2021 Air Quality Annual Status Report (ASR)

In fulfilment of Part IV of the Environment Act 1995

Local Air Quality Management

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Executive Summary: Air Quality in Our Area

Air Quality in Stroud District

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].

Road traffic emissions are the single most significant influence on air quality within the Stroud district. The principal pollutant of concern from road traffic is Nitrogen Dioxide (NO_2). Stroud District Council uses diffusion tubes located across the District in order to measure NO_2. These tubes are collected and sent away for analysis on a monthly basis. Air quality across the district remains very good and, in 2020, the concentrations of NO_2 measured at every comparable monitoring location decreased. Whilst there has been a downward trend in NO_2 concentrations across the district over the past few years, it is considered that the lack of road traffic, as a result of the Covid-19 pandemic, may have had a significant impact on the concentration of NO_2 measured 2020.

Within the Stroud District, in 2019, a new major source of emission commenced operations. The source is a 65.3 MW Energy from Waste plant at Javelin Park, near Haresfield. To account for any potential impact on air quality from this development, Stroud District Council continues to monitor NO_2 at seven nearby locations. Additionally, Stroud District Council supports a local Community Liaison Group which has two

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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 2020

[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

particulate monitors located in areas of potential exposure in order to obtain data relating to particulates. Aside from Javelin Park, there are no new major sources of emissions within the district.

Stroud District Council works in partnership with Gloucestershire County Council on the strategic transport vision. This is set out in the Local Transport Plan (2020-2041) which outlines the policies that support the Connecting Places Strategies (CPS) and Transport Scenarios. It can be found at:

https://www.gloucestershire.gov.uk/transport/gloucestershires-local-transport-plan-2020-2041/gloucestershire-ltp-2020-2041/.

The plan aims to support sustainable economic growth, enable community connectivity, protect and enhance the natural & built environment and improve community health and wellbeing. The document considers transport options such as bus travel, the cycle network, the freight network, highways and rail travel as well as looking at innovation and connectivity to feed into policy to improve travel within the County in order to meet the challenge of net zero. Within the LTP there is also a document promoting travel choice called Think Travel and a plan of publicly available electric vehicle charging points. As mentioned above, the six district based CPS can be found in the LTP. The Stroud District strategy can be found in section 4.6 at:

https://www.gloucestershire.gov.uk/media/2108466/ltp-policy-document-final-v132.pdf.

In addition to air quality monitoring and developing strategies for traffic management, Stroud District Council regulates and enforces (where necessary) industrial emissions through the environmental permitting regime.

Actions to Improve Air Quality

Whilst air quality has improved significantly in recent decades, and should 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 even more ambitious than EU requirements 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.

Conclusions and Priorities

Overall, air quality in the Stroud district continues to be good. This year's Annual Status Review (ASR) identifies improving air quality as a result of a general trend towards lower NO_2 concentrations. In fact, only one monitoring location experienced a NO_2 concentration just in excess of 30µg/m^3 which compares favourably with the air quality objective of 40µg/m^3. It is considered likely that this is as a result of the impact of Covid-19 on road traffic.

In the Stroud District Council 2019 ASR, the data from 2018 highlighted that Dudbridge was experiencing exceedances slightly above the annual air quality objective. It was concluded that the bias correction factor for 2019 may have been the cause of elevated concentrations across the district. At that time, it was agreed with the Defra helpdesk that automatic monitoring would be necessary to accurately confirm this. However, the Covid-19 pandemic led to a suspension of this plan with a watching brief agreed. Since then, NO_2 concentrations have decreased year on year. Therefore, it is a priority for Stroud District Council to continue monitoring NO_2 concentrations going forward with a view to automatic monitoring as necessary.

Local Engagement and How to get Involved

Stroud District Council engages with decision makers and the public through a number of forums. The Gloucestershire Pollution Group is made up of environmental protection professionals from all of the Gloucestershire local authorities as well as air quality

[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

representatives from Gloucestershire County Council (GCC). The forum allows for good practice and ideas for improving air quality to be shared.

Stroud District Council attends the Air Quality and Behaviour Change sub group which is made up of professionals and electoral representatives from across Gloucestershire. The group is working towards producing a Gloucestershire Air Quality and Health Strategy.

Stroud District Council is engaged with a Community Liaison Group which was set up to research air quality issues from an Energy from Waste facility. This group is made up of local electoral representatives, Environment Agency representatives, representatives from the operator as well as members of the public.

Interest in air quality issues is relatively high across the Stroud district and this is also reflected in the political composition of the Council. All Councillors actively engage in a whole range of environmental issues, including air quality. In general terms, beyond those with a professional interest in air quality, there is a lack of specialist knowledge and understanding of how air quality is measured and monitored within the district. Despite this, there is definitely an increase in those wanting to improve their understanding of air quality or wishing to become involved in air quality projects locally.

The general public can assist in improving air quality across the Stroud District by reducing unnecessary vehicular travel. In addition, disposal of household and garden waste by means other than burning would be very beneficial.

Copies of the latest air quality report for Stroud District can be found on the Council's website at https://www.stroud.gov.uk/environment/environmental-health/pollution-and-nuisance/air-quality.

Queries relating to air quality should be directed to the Environmental Protection team at Stroud District Council.

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1 Local Air Quality Management

This report provides an overview of air quality in Stroud District during 2020. 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 ASR is an annual requirement showing the strategies employed by Stroud District 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

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

Stroud District Council currently does not have any declared AQMAs.

2.2 Progress and Impact of Measures to address Air Quality in Stroud District

DEFRA's appraisal of last year's ASR concluded:

1) *The Council provide a good discussion on pollutant trends within the district and make detailed comparisons of pollutant concentrations between 2018 and 2019. This level of discussion is encouraged for future ASRs.*

2) *It would be useful if Section 2.3 could make reference to the Public Health Outcomes Framework, and the local indicator for $PM_{2.5}$ in the district. The Council may wish to consider comparing the '3.01 - Fraction of mortality attributable to particulate air pollution indicator' value for Stroud to nearby LAs and National indicator values.*

Stroud District Council has made this comparison using the most up to date data available from 2019.

3) *It is encouraging to see that the Council are continuing to review their monitoring locations and are adding new monitoring locations where they deem appropriate. This is welcomed and the Council are encouraged to continue to review their monitoring locations annually.*

4) *The Council have provided a very limited discussion on QA/QC procedures. It is strongly advised that the Council include evidence to support their QA/QC. Such as:*

    (1) Including the Diffusion Tube Bias Adjustment Factors Spreadsheet which displays the bias adjustment factor the Council are using.

    (2) Including annualisation calculations for PM_{10} and $PM_{2.5}$

Stroud District Council has included the diffusion tube bias adjustment factors spreadsheet version information which outlines the bias adjustment factor the Council is using and has undertaken annualisation calculations for PM_{10} and $PM_{2.5}$.

Stroud District Council has taken forward a number of direct measures during the current reporting year of 2020 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.1. Seven measures are included within Table 2.1, with the type of measure and the progress Stroud District Council has made during the reporting year of 2020 presented. Where there have been, or continue to be, barriers restricting the implementation of the measure, these are also presented within Table 2.1.

Table 2.1 – 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	Gloucestershire Local Transport Plan 2020 - 2041	Promoting Travel Alternatives	Intensive active travel campaign & infrastructure	2020	2041	SDC and County Council	County Council/Government	NO	Partially Funded		Implementation	Reduced vehicle emissions	NOx	LTP just updated	Lengthy timescale
2	Connecting Places Strategy - Stoud	Transport Planning and Infrastructure	Public transport improvements-interchanges stations and services	2020	2041	SDC and County Council	County Council	NO	Partially Funded		Implementation	Reduced vehicle emissions	NOx	LTP just updated	Lengthy timescale
3	Gloucestershire Air Quality and Health Strategy	Promoting Low Emission Transport	Other			SDC and County Council	LA and County Council	NO			Planning	Reduced vehicle emissions	NOx	Implementation on-going	
4	Extension of Cotswold Canals	Promoting Travel Alternatives	Promote use of rail and inland waterways			SDC and charity	LA and heritage lottery fund	NO	Funded	£1 million - £10 million	Implementation	Reduced vehicle emissions	NOx	Implementation on-going	Lengthy timescale
5	SDC carbon neutral commitment by 2030	Other	Other	2019	2030	SDC	SDC	NO	Partially Funded		Implementation	Carbon Neutral	CO_2	Implementation on-going	Lengthy timescale
6	Improve air quality	Environmental Permits	Measures to reduce pollution through IPPC Permits going beyond BAT			SDC		NO			Implementation	Reduced emissions		Implementation on-going	
7	Improve public accessibility to air quality data	Public Information	Other			SDC and County Council	LA and County Council	NO			Planning	N/A	N/A	Still in planning	

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.

