2023 Air Quality Annual Status Report (ASR)

In fulfilment of Part IV of the Environment Act 1995 Local Air Quality Management, as amended by the Environment Act 2021

Date: June, 2023

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Executive Summary: Air Quality in Our Area

Air Quality in Bristol

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 29,000 to 43,000 deaths at typical ages[3], with a total estimated healthcare cost to the NHS and social care of £157 million in 2017[4] in England.

Bristol is a city, unitary authority area and ceremonial county in Southwest England, 105 miles (169 km) west of London, and 44 miles (71 km) east of Cardiff. It has an estimated population of 472,400[5] for the unitary authority at present. Within England and Wales, it is the 8th largest city and the 11th largest local authority.

The main pollutants of concern within Bristol are nitrogen dioxide (NO_2) and particulate matter (PM). Monitoring in Bristol shows that we are currently in breach of the annual objective for nitrogen dioxide, set at 40µg/m^3.

No exceedances of objectives for particulate matter were measured in 2022, however, monitoring of particulates in the city is limited so it is possible that exceedance of objectives occurs in some isolated areas.

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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, January 2023

[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

[5] ONS 2021 Mid-Year Population Estimate

Health Impacts

Air pollution has negative impacts on the health of people in Bristol, especially vulnerable members of the population. Evidence suggests that it can cause permanent lung damage in babies and young children[6] and exacerbates lung and heart disease in older people[7].

Air pollution has negative effects on health throughout the life course, from pre-birth to old age, summarised in Table 0.1. Some individuals such as those with pre-existing respiratory or cardiovascular disease are particularly susceptible, but the effects of air pollution can be seen across the population. Many people suffer avoidable chronic ill health as a result of it. Improvements in air quality have been associated with improved health outcomes – for example, reductions in air pollution in London have led to reduced childhood asthma hospital admissions. Further reductions in air pollution will lead to significant reductions in coronary heart disease, stroke and lung cancer, among others[8].

Table 0.1 – Health Effects of Air Pollution Throughout Life[8]

Pregnancy	Children	Adults	Elderly
Low birth weight	Asthma	Asthma	Asthma
	Slower lung function development	Coronary heart disease	Accelerated decline in lung function
	Development problems	Stroke	Lung cancer
	More wheezing and coughs	Lung cancer	Diabetes
	Start of atherosclerosis (narrowing of arteries)	Chronic obstructive pulmonary disease (COPD)	Dementia
		Diabetes	Heart attack, heart failure and stroke

[6] Royal College of Pediatrics and Child Health, Every Breath We Take – The lifelong impact of air pollution, February 2016

[7] Simoni et al., Adverse effects of outdoor pollution in the elderly, Journal of Thoracic Disease, January 2015

[8] Chief Medical Officer's Annual Report 2022 (publishing.service.gov.uk)

A 2017 report into the health effects of air pollution in Bristol concluded that around 300 premature deaths each year in the City of Bristol can be attributed to exposure to nitrogen dioxide (NO_2) and fine particulate matter ($PM_{2.5}$), with roughly an equal number attributable to both pollutants. This represents about 8.5% of deaths in the administrative area of Bristol being attributable to air pollution[9]. It should be noted that the baseline year for the study into the health impacts of air pollution was 2013. Whilst NO_2 pollution at roadside locations has fallen significantly since that date, the change in background levels of NO_2 and $PM_{2.5}$ pollution, on which figures are calculated, have not seen such a significant fall.

In the UK, for both NO_2 and PM pollution, the current targets are significantly higher than the World Health Organisations health based guideline values for these pollutants.

In September 2021 the WHO revised their air pollution guidelines based on the latest available health evidence. The annual guideline value for NO_2 was revised to 10µg/m^3 as the evidence illustrated health impacts down to this concentration. The current UK objective for this pollutant is 40µg/m^3. In the 2022 UK revision of air pollution regulations no change was made to the NO_2 target, with the focus being on changes to fine particulate matter ($PM_{2.5}$).

The annual WHO guideline value for $PM_{2.5}$ is 5µg/m^3. In 2022 The UK government announced a new annual objective for $PM_{2.5}$ of 10µg/m^3 to be achieved by 2040 with a new interim target of 12 µg/m^3 to be achieved by 2028.

The WHO guideline value for PM_{10} is 15µg/m^3, the current UK annual objective for PM_{10} is 40µg/m^3.

In addition to the revised UK annual $PM_{2.5}$ targets, an exposure reduction target to reduce population exposure to $PM_{2.5}$ pollution by 35% by 2040 has been introduced. This is accompanied by an interim pollution exposure reduction target of a 22% reduction by 2028. Both are calculated from a 2018 baseline[10].

Whilst there is no legal requirement to meet the WHO guideline values in the UK, when discussing pollution and the health impacts, these guideline values illustrate the importance of continuing to reduce air pollution levels below those required to meet current UK air pollution targets.

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[9] Air Quality Consultants, Health Impacts of Air Pollution in Bristol, February 2017

[10] Environmental Improvement Plan (publishing.service.gov.uk)

Monitoring

Pollutants such as sulphur dioxide, carbon monoxide and some heavy metals used to be monitored in Bristol, however, this has ceased as compliance with health-based air quality objectives for these pollutants has been demonstrated. Extensive monitoring of nitrogen dioxide continues throughout the city. Nitrogen dioxide concentrations have demonstrated an improving trend since 2010; however, exceedances of objectives for this pollutant were still measured widely in the city in 2022.

Air Quality Management Areas (AQMAs) are declared when there is an exceedance or likely exceedance of an air quality objective. Further information related to declared AQMAs can be found on the Defra website, including maps of AQMA boundaries.

Due to exceedance of the annual and hourly objectives for NO_2 and possible exceedance of PM_{10} objectives, Bristol City Council declared an AQMA in 2001. It covers the whole of the city centre and most of the main arterial routes into the city. Due to ongoing exceedances of national pollution objectives, the AQMA is still in place in 2023. Approximately 100,000 people live within Bristol's AQMA. It includes the central employment, leisure and shopping districts, major hospitals, and dozens of schools and therefore many more people are exposed to air pollution in the AQMA in their daily lives than just those living in the AQMA. There are also two small AQMAs in South Gloucestershire, in Kingswood\Warmley and Staple Hill.

Bristol's monitoring network is focused on nitrogen dioxide (NO_2), as the concentrations of this pollutant near busy roads exceed the health-based UK objectives and EU limit values.

The Bristol City Council and Defra monitoring network in 2022 consisted of:

- 8 real time NO_2 monitors, 7 of which are BCC operated, the site at St Paul's is part of the national Automatic Urban and Rural Network operated by Defra. Data from all of these sites is uploaded automatically to a BCC Open Data Portal
- 4 real time particulate monitors (2 x $PM_{2.5}$ and 2 x PM_{10}).
- 1 real time Defra operated Ozone (O_3) monitor.
- 193 NO_2 diffusion tubes which provide a monthly and annual concentration for this pollutant.

Defra operate the Bristol St Paul's monitoring site which measures NO_2, particulate matter (PM_{10} and $PM_{2.5}$) and O_3. This site is in St Pauls at an "urban background" location away from busy roads. This Defra site is representative of general pollution levels over central Bristol but not of pollution levels at busy roadside locations in the city. Defra operate the PM_{10} monitor at the Temple Way site which also houses a BCC operated NO_2 analyser. This is known as an affiliate site where Defra and the Local Authority share infrastructure that houses monitoring equipment. All other sites are owned and operated by Bristol City Council.

Nitrogen Dioxide

The air quality data has shown that on average, NO_2 pollution levels were similar in 2022 when compared to 2021, however, some sites saw increases in pollution, whilst other saw a drop. 106 sites out of 182, that had data collected for both years, showed a reduction in annual NO_2 concentrations. The average change in measured annual NO_2 concentrations between 2021 and 2022 was a 0.7% decrease in annual NO_2 levels. Details of the locations where either a greater than 4µg/m^3 increase or decrease in annual NO_2 concentrations were measured, when comparing 2022 to 2021 concentrations, are shown in Figure 0.3 and Figure 0.4. This illustrates the complex nature of air pollution and factors influencing annual variations. The largest increases and decreases were observed at locations across the city, with relatively large increases occurring close to sites that recorded relatively large decreases in pollution levels in 2022 when compared to 2021.

It should be remembered when comparing air pollution data from one year to the next that prevailing meteorological conditions can be one of the largest factors impacting on the measured differences annually between pollution levels. Longer term trends, over 5 years for example, can help to account for these annual variations as a result of meteorological conditions. Other factors that impact roadside NO_2 pollution levels include overall traffic volumes, vehicle fleet composition and emissions and local dispersion characteristics that can be influenced by things like buildings, walls, and trees.

The number of vehicles on the roads, which are the main source of NO_2 pollution at our roadside monitoring locations, were significantly reduced on average during 2020 and 2021 due to Covid-19 restrictions. In 2022 however, levels of vehicle movements returned to similar levels as those experienced pre pandemic, in 2019.

The change between 2022 and 2021 roadside NO_2 concentrations in Bristol is similar to the national trend which was a slight decrease when compared to 2021. The national trend, when comparing 2022 roadside NO_2 concentrations to pre pandemic 2019 levels, is for a 24% reduction[11]. The data for Bristol shows a smaller reduction at BCC roadside monitoring locations, of 14.2% over this period. Figure 0.1 shows the long-term trends in NO_2 concentrations at a selection of city centre monitoring sites. Monitoring at Rupert Street was stopped due to the change in road layout associated with the Metrobus works. The plot shows that NO_2 levels fell from 2010 to 2020 at all monitoring sites. Whilst many still exceeded objectives in 2019, 2020 was the first year in which all the sites shown achieved compliance with annual NO_2 objectives. The reduction in pollution and subsequent compliance with objectives in 2020 was a result of Covid-19 travel restrictions. In 2021, as travel restrictions were lifted, pollution levels increased accordingly. In 2022, one of the selected central sites measured annual NO_2 pollution levels that exceeded the objective. As part of the CAZ monitoring, additional sites have been added to the monitoring network for which long terms trends cannot be shown. A number of these showed monitored pollution levels that exceed the air quality objective for NO_2 in 2022. More detail will be provided on the pollutant concentrations at these newer monitoring sites in this report.

In those locations that exceed the nitrogen dioxide air quality objectives, over 80% of this pollution has been shown to be from local traffic sources. Actions and decisions by BCC, other West of England (WoE) authorities and the decisions that citizens in the WoE make each day, with regards to how they move around the area, all directly impact upon the roadside levels of air pollution in the city.

[11] Nitrogen dioxide (NO2) - GOV.UK (www.gov.uk)

Figure 0.1 - Trends in Annual NO_2 at City Centre Sites (2010-2022)

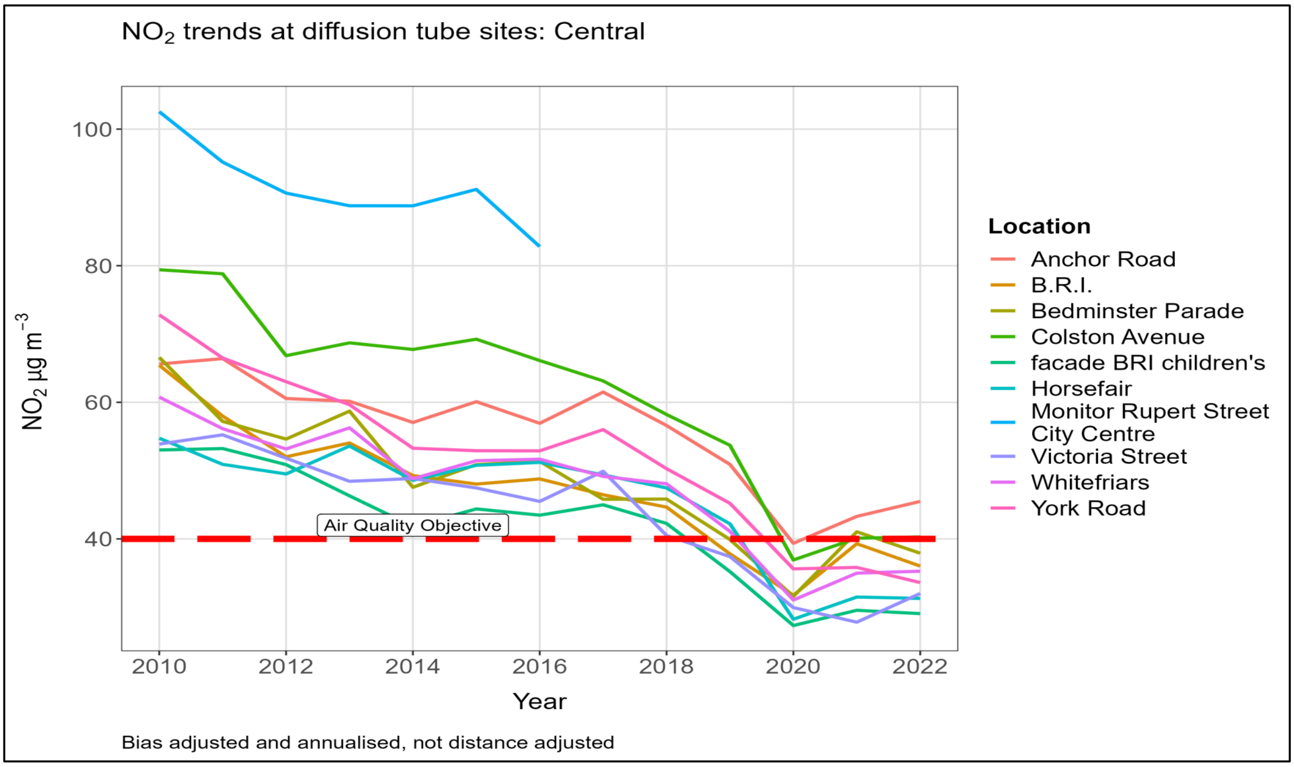


Figure 0.2 shows the locations in which monitored pollution concentrations exceed 36µg/m^3. 36µg/m^3 has been used to account for diffusion tube monitoring uncertainty. It should be noted that these are monitoring concentration and not the concentrations at relevant receptor locations as defined in the LAQM TG16 (e.g., facades of houses, schools, elderly people's homes, and hospitals).

Figure 0.2 - Monitoring Locations Where 2022 Annual NO_2 ≥ 36µg/m^3

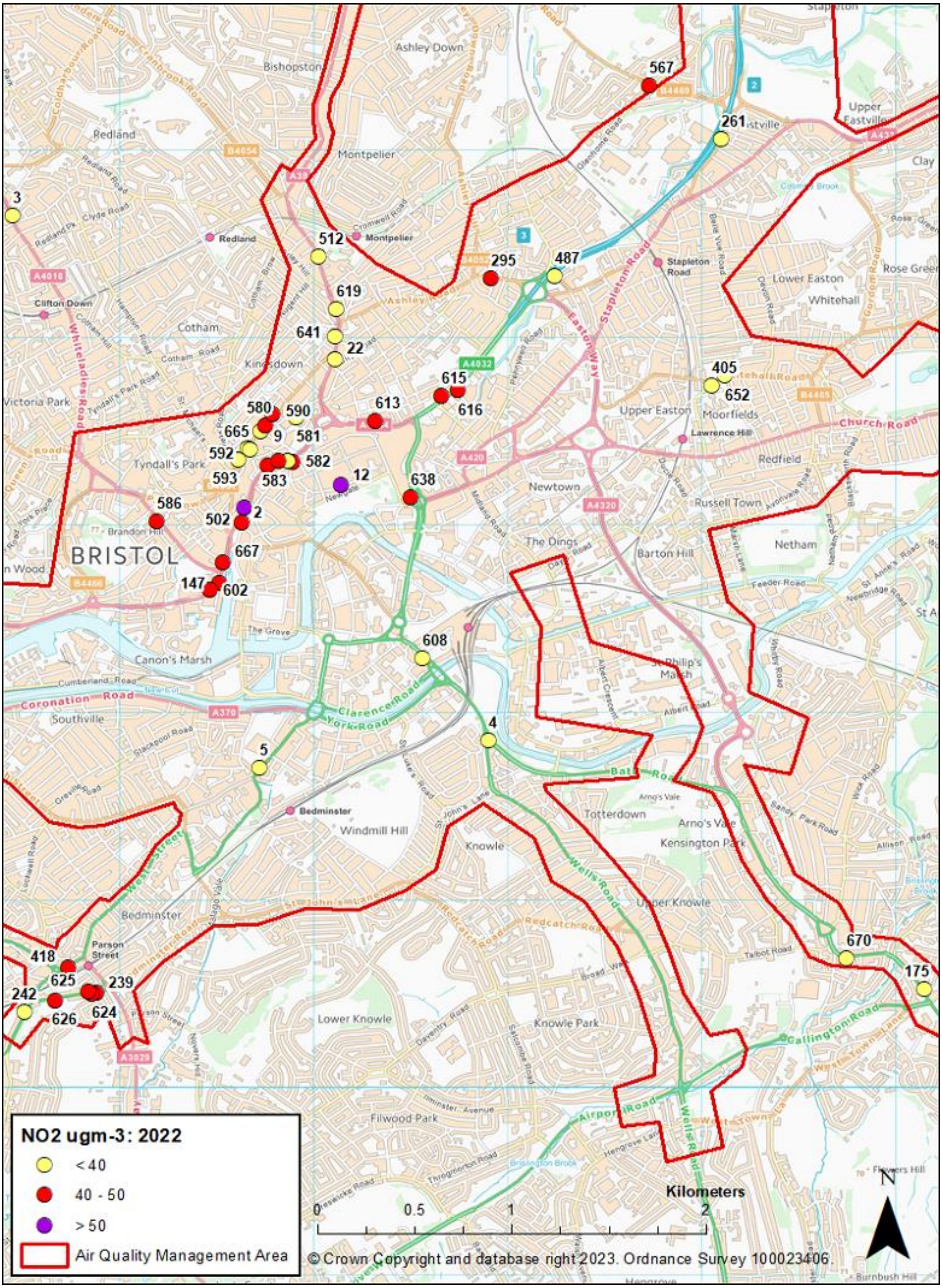


Figure 0.3 – Monitoring Locations with a > 4µg/m³ Increase in Annual NO_2 in 2022 Compared to 2021

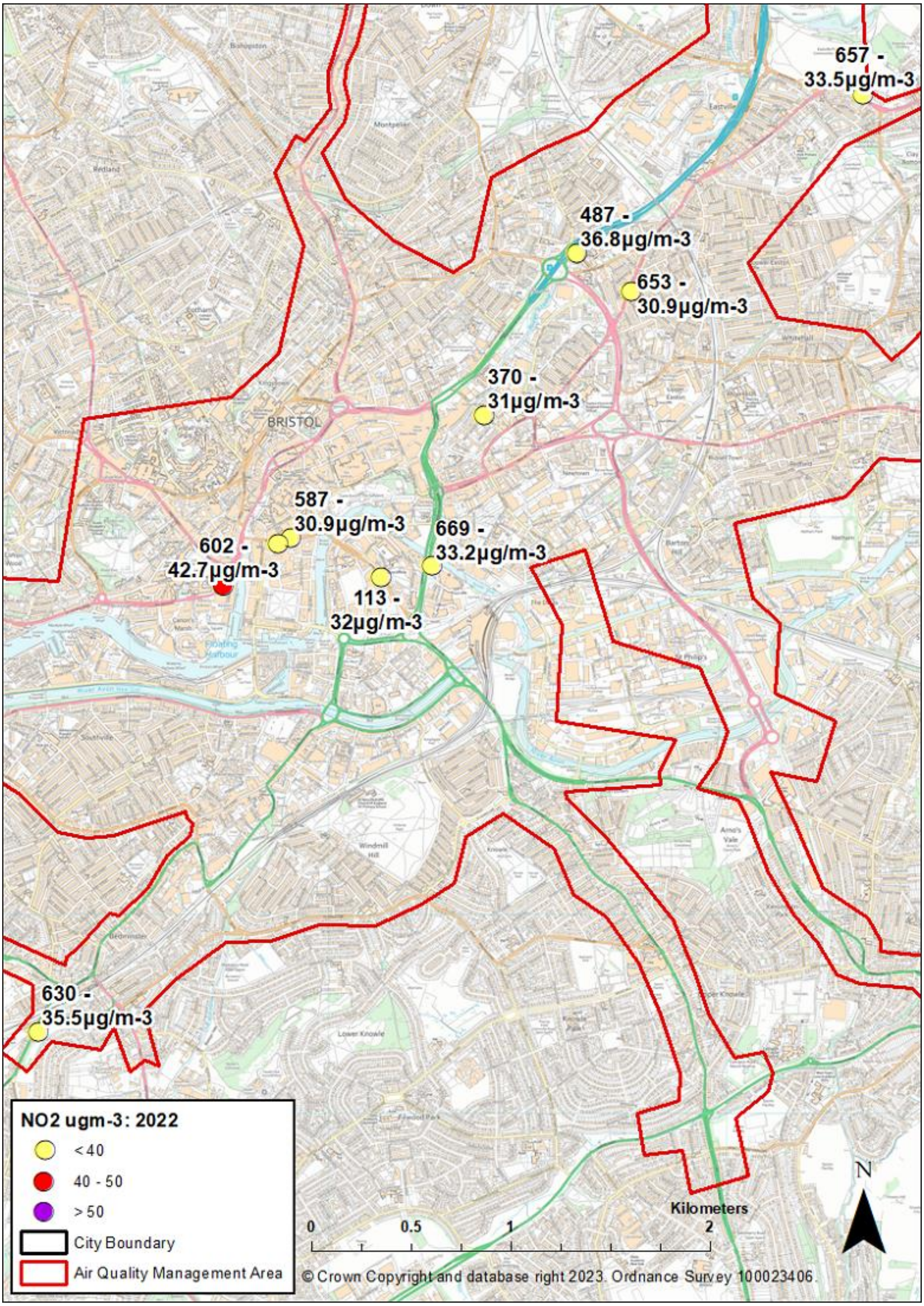
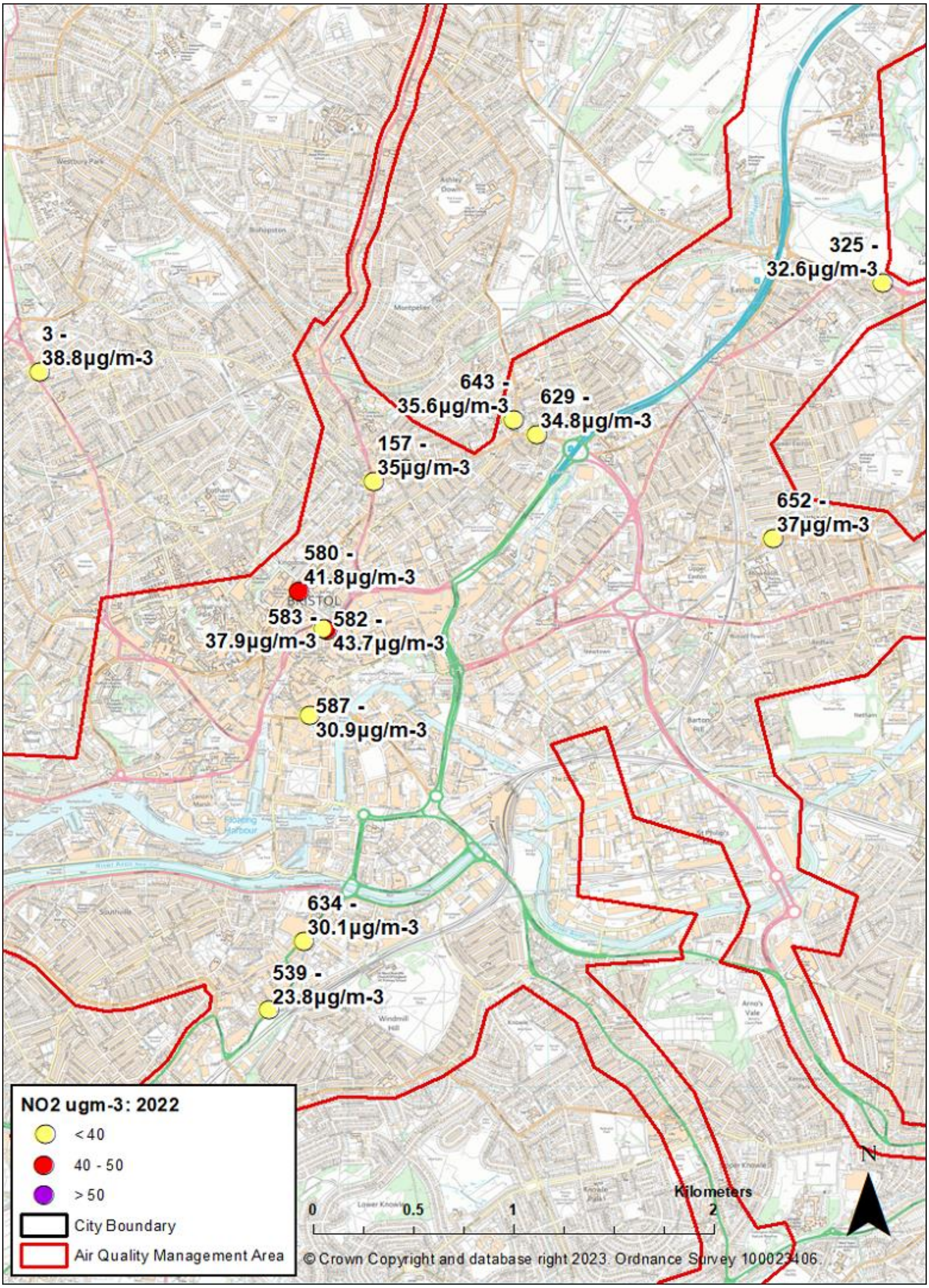


Figure 0.4 - Monitoring Locations with > 4µg/m³ Decrease in Annual NO_2 in 2022 Compared to 2021



Particulate Matter

The particulate matter (PM_{10}) trends for the past 5 years are available from an urban background site, Bristol St Pauls, and the Temple Way roadside site. At Bristol St Pauls annual PM_{10} concentrations were 17.3µg/m^3 in 2022, which is an increase of 1.6µg/m^3 when compared to 2021. 2022 annual concentrations from the roadside Temple Way site were 20.9µg/m^3, this is an increase of 2.0µg/m^3 compared to 2021 levels. Both sites meet the current UK annual and 24-hour objectives for PM_{10}.

$PM_{2.5}$ concentrations at Bristol St Pauls have seen a reduction since 2018 with a decrease from 12.0µg/m^3 in 2018 to 8.4µg/m^3 in 2022, although a 0.1µg/m^3 increase was measured between 2021 and 2022. 2022 annual $PM_{2.5}$ concentrations measured at the roadside site at Parsons Street School were 13.0µg/m^3. This is a relatively large increase of 1.0µg/m^3 when compared to 2021. The monitored concentrations at Parsons Street are above the new UK target of 10µg/m^3, with the St Pauls site meeting this target, but both sites are above the WHO guideline value of 5µg/m^3.

Whilst much of the action to improve air pollution in the UK and Bristol has focussed on achieving compliance with nitrogen dioxide limits, it is acknowledged that it is important to take action to reduce particulate pollution to improve public health. In most cases, the measures to reduce nitrogen dioxide pollution will also reduce particulate pollution.

Particulate pollution (PM) has a range of sources, both local and regional. Vehicles are a source of PM and therefore measures to reduce NO_2 pollution from this source can also help reduce emissions of particulate matter. Combustion processes such as domestic heating (especially domestic solid fuel burning) and industry can also contribute locally. There is also a contribution from sources outside of the local authority area. In the case of particulate pollution, contributions from agriculture, industry and natural sources are significant. Secondary particulate matter (PM) is formed in the atmosphere through chemical reactions between other air pollutant gases such as nitrogen oxides (NOx), ammonia (NH_3) and sulphur dioxide (SO_2).

