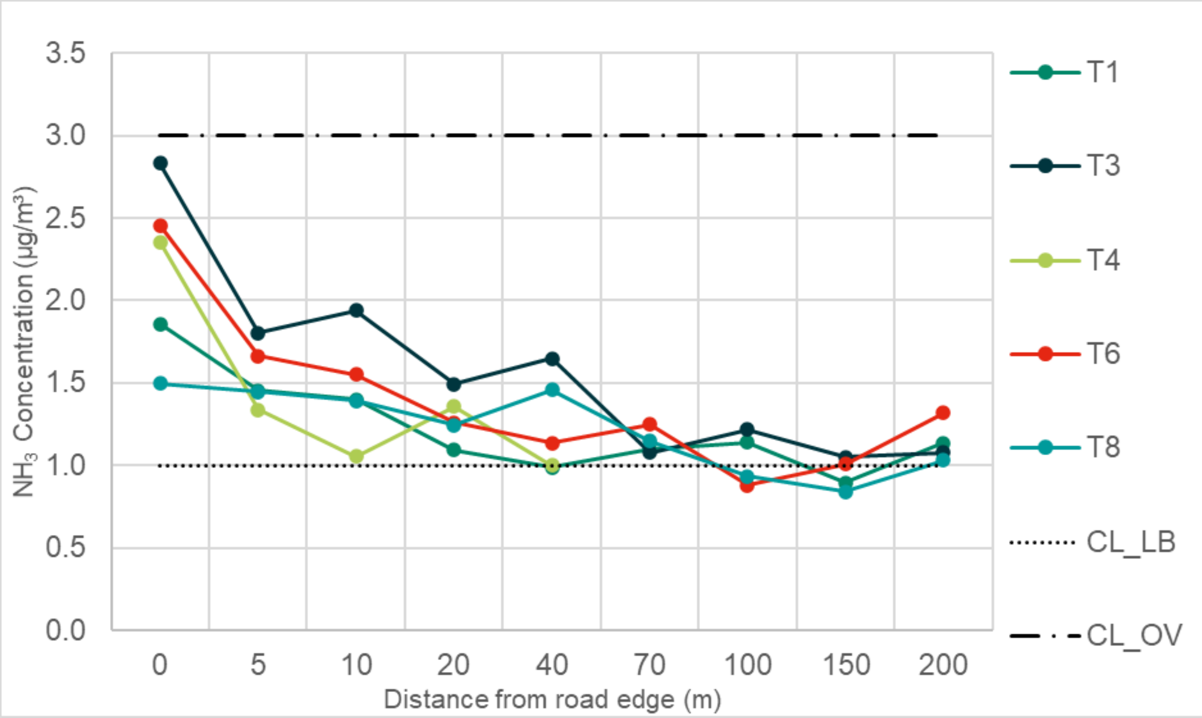
The critical level of 3 µg/m^3 of NH_3 as an annual mean is set by CLRTAP for the protection of other vegetation. The results of the 2023-24 monitoring survey indicate that concentrations of NH_3 are below this critical level at all locations in the survey, including the roadside locations. This is in contrast to the results from the 2018-19 survey, which showed a number of roadside and near roadside locations exceeding this critical level.

Table 2: Epping Forest 2023-24 NH_3 Diffusion Tube Concentrations

Monitoring Transect	Diffusion Tube Location	Distance from Road (m)	NH_3 Period Mean (µg/m^3)	Local Bias Adjustment Factor	Annualisation Factor	Bias Adjusted NH_3 2023 Annual Mean Equivalent (µg/m^3)
T1	T1_A0 (Tri)	0	3.2	0.57	1.02	1.9
T1	T1_A5	5	2.5	0.57	1.02	1.5
T1	T1_A10	10	2.4	0.57	1.02	1.4
T1	T1_A20	20	1.8	0.57	1.09	1.1
T1	T1_A40 (Tri)	40	1.5	0.57	1.14	1.0
T1	T1_A70	70	1.9	0.57	1.00	1.1

Monitoring Transect	Diffusion Tube Location	Distance from Road (m)	NH_3 Period Mean (µg/m^3)	Local Bias Adjustment Factor	Annualisation Factor	Bias Adjusted NH_3 2023 Annual Mean Equivalent (µg/m^3)
T1	T1_A100	100	1.8	0.57	1.14	1.1
T1	T1_A150	150	1.6	0.57	1.00	0.9
T1	T1_A200	200	2.2	0.57	0.90	1.1
T3	T3_A0 (Tri)	0	5.2	0.57	0.96	2.8
T3	T3_A5	5	3.1	0.57	1.02	1.8
T3	T3_A10	10	3.5	0.57	0.98	1.9
T3	T3_A20 (Tri)	20	2.7	0.57	0.98	1.5
T3	T3_A40	40	2.5	0.57	1.15	1.6
T3	T3_A70	70	1.8	0.57	1.02	1.1
T3	T3_A100	100	2.1	0.57	1.02	1.2
T3	T3_A150	150	1.9	0.57	0.99	1.1
T3	T3_A200	200	1.6	0.57	1.19	1.1
T4	T4_A0 (Tri)	0	3.8	0.57	1.09	2.4
T4	T4_A5	5	2.3	0.57	1.02	1.3
T4	T4_A10	10	1.8	0.57	1.02	1.1
T4	T4_A20	20	2.3	0.57	1.02	1.4
T4	T4_A40	40	1.8	0.57	0.96	1.0
T6	T6_A0 (Tri)	0	4.2	0.57	1.02	2.5
T6	T6_A5	5	2.8	0.57	1.02	1.7
T6	T6_A10	10	2.5	0.57	1.09	1.6
T6	T6_A20 (Tri)	20	2.2	0.57	1.00	1.3
T6	T6_A40	40	1.9	0.57	1.02	1.1
T6	T6_A70	70	2.0	0.57	1.10	1.2
T6	T6_A100	100	1.2	0.57	1.26	0.9
T6	T6_A150	150	1.6	0.57	1.09	1.0
T6	T6_A200	200	2.0	0.57	1.15	1.3
T8	T8_A0 (Tri)	0	2.6	0.57	1.02	1.5
T8	T8_A5	5	2.5	0.57	1.02	1.4
T8	T8_A10	10	2.4	0.57	1.02	1.4
T8	T8_A20 (Tri)	20	2.1	0.57	1.02	1.2
T8	T8_A40	40	2.5	0.57	1.02	1.5
T8	T8_A70	70	2.1	0.57	0.94	1.1
T8	T8_A100	100	1.6	0.57	1.02	0.9
T8	T8_A150	150	1.4	0.57	1.02	0.8
T8	T8_A200	200	1.7	0.57	1.09	1.0
T9_B3	T9_B3 (Tri)	> 200	2.3	0.57	1.02	1.3

Figure 3: Bias Adjusted and Annualised 2023 NH_3 Concentrations at 200m Transects with Distance from the Road Edge



Note: "CL_LB" denotes the NH_3 Critical Level for lichens and bryophytes, and "CL_OV" for other vegetation.

Passive ALPHA samplers were co-located with diffusion tubes at the T3_A0 roadside and T9_B3 background monitoring sites to allow for a local bias-adjustment calculation of the NH_3 diffusion tubes across the network. The ALPHA samplers were also mounted in triplicate at each co-location site to give better precision and more robust results. Due to the timescales involved in ratifying the 2024 NH_3 concentrations, ratified January and February 2024 results are not available until April 2025, and so only the ratified June 2023 to December 2023 concentrations are available and presented in Table 3 below. Bias adjustment of the diffusion tube concentrations has been carried out using the 7 months of available ALPHA data – further details of the bias adjustment and annualisation are provided in Appendix F.

Table 3: Ratified ALPHA sampler NH_3 concentrations from June 2023 – December 2023

Location ID	Distance from Road (m)	Jun 23 (µg/m^3)	Jul 23 (µg/m^3)	Aug 23 (µg/m^3)	Sep 23 (µg/m^3)	Oct 23 (µg/m^3)	Nov 23 (µg/m^3)	Dec 23 (µg/m^3)	Period Mean
T3_N0 (Rd)	0	3.89	2.58	3.46	3.40	3.23	-	2.15	3.12
T9_B3 (Bgd)	> 200	0.96	0.40	0.43	0.60	0.26	0.17	0.21	0.43

Data from the Defra UKEAP Network[5] during 2020 to 2023 are shown in Table 4 to compare against NH_3 concentrations measured in Epping Forest, and the 2023 data have been used to carry out the annualisation calculations of the NH_3 diffusion tube data in Appendix F. The sites chosen use ALPHA passive samplers that measure gaseous ammonia on a monthly basis. The London Cromwell Road and Rothamsted sites also have DEnuder for Long Term Atmospheric sampling (DELTA) active samplers, although the comparison in this report only presents the passive monitoring data as the other sites do not have these active samplers.