Stroud District Council is taking the following measures to address $PM_{2.5}$:

- Working with Gloucestershire County Council to develop and implement strategies relating to local transport, as set out in the current LTP and the CPS for Stroud district. By implementing transport schemes and promoting travel alternatives, traffic based pollutants (including $PM_{2.5}$) can be reduced.
- Working with the Gloucestershire Air Quality and Behaviour Change sub group to develop an Air Quality and Health Strategy for Gloucestershire. This strategy aims to improve the publication and availability of air quality information to the public, promote active travel in schools and workplaces, promote the uptake of low emission vehicles, a cleaner public sector vehicle fleet and cleaner public transport services.

The Public Health Outcomes Framework indicator '3.01 - Fraction of mortality attributable to particulate air pollution' which considers the impact of $PM_{2.5}$ identifies that 4.45% of all mortality in the Stroud district is attributable to fine particulates (2019). This is a slightly higher value than for the rest of the south west region as a whole, 4.14%, but is lower than the value for England; 5.13%. Therefore, it is important that work continues to improve the outcomes for this particular emission.

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

This section sets out the monitoring undertaken within 2020 by Stroud District Council and how it compares with the relevant air quality objectives. In addition, monitoring results are presented for a five-year period between 2016 and 2020 to allow monitoring trends to be identified and discussed.

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

Stroud District Council undertook automatic (continuous) monitoring at two sites during 2020. Table A.1 in Appendix A shows the details of the automatic monitoring sites. National monitoring results are available at https://uk-air.defra.gov.uk/networks/.

Maps showing the location of the monitoring sites are provided in Appendix D. Further details on how the monitors are calibrated and how the data has been adjusted are included in Appendix C.

3.1.2 Non-Automatic Monitoring Sites

Non-automatic (i.e. passive) monitoring of NO_2 was undertaken at thirty-eight sites during 2020. Table A.2 in Appendix A presents the 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)

Error! Reference source not found. and Table A.3 in Appendix A compare 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 of fall-off with distance adjustment).

For diffusion tubes, the full 2020 dataset of monthly mean values is provided in Appendix B. Note that the concentration data presented in Table B.1 includes distance corrected values only where relevant.

In 2020, every monitoring location displayed reduced concentrations of annual NO_2 against those reported in 2019. The monitoring location reporting the highest annual level of NO_2 for 2020 was site 27 at Bowbridge. The level was 30.93 µg/m^3 which is 3.66 µg/m^3 less than in 2019 and almost 10 µg/m^3 below the Air Quality Objective.

The lowest reported level of annual NO_2 was site 45 at Moreton Hill. The level was 7.10 µg/m^3 which is 0.79 µg/m^3 less than in 2019. This is also the location that showed the lowest reduction in NO_2 concentrations of all of the monitoring locations. The largest reduction in NO_2 concentrations (5.6 µg/m^3) was noted at site 29, 1 Signal House, which experienced a drop from 35.42 µg/m^3 in 2019 to 29.82µg/m^3. It should be noted that none of the monitoring locations were within 10% of the air quality objective and so it was not necessary to correct for distance at any location.

With the exception of 2018, when it was considered that the bias correction factor anomalously increased NO_2 concentrations, the general trend of a decrease in NO_2 concentrations has continued. This is despite the 2021 bias adjustment factor (0.85) being higher than the 2020 bias adjustment factor (0.78). Therefore, it appears likely that the lockdown periods during 2020, as well as the push for people to work from home and thereby reducing commuting, are the principal reasons for the drop in NO_2 concentrations found across the Stroud District. The national and local lockdown period, starting in March 2020, is also the reason that Stroud District Council was unable to complete monitoring at twenty-eight of its monitoring locations for four months until recommencement in July 2020. Therefore, annualisation of the data has been completed for those sites using data from three automatic urban background monitoring sites; Oxford St Ebbes, Swindon Walcot and Bristol St Paul's.

3.2.2 Particulate Matter (PM_{10})

Table A.4 in Appendix A: Monitoring Results compares the ratified and adjusted monitored PM_{10} annual mean concentrations for the past five years with the air quality objective of 40µg/m^3.

Table A.5 in Appendix A compares the ratified continuously monitored PM_{10} daily mean concentrations for the past five years with the air quality objective of 50 µg/m^3, not to be exceeded more than 35 times per year.

In 2020, one of the particulate matter monitoring locations, at Haresfield, was inoperable throughout the whole year and thus there is no available data. In addition, the other monitoring location at Hardwicke also had a significant period of the year where it was inoperable; data was only obtained between March and August 2020. However, this allowed for annualisation utilising sites at Oxford St Ebbes and Bristol St Paul's. It should be noted that the monitor has not been calibrated so the data should be viewed as indicative only.

Following annualisation, the mean PM_{10} at Hardwicke for 2020 was 10.19 µg/m^3 which is just higher (0.09 µg/m^3) than the 10.10 µg/m^3 reported in 2019 and slightly higher (0.34 µg/m^3) than the 9.85 µg/m^3 reported in 2018. This indicates a very slight trend towards increasing concentrations of PM_{10} but, in the context of the air quality objective, the trend is exteremely minor. However, because the major source of emissions to air in the Stroud district results from road traffic, this inrease is unexpected when the impact of the Covid-19 pandemic on NO_2 concentrations is considered. It is possible that the increase may be due to the fact that the Oxford St Ebbes and Bristol St Paul's monitoring locations used for annualisation are urban sites and subject to significantly greater traffic flows than the suburban Hardwicke site.

3.2.3 Particulate Matter ($PM_{2.5}$)

Table A.6 in Appendix A presents the ratified and adjusted monitored $PM_{2.5}$ annual mean concentrations for the past five years.

As with the PM_{10} data, the $PM_{2.5}$ data was impacted by inoperable equipment. However, due to some data being available at the Hardwicke location, this allowed for annualisation utilising sites at Oxford St Ebbes and Bristol St Paul's. It should be noted that the monitor has not been calibrated so the data should be viewed as indicative only.

Following annualisation, the mean $PM_{2.5}$ at Hardwicke for 2020 was 6.16 µg/m^3 which is just lower (0.24 µg/m^3) than the 6.4 µg/m^3 reported in 2019 and lower (0.98 µg/m^3) than the 7.14µg/m^3 reported in 2018. This indicates a slight decreasing trend in concentrations of $PM_{2.5}$. Despite $PM_{2.5}$ concentrations being more susceptible to regional influences, concentrations of $PM_{2.5}$ follow the pattern higlighted in NO_2 in 2020 of reduced concentrations.

Appendix A: Monitoring Results

Table A.1 – Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Monitoring Technique	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Inlet Height (m)
Hardwicke	Hardwicke	Suburban	380203	212842	PM10, PM2.5	No	Particulate monitor	N/A	N/A	1.5
Haresfield	Haresfield	Rural	381324	210015	PM10, PM2.5	No	Particulate monitor	N/A	N/A	1.5

Table A.2 – 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)
24	Bath Road - Nailsworth	Roadside	385023	199749	NO2	No	11.7	4.1	No	1.5
25	High Street lights - Painswick	Kerbside	386686	209781	NO2	No	3.2	0.5	No	2.0
26	Traffic camera - Painswick	Kerbside	386740	209821	NO2	No	1.0	0.5	No	2.4
27	Bowbridge - Stroud	Roadside	385784	204367	NO2	No	1.9	1.3	No	2.4
28	Signal House, Dudbridge	Roadside	383652	204557	NO2	No	5.7	2.7	No	2.4
29	1, Signal House - Dudbridge	Kerbside	383656	204551	NO2	No	0.9	0.7	No	1.5
30	2, Signal House - Dudbridge	Roadside	383659	204556	NO2	No	0.0	3.9	No	2.4
31	3, Signal House - Dudbridge	Roadside	383660	204555	NO2	No	0.0	2.9	No	2.4
32	4, Signal House - Dudbridge	Roadside	383676	204545	NO2	No	0.0	8.0	No	2.4
33	5, Signal House - Dudbridge	Roadside	383672	204538	NO2	No	0.0	2.5	No	5.0
34	50, Woodland Green - Upton St. Leonards	Kerbside	386301	215294	NO2	No	8.0	0.5	No	2.4
35	Trevose - Hardwicke	Roadside	380188	211951	NO2	No	21.7	4.7	No	2.4