Appliances that burn solid fuel contribute to local air pollution and evidence is that their contribution is increasing due to the popularity of solid fuel burning for occasional heating requirements, especially in the wintertime. Domestic solid fuel burning can generate significant levels of particulate pollution. The Department for Environment, Food & Rural Affairs (DEFRA) 2020 national estimates that domestic combustion from indoor appliances contributed 15% of all primary PM_{10} emissions and 25% of all primary $PM_{2.5}$ emissions. Wood as a fuel contributed 17% of all primary $PM_{2.5}$ emissions. From 2010 to 2020, the relative proportion of national $PM_{2.5}$ emissions from domestic wood burning increased by 35%.[12] [13] [14]

Bristol City Council commissioned a study, Impact of Solid Fuel Burning in Bristol: Policy Options for Reducing Emissions, to try to determine the scale of solid fuel burning in the city and the contribution that it has to particulate pollution.

In additional to the report quantifying pollutant emissions from solid fuel use, a report into the emissions from construction Non-Road Mobile Machinery (NRMM) has also been commissioned by BCC. The aim of the report is to provide the evidence base needed to develop appropriate policies to manage emissions from this potentially significant pollutant source.

Actions to Improve Air Quality

The Environmental Improvement Plan[15] sets out actions that will drive continued improvements to air quality and to meet the new national interim and long-term $PM_{2.5}$ targets. The National Air Quality Strategy, published in 2023, provided more information on local authorities' responsibilities to work towards these new targets and reduce $PM_{2.5}$ in their areas. The Road to Zero[16] details 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.

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[12] Emden J and Murphy L. Lethal but legal: air pollution from domestic burning. London: Institute for Public Policy Research (IPPR); 2018. [Accessed 13 September 2022]. Available from: https://www.ippr.org/research/publications/lethal-but-legal

[13] Department for Environment, Food & Rural Affairs (Defra). Emissions of air pollutants in the UK – Particulate matter (PM10 and PM2.5). Updated 18 February 2022. [Accessed 11 July 2022]. Available from: https://www.gov.uk/government/statistics/emissions-of-air-pollutants/emissions-of-air-pollutants-in-the-uk-particulate-matter-pm10-and-pm25

[14] Chief Medical Officer's Annual Report 2022: Air Pollution - https://www.gov.uk/government/publications/chief-medical-officers-annual-report-2022-air-pollution

[15] Defra. Environmental Improvement Plan 2023, January 2023

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

As previously discussed, air pollution in those locations exceeding the health-based limits for nitrogen dioxide originates predominantly from motor vehicles. The approach to reducing NO_2 concentrations is focused on measures to reduce the number of vehicles on our roads, clean up the emissions from those vehicles and to reduce congestion.

Bristol Transport Strategy

The Bristol Transport Strategy was adopted in July 2019 sets out a vision on how the city will:

- create an inclusive transport system that provides realistic transport options for everyone;
- create healthy places that promote active transport, improve air quality, and improve road safety;
- make better use of our streets to enable more efficient journeys;
- enable more reliable journeys by minimising the negative impact of congestion; and
- support sustainable growth by enabling efficient movement of people and goods, reducing carbon emissions.

Bristol City Council have developed a Shared Mobility Position Statement which is an annex of the Bristol Transport Strategy. This sets out a policy framework for how different shared mobility modes can help Bristol City Council meet transport and wider city objectives. Shared mobility refers to types of transport that are shared with other people, either concurrently or one after another. This includes car clubs, short term car rentals or micro mobility options such as e-bikes, e-cargo bikes, or e-scooters.

Local Cycling and Walking Infrastructure Plan (LCWIP)

The Local Cycling and Walking Infrastructure Plan is a detailed plan which identifies that over £400m of investment is needed and will be sought and channelled through the West of England Combined Authority. Working with Bath & North East Somerset, Bristol, North Somerset and South Gloucestershire councils, the aim is to provide high quality infrastructure to ensure the West of England is a region where cycling and walking are the preferred choice for shorter trips. Public consultation on the plan took place in early 2020.

Travel West and West of England Combined Authority (WECA)

There is long-established collaboration between the three former Avon authorities (now referred to as the West of England authorities). In this regard, the Travel West brand acknowledges the fact that the commuter doesn't think in terms of authority boundaries.

TravelWest is part of the West of England Combined authority (WECA) and brings together partners to improve transport across the region, to provide sustainable, long-term solutions to help people move around the region more easily.

A website is available to help people plan journeys and to learn about the resources available to residents in the area to help them travel more sustainably.

The Joint Local Transport Plan, JTLP 4 was published in March 2020 and sets the West of England Combined Authority (WECA) regions transport vision through to 2036. A greater emphasis than previously is placed on air pollution compared to the superseded JLTP (3). The JLTP 4 document *"shows how we will aim to achieve a well-connected sustainable transport network that works for residents across the region; a network that offers greater, realistic travel choices and makes walking, cycling and public transport the natural way to travel"*

WECA are at the early stages of developing the JLTP 5 which will look to further increase use of active and sustainable transport options.

One City Plan

The One City approach brings together a wide range of public, private, and third sector partners within Bristol. They share an aim to make Bristol a fair, healthy, and sustainable city. A city of hope and aspiration, where everyone can share in its success.

Within the plan there are commitments and aspirations on air pollution including:

- Making progress towards cleaner air in the fastest time possible by working with city partners on successfully planning the launch of the Clean Air Zone; and
- An aspiration to achieve the WHO interim guideline value (WHO-10µg/m^3) for $PM_{2.5}$ by 2030.
- By 2033 all mean annual NO_2 concentrations are below 30µg/m^3. The setting of this target predated the revised WHO Guideline values for NO_2 which now show there are health impacts down to an annual value of 10µg/m^3 for this pollutant.

Bristol Climate Emergency Declaration

- In November 2018 the Mayor declared a Climate Emergency and an initial plan of action has been developed to address this. The initial plan provided funding to work with city partners and stakeholders to develop a climate strategy for the city. For more details go to The Mayor's Climate Emergency Action Plan.

Whilst the climate emergency declaration focuses on reducing emissions of CO_2 pollution, many sources of CO_2 emissions are the same as those that emit pollutants that are directly harmful to health locally such as NO_2, particulate matter and sulphur dioxide. Many measures to reduce emissions of CO_2 from combustion sources will reduce emissions of these other pollutants that are harmful when breathed in. As a result, action to address the climate emergency are acknowledged here as important in reducing concentrations of local air pollution.

One City Climate Strategy

This Strategy provides more detail on the commitment within the One City Plan for Bristol to become carbon neutral by 2030. Within the One City Climate Strategy transport is an area where it has been identified that action is needed with a focus on:

switching to significantly more walking, cycling and zero carbon public transport modes; converting the remaining vehicles to zero carbon fuels; transforming freight, aviation and shipping.

East Bristol Liveable Neighbourhood Pilot Project

Liveable neighbourhoods are areas of a city that are improved to be people-centred and more 'liveable'. They are safe, healthy, inclusive, and attractive places where everyone can breathe clean air, have access to better quality green spaces and safe spaces to play, and feel a part of a community. The improvements in a liveable neighbourhood aim to make it easier to catch a bus and to walk or cycle, with improved infrastructure and less through traffic.

An East Bristol pilot liveable neighbourhood is being developed in an area including Barton Hill and parts of Redfield and St George, south of Church Road and north of the river Avon. This pilot project is being designed with the local community to make sure it will meet local needs.

School Streets

Bristol City Council is committed to making Bristol's streets safer for everyone living, working, and visiting the city. An area of priority are the streets outside our schools. One of the ways we are doing this is through the introduction of School Streets, whereby the street or streets immediately outside the school entrance are closed to non-essential vehicles at school opening and closing times. Only people walking, wheeling, cycling, and scooting are permitted access to the School Street zone while the restriction is in place, with exemptions given to emergency vehicles and Blue Badge holders. In some cases, permits will be given to residents and businesses living or working within the zone – this varies from scheme to scheme and is decided on an individual basis.

School Streets are now being rolled out by local authorities across the country. In February 2020 BCC launched a pilot scheme at two schools: St Peter's CofE Primary School and Wansdyke Primary School.

In May 2021 BCC launched School Streets at two additional schools: Redfield Educate Together Primary Academy and Victoria Park Primary School. Three more schools joined in 2022 with plans to extend this to a further 3 schools in 2023 with parents, carers, businesses and residents currently being asked for their opinions on the proposed schemes.

E-Scooter Trial

Hop-on hop-off e-scooters are available in Bristol, Bath and in parts of South Gloucestershire to help residents and visitors to get around central areas. Clusters of e-scooters will also be available at other key locations such as stations, university campuses, hospitals, and large employment sites. It is also possible for residents to get an e-scooter for a long-term trial to allow them to keep one at home for an extended period.

MetroWest

MetroWest will transform rail travel in the region, generating over a million new rail journeys and give 80,000 more people access to train services.

Portishead Rail Line: MetroWest Phase 1

- Severn Beach: Hourly services on the Severn Beach Line to Bristol Temple Meads and half hourly services from Avonmouth to Bristol Temple Meads calling at a new station at Portway next to the Park and Ride.
- Bath & Westbury: Half hourly services from Bristol Temple Meads.

- Portishead Line: Re-opening of the Portishead Line providing an hourly service between Portishead and Bristol Temple Meads with new stations at Pill and Portishead.

The Department for Transport announced consent for the Portishead Branch Line on the 14th November 2022.

Henbury Rail Line: MetroWest Phase 2

- Henbury Line: Re-opening of the Henbury Line with new stations at Henbury, North Filton and Ashley Down, providing an hourly service from Bristol Temple Meads to Filton Abbey Wood and onto North Filton and Henbury.

- Yate & Gloucester Line: Half hourly services between Bristol Temple Meads and to Gloucester via Yate with a potential new station at Charfield.

The MetroWest Phase 1 and Phase 2 proposals include new or reopened rail stations at Portishead, Pill, Henbury, North Filton and Ashley Down. Portway Park & Ride will open in 2023 and will be served by the recently improved service between Bristol Temple Meads and Severn Beach. Works on the Ashely Down Station commenced in March 2023 and should be complete in 2024.

In addition to these stations, a separate new stations package is looking at the potential for future new stations in other locations.

Proposals for a new station at Saltford on the line between Bristol and Bath are being pursued by Bath & North East Somerset Council. Bristol City Council has commissioned a study to investigate the likely costs, benefits, and operational feasibility of a new station at Ashton Gate.

Figure 0.5 – MetroWest Map

Development of a Clean Air Zone

Bristol City Council has been directed by the UK Government to achieve compliance with air quality objectives in the shortest possible time. A small area Class D Clean Air Zone came into operation in November 2022.

For updates on the progress with the Bristol Clean Air Plan please visit the Clean Air for Bristol Website

GoUltraLowWest

As part of creating a better environment, all the West of England's local authorities are committed to encouraging the widespread use of electric cars, vans, and bikes.

Go Ultra Low West is a £7m project that aims to accelerate the purchase of electric vehicles across Bristol, South Gloucestershire, North Somerset and Bath & North East Somerset.

Over 120 new charge point connections are being installed to double the size of the current public charging network. The Revive vehicle charging network has been launched, taking over from the previous Source West network. This ensures that owners of electric vehicles will be able to charge at more destinations in the region.

The project includes the delivery of 4 new rapid EV charging hubs, new electric car clubs, business grants for charge point installation, updating council fleet vehicles and providing residents in the WECA region the opportunity to try out an EV for two weeks.

Slow the Smoke Citizen Engagement Project

Bristol City Council were awarded £122,000 through the annual Defra Air Quality Grant fund to carry out a study into solid fuel use in Bristol. This project raised awareness of air pollution with a focus on particulate matter (PM) emissions from domestic solid fuel burning, which is an important and growing source of pollution. The project aim was to achieve air quality benefits in both the short and long term through the planned monitoring, engagement and awareness raising activities in a pilot area of the city (Ashley Ward which includes the areas of St Werburghs, St Pauls, Ashley, and Montpelier). The principles of the Slow the Smoke project are based on the established but innovative citizen led engagement process, the Bristol Approach. 10 citizens built their own pollution sensors, a number of workshops were held, and two surveys were sent out to residents in the ward, before and after the community workshops. As a pilot project, the template was successful in promoting a greater understanding of the issues and testing a methodology that is scalable and transferrable. However, this pilot project illustrated the importance of continued and sustained engagement around the challenge going forward.

Conclusions and Priorities

Monitoring – Pollutant Trends

When considering trends in pollution levels, comparing one year to a previous year for example, it should be noted that air pollution levels can be impacted significantly year on year by the prevailing meteorological conditions, with some years being worse for pollution dispersal and pollutant formation than others. Considering pollution trends over longer periods, such as the 5 years period considered in this report, can help to account for these annual variations due to meteorology.

In 2022 monitored NO_2 concentrations decreased slightly, with an average of a 0.7% reduction when compared to measured 2021 concentrations. When compared to 2019 figures, the last full year of data before Covid-19 impacted travel patterns, annual NO_2 concentrations at roadside locations were 14.2% lower in 2022, however, this is less than the national average of a 24% reduction at roadside locations between these two periods.

The particulate matter (PM_{10}) increased at both monitoring sites in Bristol in 2022 when compared to 2021, however, both sites meet the current UK annual and 24-hour objectives for PM_{10}.

$PM_{2.5}$ concentrations at Bristol St Pauls have seen a reduction since 2018 with a decrease from 12.0µg/m^3 in 2018 to 8.4µg/m^3 in 2022, although a 0.1µg/m^3 increase was measured between 2021 and 2022. 2022 annual $PM_{2.5}$ concentrations measured at the roadside site at Parsons Street School were 13.0µg/m^3. This is a relatively large increase of 1.0µg/m^3 when compared to 2021. The monitored concentrations at Parsons Street are above the UK new target of 10µg/m^3, with the St Pauls site meeting this target, but both sites are above the WHO guideline value of 5µg/m^3.

The monitoring data indicates that a reduction in pollution levels is still needed to achieve compliance with annual NO_2 objectives in all parts of the city. It also demonstrates that at some background locations, away from busy roadsides, that $PM_{2.5}$ concentrations already meet the new UK 2040 target of 10µg/m^3. The Bristol St Pauls site is not a location at which it is thought there is a large amount of domestic solid fuel use and so may not be representative of other background locations in the city where this activity is thought to be more prevalent. In 2023 BCC intend to install a new background $PM_{2.5}$ monitor in a location with relatively high levels of solid fuel use to gain a better understanding of the impact this has on $PM_{2.5}$ concentrations. The new UK target is exceeded at the one roadside monitoring location in the city, however, as this site is close to a junction, it does not technically meet the monitoring site criteria as defined in The Environmental Targets (Fine Particulate Matter) (England) Regulations 2023. $PM_{2.5}$ concentrations at this site are however likely to be indicative of $PM_{2.5}$ concentrations at busy roadside locations in many parts of the city.

Measured exceedance of the annual objective outside of the AQMA boundary occurred at one location in Bristol in 2022. The location is on Muller Road (Tube 567) on the Muller Road/Glenfrome Road Junction. An annual NO_2 concentration of 43.2µg/m^3 was measured in 2022. When adjusted for distance to the closest relevant exposure, the concentration fell to below the objective at 38.7µg/m^3. Despite being outside of the AQMA, it is only marginally outside, with the AQMA boundary passing within 20m to the south of this monitoring location.

Details of this and other recent exceedances outside of the AQMA are contained within Table C. 1. Monitoring in these locations has continued in 2023.

Pollution Reduction Actions - Transport

The priority for Bristol City Council is to monitor the impact that the Clean Air Zone (CAZ), which was introduced in November 2022, has on air pollution across the city. The work to monitor changes in pollution levels and assess the success of the CAZ is progressing with the governments Joint Air Quality Unit (JAQU).

The other initiatives and plans, as described in this report, will continue to be taken forward and developed. Additional actions on transport emissions are focussed on encouraging and facilitating modal shift by providing safe, convenient, and reliable alternatives to car use, alongside facilitating a shift towards cleaner vehicles where they still need to be used.

Pollution Reduction Actions – Solid Fuel/Bonfires

The BCC website contains information on Smoke Control Regulations and guidance on burning. This aims to raise awareness of the health effects of PM pollution from these sources, reduce the amount of burning in the city and to ensure best practice is used if burning still takes place. In addition, the Defra air quality grant funded ‘Slow the Smoke’ project, which involved citizens using low-cost pollution sensors, finished in late 2022. This raised awareness of air pollution in the city and used innovative engagement methods to talk about air pollution. The report for this project will be published in 2023. A new equivalence standard $PM_{2.5}$ monitor will be installed as a legacy of this project in a location where high levels of solid fuel use occur.

Local Engagement and How to get Involved

How Can Pollution Be Reduced? - Transport

There are many ways in which people can help contribute towards reducing air pollution in Bristol. Air pollution, at locations where we are recording illegal levels of nitrogen dioxide, comes predominantly from emissions from vehicles. Choosing to travel around the city by foot, by bicycle or using public transport, whenever it is possible, can reduce an individual's personal contribution to air pollution in the city. To find out more information on sustainable transport options throughout the West of England region you can visit the Travel West Website or its sister website Better by Bike.

For those journeys taken by cars, choosing to travel outside of peak times can help reduce congestion and pollution levels. In 2022 Bristol introduced a charging clean air zone. If you are thinking of replacing your vehicle you can check to see if it will be compliant, and therefore not be subject to a daily charge to drive in the zone, by using this vehicle checker.

Whilst government vehicle taxation is based on the relative emissions of carbon dioxide (CO_2), this can be misleading to those looking for a vehicle with low emissions of pollutants that are directly harmful to health. Diesel cars have been promoted as being 'low emission / eco' vehicles. Whilst these may offer relatively low advertised CO_2 emissions, on average, older diesel vehicles, have been worse for air pollutants such as nitrogen dioxide and particulates, which are of greatest concern for local air quality.

Measurement of real-world vehicle emissions have shown that large discrepancies exist between the required vehicle emissions standards, as defined by Euro emissions standards, and the level of pollution emitted under real world driving conditions. The largest discrepancies are related to nitrogen oxides (NO_x) emissions which lead to the formation of NO_2 pollution.

This illustrates why older diesel cars continue to present problems to achievement of NO_2 air quality objectives in the city and why older diesel vehicles in particular are contributing significantly to NO_2 pollution.

How Can Pollution Be Reduced? - Domestic Heating

From an air pollution perspective, if a property does not already have a stove or open fireplace, the best option is not to install one. Even the cleanest wood burning appliance emits significantly more particulate matter than a gas oil or gas appliance.

Within Bristol, as a minimum, a wood burning stove should be approved for use within a smoke control area, known as an ‘exempt appliance’.

If you do chose to burn solid fuel it is important to ensure that you do not breach the Smoke Control Area regulations. The whole of Bristol is a smoke control area. This means that, for domestic heating purposes, wood can only be burnt in a Defra approved stove. It is not permitted to burn wood in an open fire in a domestic property in Bristol.

Whilst the type of solid fuel appliance used is an important factor in determining the level of pollution emitted, the way in which they are used is equally as important. Understanding which fuels emit less pollution and the least polluting way to use them is explained within guidance issued by Defra: Open fires and wood-burning stoves – A practical guide. The measure outlined for reducing emissions include:

- Choosing the right stove
- Considering burning less
- Buying ‘Ready to Burn’ fuel
- Season freshly chopped wood before use (wood can only be burnt in Bristol within a Defra exempt appliance. It is not permitted to burn even seasoned wood in an open fire, or an appliance not considered exempt by Defra for use in a smoke control area).
- Do not burn treated waste wood (e.g., old furniture) or household rubbish
- Regularly service and maintain your stove (annually)
- Get your chimney swept regularly (up to twice a year)

In May 2021 the Air Quality (Domestic Solid Fuels Standards) (England) Regulations 2020 came into force. They have been introduced to reduce emissions of PM from residential burning of wood and other solid fuels. The regulations attempt to phase out the use of bituminous coal and unseasoned wood in residential heating appliances.

A study by The University of Sheffield and The University of Nottingham, published in 2020 concluded that, even when best practice is used, solid fuels can emit significant levels of particulate matter pollution into the local atmosphere and can have a detrimental impact on indoor air pollution.

“*The PM that is released into the home is not an aberration from normal use but results* *directly from it. This is because real-world operation cannot occur without opening the stove door. It may be that with regulatory encouragement stove designs can be modified in a way that limits such instances. In the meantime, or in the event that appropriate modification cannot be achieved, it is also recommended that new residential stoves be accompanied by a health warning at the point of sale in order to indicate the normative health risks posed to users".*

Local Responsibilities and Commitment

This ASR was prepared by the Sustainable City and Climate Change Team of Bristol City Council with the support and agreement of the following officers and departments:

Strategic City Transport

Sustainable City and Climate Change

Public Health

Regulatory Services

Fleet Services

City Leap

Highways and Traffic

This ASR has been signed off by a Director of Public Health.

If you have any comments on this ASR please send them to Andrew Edwards at:

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1 Local Air Quality Management

This report provides an overview of air quality in Bristol during 2022. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995), as amended by the Environment Act (2021), 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 to achieve and maintain the objectives and the dates by which each measure will be carried out. This Annual Status Report (ASR) is an annual requirement showing the strategies employed by Bristol 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 18 months. The AQAP should specify how air quality targets will be achieved and maintained, and provide dates by which measures will be carried out.

A summary of AQMAs declared by Bristol City Council can be found in Table 2.1. The table presents a description of the AQMA that is currently designated within the Bristol City Council area. Appendix D: Map(s) of Monitoring Locations and AQMAs provides maps of the AQMA and the air quality monitoring locations in relation to the AQMA. The air quality objectives pertinent to the current AQMA designation are as follows:

- <NO_2 annual mean;
- <PM_{10} 24-hour mean.

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 Highways England?	Level of Exceedance: Declaration	Level of Exceedance: Current Year	Number of Years Compliant with Air Quality Objective	Name and Date of AQAP Publication	Web Link to AQAP
Bristol AQMA	Declared 01/05/2001. Amended on 01/05/2003 and 01/05/2008 and 26/10/2011	NO_2 Annual Mean	An area covering the city centre and parts of the main radial roads including the M32.	YES	N/A	N/A	0	Clean Air Zone -2022	Clean Air for Bristol Website for CAZ Plans
Bristol AQMA	Declared 01/05/2001. Amended on 01/05/2003 and 01/05/2008 and 26/10/2011	NO_2 1 Hour Mean	An area covering the city centre and parts of the main radial roads including the M32.	YES	N/A	N/A	0	Clean Air Zone - 2022	Clean Air for Bristol Website for CAZ Plans
Bristol AQMA	Declared 01/05/2001. Amended on 01/05/2003 and 01/05/2008 and 26/10/2011	PM_{10} 24 Hour Mean	An area covering the city centre and parts of the main radial roads including the M32.	YES	N/A	N/A	0	Clean Air Zone - 2022	Clean Air for Bristol Website for CAZ Plans

☒ **Bristol City Council confirm the information on UK-Air regarding their AQMA is up to date.**

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

The monitoring network in Bristol has changed considerably since the declaration of the Air Quality Management Area in 2001. There is an extensive air quality monitoring network throughout the city which provides annual NO_2 data. The monitoring locations in 2022 are not directly comparable to those in 2001 and therefore the comparison between exceedance levels at declaration in 2001 and 2022 would not provide a true reflection of trends in air pollution over that timeframe. For this reason, the corresponding columns in Table 2.1 above have not been completed. Distance adjusted (where relevant) data for all 193 nitrogen dioxide diffusion tube monitoring sites has been provided in Table B.1. An indication of general trends in annual NO_2 values from 2010 are shown in Figure A.1 to Figure A.4 and is considered to be more representative of trends in recent years than would be established from looking at data from one worst case site as requested in Table 2.1.

Progress and Impact of Measures to address Air Quality in Bristol

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

'the report is well structured, detailed, and provides the information specified in the Guidance. The following comments are designed to help inform future reports:'

- The Council have provided a well detailed discussion regarding the areas outside the AQMA which have reported exceedances in the AQO, highlighting that the Council is committed to ensuring that targeted monitoring is completed. The Council should continue to provide these discussions in future ASRs.

These discussions have been included in the 2023 ASR.

- Figures are well presented, and it is welcomed that the Council have included measured concentrations on their figures to highlight those areas which are more polluted. However, it may be useful to provide some figures at a smaller scale to provide the reader with a good indication of where the sites are located.

This advice has been taken into account with additional maps included in the 2023 ASR.

- QA/QC procedures have been provided, and there is good reasoning for the chosen bias adjustment factor. A more cautious approach has been taken to identify potential areas of concern.

- Trends of monitored concentrations over the past 5-years have been given, and the Council highlights that increases in concentrations between 2020 and 2021 are representative of the increase in traffic flow following the COVID-19 pandemic. The Council did not provide the level of exceedance at declaration/current year within Table 2.1, though explained that this is due to an unfair comparison as the AQMA was declared twenty-years ago.

- The Council have responded to and completed those comments provided in the previous ASR appraisal and should continue to do this in future reports.

This has been done in the 2023 ASR.

Bristol City Council has taken forward a number of direct measures during the current reporting year of 2022 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2. 33 measures are included within Table 2.2, with the type of measure and the progress Bristol City Council has made during the reporting year of 2022 presented. Where there have been, or continue to be, barriers restricting the implementation of the measure, these are also presented within Table 2.2.

More detail on some of these measures can be found in their respective online portals, for example at the Clean Air for Bristol website or on the TravelWest website and within sections of this report.

Bristol City Council expects the following measures to be completed over the course of the next reporting year:

- Monitoring the impact and effectiveness of the Bristol Clean Air Zone in agreement with the Government's Joint Air Quality Unit, to deliver compliance with air quality objectives in the shortest time possible.

- Continue planning and implementing a range of actions intended to improve public transport provision, and the infrastructure for walking and cycling, to make these transport modes more attractive.

Bristol City Council anticipates that the measures stated above and in Table 2.2 will achieve compliance in the Bristol AQMA in the shortest possible time, as required by the JAQU.

