Gloucester City Council

Annual Progress Report 2022

Bureau Veritas

August 2022

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2022 Air Quality Annual Status Report (ASR)

In fulfilment of Part IV of the Environment Act 1995 Local Air Quality Management

Date: August 2022

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Executive Summary: Air Quality in Our Area

Air Quality in Gloucester City Council

Air pollution is associated with a number of adverse health impacts. It is recognised as a contributing factor in the onset of heart disease and cancer. Additionally, air pollution particularly affects the most vulnerable in society: children, the elderly, and those with existing heart and lung conditions. There is also often a strong correlation with equalities issues because areas with poor air quality are also often less affluent areas[1,2].

The mortality burden of air pollution within the UK is equivalent to 28,000 to 36,000 deaths at typical ages[3], with a total estimated healthcare cost to the NHS and social care of £157 million in 2017[4].

Gloucester is a small city (population circa 150,000) located on the eastern bank of the River Severn between the Cotswolds in the east and the Forest of Dean in the west. The M5 motorway forms a boundary along the east of Gloucester, which is densely populated in comparison to its neighbouring Councils (Stroud District Council, Forest of Dean District Council and Tewkesbury Borough Council), which are predominantly rural.

The main source of air pollution within Gloucester is road traffic emissions from major roads (notably the A417, A430 and the A38) which connect Gloucester city with the main highway network in Gloucestershire. In addition, local traffic within the centre of Gloucester can give rise to increased pollutant concentrations.

Three Air Quality Management Areas (AQMAs) have been declared within Gloucester due to exceedances of the $40\mu g/m^3$ annual mean objective for Nitrogen Dioxide (NO_2):

- Barton Street AQMA (in the city centre) declared in 2005.
- Priory Road AQMA (on the A417) also declared in 2005.

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[1] Public Health England. Air Quality: A Briefing for Directors of Public Health, 2017

[2] Defra. Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006

[3] Defra. Air quality appraisal: damage cost guidance, July 2021

[4] Public Health England. Estimation of costs to the NHS and social care due to the health impacts of air pollution: summary report, May 2018

- Painswick Road AQMA (in the city centre, consisting of a section of the B4073 between the railway line and the A38) declared in 2007.

Monitoring of NO_2 is completed throughout Gloucester City Council's area using a network of passive diffusion tubes. During 2021 there were twenty-two monitoring locations where diffusion tubes were deployed, an increase of four sites since 2020.

Whilst none of the monitoring locations reported an exceedance of the annual mean NO_2 objective of 40μg/m^3 during 2021, concentrations at all except one site increased in comparison to 2020. This is most likely due to a return to business as usual following the COVID-19 pandemic, whereby the UK Government issued advice to stay at home where possible, alongside strict lockdowns. This resulted in decreased levels of traffic observed across the UK, and therefore significantly reduced NO_2 concentrations recorded during 2020.

Actions to Improve Air Quality

Whilst air quality has improved significantly in recent decades and will continue to improve due to national policy decisions, there are some areas where local action is needed to improve air quality further.

The 2019 Clean Air Strategy[5] sets out the case for action, with goals to reduce exposure to harmful pollutants. The Road to Zero[6] sets out the approach to reduce exhaust emissions from road transport through a number of mechanisms; this is extremely important given that the majority of Air Quality Management Areas (AQMAs) are designated due to elevated concentrations heavily influenced by transport emissions.

During 2019 Gloucester City Council commissioned an update to the 2008 Air Quality Action Plan (AQAP) (last updated 2011)[7]. As part of this process a review of the current AQMAs has been completed and stakeholder workshops have been held in order to

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[5] Defra. Clean Air Strategy, 2019

[6] DfT. The Road to Zero: Next steps towards cleaner road transport and delivering our Industrial Strategy, July 2018

[7] Following declaration of an AQMA, an AQAP should be produced by the local authority as part of their statutory duties required by the LAQM framework. The AQAP sets out measures the local authority intends to put in place in pursuit of compliance with the objectives.

inform new measures. The draft of the revised AQAP has now been completed and, whilst there has been a delay in releasing the document for consultation, the release is now expected later this year.

The measures from the 2011 Gloucester Air Quality Action Plan are included within this document, along with the progress that has been made on implementation to date. A brief summary of core actions is as follows:

- Greater restriction and better timing of deliveries;
- Encouraging Stagecoach to buy new vehicles for bus services;
- Upgrading/retrofitting the existing bus fleet;
- Reducing illegal parking contributing to congestion;
- Introducing air quality measures into Gloucester City Council Taxi Licensing Policy;
- Improving age and euro standard of vehicles within Amey recycling and street cleaning fleet;
- Improving Planning Application validation requirements;
- Requiring new developments to install electric charging points where possible;
- Prioritising uptake of low emission vehicles for taxis and company vehicle procurement;
- Encouraging residents not to burn waste;
- Promoting travel alternatives, including adding a pop-up cycle route into the city on London Road.

Conclusions and Priorities

During 2021 no exceedances of the NO_2 annual mean objective were recorded within or outside existing AQMAs (i.e., known pollutant hotspots). When compared with 2020 data, NO_2 concentrations monitored via diffusion tubes increased at all except one site during 2021. This is most likely due to the return to business as usual following the COVID-19 pandemic, whereby the UK Government issued advice to stay at home where possible, alongside strict lockdowns. This resulted in decreased levels of traffic observed across the UK, and therefore significantly reduced NO_2 concentrations recorded during 2020. This likely also continued to contribute to the 2021 concentrations that were recorded.

The following has been recommended in relation to the three existing AQMAs:

- Barton Street AQMA – To remain in force as one of the six monitoring sites has recorded exceedances of the annual mean objective within the past five years,

during 2017 - 2019. As the remaining five sites have not exceeded the annual mean objective in the three years prior to 2021 consideration will be given to whether the boundary of this AQMA should be amended. The AQMA review which has been completed as part of the update to the AQAP will be used to support any decision;

- Priory Road AQMA – To remain in force due to monitored exceedances of the air quality objective over the past five years, during 2017 - 2019; and

- Painswick Road AQMA – To remain in force, although there have been no monitored exceedances of the air quality objective over the past five years. This is so that further monitored data that has not been impacted upon by COVID-19 can be collected. Consideration will be given to the possible revocation of this AQMA once further monitored evidence is available, and supported by the AQMA review that has been completed as part of the AQAP update.

Due to the impacts of the COVID-19 pandemic, it is likely that the concentrations recorded during 2020 and 2021 are lower than they would be in a business-as-usual scenario. Therefore these years

As highlighted above, Gloucester City Council expect to release an updated AQAP for consultation later this year. The revised set of targeted measures, as set out in the revised AQAP, will be included within next year's ASR following the consultation process. Gloucester City Council anticipate that these measures will further contribute to achieving compliance with the NO_2 annual mean objective within the existing AQMAs, as well as contributing to improved pollutant concentrations throughout the rest of the city.

Local Engagement and How to get Involved

The public can engage with Gloucester City Council via their website which contains further local information on the following:

- Air quality monitoring;
- Declared AQMAs;
- Electric charging points; and
- Open fires and wood burning stoves.

In addition, Gloucestershire County Council host the Think Travel website which provides further information about the sustainable travel options available across the county of Gloucestershire, such as:

- Local walking maps;

- Cycle routes;

- Public transport journey planner

- Park & Ride facilities;

- Eco driving;

- Car sharing; and

- Electric vehicles.

Local Responsibilities and Commitment

This ASR was prepared by the Community Wellbeing department of Gloucester City Council with the support and agreement of the following officers and departments:

- Planning
- Climate change officer
- County Council Highways and Air quality Group

This ASR has been approved by:

Gloucestershire County Council Director of Public Health – Siobhan Farmer:

Community Wellbeing Portfoilio holder and leader of the City Council – Richard Cook:

If you have any comments on this ASR please send them to Community Wellbeing at:

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1 Local Air Quality Management

This report provides an overview of air quality in Gloucester City Council during 2021. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995) and the relevant Policy and Technical Guidance documents.

The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where an exceedance is considered likely the local authority must declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives. This Annual Status Report (ASR) is an annual requirement showing the strategies employed by Gloucester City Council to improve air quality and any progress that has been made.

The statutory air quality objectives applicable to LAQM in England are presented in Table E.1.

2 Actions to Improve Air Quality

2.1 Air Quality Management Areas

Air Quality Management Areas (AQMAs) are declared when there is an exceedance or likely exceedance of an air quality objective. After declaration, the authority should prepare an Air Quality Action Plan (AQAP) within 12 months setting out measures it intends to put in place in pursuit of compliance with the objectives.

A summary of AQMAs declared by Gloucester City Council can be found in Table 2.1. The table presents a description of the three AQMAs that are currently designated within Gloucester. All three of the current AQMAs have been declared in response to exceedances of the NO_2 annual mean objective.

Appendix D: Maps of Monitoring Locations and AQMAs provides maps of AQMAs and also the air quality monitoring locations in relation to the AQMAs.

Table 2.1 – Declared Air Quality Management Areas

AQMA Name	Date of Declaration	Pollutants and Air Quality Objectives	One Line Description	Is air quality in the AQMA influenced by roads controlled by National Highways?	Level of Exceedance: Declaration	Level of Exceedance: Current Year	Name and Date of AQAP Publication	Web Link to AQAP
Painswick Road AQMA	05/10/2007	NO$_2$ Annual Mean	An area encompassing a number of properties on either side of Painswick Road, Gloucester.	No	48	28.8	Gloucester AQAP 2008 (2011 Review)	https://www.gloucester.gov.uk/environment-waste-recycling/pollution/air-quality/
Barton Street AQMA	08/08/2005	NO$_2$ Annual Mean	An area encompassing Barton Street, Gloucester from its junction with Trier Way/Bruton Way to the northwest and Upton Street to the southeast.	No	41 - 47	34.8	Gloucester AQAP 2008 (2011 Review)	https://www.gloucester.gov.uk/environment-waste-recycling/pollution/air-quality/
Priory Road AQMA	08/08/2005	NO$_2$ Annual Mean	An area encompassing the junction of St Oswalds Road and Priory Road.	No	41 - 48	37.2	Gloucester AQAP 2008 (2011 Review)	https://www.gloucester.gov.uk/environment-waste-recycling/pollution/air-quality/

☒ **Gloucester City Council confirm the information on UK-Air regarding their AQMA(s) is up to date.**

☒ **Gloucester City Council confirm that all current AQAPs have been submitted to Defra.**

2.2 Progress and Impact of Measures to address Air Quality in Gloucester City Council

Defra's appraisal of last year's ASR concluded the following:

- Trends have been clearly presented and discussed, with a robust comparison to relevant air quality objectives.