[5] UK Eutrophying & Acidifying Network (UKEAP) National Ammonia Monitoring Network: https://uk-air.defra.gov.uk/networks/network-info?view=nh3

Table 4: UKEAP Site Information and Annual Mean NH_3 Concentrations

UKEAP Site Name	Site Type	Analyser Type	NH_3 Monitoring Method	Annual Mean NH_3 Concentration (µg/m^3)			
				2020	2021	2022	2023
London - Cromwell Road	Urban Traffic	ALPHA sampler	Gaseous (passive)	2.92	2.76	3.04	2.42
Rothamsted	Rural Background	ALPHA sampler	Gaseous (passive)	1.31	1.23	1.25	0.99
Burnham Beeches	Rural Background	ALPHA sampler	Gaseous (passive)	0.93	0.59	0.79	0.53
Alice Holt 2	Rural Background	ALPHA sampler	Gaseous (passive)	0.60	0.63	0.64	0.41
Thursley Common 2	Rural Background	ALPHA sampler	Gaseous (passive)	1.31	1.23	0.93	0.47

Compared to the 2020-2023 annual mean NH_3 concentrations monitored at the UKEAP locations in Table 4, the NH_3 concentrations monitored in Epping Forest along the five transects were in general higher, even at the locations furthest from the roads. Concentrations in these years were typically around 2.4-3.0 µg/m^3 at the London Cromwell Road urban traffic site, but as low as between 0.4-1.3 µg/m^3 at the rural background sites.

5. Comparison with 2018-19 Survey

NO_X and NO_2

The comparison of NO_2 and derived NO_X concentrations over the periods 2018-19 and 2023-24 reveals significant trends and improvements in air quality near roads, based on the data from multiple transects (T1 to T14). In the 2018-19 survey, the NO_2 concentrations were recorded across various distances from the road, with the highest concentrations observed right at the roadside. For instance, T2_N0 showed a maximum NO_2 concentration of 54.1 µg/m³, and T3_N0 recorded 59.5 µg/m³, which equated to derived NO_X concentrations of 105.3 µg/m³ and 119.6 µg/m³, respectively. These values highlight the intense exposure to NO_2/NO_X pollution immediately adjacent to the road. However, as distance from the road increased, the NO_2 and NO_X levels dropped significantly, highlighting the localised nature of road traffic emissions. In contrast, the 2023-24 graphs shown in Figure 2, which focus on NO_X concentrations, show a much lower starting point. Initial NO_X concentrations peak around 55 µg/m³ at the closest proximity to the road, already near or below the air quality objective. As distance from the road increases, both sets of NO_2 data (200m and 40m transects) exhibit a more gradual decline compared to the 2018-19 data. The NO_X concentrations decrease sharply within the first 20m and then level off to stabilise around 15 to 20 µg/m³.

The comparative data between 2018-19 and 2023-24 indicates a significant improvement in air quality. There are a number of factors that may have contributed to this. One significant factor could have been the implementation and expansion of London's Ultra Low Emission Zone (ULEZ), which started in April 2019 and was fully expanded to cover the whole of Greater London in August 2023. Although EFDC is outside Greater London and not within the ULEZ, it is adjacent to and likely influenced by it. It is also likely that a general reduction in background concentrations from wider-reaching policies, targeted not only at road emissions but also non-road sources, are likely to have influenced the results here. Changes in travel behaviours and types of vehicles since the last survey may also have influenced the results. It is understood that traffic and ANPR surveys have recently been undertaken, which will provide a better understanding of any such changes. Additionally, reduced variability among transects in the 2023-24 data compared to the 2018-19 data could indicate a more consistent and effective influence of air quality measures across various locations. Compliance with air quality objectives is markedly better in the recent data, where NO_X levels remain close to or below the critical level even at the closest distances to the road. This improved compliance reflects the success of interventions aimed at reducing vehicular emissions and other pollutants over the past few years. Meteorological conditions can influence pollutant dispersion and concentration levels, which could have also partially contributed to the differences seen between the two surveys, noting that neither this report nor the 2018/19 report provide information in this regard as this was outside the scope. The consistency across different transects in the 2023-24 data also points towards uniformity in the implementation of these measures, resulting in a more homogeneous improvement in air quality.

Figure 4: Transect Averaged Bias-Adjusted and Annualised Derived NO_X Concentrations with Distance from the Road

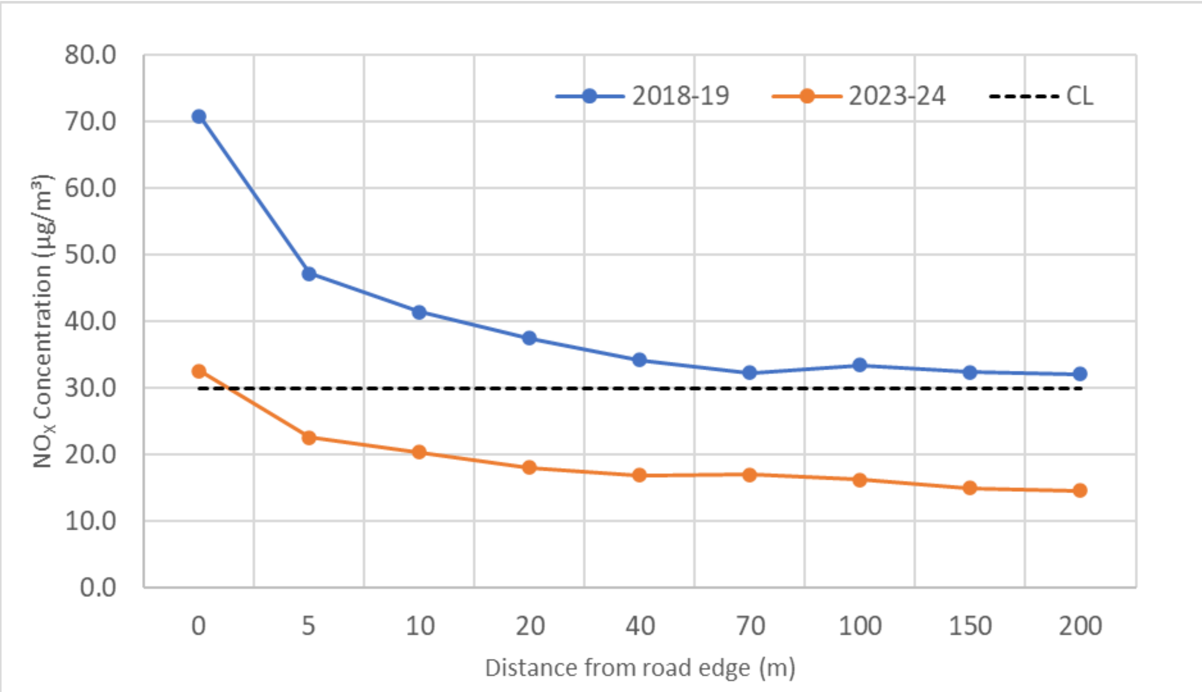


Figure 4 shows the distance-averaged derived NO_X concentration data across all transects from the 2018-19 and 2023-24 surveys across distances from the road edge. It clearly illustrates the substantial reduction in NO_X levels between the two surveys. In 2018-19, NO_X concentrations start around 70 µg/m³ at the road edge and sharply decrease to approximately 31-32 µg/m³ at 200m. The 2023-24 data, however, starts at a much lower concentration of about 32 µg/m³ at the road edge and gradually declines at around 14 µg/m³ at 200m. This again shows that while the annual mean NO_X critical level was predominantly exceeded at all locations in the 2018-19 survey, the 2023-24 survey shows the reverse, with most locations having achieved the critical level except for the roadside sites.

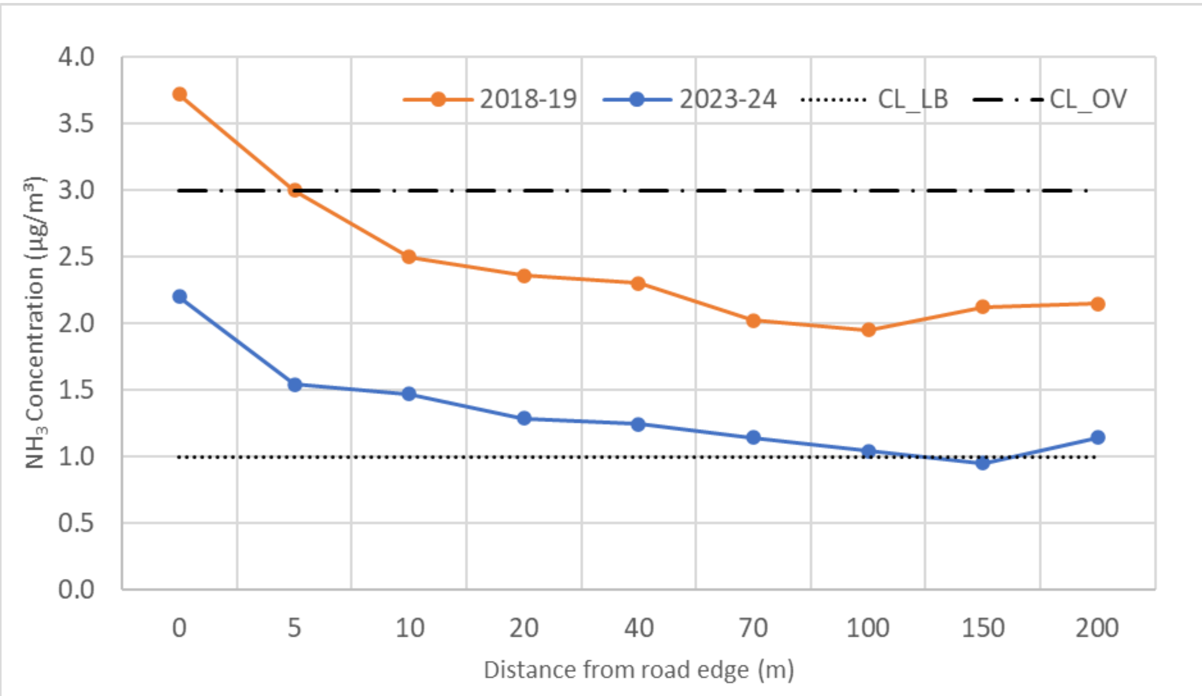
Overall, the data reflects a positive trajectory in managing and mitigating air pollution near roads, with significant reductions in NO_2 and NO_X concentrations from 2018-19 to 2023-24. These findings demonstrate the importance of continued and enhanced efforts in air quality management to sustain and further this progress, ensuring a healthier ecological environment.