Table 2.2 – Progress on Measures to Improve Air Quality

Measure No.	Measure	Category	Classification	Year Measure Introduced in AQAP	Estimated / Actual Completion Date	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	Bristol Clean Air Zone	Promoting Low Emission Transport	Low Emission Zone	TBC	2021	BCC	Government	NO	Funded	> £10 million	Planning	Reduced vehicle emissions	Achieving Compliance within the shortest timeframe possible	CAZ introduced in November 2022. For latest Developments see https://www.cleanairforbristol.org/	
2	MetroBus BRT scheme	Transport Planning and Infrastructure	Bus route improvements	2018	2018	BCC/S.Glos/NE Somerset.	Government Funding/WECA		Funded	> £200 million	Implementation	Encouragement of modal shift through provision of quick reliable bus services.	Improved bus Services, quicker journey times and more reliable services from both northern and southern city fringes	Complete	
3	Make improvements to the city centre through the City Centre Framework.	Alternatives to private vehicle use	Other	2020	2027	BCC	WECA/BCC		Funded		Planning	Improving conditions for active and public transport in the city centre	Improved bus journey times and reliability. Uplift in walking, cycling and scooting	Ongoing development and review of the measures introduced	
4	Freight Consolidation	Freight and Delivery Management	Freight Consolidation Centre	2020	2021	BCC, Zedify	OLEV		Funded	£50k - £100k	Implementation	Reduction in GHV and LDV mileage in city centre and replaced with zero emission last mile	95% of deliveries in the city centre by EVs or bikes by 2030	Ongoing development and expansion of the FCC	
5	Prioritising purchase of EV vehicles in public sector fleets	Promoting Low Emission Transport	Public Vehicle Procurement -Prioritising uptake of low emission vehicles	2017		WoE Authorities	Govt, LA	NO	Funded		Implementation	Reduce emissions from LA vehicle fleet	BCC Fleet Services operate 42 EVs in the current fleet and this will increase to 97 by the end of March 2024. This will represent approximately 10% of the BCC fleet.	Ongoing	Charging Infrastructure
6	Car Clubs	Alternatives to private vehicle use	Car Clubs			WoE Authorities	Private and LA, EU H2020 -Replicate		Funded		Implementation	Reduced car ownership	120 car club cars currently in use in Bristol. BCC EU H2020 Replicate project. 11 EVs being trialled in Replicate project and	Ongoing	

Measure No.	Measure	Category	Classification	Year Measure Introduced in AQAP	Estimated / Actual Completion Date	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
													24 on street charge points installed		
7	School Streets Project	Promoting Travel Alternatives	Other	2020		BCC	LA Funded				Implementation	Lower pollution outside schools and increased active travel	Closing streets to motor vehicles outside schools at the start and end of the school day	7 School Streets in operation in early 2023 with 4 more planned for September 2023.	
8	10 rapid chargepoints for use by taxi and private hire vehicles, and 2-3 ultra rapid chargepoint hubs for commercial and public use	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	2022	2024	BCC	BCC	NO	Funded		Implementation	Promote low emission vehicle use.	Install rapid and ultra rapid chargers	Implementation on-going. The 10 rapid chargepoints have been installed, the ultra-rapid chargepoints should be installed in 2024.	
9	Run the Electric Vehicle Centre of Excellent to provide support for businesses and build confidence to change their fleet to electric vehicles. We will buy and loan 58 electric vehicles	Promoting Low Emission Transport	Other	2021	2024	BCC	Grant Funded	NO	Funded		Implementation	Promote low emission vehicle use.	Centre of Excellence up and running	Implementation on-going. Positive feedback. 91% of people very satisfied with the EV driving experience. 77% said the trial made them speed up their decision to buy EVs for their fleet.	
10	Develop a freight strategy describing how we will help freight transported on Bristol roads to be zero carbon and efficient	Freight and Delivery Management	Freight Partnerships for city centre deliveries	2022	2024	BCC	BCC		Funded	£10k - 50k	Planning	Develop zero carbon freight delivery in Bristol			
11	Develop plans for a Mass Transit system together with neighbouring authorities	Transport Planning and Infrastructure	Other	2022		WECA authorities/BCC	WECA/Network Rail				Planning		Develop a viable business case for mass transit	A4 corridor being designed. Work ongoing	
12	Improve walking, cycling and public transport infrastructure through the	Transport Planning and Infrastructure	Other	2019	2027	BCC	WECA CRST/BCC			> £10 million	Planning	Increase public and active transport use along this corridor	Improvements to walking, cycling and public transport infrastructure along the	OBC signed off	

Measure No.	Measure	Category	Classification	Year Measure Introduced in AQAP	Estimated / Actual Completion Date	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
	A37/A4018 project												A37/A4018 corridors.		
13	Leading the Bristol to Bath project to provide a continuous bus priority, walking and cycling routes on adjacent to A4	Transport Planning and Infrastructure	Other	2022	2025	BCC/BANES	WECA				Planning	Increase public and active transport use along this corridor	Improvements to walking, cycling and public transport infrastructure along the A4 corridor.	Scheme and design being developed	
14	Develop mobility hubs to offer bike hire, e-scooters, bus, and e-cargo bikes in one place	Transport Planning and Infrastructure	Other	2022	2024	BCC/WECA Authorities	WECA		Funded		Planning	Increase active and public transport use	Hubs developed	Procurement of hub components	
15	Build a regional cycling centre for cycle training, rehabilitation, inclusive cycling, and a sports facility	Promoting Travel Alternatives	Promotion of cycling			BCC	Unknown		Not Funded		Planning	Increase accessibility to cycling	Cycling centre built and operational	Feasibility work being carried out	
16	Voi Scooter trial	Promoting Travel Alternatives	Other	2021	2022	WECA authorities/BCC			Funded		Completed	Trial scooters in the WECA region		Trials underway. Trials extended until November 2022. Unclear what will happen after this date.	
17	Providing continuous bus priority and better walking and cycling links along the A4 Portway Strategic Corridor and the delivery of Portway rail station and associated access improvements	Transport Planning and Infrastructure	Other	2022	2027	BCC	WECA/DfT		Not funded		Planning	Improved active and public transport offer on A4 corridor to encourage modal shift	New, effective Infrastructure delivered	Station currently being delivered and Strategic Corridor improvements developing Outline Business Case for WECA funding	
18	M32 Strategic Corridor: providing improved public transport infrastructure and delivery of a P&R.	Transport Planning and Infrastructure	Bus route improvements	2021	2027	BCC/S.Glos	WECA				Planning	Improved public transport offer to reduce emissions from private car use.	Improved M32 corridor to encourage public transport use.	Strategic Outline Business Case being developed	
19	Active Travel Fund walking and cycling improvements at Park Row,	Transport Planning and Infrastructure	Other	2021	2024	BCC	DfT		Funded	£5m	Planning	Increase in active travel and reduction in private vehicle emissions	Infrastructure improvements made	Detailed designs being developed for schemes following engagement	

Measure No.	Measure	Category	Classification	Year Measure Introduced in AQAP	Estimated / Actual Completion Date	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
	Old Market and Cotham Hill														
20	Active Travel Fund 4, delivery of Old City-King Street pedestrianisation and Queen Charlotte Street cycle lane	Transport Planning and Infrastructure	Other	2023	2024	BCC	DfT via WECA		Funded	£1.6m	Tender	Better enforcement of existing temporary pedestrianisation of Old City, including ban on mopeds; cycle lane on Queen Charlotte Street	Infrastructure improvements made	OBC approval via different funding stream in 2022	Funded
21	Active Travel Fund 4, design of 4 cycling schemes	Transport Planning and Infrastructure	Cycle network	2023	2024	BCC	DfT via WECA		Funded	£850k	Concept design	Design and OBC of 4 cycling schemes to be ‘shovel-ready’ for future funding bids	4 approved OBCs	None, funding only just announced	
22	Zero Emission Transport City: developing an Outline Business Case for how the city can accelerate plans to decarbonise the transport network through measures such as electrifying the bus fleet, delivering e-cargo freight consolidation hubs, and introducing a Zero Emission Zone. Note that no funding is guaranteed or confirmed to take forward these initiatives at this stage	Promoting Low Emission Transport	Other	2022	2023	BCC	DfT via WECA		Not Funded		Planning	Business case development is the first step to Zero emission transport	Business case developed	Business case being developed	
23	Zero Emissions Transport City – Rescoped	Promoting Low Emission Transport	Other	2023	TBC	BCC/WECA	DfT via WECA		Funded	£450k	Planning	Likely to support a range of measures via feasibility studies/business cases (TBC)	Business Case development (TBC)	Rescoping stage	
24	Delivery of up to 10-30 cycle hangars at council owned properties	Promoting Travel Alternatives	Promotion of cycling	2022	2023	BCC	WECA		Not funded		Planning	Infrastructure leads to increase in cycling	Infrastructure delivered	Full Business Case for WECA funding being developed	

Measure No.	Measure	Category	Classification	Year Measure Introduced in AQAP	Estimated / Actual Completion Date	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
25	Muller Road Sustainable Transport Improvements to improve walking, cycling and public transport links	Transport Planning and Infrastructure	Other	2020	2024	BCC	WECA/CIL/HIF		Funded		Implementation	Increase use of sustainable transport options for trips	Infrastructure delivered	First phase of scheme to be delivered this year including Stoke Park 'all weather path', second phase (Muller Road) Outline Business Case being developed	
26	Joint Local Transport Plan 5	Policy Guidance and Development Control	Other policy	2023	2024	WECA, BCC, BANES, South Glos, N Somerset	WECA/BCC		Not funded	Circa £800k	Planning	Increase use of active and sustainable transport	Adopted Plan	Scoping stage	
27	Bedminster Green Transport improvements – New segregated cycle route on Whitehouse Lane, new bus priority on Malago Rd and Dalby Avenue, street scene enhancements	Transport Planning and Infrastructure		2023	2025	BCC	Government Funding/WECA		Funded	£11m	Construction	Encouragement of modal shift through provision of quick reliable bus services, provision of off-carriageway cycle route, and better walking environment	Improved bus Services, quicker journey times and more reliable services, greater numbers of bus, cycle and pedestrian journeys within vicinity	25%	
28	Walking and cycling improvements at Park Row	Transport Planning and Infrastructure	Other	2020	2025	BCC	DfT (ATF), match funding		Funded	£3.38m	Planning	Increase in active travel and reduction in private vehicle emissions	Infrastructure improvements made	Detailed designs being finalised, TRO processes in progress, hoping to go out to tender soon, construction due to commence late 2023	
29	Walking and cycling improvements at Old Market	Transport Planning and Infrastructure	Other	2021	2024	BCC	DfT (ATF and TCF), match funding		Funded	£922k	Implementation	Increase in active travel	Infrastructure improvements made	Construction due to commence Summer 2023	
30	Walking and cycling improvements at Cotham Hill	Traffic Management	Other	2021	2024	BCC	DfT (ATF and CRSTS)		Funded	£645k	Implementation	Increase in active travel and reduction in private vehicle emissions	Infrastructure improvements made	Construction due to commence June 2023	
31	Local Plan Review	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	Ongoing	2023	BCC	LA Funded	NO	Funded	£100k - £500k	Planning	Adoption of standalone policy for Air Quality and strengthen weight given to air pollution in Local Plan policy documents	Development and Adoption of New Local Plan Documents	Public consultation on revised plan at the end of 2022.	
32	Slow the Smoke	Other	Other	2021	2023	BCC, Knowle West Media Centre, University of the West of England	Government	YES	Funded	£100k - £500k	Completed	Raised awareness of emissions and impact from solid fuel use leading to	Increased public understanding of solid fuel impacts on health and air	Project complete. Report submitted to Defra	

Measure No.	Measure	Category	Classification	Year Measure Introduced in AQAP	Estimated / Actual Completion Date	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
												behaviour change	quality. Improved understanding of BCC of impact of solid fuel use on air pollution.		
33	Liveable Neighbourhood trial in East Bristol	Promoting Travel Alternatives	Other	2021	2024	BCC	WECA	NO	Funded		Planning	Prioritisation of safe and active travel by reducing impact of motor vehicles	Improved environment for active travel and increase in those modes	Extensive public engagement to develop the pilot LN	

2.2 $PM_{2.5}$ – Local Authority Approach to Reducing Emissions and/or Concentrations

As detailed in Policy Guidance LAQM.PG22 (Chapter 8), 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.

Bristol City Council have identified that the recent focus on NO_2 compliance at both a national and local level through the LAQM process has resulted in there being a lack of in-depth knowledge on the scale and local sources of primary $PM_{2.5}$ emissions. The clear evidence on health impacts and requirement to work towards reducing $PM_{2.5}$ emissions and/or concentrations led Bristol City Council to commission studies to develop a more in depth understanding of local emissions of this pollutant. Whilst many actions targeted at reducing emissions of NO_2 will also reduce $PM_{2.5}$ emissions, other potentially significant sources of local primary $PM_{2.5}$ have been identified that will not be directly addressed by actions to reduce NO_2 concentrations.

$PM_{2.5}$ is monitored at two locations in Bristol. Concentrations at Bristol St Pauls were 8.4µg/m^3 in 2022. $PM_{2.5}$ concentrations measured at the roadside site at Parsons Street School were 13.0µg/m^3. The maximum $PM_{2.5}$ concentration for 2022 using Defra background mapping was 11.1µg/m^3.

In 2020 two studies were commissioned by BCC. These attempted to quantify pollutant emissions from solid fuel and construction non-road mobile machinery (NRMM) and identify policy measures to reduce emissions from these sources.

The lowest estimate from the study into solid fuel showed that solid fuel burning accounted for a third of all PM_{10} emissions and half of $PM_{2.5}$ emissions in Bristol. The report provided recommendations that could reduce emissions from this source. In 2020/21 Bristol City Council launched a 'Slow the Smoke' communications campaign aimed at raising awareness of the health impacts of solid fuel and options for people to reduce emissions. Additionally, a Defra air quality grant funded project ran from 2021 through to 2023 which used low-cost sensors and innovate citizen engagement to better understand the impact of solid fuel use on air pollution and to raise awareness of its impacts. A report on the Defra grant funded project will be published in 2023.

Estimates of NRMM emissions using national data showed that this source accounts for approximately 3% of total PM_{10}, 5% of $PM_{2.5}$ and 6% of NOx emissions in Bristol. Whilst not representing a large proportion of total emissions it should be recognised that close to large scale construction sites, NRMM will be a more significant source locally than the Bristol-wide emissions calculations suggest. The estimates are based on national data as local data is limited on this source.

Bristol City Council is taking these additional measures to address $PM_{2.5}$:

- Amendments to the Clean Air Act 1993 made under Schedule 12 of the Environment Act 2021 came into force from 1 May 2022 by adding Section 19A and Schedule 1A, introducing civil financial penalties. BCC is seeking approval for the introduction of a new financial penalty (civil) under these revisions
- In 2022/2023, BCC raised awareness of smoke control regulations and sales of fuels during routine site visits
- Development of a Clean Air Zone to tackle nitrogen dioxide pollution and to achieve compliance with annual objectives for NO_2 in the shortest time possible. Whilst the plan is focussed on compliance with nitrogen dioxide objectives, it will have benefits for particulate pollution
- The development of policy and infrastructure to support public and active travel will contribute to reducing particulate pollution
- The projects, as outlined in Table 2.2, that provide investment in cleaner buses and electric vehicles will help to reduce particulate emissions from transport.

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

This section sets out the monitoring undertaken in 2022 by Bristol City Council and how it compares with the relevant air quality objectives. In addition, monitoring results are presented for a five-year period between 2018 and 2022 to allow monitoring trends to be identified and discussed.

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

Bristol City Council undertook automatic (continuous) monitoring at 7 sites during 2022. Table A.1 in Appendix A shows the details of the automatic monitoring sites. The new open data portal for Bristol presents automatic monitoring results for Bristol City Council and replaces a previous open data platform that BCC stopped using in June 2023.

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

Bristol City Council undertook non- automatic (i.e. passive) monitoring of NO_2 at 193 sites during 2022. 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: Map(s) of Monitoring Locations and AQMAs. 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.3 and Table A.4 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 represents 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).

For diffusion tubes, the full 2022 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.

Table A.5 in Appendix A compares the ratified continuous monitored NO_2 hourly mean concentrations for the past five years with the air quality objective of 200µg/m^3, not to be exceeded more than 18 times per year.

Data capture rates at all of the 8 automatic NO_2 monitoring sites were above the required 85% rate. The lowest capture rate of 98.3% was recorded at the Parsons Street site.

The continuous monitoring data in 2022 shows a mixed pattern when comparing 2022 NO_2 pollution levels to 2021. 4 of the sites saw an increase in recorded annual NO_2 concntrations in 2022 when compared to 2021 with 4 showing a decrease. The largest increase was 16.4µg/m^3 at Colston Avenue to 66.2µg/m^3. This brings the 2022 NO_2 levels at this site back to similar levels that were measured in 2018 and 2019, before the pandemic travel restrictions and changes to travel patterns. The largest decreased at an automatic monitoring site was -4.2µg/m^3 at Marlborough Street, which fell from 32.7µg/m^3 in 2021 to 28.5µg/m^3 in 2022.

With the exception of the Colston Avenue site, 2022 concentrations were lower at all automoatic monitoring sites than they were in 2019, which was the last year before Covid-19 restrictions resulted in some changes to vehilce movements. The biggest decrease when comparing these years was 12.9µg/m^3 at Fishponds Road.

Colston Avenue was the only site at which hourly values greater than the 200 µg/m^3 hourly objective were recorded in 2022, with 9 hours being recorded. This compares to 0 hours in 2021, 6 hours in 2020 and 8 hours in 2019. 9 hours is half of the allowed 18 hours of exceedance of this hourly average per year.

Consideration of trends in NO_2 concentrations at a selection of kerb/roadside sites on the busiest road corridors throughout Bristol, since 2010, show that a similar pattern is observed in all parts of the city. Monitoring has shown consistent exceedence of the annual objectives for NO_2 at many locations but with a reduction in concentrations of NO_2 over this period. Concentrations in 2021 concentrations inceased when compared to 2020 due to 2020 being a year with significant restrictions on movements due to the Covid-19 pandemic. Changes at this selection of diffusion tube sites between 2022 and 2021 show a similar patern to that demonstrated with the automatic data analysis, with some sites improving, whilst others have deteriorated. Trends in various parts of the city from 2010 to 2022 are shown in Figure A.1 to Figure A.4. Figure 3.1 and Figure 3.2 show nitrogen dioxide diffusion tube monitoring locations in Bristol. Those sites shown in red or purple indicate locations where exceedence of the annual objective was measured in 2022. The data has been annualised but not distance adjusted in these maps.

All our air pollution monitoring data is available on the Bristol City Council open data portal.

Figure 3.1 - Nitrogen Dioxide Monitoring Locations and Results 2022 – Central Area

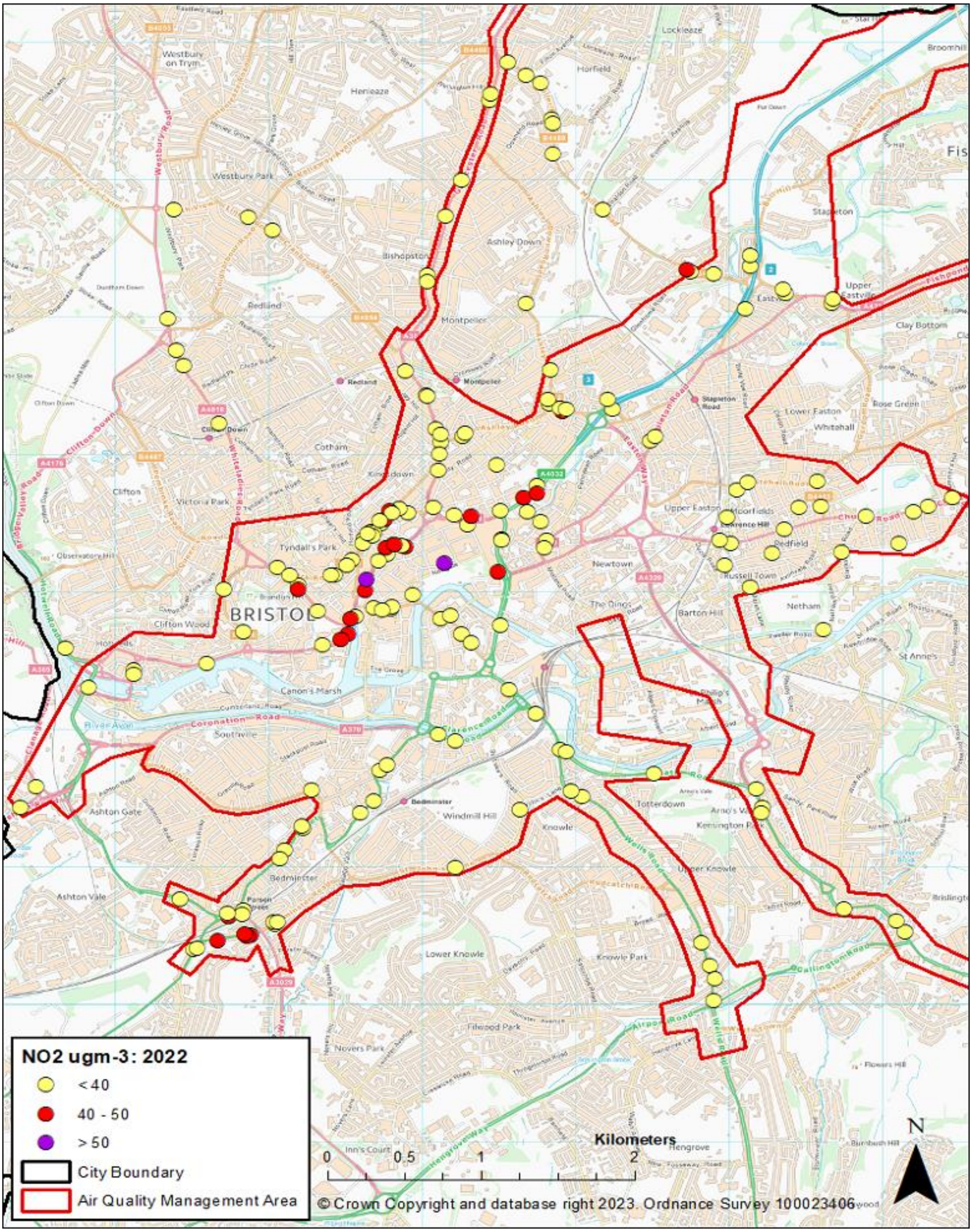
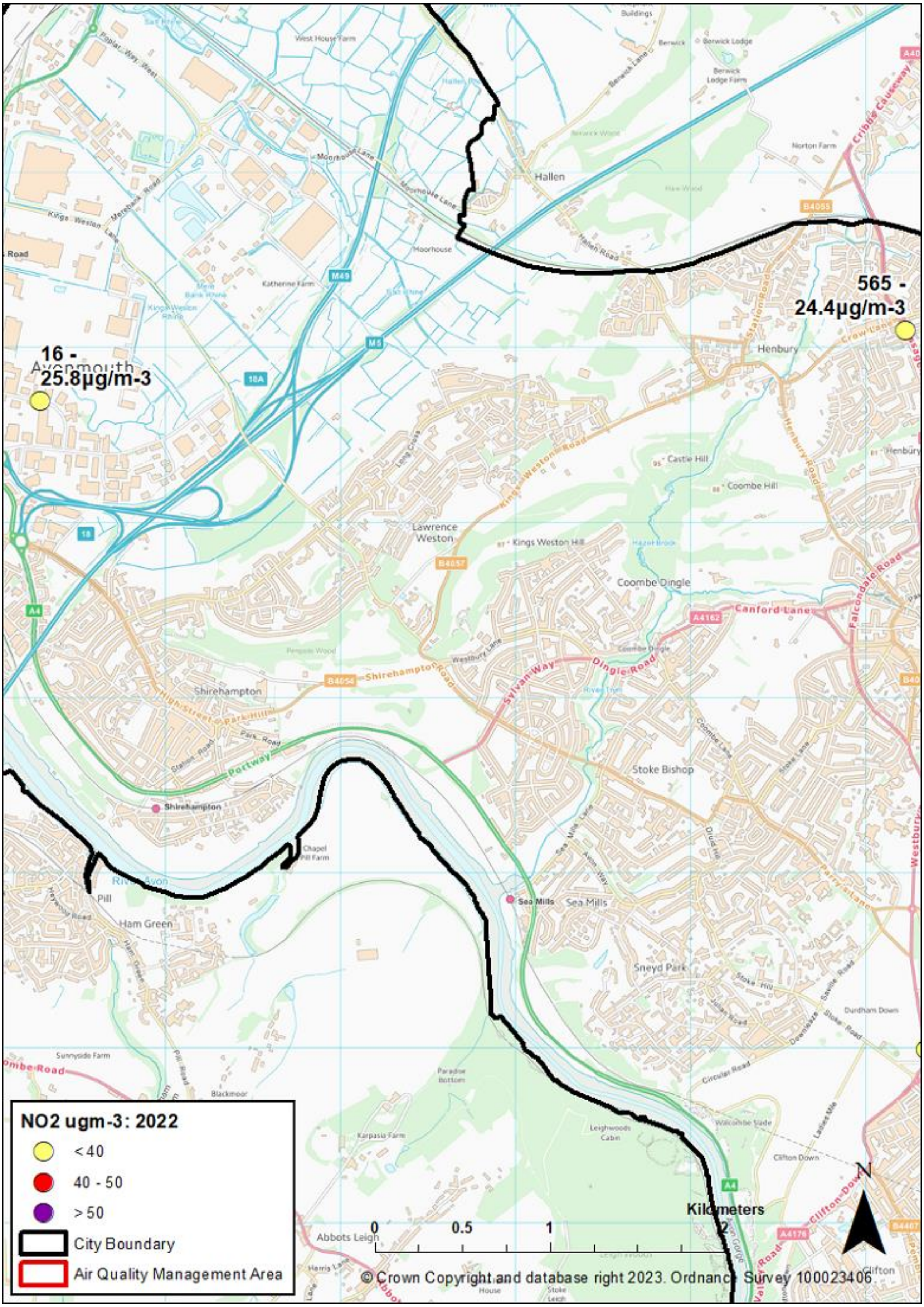


Figure 3.2 - Nitrogen Dioxide Monitoring Locations and Results 2022 – Avonmouth



3.2.2 Particulate Matter (PM_{10})

Table A.6 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.7 in Appendix A compares the ratified continuous monitored PM_{10} daily mean concentrations for the past five years with the air quality objective of 50µg/m^3, not to be exceeded more than 35 times per year.

PM_{10} was monitored at two locations in 2022, one urban background site and one roadside site. The PM_{10} monitor at Colston Avenue failed in July 2021 and it was not possible to fix and reinstate the data collection from this location. There are no exceedances of the annual mean or hourly mean objectives at either of the monitoring sites. Data for 2022 at the St Pauls urban background site shows a 1.6µg/m^3 increase in annual concentrations compared to 2021 to 17.3µg/m^3 in 2022. In 2022 there were two 24-hr periods averaging above above 50µg/m^3, this compares to none in both 2018 and 2019 and two in 2020 and 2021.

Data for 2022 from the Temple Way AURN site did not show an exceedence of objectives with an annual PM_{10} concentration of 20.9µg/m^3 measured in 2022. As would be expected, the measured PM_{10} concentration is higher at this roadside site than the AURN urban background site. The data from Temple Way shows an increase of 3.0µg/m^3 in 2022 when compared to 2021. This reverses the recent trend of decreasing annual PM_{10} concentrations at Temple Way, with 2022 concentrations matching those recorded in 2019. There were 4 days of the year when the 24 hour average was above the 50 µg/m^3 in 2022 compared to 10 in 2019, four in 2020 and three in 2021. The number of days exceeding the 24 hour average of 50µg/m^3 were below the 35 days per year which are allowed to exceed this average value before breach of the air quality objective occurs.

Although no exceedances are reported from the monitoring data it is proposed that the AQMA declaration for PM_{10} is retained as a precautionary measure given the limted number of locations at which PM_{10} is measured in the city.

3.2.3 Particulate Matter ($PM_{2.5}$)

Table A.8 in Appendix A presents the ratified and adjusted monitored $PM_{2.5}$ annual mean concentrations for the past five years.

$PM_{2.5}$ is measured at the Bristol St Pauls AURN and the BCC operated Parsons Street

School sites. The annual average for this pollutant in 2022 was 8.4µg/m^3 at St Pauls and 13.0µg/m^3 at Parsons Street School. For the St Pauls site this is an increase of 0.1µg/m^3 when compared to the 2021 annual average of 8.3µg/m^3. The roadside Parsons Street School site recorded higher $PM_{2.5}$ concentrations than the urban background site, which is to be expected. In 2022 Parsons Street saw an increase of 1.0µg/m^3 when compared to 2021 to 13.0µg/m^3. Both sites are above the World Health Organisations (WHO) air quality annual guideline value of 5µg/m^3 for this pollutant. The Bristol St Pauls site is already below the Governments newly introduced 2040 $PM_{2.5}$ target of 10.0µg/m^3.