- The report includes a thorough and concise analysis of monitoring results within their AQMAs. The Council have stated they intend to conduct a detailed modelling study as part of the update to their AQAP and will consider revoking the Painswick AQMA following the results. This decision is supported, and an update is expected in the 2022 ASR.

- QA/QC procedures have been applied accurately and appropriately, with sufficient discussion and justification within the Appendix.

- The Public Health Outcomes Frameworks was mentioned, and this is encouraged. The Council have referred specifically to indicator D01, which is the fraction of mortality attributable to particulate air pollution. This demonstrates the Councils dedication to improve particulate pollution for public health. However, the Council could identify specific measures to target $PM_{2.5}$ concentrations and/or emissions. These can be measures which jointly improve NO_2 and particulate pollution.

- Table 2.2 provides an update on the Councils progress against measures in their current AQAP. However, columns regarding funding and cost are blank. This information should be included.

- The Councils monitoring network has reduced from 34 to 18 locations this year; reasons for the decrease are not known.

- Overall the report is detailed, concise and satisfies the criteria of relevant standards. The Council should continue their good and thorough work.

The comments made within the appraisal report, as shown above, have been taken into account for the completion of the 2022 ASR.

During 2019 Gloucester City Council commissioned an update to the 2008 AQAP (last updated 2011). As part of this process a review of the current AQMAs has been completed and stakeholder workshops have been held in order to inform new measures. The draft of the revised AQAP has now been finalised and, whilst there has been a delay in releasing

the document for consultation due to internal changes within the Council, it is now expected to be released for consultation later this year.

As a result, Table 2.2 has not yet been updated for the new measures within the updated AQAP. Details of all previous measures are set out in Table 2.2. Sixteen measures are included within Table 2.2, more detail on which can be found in the 2011 Gloucester Air Quality Action Plan.

The measures in Table 2.2 have helped to contribute towards compliance; however, Gloucester City Council anticipates that further additional measures will be required in subsequent years to achieve compliance within the currently declared AQMAs. A revised set of targeted measures, as set out in the revised AQAP, will be included within next year's ASR following consultation.

Table 2.2 – Progress on Measures to Improve Air Quality

Measure No.	Measure	Category	Classification	Year Measure Introduced	Estimated / Actual Completion Year	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
1	Enforce the existing HGV ban on Painswick Road North/Chequers Bridge/Barton Street except for buses and access	Freight and Delivery Management	Route Management Plans/ Strategic routing strategy for HGV's	2011	-	Gloucestershire Police	Police force				Aborted	0.2 - 1µg/m³	Number of HGVs on named roads	HGV ban continues to be enforced	
3	Variable Message Signs (VMS)	Traffic Management	Other	2011	-	Gloucestershire County Council	No further funding is available at this time.				Planning	> 0.2µg/m³	Number of VMS signs	Currently no funding available	
4	Improvements/Control of the signals	Traffic Management	UTC, Congestion management, traffic reduction	2017	-	Gloucestershire County Council	Gloucestershire County Council				Planning	< 0.2µg/m³	N/A	No planned improvements for the foreseeable future.	
8	Greater restriction and better timing of deliveries	Freight and Delivery Management	Route Management Plans/ Strategic routing strategy for HGV's	2011	On-going	Gloucestershire County Council	No additional funding required				Implementation	< 0.2µg/m³	Number of HGVs on named roads	Currently deliveries are banned from 8-9am and 5-6pm	
9	Encourage bus company to buy new vehicles to provide the bus services	Vehicle Fleet Efficiency	Promoting Low Emission Public Transport	2011	2020	Gloucester City Council and Gloucestershire County Council	Central government funding and incentives				Completed	< 0.2µg/m³	Number of new vehicles	Continued promotion and information on council website. Meeting with Stagecoach at the end of 2017 revealed that their bus fleet is renewed on a countywide basis and is related to ages of vehicles.	
10	Upgrade existing bus fleet	Vehicle Fleet Efficiency	Vehicle Retrofitting programmes	2011	2020	Bus companies	Bus companies				Completed	< 0.2µg/m³	Number of buses retrofitted	On-going	
11	Reduce illegal parking	Traffic Management	UTC, Congestion management, traffic reduction	2011	On-going	Gloucestershire County Council	No additional funding required				Implementation	< 0.2µg/m³	Reduction in illegal parking and less parking on city centre roads.	Controlled zones established and Civil Enforcement Officer's in place to enforce zones.	
12	Introduce air quality measures into Gloucester City Council Taxi Licensing Policy	Promoting Low Emission Transport	Taxi Licensing conditions	2018	Completed	Gloucestershire County Council	No additional funding required				Completed	Reduced vehicle emissions	Improvement in age and euro standard of vehicles within the taxi fleet	December 18 saw introduction of new rule book where vehicles must comply with specific condition in relation to the age and length of service, e.g. Euro 6 compliant by 2023	

Measure No.	Measure	Category	Classification	Year Measure Introduced	Estimated / Actual Completion Year	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
13	Ubico Fleet	Promoting Low Emission Transport	Company Vehicle Procurement - Prioritising uptake of low emission vehicles	2018	2022	Gloucester City Council/ Amey	No additional funding required				Implementation	Reduced vehicle emissions	Improvements in age and euro standard of vehicles within Amey fleet	14 recycling and 4 street cleaning vehicles that are Euro 6 compliant have been added to the fleet	Will be changing to Ubico in April 2022 and the contract will see the procurement of new waste, recycling and street cleansing vehicles, including carbon reduction technologies
16	Improvement in Planning Application Validation Requirements	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	2018	On-going	Gloucester City Council	Building developers				Implementation	Construction dust emissions controlled during the construction phase and NO2 controlled during the operational phase.	Increase in air quality assessments being received with the submission of applications for major developments	Liaison with Planning Department to provide criteria for air quality in relation to major developments. Applications are not validated until all information is received.	Looking to monitor air quality at Black Dog Way flats and Hempsted Lane when site complete
17	Low Emission	Promoting Low Emission Transport	Other	2017	Ongoing	Local Authority Planning	Building developers				Implementation	Reduced vehicle emissions	Diffusion tube data	New developments - to install electric charging points where possible. In the JCS.	
18	Low Emission	Promoting Low Emission Transport	Taxi emission incentives	2018	Completed	Local taxi drivers	Taxi drivers				Implementation	Reduced vehicle emissions	Diffusion tube data	Currently 1 electric taxi in city	
19	Low Emission	Promoting Low Emission Transport	Company Vehicle Procurement - Prioritising uptake of low emission vehicles	2019	Ongoing	Gloucester City Council	Local Authority, Funding: Defra Air Quality Grant				Implementation	Reduced vehicle emissions	Diffusion tube data	Implementation - on-going	
20	Improve Air Quality	Public Information	Via the Internet	2020	Ongoing	Gloucester City Council	-				Implementation	Visible smoke plumes. Reduction in complaints.	Smoke control zone	Encouraging residents not to burn waste.	
21	Active Travel	Promoting Travel Alternatives	Promotion of cycling	2020	Ongoing	Gloucester City Council and Gloucestershire County Council	County Council				Implementation	Reduced vehicle emissions	Diffusion tube data	Adding a pop-up cycle route into the city on London Road.	
22	Active Travel	Promoting Travel Alternatives	Promotion of cycling	2018	Ongoing	Gloucester City Council	-				Implementation	Reduced vehicle emissions	Annual report to track mileage.	Annual basis	

2.3 PM$_{2.5}$ – Local Authority Approach to Reducing Emissions and/or Concentrations

As detailed in Policy Guidance LAQM.PG16 (Chapter 7), local authorities are expected to work towards reducing emissions and/or concentrations of PM$_{2.5}$ (particulate matter with an aerodynamic diameter of 2.5µm or less). There is clear evidence that PM$_{2.5}$ has a significant impact on human health, including premature mortality, allergic reactions, and cardiovascular diseases.

Efforts within Gloucester are being concentrated on monitoring NO$_2$ levels, with a particular focus on the established AQMAs. As primary emissions of both NO$_2$ and particulates predominately originate from the same source, measures implemented to reduce NO$_2$ levels within Gloucester will also reduce levels of PM$_{10}$ and PM$_{2.5}$.

The Defra background mapped data for Gloucester (2018 reference year) show that all 2021 background concentrations of PM$_{2.5}$ were far below the recommended annual mean AQS objective for PM$_{2.5}$ of 20µg/m^3. The highest concentration is predicted to be 10.6µg/m^3 within the 1km x 1km grid square with the centroid grid reference of 383500, 217500, an area just south of the city centre. This indicates that concentrations of PM$_{2.5}$ are generally low across Gloucester, although it is noted concentrations may be higher in close proximity to emissions sources, such as roads.

Smoke control zones are a defined geographical region within which smoke cannot be legally emitted from a chimney, unless using authorised fuels or using exempt appliances. The aim is to prevent air pollution, particularly emissions of particulates (including PM$_{2.5}$). There is currently one designated smoke control zone within Gloucester. The area includes the Cathedral, the Gaol and the County Council offices. Housing built before the area was designated is excluded from control, as it was expected that the area would be redeveloped. This has indeed taken place over the years, so that the only excluded housing today is in Priory Road, Mount Street and Pitt Street. The smoke control area is bounded by The Quay, Royal Oak Road, St. Oswald's Road, Priory Road, St. Mary's Street, Pitt Street, Hare Lane, Northgate Street, Southgate Street and Commercial Road.

Measures that reduce the concentration of PM$_{2.5}$ are of particular importance due to the health impact of PM$_{2.5}$, for example the Public Health Outcomes Framework data tool compiled by Public Heath England quantifies the mortality burden of PM$_{2.5}$ within England on a county and local authority scale. The 2020 (most recent year available) fraction of

mortality attributable to $PM_{2.5}$ pollution within Gloucester is 5.9%. This is slightly higher than average for England as a whole and the South West region, which are 5.6% and 5.2% respectively.

3 Air Quality Monitoring Data and Comparison with Air Quality Objectives and National Compliance

This section sets out the monitoring undertaken within 2021 by Gloucester City Council and how it compares with the relevant air quality objectives. In addition, monitoring results are presented for a five-year period between 2017 and 2021 to allow monitoring trends to be identified and discussed.

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

Gloucester City Council did not carry out any automatic (continuous) monitoring of pollutants during 2021.