NH_3

Similar findings to those for NO_2 and NO_X concentrations described above can be found for the NH_3 concentrations, with substantial decreases in the distance-averaged concentrations across all transects in the 2023-24 survey compared to the 2018-19 survey. In 2023-24, all locations comfortably achieved the 3 µg/m^3 critical level for other vegetation, whereas roadside sites generally did not achieve this in 2018-19. Figure 5 shows the comparison between the two surveys.

While improvements to the overall vehicle fleet and potential reductions in amounts of traffic using the Forest roads, as discussed above, could explain some of the decreases in NH_3 concentrations shown, it is expected that as vehicles (particularly cars) increasingly switch to petrol engines and petrol hybrids from diesel, emissions of NH_3 are expected to potentially increase slightly, before the increasing electrification of the vehicle fleet starts to dominate the changes to the vehicle fleet. This perhaps serves as a reminder that although the trends seen in the monitoring surveys paint a very encouraging picture, they cannot rule out significant influences from other large-scale factors, including meteorological/climatic factors that could have meant that the 2018-19 and 2023-24 monitoring periods were very different in terms of pollutant dispersion conditions. Further work and monitoring studies would help to increase confidence in trends in pollutant concentrations and reduce the risk of having contrasting conditions influencing and/or masking trends in vehicle usage, behaviour and type.

Figure 5: Transect Averaged Bias-Adjusted and Annualised NH_3 Concentrations with Distance from the Road



6. Limitations and Further Work

Due to the nature of the study, it was not possible to mount the diffusion tubes on stakes driven into the ground and so appropriate tree trunks or large branches were chosen to mount the tubes, subject to sufficient clearance around the tubes from smaller branches and/or summer leaves. As such, the diffusion tubes are subject to frequent contamination from the ecology present in the Forest (especially spiders, nests and webs), which can reduce the robustness and accuracy of the results. Where values are unusual and/or where the laboratory has marked a tube as contaminated on receipt, the tube results have been excluded from the calculation of the corrected period mean NO_2 and NH_3 concentrations.

For the 2023-24 survey, there have been two passive ALPHA NH_3 samplers co-located at diffusion tube monitoring locations, which has enabled the calculation of a more robust and locally-specific bias adjustment factor. However, due to timescales involved with processing ALPHA sampler results, only data for seven out of the nine months of monitoring in total have been ratified, and the January and February 2024 provisional ALPHA results are also unavailable at the time of writing. Therefore, the NH_3 bias adjustment is based on the first seven months of ratified ALPHA data.

It is understood that trends in NO_2/NO_x and NH_3 concentrations will be tracked going forward by a repetition of this monitoring survey every five years for a period of at least nine months. A period of nine months will allow for monitoring across the different seasons, since there tends to be a strong seasonality in pollutant concentrations as dispersion conditions are generally more favourable in the warmer months, and so a nine month period of monitoring will provide a robust dataset from which to derive annual mean concentrations. Whilst ongoing monitoring is not considered to be necessary, periodic monitoring of pollutant concentrations will allow EFDC to further track trends over the course of their Local Plan implementation. It is also understood that Defra has established a permanent monitoring site for NH_3 within the Forest, which would provide useful background data on an annual basis moving forward.

7. Summary and Conclusions

AECOM was commissioned to undertake a second monitoring campaign in the Epping Forest SAC/SSSI, effectively reinstating the diffusion tube network originally set up five years earlier in 2018, monitoring ambient nitrogen dioxide (NO_2) and ammonia (NH_3) concentrations. The survey was conducted during a roughly equivalent 9-month period as was previously carried out in 2018/19, with the survey being commissioned in early June 2023 and decommissioned in early March 2024.

Monitoring locations were set up along the original thirteen transects extending away from roads and junctions within Epping Forest. As for the previous survey, the locations included the background site located well away from roads (T9_B3) and a co-location with an automatic monitor measuring NO_2. Instead of an additional 3-month co-location with a passive NH_3 ALPHA sampler in London, as conducted for the original survey, two ALPHA samplers (measuring in triplicate) were additionally installed and co-located with NH_3 diffusion tubes at a roadside location along the T3 transect and the T9_B3 background location to enable local bias adjustment of the NH_3 results.

Annualised and bias-adjusted NO_2 diffusion tube results from the study showed that concentrations varied from 8.5 µg/m^3 at the background location to 31.3 µg/m^3 at the T3_N0 roadside location on the T3 transect just to the west of the Wake Arms Roundabout. The trend of highest concentrations being found at the roadside locations, and a corresponding fall-off in concentration with distance from the road, was consistent across all transects, with concentrations generally falling to between 10 - 12 µg/m^3 at the most distant transect locations. When compared to the 2018-19 study, these concentrations represent a large decrease, both at roadside locations and background locations.

With regards to derived NO_X concentrations, in the 2023-24 study, concentrations were often below the annual mean NO_X Critical Level of 30 µg/m^3, except for 6 locations out of the 13 above the Critical Level at 0m from road and one location at 5m from the road. This is in stark contrast to concentrations in the 2018-19, which were predominantly greater than the Critical Level, except for some more distant transect locations and at the background location.

Annualised and bias-adjusted NH_3 diffusion tube results from the study showed that concentrations generally varied from between 0.9 - 1.1 µg/m^3 between 100m - 200m from the roadside, to 2.8 µg/m^3 at the T3_A0 triplicate roadside site (immediately west of the Wake Arms roundabout), with a measured concentration of 2.5 µg/m^3 also recorded at the T6_A0 roadside location on the T6 transect east of the Wake Arms Roundabout. As for NO_2 and NO_X, the trend of highest concentrations being found at the roadside locations, and a corresponding fall-off in concentration with distance from the road, was consistent across all transects. Despite the fall-off in concentrations away from roads, most monitoring locations were shown to equal or exceed the NH_3 Critical Level of 1 µg/m^3 on an annual mean basis for the protection of lichen and bryophytes. However, no monitoring sites exceeded the Critical Level of 3 µg/m^3, set for the protection of other vegetation. This contrasts with the 2018-19 study, where some roadside and near-roadside sites exceeded this Critical Level. Overall, and similar to NO_X and NO_2, NH_3 concentrations were lower in the 2023-24 study both at roadside and background locations, compared to 2018-19. Background concentrations of NH_3 recorded in Epping Forest were found to be similar to, but slightly higher than, the concentrations recorded at the UKEAP Rothamsted site, whilst roadside concentrations were similar to those concentrations recorded at the London Cromwell Road urban traffic UKEAP site.

The comparative data between 2018-19 and 2023-24 indicates significant improvement in air quality. There are a number of factors that may have contributed to this. One significant factor could have been the implementation and expansion of London's Ultra Low Emission Zone (ULEZ), which started in April 2019 and was fully expanded to cover the whole of Greater London in August 2023. Although EFDC is outside Greater London and not within the ULEZ, it is adjacent and likely influenced by it. It is also likely that a general reduction in background concentrations from wider-reaching policies, targeted not only at road emissions but also non-road sources, are likely to have influenced the results here. Changes in travel behaviours and types of vehicles since the last survey may also have influenced the results. It is understood that traffic and ANPR surveys have recently been undertaken which will provide a better understanding of any such changes. Meteorological conditions can influence pollutant dispersion and concentration levels, which could have also partially contributed to the differences seen between the two surveys, noting that neither this report nor the 2018/19 report provide information in this regard as this was outside the scope.

This report recommends that further 9-month periods of NO_2 and NH_3 monitoring are conducted every five years in order to cost-effectively obtain good seasonal coverage of conditions and to help track any further trends in NO_2 and NH_3 concentrations across the project over the course of the Local Plan.