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?	Monitoring Technique	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Inlet Height (m)
203	Brislington Depot	Urban background	361178	171566	NOX NO2 NO	No	Chemiluminescent		18	3.5
215	Parson Street School	Roadside	358042	170582	NOX NO2 NO PM2.5	Yes	Chemiluminescent (NOx) and Beta Attenuation (PM)	0	4	1.5
270	Wells Road	Roadside	360903	170024	NOX NO2 NO	Yes	Chemiluminescent	9	1	1.5
452	AURN St Pauls	Urban background	359488	173924	NOX NO2 NO PM2.5 PM10 O3	Yes	Chemiluminescent (NOx) and Beta attenuation (PM)			4
463	Fishponds Road	Roadside	362926	175590	NOX NO2 NO	Yes	Chemiluminescent	0	3	1.5
500	Temple Way	Roadside	359522	173381	NOX NO2 NO PM10	Yes	Chemiluminescent (NOx) and Beta Attenuation (PM)	0	5	1.5
501	Colston Avenue	Roadside	358640	173090	NOX NO2 NO	Yes	Chemiluminescent	3	2	1.5
672	Marlborough Street	Roadside	358728	173520	NOX NO2 NO	Yes	Chemiluminescent	0	3	1.5

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 – 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?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube Co-located with a Continuous Analyser?	Tube Height (m)
2	Colston Avenue	Roadside	358628	173011	NO2	Yes	0.0	1.0	No	2.8
3	Blackboy Hill	Roadside	357448	174650	NO2	No	0.0	3.0	No	2.8
4	Three Lamps	Roadside	359903	171850	NO2	Yes	0.0	3.0	No	3.2
5	Bedminster Parade	Roadside	358723	171704	NO2	Yes	0.0	1.0	No	3.2
9	B.R.I.	Roadside	358729	173499	NO2	Yes	0.0	1.0	No	2.4
10	Bath Road	Roadside	361217	171429	NO2	Yes	5.0	4.0	No	3.2
11	Whitefriars	Roadside	358813	173342	NO2	Yes	0.0	5.0	No	3.2
12	Galleries	Roadside	359142	173211	NO2	Yes	0.0	1.0	No	2.4
14	Red Lion Knowle	Roadside	360877	170280	NO2	Yes	6.0	2.0	No	2.4
15	Horsefair	Roadside	359294	173485	NO2	Yes	0.0	2.0	No	2.2
16	Third Way	Roadside	352287	178698	NO2	No	0.0	2.0	No	2.7
21	Gloucester Road	Roadside	359035	175306	NO2	Yes	3.0	2.0	No	2.8
22	Stokes Croft	Roadside	359109	173886	NO2	Yes	0.0	2.0	No	2.5
113	Victoria Street	Roadside	359258	172696	NO2	Yes	2.0	3.0	No	2.8
125	York Road	Roadside	359214	171917	NO2	Yes	3.0	2.0	No	1.8
147	Anchor Road	Roadside	358514	172691	NO2	Yes	0.0	1.0	No	2.2
154	Hotwells Road	Roadside	357601	172483	NO2	Yes	0.0	1.0	No	2.4
155	Jacobs Wells Road South	Roadside	357838	172713	NO2	Yes	0.0	2.0	No	3.2
156	Jacobs Wells road opp Clifton hill	Roadside	357709	173018	NO2	Yes	0.0	2.0	No	2.5
157	Stokes Croft Ashley Road	Roadside	359119	174090	NO2	Yes	0.0	2.0	No	2.4
159	Cromwell Road	Roadside	358891	174608	NO2	Yes	4.0	2.0	No	2.5
161	Bishop Road	Roadside	359152	175733	NO2	Yes	4.0	2.0	No	2.2
163	Strathmore Road	Roadside	359435	176574	NO2	Yes	7.0	3.0	No	3.6
175	top of Brislington Hill	Roadside	362147	170525	NO2	Yes	13.0	2.0	No	3.2
239	Parson St. A38 East	Kerbside	357880	170506	NO2	Yes	8.3	0.7	No	3.2
242	Parson Street Bedminster Down Road	Kerbside	357510	170401	NO2	Yes	5.0	0.5	No	3.2
254	Merchants Road Hotwells	Kerbside	357118	172429	NO2	Yes	3.7	0.8	No	2.6
260	Stapleton Road South	Roadside	361140	175366	NO2	Yes	1.5	3.5	No	2.4
261	Stapleton Road Heath Street	Roadside	361103	175059	NO2	Yes	5.0	3.0	No	2.1

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In 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)
295	Lamppost 16 Ashley Road St. Pauls	Roadside	359913	174315	NO2	Yes	0.0	2.0	No	2.8
300	Facade Haart Estate Agents 755 Fishponds Road Fishponds	Roadside	363365	175883	NO2	Yes	2.0	1.0	No	2.4
303	Facade 784 Muller Road Fishponds	Roadside	361368	175170	NO2	Yes	0.0	6.0	No	2.2
307	Lamppost Glenfrome Road \ Muller Road Horfield	Roadside	360747	175328	NO2	Yes	3.0	2.0	No	2.2
312	Lamppost Ashley Hill St. Pauls	Roadside	359832	174616	NO2	Yes	4.0	2.0	No	2.7
320_1, 320_2, 320_3	Monitor Bath Road Brislington	Urban background	361180	171567	NO2	Yes	0.0	18.0	Yes	6
325	Facade 258 Fishponds Road Fishponds	Roadside	361667	175103	NO2	Yes	0.0	8.0	No	2.4
363	5102 façade	Roadside	359075	173613	NO2	Yes	0.0	3.0	No	2.7
370	Great George Street lamppost	Roadside	359775	173513	NO2	Yes	0.0	2.0	No	2.5
371	Lamb Street façade	Roadside	359813	173373	NO2	Yes	14.0	1.0	No	2.6
373	123 Newfoundland Street façade	Roadside	359747	173774	NO2	Yes	0.0	17.0	No	2.1
374	St. Paul Street	Roadside	359509	173595	NO2	Yes	0.0	8.0	No	2.3
403	Lamp post 48 230 Bath Road	Roadside	360508	171676	NO2	Yes	0.0	2.0	No	2.8
405	Whitehall Rd/Easton Rd lamppost 4TZ	Roadside	361051	173743	NO2	Yes	1.0	1.0	No	2.5
406	Whitehall Rd lamppost 17 nr juction with Chalks Rd	Roadside	361576	173806	NO2	Yes	0.0	2.0	No	2.3
407	lamppost sussex place	Roadside	359829	174370	NO2	Yes	6.7	1.8	No	3.2
413	Wells Rd bus lane sign just below junction with Knowle Rd	Roadside	360043	171508	NO2	Yes	4.0	3.0	No	3.2

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In 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)
417	St John's Lane No 26 lamppost 15 (just past roundabout)	Roadside	359635	171413	NO2	Yes	0.0	1.0	No	3.2
418	Bedminster Down Rd lamppost between Ashton Motors & Plough PH	Roadside	357737	170642	NO2	Yes	0.0	2.0	No	2.8
419	Parson St lamppost outside Bristol Scuba	Kerbside	357832	170686	NO2	Yes	4.0	0.5	No	2.8
420	North St/Dean Lane on roundabout sign	Roadside	358277	171562	NO2	Yes	1.0	1.0	No	2.8
423	facade BRI children's	Roadside	358623	173386	NO2	Yes	0.0	13.0	No	2
429	facade villiers road stapleton road junction	Roadside	360484	174097	NO2	Yes	0.0	6.0	No	2.6
436	Shiners Garage	Roadside	361013	173352	NO2	Yes	0.0	3.0	No	2.5
438_1, 438_2, 438_3	A37 Junction w/ Airport Road	Kerbside	360903	170024	NO2	Yes	9.0	1.0	Yes	2.4
439_1, 439_2, 439_3	Parson Street School	Roadside	358042	170582	NO2	Yes	0.0	4.0	Yes	1.5
455_1, 455_2, 455_3	St. Pauls Day Nursery	Urban background	359487	173924	NO2	Yes	0.0	4.0	Yes	2.8
464_1, 464_2, 464_3	Fishponds Road	Roadside	362927	175592	NO2	Yes	0.0	3.0	Yes	3
470	Victoria Park Primary	Roadside	359213	170997	NO2	Yes	10.0	3.0	No	3.2
472	Jamiesons Autos	Roadside	358226	171284	NO2	Yes	0.0	4.0	No	2.4
473	B&G Snax West St	Roadside	358105	171124	NO2	Yes	0.0	2.0	No	2.8
487	Junction 3 Millpond Street	Roadside	360243	174327	NO2	Yes	4.0	5.0	No	2
492	On 1 way sign at bottom of Wellington Hill	Roadside	359445	176627	NO2	Yes	10.0	3.0	No	2.8
493	No 67 Filton Avenue on wall facing Muller Rd	Roadside	359677	176758	NO2	No	0.0	2.0	No	2.3

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In 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)
494	Muller Road - Adjacent to Darnley Avenue	Kerbside	359558	176850	NO2	No	5.5	0.5	No	2.1
496	385 Church Road Redfield	Roadside	362296	173620	NO2	Yes	0.0	3.0	No	2.3
497	20 Ashley Road	Roadside	359268	174132	NO2	Yes	4.0	1.0	No	2.3
499_1, 499_2, 499_3	Temple Way Nox site	Roadside	359522	173381	NO2	Yes	0.0	5.0	Yes	1.5
502_1, 502_2, 502_3	Co-located Colston Ave	Roadside	358640	173090	NO2	Yes	3.0	2.0	Yes	1.5
512	Colston girls	Roadside	359026	174432	NO2	Yes	2.0	3.0	No	2
525	Summer hill a420	Roadside	362455	173687	NO2	Yes	0.0	1.0	No	2
538	Dalby avenue	Roadside	358681	171478	NO2	Yes	0.0	1.2	No	2
539	Dalby avenue church lane	Roadside	358599	171391	NO2	Yes	2.0	2.0	No	2
545	Ashton park school	Roadside	356379	171436	NO2	Yes	0.0	4.0	No	2
550	Cathedral School	Roadside	358353	172613	NO2	Yes	0.0	9.0	No	2
555	420 Hotwell Road A4	Roadside	356679	172589	NO2	Yes	2.0	3.0	No	2
556	South Eastern stair access Plimsoll Bridge	Roadside	356827	172303	NO2	Yes	0.0	2.0	No	2
559	Except local buses sign Blackmoors Lane	Roadside	356485	171580	NO2	Yes	8.0	2.0	No	2
560_1, 560_2	Lamppost outside BRI CAZ	Roadside	358665	173439	NO2	Yes	2.0	2.5	No	2
561_1, 561_2	Lamppost opposite BRI CAZ	Roadside	358688	173431	NO2	Yes	3.0	5.0	No	2
565	A4018 Lamp post by layby before roundabout for Crow Ln/ Knole Ln	Roadside	357227	179101	NO2	No	0.0	1.0	No	2
567	Muller road/ Glenfrome road junction north	Roadside	360728	175345	NO2	No	1.5	1.5	No	2
568	Traffic light on the corner of Shaldon road	Kerbside	360178	175779	NO2	No	3.5	0.5	No	2

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In 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)
569	Lampost on North corner of Draycott road junction with Muller road.	Roadside	359855	176186	NO2	No	2.0	2.5	No	2
570	Muller road junction with Downend road lampost north of the junction.	Kerbside	359847	176439	NO2	No	2.6	0.4	No	2
571	Muller road junction with Downend road traffic light to the south of the junction.	Roadside	359848	176411	NO2	No	5.5	1.0	No	2
574	Whiteladies road, on loading sign next to Redland library	Roadside	357678	174229	NO2	No	0.0	3.0	No	2
575	Baldwin Street traffic light outside domino's	Kerbside	358685	172881	NO2	Yes	0.0	0.1	No	2
576	Baldwin Street lamp post by cycle way, opp St Stephens St	Roadside	358792	172874	NO2	Yes	0.0	1.0	No	2
577	High St lamp post outside Wards solicitors	Roadside	358935	172981	NO2	Yes	0.0	4.0	No	2
578	Church Road-CAZ-Outside Gurdwara	Roadside	361892	173552	NO2	Yes	4.0	2.0	No	2.5
579	Church Road-CAZ-Lamppost	Kerbside	362198	173580	NO2	Yes	1.9	0.1	No	2.5
580	Marlborough St-CAZ-Lamppost opposite hosp	Roadside	358754	173528	NO2	Yes	0.0	2.0	No	2.5
581	Marlborough St-CAZ-Lamppost by coach station	Kerbside	358908	173574	NO2	Yes	0.0	0.1	No	2.5
582	Rupert St-CAZ-Post outside fire station	Roadside	358893	173333	NO2	Yes	0.0	2.0	No	2.5
583	Rupert St-CAZ-Post outside police station	Roadside	358870	173340	NO2	Yes	0.0	3.0	No	2.5
584	Rupert St-CAZ-Post outside Fusion Tower	Roadside	358773	173276	NO2	Yes	13.0	3.0	No	2.5
585	Park St-CAZ-Lamppost by Guild	Roadside	358192	173050	NO2	Yes	5.0	2.0	No	2.5
586	Park St-CAZ-Lamppost by Agora	Kerbside	358195	173018	NO2	Yes	3.9	0.1	No	2.5

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In 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)
587	Baldwin St-CAZ-Lamppost by Yelland House	Roadside	358802	172896	NO2	Yes	2.1	2.5	No	2.5
588	Baldwin St-CAZ-Drainpipe on building	Roadside	358739	172869	NO2	Yes	0.0	6.4	No	2.5
589	Marlborough St-CAZ-On sign leg	Roadside	358849	173606	NO2	Yes	6.0	1.0	No	2.5
590	Marlborough St-CAZ-Post by bollards	Roadside	358789	173589	NO2	Yes	0.0	2.1	No	2.5
591	Marlborough St-CAZ-Post	Roadside	358805	173575	NO2	Yes	0.0	0.4	No	2.5
592	Upper Maudlin St-CAZ-Crossing by BRI	Kerbside	358662	173409	NO2	Yes	0.0	0.1	No	2.5
593	Upper Maudlin St-CAZ-Post by BRI	Roadside	358610	173350	NO2	Yes	3.0	1.0	No	2.5
594	Lower Park Row-CAZ-Post by Art shop	Roadside	358540	173234	NO2	Yes	0.0	2.0	No	2.5
595	Lower Park Row-CAZ-Post after OTR	Roadside	358510	173197	NO2	Yes	0.0	2.0	No	2.5
596	Park Row-CAZ-Lamppost by museum	Roadside	358431	173120	NO2	Yes	5.0	3.0	No	2.5
597	Park Row-CAZ-Post by house	Roadside	358403	173124	NO2	Yes	0.0	2.0	No	2.5
598	Queens Road-CAZ-Lamppost by UoB	Roadside	358061	173182	NO2	Yes	0.0	2.4	No	2.5
599	Park St-CAZ-Lamppost by bike stands	Roadside	358135	173123	NO2	Yes	4.0	2.0	No	2.5
600	Park St-CAZ-Lamppost by City Hall	Roadside	358322	172858	NO2	Yes	11.0	5.0	No	2.5
601	College Green-CAZ-Lamppost opp Denmark St	Roadside	358563	172818	NO2	Yes	0.0	2.6	No	2.5
602	Anchor Road-CAZ-Lamppost	Roadside	358469	172656	NO2	Yes	0.3	2.0	No	2.5
603	Lewins Mead-CAZ-Post by Evans Cycles	Roadside	358767	173320	NO2	Yes	0.0	1.5	No	2.5
604	Lewins Mead-CAZ-Post by PMT	Roadside	358817	173342	NO2	Yes	0.0	1.0	No	2.5

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In 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)
605	Rupert St-CAZ-Post by Courtrooms	Roadside	358718	173227	NO2	Yes	6.0	6.0	No	2.5
606	Victoria Street-CAZ-No entry sign	Roadside	359124	172803	NO2	Yes	11.6	1.0	No	2.5
607	Counterslip-CAZ-Drainpipe on building	Roadside	359183	172826	NO2	Yes	2.5	1.1	No	2.5
608	Temple Gate-CAZ-Lamppost	Kerbside	359563	172290	NO2	Yes	2.6	0.4	No	2.5
609	Bath Road-CAZ-Lamppost or sign	Roadside	359740	172116	NO2	Yes	0.0	2.0	No	2.5
610	Wells Road-CAZ-Lamppost	Roadside	359967	171548	NO2	Yes	0.0	2.0	No	2.5
611	Winterstoke Road-CAZ-Lamppost	Roadside	357425	170769	NO2	Yes	0.0	1.0	No	2.5
612	Newfoundland St-CAZ-Lamppost by layby	Roadside	359206	173557	NO2	Yes	0.0	4.0	No	2.5
613	Newfoundland St-CAZ-Lamppost by crossing	Kerbside	359316	173554	NO2	Yes	0.0	0.1	No	2.5
614	Temple Way-CAZ-Sign by Champ Square	Roadside	359516	173374	NO2	Yes	0.0	1.0	No	2.5
615	Newfoundland Way-CAZ-Lamppost by petrol station	Kerbside	359659	173688	NO2	Yes	0.0	0.8	No	2.5
616	Newfoundland Way-CAZ-Road sign	Kerbside	359747	173717	NO2	Yes	0.0	0.7	No	2.5
617	Houlton St-CAZ-30mph sign	Kerbside	359686	173587	NO2	Yes	0.0	0.5	No	2.5
618	Cheltenham Rd-CAZ-Sign opp Tesco	Roadside	359086	174187	NO2	Yes	4.7	3.0	No	2.5
619	Cheltenham Rd-CAZ-Lamppost by Bite	Roadside	359119	174149	NO2	Yes	0.0	3.0	No	2.5
621	Gloucester Rd-CAZ-Lamppost by bus stop	Roadside	359256	175999	NO2	Yes	0.0	3.0	No	2.5
622	Bedminster Rd-CAZ-Lamppost opp school	Roadside	358034	170602	NO2	Yes	2.5	2.0	No	2.5
623	Bedminster Rd-CAZ-Lamppost by school	Roadside	358059	170597	NO2	Yes	4.1	2.2	No	2.5

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In 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)
624	Bedminster Rd-CAZ-Post opp Van Sales	Roadside	357858	170499	NO2	Yes	8.0	2.0	No	2.5
625	Bedminster Rd-CAZ-Lamppost by Van Sales	Roadside	357842	170514	NO2	Yes	0.0	1.2	No	2.5
626	Bedminster Rd-CAZ-Post	Roadside	357667	170466	NO2	Yes	0.0	2.0	No	2.5
627	Parson St-CAZ-Lamppost by Station	Roadside	357829	170658	NO2	Yes	0.0	3.0	No	2.5
628	Lower Ashley Rd-CAZ-Lamppost by Geo Jones	Roadside	359899	174335	NO2	Yes	0.0	4.0	No	2.5
629	Lower Ashley Rd-CAZ-Lamppost opp London Rd	Roadside	359936	174330	NO2	Yes	1.0	2.0	No	2.5
630	Bedminster Down Rd-CAZ-Lamppost by billboard	Roadside	357533	170410	NO2	Yes	0.0	3.0	No	2.5
631	Bedminster Down Rd-CAZ-Roadsign by Winterstoke	Roadside	357729	170660	NO2	Yes	10.5	1.5	No	2.5
632	West St-CAZ-Lamppost by Argus Rd	Roadside	358073	171063	NO2	Yes	6.2	1.6	No	2.5
633	West St-CAZ-Lamppost opp Jamiesons	Roadside	358217	171299	NO2	Yes	0.4	2.3	No	2.5
634	Bedminster Parade-CAZ-Lamppost by William Hill	Roadside	358772	171741	NO2	Yes	0.4	2.3	No	2.5
635	York Rd-CAZ-Sign after bridge	Kerbside	359106	171962	NO2	Yes	0.0	0.5	No	2.5
636	Bath Rd-CAZ-Lamppost by Bus Lane	Roadside	359940	171838	NO2	Yes	0.0	3.0	No	2.5
637	Bath Rd-CAZ-Lamppost by Kings Road	Roadside	361206	171390	NO2	Yes	0.0	1.5	No	2.5
638	A4044 Roundabout-CAZ-Lamppost	Roadside	359498	173144	NO2	Yes	0.0	17.0	No	2.5
639	Victoria St-CAZ-Lamppost opp Mitchell Lane	Roadside	359318	172634	NO2	Yes	3.0	1.0	No	2.5
640	Lamb Street-CAZ-One way sign by Church	Roadside	359792	173319	NO2	Yes	0.0	3.0	No	2.5
641	Stokes Croft-CAZ-Lamppost	Roadside	359114	174007	NO2	Yes	0.0	2.5	No	2.5

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In 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)
642	Ashley Road-CAZ-Lamppost opp Drumd Rd	Roadside	359276	174155	NO2	Yes	0.0	2.0	No	2.5
643	Sussex Place-CAZ-Lamppost	Kerbside	359817	174401	NO2	Yes	10.4	0.2	No	2.5
644	Ashley Down Rd-CAZ-Lamppost	Roadside	359676	175102	NO2	No	6.0	2.0	No	2.5
645	Gloucester Rd-CAZ-Lamppost opp Baths	Kerbside	359033	175259	NO2	Yes	5.9	0.1	No	2.5
646	Cheltenham Rd-CAZ-Post by Papa Johns	Kerbside	359035	174427	NO2	Yes	2.9	0.1	No	2.5
647	Merchants Rd-CAZ-Lamppost by house	Roadside	357124	172400	NO2	Yes	2.8	1.7	No	2.5
648	Wells Rd-CAZ-Lamppost by Red Lion Carpets	Roadside	360905	170185	NO2	Yes	4.3	2.0	No	2.5
649	Bath Rd-Lamppost	Roadside	362089	170606	NO2	Yes	10.5	2.0	No	2.5
650	Wells Rd-CAZ-Lamppost	Roadside	360818	170448	NO2	Yes	0.0	2.0	No	2.5
651	Church Rd-CAZ-Post by Barwaaqo Cafe	Roadside	360938	173376	NO2	Yes	0.0	2.0	No	2.5
652	Whitehall Rd-CAZ-Lamppost by house	Roadside	361119	173796	NO2	Yes	3.5	1.0	No	2.5
653	Stapleton Rd-CAZ-Lamppost by house	Roadside	360515	174134	NO2	Yes	2.5	1.5	No	2.5
654	Mina Rd-CAZ-Lamppost by house	Roadside	360207	174403	NO2	Yes	2.1	3.2	No	2.5
655	Muller Rd-CAZ-Lamppost opp LA DT	Roadside	361355	175203	NO2	Yes	0.0	2.0	No	2.5
656	Stapleton Rd-CAZ-Lamppost	Kerbside	361141	175446	NO2	Yes	7.6	0.5	No	2.5
657	Fishponds Rd-CAZ-Lamppost	Roadside	361676	175127	NO2	Yes	0.0	3.0	No	2.5
658	Fishponds Rd-CAZ-Lamppost	Roadside	363325	175803	NO2	Yes	3.8	1.5	No	2.5
659	Muller Rd-CAZ-Lamppost	Kerbside	359773	176702	NO2	No	8.8	0.1	No	2.5
660	Muller Rd-CAZ-Lamppost	Kerbside	360896	175312	NO2	Yes	5.8	0.2	No	2.5

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In 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)
661	Linden Rd-CAZ-Lamppost by house	Kerbside	358022	175630	NO2	No	6.6	0.4	No	2.5
662	Linden Rd-CAZ-Lamppost by house	Roadside	357868	175723	NO2	No	10.5	3.0	No	2.5
663	Whiteladies Rd-CAZ-Lamppost after petrol station	Roadside	357396	174761	NO2	No	3.0	3.0	No	2.5
664	Westbury Rd-CAZ-Lamppost by hospital	Kerbside	357347	174992	NO2	No	0.0	0.1	No	2.5
665	Upper Maudlin St-CAZ-Lamppost opp BRI	Roadside	358675	173405	NO2	Yes	2.0	2.0	No	2.5
666	Upper Maudlin St-CAZ-Lamppost by BRI	Roadside	358646	173426	NO2	Yes	5.0	5.0	No	2.5
667	College Green-CAZ-Post by Toni&Guy	Kerbside	358531	172803	NO2	Yes	4.5	0.5	No	2.5
669	Temple Way Bridge-CAZ-Lamppost Temple Way Bridge	Roadside	359511	172754	NO2	Yes	0.0	3.0	No	2.5
670	Bristol Hill-CAZ-Lamppost Bristol Hill	Roadside	361749	170690	NO2	Yes	1.5	3.0	No	2.5
671	North View Downs Park West	Kerbside	357381	175781	NO2	No	1.0	0.3	No	2
673_1, 673_2, 673_3	Marlborough Street - co - located	Roadside	358728	173520	NO2	Yes	0.0	3.0	Yes	1.5
674	Troopers Hill Opposite No 30	Urban background	363157	173215	NO2	No	4.8	1.2	No	2.1
675	Netham Lock Junction	Urban background	361615	172728	NO2	No	0.0	1.5	No	2.1
676	Blackswarth Road Opposite St Patrick's School	Urban background	361734	173291	NO2	Yes	3.8	2.2	No	2.1
677	Beaufort Road Opposite No 109	Urban background	362105	173350	NO2	Yes	1.8	0.0	No	2.1
678	Victoria Avenue Opposite No 90	Urban background	361279	173283	NO2	Yes	0.0	1.5	No	2.1

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In 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)
679	Avonvale Road Opposite Bristol Futures Academy	Urban background	361134	173034	NO2	Yes	2.0	0.3	No	2.1
680	Morely Street/Bright Street Ped Crossing	Urban background	360973	173193	NO2	Yes	4.0	1.5	No	2.1
681	Russel Town Avenue Opposite Pheonix Social Enterprise Club	Urban background	360985	173541	NO2	Yes	13.5	1.5	No	2.1
682	Church Road Miss Millies	Roadside	361359	173460	NO2	Yes	2.0	0.5	No	2.1
683	Victoria Parade Opposite No 39	Urban background	361451	173617	NO2	Yes	1.5	1.5	No	2.1
684	Lyppiatt Road Opposite No 25	Urban background	361597	173622	NO2	Yes	3.5	1.0	No	2.1

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.3 – Annual Mean NO_2 Monitoring Results: Automatic Monitoring (µg/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 2022 (%) (2)	2018	2019	2020	2021	2022
203	361178	171566	Urban background	99.4	99.4	25.4	25.2	18.8	20	20.4
215	358042	170582	Roadside	98.3	98.3	39	32.3	28.6	31.4	28.8
270	360903	170024	Roadside	98.9	98.9	33	29.7	27.9	23.9	22.7
452	359488	173924	Urban background	96.1	96.1	23.8	23.4	15.2	17.5	19.2
463	362926	175590	Roadside	99.3	99.2	**41.5**	39.5	22.2	29.4	26.6
500	359522	173381	Roadside	97.2	97.2	**44.3**	39.2	28.3	32.1	31.2
501	358640	173090	Roadside	99.5	99.5	**67.2**	**65.5**	**45.2**	**49.8**	**66.2**
672	358728	173520	Roadside	98.4	98.4				32.7	28.5

☒ **Annualisation has been conducted where data capture is <75% and >25% in line with LAQM.TG22**

☒ **Reported concentrations are those at the location of the monitoring site (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 40µg/m^3 are shown in **bold**.

All means have been "annualised" as per LAQM.TG22 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%).