3.1.2 Non-Automatic Monitoring Sites

Gloucester City Council undertook non-automatic (i.e., passive) monitoring of NO_2 at 22 sites during 2021. This is an increase of 4 sites in comparison to 2020, with the addition of:

- Site 27: 38 Priory Road – deployed as additional monitoring in the vicinity of the Priory Road AQMA.

- Site 28: Sweetbriar Street – part of ongoing work in collaboration with the County Council to monitor air quality in the vicinity of schools. Gloucester City Council monitored at three school locations during 2021.

- Site 29: Parliament Street - deployed temporarily as a bus route has been diverted along this street.

- Site 30: Black Dog Way – deployed to monitor in the vicinity of new flats that have been developed.

Table A.1 in Appendix A presents the full details of the non-automatic sites.

Maps showing the location of the monitoring sites are provided in Appendix D. Further details on Quality Assurance/Quality Control (QA/QC) for the diffusion tubes, including bias adjustments and any other adjustments applied (e.g., annualisation and/or distance correction), are included in Appendix C.

3.2 Individual Pollutants

The air quality monitoring results presented in this section are, where relevant, adjusted for bias, annualisation (where the annual mean data capture is below 75% and greater than 25%), and distance correction. Further details on adjustments are provided in Appendix C.

3.2.1 Nitrogen Dioxide (NO$_2$)

Table A.2 in Appendix A compares the ratified and adjusted monitored NO$_2$ annual mean concentrations for the past five years with the air quality objective of 40µg/m^3. Note that the concentration data presented represent the concentration at the location of the monitoring site, following the application of bias adjustment and annualisation, as required (i.e., the values are exclusive of any consideration to fall-off with distance adjustment).

The full 2021 dataset of monthly mean values is provided in Appendix B. Note that the concentration data presented in Table B.1 include distance corrected values, only where relevant.

Data capture for one of the diffusion tube sites (site 30) within 2021 was below 75%, therefore annualisation (short-term to long-term adjustment) has been completed in line with LAQM.TG(16) using data from background automatic monitoring stations located within 50 miles of the diffusion tube locations. The NO$_2$ results for 2021 have been bias adjusted using a national bias adjustment factor of 0.84. Full details of the annualisation, bias adjustment, and QA/QC monitoring procedures are provided in Appendix C.

The analysis of the 2021 monitoring data is completed below in relation to the designated AQMAs within Gloucester City Council.

The annual mean NO$_2$ concentration was not greater than 60µg/m^3 at any monitoring site and therefore, as per LAQM.TG(16) guidance, it is unlikely there were any exceedances of the NO$_2$ 1-hour mean objective at any of the sites.

Concentrations at all sites, with the exception of site 13, increased during 2021 in comparison to 2020. This is most likely due to a return to business as usual following the COVID-19 pandemic, whereby the UK Government issued advice to stay at home where possible, alongside strict lockdowns. This resulted in decreased levels of traffic observed across the UK, and therefore significantly reduced NO$_2$ concentrations recorded during 2020.

Barton Street AQMA

Monitored concentrations are presented in Table A.2 and Figure A.1. The concentrations in the Figure are compared against the annual mean objective value for NO_2.

There are six diffusion tube locations within the Barton Street AQMA. All sites had a data capture in excess of 75% during 2021. During 2021 site 16 recorded the lowest concentration (24.8µg/m^3) of any of the Barton Street AQMA monitoring sites, whilst the highest concentration within the AQMA was recorded at site 14 (35.1µg/m^3).

As concentrations at site 14 were in exceedance of the annual mean objective of 40µg/m^3 in 2017, 2018 and 2019 (i.e., within the last five years), the AQMA will remain in force.

Priory Road AQMA

Monitored concentrations are presented in Table A.2 and Figure A.2. The concentrations in the Figure are compared against the annual mean objective value for NO_2.

There are three diffusion tube locations within the Priory Road AQMA, all with sufficient data capture during 2021 that annualisation has not been required. During 2021 site 23 recorded the lowest concentration (34.1µg/m^3) of any of the Priory Road AQMA monitoring sites, whilst the highest concentrations within the AQMA were recorded at site 24 (37.6µg/m^3).

Despite concentrations falling below the objective in 2020 and 2021, the NO_2 concentration at the three monitoring locations within the Priory Road AQMA has exceeded the annual mean objective of 40µg/m^3 within the past five years, therefore the AQMA will remain in force.

Painswick Road AQMA

Monitored concentrations are presented in Table A.2 and Figure A.3. The concentrations in the Figure are compared against the annual mean objective value for NO_2.

There are three diffusion tube locations within the Painswick Road AQMA, all with sufficient data capture during 2021 that annualisation has not been required. During 2021, site 5 recorded the lowest concentration (25.4µg/m^3) of any of the Painswick Road AQMA monitoring sites, whilst the highest concentrations within the AQMA were recorded at site 8 (29.9µg/m^3).

Although there have not been any monitored exceedances of the annual mean objective at any of the three sites over the past five years, the modelling completed as part of the AQAP update process indicated that there was potential for exceedances. The Painswick

Road AQMA is therefore to remain in place so that further monitored data that has not been impacted upon by COVID-19 can be collected.

Diffusion Tubes Outside of Existing AQMAs

Monitored concentrations are presented in Table A.2 and Figure A.4. The concentrations in the Figure are compared against the annual mean objective value for NO_2.

There are ten diffusion tube monitoring sites located outside of the existing AQMAs. Six of these have been monitoring for at least five years, with sites 27, 28, 29 and 30 being added for 2021.

In terms of data processing, site 30 had data capture of less than 75% and, therefore, data for this site were annualised. During 2021, site 28 recorded the lowest concentration ($14.0\mu g/m^3$) of any of the monitoring sites located outside of the AQMAs, whilst the highest concentration outside of the AQMAs was recorded at site 19 ($29.8\mu g/m^3$).

Site 27 is located at 38 Priory Road, just outside of the Priory Road AQMA. The concentration monitored at this site during 2021 was $25.1\mu g/m^3$. This is well below the NO_2 annual mean objective, providing evidence to support the current boundary of the AQMA.

Outside of the existing AQMAs, NO_2 concentrations are compliant and there have been no exceedances of the NO_2 annual mean objective recorded over the past five years.

Due to all monitoring locations reporting concentrations below the annual mean objective, no further AQMAs need to be designated within Gloucester City Council at the current time. As detailed earlier within the ASR, a detailed modelling study to review the current AQMA boundaries has been completed as part of the AQAP process, this assessment will help to inform whether any amendments and/or revocations are required.

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Appendix A: Monitoring Results

Table A.1 – Details of Non-Automatic Monitoring Sites

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) [1]	Distance to kerb of nearest road (m) [2]	Tube Co-located with a Continuous Analyser?	Tube Height (m)
3	35 Buscombe Gardens	Roadside	387670	217250	NO$_2$	No	0.0	26.8	No	2.6
5	97 Painswick Rd	Roadside	384558	216946	NO$_2$	Yes - Painswick Road	0.0	4.6	No	2.6
7	76 Painswick Rd	Roadside	384490	217027	NO$_2$	Yes - Painswick Road	0.0	3.5	No	2.7
8	88 Painswick Road	Roadside	384509	216998	NO$_2$	Yes - Painswick Road	0.0	3.5	No	2.5
12	219A Barton St (post)	Roadside	384000	217863	NO$_2$	Yes - Barton Street	0.0	2.0	No	2.6
13	99 Barton St	Roadside	383717	218094	NO$_2$	Yes - Barton Street	0.0	2.0	No	2.5
14	124 Barton St	Roadside	383726	218074	NO$_2$	Yes - Barton Street	0.0	1.5	No	2.6
15	196 Barton St (Lamppost)	Roadside	383989	217857	NO$_2$	Yes - Barton Street	0.0	2.5	No	2.6
16	240 Barton Street	Roadside	384081	217725	NO$_2$	Yes - Barton Street	0.0	1.9	No	2.6
17	316 Barton St	Roadside	384175	217501	NO$_2$	Yes - Barton Street	0.0	2.3	No	2.6

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) [1]	Distance to kerb of nearest road (m) [2]	Tube Co-located with a Continuous Analyser?	Tube Height (m)
18	79 Millbrook Road	Roadside	384190	218160	NO$_2$	No	0.0	1.0	No	2.6
19	61 Barnwood Rd	Roadside	385130	218585	NO$_2$	No	0.0	5.0	No	2.6
20	53 Barnwood Rd	Roadside	385113	218595	NO$_2$	No	0.0	2.3	No	2.5
21	Elmbridge Road	Urban Background	385430	218870	NO$_2$	No	9.5	101.6	No	2.6
23	46 Priory Rd	Roadside	382898	219029	NO$_2$	Yes - Priory Road	0.0	4.5	No	2.5
24	56 Priory Rd	Roadside	382921	219034	NO$_2$	Yes - Priory Road	0.0	4.4	No	2.5
25	66 Priory Rd	Roadside	382950	219040	NO$_2$	Yes - Priory Road	0.0	5.4	No	2.7
26	16 London Rd	Roadside	383560	218775	NO$_2$	No	30.0	2.7	No	2.5
27	38 Priory Road	Roadside	382818	218993	NO$_2$	No	0.0	10.0	No	2.2
28	Sweetbriar Street (School)	Urban background	383639	219134	NO$_2$	No	3.0	2.5	No	2.3
29	Paliament Street (Temp)	Kerbside	383027	218253	NO$_2$	No	10.0	0.5	No	2.2
30	Black Dog Way (Temp)	Roadside	383483	218830	NO$_2$	No	0.0	3.5	No	2.0

Notes:

(1) 0m if the monitoring site is at a location of exposure (e.g. installed on the façade of a residential property). (2) N/A if not applicable.