Appendix A Epping Forest NO_2 and NH_3 Monitoring Locations

Monitoring Transect / Location	Location Details	NO_2 monitoring	NH_3 monitoring
Transect 1 (T1)	South of A121 Honey Lane	0-200m	0-200m
Transect 2 (T2)	South of A121, west of Wake Arms roundabout	0-40m	-
Transect 3 (T3)	North of A121, west of Wake Arms roundabout	0-200m	0-200m (co-located ALPHA at 0m)
Transect 4 (T4)	West of B1393 Epping Road, north of Wake Arms roundabout	0-200m	0-40m
Transect 5 (T5)	North of B172, east of Wake Arms roundabout	0-40m	-
Transect 6 (T6)	East of Wake Arms roundabout, between A121 Golding's Hill and B172	0-200m	0-200m
Transect 7 (T7)	East of A104 Epping New Road, south of Wake Arms roundabout	0-40m	-
Transect 8 (T8)	East of A104 Epping New Road, south of Wake Arms roundabout	0-200m	0-200m
Transect 10 (T10)	East of B1393 Epping Road, north of Wake Arms roundabout	0-40m	-
Transect 11 (T11)	East of A104 Epping New Road, north of Robin Hood roundabout	0-40m	-
Transect 12 (T12)	north of A1069 Ranger's Road	0-40m	-
Transect 13 (T13)	South of B1393 High Road	0-40m	-
Transect 14 (T14)	West of Theydon Road, opposite Theydon Bois Golf Club	0-40m	-
T9_B3	Rural background location >200m from trafficked roads	Triplicate	Triplicate (co-located ALPHA)
Prince of Wales (PoW) School, Enfield	Co-located with continuous NO_2 analyser	Triplicate	-