Table A.4 – Annual Mean NO_2 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 2022 (%) [(2)]	2018	2019	2020	2021	2022
2	358628	173011	Roadside	92.3	92.3	**58.2**	**53.7**	36.9	**40.1**	**40.3**
3	357448	174650	Roadside	100	100.0	34.4	27.7	28.7	**44.4**	38.8
4	359903	171850	Roadside	100	100.0	**53.5**	**41**	36.8	38.9	38.4
5	358723	171704	Roadside	100	100.0	**45.8**	39.9	31.6	**41**	37.9
9	358729	173499	Roadside	100	100.0	**44.7**	37.8	31.7	39.3	36.0
10	361217	171429	Roadside	100	100.0	**51.5**	**42.2**	33.6	36.8	35.9
11	358813	173342	Roadside	100	100.0	**48.1**	**41.1**	31.1	35	35.3
12	359142	173211	Roadside	92.3	92.3	**57.5**	**51.8**	**41.9**	**46.5**	**50.2**
14	360877	170280	Roadside	100	100.0	**47.6**	38.7	32.4	32.7	30.3
15	359294	173485	Roadside	90.7	90.4	**47.5**	**42.2**	28.2	31.5	31.3
16	352287	178698	Roadside	100	90.4	32.6	28.7	23.2	24.9	25.8
21	359035	175306	Roadside	100	90.4	**46.4**	38.3	33.4	34.9	34.0
22	359109	173886	Roadside	84.1	84.6	**51**	**44.3**	34.3	37.5	36.7
113	359258	172696	Roadside	100	100.0	**40.5**	37.4	29.9	27.8	32.0
125	359214	171917	Roadside	82.7	82.7	**50.3**	**45.2**	35.6	35.8	33.6
147	358514	172691	Roadside	100	100.0	**56.6**	**50.9**	39.4	**43.3**	**45.5**
154	357601	172483	Roadside	100	100.0	36.2	30	22.1	25.4	26.1
155	357838	172713	Roadside	92	92.3	**40.1**	31.1	22.9	25.5	24.2
156	357709	173018	Roadside	100	100.0	36.2	30.5	20.7	24.9	25.9
157	359119	174090	Roadside	67.4	67.3	**45.4**	**43.1**	35.7	**40.3**	35.0
159	358891	174608	Roadside	100	90.4	**43.3**	35.8	28.5	31.9	32.1
161	359152	175733	Roadside	100	90.4	38	31.7	25.3	27.4	26.0
163	359435	176574	Roadside	100	90.4	36.6	30.8	24.5	27.4	27.2
175	362147	170525	Roadside	100	100.0	**54.9**	**44.6**	36.4	**41.4**	38.7
239	357880	170506	Kerbside	83	82.7	**65.2**	**54.4**	**47.6**	**51.4**	**48.6**
242	357510	170401	Kerbside	90.7	90.4	**51.1**	**41**	32.2	34.5	36.6
254	357118	172429	Kerbside	100	100.0	**49.4**	**40.5**	31.1	34.6	33.0
260	361140	175366	Roadside	100	90.4	**43.1**	36.2	29.5	33.2	31.6
261	361103	175059	Roadside	100	82.7	**51**	**41.5**	34.7	39.1	39.3
295	359913	174315	Roadside	100	90.4	**59.6**	**48.1**	37.2	**44.5**	**41.0**
300	363365	175883	Roadside	100	90.4	**41.1**	35.1	28.9	28.7	27.5
303	361368	175170	Roadside	100	90.4	**43.8**	36.5	29.2	31.8	31.2
307	360747	175328	Roadside	91.3	75.0	37.3	30.7	24.6	27.5	26.8
312	359832	174616	Roadside	100	90.4	38.5	32.8	26.2	29.5	29.8

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 2022 (%) (2)	2018	2019	2020	2021	2022
320_1, 320_2, 320_3	361180	171567	Urban background	100	100.0	27.9	23.5	19.3	20.8	20.6
325	361667	175103	Roadside	100	90.4	**48.1**	39.4	34.1	37.3	32.6
363	359075	173613	Roadside	92.3	92.3	37.2	34	23.5	26.8	28.0
370	359775	173513	Roadside	100	100.0	36.6	30.1		25	31.0
371	359813	173373	Roadside	100	100.0	**42.2**	34.1	25.8	29.4	29.0
373	359747	173774	Roadside	82.2	82.7	35.7	31.2	23.9	27.9	27.4
374	359509	173595	Roadside	100	100.0	**47.8**	39.9	29.9	35	33.7
403	360508	171676	Roadside	100	100.0	35.6	28.1	23.4	25.5	25.5
405	361051	173743	Roadside	92.3	92.3	**56.2**	**48.5**	38.7	**40.4**	38.0
406	361576	173806	Roadside	90.7	90.4	38.5	31	26.6	29.3	29.6
407	359829	174370	Roadside	100	90.4	**46.7**	37.3	26.7	30.2	29.5
413	360043	171508	Roadside	100	100.0	37.6	31.2	25.5	27.4	27.2
417	359635	171413	Roadside	100	100.0	36	31	26.3	27.9	27.0
418	357737	170642	Roadside	100	100.0	**55.7**	**51.1**	**40.2**	**45.9**	**44.1**
419	357832	170686	Kerbside	92	92.3	**45**	39	31.4	34.3	33.6
420	358277	171562	Roadside	82.7	82.7	37.1	30.4	23.2	25.6	28.8
423	358623	173386	Roadside	100	100.0	**42.3**	35.2	27.3	29.5	29.1
429	360484	174097	Roadside	76.4	76.9	**46.8**	**41.2**	38.8	36.4	35.5
436	361013	173352	Roadside	100	100.0	**50.6**	**42**	29.2	31.2	30.6
438_1, 438_2, 438_3	360903	170024	Kerbside	94.8	100.0	36.6	31.8	27.1	29	29.4
439_1, 439_2, 439_3	358042	170582	Roadside	100	100.0	37.7	31.7	25.4	28.6	27.2
455_1, 455_2, 455_3	359487	173924	Urban background	100	100.0	24.4	20.8	15.9	16.4	16.7
464_1, 464_2, 464_3	362927	175592	Roadside	100	90.4	34.4	29.7	24.2	23.7	24.0
470	359213	170997	Roadside	100	100.0	37.9	29.4	25.1	26.8	28.3
472	358226	171284	Roadside	100	90.4	37.3	33.7	26.2	28.7	29.0
473	358105	171124	Roadside	90.7	90.4	**44**	**42.4**	**40**	28.4	28.4
487	360243	174327	Roadside	88.1	65.4	**41.9**	35.1	27.7	29.6	36.8

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 2022 (%) (2)	2018	2019	2020	2021	2022
492	359445	176627	Roadside	100	90.4	34.8	31.3	25.2	26.4	27.5
493	359677	176758	Roadside	100	90.4	**41.8**	37	29.5	31.8	31.2
494	359558	176850	Kerbside	100	90.4	38.7	32	25.1	25	26.4
496	362296	173620	Roadside	100	100.0	39.2	33	25	25.9	26.7
497	359268	174132	Roadside	100	100.0	38	29.1	24.6	27.1	24.7
499_1, 499_2, 499_3	359522	173381	Roadside	100	100.0	**43.2**	33.6	26	31.1	30.9
502_1, 502_2, 502_3	358640	173090	Roadside	78.4	84.6		**<u>68.7</u>**	**52.1**	**58**	**54.1**
512	359026	174432	Roadside	100	100.0	**47.6**	**40.6**	30.7	36.1	36.2
525	362455	173687	Roadside	100	100.0	**43.5**	35.3	24.1	28.5	29.8
538	358681	171478	Roadside	100	42.3	33.7	26.6	20.4	22.5	21.3
539	358599	171391	Roadside	100	100.0	**43.3**	35.6	27.4	30.9	23.8
545	356379	171436	Roadside	100	100.0	34.9	28.6	22	24.3	23.3
550	358353	172613	Roadside	84.3	84.6	36.9	35.1	21.1	29.1	29.4
555	356679	172589	Roadside	100	100.0		32	26.5	28	28.0
556	356827	172303	Roadside	100	100.0		37	31.7	35	31.8
559	356485	171580	Roadside	89.6	82.7		29	19.8	24.5	24.2
560_1, 560_2	358665	173439	Roadside	100	100.0		**40.4**	30.2	32.2	31.5
561_1, 561_2	358688	173431	Roadside	100	100.0		**47**	33.8	36.7	34.8
565	357227	179101	Roadside	100	90.4		31.4	24.5	26.3	24.4
567	360728	175345	Roadside	100	90.4		**44**	**41.3**	**44.8**	**43.2**
568	360178	175779	Kerbside	100	90.4		36.2	29	32.9	32.2
569	359855	176186	Roadside	100	90.4		31.4	22.8	24.1	24.1
570	359847	176439	Kerbside	100	90.4		33.1	28.4	28.2	29.6
571	359848	176411	Roadside	100	90.4		**42.8**	31.3	33.1	32.3
574	357678	174229	Roadside	90.9	90.4			27.3	28.9	29.6
575	358685	172881	Kerbside	100	92.3			30.9	29.6	31.5
576	358792	172874	Roadside	100	100.0			23.9	26.8	29.8
577	358935	172981	Roadside	100	100.0			30.5	27.8	31.1
578	361892	173552	Roadside	100	100.0				33	31.1
579	362198	173580	Kerbside	100	100.0				35.4	32.2
580	358754	173528	Roadside	90.1	82.7				**47.9**	**41.8**

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 2022 (%) [(2)]	2018	2019	2020	2021	2022
581	358908	173574	Kerbside	91.8	92.3				**40.8**	39.1
582	358893	173333	Roadside	83.3	75.0				**50**	**43.7**
583	358870	173340	Roadside	67	67.3				**42.3**	37.9
584	358773	173276	Roadside	92	92.3				33	34.3
585	358192	173050	Roadside	84.1	84.6				30.5	32.1
586	358195	173018	Kerbside	77.7	57.7				38.6	**41.8**
587	358802	172896	Roadside	90.1	90.4				26.5	30.9
588	358739	172869	Roadside	100	100.0				26.5	31.5
589	358849	173606	Roadside	100	100.0				26.5	27.2
590	358789	173589	Roadside	100	100.0				**42.3**	**40.7**
591	358805	173575	Roadside	100	100.0				34.9	33.1
592	358662	173409	Kerbside	100	100.0				39.6	38.6
593	358610	173350	Roadside	72.6	67.3				35.2	36.3
594	358540	173234	Roadside	100	100.0				34.1	34.1
595	358510	173197	Roadside	60.6	51.9				32.2	30.6
596	358431	173120	Roadside	92	92.3				30	31.2
597	358403	173124	Roadside	78.8	67.3				32.7	33.0
598	358061	173182	Roadside	82.1	82.7				26.9	26.8
599	358135	173123	Roadside	75	75.0				33.3	31.0
600	358322	172858	Roadside	100	100.0				23.9	23.9
601	358563	172818	Roadside	100	100.0				29.4	30.8
602	358469	172656	Roadside	75	75.0				38	**42.7**
603	358767	173320	Roadside	90.4	90.4				39.6	**41.9**
604	358817	173342	Roadside	100	100.0				**43**	**43.1**
605	358718	173227	Roadside	65.1	65.4				32.4	30.2
606	359124	172803	Roadside	100	100.0				25.5	25.7
607	359183	172826	Roadside	100	100.0				27.8	28.4
608	359563	172290	Kerbside	91.5	82.7				39.4	38.4
609	359740	172116	Roadside	100	100.0				30.2	30.4
610	359967	171548	Roadside	100	100.0				32.3	32.4
611	357425	170769	Roadside	100	100.0				19.5	20.1
612	359206	173557	Roadside	100	100.0				29.9	30.9
613	359316	173554	Kerbside	100	100.0				**40.6**	**42.0**
614	359516	173374	Roadside	90.7	90.4				28.4	29.4
615	359659	173688	Kerbside	82.5	82.7				**53**	**49.4**
616	359747	173717	Kerbside	91.5	82.7				**44**	**42.5**
617	359686	173587	Kerbside	92.1	92.3				28.4	25.3

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 2022 (%) [(2)]	2018	2019	2020	2021	2022
618	359086	174187	Roadside	100	100.0				33.8	31.5
619	359119	174149	Roadside	90.7	90.4				34.7	38.2
621	359256	175999	Roadside	74	65.4				24.9	25.4
622	358034	170602	Roadside	100	100.0				33.7	34.3
623	358059	170597	Roadside	92	92.3				30.6	28.4
624	357858	170499	Roadside	83.3	76.9				**49.7**	**48.4**
625	357842	170514	Roadside	90.7	90.4				**45.4**	**44.7**
626	357667	170466	Roadside	92.3	92.3				**43**	**43.3**
627	357829	170658	Roadside	75	75.0				34	33.3
628	359899	174335	Roadside	100	90.4				35.9	33.2
629	359936	174330	Roadside	100	82.7				38.9	34.8
630	357533	170410	Roadside	89.7	80.8				30.3	35.5
631	357729	170660	Roadside	92	92.3				24.8	25.9
632	358073	171063	Roadside	90.4	90.4				23.4	24.6
633	358217	171299	Roadside	92.3	92.3				36.5	34.6
634	358772	171741	Roadside	100	100.0				34.6	30.1
635	359106	171962	Kerbside	100	100.0				25.3	23.8
636	359940	171838	Roadside	100	100.0				26.2	25.5
637	361206	171390	Roadside	92.1	92.3				21.7	24.2
638	359498	173144	Roadside	100	100.0				**43.8**	**42.4**
639	359318	172634	Roadside	100	100.0				27	29.5
640	359792	173319	Roadside	100	100.0				28.1	27.1
641	359114	174007	Roadside	100	100.0				39.7	38.1
642	359276	174155	Roadside	100	100.0				28.9	24.6
643	359817	174401	Kerbside	100	90.4				39.7	35.6
644	359676	175102	Roadside	100	82.7				31.8	31.7
645	359033	175259	Kerbside	92	82.7				30.3	28.9
646	359035	174427	Kerbside	100	100.0				31.7	31.7
647	357124	172400	Roadside	76.6	76.9				34.3	30.9
648	360905	170185	Roadside	92.3	92.3				29	29.2
649	362089	170606	Roadside	100	100.0				30.1	30.0
650	360818	170448	Roadside	100	100.0				22.8	21.6
651	360938	173376	Roadside	75.3	75.0				35.2	33.9
652	361119	173796	Roadside	92.3	92.3				**41.5**	37.0
653	360515	174134	Roadside	66.3	65.4				26	30.9
654	360207	174403	Roadside	100	90.4				22.9	24.0
655	361355	175203	Roadside	100	90.4				29.2	28.6

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 2022 (%) (2)	2018	2019	2020	2021	2022
656	361141	175446	Kerbside	92.3	82.7				28.8	27.3
657	361676	175127	Roadside	100	90.4				29.2	33.5
658	363325	175803	Roadside	100	90.4				23.6	24.1
659	359773	176702	Kerbside	100	90.4				26.5	25.1
660	360896	175312	Kerbside	92	82.7				32.1	32.4
661	358022	175630	Kerbside	100	90.4				23.3	22.0
662	357868	175723	Roadside	100	90.4				21.2	20.7
663	357396	174761	Roadside	100	100.0				24.7	25.9
664	357347	174992	Kerbside	100	90.4				25.5	24.8
665	358675	173405	Roadside	100	100.0				37.6	37.1
666	358646	173426	Roadside	100	100.0				32.8	31.3
667	358531	172803	Kerbside	100	84.6				**43.6**	**45.3**
669	359511	172754	Roadside	100	65.4				28.6	33.2
670	361749	170690	Roadside	100	100.0				39.9	38.8
671	357381	175781	Kerbside	92.3	82.7				26.1	23.5
673_1, 673_2, 673_3	358728	173520	Roadside	100	100.0				36.1	33.5
674	363157	173215	Urban background	81.5	75.0					15.2
675	361615	172728	Urban background	82.6	82.7					26.4
676	361734	173291	Urban background	90.5	90.4					19.8
677	362105	173350	Urban background	83.4	82.7					21.4
678	361279	173283	Urban background	66.2	65.4					17.7
679	361134	173034	Urban background	66.2	65.4					21.0
680	360973	173193	Urban background	84.5	84.6					20.8
681	360985	173541	Urban background	80.8	73.1					24.8
682	361359	173460	Roadside	100	100.0					26.7
683	361451	173617	Urban background	82.8	82.7					18.6
684	361597	173622	Urban background	36.9	32.7					20.1

☒ **Annualisation has been conducted where data capture is <75% and >25% in line with LAQM.TG22.**

☒ **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 40µg/m^3 are shown in **bold**.

NO_2 annual means exceeding 60µg/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.TG22 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 at City Centre Locations 2010 to 2022

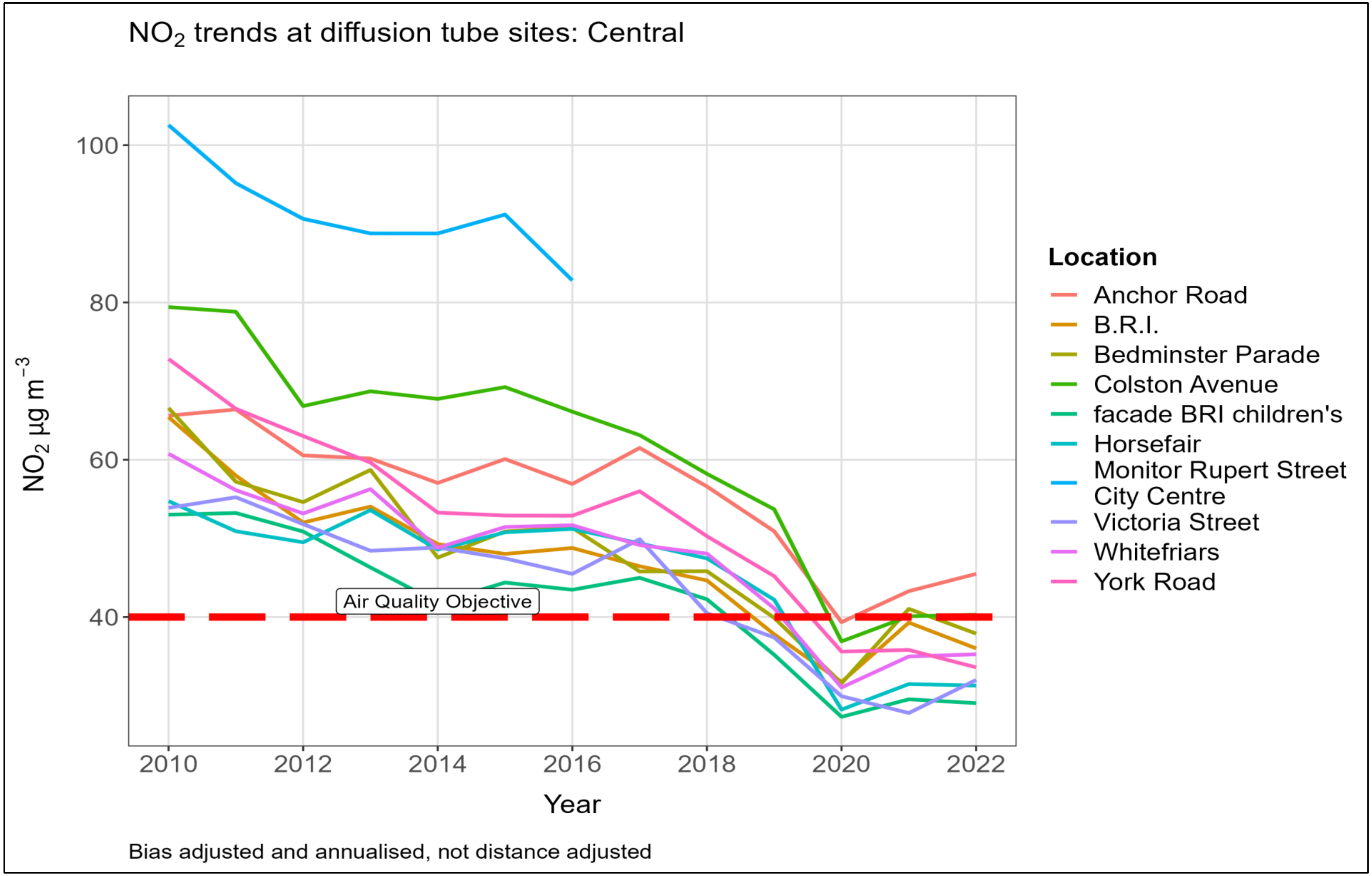


Figure A.2 - Trends in Annual Nitrogen Dioxide at Gloucester Road/Cheltenham Road Locations 2010 to 2022

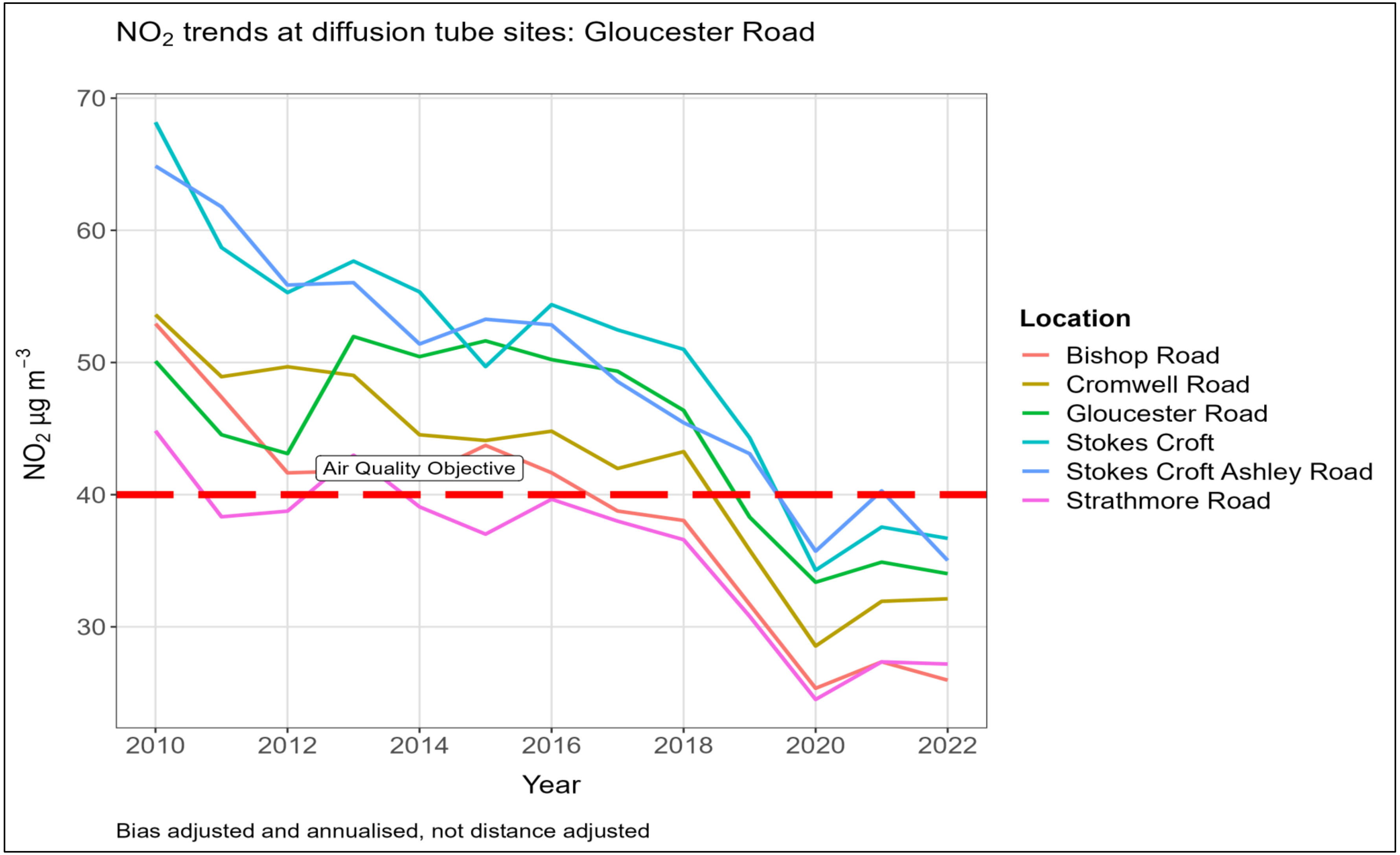


Figure A.3 - Trends in Annual Nitrogen Dioxide at Parson Street Gyratory Locations 2010 to 2022

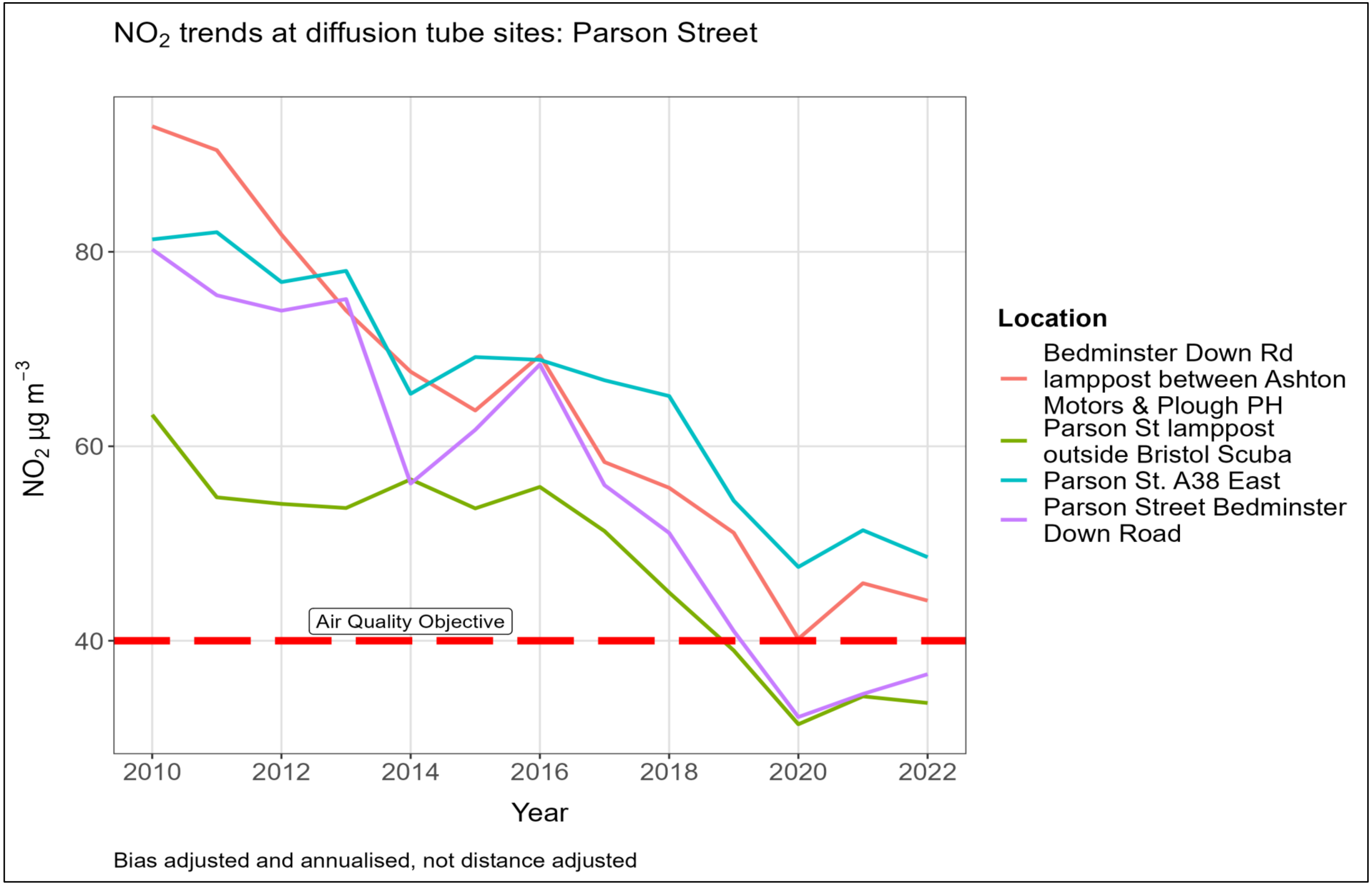


Figure A.4 - Trends in Annual Nitrogen Dioxide at Newfoundland Way / M32 Locations 2010 to 2022

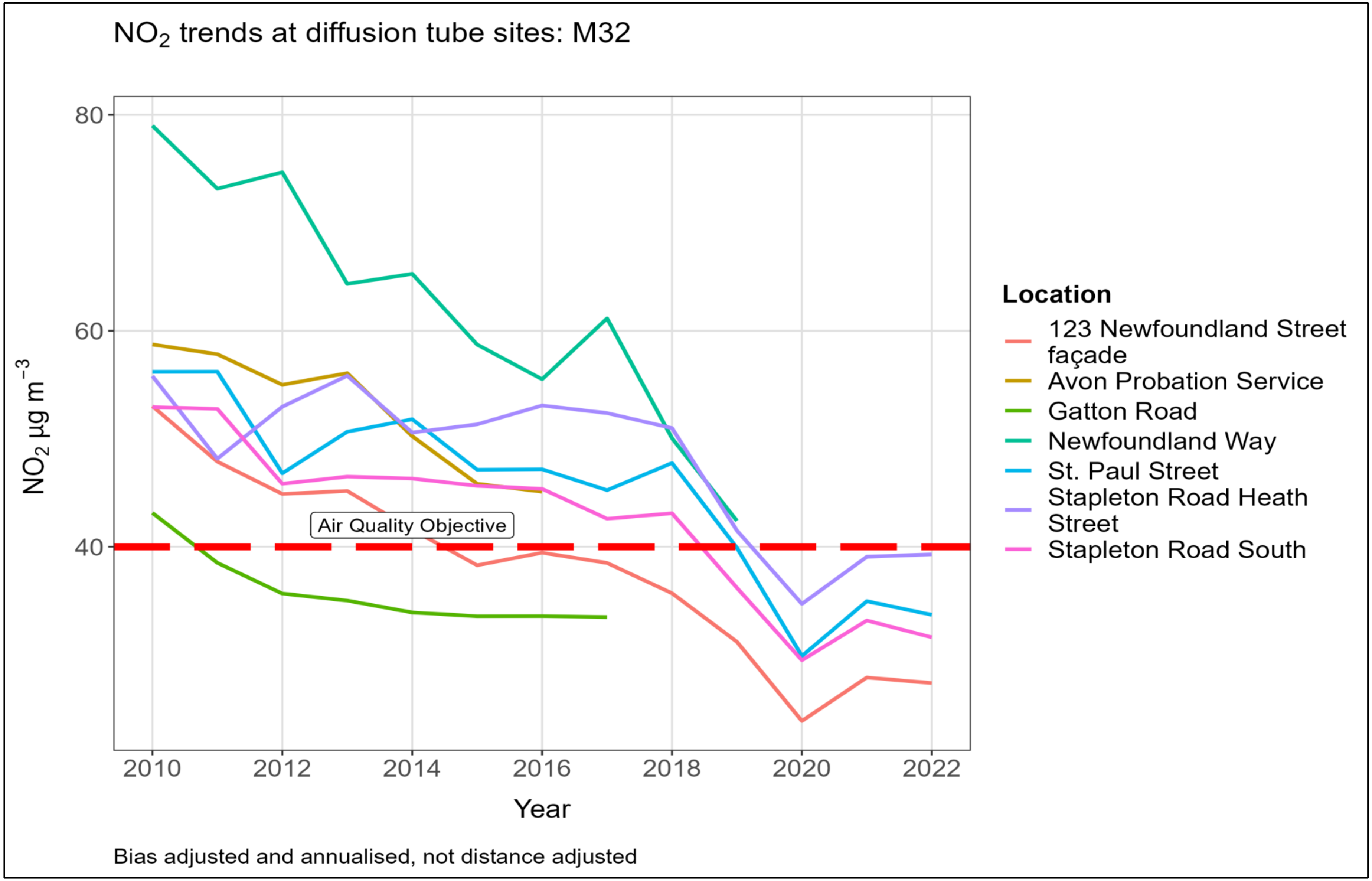


Table A.5 – 1-Hour Mean NO_2 Monitoring Results, Number of 1-Hour Means > 200µg/m^3

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022
203	361178	171566	Urban background	99.4	99.4	0	0	0	0	0
215	358042	170582	Roadside	98.3	98.3	0	0	0	0	0
270	360903	170024	Roadside	98.9	98.9	0	0	0	0	0
452	359488	173924	Urban background	96.1	96.1	0(92.5)	0	0	0	0
463	362926	175590	Roadside	99.3	99.2	1	0(118)	0(81.3)	0	0
500	359522	173381	Roadside	97.2	97.2	0	0	0	0	0
501	358640	173090	Roadside	99.5	99.5	0(186)	8	6	0	9
672	358728	173520	Roadside	98.4	98.4				0(80.2)	0

Notes:

Results are presented as the number of 1-hour periods where concentrations greater than 200µg/m^3 have been recorded.