Table A.2 – Annual Mean NO₂ Monitoring Results: Non-Automatic Monitoring (µg/m³)

Diffusion Tube ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2021 (%) [2]	2017	2018	2019	2020	2021
3	387670	217250	Roadside	84.1	84.1	24.0	23.7	24.3	16.9	19.4
5	384558	216946	Roadside	84.1	84.1	29.6	29.6	27.3	21.6	25.4
7	384490	217027	Roadside	84.1	84.1	32.1	29.8	31.9	23.8	27.8
8	384509	216998	Roadside	84.1	84.1	35.2	33.7	34.2	27.9	29.9
12	384000	217863	Roadside	84.1	84.1	36.5	36.8	36.2	27.8	32.3
13	383717	218094	Roadside	84.1	84.1	35.0	37.6	37.2	31.7	30.9
14	383726	218074	Roadside	84.1	84.1	**48.1**	**42.4**	**43.9**	31.5	35.1
15	383989	217857	Roadside	84.1	84.1	39.3	38.4	39.7	30.1	32.5
16	384081	217725	Roadside	84.1	84.1	33.0	32.1	31.2	21.6	24.8
17	384175	217501	Roadside	84.1	84.1	35.2	32.7	35.5	26.1	29.9
18	384190	218160	Roadside	84.1	84.1	30.2	29.1	29.4	21.8	25.5
19	385130	218585	Roadside	84.1	84.1	34.1	35.4	34.1	25.8	29.8
20	385113	218595	Roadside	84.1	84.1	36.5	33.0	34.7	24.8	28.3

Diffusion Tube ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2021 (%) [2]	2017	2018	2019	2020	2021
21	385430	218870	Urban Background	84.1	84.1	17.6	17.5	17.7	17.2	18.7
23	382898	219029	Roadside	84.1	84.1	**42.8**	**46.3**	**40.5**	29.5	34.1
24	382921	219034	Roadside	84.1	84.1	**48.3**	**47.4**	**43.0**	32.5	37.6
25	382950	219040	Roadside	84.1	84.1	**46.7**	**47.1**	**43.2**	31.9	35.1
26	383560	218775	Roadside	84.1	84.1	30.4	33.4	33.9	26.5	27.2
27	382818	218993	Roadside	76.1	76.1					25.1
28	383639	219134	Urban background	74.7	74.7					14.0
29	383027	218253	Kerbside	84.1	84.1					21.4
30	383483	218830	Roadside	42.3	42.3					21.4

☒ **Annualisation has been conducted where data capture is <75% and >25% in line with LAQM.TG16.**

☒ **Diffusion tube data have been bias adjusted.**

☒ **Reported concentrations are those at the location of the monitoring site (bias adjusted and annualised, as required), i.e. prior to any fall-off with distance correction.**

Notes:

The annual mean concentrations are presented as $\mu g/m^3$.

Exceedances of the NO_2 annual mean objective of $40\mu g/m^3$ are shown in **bold**.

NO_2 annual means exceeding $60\mu g/m^3$, indicating a potential exceedance of the NO_2 1-hour mean objective are shown in **bold and underlined**.

Means for diffusion tubes have been corrected for bias. All means have been "annualised" as per LAQM.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Concentrations are those at the location of monitoring and not those following any fall-off with distance adjustment.

(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) Data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

Figure A.1 – Trends in Annual Mean NO₂ Concentrations: Barton Street AQMA
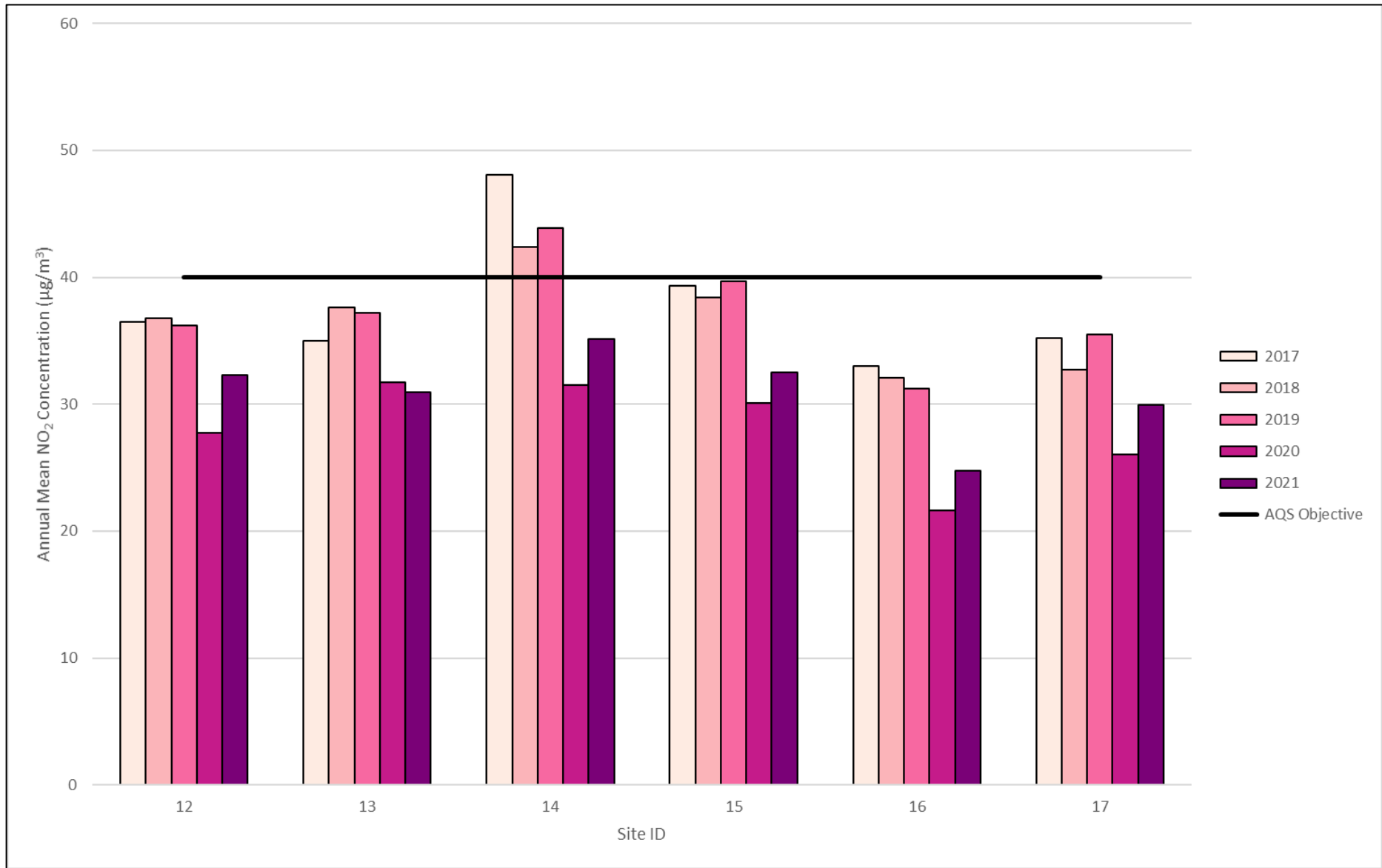
Figure A.2 - Trends in Annual Mean NO₂ Concentrations: Priory Road AQMA
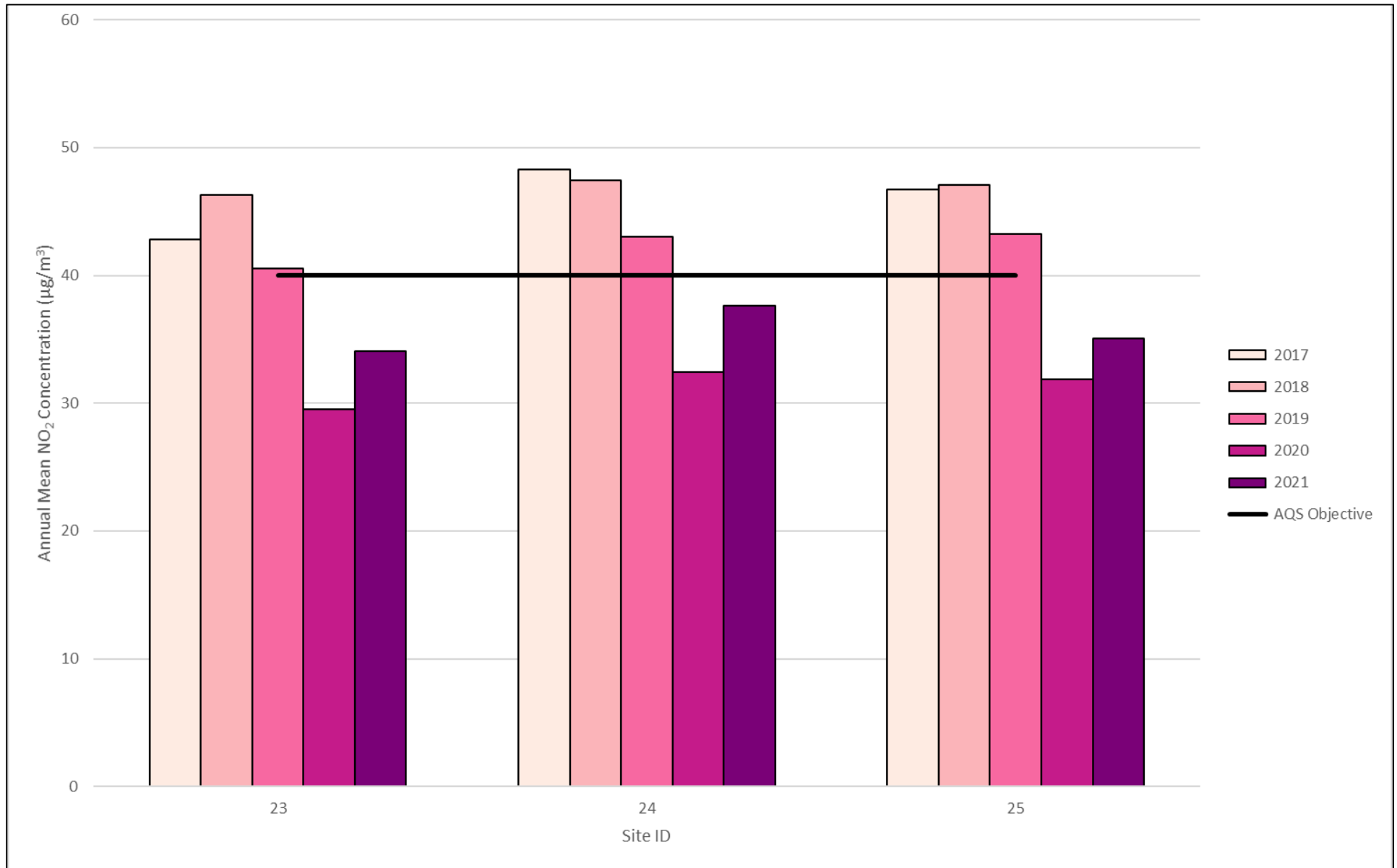
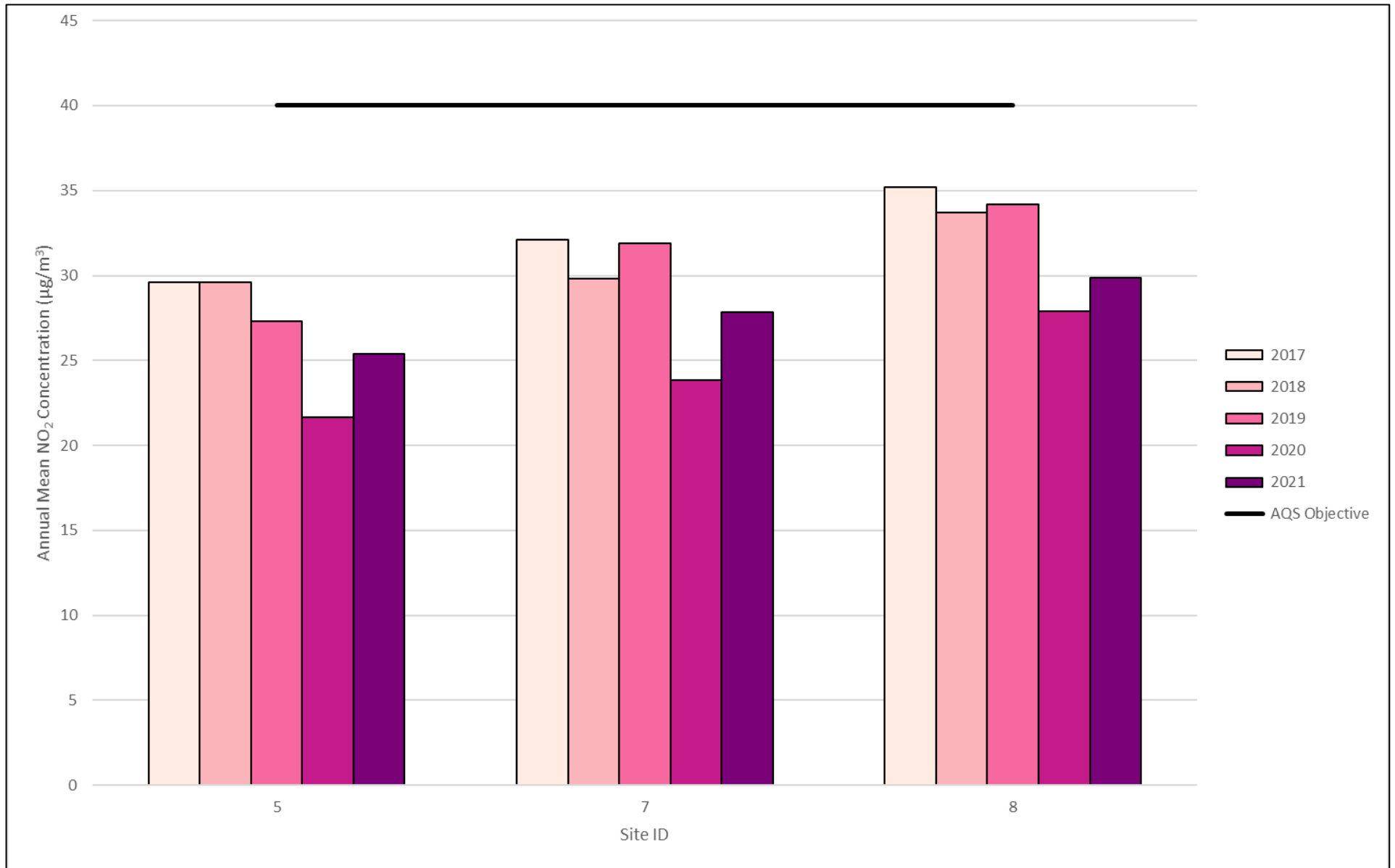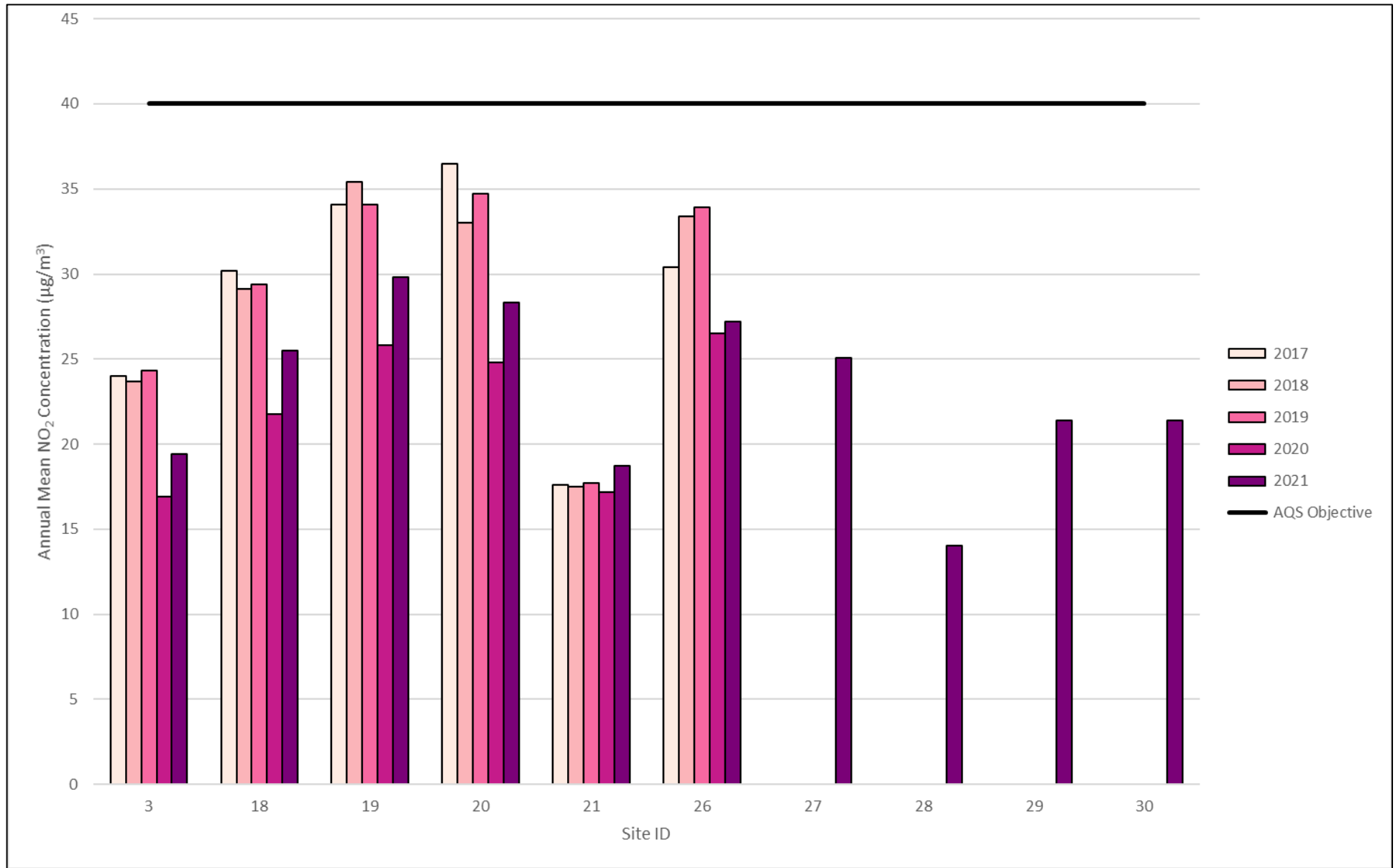**Figure A.3 - Trends in Annual Mean NO₂ Concentrations: Painswick Road AQMA**