Figure 6: Monitoring Locations near Wake Arms Roundabout

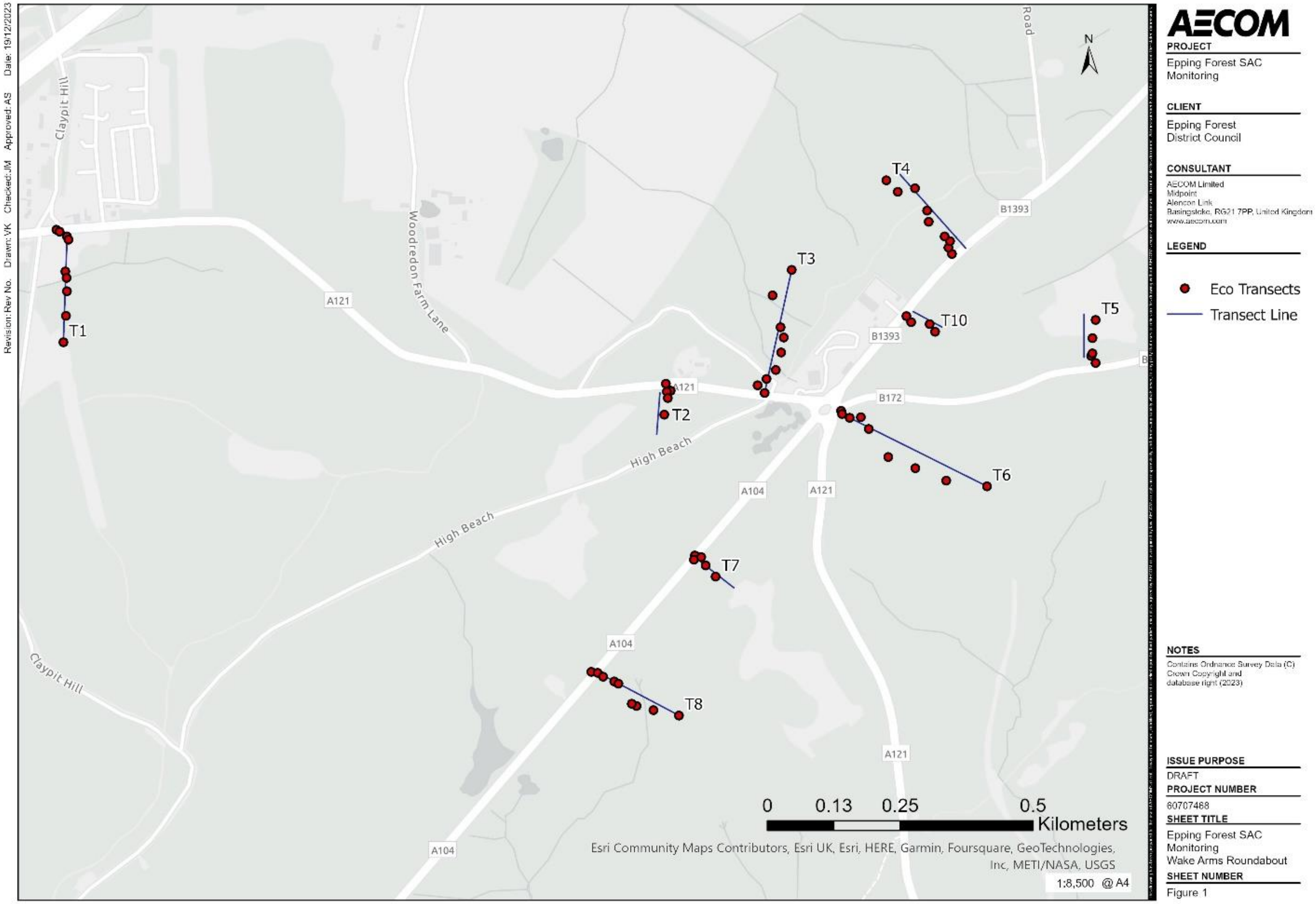


Figure 7: Monitoring Locations at Transects 9 and 11

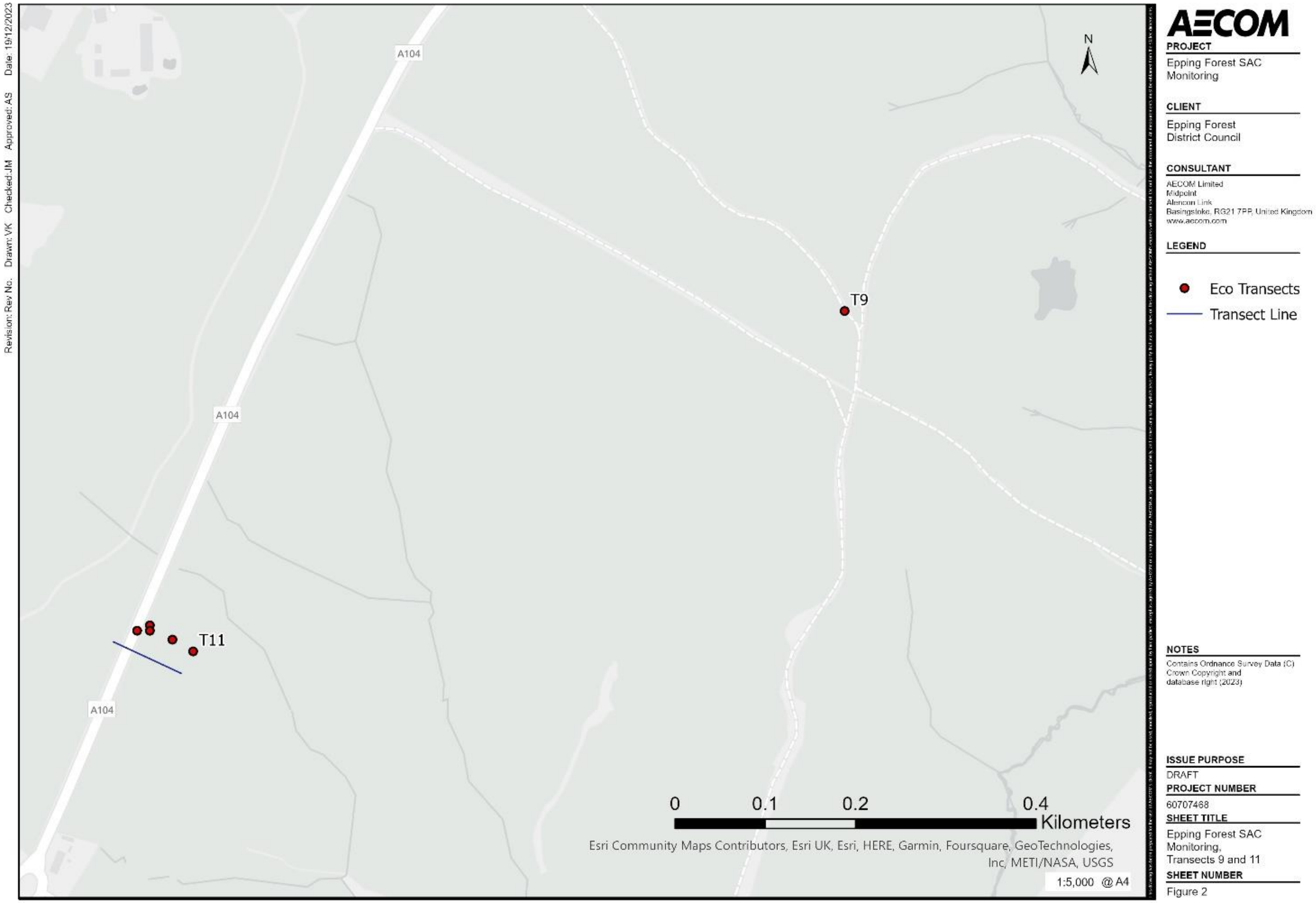
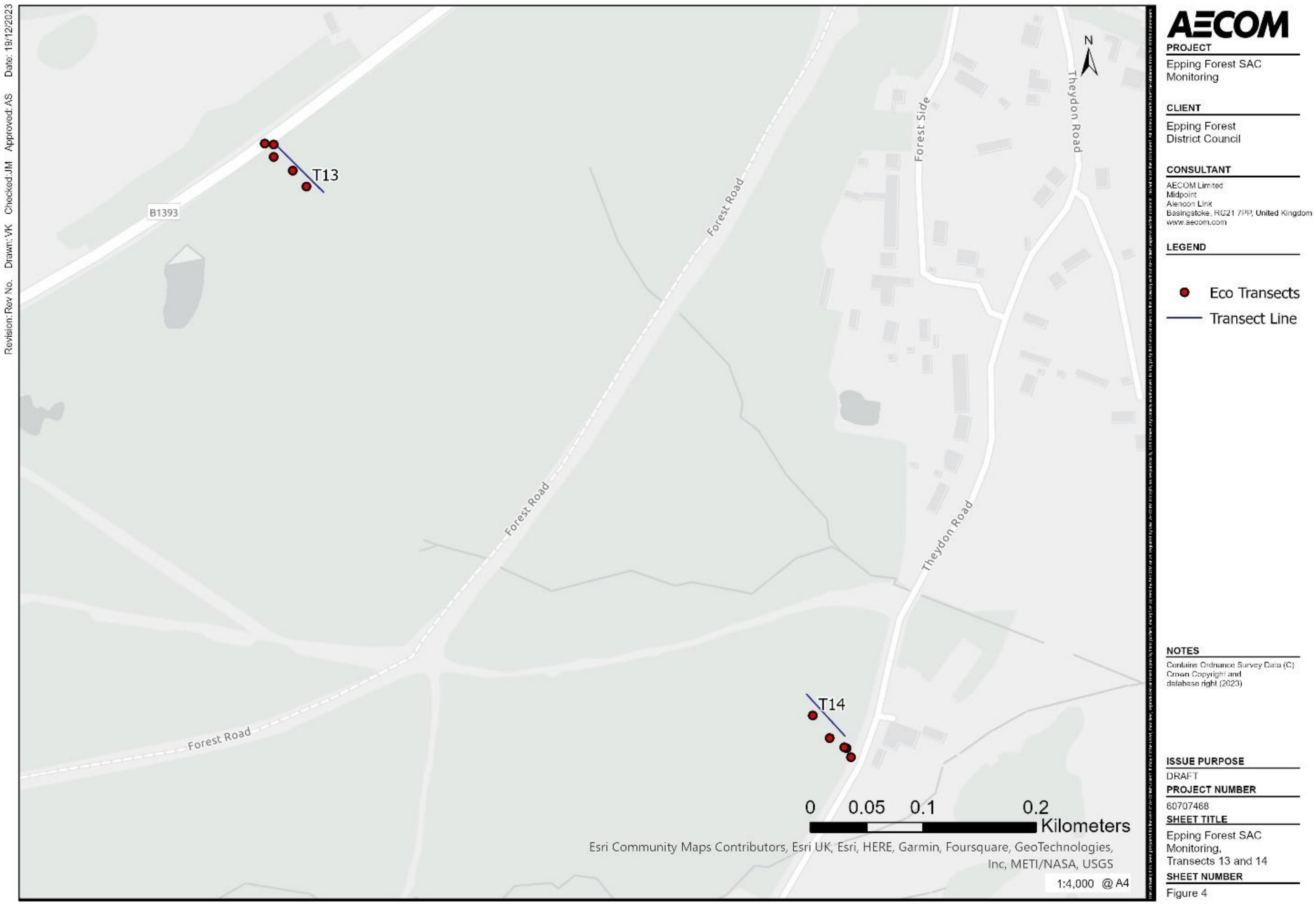


Figure 8: Monitoring Locations at Transect 12

Figure 9: Monitoring Locations at Transects 13 and 14



Appendix B Air Quality Standards for the Protection of Ecosystems

Pollutant	Reference	Concentration ($\mu g/m^3$)	Measured as	Notes
Oxides of nitrogen (NOx, as nitrogen dioxide)	WHO, CLRTAP, UK AQ Directive	30	Annual mean	-
	WHO, CLRTAP	75	Daily mean	-
Ammonia (NH_3)	CLRTAP	1	Annual mean	For lichens and bryophytes
		3	Annual mean	Other vegetation

Appendix C Raw NO_2 Monitoring Data

Location ID	Distance from Road (m)	Monthly Mean NO_2 Concentration (µg/m^3)								
		Jun (07/06-06/07)	Jul (06/07-03/08)	Aug (03/08-04/09)	Sep (04/09-05/10)	Oct (05/10-07/11)	Nov (07/11-05/12)	Dec (05/12-11/01)	Jan (11/01-08/02)	Feb (08/02-06/03)
T1_N0	0	31.5	22.8	23.0	25.9	24.9	33.3	23.9	29.8	25.9
		30.6	22.4	24.1	26.8	No data	31.3	24.8	32.5	26.0
		31.4	21.1	23.8	26.5	25.8	33.2	24.8	29.9	25.6
T1_N5	5	18.7	No data	No data	18.2	16.7	24.0	17.8	22.8	11.4
T1_N10	10	18.7	14.6	15.8	15.8	19.2	26.4	17.3	23.7	17.4
T1_N20	20	16.2	No data	6.9	14.9	No data	22.7	No data	18.8	17.3
T1_N40	40	11.6	9.6	10.8	No data	10.9	19.0	13.0	15.8	12.2
		11.4	10.1	10.8	12.1	6.2	19.8	12.6	14.2	13.8
		11.5	9.6	11.2	12.1	11.7	19.4	12.9	16.9	14.0
T1_N70	70	11.3	No data	11.3	12.7	13.2	19.5	12.7	17.1	14.9
T1_N100	100	9.9	8.7	8.7	10.1	13.0	16.0	11.7	15.3	13.4
T1_N150	150	9.1	No data	9.9	11.2	13.0	17.0	12.2	15.9	12.9
T1_N200	200	6.5	No data	10.1	11.2	13.7	18.0	10.1	16.3	13.5
T2_N0	0	32.7	No data	30.6	31.4	28.1	32.8	23.8	31.9	30.5
		33.5	No data	30.1	32.1	29.8	33.2	21.4	30.0	31.2
		32.3	No data	29.1	31.2	29.3	34.6	21.0	29.6	30.3
T2_N5	5	20.0	14.9	17.7	20.8	No data	24.7	15.5	22.2	20.4
T2_N10	10	16.1	10.8	16.1	18.7	18.6	24.4	15.7	20.5	15.8
T2_N20	20	13.9	9.7	14.0	16.5	17.4	22.3	14.1	17.0	16.9
T2_N40	40	12.6	9.9	12.1	15.3	16.5	20.1	15.4	17.8	17.0
T3_N0	0	38.4	30.8	35.2	39.6	37.4	35.2	27.0	34.5	38.4
		36.2	31.2	35.0	39.3	36.2	38.3	25.4	37.2	33.8
		38.4	31.3	35.9	40.4	No data	38.6	24.4	35.4	37.9
T3_N5	5	22.4	17.9	23.0	28.3	26.0	23.7	17.6	25.0	27.6
T3_N10	10	15.7	13.9	17.7	21.8	22.0	23.1	15.4	21.4	22.8
T3_N20	20	12.6	10.9	14.3	17.9	No data	20.0	14.7	16.2	16.9
		11.9	11.5	No data	17.1	No data	19.5	14.7	20.8	No data
		11.8	10.9	No data	17.3	No data	20.1	14.3	18.6	23.1