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)
36	30, Hunts Grove Drive - Hardwicke	Kerbside	381140	212269	NO2	No	23.7	0.1	No	2.4
37	The Lodge - Haresfield	Other	380232	210421	NO2	No	N/A	N/A	No	2.4
38	Bath Road, Rodborough	Roadside	384448	204934	NO2	No	4.2	1.9	No	2.4
39	Westward Road - Cainscross	Roadside	383471	204988	NO2	No	0.0	3.7	No	2.4
40	London Road - Stroud	Roadside	385529	204701	NO2	No	5.1	2.2	No	2.4
41	Westward Road - Ebley	Roadside	382845	204720	NO2	No	1.4	1.3	No	2.4
42	Russell Street - Stroud	Kerbside	385009	205178	NO2	No	2.9	0.4	No	2.4
43	Slad Brook - Stroud	Roadside	385082	205398	NO2	No	7.6	1.6	No	2.4
44	Oldends Lane - Stonehouse	Roadside	380548	205948	NO2	No	2.7	2.2	No	2.4
45	Moreton Hill	Rural	381872	206279	NO2	No	N/A	N/A	No	2.4
46	Standish Lane	Rural	379342	208604	NO2	No	N/A	1.2	No	2.4
47	Little Haresfield	Rural	380374	209112	NO2	No	N/A	0.4	No	2.4
48	Haresfield village hall	Rural	381349	210005	NO2	No	7.0	0.2	No	2.4

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)
49	Haresfield Beacon	Rural	382295	209217	NO2	No	N/A	0.2	No	2.4
50	Hiltmead Lane	Rural	380110	211214	NO2	No	N/A	N/A	No	2.4
51	Hardwicke village hall	Suburban	380217	212821	NO2	No	N/A	0.6	No	2.4
52	Merrywalks Bus Station - Lamp Post 64	Roadside	384991	205352	NO2	No	N/A	2.5	No	2.7
53	Merrywalks South - Lamp Post 60	Roadside	384868	205260	NO2	No	N/A	1.5	No	2.8
54	Cainscross Rd - Junction with Gannicox Road	Roadside	384389	205185	NO2	No	9.5	1.8	No	3.0
55	Locking Hill Surgery	Roadside	385145	205414	NO2	No	N/A	1.6	No	2.7
56	Beeches Green - Lamp Post 76	Roadside	384934	205516	NO2	No	N/A	1.9	No	2.9
57	Grove Cottages - A46	Roadside	384669	206344	NO2	No	23.9	1.3	No	2.7
58	Bath Road - A46	Roadside	384717	205057	NO2	No	N/A	2.9	No	3.1
59	Station Forecourt	Kerbside	384973	205152	NO2	No	N/A	0.3	No	2.7
60	58, London Road	Kerbside	385112	205085	NO2	No	N/A	0.3	No	2.7
61	Parliament Street/Cornhill/Nelson	Roadside	385282	205159	NO2	No	N/A	1.1	No	2.7

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)
	Street Mini Roundabout									

Table A.3 – Annual Mean NO_2 Monitoring Results: Non-Automatic Monitoring (µg/m^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 2020 (%) (2)	2016	2017	2018	2019	2020
24	385023	199749	Roadside	100	66.6	25.54	22.06	25.46	20.45	17.53
25	386686	209781	Kerbside	100	66.6	30.10	35.51	37.28	31.79	25.93
26	386740	209821	Kerbside	100	66.6	31.50	28.57	32.22	25.49	23.60
27	385784	204367	Roadside	100	66.6	38.40	38.64	**42.18**	34.59	30.93
28	383652	204557	Roadside	100	66.6	36.20	30.98	**42.54**	31.41	25.78
29	383656	204551	Kerbside	100	66.6	39.10	38.98	**43.12**	35.42	29.82
30	383659	204556	Roadside	100	66.6	37.10	34.02	38.83	31.83	29.02
31	383660	204555	Roadside	100	66.6	37.80	35.97	**40.34**	33.11	28.59
32	383676	204545	Roadside	100	66.6	28.09	25.54	27.74	22.15	19.09
33	383672	204538	Roadside	100	66.6	28.93	24.77	29.02	23.49	19.96
34	386301	215294	Kerbside	100	66.6	27.05	21.42	22.52	18.72	16.69
35	380188	211951	Roadside	100	66.6	34.64	30.15	32.83	28.02	25.95
36	381140	212269	Kerbside	87.5	58.3	**N/A**	**N/A**	**N/A**	**N/A**	11.30
37	380232	210421	Other	100	66.6	24.08	20.00	21.35	19.15	15.28
38	384448	204934	Roadside	100	66.6	**N/A**	**N/A**	**N/A**	**N/A**	25.54
39	383471	204988	Roadside	100	66.6	**N/A**	36.32	39.71	21.65	19.42
40	385529	204701	Roadside	100	66.6	**N/A**	**N/A**	**N/A**	**N/A**	25.35
41	382845	204720	Roadside	100	66.6	**N/A**	**N/A**	27.12	23.29	21.36
42	385009	205178	Kerbside	100	66.6	**N/A**	**N/A**	**N/A**	**N/A**	17.41
43	385082	205398	Roadside	100	66.6	**N/A**	**N/A**	25.23	30.86	28.97
44	380548	205948	Roadside	100	66.6	**N/A**	**N/A**	**N/A**	**N/A**	14.12
45	381872	206279	Rural	100	66.6	**N/A**	**N/A**	**N/A**	7.89	7.10
46	379342	208604	Rural	100	66.6	**N/A**	**N/A**	**N/A**	10.89	9.11
47	380374	209112	Rural	100	66.6	**N/A**	**N/A**	**N/A**	10.86	9.30
48	381349	210005	Rural	100	66.6	**N/A**	**N/A**	**N/A**	10.27	8.50
49	382295	209217	Rural	100	66.6	**N/A**	**N/A**	**N/A**	9.01	7.78

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 2020 (%) (2)	2016	2017	2018	2019	2020
50	380110	211214	Rural	100	66.6	N/A	N/A	N/A	18.51	13.81
51	380217	212821	Suburban	100	66.6	N/A	N/A	N/A	13.12	11.53
52	384991	205352	Roadside	100	100	N/A	N/A	N/A	N/A	24.00
53	384868	205260	Roadside	100	100	N/A	N/A	N/A	N/A	29.74
54	384389	205185	Roadside	100	100	N/A	N/A	N/A	N/A	20.10
55	385145	205414	Roadside	100	100	N/A	N/A	N/A	N/A	20.94
56	384934	205516	Roadside	100	100	N/A	N/A	N/A	N/A	29.00
57	384669	206344	Roadside	83.3	83.3	N/A	N/A	N/A	N/A	17.16
58	384717	205057	Roadside	100	100	N/A	N/A	N/A	N/A	15.36
59	384973	205152	Kerbside	91.6	91.6	N/A	N/A	N/A	N/A	13.79
60	385112	205085	Kerbside	100	100	N/A	N/A	N/A	N/A	19.35
61	385282	205159	Roadside	100	100	N/A	N/A	N/A	N/A	14.26

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

☒ **Diffusion tube data has 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 µg/m^3.

Exceedances of the NO_2 annual mean objective of 40 µg/m^3 are shown in **bold**.

NO_2 annual means exceeding 60 µg/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 NO_2 Concentrations