Figure A.4 – Trends in Annual Mean NO₂ Concentrations: Outside of AQMAs

Appendix B: Full Monthly Diffusion Tube Results for 2021

Table B.1 – NO₂ 2021 Diffusion Tube Results (µg/m³)

DT ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Annualised and Bias Adjusted (0.84)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
3	387670	217250	24.6	27.8	22.5	24.4			20.8	18.2	25.4	24.1	23.9	20.3	23.1	19.4	-	
5	384558	216946	30.3	33.4	29.8	33.6			27.9	28.7	29.8	27.7	34.1	27.9	30.2	25.4	-	
7	384490	217027	40.8	34.3	31.1	30.4			30.8	27.7	35.9	33.5	38.3	29.9	33.1	27.8	-	
8	384509	216998	39.5	34.7	33.9	32.6			33.6	31.2	37.0	36.5	40.4	37.0	35.6	29.9	-	
12	384000	217863	41.4	39.1	33.0	44.0			42.2	33.8	43.0	35.3	41.9	31.4	38.4	32.3	-	
13	383717	218094	39.6	37.1	34.0	42.4			38.3	34.1	36.1	32.5	43.8	31.3	36.8	30.9	-	
14	383726	218074	45.5	38.6	37.4	40.0			42.7	37.4	45.2	45.8	47.7	38.2	41.8	35.1	-	
15	383989	217857	45.8	38.0	33.8	36.8			37.6	34.9	40.3	40.6	43.4	36.8	38.7	32.5	-	
16	384081	217725	32.9	32.2	27.9	33.2			27.2	24.0	29.8	28.0	34.7	25.8	29.5	24.8	-	
17	384175	217501	43.7	35.6	28.4	32.6			34.1	30.1	36.4	38.1	43.8	34.2	35.6	29.9	-	
18	384190	218160	34.2	30.6	28.8	30.0			29.0	26.0	29.9	29.3	38.7	28.1	30.3	25.5	-	
19	385130	218585	38.2	39.6	35.6	43.6			34.6	28.6	36.0	31.4	39.2	29.1	35.5	29.8	-	
20	385113	218595	38.5	37.8	33.8	37.9			29.3	27.4	34.4	32.9	38.7	27.6	33.7	28.3	-	
21	385430	218870	27.7	22.6	24.3	21.4			15.7	16.1	18.9	22.8	30.4	24.1	22.3	18.7	-	
23	382898	219029	39.0	43.8	39.3	38.2			39.6	39.5	43.8	41.9	42.8	38.6	40.6	34.1	-	
24	382921	219034	44.6	44.9	43.4	41.8			46.8	47.2	46.4	46.9	47.1	39.8	44.8	37.6	-	
25	382950	219040	46.3	47.4	41.3	40.5			42.7	40.6	41.9	39.6	47.4	32.9	41.8	35.1	-	
26	383560	218775	41.5	35.9	29.0	25.3			25.6	25.5	34.5	37.0	40.0	31.5	32.4	27.2	-	

DT ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Annualised and Bias Adjusted (0.84)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
27	382818	218993		35.1	31.1	27.2			25.6	25.4	30.7	27.7	35.0	32.3	29.8	25.1	-	
28	383639	219134	25.1	21.2	18.1	11.9			5.5	10.8	14.3		24.8	20.5	16.7	14.0	-	
29	383027	218253	31.6	27.6	22.4	27.5			20.8	19.3	24.0	25.5	31.7	24.7	25.4	21.4	-	
30	383483	218830								18.2	25.3	27.7	32.3	28.1	26.5	21.4	-	

☒ **All erroneous data have been removed from the NO₂ diffusion tube dataset presented in Table B.1.**

☒ **Annualisation has been conducted where data capture is <75% and >25% in line with LAQM.TG16.**

☐ **Local bias adjustment factor used.**

☒ **National bias adjustment factor used.**

☒ **Where applicable, data have been distance corrected for relevant exposure in the final column.**

☒ **Gloucester City Council confirm that all 2021 diffusion tube data have been uploaded to the Diffusion Tube Data Entry System.**

Notes:

Exceedances of the NO₂ annual mean objective of 40µg/m³ are shown in **bold**.