Location ID	Distance from Road (m)	Monthly Mean NO_2 Concentration (µg/m^3)								
		Jun (07/06-06/07)	Jul (06/07-03/08)	Aug (03/08-04/09)	Sep (04/09-05/10)	Oct (05/10-07/11)	Nov (07/11-05/12)	Dec (05/12-11/01)	Jan (11/01-08/02)	Feb (08/02-06/03)
T3_N40	40	10.9	6.7	11.1	15.7	17.3	19.6	12.3	17.3	No data
T3_N70	70	10.2	9.0	11.6	14.9	17.2	18.5	12.6	16.4	17.1
T3_N100	100	10.4	9.7	11.7	15.7	18.5	20.5	13.7	18.8	16.6
T3_N150	150	8.9	9.1	No data	9.9	No data	18.8	13.6	18.0	17.0
T3_N200	200	9.9	9.7	10.9	14.4	17.0	18.7	13.4	18.4	16.2
T4_N0	0	27.2	26.1	24.1	No data	28.1	27.2	18.7	No data	26.4
		26.7	22.1	22.8	No data	28.1	27.6	18.7	27.5	23.8
		24.7	24.3	25.7	No data	27.8	27.7	20.1	28.9	26.0
T4_N5	5	15.7	15.2	17.0	20.1	21.1	20.6	14.6	20.8	20.3
T4_N10	10	12.8	11.7	13.2	16.5	16.6	18.8	12.8	18.6	16.9
T4_N20	20	11.4	10.7	12.8	15.4	15.1	18.7	12.7	18.6	16.4
		11.1	11.1	12.7	15.6	17.3	18.1	10.9	18.1	15.6
		11.1	10.8	11.5	15.1	No data	17.8	12.4	16.2	16.5
T4_N40	40	10.2	9.5	11.4	14.0	16.4	18.5	12.1	17.3	16.6
T4_N70	70	10.1	7.2	10.9	13.5	15.4	18.2	12.3	16.8	14.8
T4_N100	100	9.8	9.3	11.0	14.2	17.0	18.8	12.3	17.5	15.6
T4_N150	150	12.4	No data	10.6	13.2	15.4	20.8	No data	No data	16.2
T4_N200	200	8.6	8.5	10.7	12.9	15.0	17.9	12.7	17.6	15.5
T5_N0	0	14.5	16.1	16.1	No data	19.7	21.5	13.8	19.1	18.8
		No data	16.5	15.6	No data	20.1	21.5	16.0	21.7	17.0
		15.3	16.1	16.1	No data	20.8	21.9	13.8	17.7	18.6
T5_N5	5	12.1	12.6	No data	14.9	17.9	19.0	14.2	18.6	15.9
T5_N10	10	11.1	11.2	11.7	13.9	17.2	19.7	13.1	17.8	15.4
T5_N20	20	10.2	8.9	10.3	12.9	15.6	19.5	12.7	16.5	16.8
T5_N40	40	9.1	9.2	10.0	No data	15.5	19.5	13.0	17.7	15.7
T6_N0	0	23.5	23.1	25.2	28.4	22.8	25.7	No data	28.7	27.5
		27.1	24.6	24.3	27.4	25.6	31.6	20.2	27.5	25.1
		27.2	23.4	24.7	27.5	25.9	31.4	20.7	27.5	26.9
T6_N5	5	15.9	16.5	17.6	18.8	No data	23.0	16.1	22.8	20.0
T6_N10	10	14.2	10.2	15.7	17.0	No data	22.9	15.1	20.8	18.4
T6_N20	20	12.5	No data	13.4	14.1	17.8	22.1	13.9	19.8	16.8
		12.8	No data	14.1	18.0	17.5	21.7	14.7	19.7	17.8

Location ID	Distance from Road (m)	Monthly Mean NO_2 Concentration (µg/m³)								
		Jun (07/06-06/07)	Jul (06/07-03/08)	Aug (03/08-04/09)	Sep (04/09-05/10)	Oct (05/10-07/11)	Nov (07/11-05/12)	Dec (05/12-11/01)	Jan (11/01-08/02)	Feb (08/02-06/03)
		12.7	No data	12.3	15.5	17.7	22.2	14.2	20.4	No data
T6_N40	40	11.1	9.3	13.3	14.4	16.5	22.0	13.8	18.9	15.4
T6_N70	70	No data	10.1	No data	11.3	No data	No data	23.0	18.2	No data
T6_N100	100	8.5	9.1	9.2	No data	14.3	19.1	13.3	18.2	16.0
T6_N150	150	9.2	7.2	10.3	No data	14.6	18.7	12.0	16.8	15.4
T6_N200	200	8.9	8.7	10.4	11.1	13.2	16.8	7.9	No data	No data
T7_N0	0	16.6	18.9	17.7	20.6	No data	26.3	17.1	25.4	21.7
		21.1	18.8	18.9	No data	22.6	26.0	18.8	23.9	21.3
		20.7	18.0	18.3	21.5	23.4	26.0	18.3	25.7	22.7
T7_N5	5	15.4	13.9	14.4	15.6	17.5	22.8	16.6	20.2	18.9
T7_N10	10	12.9	11.5	12.7	14.1	17.4	20.8	15.3	20.6	18.2
T7_N20	20	10.6	9.9	12.0	13.1	17.0	20.8	13.8	19.7	16.5
T7_N40	40	9.5	9.0	10.7	12.5	14.9	19.9	13.6	18.6	16.9
T8_N0	0	17.7	16.3	17.6	20.0	No data	24.5	17.2	22.7	20.9
		18.2	16.4	18.1	19.5	19.6	23.8	16.9	22.1	21.2
		18.3	15.4	18.3	20.7	20.7	24.7	17.0	22.8	21.9
T8_N5	5	14.7	14.4	15.0	16.0	16.8	21.6	13.1	19.4	17.5
T8_N10	10	12.5	13.0	13.2	14.8	17.3	21.0	13.8	17.9	16.2
T8_N20	20	11.5	11.8	12.0	13.7	12.8	18.9	12.9	16.1	16.4
		11.6	10.6	12.3	13.4	16.4	18.1	12.7	16.9	14.6
		10.6	11.1	11.4	13.6	16.4	20.1	12.8	18.1	14.9
T8_N40	40	11.5	11.1	11.7	13.1	16.2	20.5	12.9	12.4	16.9
T8_N70	70	9.5	9.5	10.3	11.9	15.1	19.1	12.7	17.2	15.0
T8_N100	100	9.6	9.1	10.2	11.9	15.7	20.5	12.8	17.3	14.7
T8_N150	150	8.7	8.1	9.4	11.1	13.3	17.8	11.1	16.3	14.2
T8_N200	200	8.8	7.9	9.3	No data	13.3	16.4	12.1	16.1	14.5
T10_N5	5	13.7	15.0	14.3	15.6	17.5	22.9	16.4	22.4	18.4
		13.8	14.4	15.6	16.1	17.4	21.3	14.4	22.2	20.4
		13.1	15.9	14.6	16.8	16.4	23.0	18.0	23.3	17.7
T10_N10	10	11.6	13.1	13.3	14.8	No data	21.4	15.3	22.5	18.1
T10_N20	20	10.5	11.9	12.2	14.2	No data	18.7	13.0	20.7	17.5
T10_N40	40	10.6	11.9	12.0	13.7	17.0	20.8	14.9	20.0	17.5
T11_N0	0	19.3	No data	19.1	22.3	23.2	25.8	19.2	25.7	22.4
		18.5	18.9	19.6	22.3	23.2	24.8	18.8	28.9	23.0

Location ID	Distance from Road (m)	Monthly Mean NO_2 Concentration (µg/m³)								
		Jun (07/06-06/07)	Jul (06/07-03/08)	Aug (03/08-04/09)	Sep (04/09-05/10)	Oct (05/10-07/11)	Nov (07/11-05/12)	Dec (05/12-11/01)	Jan (11/01-08/02)	Feb (08/02-06/03)
		19.0	19.7	19.3	22.5	21.3	25.6	18.6	24.5	24.5
T11_N5	5	14.9	14.8	16.1	17.2	18.3	20.0	No data	21.2	17.5
T11_N10	10	12.1	12.6	13.8	16.4	18.0	19.5	14.2	20.1	15.9
T11_N20	20	11.4	11.7	13.0	No data	15.8	18.7	12.7	19.6	15.6
T11_N40	40	10.9	10.6	12.3	13.8	No data	19.1	13.6	18.5	14.7
T12_N0	0	15.4	15.7	15.1	18.3	20.3	22.0	16.2	22.2	19.8
		15.8	14.4	14.6	18.8	18.3	19.3	15.6	22.9	19.7
		16.5	14.4	15.3	19.2	19.6	20.8	15.2	22.5	12.7
T12_N5	5	12.4	11.4	12.4	15.4	16.1	17.3	14.1	18.2	16.7
T12_N10	10	11.3	10.7	11.1	13.7	14.6	14.9	12.2	15.7	15.3
T12_N20	20	10.6	9.9	11.0	13.5	14.3	16.7	12.4	16.7	14.3
T12_N40	40	10.3	9.8	10.5	12.7	13.6	15.2	11.7	16.2	13.8
T13_N0	0	25.4	21.6	21.8	24.0	22.6	30.2	20.1	23.2	21.8
		25.9	22.7	21.6	25.5	21.7	28.6	19.7	25.7	21.7
		23.2	20.5	21.9	24.6	25.3	24.9	19.9	25.2	22.3
T13_N5	5	18.0	16.2	17.3	No data	18.6	No data	17.5	21.8	No data
T13_N10	10	16.0	13.8	15.6	16.2	17.4	23.9	16.0	19.7	No data
T13_N20	20	14.8	No data	13.8	15.3	No data	24.9	17.2	19.2	18.2
T13_N40	40	12.1	12.3	13.1	13.8	16.7	No data	14.6	18.4	No data
T14_N0	0	15.0	11.7	12.3	15.1	15.3	19.2	12.1	16.1	14.1
		15.5	12.3	12.6	10.5	15.6	18.7	12.2	16.4	No data
		14.0	11.7	12.5	14.6	14.8	19.5	12.2	16.1	No data
T14_N5	5	13.3	10.9	11.0	12.5	13.4	16.9	10.0	14.4	13.6
T14_N10	10	13.0	10.4	11.0	13.2	No data	16.3	10.7	13.1	13.0
T14_N20	20	12.8	9.0	10.1	11.5	12.9	16.0	10.1	13.7	12.8
T14_N40	40	11.4	8.8	9.4	11.0	12.3	16.1	9.5	12.9	12.3
T9_B3	550	8.5	6.7	7.2	9.4	10.5	14.4	9.3	13.5	10.9
		5.6	7.4	No data	8.9	11.4	13.7	8.7	10.6	10.5
		8.2	5.6	No data	9.3	10.3	13.0	10.0	7.8	No data
PoW		14.0	10.7	13.1	14.9	17.5	20.8	14.4	20.7	20.8
		13.4	10.2	13.6	17.6	18.3	22.0	14.6	22.1	19.1
		13.6	10.1	13.9	17.9	18.0	21.3	15.2	22.4	19.4