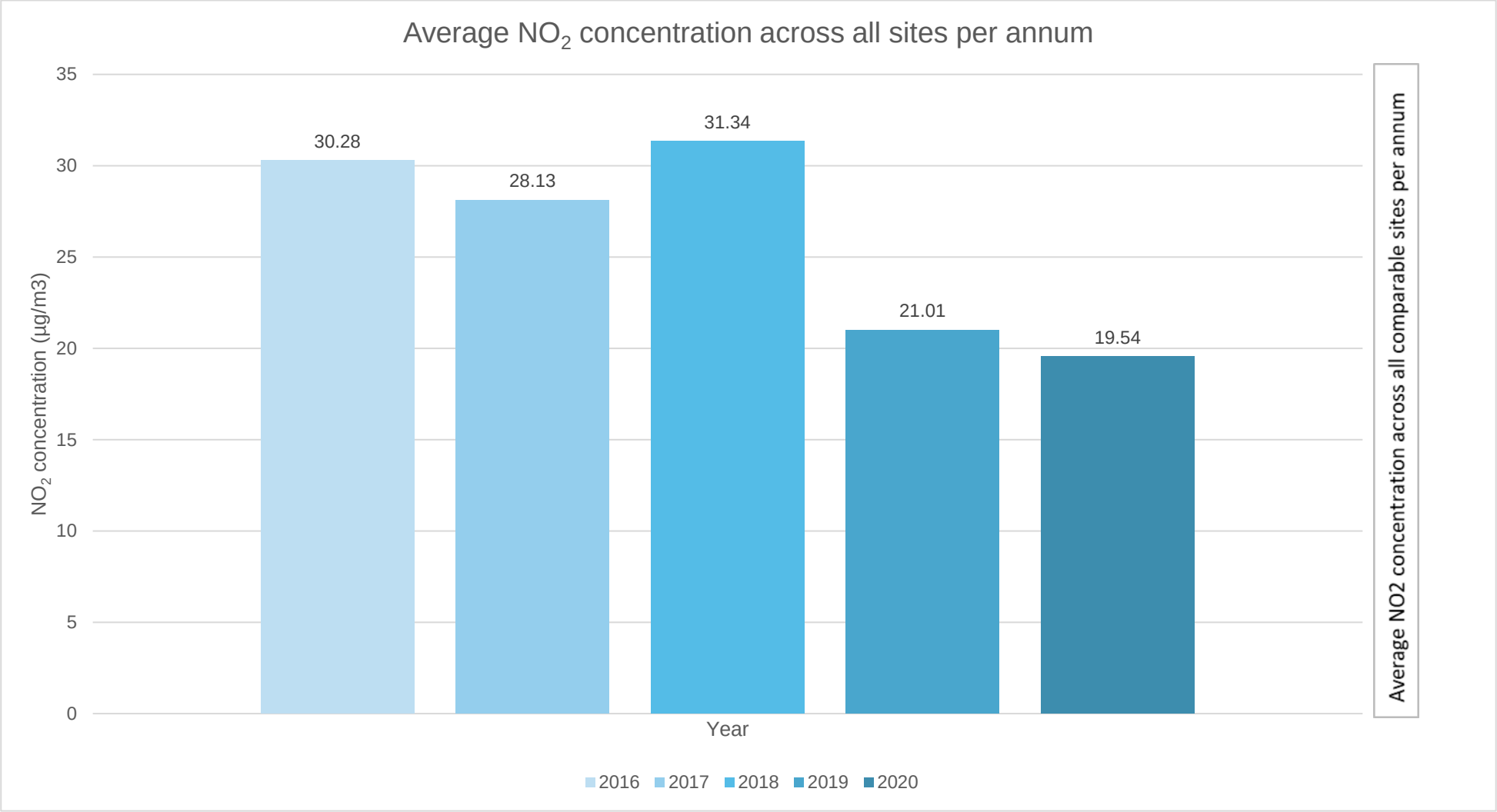


Table A.4 – Annual Mean PM_{10} Monitoring Results ($\mu g/m^3$)

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2020 (%) (2)	2016	2017	2018	2019	2020
Hardwicke	380203	212842	Suburban	N/A	41.8	**N/A**	**N/A**	9.85	10.10	**10.19**
Haresfield	381324	210015	Rural	N/A	0	**N/A**	**N/A**	9.9	8.58	N/A

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

Notes:

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

Exceedances of the PM_{10} annual mean objective of 40 $\mu g/m^3$ are shown in **bold**.

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.

(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.2 – Trends in Annual Mean PM_{10} Concentrations

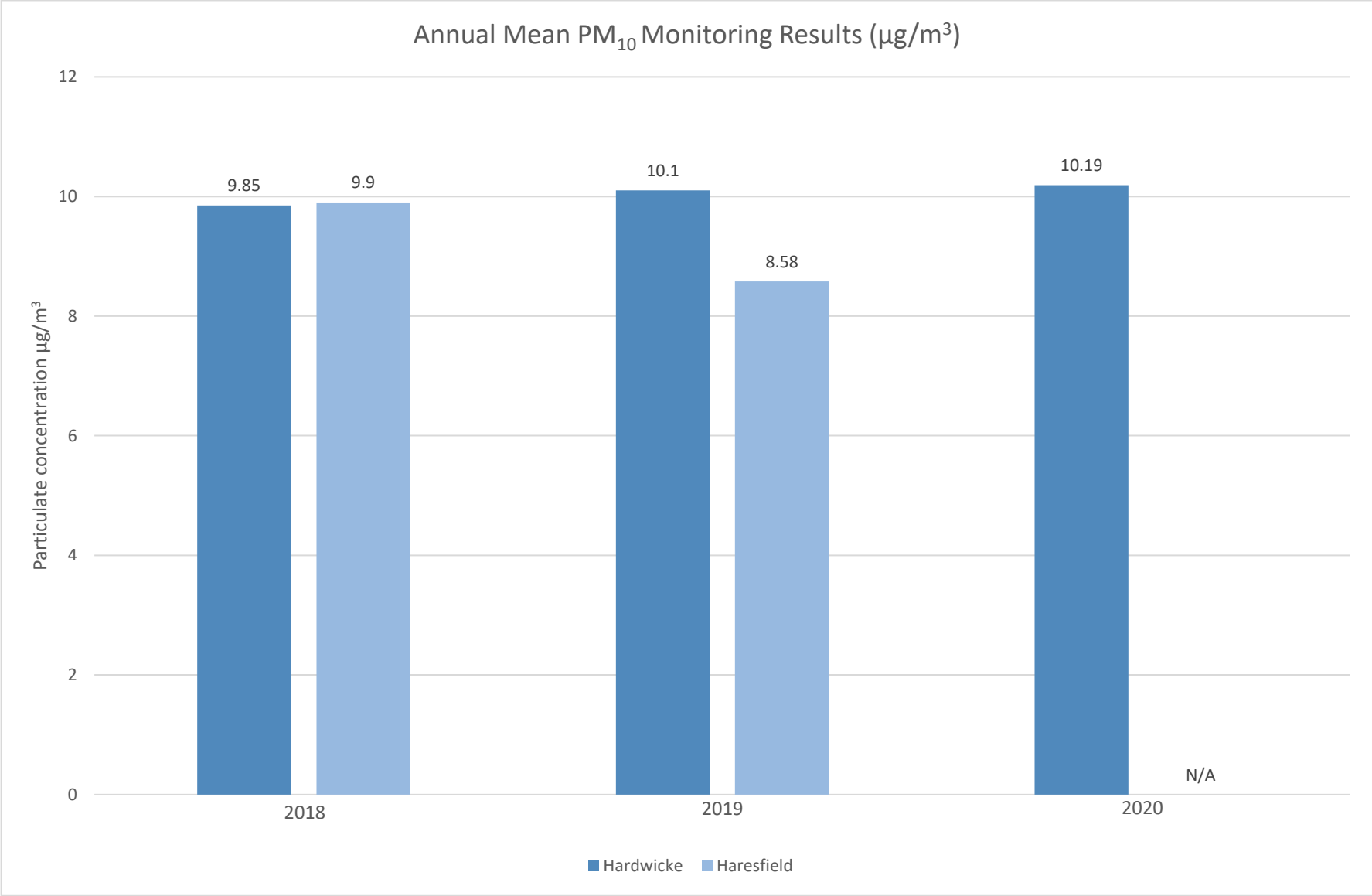


Table A.5 – 24-Hour Mean PM_{10} Monitoring Results, Number of PM_{10} 24-Hour Means > 50µg/m^3

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2020 (%) (2)	2016	2017	2018	2019	2020
Hardwicke	380203	212842	Suburban	N/A	41.8	**N/A**	**N/A**	0	0	0
Haresfield	381324	210015	Rural	N/A	0	**N/A**	**N/A**	0	0	**N/A**

Notes:

Results are presented as the number of 24-hour periods where daily mean concentrations greater than 50 µg/m^3 have been recorded.

Exceedances of the PM_{10} 24-hour mean objective (50 µg/m^3 not to be exceeded more than 35 times/year) are shown in **bold**.

If the period of valid data is less than 85%, the 90.4th percentile of 24-hour means is provided in brackets.

(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%).

Table A.6 – Annual Mean $PM_{2.5}$ Monitoring Results ($\mu g/m^3$)

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2020 (%) (2)	2016	2017	2018	2019	2020
Hardwicke	380203	212842	Suburban	N/A	41.8	N/A	N/A	7.14	6.4	6.16
Haresfield	381324	210015	Rural	N/A	0	N/A	N/A	7.16	5.82	N/A

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

Notes:

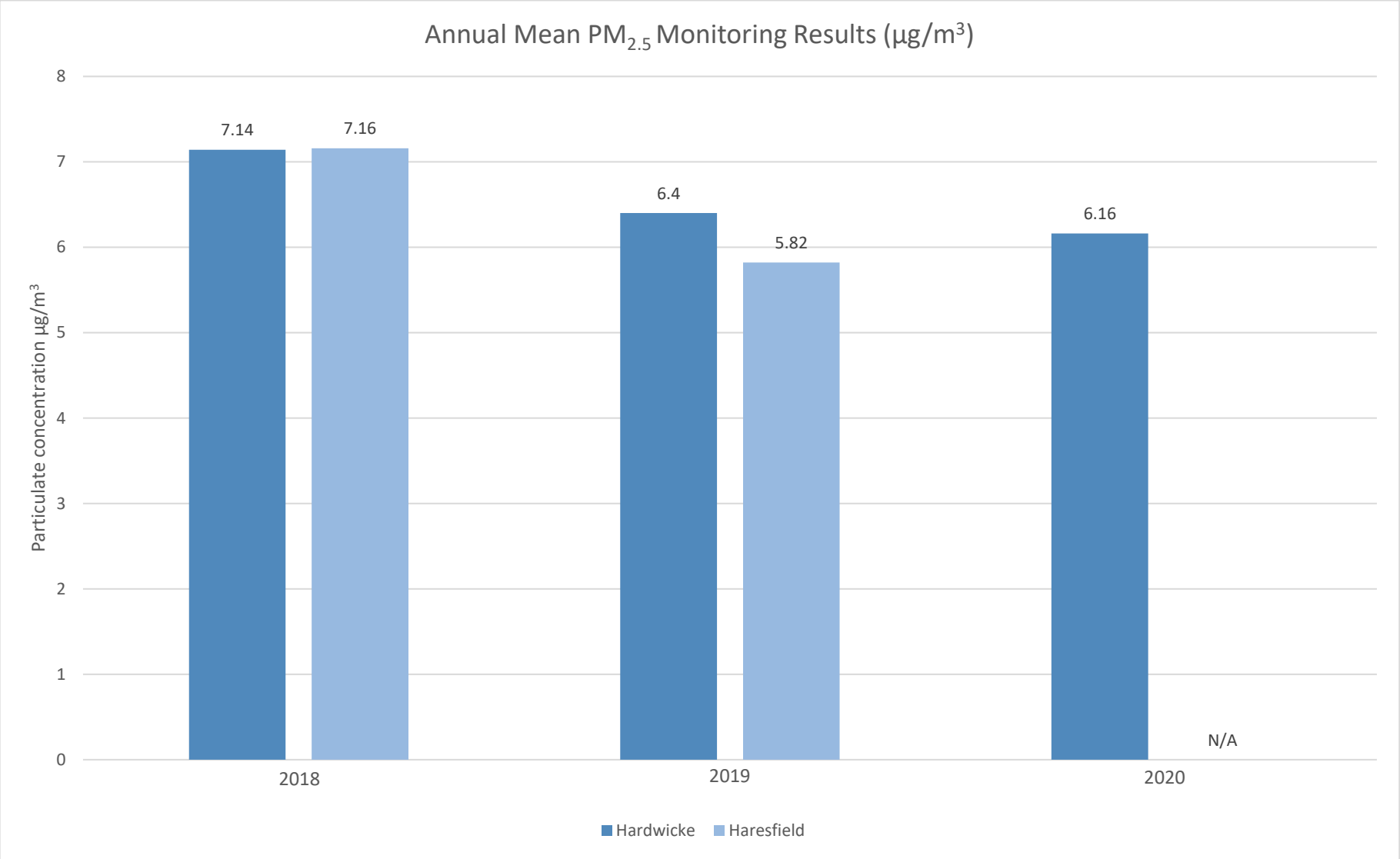
The annual mean concentrations are presented as $\mu g/m^3$.

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.

(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.3 – Trends in Annual Mean $PM_{2.5}$ Concentrations



Appendix B: Full Monthly Diffusion Tube Results for 2020

Table B.1 – NO_2 2020 Diffusion Tube Results ($\mu g/m^3$)

DT ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Easting)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Annualised and Bias Adjusted (x x)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
24	385023	199749	27.7	23.6					13.5	19.7	21.2	22.9	27.3	24.5	22.6	17.5		
25	386686	209781	40.7	33.4					27.6	25.0	33.7	30.4	39.1	37.0	33.4	25.9		
26	386740	209821	34.3	26.3					20.0	28.2	29.1	33.3	34.5	37.3	30.4	23.6		
27	385784	204367	47.1	41.1					33.1	38.3	38.4	40.4	39.4	40.7	39.8	30.9		
28	383652	204557	41.7	34.3					23.4	26.1	35.9	28.7	38.1	37.3	33.2	25.8		
29	383656	204551	43.0	36.4					25.3	38.5	38.8	41.7	43.2	40.1	38.4	29.8		
30	383659	204556	40.0	39.5					31.7	37.7	37.4	37.2	37.4	38.0	37.4	29.0		
31	383660	204555	42.7	41.0					29.4	36.9	36.9	35.5	36.1	36.1	36.8	28.6		
32	383676	204545	26.2	22.0					19.6	24.1	25.0	26.9	25.1	27.6	24.6	19.1		
33	383672	204538	28.7	22.0					21.4	26.2	26.4	26.2	26.6	28.1	25.7	20.0		
34	386301	215294	24.7	22.5					16.2	17.2	21.1	20.0	19.5	30.7	21.5	16.7		
35	380188	211951	43.6	36.3					26.6	30.8	30.5	33.9	34.0	31.6	33.4	25.9		
36	381140	212269	17.6						7.6	11.5	13.7	13.8	20.8	18.1	14.7	11.3		
37	380232	210421	23.3	18.5					12.0	16.8	19.5	19.7	25.6	21.9	19.7	15.3		
38	384448	204934	37.4	31.6					21.6	30.1	33.7	33.0	36.8	38.9	32.9	25.5		
39	383471	204988	28.5	21.4					13.7	20.2	23.6	22.9	29.0	40.8	25.0	19.4		
40	385529	204701	39.4	31.7					24.7	30.6	31.3	34.0	34.8	34.7	32.6	25.4		
41	382845	204720	37.3	29.4					18.6	20.8	24.3	25.8	29.4	34.4	27.5	21.4		
42	385009	205178	28.6	23.1					14.0	17.3	19.2	21.9	26.2	29.0	22.4	17.4		
43	385082	205398	57.1	40.6					27.6	34.7	32.6	35.6	36.9	33.4	37.3	29.0		
44	380548	205948	22.4	17.7					13.0	15.5	18.3	17.1	21.1	20.5	18.2	14.1		
45	381872	206279	11.4	8.1					6.0	7.5	8.0	9.1	12.6	10.4	9.1	7.1		
46	379342	208604	14.5	10.8					7.2	8.8	12.4	11.6	15.5	13.1	11.7	9.1		
47	380374	209112	14.3	10.4					8.0	9.7	12.6	12.7	14.9	13.2	12.0	9.3		
48	381349	210005	14.4	9.1					8.0	8.4	9.2	11.7	14.8	12.0	10.9	8.5		
49	382295	209217	12.4	7.6					8.5	8.5	10.4	8.6	13.0	11.1	10.0	7.8		
50	380110	211214	22.2	14.8					9.1	17.0	18.2	18.1	22.3	20.5	17.8	13.8		
51	380217	212821	20.2	12.1					7.1	10.9	12.9	13.4	21.7	20.5	14.8	11.5		
52	384991	205352	40.0	34.8	27.3	18.2	16.2	22.8	18.8	28.6	27.9	29.2	33.5	41.6	28.2	24.0		
53	384868	205260	47.8	50.3	35.1	20.2	20.3	28.1	31.2	28.3	39.2	40.0	41.1	38.4	35.0	29.7		
54	384389	205185	33.7	26.2	23.4	16.4	14.5	19.1	10.6	20.4	26.2	22.9	31.2	39.2	23.6	20.1		
55	385145	205414	35.4	34.2	26.2	12.5	13.7	19.6	19.2	23.6	25.6	28.5	27.9	29.2	24.6	20.9		
56	384934	205516	41.3	40.3	30.9	26.2	25.8	34.6	29.4	38.0	34.6	36.6	36.0	35.7	34.1	29.0		
57	384669	206344	28.1	23.9	15.9	11.6	13.6	18.6	18.9		22.4	23.2	25.8		20.2	17.2		
58	384717	205057	23.7	16.8	21.7	13.3	10.5	16.8	10.5	11.8	21.3	20.2	24.0	26.0	18.1	15.4		
59	384973	205152	25.5	20.5	17.4	9.1	8.8	12.2	12.6	13.1	17.2	18.4	23.6		16.2	13.8		
60	385112	205085	39.1	33.7	24.7	16.1	15.3	22.0	13.1	11.6	14.4	21.6	33.1	28.4	22.8	19.3		
61	385282	205159	24.9	18.8	14.4	11.7	10.2	13.7	10.3	14.6	16.3	17.1	24.2	25.1	16.8	14.3		

☒ **All erroneous data has been removed from the NO_2 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 has been distance corrected for relevant exposure in the final column.**

☒ **Stroud District Council confirm that all 2020 diffusion tube data has been uploaded to the Diffusion Tube Data Entry System.**

Notes:

Exceedances of the NO_2 annual mean objective of 40 µg/m^3 are shown in **bold**.

NO_2 annual means exceeding 60 µg/m^3, indicating a potential exceedance of the NO_2 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 Stroud district During 2020

Stroud District Council has not identified any significant new sources relating to air quality within the reporting year of 2021.

Additional Air Quality Works Undertaken by Stroud District Council During 2020

Stroud District Council has not completed any additional works within the reporting year of 2021.

QA/QC of Diffusion Tube Monitoring

The diffusion tubes that Stroud District Council uses for monitoring air quality in its district are prepared in 20% TEA in water. They are supplied and analysed by Somerset Scientific Services (SSS). To obtain laboratory accreditation to undertake analysis of diffusion tubes, SSS participates in an external laboratory scheme called the Air & Stack Emissions Scheme. This is a proficiency testing scheme operated through the Laboratory of the Government Chemist (LGC). It requires that SSS undertakes four rounds of testing per year which are confirmed as accurate before SSS can be ratified to undertake testing. All of SSS's proficiency tests this year have been returned as satisfactory. SSS is included in the annual field inter-comparison exercise from which the bias adjustment factor is obtained.