NO₂ annual means exceeding 60µg/m³, indicating a potential exceedance of the NO₂ 1-hour mean objective are shown in **bold and underlined**.

See Appendix C for details on bias adjustment and annualisation.

Appendix C: Supporting Technical Information / Air Quality Monitoring Data QA/QC

New or Changed Sources Identified Within Gloucester City Council During 2021

Gloucester City Council has not identified any new sources relating to air quality within the reporting year of 2021.

In order to ensure that it would not adversely impact upon air pollution within the borough, an air quality assessment (AQA) is being prepared for the development of a large site on Cole Avenue/Podsmead Road. This site forms part of the Podsmead Estate Regeneration project. Further information can be found on the Shape the Future and Gloucester City Council Supplementary Planning Documents websites.

Additional Air Quality Works Undertaken by Gloucester City Council During 2021

During 2019 Gloucester City Council commissioned an update to the 2008 AQAP (last updated 2011). As part of this process a review of the current AQMAs has been completed and stakeholder workshops have been held in order to inform new measures. The draft of the revised AQAP has now been finalised and, whilst there has been a delay in releasing the document for consultation due to internal changes within the Council, it is now expected to be released for consultation later this year.

QA/QC of Diffusion Tube Monitoring

The diffusion tubes for the year 2021 were supplied and analysed by Gradko International Ltd, the tubes were prepared using the 20% TEA in water preparation method.

Gradko is a UKAS accredited laboratory and participates in the AIR-PT Scheme for NO_2 tube analysis and the Annual Field Inter-Comparison Exercise. These provide strict performance criteria for participating laboratories to meet, thereby ensuring NO_2 concentrations reported are of a high calibre. The latest available AIR-PT results are AIR-PT AR042 (January – February 2021), AIR-PT AR043 (May – June 2021), AIR-PT AR045

(July – August 2021) and AIR-PT AR046 (September – October 2021). Whilst the round PT AR042 scored 25%, Gradko scored 100% on PT AR043, PT AR045, and PT AR046. The percentage score reflects the results deemed to be satisfactory based upon the z-score of $< \pm 2$.

The precision of the current 34 local authority co-location studies in 2021 detailed within the national bias adjustment factor spreadsheet (version 06/22) was rated as 'good' (tubes are considered to have "good" precision where the coefficient of variation of duplicate or triplicate diffusion tubes for eight or more periods during the year is less than 20%). Further information on the precision summary results can be found on the LAQM website.

Diffusion tube monitoring during 2021 was largely undertaken in line with the Diffusion Tube Monitoring Calendar and recommended exposure period (5 weeks (+/- 4 days)), with the exception of the May and June exposure periods. During May the tubes were overexposed and during June the tubes were underexposed. The monitored concentrations have been reviewed and have not been included in the calculation of the site specific annual means, due to increased uncertainty in the results, in line with laboratory advice and LAQM.TG(16).

The erroneous data noted above have been removed from the NO_2 diffusion tube dataset presented in Table B.1.

Diffusion Tube Annualisation

As per LAQM.TG(16), annualisation is required for any site which has a data capture of less than 75%, but greater than 25%. Annualisation was therefore required to be completed for one site, site 30, due to there being a 42.3% data capture for 2021. This was completed by using version 2 (March 2022) of the Diffusion Tube Data Processing Tool. The four closest continuous monitoring background locations which were selected to annualise the data were:

- Swindon Walcot;
- Newport;
- Bristol St. Pauls; and
- Leamington Spa.

All of these sites have a data capture of >85% and therefore could be used for annualisation. Table C.1 presents the annualisation summary and is taken directly from the Diffusion Tube Data Processing Tool.

Table C.1 - Annualisation Summary (concentrations presented in µg/m³)

Site ID	Annualisation Factor Swindon Walcot	Annualisation Factor Newport	Annualisation Factor Bristol St. Pauls	Annualisation Factor Leamington Spa	Average Annualisation Factor	Raw Data Annual Mean	Annualised Annual Mean
30	1.0487	0.9632	0.9010	0.9325	0.9614	26.5	25.4

Diffusion Tube Bias Adjustment Factors

The diffusion tube data presented within the 2022 ASR 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.TG16 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.

Diffusion tubes for Gloucester City Council are supplied and analysed by Gradko International Ltd. The tubes were prepared using the 20% TEA in water preparation method. The national bias adjustment factor for Gradko 20% TEA in water is 0.84 for the year 2021 (based on 34 studies) as derived from the National Bias Adjustment Factor Spreadsheet (version 06/22).

Analysed By[1]	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[s]	Bias Adjustment Factor (A) (Cm/Dm)
Gradko	20% TEA in water	2021	R	Gedling Borough Council	12	32	26	23.1%	G	0.81
Gradko	20% TEA in water	2021	UB	West Northamptonshire Council	11	14	10	32.1%	G	0.76
Gradko	20% TEA in water	2021	R	Ards and North Down Borough Council	10	30	22	38.4%	G	0.72
Gradko	20% TEA in water	2021	R	Birmingham City Council	10	33	25	35.2%	G	0.74
Gradko	20% TEA in water	2021	R	Cheshire West and Chester	12	34	29	14.1%	G	0.88
Gradko	20% TEA in water	2021	R	Cheshire West and Chester	12	33	29	12.6%	G	0.89
Gradko	20% TEA in water	2021	R	Lisburn & Castlereagh City Council	12	25	19	31.9%	G	0.76
Gradko	20% TEA in water	2021	R	Nottingham City Council	12	32	35	-8.1%	G	1.09
Gradko	20% TEA in water	2021	R	SOUTHAMPTON CITY COUNCIL	12	34	32	5.2%	G	0.95
Gradko	20% TEA in water	2021	R	SOUTHAMPTON CITY COUNCIL	12	34	27	28.6%	G	0.78
Gradko	20% TEA in water	2021	R	Bath & North East Somerset	12	31	27	15.1%	G	0.87
Gradko	20% TEA in water	2021	R	Bedford Borough Council	11	34	31	7.6%	G	0.93
Gradko	20% TEA in water	2021	R	Bedford Borough Council	11	19	17	11.7%	G	0.90
Gradko	20% TEA in water	2021	R	Blackburn with Darwen Borough Council	12	27	20	32.3%	G	0.76
Gradko	20% TEA in water	2021	R	Brent Council	12	51	46	9.9%	G	0.91
Gradko	20% TEA in water	2021	R	Gateshead Council	10	23	19	23.8%	G	0.81
Gradko	20% TEA in water	2021	R	Gateshead Council	12	25	22	13.7%	G	0.88
Gradko	20% TEA in water	2021	R	Gateshead Council	11	27	25	9.8%	G	0.91
Gradko	20% TEA in water	2021	R	Gateshead Council	12	31	25	26.6%	G	0.79
Gradko	20% TEA in water	2021	R	Gateshead Council	12	32	34	-4.1%	G	1.04
Gradko	20% TEA in water	2021	KS	Marylebone Road Intercomparison	11	53	42	25.0%	G	0.80
Gradko	20% TEA in Water	2021	R	Monmouthshire County Council	11	35	29	21.8%	G	0.82
Gradko	20% TEA in water	2021	R	Belfast City Council	12	25	21	20.9%	G	0.83
Gradko	20% TEA in water	2021	UC	Belfast City Council	11	26	21	25.4%	G	0.80
Gradko	20% TEA in water	2021	R	Belfast City Council	12	42	36	17.7%	G	0.85
Gradko	20% TEA in water	2021	R	Belfast City Council	12	38	27	39.4%	G	0.72
Gradko	20% TEA in water	2021	UB	Dudley MBC	12	20	15	36.0%	G	0.74
Gradko	20% TEA in water	2021	R	Dudley MBC	12	30	29	4.2%	G	0.96
Gradko	20% TEA in water	2021	R	Dudley MBC	12	42	40	5.5%	G	0.95
Gradko	20% TEA in Water	2021	R	Lambeth	10	91	62	46.6%	G	0.68
Gradko	20% TEA in water	2021	R	Lancaster City Council	13	38	32	18.4%	G	0.84
Gradko	20% TEA in water	2021	R	Lancaster City Council	13	28	27	4.9%	G	0.95
Gradko	20% TEA in water	2021	R	Cheltenham Borough Council	12	29	25	13.4%	G	0.88
Gradko	20% TEA in water	2021	R	Preston City Council	12	24	21	12.2%	G	0.89
Gradko	20% TEA in water	2021		Overall Factor[1] (34 studies)				Use		0.84

During 2021 there was no available co-location study within Gloucester, therefore a local bias adjustment factor could not be derived. As a result, the national factor has been applied to all 2021 monitoring results.

A summary of bias adjustment factors used by Gloucester City Council over the past five years is presented in Table C.2.

Table C.2 – Bias Adjustment Factor

Monitoring Year	Local or National	If National, Version of National Spreadsheet	Adjustment Factor
2021	National	06/22	0.84
2020	National	03/21	0.81
2019	National	03/19	0.93
2018	National	03/18	0.93
2017	National	03/17	0.89

NO_2 Fall-off with Distance from the Road

No diffusion tube NO_2 monitoring locations within Gloucester required distance correction during 2021.