Exceedances of the NO_2 1-hour mean objective (200µg/m^3 not to be exceeded more than 18 times/year) are shown in **bold**.

If the period of valid data is less than 85%, the 99.8th percentile of 1-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_{10} Monitoring Results (µg/m³)

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022
452	359488	173924	Urban background	93.8	93.8	15.9	16	17.3	15.7	17.3
500	359522	173381	Roadside	76.7	76.7	22.6	20.9	19.7	17.9	20.9
501	358640	173090	Roadside				21.8	19.4	18.2	

☐ **Annualisation has been conducted where data capture is <75% and >25% in line with LAQM.TG22**

Notes:

The annual mean concentrations are presented as µg/m³.

Exceedances of the PM_{10} annual mean objective of 40µg/m³ are shown in **bold**.

All means have been "annualised" as per LAQM.TG22 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%).

Table A.7 – 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 2022 (%) (2)	2018	2019	2020	2021	2022
452	359488	173924	Urban background	93.8	93.8	0(27.4)	0	2	2	2
500	359522	173381	Roadside	76.7	76.7	4	10	4	3	4(31.7)
501	358640	173090	Roadside				4	0	2(27.4)	

Notes:

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

Exceedances of the PM_{10} 24-hour mean objective (50µg/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.8 – 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 2022 (%) (2)	2018	2019	2020	2021	2022
215	358042	170582	Roadside	81.4	81.4			11.8	12.0	13.0
452	359488	173924	Urban background	94.6	94.5	12.0	10.8	9.7	8.3	8.4

☒ **Annualisation has been conducted where data capture is <75% and >25% in line with LAQM.TG22.**

Notes:

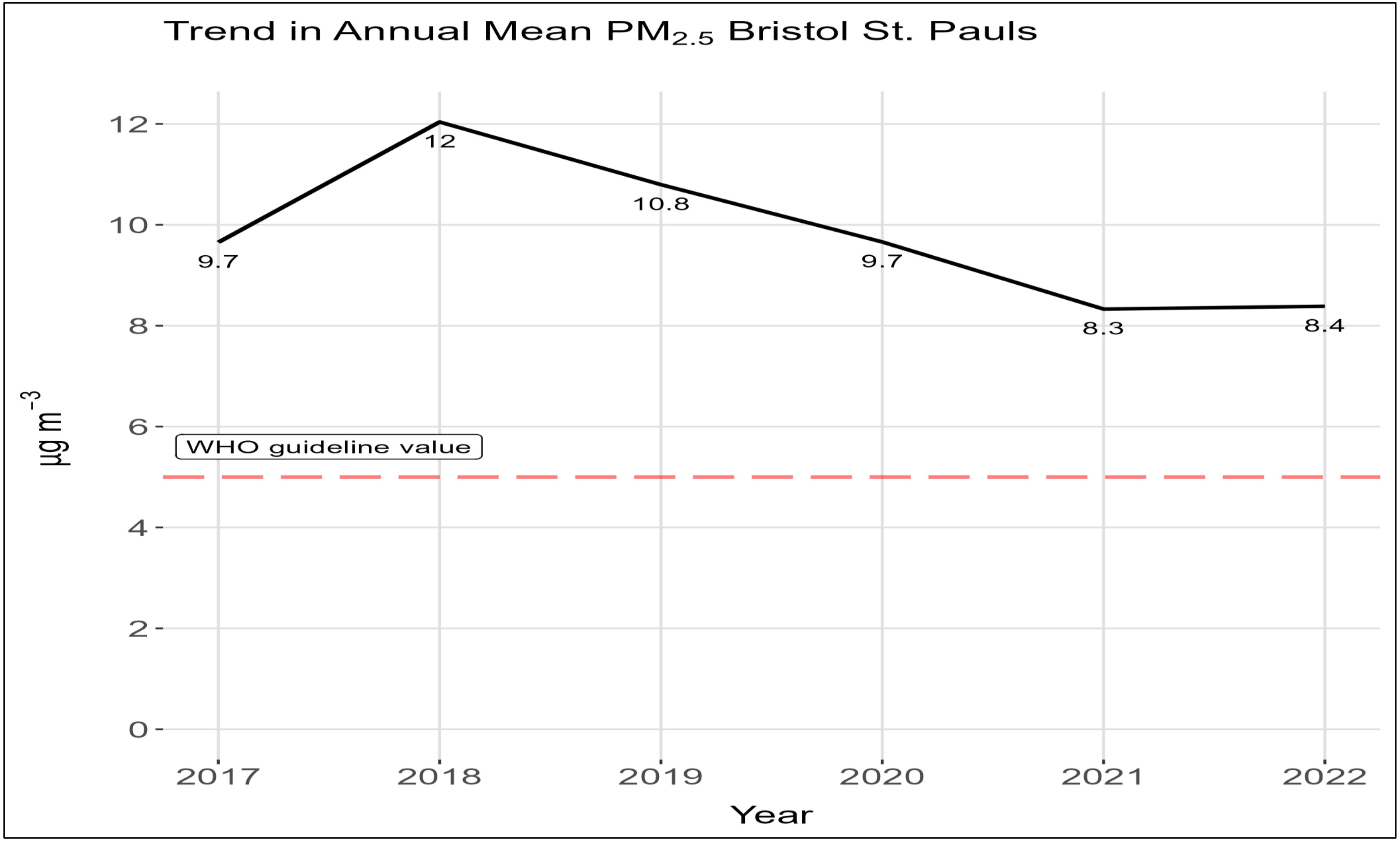
The annual mean concentrations are presented as $\mu g/m^3$.

All means have been “annualised” as per LAQM.TG22 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.5 – Trends in Annual Mean $PM_{2.5}$ Concentrations – AURN St Pauls



Appendix B: Full Monthly Diffusion Tube Results for 2022

Table B.1 – 2022 NO_2 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 (0.86)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
2	358628	173011	54.5	45.9	56.6	45.0	41.1	42.8	40.0		42.6	48.8	51.5	45.4	**46.7**	**40.3**		
3	357448	174650	57.7	28.5	57.1	48.2	36.3	32.3	35.8	45.6	36.0	42.1	49.8	70.3	**45.0**	38.8		
4	359903	171850	56.8	37.7	54.8	48.1	37.1	41.1	40.1	48.6	48.6	38.3	45.9	37.4	**44.5**	38.4		
5	358723	171704	57.0	41.8	47.6	38.6	40.0	43.5	43.8	47.2	44.4	36.7	42.1	44.9	**44.0**	37.9		
9	358729	173499	54.9	39.9	54.2	35.8	33.0	36.4	37.6	41.6	42.4	40.6	43.8	41.2	**41.8**	36.0		
10	361217	171429	52.0	35.7	50.5	36.3	34.8	35.1	39.4	44.9	44.2	41.7	41.4	44.1	**41.7**	35.9		
11	358813	173342	49.8	35.4	53.7	36.3	33.9	37.8	35.7	43.3	44.4	34.1	44.4	42.2	**40.9**	35.3		
12	359142	173211	62.6	59.4	74.6	58.4	53.1	48.6	63.6	87.4		39.8	49.2	43.5	**58.2**	**50.2**		
14	360877	170280	15.1	26.4	51.4	37.6	30.0	35.0	36.9	44.8	37.8	34.0	35.1	38.2	35.2	30.3		
15	359294	173485	45.0	30.2	45.0	34.4		30.5	32.6	36.9	41.5	30.1	35.2	37.8	36.3	31.3		
16	352287	178698	39.2	33.1	36.3	24.9	22.7	27.0	31.3	27.1	23.6	29.4	34.8		29.9	25.8		
21	359035	175306	51.2	43.7	42.8	36.2	33.8	33.0	38.8	30.0	39.6	38.0	47.1		39.5	34.0		
22	359109	173886	53.1		59.2	44.8	38.4	42.4	41.4	27.6	47.5	42.2		29.2	**42.6**	36.7		
113	359258	172696	51.6	35.9	44.7	32.9	27.3	32.2	33.3	31.9	34.6	40.5	43.4	37.3	37.1	32.0		
125	359214	171917	55.0	38.1			31.8	32.4	35.4	42.8	37.0	38.7	40.8	37.8	39.0	33.6		
147	358514	172691	59.6	58.5	73.2	48.2	51.3	44.2	49.3	47.3	41.7	53.6	52.7	53.8	**52.8**	**45.5**		
154	357601	172483	46.5	30.4	39.1	31.2	24.0	22.0	23.1	34.2	27.2	25.1	26.2	34.4	30.3	26.1		
155	357838	172713	38.3		31.4	28.2	15.3	24.8	24.9	30.0	31.4	25.7	28.4	30.6	28.1	24.2		
156	357709	173018	42.2	25.1	36.1	28.6	21.9	42.6	23.8	26.1	26.5	26.5	32.0	28.7	30.0	25.9		
157	359119	174090	57.0	40.7			38.7		30.9	42.8		36.8	45.3	41.5	**41.7**	35.0		
159	358891	174608	47.5	32.2	46.9	37.8	28.8	31.3	29.7	36.9	38.0	39.7	41.2		37.3	32.1		
161	359152	175733	44.1	21.8	37.3	27.5	26.1	24.5	25.9	25.0	30.1	31.6	37.4		30.1	26.0		
163	359435	176574	46.5	25.1	35.1	32.4	26.4	26.6	25.1	30.1	33.3	32.0	34.3		31.5	27.2		
175	362147	170525	53.5	42.6	40.8	37.0	40.9	43.3	44.1	51.4	47.1	44.5	47.7	45.9	**44.9**	38.7	26.4	
239	357880	170506	71.9	50.7	64.2	40.0	57.1		56.6	67.5	55.6		42.3	57.8	**56.4**	**48.6**	31.9	
242	357510	170401	52.4	36.6	55.7	41.7		39.4	44.2	53.0	47.0	15.0	39.6	42.0	**42.4**	36.6	26.9	
254	357118	172429	48.7	37.0	42.2	37.6	35.8	36.6	35.4	40.9	33.1	32.9	39.8	39.4	38.3	33.0		
260	361140	175366	47.4	36.1	39.6	35.6	31.4	33.1	36.3	33.2	36.6	34.8	39.6		36.7	31.6		

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 (0.86)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
261	361103	175059	62.1	40.2	51.0	45.8	38.5	41.0	45.8	44.0	48.8	38.8			**45.6**	39.3	33.3	
295	359913	174315	69.1	50.1	53.8	43.6	47.7	45.4	40.6	35.5	41.1	44.3	52.6		**47.6**	**41.0**		
300	363365	175883	46.7	36.4	34.6	31.1	22.7	33.6	30.7	30.1	31.3	25.6	27.5		31.8	27.5		
303	361368	175170	46.0	36.9	37.7	34.1	43.4	31.1	36.7	35.4	20.3	35.9	40.3		36.2	31.2		
307	360747	175328		28.3	43.0	33.8	24.7	24.8		27.8	32.5	29.4	35.8		31.1	26.8		
312	359832	174616	45.0	29.1	40.5	35.6	29.6	28.7	34.0	32.3	34.8	32.4	37.9		34.5	29.8		
320_1, 320_2, 320_3	361180	171567	35.6	22.5	25.2	20.8	19.0	20.3	21.6	22.4	24.5	21.9	25.1	28.0	23.9	20.6		
325	361667	175103	47.6	37.9	42.7	39.4	41.5	40.0	32.9	30.2	30.0	32.7	40.8		37.8	32.6		
363	359075	173613	45.2	31.3	38.8	30.0	27.0	29.4		25.7	34.4	28.2	33.8	33.2	32.4	28.0		
370	359775	173513	46.7	39.9	34.6	32.5	30.8	30.1	35.0	29.6	38.9	34.2	39.0	40.3	36.0	31.0		
371	359813	173373	47.1	34.3	38.8	32.9	26.3	28.3	32.5	29.0	37.6	29.2	32.5	35.4	33.6	29.0		
373	359747	173774	39.1	30.2	40.3		23.8	28.1	26.5	27.7	33.5	32.5		36.1	31.8	27.4		
374	359509	173595	45.7	37.1	53.9	34.8	31.3	35.1	34.7	35.0	40.5	38.3	43.0	39.8	39.1	33.7		
403	360508	171676	43.4	30.5	35.5	28.5	23.6	24.3	24.6	27.6	31.3	23.0	28.9	33.2	29.5	25.5		
405	361051	173743	57.7	43.2		45.4	40.6	25.9	50.1	42.1	46.7	40.0	49.9	42.7	**44.0**	38.0	34.8	
406	361576	173806	46.5	30.9	37.1	32.5	23.9	25.9	28.7	28.2	34.8		54.1	34.6	34.3	29.6		
407	359829	174370	49.1	27.5	54.8	32.6	26.6	20.6	26.6	30.9	37.1	33.5	37.0		34.2	29.5		
413	360043	171508	43.6	30.7	40.3	28.9	26.5	27.1	30.2	32.2	31.4	24.0	30.2	34.1	31.6	27.2		
417	359635	171413	47.7	32.3	40.1	32.3	26.4	19.7	29.7	33.1	31.5	28.2	31.8	22.7	31.3	27.0		
418	357737	170642	74.7	50.7	56.9	48.5	43.0	45.6	48.7	49.5	48.3	45.9	53.9	48.6	**51.2**	**44.1**		
419	357832	170686	59.5	35.3	44.1	33.3	29.3	33.9	37.9	32.1		39.5	44.0	39.9	39.0	33.6		
420	358277	171562	49.7	30.7	42.9	34.5	25.9	26.8	28.3	29.2			31.0	35.7	33.5	28.8		
423	358623	173386	45.7	37.6	37.6	29.6	30.6	28.8	33.3	29.5	28.5	34.1	37.1	32.1	33.7	29.1		
429	360484	174097	57.6	41.3	40.1	33.6	35.5	38.5			48.9	37.1		37.9	**41.2**	35.5		
436	361013	173352	44.8	36.1	38.8	31.3	33.0	32.5	35.8	31.5	37.2	32.8	38.1	34.1	35.5	30.6		
438_1, 438_2, 438_3	360903	170024	45.0	35.4	36.4	28.8	28.8	31.4	32.7	30.7	31.9	34.8	37.2	36.3	34.1	29.4		
439_1, 439_2, 439_3	358042	170582	42.3	30.1	35.5	28.4	26.6	27.8	30.8	34.8	30.0	27.8	33.8	31.0	31.6	27.2		
455_1, 455_2, 455_3	359487	173924	32.3	18.3	24.2	18.1	12.3	16.0	15.6	14.5	18.1	16.8	20.5	25.8	19.4	16.7		

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 (0.86)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
464_1, 464_2, 464_3	362927	175592	45.2	32.0	29.3	25.7	24.5	26.6	22.9	21.2	22.3	26.7	30.6		27.9	24.0		
470	359213	170997	46.8	33.7	37.6	34.3	25.9	32.0	29.4	34.9	31.8	25.5	28.3	33.9	32.8	28.3		
472	358226	171284	46.4	29.0	43.3	35.0	25.9	27.0	28.9	33.2	32.1	32.7	36.6		33.6	29.0		
473	358105	171124	48.7	25.1	37.6	31.2		27.1	29.4	34.7	32.0	28.3	30.2	38.2	33.0	28.4		
487	360243	174327			34.1	29.9	33.0	29.2	34.7	28.8	33.0		67.9		36.3	36.8	33.5	
492	359445	176627	46.9	28.3	35.0	29.4	25.5	24.1	26.2	27.8	31.6	35.2	40.6		31.9	27.5		
493	359677	176758	51.9	38.0	37.4	35.6	33.3	29.7	35.4	34.0	34.8	33.3	35.1		36.2	31.2		
494	359558	176850	48.1	27.4	37.1	29.6	23.9	22.7	25.6	23.2	31.3	29.3	39.0		30.7	26.4		
496	362296	173620	46.9	36.2	30.1	30.7	27.7	27.5	28.4	28.4	29.2	24.1	31.4	30.6	30.9	26.7		
497	359268	174132	46.8	31.8	32.0	21.5	15.2	17.8	17.7	21.5	31.1	30.8	37.9	39.4	28.6	24.7		
499_1, 499_2, 499_3	359522	173381	45.5	32.0	41.3	38.5	27.4	29.4	30.2	38.2	38.4	31.1	34.5	43.6	35.8	30.9		
502_1, 502_2, 502_3	358640	173090	83.7			60.8	41.8	67.5	61.8	60.2	60.3	65.9	73.0	52.7	**62.8**	**54.1**	**46.9**	
512	359026	174432	55.6	36.0	45.3	39.1	32.9	41.4	38.6	40.5	47.3	38.3	42.2	47.1	**42.0**	36.2	33.5	
525	362455	173687	50.0	38.3	35.8	35.4	29.7	25.6	32.8	32.0	35.2	28.4	35.4	36.9	34.6	29.8		
538	358681	171478	40.0	21.5	33.7	27.6	17.4								28.1	21.3		
539	358599	171391	43.2	26.0	28.4	25.4	15.4	20.0	26.5	29.9	24.1	22.8	30.2	40.1	27.7	23.8		
545	356379	171436	36.0	27.5	35.7	27.1	22.9	24.2	18.7	27.8	23.0	24.9	28.3	28.1	27.0	23.3		
550	358353	172613	45.1	30.2	43.5	38.1	32.2	26.8			32.8	27.4	28.1	37.2	34.1	29.4		
555	356679	172589	46.3	22.7	41.7	36.7	24.4	29.2	32.7	41.1	36.7	23.9	25.5	28.9	32.5	28.0		
556	356827	172303	53.0	34.3	37.4	34.0	36.5	22.7	39.3	39.7	38.2	35.7	38.7	33.3	36.9	31.8		
559	356485	171580		23.7	35.6		22.9	23.7	25.8	29.4	28.9	26.8	33.0	31.2	28.1	24.2		
560_1, 560_2	358665	173439	54.1	37.2	40.2	34.3	28.0	31.6	31.6	34.6	36.7	34.0	41.5	35.4	36.6	31.5		
561_1, 561_2	358688	173431	55.1	36.0	52.0	39.5	30.1	37.0	36.3	36.0	38.1	39.7	42.9	41.1	**40.3**	34.8		
565	357227	179101	41.5	22.7	30.9	30.4	24.0	25.9	27.2	29.6	29.0	24.9	25.1		28.3	24.4		
567	360728	175345	67.6	48.2	50.9	51.7	43.8	42.3	47.4	45.7	48.0	52.2	53.1		**50.1**	**43.2**	38.7	
568	360178	175779	50.2	34.1	45.5	36.6	32.3	29.9	35.1	36.2	39.5	35.7	35.9		37.4	32.2		
569	359855	176186	44.3	23.5	31.4	27.7	22.5	20.6	24.1	26.0	27.4	28.0	32.1		28.0	24.1		
570	359847	176439	51.9	32.5	37.5	32.8	30.3	27.1	30.0	26.9	34.0	36.3	39.1		34.4	29.6		
571	359848	176411	54.3	31.2	41.5	32.3	37.2	31.8	34.6	33.2	38.9	33.6	43.3		37.4	32.3		

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 (0.86)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
574	357678	174229	51.6	29.4	34.9	30.6	31.1	34.1	33.3	29.2	33.3		34.0	36.4	34.4	29.6		
575	358685	172881		32.6	37.0	26.8	25.7	23.7	31.3	38.4	47.8	49.2	44.5	45.1	36.5	31.5		
576	358792	172874	47.1	25.8	36.3	28.1	25.3	25.5	26.4	33.2	38.5	46.0	45.6	37.6	34.6	29.8		
577	358935	172981	48.4	37.5	34.9	30.1	30.2	27.8	30.8	33.9	33.2	42.6	44.1	39.3	36.1	31.1		
578	361892	173552	48.8	30.0	44.8	37.8	29.0	32.0	37.5	41.2	40.4	25.1	29.6	36.8	36.1	31.1		
579	362198	173580	55.2	34.9	40.6	32.7	28.8	33.0	37.2	36.7	40.3	32.5	38.6	38.0	37.4	32.2		
580	358754	173528		52.6	59.3	49.9	49.7	50.9	48.0	45.9	50.4		32.6	45.8	**48.5**	**41.8**		
581	358908	173574	66.0	44.6	54.6	42.3	35.6	41.1	39.7	45.2		38.4	48.4	42.6	**45.3**	39.1		
582	358893	173333	75.0	49.1		48.0	44.7	40.8	49.3		46.3	50.5	52.1		**50.6**	**43.7**		
583	358870	173340	65.2	57.4	51.0	43.2				45.0		45.3	51.8	48.3	**50.9**	37.9		
584	358773	173276	58.9		45.6	42.2	22.5	30.9	34.7	49.5	39.4	31.8	34.7	47.4	39.8	34.3		
585	358192	173050	51.1		48.2	39.5	29.0	28.3	37.0	33.6		32.7	34.6	38.9	37.3	32.1		
586	358195	173018			50.0	40.5	41.3	35.4	41.6		39.2		46.0		**42.0**	**41.8**	31.0	
587	358802	172896	48.4	32.8	41.7		27.4	26.6	26.9	34.9	37.4	41.2	38.5	38.3	35.8	30.9		
588	358739	172869	49.7	33.8	39.8	32.9	30.1	30.1	27.7	31.0	35.7	42.8	46.0	39.5	36.6	31.5		
589	358849	173606	41.5	28.3	38.6	31.3	24.2	26.1	26.8	31.2	37.4	26.5	32.6	34.4	31.6	27.2		
590	358789	173589	63.0	49.6	48.6	32.3	42.9	48.0	50.1	43.8	51.4	45.5	48.1	43.9	**47.3**	**40.7**		
591	358805	173575	43.8	40.4	47.9	34.2	34.7	30.1	36.3	30.3	41.1	39.4	45.1	37.3	38.4	33.1		
592	358662	173409	53.4	40.3	54.7	39.5	37.9	41.4	42.0	50.4	40.0	46.5	46.8	44.9	**44.8**	38.6		
593	358610	173350		39.3			31.4	35.8		37.2	35.6	39.0	39.2	38.7	37.0	36.3	31.8	
594	358540	173234	53.9	39.2	45.1	36.0	33.8	35.4	34.7	39.3	37.2	39.3	41.1	39.3	39.5	34.1		
595	358510	173197			41.1		29.7		33.3			37.5	37.4	37.3	36.1	30.6		
596	358431	173120	44.7	34.4	35.2	33.6	31.3	27.6	32.1	34.7		39.2	44.0	40.9	36.1	31.2		
597	358403	173124			50.6		31.5	33.7	33.9	33.1		35.2	33.9	33.5	35.7	33.0		
598	358061	173182	46.3	23.8	42.1		21.7	25.2	28.3	32.5		26.8	28.9	34.9	31.1	26.8		
599	358135	173123	48.9	36.4			31.6	34.2	35.6		33.0	32.9	34.7	36.7	36.0	31.0		
600	358322	172858	37.4	24.1	38.6	27.7	23.4	21.7	23.2	25.6	26.9	25.3	28.9	30.2	27.8	23.9		
601	358563	172818	44.7	40.7	44.4	35.2	31.1	27.5	32.3	31.9	29.7	31.8	34.8	44.1	35.7	30.8		
602	358469	172656	50.3	46.7	67.8	44.7		42.5			43.3	47.9	51.4	51.0	**49.5**	**42.7**	**41.9**	
603	358767	173320	56.1	47.2	66.5	44.4	39.5	40.0	44.3	51.1	48.9		48.7	48.1	**48.6**	**41.9**		
604	358817	173342	58.2	42.7	68.4	49.4	40.6	44.5	47.1	56.8	54.2	40.3	50.0	48.6	**50.1**	**43.1**		
605	358718	173227	43.6		51.4		30.2	30.4	26.2	34.7			38.7	42.5	37.2	30.2		