Note: Results marked as "No data" were either missing, found on ground or contaminated, or suspicious/erroneous results

Appendix D NO_2 bias adjustment and annualisation

Bias Adjustment

A local bias adjustment factor was calculated using data from the triplicate diffusion tubes co-located with the Enfield Prince of Wales (PoW) School continuous monitoring station and a spreadsheet tool provided by Defra to calculate precision and accuracy of diffusion tubes. The local NO_2 bias adjustment factor was calculated to be 0.89 and applied to the raw diffusion tube monitoring results. The local bias adjustment factor calculated for the original 2018-19 monitoring survey was 1.04, and so the 2023-24 factor is slightly lower in comparison.

Calculation of Local Bias Adjustment Factor for NO_2

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements										Automatic Method		Data Quality Check	
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 (CV)	95% CI of mean	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
1	11/01/2024	08/02/2024	20.7	22.1	22.4	22	0.9	4	2.3	20.02	99.55	Good	Good
2	08/02/2024	06/03/2024	20.8	19.1	19.4	20	0.9	5	2.2	18.43	99.52	Good	Good
3										14.62	99.31		Good
4										13.67	99.70		Good
5										10.23	99.88		Good
6	07/06/2023	06/07/2023	14.0	13.4	13.6	14	0.3	2	0.8	12.25	89.22	Good	Good
7	06/07/2023	03/08/2023	10.7	10.2	10.1	10	0.3	3	0.8	8.98	98.36	Good	Good
8	03/08/2023	04/09/2023	13.1	13.6	13.9	14	0.4	3	1.0	11.88	96.74	Good	Good
9	04/09/2023	05/10/2023	14.9	17.6	17.9	17	1.7	10	4.1	14.17	81.18	Good	Good
10	05/10/2023	08/11/2023	17.5	18.3	18.0	18	0.4	2	1.0	15.71	99.49	Good	Good
11	08/11/2023	05/12/2023	20.8	22.0	21.3	21	0.6	3	1.5	19.54	99.85	Good	Good
12	05/12/2023	11/01/2024	14.4	14.6	15.2	15	0.4	3	1.0	13.08	98.65	Good	Good
13													
										Overall survey -->		Good precision	Good Overall DC

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

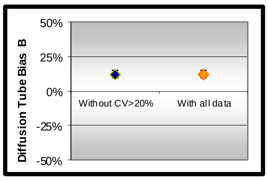
Site Name/ ID:

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 9 periods of data	
Bias factor A	0.89 (0.87 - 0.92)
Bias B	12% (9% - 14%)
Diffusion Tubes Mean:	17 μgm^{-3}
Mean CV (Precision):	4
Automatic Mean:	15 μgm^{-3}
Data Capture for periods used:	96%
Adjusted Tubes Mean:	15 (14 - 15) μgm^{-3}

Accuracy (with 95% confidence interval)	
WITH ALL DATA	
Bias calculated using 9 periods of data	
Bias factor A	0.89 (0.87 - 0.92)
Bias B	12% (9% - 14%)
Diffusion Tubes Mean:	17 μgm^{-3}
Mean CV (Precision):	4
Automatic Mean:	15 μgm^{-3}
Data Capture for periods used:	96%
Adjusted Tubes Mean:	15 (14 - 15) μgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

An example of the annualisation calculation for the NO_2 diffusion tubes for the 07/06/2023 to 06/03/2024 period is presented below. An average factor of 0.98 is calculated using data from four background continuous monitoring locations. The time period used to calculate the period mean for the background monitoring locations was broadly the same as for the diffusion tubes (June 2023 to March 2024), and the annual mean period used was the 2023 calendar year in order to calculate a 2023 annual mean equivalent. Additional annualisation factors were calculated for each tube location where there were missing or excluded data from the monitoring period. These location-specific factors are presented in Section 3.

Annualisation Calculation for NO_2 Tubes for June 2023 to March 2024 Period

Site Name	2023 Annual Mean NO_2 Concentration (µg/m^3)	2023 Period Mean NO_2 Concentration (µg/m^3)	Am/Pm Ratio
Bush Hill Park	15.1	15.4	0.97
Enfield Prince of Wales School	14.2	14.4	0.99
Haringey Priory Park	15.5	15.6	0.99
Islington Arsenal	14.4	14.8	0.96
		Average Am/Pm Ratio:	**0.98**

Appendix E Raw NH_3 Monitoring Data

Location ID	Distance from Road (m)	Monthly Mean NH_3 Concentration (µg/m^3)								
		Jun (07/06-06/07)	Jul (06/07-03/08)	Aug (03/08-04/09)	Sep (04/09-05/10)	Oct (05/10-07/11)	Nov (07/11-05/12)	Dec (05/12-11/01)	Jan (11/01-08/02)	Feb (08/02-06/03)
T1_A0	0	5.7	3.7	3.4	3.8	3.6	1.8	2.2	2.0	3.0
		5.4	2.7	3.5	3.6	3.9	2.5	2.2	1.7	3.0
		5.2	2.2	2.8	3.7	No data	3.2	2.3	2.2	2.9
T1_A5	5	5.1	2.0	2.2	2.6	1.9	1.6	1.6	2.5	2.8
T1_A10	10	4.2	2.8	2.0	2.5	1.4	2.6	1.7	2.6	1.8
T1_A20	20	No data	No data	No data	No data	No data	1.3	No data	1.6	2.4
T1_A40	40	No data	1.9	1.7	1.7	1.1	1.5	0.9	1.6	2.0
		No data	1.6	1.6	2.0	1.7	1.1	1.0	1.6	1.4
		No data	2.2	1.9	1.7	1.2	1.3	0.9	1.4	1.3
T1_A70	70	3.2	No data	3.3	2.0	1.0	0.9	1.1	2.1	1.8
T1_A100	100	No data	1.2	2.4	1.7	0.7	4.1	1.0	1.3	1.6
T1_A150	150	2.1	No data	1.6	1.9	0.9	0.8	0.8	2.6	1.9
T1_A200	200	2.6	No data	No data	1.8	1.4	0.8	No data	4.7	1.8
T3_A0	0	6.4	4.5	5.3	6.4	6.0	No data	2.4	2.0	5.5
		6.6	4.9	5.5	7.5	6.9	No data	3.3	3.8	5.6
		6.5	4.2	5.6	6.3	5.9	No data	3.4	3.9	5.1
T3_A5	5	4.4	1.8	3.6	4.4	2.6	2.2	1.8	3.2	3.8
T3_A10	10	3.3	2.0	2.2	2.8	No data	1.8	1.1	12.5	2.2
T3_A20	20	3.3	2.5	No data	2.1	No data	3.1	1.1	3.2	2.0
		3.4	1.8	1.5	3.5	No data	4.1	0.7	7.5	1.9
		3.0	1.6	No data	2.7	No data	3.6	1.2	No data	2.1
T3_A40	40	4.4	1.6	1.7	2.3	1.6	1.6	1.0	5.8	No data
T3_A70	70	2.7	2.0	1.7	1.8	2.3	1.6	1.0	2.4	1.2
T3_A100	100	2.8	2.0	1.3	2.2	3.3	1.7	1.1	2.4	2.0
T3_A150	150	2.7	2.8	No data	1.8	No data	0.9	1.0	2.4	1.5
T3_A200	200	No data	1.5	No data	2.2	1.1	1.1	1.0	2.7	1.6