SSS analyses diffusion tubes using the colorimetry method. This method requires a solution to be added to the diffusion tubes so that the nitrite collected on the grids within the tubes is dissolved. The solution reacts with nitrite collected in the tube to produce a coloured compound. The intensity of the colour produced is then measured using spectrophotometry and is calibrated against a set of standard nitrite solutions to identify the concentration of nitrite present in the sample. The concentration is then used to

calculate the mass of nitrite collected by the tube from which an average ambient concentration of NO_2 is calculated for the exposure period.

Diffusion tube monitoring has been largely completed in adherence with the 2020 diffusion tube monitoring calendar with the exception of the months March – June when no tubes were removed and replaced as a result of the national and local lockdown.

Diffusion Tube Annualisation

As a result of the national lock down response to the Covid-19 pandemic, Stroud District Council was unable to complete collection and replacement of diffusion tubes in March, April, May and June of 2020 at twenty-eight of its thirty-eight monitoring locations. This meant that it was necessary to undertake annualisation of the data from the twenty-eight locations to produce an annual mean pollutant concentration. The remaining ten locations had captured sufficient data in order to not require any further action.

In conducting annualisation calculations in conjunction with the method set out in Local Air Quality Management Technical Guidance (LAQM.TG16), it was necessary to obtain NO_2 concentration data from relatively nearby continuous background monitoring sites. Ideally, these sites should be located within a radius of approximately 50 miles from the site to be estimated. For the locations requiring annualisation in 2020, data was obtained from three automatic urban background monitoring sites at Oxford St Ebbes, Swindon Walcot and Bristol St Paul's.

Diffusion Tube Bias Adjustment Factors

The diffusion tube data presented within the 2021 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.

Stroud District Council has applied a national bias adjustment factor of 0.85 to the 2020 monitoring data. A summary of bias adjustment factors used by Stroud District Council over the past five years is presented in Table C.1.

As Stroud District Council does not operate any automatic NO_2 monitoring locations, it was unable to undertake its own triplicate co-location studies in order to determine a local bias factor. Therefore, it was necessary to choose a national bias adjustment factor. The factor chosen by Stroud District Council to use for the correction of the diffusion tube data was 0.85, as per Table C.1. This factor arises from SSS laboratory data utilising 10 studies to produce the overall factor and was obtained from version 09/21 of the national spreadsheet.

Table C.1 – Bias Adjustment Factor

Year	Local or National	If National, Version of National Spreadsheet	Adjustment Factor
2020	National	09/21	0.85
2019	National	03/20	0.78
2018	National	03/19	0.89
2017	National	06/18	0.77
2016	National	06/17	0.88

NO_2 Fall-off with Distance from the Road

Wherever possible, local authorities should ensure that monitoring locations are representative of exposure. However, where this is not possible, the NO_2 concentration at the nearest location relevant for exposure should be estimated using the Diffusion Tube Data Processing Tool/NO_2 fall-off with distance calculator available on the LAQM Support website. Where appropriate, non-automatic annual mean NO_2 concentrations corrected for distance are presented in Table B.1.

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

QA/QC of Automatic Monitoring

As a result of concern about emissions from an Energy from Waste plant, which commenced operations in July 2019, a Community Liaison Group (CLG) was set up on behalf of residents in the local area. The CLG obtained two particulate matter monitors, which were located in areas of potential exposure, and Stroud District Council provides support by acting as the local site operator. Stroud District Council downloads the data on

a monthly basis and changes the filters on behalf of the CLG. The data accrued is not available live but historic data can be obtained at: https://clgglos.wixsite.com/data.

The equipment is supposed to be serviced and calibrated on an annual basis. Unfortunately, due to the national and local lockdown response to the Covid-19 pandemic, the equipment was not serviced and calibrated in time and one monitor was inoperable for the whole year and the other was inoperable for 7 months. As the equipment had not been calibrated, the five-month period of data obtained from it cannot be ratified and should be viewed as indicative only.

PM_{10} and $PM_{2.5}$ Monitoring Adjustment

The type of PM_{10}/$PM_{2.5}$ monitors utilised within Stroud district do not require the application of a correction factor.

Automatic Monitoring Annualisation

Given that one monitor provided data over a five-month period only, it was necessary to undertake annualisation calculations in conjunction with the method set out in Box 7.9 of LAQM.TG16. This required particulate matter concentration data from nearby continuous background monitoring sites. Ideally, these sites should be located within a radius of approximately 50 miles from the site to be estimated. The data was obtained from two automatic urban background monitoring sites at Oxford St Ebbes and Bristol St Paul's.

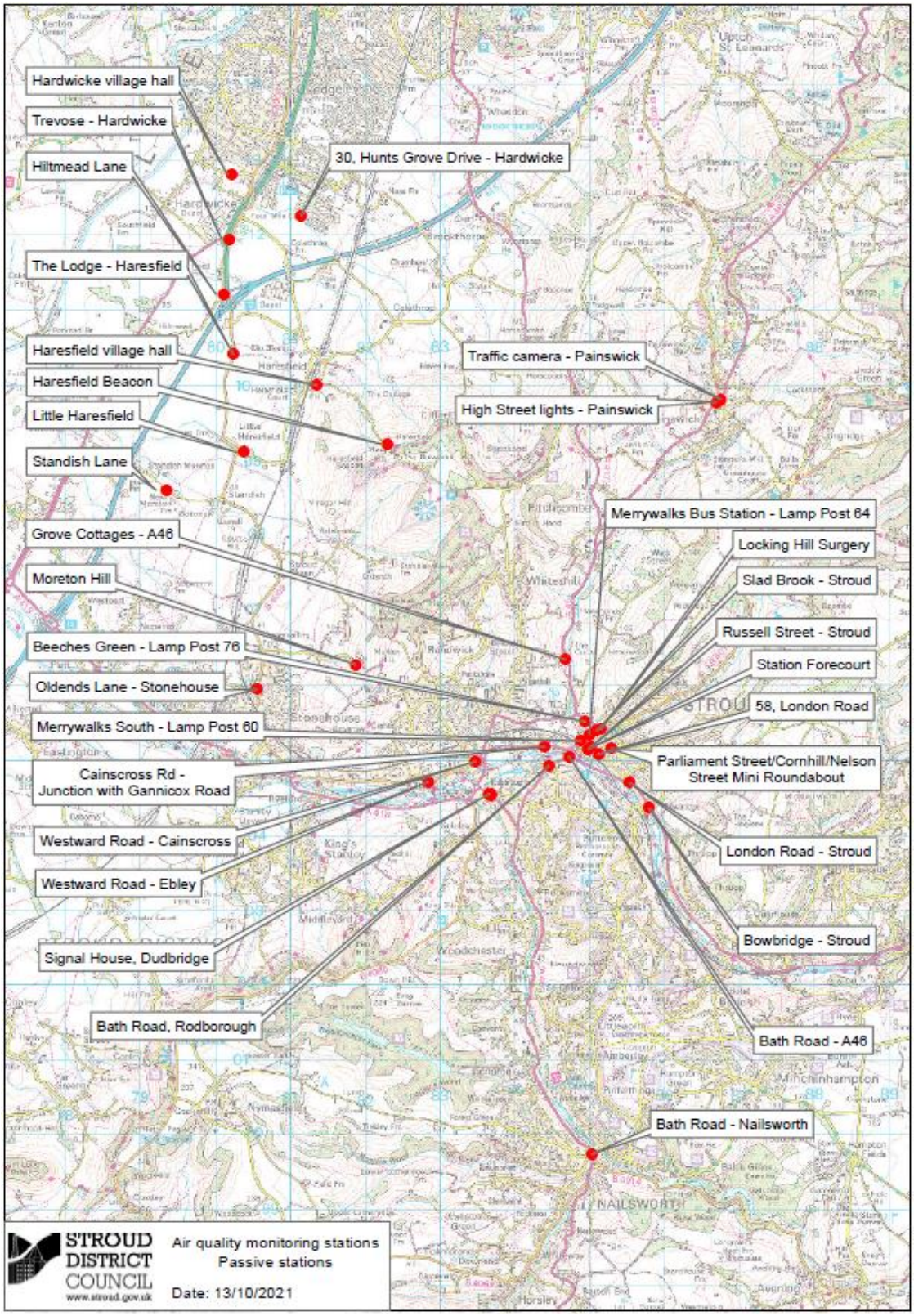
The method required that an annual mean was obtained from the Oxford St Ebbes and Bristol St Paul's sites as well as the calculation of a period mean covering the period that data was obtained from the monitor on the Stroud district at Hardwicke. From this, a ratio is calculated, which is averaged and then applied to the period mean for the Hardwicke data. This is demonstrated in Table C.2.