Appendix D: Maps of Monitoring Locations and AQMAs

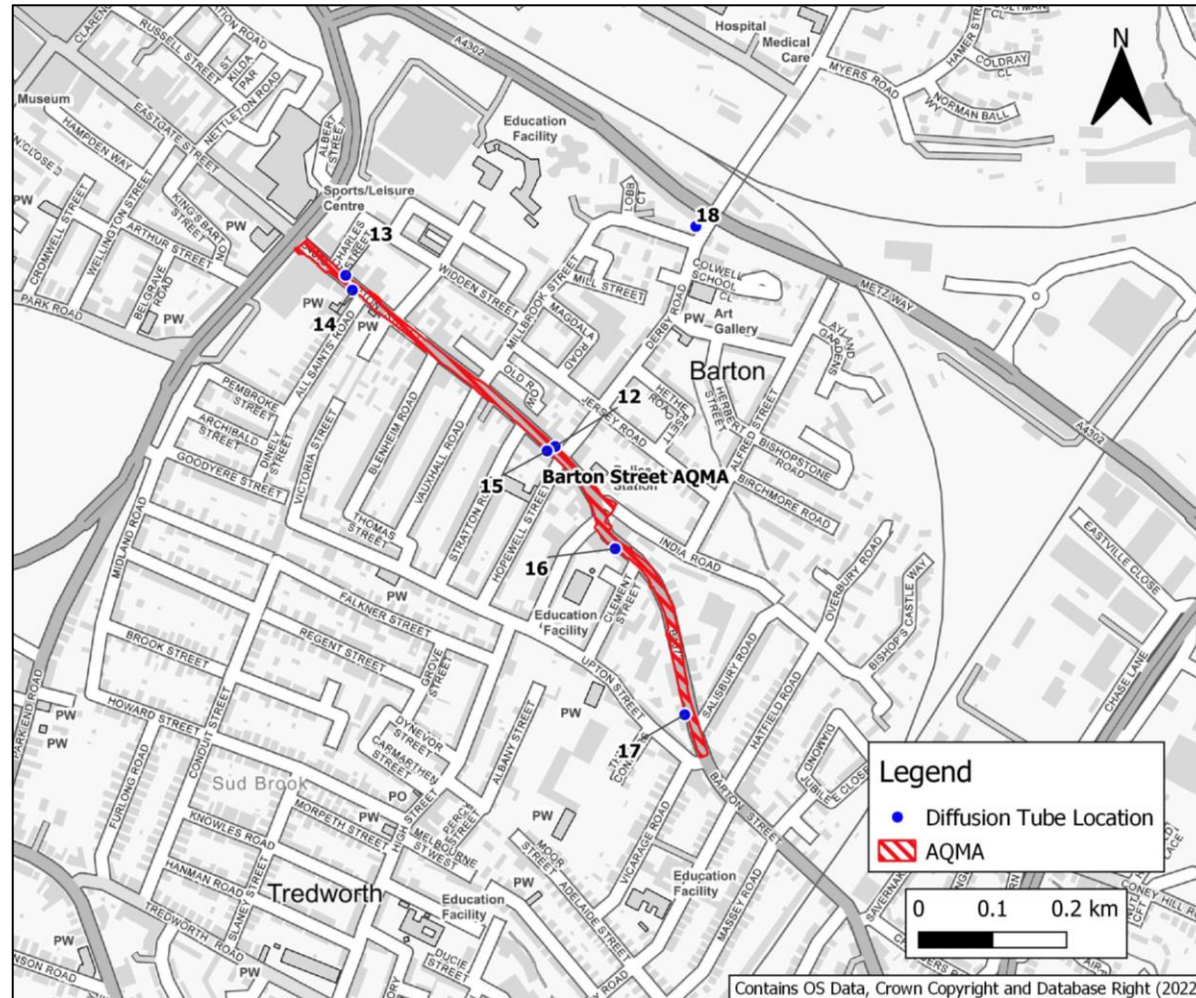**Figure D.1 – Map of NO₂ Diffusion Tube Monitoring Locations: Barton Street AQMA**

Figure D.2 - Map of NO₂ Diffusion Tube Monitoring Locations: Priory Road AQMA
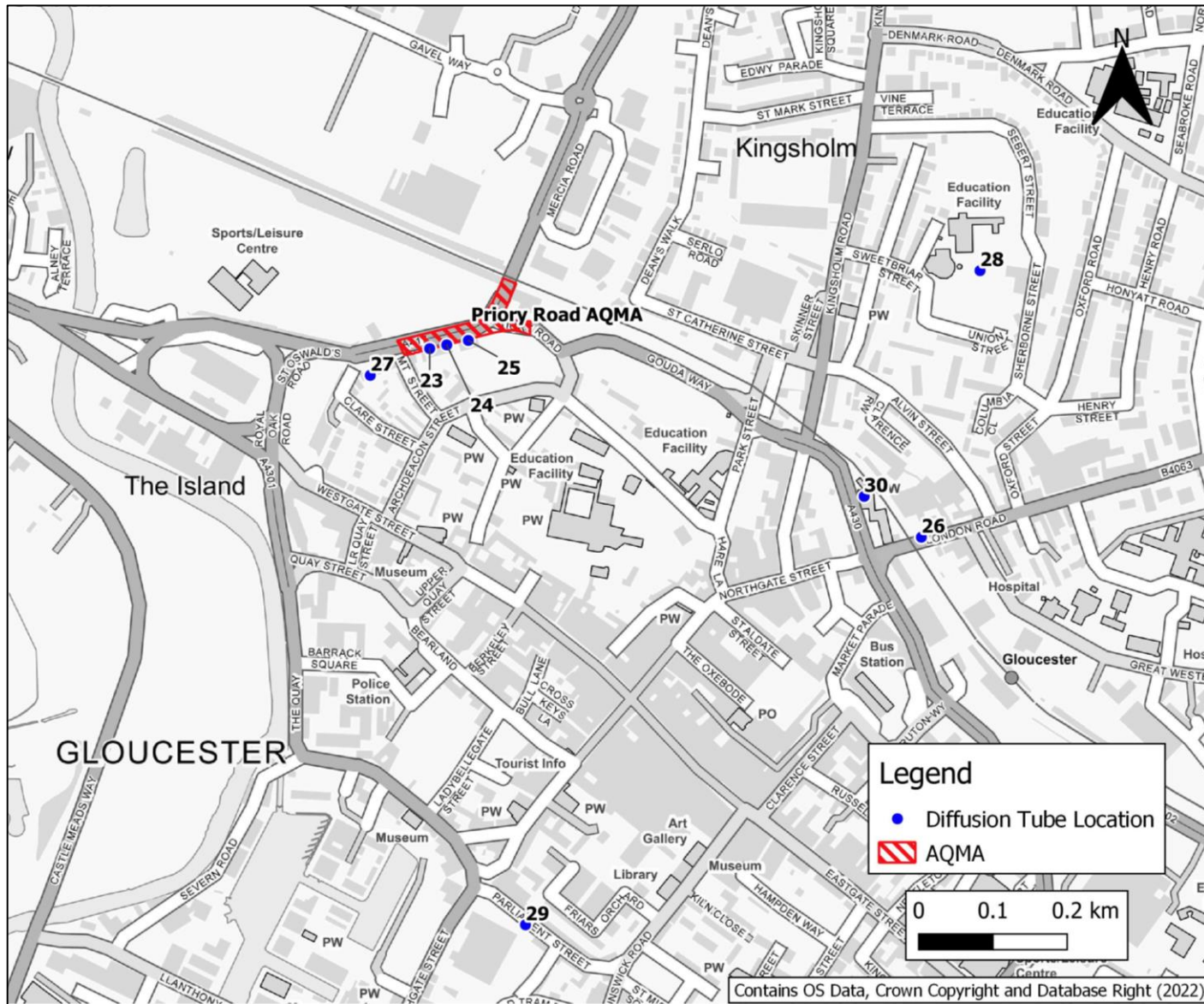
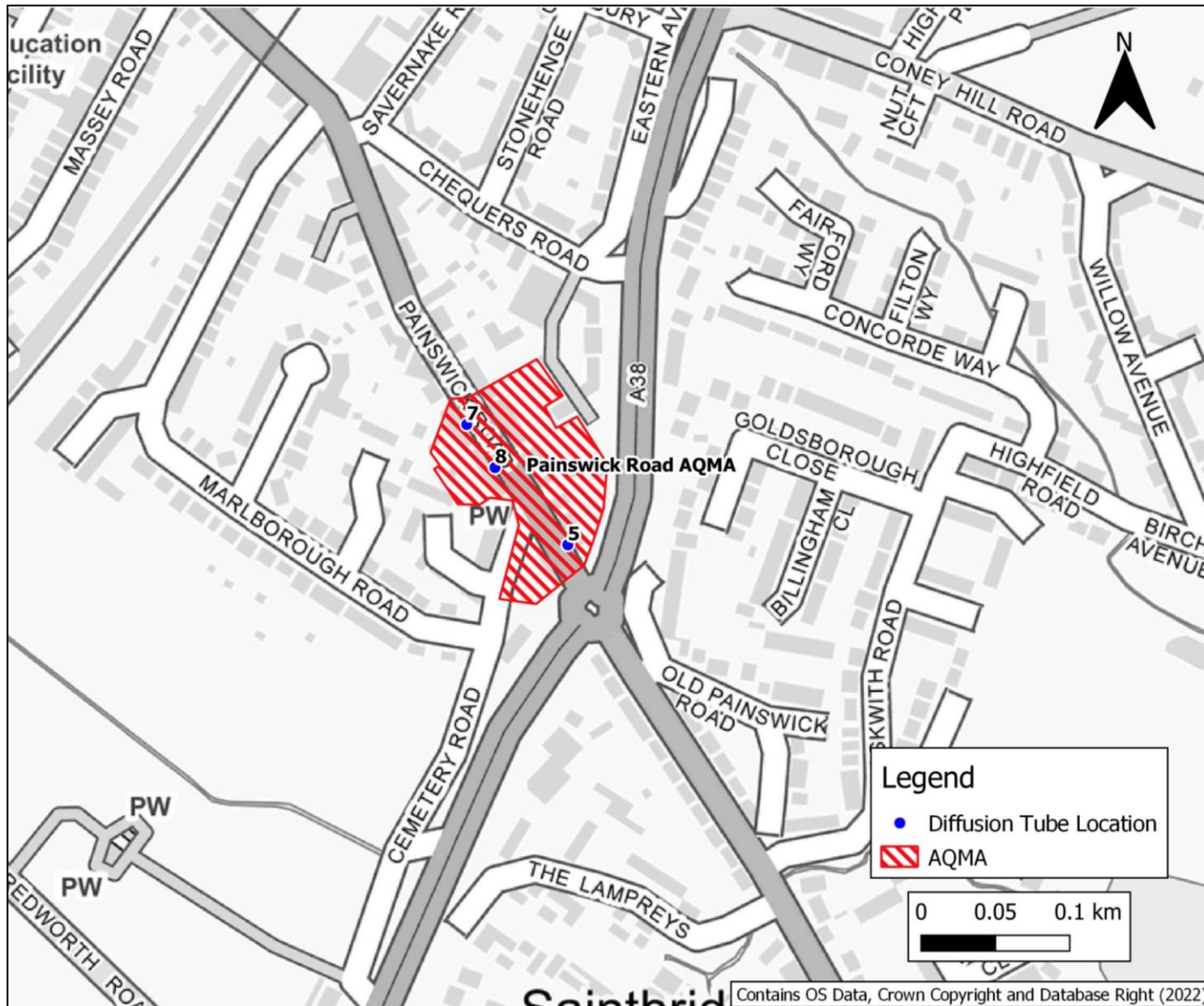**Figure D.3 – Map of NO₂ Diffusion Tube Monitoring Locations: Painswick Road AQMA**