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 (0.86)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
606	359124	172803	40.9	24.0	40.9	25.5	21.0	23.3	23.0	29.9	31.8	30.7	30.7	36.3	29.8	25.7		
607	359183	172826	43.3	30.9	42.0	29.8	28.6	29.5	25.3	38.4	32.4	30.8	30.9	33.8	33.0	28.4		
608	359563	172290	52.9	40.8		47.6	39.5	39.4	47.6	48.3	46.7	38.7	44.3		**44.6**	38.4	31.8	
609	359740	172116	45.7	26.6	47.0	41.0	26.5	26.7	31.2	45.7	36.9	28.5	30.1	36.9	35.2	30.4		
610	359967	171548	46.2	33.2	42.7	34.9	30.2	32.9	37.6	41.6	38.6	33.9	40.6	38.4	37.5	32.4		
611	357425	170769	38.0	17.0	33.0	22.6	15.0	17.4	19.7	26.9	21.1	18.3	23.3	27.4	23.3	20.1		
612	359206	173557	45.3	31.2	44.4	37.1	28.9	27.2	32.2	42.4	38.1	27.1	34.7	42.0	35.9	30.9		
613	359316	173554	60.6	54.4	57.8	49.9	44.4	43.3	45.6	45.4	51.1	40.8	46.7	44.7	**48.7**	**42.0**		
614	359516	173374	39.9	30.8	36.0	27.3		33.2	31.5	29.0	35.3	33.7	33.2	45.1	34.1	29.4		
615	359659	173688	78.3	58.9	55.0		55.9	48.9		58.4	59.0	54.4	54.9	49.7	**57.3**	**49.4**		
616	359747	173717	65.8	43.3	50.6	45.7	43.4		52.3	58.0	53.2	37.9	42.9		**49.3**	**42.5**		
617	359686	173587	40.6	26.9	36.1	26.7	18.8	24.2	26.3	28.0	32.9	25.9		35.8	29.3	25.3		
618	359086	174187	46.2	41.5	37.7	28.8	31.4	26.0	30.8	32.0	39.1	39.5	44.0	41.9	36.6	31.5		
619	359119	174149	53.5	35.5	59.0	40.0		33.0	33.8	45.5	51.6	41.0	44.8	50.1	**44.3**	38.2		
621	359256	175999	45.1	29.3	30.4	26.9	23.6	24.5	23.8	23.9					28.4	25.4		
622	358034	170602	47.9	38.9	42.8	34.0	33.0	38.2	37.8	41.9	37.6	40.3	44.9	40.9	39.8	34.3		
623	358059	170597	44.5	33.9	36.3	31.0	28.2	21.6	31.0	34.4	32.0	30.2		39.2	32.9	28.4		
624	357858	170499		58.0	64.0	61.2	52.4	55.1			53.0	48.7	59.3	53.2	**56.1**	**48.4**	35.4	
625	357842	170514	71.8	53.6	61.3	57.2	51.1	35.4	48.8	49.9	41.8		49.9	50.1	**51.9**	**44.7**		
626	357667	170466	58.8	49.1	65.3	22.4	40.2		50.4	51.0	54.0	52.4	55.7	53.0	**50.2**	**43.3**		
627	357829	170658	48.6		47.5	39.2	31.7		17.5	38.7	40.7		41.9	41.5	38.6	33.3		
628	359899	174335	51.4	32.0	48.3	40.0	30.0	32.4	32.6	42.1	41.4	34.6	38.3		38.5	33.2		
629	359936	174330		33.7	24.5	36.4	40.2	42.3	39.1	38.7	47.4	48.5	53.4		**40.4**	34.8		
630	357533	170410	42.7	37.0	57.2	44.7		35.8	33.2	47.7	32.8	41.4	39.0		**41.1**	35.5		
631	357729	170660	41.6	25.6	39.6	30.9	22.7	19.8	26.3	33.6	29.8	26.5		33.3	30.0	25.9		
632	358073	171063	40.5	24.8	37.1		21.4	20.7	22.8	28.5	26.8	25.9	30.2	35.4	28.6	24.6		
633	358217	171299	55.4	38.8	44.3	35.4	32.3	32.6		42.7	36.8	33.9	42.2	47.8	**40.2**	34.6		
634	358772	171741	44.3	28.4	41.6	34.9	28.2	32.3	30.0	36.4	35.3	33.7	35.4	38.2	34.9	30.1		
635	359106	171962	42.5	25.7	37.2	27.0	21.1	10.1	22.8	30.7	28.4	25.4	27.1	33.1	27.6	23.8		
636	359940	171838	47.1	33.7	31.1	26.9	21.1	23.4	22.6	30.2	28.9	25.8	33.2	31.5	29.6	25.5		
637	361206	171390	40.7	22.6	34.8	23.7	10.1	16.9	17.1	54.3		23.5	25.8	39.2	28.1	24.2		
638	359498	173144	58.8	60.1	65.0	51.4	45.2	46.8	39.4	35.1	37.8	43.5	50.1	56.6	**49.1**	**42.4**		

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 (0.86)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
639	359318	172634	47.8	26.2	50.2	30.2	23.7	25.3	25.8	34.0	32.9	35.8	37.8	41.4	34.3	29.5		
640	359792	173319	40.0	9.9	40.8	31.7	25.9	25.8	25.8	31.6	51.1	28.2	30.7	36.1	31.5	27.1		
641	359114	174007	52.5	46.5	46.9	46.1	40.5	43.1	40.0	40.0	41.6	38.7	49.6	45.0	**44.2**	38.1		
642	359276	174155	45.8	31.2	32.1	21.6	17.1	19.3	17.0	24.3	35.5	27.6	34.6	36.6	28.6	24.6		
643	359817	174401	56.2	47.1	46.4	35.6	37.2	35.9	33.9	35.0	39.0	40.3	47.5		**41.3**	35.6		
644	359676	175102		39.5	35.8	34.0	33.7	41.1	33.5	36.3	38.9	35.5	39.4		36.8	31.7		
645	359033	175259	46.6	26.1		32.3	27.2	32.6	30.2	33.6	37.5	29.5	39.9		33.5	28.9		
646	359035	174427	49.6	36.0	42.3	30.0	28.3	33.7	29.2	34.3	48.8	30.1	39.9	39.7	36.8	31.7		
647	357124	172400	50.3		30.9	37.5	30.9		30.3		33.9	35.2	36.4	37.1	35.8	30.9		
648	360905	170185	43.5	31.0	38.6	30.2	25.3	27.1		33.1	35.5	32.3	38.4	38.0	33.9	29.2		
649	362089	170606	44.0	27.2	42.7	33.4	25.4	29.4	32.8	44.8	39.0	28.0	28.7	41.6	34.8	30.0		
650	360818	170448	41.2	19.5	33.8	24.4	18.2	18.0	24.8	26.6	18.7	21.5	23.1	30.4	25.0	21.6		
651	360938	173376	52.5		44.6	38.3		30.0		38.9	40.8	30.9	38.4	39.5	39.3	33.9		
652	361119	173796	52.6	46.8	44.0	41.8	35.8	37.5	37.9	41.7		37.5	46.6	50.2	**43.0**	37.0	30.4	
653	360515	174134	50.1	32.3		31.1		30.8		33.3	33.9		45.9	48.1	38.2	30.9		
654	360207	174403	41.7	23.8	33.7	26.3	21.9	22.2	21.9	22.9	27.1	29.9	34.7		27.8	24.0		
655	361355	175203	46.2	40.1	34.1	25.6	29.7	23.7	29.0	27.4	37.4	32.6	39.9		33.2	28.6		
656	361141	175446	40.5	33.5	35.2	26.6	27.6	26.9	25.7	27.6		32.7	40.0		31.6	27.3		
657	361676	175127	53.2	45.2	37.7	32.4	30.6	26.1	38.9	40.2	41.7	39.1	42.3		38.9	33.5		
658	363325	175803	39.2	22.0	35.6	24.3	29.3	22.7	22.9	23.0	25.3	31.1	32.2		28.0	24.1		
659	359773	176702	48.1	22.7	34.9	27.9	22.0	17.6	23.1	26.3	29.5	30.5	37.5		29.1	25.1		
660	360896	175312	51.4	26.2	45.1	37.0	30.4	30.7		39.0	35.7	37.0	43.9		37.6	32.4		
661	358022	175630	44.3	19.4	33.4	22.5	16.5	21.5	20.9	22.7	27.9	25.4	25.7		25.5	22.0		
662	357868	175723	41.9	17.4	34.1	22.5	16.5	16.6	19.0	20.9	25.2	24.1	25.9		24.0	20.7		
663	357396	174761	42.6	24.3	37.9	31.1	23.7	24.8	29.3	31.0	31.2	28.1	25.2	31.8	30.1	25.9		
664	357347	174992	44.3	22.5	31.3	30.2	23.5	26.4	24.7	24.7	32.2	28.2	28.2		28.8	24.8		
665	358675	173405	55.3	37.8	51.4	46.0	34.6	37.1	35.8	41.4	39.3	44.2	48.0	45.0	**43.0**	37.1	34.3	
666	358646	173426	51.1	39.6	37.2	36.4	30.0	28.1	30.0	35.4	33.4	35.5	42.3	37.0	36.3	31.3		
667	358531	172803			52.8	45.9	47.2	52.4	49.8	47.0	47.2	61.9	65.9	55.9	**52.6**	**45.3**	34.3	
669	359511	172754		30.9	45.3	29.6	25.3	25.5	32.3	29.7	38.2				32.1	33.2		
670	361749	170690	64.9	38.8	62.3	44.3	33.6	25.3	42.0	51.1	45.9	42.9	41.7	47.9	**45.1**	38.8	36.0	
671	357381	175781	41.8	24.2	33.7	22.9	18.5	22.6	21.4	24.5		26.5	36.2		27.2	23.5		

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 (0.86)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
673_1, 673_2, 673_3	358728	173520	51.6	40.9	43.6	38.9	33.3	35.5	36.8	38.2	45.0	33.1	31.2	37.9	38.8	33.5		
674	363157	173215		15.0	20.5	18.6		13.2	15.7	17.1		15.1	18.6	24.5	17.6	15.2		
675	361615	172728	33.2	35.0	33.5		24.7	30.3	31.1	30.8	34.3	19.8		33.4	30.6	26.4		
676	361734	173291	46.9	20.6	24.5		16.9	11.1	20.0	20.7	24.1	17.2	21.7	29.2	23.0	19.8		
677	362105	173350	39.5	25.4	24.1	24.4	21.0	19.7		19.2	23.6		24.8	27.1	24.9	21.4		
678	361279	173283	32.6	22.8	31.8	4.6		16.6		16.2	18.1			40.7	22.9	17.7		
679	361134	173034	42.2	25.4	28.7	24.0				20.7	26.5		28.5	31.7	28.5	21.0		
680	360973	173193	43.2	28.1	24.9	23.7	10.5	19.4	22.2	20.8		20.4		27.9	24.1	20.8		
681	360985	173541	47.7		27.4		23.6	23.1	24.1	22.9	28.7	26.9	34.6		28.8	24.8		
682	361359	173460	45.6	27.9	34.5	33.5	25.6	22.4	29.2	32.8	30.8	24.5	30.7	34.7	31.0	26.7		
683	361451	173617	36.0	21.8	21.7	18.5			17.4	14.1	19.4	17.6	24.0	25.4	21.6	18.6		
684	361597	173622	37.6	20.0			16.0						26.1		24.9	20.1		

☐ **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.TG22.**

☒ **Local bias adjustment factor used.**

☐ **National bias adjustment factor used.**

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

☒ **Bristol City Council confirm that all 2022 diffusion tube data has been uploaded to the Diffusion Tube Data Entry System.**

Notes:

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

NO_2 annual means exceeding 60µg/m^3, indicating a potential exceedance of the NO_2 1-hour mean objective are shown in **<u>bold and underlined</u>**.

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 Bristol During 2022

Bristol City Council has not identified any new sources relating to air quality within the reporting year of 2022.

Additional Air Quality Works Undertaken by Bristol City Council During 2022

Bristol City Council has not completed any additional works within the reporting year of 2022 other than the work completed for the development of the Full Business Case for the Clean Air Zone as submitted to Defra and reported on the Clean Air for Bristol website.

Locations Recording Exceedence Outside the AQMA

The next section of the report discusses the locations which have shown some exceedances of the annual objective for NO_2 in the past 5 years that are located outside of the AQMA. Table C. 1 shows these locations and provides measured pollutant concentrations for the past 5 years where available. In 2022, there was one location, on Muller Road, where exceedances of the annual objective was measured outside of the AQMA. However, when adjusted for distance to the closest relavant receptor location, pollution levels fell below the 40µg/m^3 annual objective.

Table C. 1 - Tubes Outside AQMA Exceeding the Annual Air Quality Objective for NO_2 Since 2018

Site Location	Site ID	Annual Mean Concentrations (µg/m[3])					Action
		2018	2019	2020	2021	2022	
Blackboy Hill	3	34.4	27.7	28.7	**44.4**	38.8	Until the monitored exceedance in 2021, 2013 was the last year in which this site exceeded the objective for NO_2 with 41.2µg/m^3 being recorded. In 2020 it was the only location to show an increase in NO_2 levels when compared to 2019. The large increase in pollution in 2021 indicates that something has significantly changed in this location. It indicates that there is potentially a local source of pollution that needs investigating, however, 2022 data again showed compliance with objectives. Further discussion is included in this section of the report.
No.67 Filton Avenue on wall	493	**41.8**	37.0	29.5	31.8	31.2	2019 data shows that the site was compliant with the annual objective for nitrogen dioxide for the first time since 2015.

Site Location	Site ID	Annual Mean Concentrations (µg/m^3)					Action
		2018	2019	2020	2021	2022	
facing Muller Rd							2022 data again shows compliance and levels of NO_2 that fell by 0.6µg/m^3 compared to 2021. The monitoring location is on the façade of a residential dwelling and is representative of relevant exposure.
Muller Road/ Glenfrome Road junction north	567	N/A	**44.0** (39.9)	**41.3** (37.3)	**44.8** **(40.2)**	**43.2** (38.7)	This site was set up in 2019 to investigate possible exceedances along Muller Road. Monitoring data exceeds air quality objectives at this location for all years, however 2021 has been the only year during which the distance adjusted concentration to the nearest receptor was in breach of objectives at 40.2µg/m^3. Monitoring will continue in this location and consideration will be made as to whether the AQMA needs to be extended to cover this location.

Distance adjusted data reported in ()

Blackboy Hill

2021 monitoring data for this site showed an exceedance of air quality objective with an annual NO_2 concentration of 44.4µg/m^3, however, in 2022 it fell to 38.8µg/m^3. Before 2021, the last time that this site recorded an exceedance of the objective was 2013. Analysis of the monthly diffusion tube monitoring data indicate that from 2020, it appears that there is a new local source of pollution, other than traffic, impacting upon NO_2 concentrations at this monitoring site. Analysis of monthly data from Site 3 has been carried out and has been compared to monthly data from a number of locations in Bristol at similar roadside locations up until early 2022. Figure C.1 and Figure C.2 show that in early 2020, NO_2 pollution levels rose sharply at site 3, at a time when it was falling or stable at other sites. This indicates that it is not just NO_2 pollution from road sources that are impacting pollution levels at this site. Site investigations were carried out in 2022 but no obvious additional source of pollution was observed. Monitoring will continue in 2023.

Figure C.1 - Comparison of Site 3 to Site 154 Hotwells Road

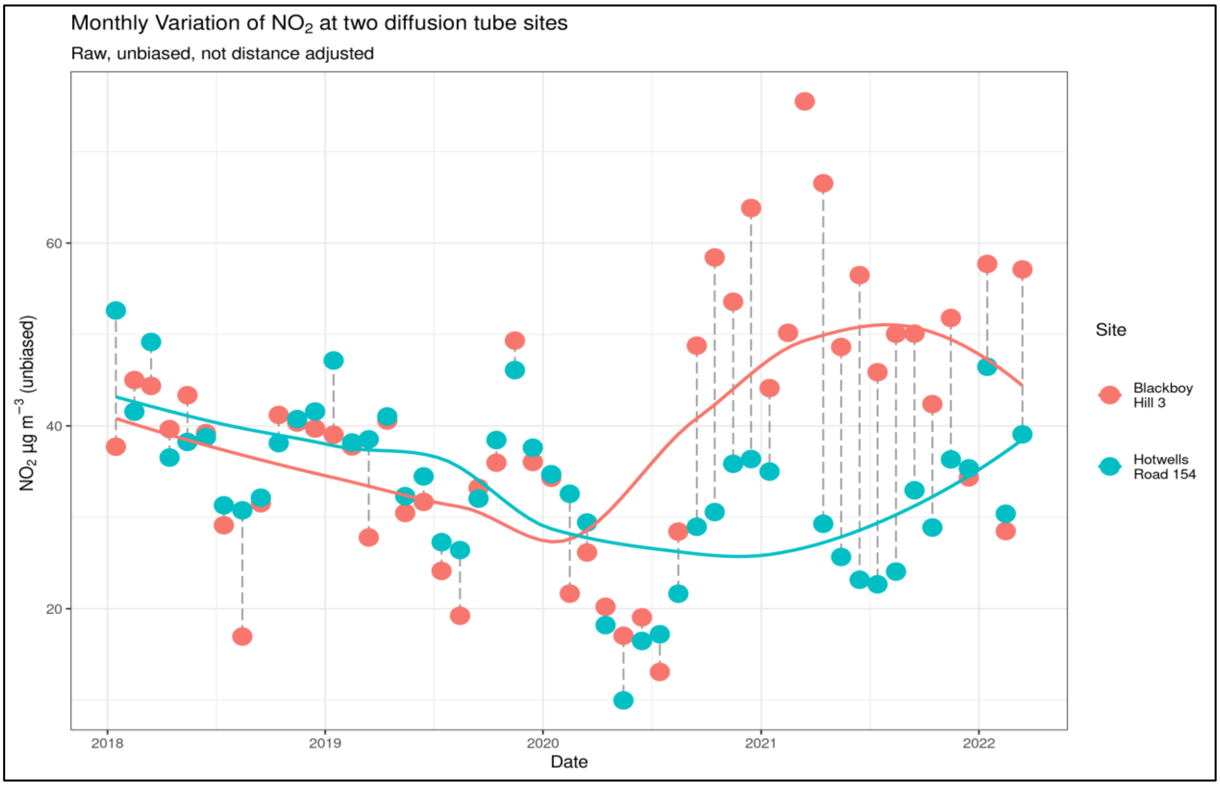
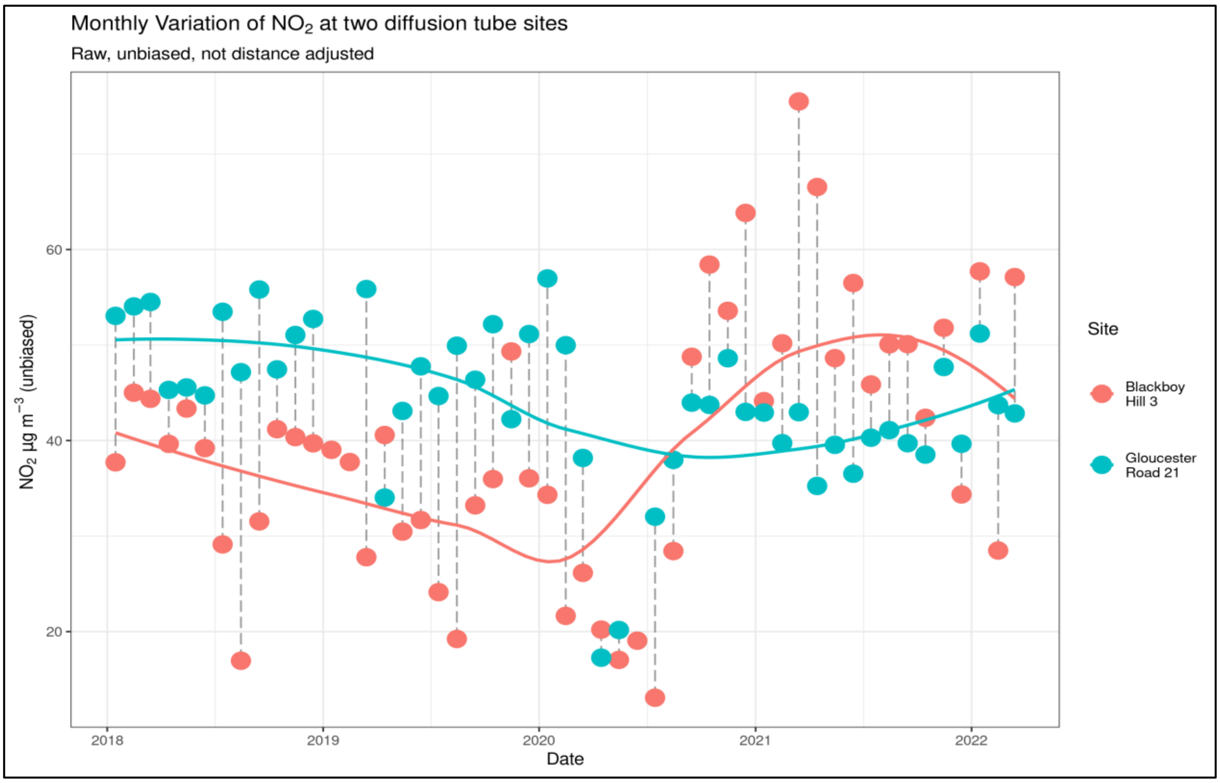


Figure C.2 - Comparison of Site 3 to Site 21 Gloucester Road



Muller Road

Monitoring site 493 was added to the monitoring network in 2015 along Muller Road. For 3 years, 2016, 2017 and 2018, this tube, which is representative of relevant exposure, measured an exceedance of air quality objectives. Tube 493 is located approximately 175m from the boundary of the current AQMA which runs along Gloucester Road. Monitoring data since 2019 has however shown compliance at Tube 493 with an annual average NO_2 concentration of 31.2µg/m^3 in 2022.

Due to the monitored exceedance outside of the existing AQMA at tube 493, the Local Air Quality Management helpdesk was consulted in 2019 to agree an appropriate course of action. BCC asked the LAQM Helpdesk four questions via e-mail in July 2019. The query reference was 5607 with the following answers received to the following questions:

Q1: Should BCC consider amending the AQMA boundary to include the monitored location of exceedance based on the 3 years of monitored marginal exceedance?

A1: *Due to the marginal exceedances I think the best approach would be for further investigation to understand the extent of the additional exceedances outside of the AQMA, this could be additional monitoring or a detailed modelling assessment.*

Q2: Would there be a requirement to conduct modelling to support this or is diffusion tube data sufficient evidence given that modelling will be verified against monitoring data anyway?

A2: *A modelling study would provide information on the wider area, across areas where monitoring has possibly not been completed. This could lead to a better understanding of the area and provide a full review of the current designations of AQMAs.*

Q3: Would consideration be needed of possibly extending the AQMA further along Muller Road given that there is the possibility of other locations of exceedance outside of the AQMA boundary?

A3: *Following the completion of a detailed study (modelling or further monitoring), the extent of any possible amendments should be investigated and implemented where required.*

Q4: Should BCC amend the AQMA boundary, what is the current process by which this can be done, and does it involve a requirement for public consultation?

A4: *Consultation is encouraged, with Defra being the key statutory consultee but a recommended list is provided within Chapter 6 of PG(16).*

As a result of the information provided above, Bristol City Council added several new diffusion tube monitoring locations along Muller Road in August 2019. Diffusion tube monitoring was chosen over modelling as it provides more robust data and will be helpful if modelling is conducted at a later date. Figure C.3 and Figure C.4 show the location of the monitoring sites on Muller Road and the 2022 measured NO_2 concentrations at each site. Measured and distance adjusted concentrations for those tubes exceed the objective in 2022, or have exceeded it in recent years, are reported in Table C. 1.

Additional monitoring location 567 was added to the network in 2019 along with a number of other tubes along Muller Road. Tube 567 has recorded exceedance for all years, however, 2021 was the only year in which this exceedance is shown to occur when adjusted for distance to relvant exposure. In 2022, annual NO_2 concentrations fell at this location to 43.2µg/m^3 and when adjusted for distance to the nearest location of relevant exposure compliance with objectives, at 38.7µg/m^3 was predicted.

As no locations outside of the AQMA in 2022 were shown to exceed air quality objectives at locations at which there is relevant exposure it is not proposed to consider any extensions to the AQMA. It is proposed to continue monitoring in locations along Muller Road in 2023.

Figure C.3 - Muller Road 2022 Measured Annual NO_2 Concentrations – North

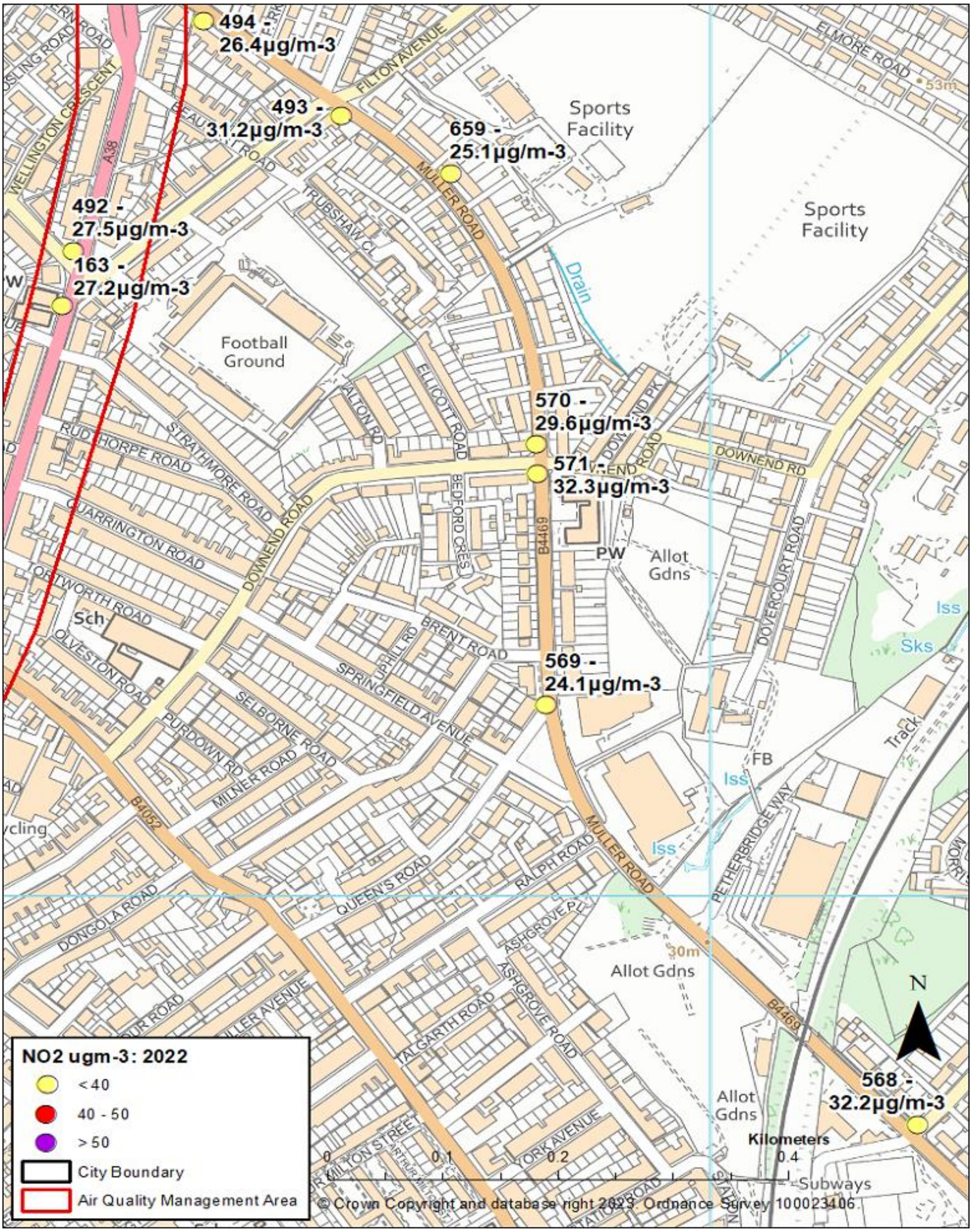


Figure C.4 - Muller Road 2022 Measured Annual NO_2 Concentrations – South

Local Pollution Hotspots – Measured Data

In the review of the 2019 ASR provided by Defra, a request was made for future ASRs to highlight and identify pollution hotspots in the city.

To identify the locations in the city with the highest monitored pollution levels, a summary of data, in locations where annual NO_2 concentrations above 50µg/m^3 were measured in 2019, or in subsequent years, has been included within the 2023 ASR. These are shown in Table C.2. Six monitoring locations had measured concentrations above 50µg/m^3 in 2019. In 2022 there were 2 sites with annual NO_2 concentrations of 50µg/m^3 or above. Both are in the city centre area with the location of these site is shown in Figure C.5. This figure of over 50µg/m^3 has been chosen by BCC to illustrate the most polluted sites in the city. The values are as measured and do not necessarily represent relevant exposure.

There are several other monitoring locations with NO_2 concentrations above 40µg/m^3 at locations of relevant exposure occur. Whilst these locations are of significant concern due to the high levels of pollution, the dispersed and relatively widespread nature of these locations mean that the term 'hotspots' does not properly reflect the nature of these exceedances. As a result, these locations have been discussed in the general commentary of the report, rather than being included in this specific section of the report.