Table C.2 – Annualisation Summary (concentrations presented in µg/m^3)

Site ID	Annualisation Factor Swindon Walcot	Annualisation Factor Bristol St Paul's	Annualisation Factor Oxford St Ebbes	Annualisation Factor Site 4 Name	Average Annualisation Factor	Raw Data Annual Mean	Annualised Annual Mean	Comments
24	0.9301	0.8953	0.9162		0.9139	22.6	20.6	
25	0.9301	0.8953	0.9162		0.9139	33.4	30.5	
26	0.9301	0.8953	0.9162		0.9139	30.4	27.8	
27	0.9301	0.8953	0.9162		0.9139	39.8	36.4	
28	0.9301	0.8953	0.9162		0.9139	33.2	30.3	
29	0.9301	0.8953	0.9162		0.9139	38.4	35.1	
30	0.9301	0.8953	0.9162		0.9139	37.4	34.1	
31	0.9301	0.8953	0.9162		0.9139	36.8	33.6	
32	0.9301	0.8953	0.9162		0.9139	24.6	22.5	
33	0.9301	0.8953	0.9162		0.9139	25.7	23.5	
34	0.9301	0.8953	0.9162		0.9139	21.5	19.6	
35	0.9301	0.8953	0.9162		0.9139	33.4	30.5	
36	0.9147	0.8870	0.9078		0.9031	14.7	13.3	
37	0.9301	0.8953	0.9162		0.9139	19.7	18.0	
38	0.9301	0.8953	0.9162		0.9139	32.9	30.1	
39	0.9301	0.8953	0.9162		0.9139	25.0	22.9	
40	0.9301	0.8953	0.9162		0.9139	32.6	29.8	
41	0.9301	0.8953	0.9162		0.9139	27.5	25.1	
42	0.9301	0.8953	0.9162		0.9139	22.4	20.5	
43	0.9301	0.8953	0.9162		0.9139	37.3	34.1	
44	0.9301	0.8953	0.9162		0.9139	18.2	16.6	
45	0.9301	0.8953	0.9162		0.9139	9.1	8.3	
46	0.9301	0.8953	0.9162		0.9139	11.7	10.7	
47	0.9301	0.8953	0.9162		0.9139	12.0	10.9	
48	0.9301	0.8953	0.9162		0.9139	10.9	10.0	
49	0.9301	0.8953	0.9162		0.9139	10.0	9.2	
50	0.9301	0.8953	0.9162		0.9139	17.8	16.2	
51	0.9301	0.8953	0.9162		0.9139	14.8	13.6	
Hardwicke PM_{10}	1.04	0.97			1.005	10.14	10.19	Raw data annual mean is actually the period mean as per Box 7.9
Hardwicke $PM_{2.5}$	1.0	1.01			1.005	6.13	6.16	Raw data annual mean is actually the period mean as per Box 7.9