Location ID	Distance from Road (m)	Monthly Mean NH_3 Concentration (µg/m^3)								
		Jun (07/06-06/07)	Jul (06/07-03/08)	Aug (03/08-04/09)	Sep (04/09-05/10)	Oct (05/10-07/11)	Nov (07/11-05/12)	Dec (05/12-11/01)	Jan (11/01-08/02)	Feb (08/02-06/03)
T4_A0	0	4.9	4.3	4.5	No data	2.7	2.3	2.1	5.0	2.5
		4.8	3.1	4.5	No data	No data	3.2	1.6	6.5	2.8
		4.8	3.1	4.2	No data	6.2	3.6	2.0	4.0	3.3
T4_A5	5	2.7	2.0	2.3	2.7	2.2	1.7	1.2	3.8	1.9
T4_A10	10	2.5	1.4	2.1	2.3	1.4	1.1	0.9	2.3	2.4
T4_A20	20	2.9	1.2	1.7	2.3	6.5	1.5	0.9	2.7	1.1
T4_A40	40	2.7	1.2	1.6	2.1	1.9	No data	0.8	2.8	1.3
T6_A0	0	5.7	2.2	3.8	4.5	4.2	3.9	1.9	2.7	4.2
		5.1	3.3	2.1	4.9	4.1	3.0	3.0	9.1	4.3
		5.4	4.1	3.6	4.7	6.1	3.9	2.7	7.1	3.7
T6_A5	5	6.4	2.8	2.7	2.6	2.5	2.0	1.7	2.5	2.4
T6_A10	10	4.5	2.8	3.8	No data	1.5	1.9	1.1	2.2	2.0
T6_A20	20	3.3	No data	1.8	2.5	2.7	4.1	1.4	1.4	1.6
		3.2	No data	2.6	2.3	1.3	3.4	1.7	1.0	1.6
		3.2	No data	No data	2.3	1.4	No data	1.2	1.4	2.0
T6_A40	40	3.3	1.5	2.2	1.9	2.1	2.0	1.0	2.0	1.5
T6_A70	70	2.8	1.0	No data	1.7	3.2	No data	1.4	1.8	No data
T6_A100	100	No data	1.2	1.1	No data	1.0	1.6	0.9	1.4	1.4
T6_A150	150	2.6	1.7	0.9	No data	2.0	1.2	0.8	2.1	1.6
T6_A200	200	2.8	1.7	1.4	2.8	1.7	0.9	0.8	4.1	No data
T8_A0	0	2.8	3.0	3.2	3.2	1.9	4.0	1.5	2.4	2.2
		3.5	2.6	3.1	2.8	1.9	3.5	1.7	1.9	2.2
		3.7	2.8	2.9	2.0	1.4	2.3	1.8	2.6	2.4
T8_A5	5	5.6	2.4	3.2	2.7	2.0	1.8	1.1	1.6	1.9
T8_A10	10	2.7	2.2	2.3	2.3	1.6	3.0	1.4	3.0	3.0
T8_A20	20	3.1	2.0	2.0	2.3	1.2	2.7	No data	No data	1.3
		3.9	1.6	2.0	2.1	1.2	3.1	1.2	3.3	1.6

Location ID	Distance from Road (m)	Monthly Mean NH_3 Concentration (µg/m^3)								
		Jun (07/06-06/07)	Jul (06/07-03/08)	Aug (03/08-04/09)	Sep (04/09-05/10)	Oct (05/10-07/11)	Nov (07/11-05/12)	Dec (05/12-11/01)	Jan (11/01-08/02)	Feb (08/02-06/03)
		3.0	2.1	1.8	2.0	1.3	2.6	1.0	3.2	1.5
T8_A40	40	2.6	2.8	2.1	1.8	1.1	2.2	1.0	5.9	3.0
T8_A70	70	2.6	1.3	1.5	2.9	1.3	1.9	No data	2.2	3.3
T8_A100	100	3.3	1.0	1.2	1.9	1.0	1.0	1.0	1.6	2.4
T8_A150	150	2.5	1.4	1.3	1.7	0.7	1.3	0.7	1.7	1.5
T8_A200	200	1.8	2.6	1.1	No data	0.9	1.1	0.8	2.3	2.6
T9_B3	> 200	2.6	2.5	1.0	1.8	2.4	2.6	0.6	4.7	2.3
		3.2	No data	1.7	1.7	1.2	2.4	0.7	3.5	1.9
		3.2	4.8	2.3	1.8	1.2	1.6	0.7	4.1	1.3

Note: Results marked as "No data" were either missing, found on ground or contaminated, or suspicious/erroneous results

Appendix F NH_3 bias adjustment and annualisation

Bias Adjustment

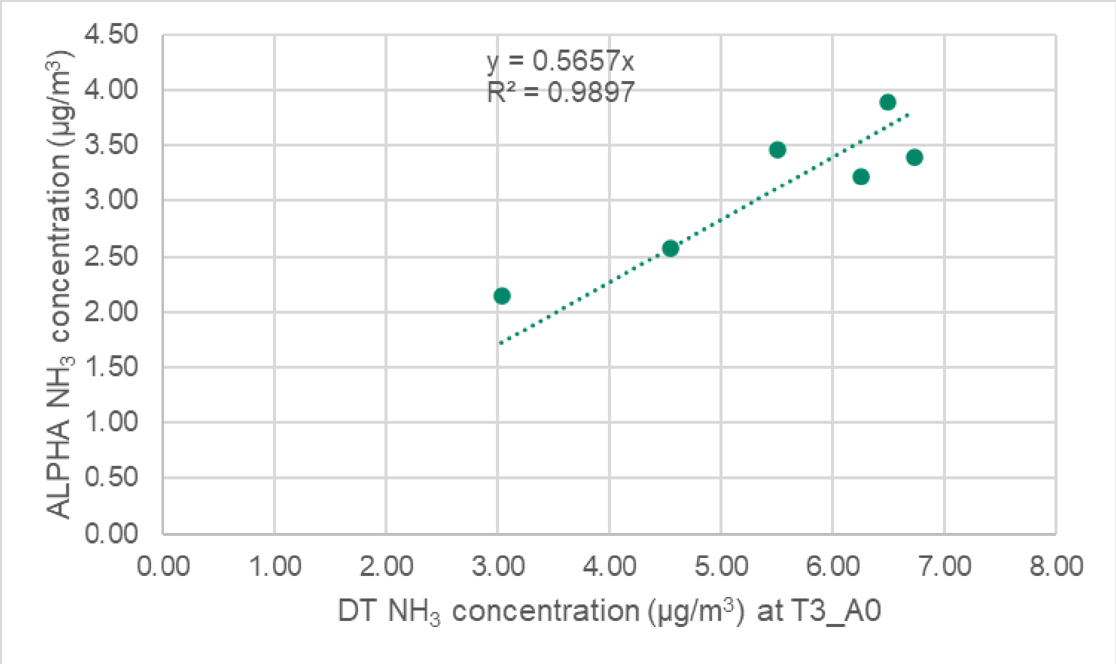
In the original 2018-19 monitoring survey, a three-month co-location at the London Cromwell Road UK Eutrophying and Acidifying Pollutant (UKEAP) network site was carried out at the same time as the SAC monitoring, between December 2018 and February 2019, in order to derive a bias adjustment factor against the Adapted Low-cost Passive High-Absorption (ALPHA) passive samplers that measure gaseous ammonia on a monthly basis.

For the 2023-24 survey, ALPHA samplers were instead co-located with the triplicate NH_3 DT tubes at one roadside location (T3_A0) and one background (T9_B3) location, allowing for the calculation of a more local bias adjustment factor. It was found that due to the very low concentrations present at the background site, there was a lot of scatter in the DT and ALPHA NH_3 measurements, and so only the roadside (T3_A0) measurements were used to derive a NH_3 bias adjustment factor, which was found to be 0.57. However, by combining the background and roadside measurements, a similar but slightly lower bias adjustment factor was calculated (0.55), but the 0.57 value was used in order to present a worst-case assessment. The value of 0.57 calculated compares very well with the value of 0.59 calculated for the London Cromwell Road co-location in the original 2018-19 monitoring survey. The calculations are presented below.

NH_3 Bias Adjustment Determination at T3_A0 location

Month	ALPHA NH_3 Concentration (µg/m^3)	DT NH_3 Concentration (µg/m^3)	Ratio ALPHA:DT
June 2023	3.89	6.49	0.60
July 2023	2.58	4.55	0.57
August 2023	3.46	5.50	0.63
September 2023	3.40	6.73	0.50
October 2023	3.23	6.26	0.52
November 2023	-	-	-
December 2023	2.15	3.04	0.71
Period Average	3.12	5.43	0.57
		Bias Adjustment Factor:	**0.57**

Linear Regression of DT and ALPHA Concentrations for NH_3 Bias Adjustment Factor Determination



Annualisation

An example of the annualisation calculation for the NH_3 diffusion tubes for the 07/06/2023 to 06/03/2024 period is presented below. An average factor of 1.02 is calculated using data from four UKEAP background monitoring locations. The time period used to calculate the period mean for the UKEAP monitoring locations was broadly the same as for the diffusion tubes (June 2023 to March 2024), and the annual mean period used was the 2023 calendar year in order to calculate a 2023 annual mean equivalent. Additional annualisation factors were calculated for each tube location where there were missing or excluded data from the monitoring period. These location-specific factors are presented in Section 4.

Annualisation Factor Calculation for NH_3 Tubes for June 2023 to March 2024 Period

Site Name	2023 Annual Mean (Am) NH_3 Concentration (µg/m³)	Period Mean (Pm) NH_3 Concentration (µg/m³)	Am/Pm Ratio
Rothamsted	0.99	1.01	0.98
Burnham Beeches	0.53	0.54	0.98
Alice Holt 2	0.41	0.38	1.07
Thursley Common 2	0.48	0.45	1.05
		Average Am/Pm Ratio	**1.02**