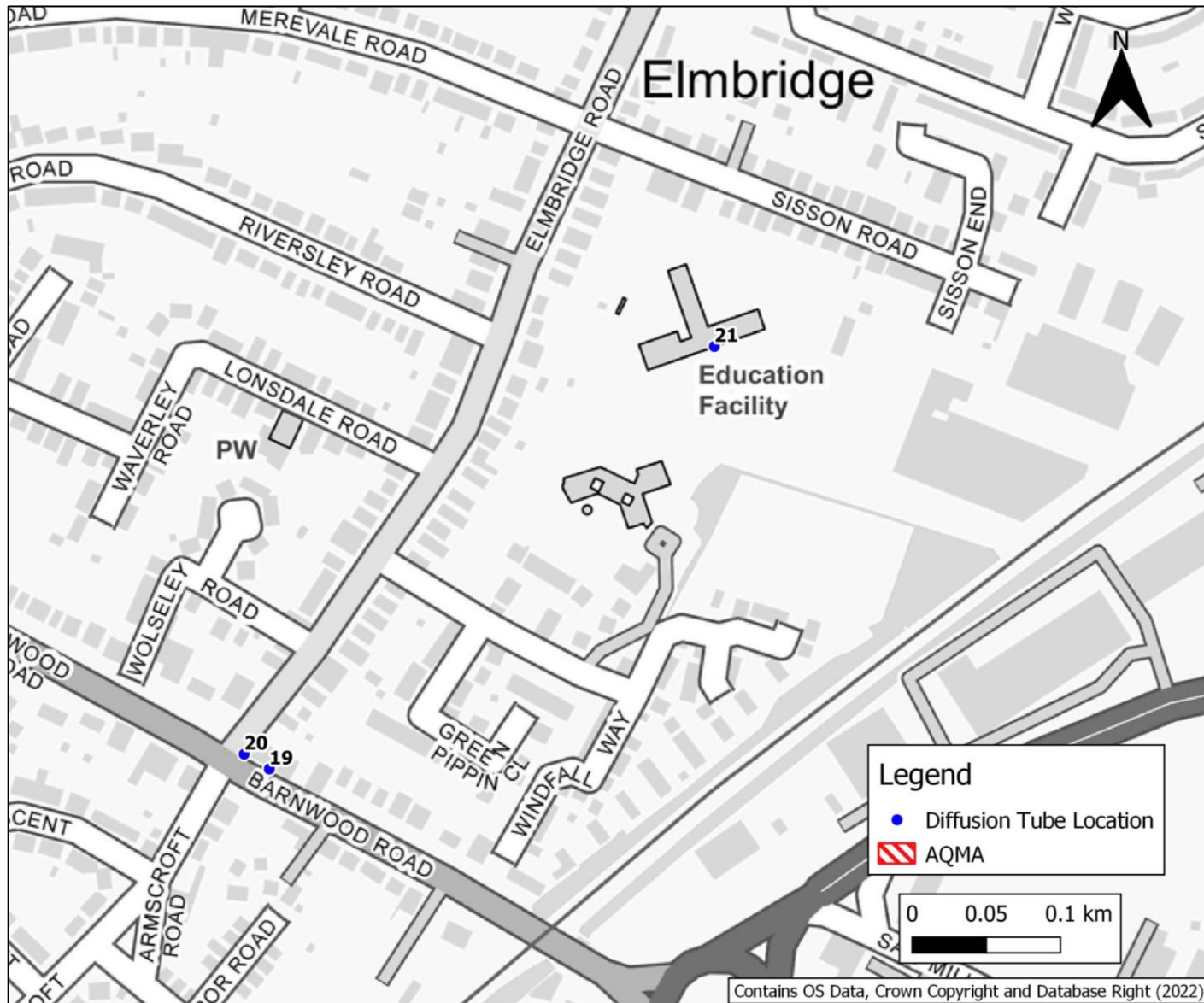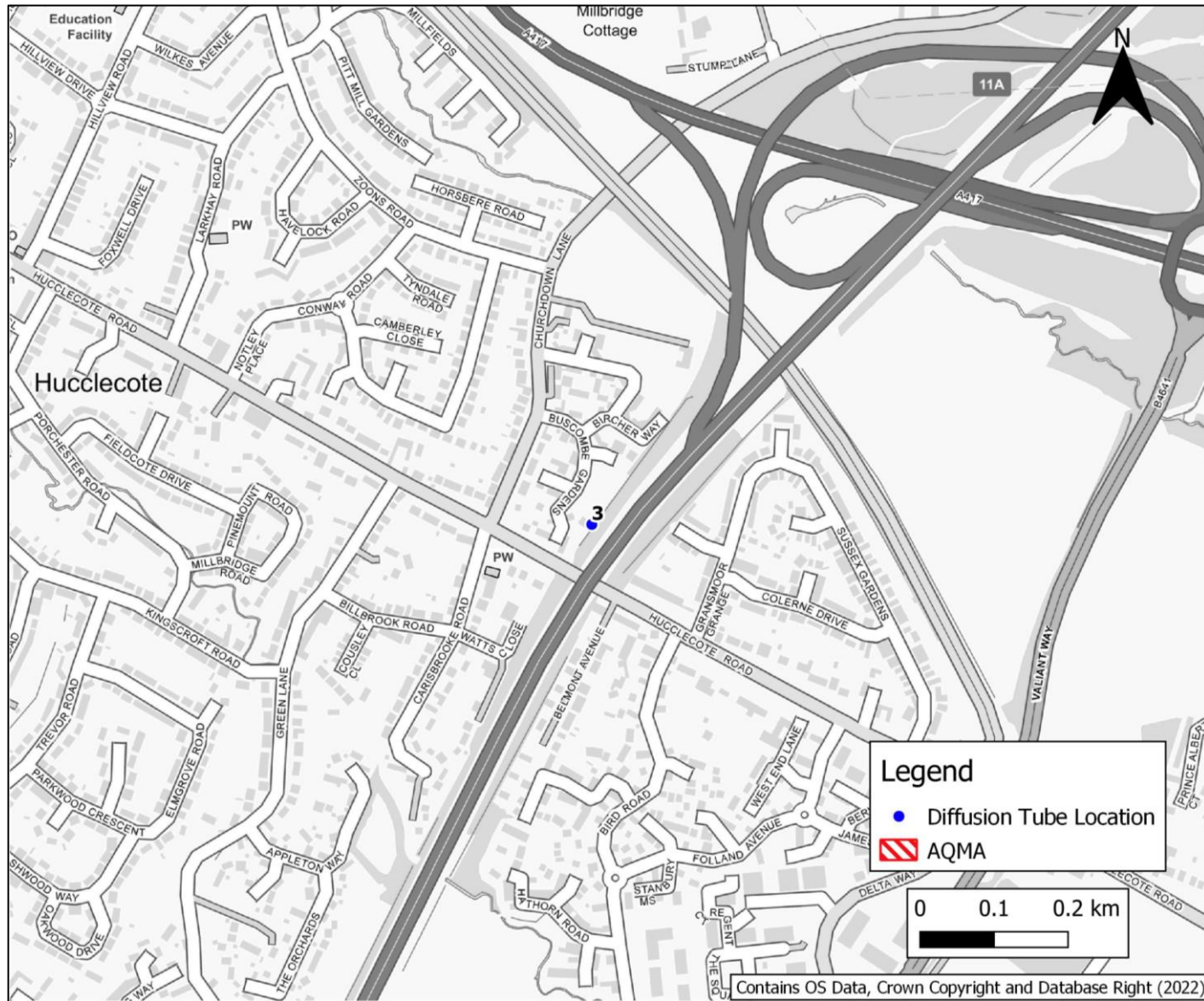**Figure D.4 - Map of NO₂ Diffusion Tube Monitoring Locations: Elmbridge**

Figure D.5 - Map of NO₂ Diffusion Tube Monitoring Locations: M5

Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England[8]

Pollutant	Air Quality Objective: Concentration	Air Quality Objective: Measured as
Nitrogen Dioxide (NO$_2$)	200µg/m^3 not to be exceeded more than 18 times a year	1-hour mean
Nitrogen Dioxide (NO$_2$)	40µg/m^3	Annual mean
Particulate Matter (PM$_{10}$)	50µg/m^3, not to be exceeded more than 35 times a year	24-hour mean
Particulate Matter (PM$_{10}$)	40µg/m^3	Annual mean
Sulphur Dioxide (SO$_2$)	350µg/m^3, not to be exceeded more than 24 times a year	1-hour mean
Sulphur Dioxide (SO$_2$)	125µg/m^3, not to be exceeded more than 3 times a year	24-hour mean
Sulphur Dioxide (SO$_2$)	266µg/m^3, not to be exceeded more than 35 times a year	15-minute mean

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[8] The units are in microgrammes of pollutant per cubic metre of air (µg/m^3).

Glossary of Terms

Abbreviation	Description
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the local authority intends to achieve air quality limit values'
AQMA	Air Quality Management Area – An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives
ASR	Annual Status Report
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by National Highways
EU	European Union
FDMS	Filter Dynamics Measurement System
LAQM	Local Air Quality Management
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
PM_{10}	Airborne particulate matter with an aerodynamic diameter of 10μm or less
$PM_{2.5}$	Airborne particulate matter with an aerodynamic diameter of 2.5μm or less
QA/QC	Quality Assurance and Quality Control
SO_2	Sulphur Dioxide

References

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