Appendix D: Maps of Monitoring Locations

Figure D.1 – Map of Non-Automatic Monitoring Sites



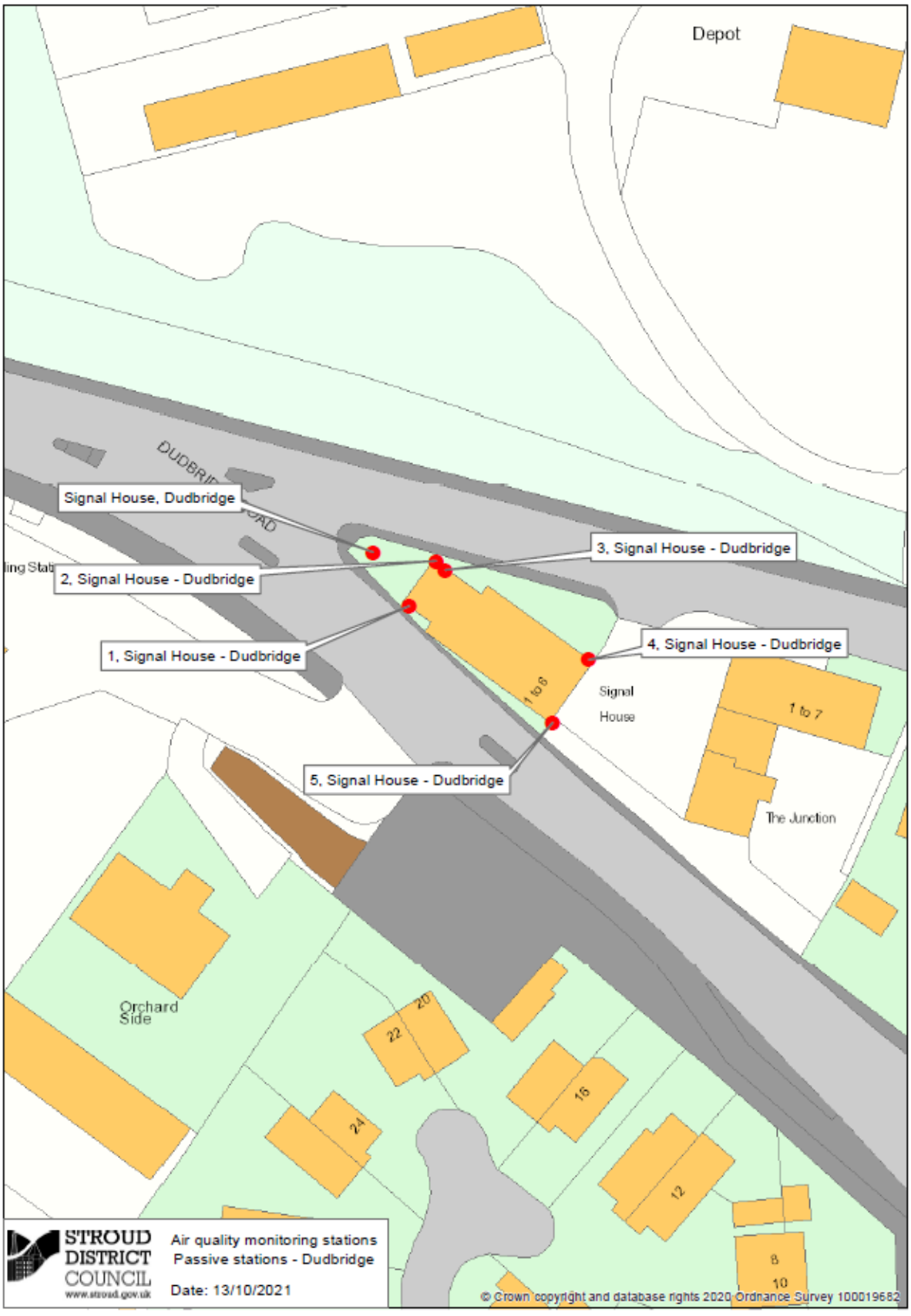

Depot
Signal House, Dudbridge
3, Signal House - Dudbridge
2, Signal House - Dudbridge
1, Signal House - Dudbridge
4, Signal House - Dudbridge
5, Signal House - Dudbridge
1 to 6
Signal House
1 to 7
The Junction
Orchard Side
20
22
24
16
12
8
10
STROUD DISTRICT COUNCIL
www.stroud.gov.uk
Air quality monitoring stations
Passive stations - Dudbridge
Date: 13/10/2021
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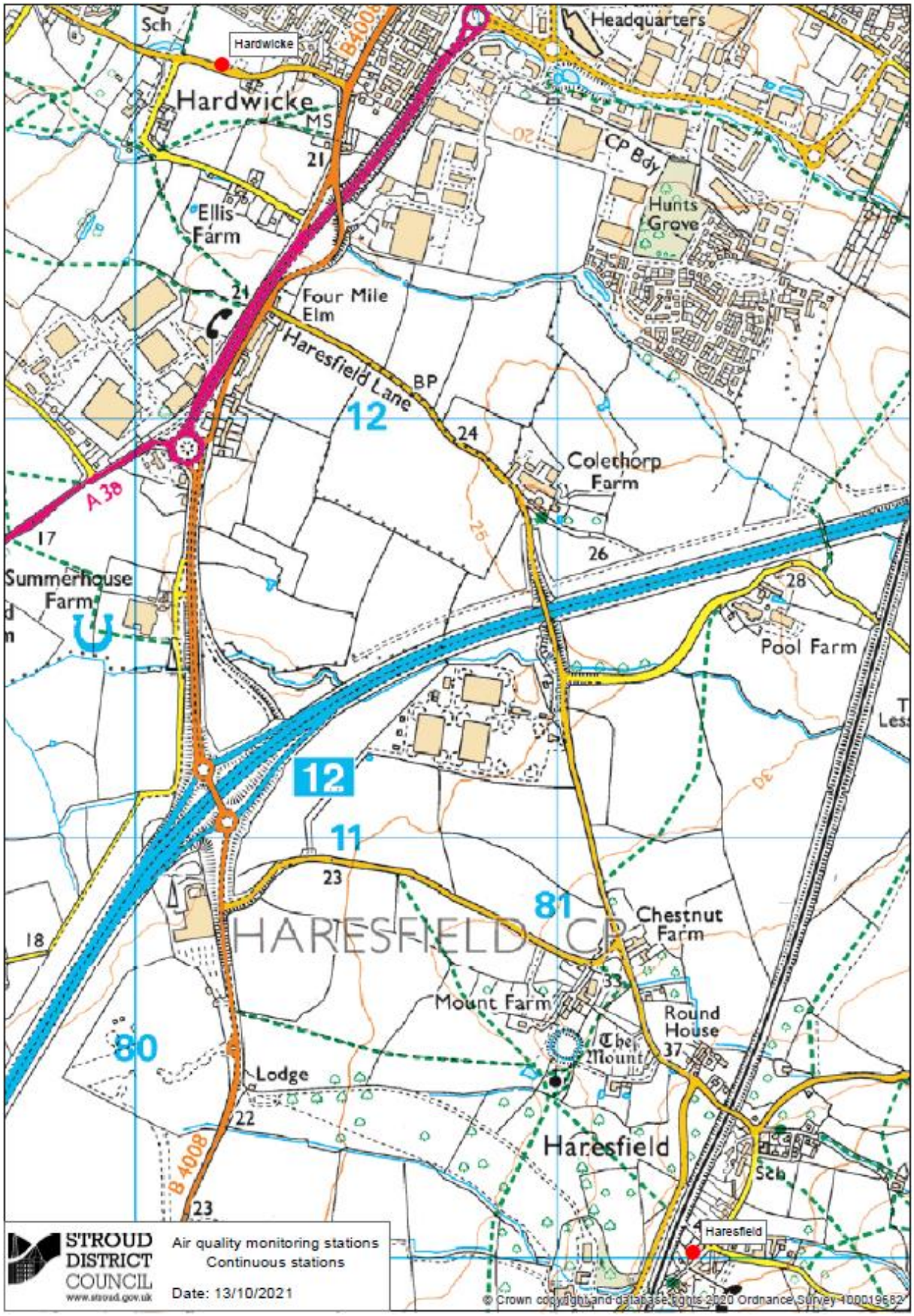
Figure D.2 – Map of Automatic Monitoring Sites



Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England[7]

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

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

Appendix F: Impact of COVID-19 upon LAQM

COVID-19 has had a significant impact on society. Inevitably, COVID-19 has also had an impact on the environment, with implications to air quality at local, regional and national scales.

COVID-19 has presented various challenges for Local Authorities with respect to undertaking their statutory LAQM duties in the 2021 reporting year. Recognising this, DEFRA provided various advice updates throughout 2020 to English authorities, particularly concerning the potential disruption to air quality monitoring programmes, implementation of Air Quality Action Plans (AQAPs) and LAQM statutory reporting requirements. DEFRA has also issued supplementary guidance for LAQM reporting in 2021 to assist local authorities in preparing their 2021 ASR. Where applicable, this advice has been followed.

Despite the challenges that the pandemic has given rise to, the events of 2020 have also provided Local Authorities with an opportunity to quantify the air quality impacts associated with wide-scale and extreme intervention, most notably in relation to emissions of air pollutants arising from road traffic. The vast majority (>95%) of AQMAs declared within the UK are related to road traffic emissions, where attainment of the annual mean objective for nitrogen dioxide (NO_2) is considered unlikely. On 23rd March 2020, the UK Government released official guidance advising all members of public to stay at home, with work-related travel only permitted when absolutely necessary. During this initial national lockdown (and to a lesser extent other national and regional lockdowns that followed), marked reductions in vehicle traffic were observed; Department for Transport (DfT) data[8] suggests reductions in vehicle traffic of up to 70% were experienced across the UK by mid-April, relative to pre COVID-19 levels.

This reduction in travel in turn gave rise to a change of air pollutant emissions associated with road traffic, i.e. nitrous oxides (NO_x), and exhaust and non-exhaust particulates (PM). The Air Quality Expert Group (AQEG)[9] has estimated that during the initial lockdown period in 2020, within urbanised areas of the UK, reductions in NO_2 annual mean

[8] Prime Minister's Office, COVID-19 briefing on the 31st of May 2020

[9] Air Quality Expert Group, Estimation of changes in air pollution emissions, concentrations and exposure during the COVID-19 outbreak in the UK, June 2020

concentrations were between 20 and 30% relative to pre-pandemic levels, which represents an absolute reduction of between 10 to 20 µg/m^3 if expressed relative to annual mean averages. During this period, changes in $PM_{2.5}$ concentrations were less marked than those of NO_2. $PM_{2.5}$ concentrations are affected by both local sources and the transport of pollution from wider regions, often from well beyond the UK. Through analysis of AURN monitoring data for 2018-2020, AQEG have detailed that $PM_{2.5}$ concentrations during the initial lockdown period are of the order 2 to 5 µg/m^3 lower relative to those that would be expected under business-as-usual conditions.

As restrictions are gradually lifted, the challenge is to understand how these air quality improvements can benefit the long-term health of the population.

Impacts of COVID-19 on Air Quality within Stroud District

Whilst there were no measureable impacts as a consequence of Covid-19 upon air quality within Stroud district, it is noted that NO_2 concentrations have decreased in comparison to those reported in the 2020 ASR despite the 2021 bias adjustment factor (0.85) being higher than the 2020 bias adjustment factor (0.78). Therefore, it is considered likely that Covid-19 has had a positive impact on air quality across all Stroud District Council monitoring locations.

Opportunities Presented by COVID-19 upon LAQM within Stroud District

No LAQM related opportunities have arisen as a consequence of Covid-19 within Stroud district.

Challenges and Constraints Imposed by COVID-19 upon LAQM within Stroud District

During 2020, due to national and local restrictions imposed as a result of the Covid-19, it was not possible to maintain diffusion tube exposure periods for March to June in line with the national monitoring calendar for a number of sites. This affected data capture and resulted in data from monitoring locations having to be annualised. This represents a **Small Impact.**

Due to the national and local restrictions imposed as a result of the Covid-19, it was not possible for the CLG to get the particulate monitors operational and serviced. This restricted data capture to 41% at Hardwicke, which is a **Medium Impact.** Overall, in combination with Haresfield, data capture amounts to 21%; a **Large Impact.**

Table F 1 – Impact Matrix

Category	Impact Rating: None	Impact Rating: Small	Impact Rating: Medium	Impact Rating: Large
Automatic Monitoring – Data Capture (%)	More than 75% data capture	50 to 75% data capture	25 to 50% data capture	Less than 25% data capture
Automatic Monitoring – QA/QC Regime	Adherence to requirements as defined in LAQM.TG16	Routine calibrations taken place frequently but not to normal regime. Audits undertaken alongside service and maintenance programmes	Routine calibrations taken place infrequently and service and maintenance regimes adhered to. No audit achieved	Routine calibrations not undertaken within extended period (e.g. 3 to 4 months). Interruption to service and maintenance regime and no audit achieved
Passive Monitoring – Data Capture (%)	More than 75% data capture	50 to 75% data capture	25 to 50% data capture	Less than 25% data capture
Passive Monitoring – Bias Adjustment Factor	Bias adjustment undertaken as normal	<25% impact on normal number of available bias adjustment colocation studies (2020 vs 2019)	25-50% impact on normal number of available bias adjustment studies (2020 vs 2019)	>50% impact on normal number of available bias adjustment studies (2020 vs 2019) and/or applied bias adjustment factor studies not considered representative of local regime
Passive Monitoring – Adherence to Changeover Dates	Defra diffusion tube exposure calendar adhered to	Tubes left out for two exposure periods	Tubes left out for three exposure periods	Tubes left out for more than three exposure periods
Passive Monitoring – Storage of Tubes	Tubes stored in accordance with laboratory guidance and analysed promptly.	Tubes stored for longer than normal but adhering to laboratory guidance	Tubes unable to be stored according to be laboratory guidance but analysed prior to expiry date	Tubes stored for so long that they were unable to be analysed prior to expiry date. Data unable to be used
AQAP – Measure Implementation	Unaffected	Short delay (<6 months) in development of a new AQAP, but is on-going	Long delay (>6 months) in development of a new AQAP, but is on-going	No progression in development of a new AQAP
AQAP – New AQAP Development	Unaffected	Short delay (<6 months) in development of a new AQAP, but is on-going	Long delay (>6 months) in development of a new AQAP, but is on-going	No progression in development of a new AQAP

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 Highways England
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

- Local Air Quality Management Technical Guidance LAQM.TG16. April 2021. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.
- Local Air Quality Management Policy Guidance LAQM.PG16. May 2016. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.