The following section includes additional information on locations where annual NO_2 concentrations of 50µg/m^3 or above were measured in 2022.

Colston Avenue – Tube 502

In 2019 the annual NO_2 concentration at Tube 502 was 68.7µg/m^3, this fell to 52.1 µg/m^3 in 2020 but increased again in 2021 to 58.0µg/m^3 and in 2022 measured 54.1µg/m^3. Tube 502 has the highest recorded annual NO_2 concentration of any diffusion tube in Bristol. It is a city centre location impacted by large numbers of vehicles, including many buses, with high levels of congestion and restricted pollutant dispersion. At the nearest location of relevant exposure, concentrations of 46.9µg/m^3 have been calculated.

Galleries – Tube 12

This tube is located in a tunnel and therefore not representative of relevant exposure, however, there is public access to this location. It is a tube that has been in the network for a long time and is one of the more polluted locations, as a result, we have decided to continue to monitor and report pollution concentrations. In 2022 annual NO_2 concentrations of 50.2µg/m^3 were measured here.

Table C.2 – Locations at which NO_2 Concentrations Above 50µg/m^3 were Measured During the Period 2019 to 2022

Site ID	Site Name	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	NO_2 Annual Mean Concentration (µg/m^3)				
				2018	2019	2020	2021	2022
2	Colston Avenue	358628	173011	**58.2**	**53.7**	36.9	**40.1**	**40.3**
12	Galleries	359142	173211	**57.5**	**51.8**	**41.9**	**46.5**	**50.2**
147	Anchor Road	358514	172691	**56.6**	**50.9**	39.4	**43.3**	**45.5**
239	Parson St. A38 East	357880	170506	<u>**65.2**</u>	**54.4**	**47.6**	**51.4**	**48.6**
418	Bedminster Down Rd lamppost between Ashton Motors & Plough PH	357737	170642	**55.7**	**51.1**	**40.2**	**45.9**	**44.1**
502	Co-located Colston Ave	358640	173090		<u>**68.7**</u>	**52.1**	**58.0**	**54.1**
582	Rupert St-CAZ-Post outside fire station	358893	173333				**50.0**	**43.7**

615	Newfoundland Way-CAZ-Lamppost by petrol station	359659	173688				**53.0**	**49.4**

Figure C.5 – Locations with Measured Annual NO_2 Concentrations ≥ 50µg/m^3 Between 2019 and 2022 – Central Area

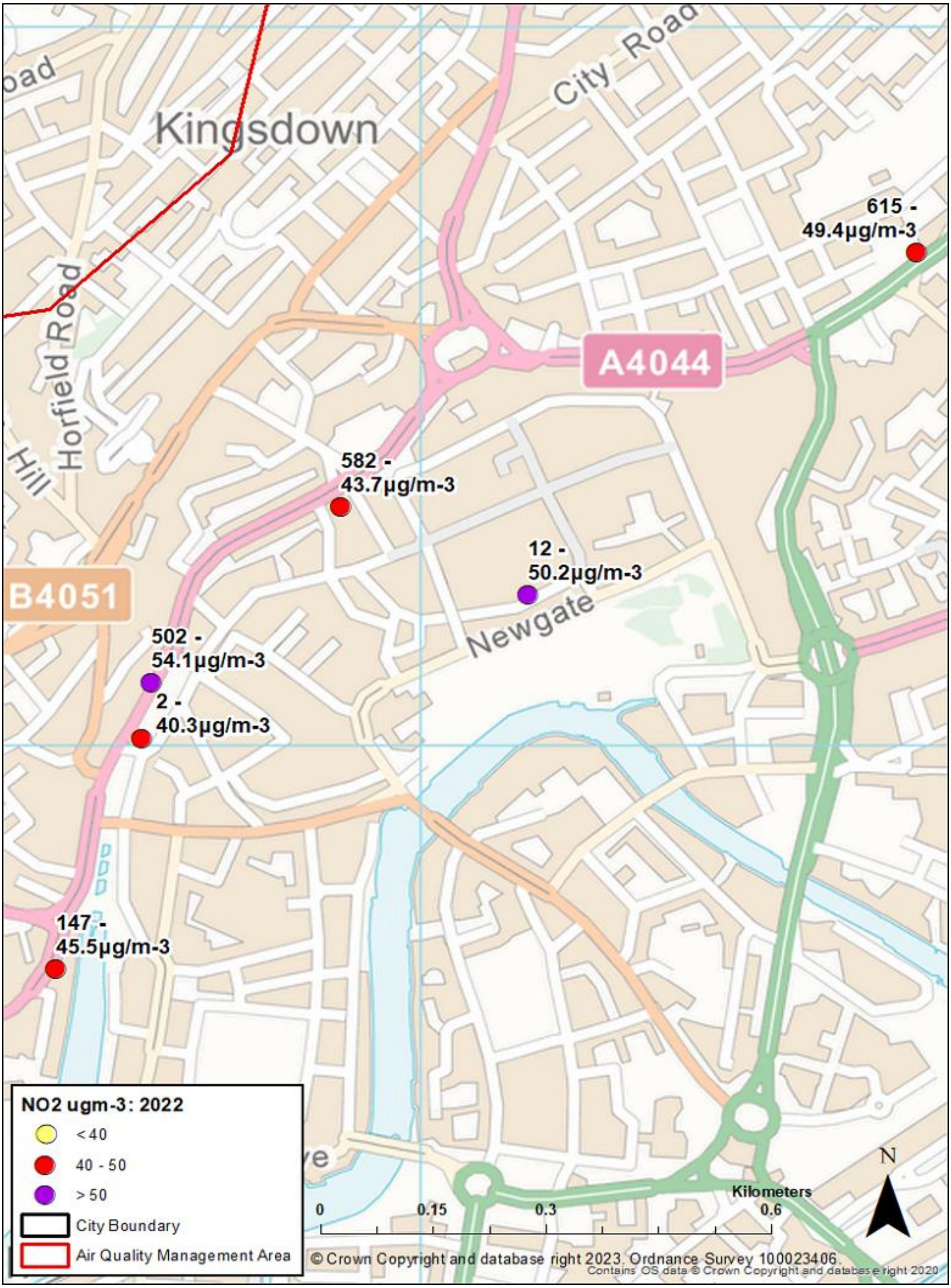


Figure C.6 – All NO_2 Monitoring Sites – Central Area

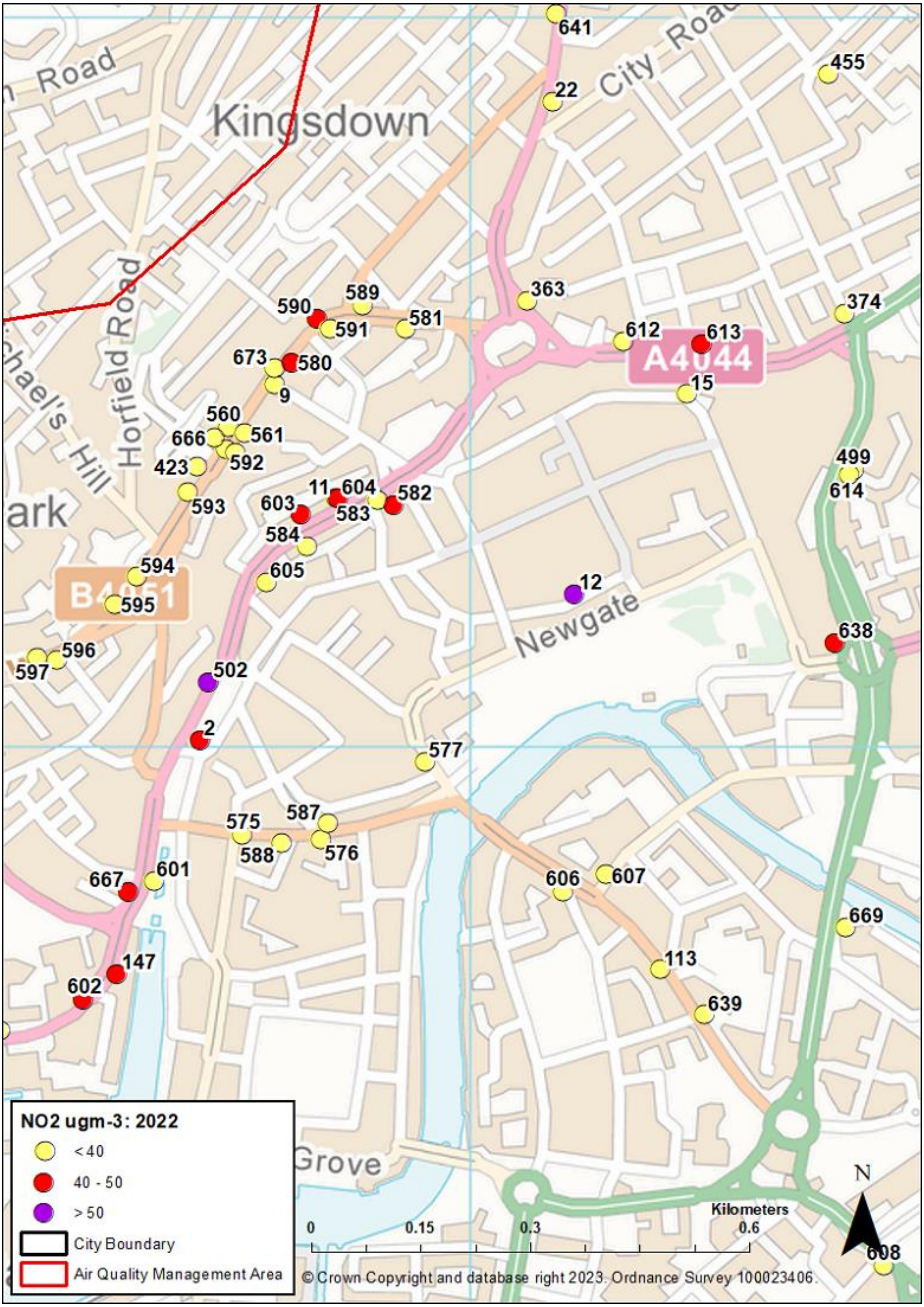


Figure C.7 - Locations with Measured Annual NO_2 Concentrations ≥ 50µg/m^3 Between 2019 and 2022 – Parsons Street Gyratory

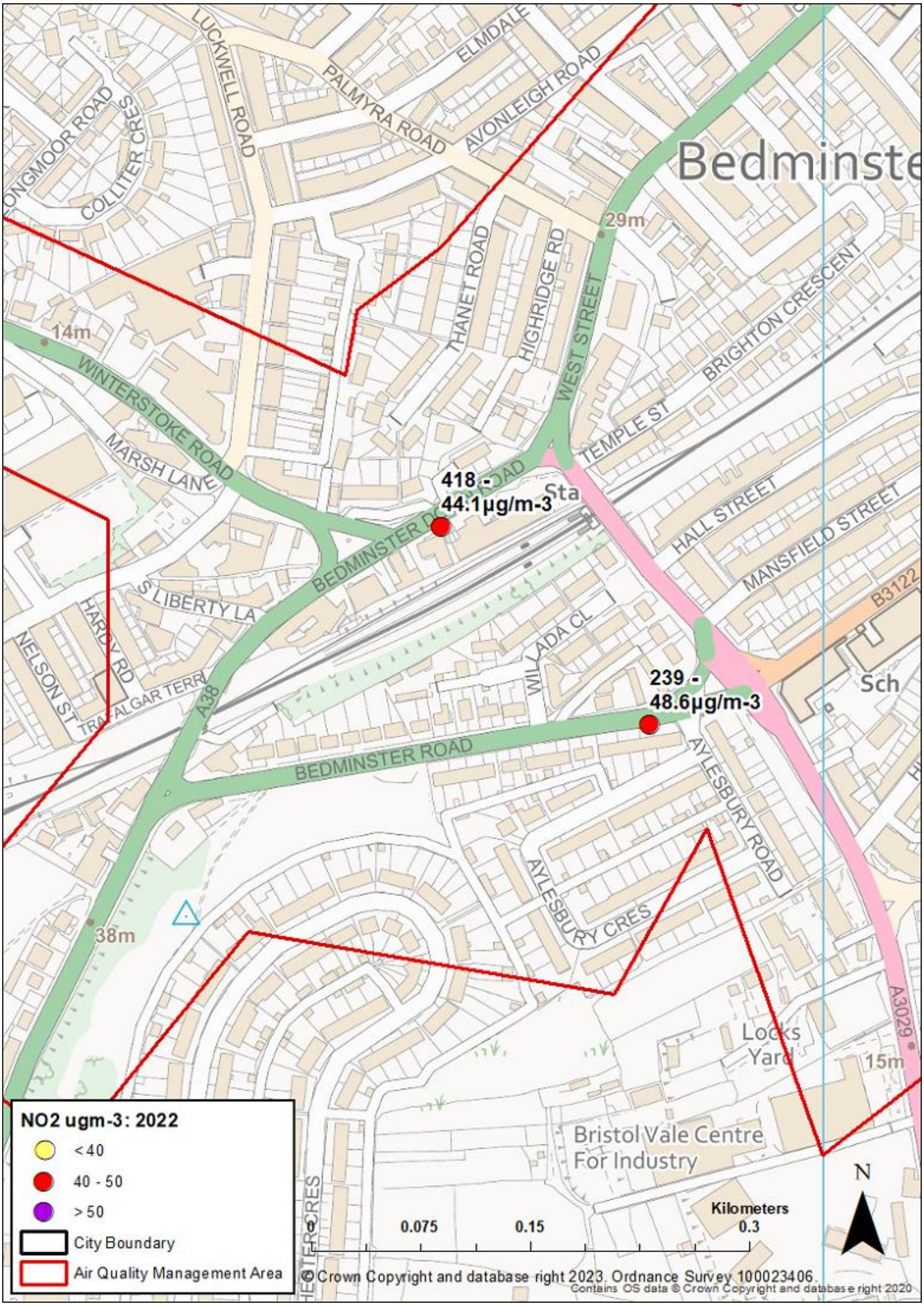
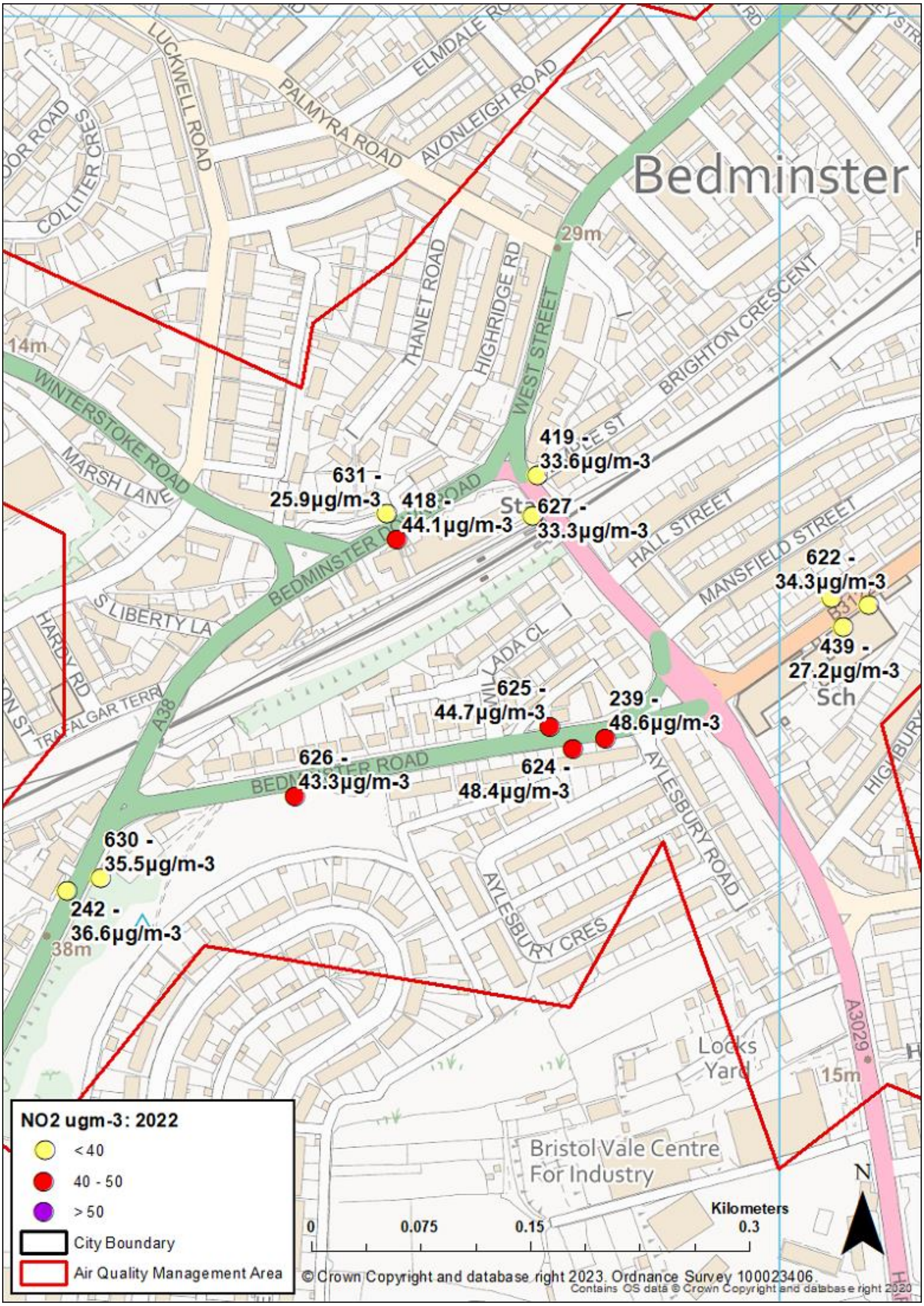


Figure C.8 - All NO_2 Monitoring Sites – Parsons Street Gyratory

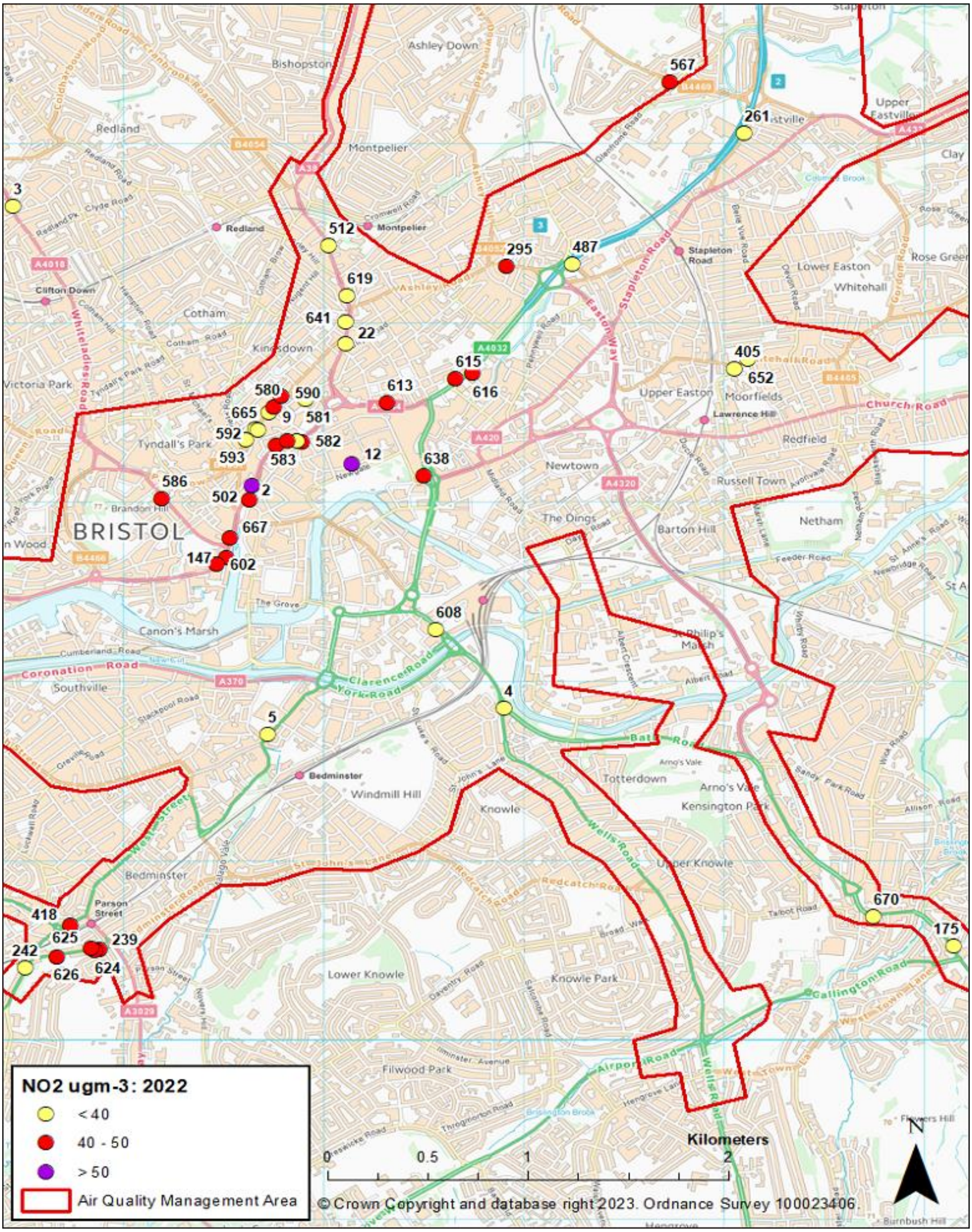


Diffusion tube data for 2022 shows that there were 23 monitoring locations at which exceedances of the annual objective for NO_2 were measured. This compares to 28 sites in 2021. When considering diffusion tube measurement uncertainty, it is useful to consider monitoring locations with annual concentrations above 36µg/m^3, which could indicate a location of possible exceedance. An additional 21 locations were at risk of exceedance in 2022 if this criterion is used, this is the same as the 21 tubes at risk of exceedance in the 2021 data.

It should be noted that in 2022 there were an additional 104 diffusion tube monitoring locations when compared to 2019. Most of these additional tubes were added as part of the CAZ assessment work. As a result, comparison of number of sites exceeding between earlier years does not give a good indication of trends of air pollution, however, it provides a good indication of the scale of the air pollution problem in Bristol.

The locations with NO_2 concentrations greater than 36µg/m^3 are spread throughout the city on many different central roads and arterial routes, the locations of which are shown in Figure C.9.

Figure C.9 – Sites with Measured Annual NO_2 Concentrations ≥ 36µg/m³ in 2022



QA/QC of Diffusion Tube Monitoring

Somerset Scientific Services were used throughout the whole of 2022 to provide and analyse diffusion tubes for BCC. This lab is not UKAS accredited for diffusion tube analysis but does participate in the AIR PT Scheme for nitrogen dioxide tubes. All reference materials are of at least analytical grade or equivalent. Standards are prepared using equipment that is all within the normal quality system. The tubes used are recycled Gradko tubes prepared and set on a monthly basis. The tube changing frequency is as per the calendar on the Air Quality Archive web site and is carried out by Bristol City Council officers. In December 2022, 43 of the December tubes were removed on the 19th December 2022 instead of the required week of the 4th January. The LAQM helpdesk were consulted ref #8425. The advice given was that:

'*As some of the diffusion tubes have been changed on 19/12/2022, the exposure period for December 2022 is approx. 3 weeks and the exposure period for January 2023 (next changeover date 01/02/2022) will be 6 weeks. The exposure period of both these months are outside the recommended four to five weeks. As a result, this may lead to erroneous results which are not representative of the monitoring period. In this case, the monitoring results of December 2022 and January 2023 will need to be excluded when calculating the annual mean concentration'.*

The December monthly values for all these tubes have been excluded from the results as per the instructions from the LAQM Helpdesk. Annual values have been reported for these sites and as with all sites, the values have been annualised where required.

The tubes are prepared with 50 µL of 20% triethanolamine in water. The method follows that set out in the practical guidance document.

Table C.3 – AIR PT Scheme Results for Somerset County Council

Air PT Round	Percent Of tubes submitted found to be satisfactory
Air PT AR049 – January/February 2022	75%
Air PT AR050 – May/June 2022	100%

Diffusion Tube Annualisation

Data capture rates for 15 tube sites were below 75%. This is mostly as a result of tubes being tampered with by members of the public and taken from their sites.

Annualisation of diffusion tube data for all sites with less than 75% data capture was carried out in accordance with the methodology in Box 7.10 of LAQM TG16[17]. Data from the Background AURN monitoring sites at Swindon Walcot, Bournemouth and Bristol St Paul's were used in the process. There was insufficient data capture for Newport in 2022 for it to be used for annualisation.

The calculations made to annualise the data for these sites are included in Table C.4.

Table C.4 – Annualisation Summary (concentrations presented in µg/m^3)

Site ID	Annualisation Factor Bristol St Paul's	Annualisation Factor Bournemouth	Annualisation Factor Swindon Walcot	Average Annualisation Factor	Raw Data Annual Mean	Annualised Annual Mean
157	0.9678	0.9677	0.9869	0.9741	41.7	40.6
487	1.1671	1.1749	1.1851	1.1757	36.3	42.7
538	0.9233	0.8541	0.8630	0.8802	28.1	24.7
583	0.8733	0.8629	0.8530	0.8631	50.9	43.9
586	1.1343	1.1570	1.1715	1.1542	42.0	48.5
593	1.0882	1.1546	1.1689	1.1372	37.0	42.1
595	0.9452	1.0099	0.9937	0.9829	36.1	35.4
597	1.0412	1.0962	1.0827	1.0734	35.7	38.3
605	0.9447	0.9625	0.9222	0.9431	37.2	35.1
621	1.0801	1.0031	1.0266	1.0366	28.4	29.5
653	0.9502	0.9299	0.9327	0.9376	38.2	35.8
669	1.2284	1.1554	1.2134	1.1991	32.1	38.5
678	0.9336	0.8821	0.8702	0.8953	22.9	20.5
679	0.8793	0.8519	0.8395	0.8569	28.5	24.4
684	0.9202	0.9273	0.9518	0.9331	24.9	23.3

Diffusion Tube Bias Adjustment Factors

The diffusion tube data presented within the 2023 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.TG22 provides guidance with regard to the application of a bias adjustment factor to correct diffusion tube monitoring. Triplicate co-location studies can be used to determine a local bias factor based on the comparison of diffusion tube results with data taken from NO_x/NO_2

[17] Defra, Local Air Quality Management Technical Guidance TG16 (Feb 2018)

continuous analysers. Alternatively, the national database of diffusion tube co-location surveys provides bias factors for the relevant laboratory and preparation method.

Bristol City Council have applied a local bias adjustment factor of 0.86 to the 2023 monitoring data. Bristol City Council have 8 co-location studies; however, the Diffusion Tube Data Process Tool can only accommodate co-locations details for 7 sites. As a result, BCC manually calculated the local BAF and added it into the DTDPT as a national factor to allow it to be applied to the diffusion tube data in the DTDPT. A summary of bias adjustment factors used by Bristol City Council over the past five years is presented in Table C.5.

Discussion of Choice of Factor to Use

Box 7.1 of LAQM TG16 was used in order to determine the most appropriate BAF to use in 2022. Bristol has a relatively large network of automatic NO_X analysers that are operated using robust QA/QC procedures. In 2022, 8 of these sites recorded data capture rates of more than 90%. Precision calculations were undertaken for all sites in the co-location study. The precision checks indicated a “good” precision rating for all measurement periods at all sites when two or more tubes were available for analysis with the exception of St Pauls (February and May), Marlborough Street (November) and Colston Avenue (May). Automatic monitor data capture rates were good at all sites for all months.

The locally derived bias adjustment factor calculated for 2022 was 0.86.

The national diffusion tube BAF spreadsheet at the time of writing contained 6 studies for sites that are not BCC sites. In 2022 the national BAF for Somerset Scientific Services, before the additional of the BCC co-location studies was 0.82, therefore, using our own BAF, excluding the additional 6 tubes from the national calculations, provides a worst case BAF.

Bias adjustment factors used since 2018 have been provided in Table C.5 to provide transparency and put the 2022 BAF in context to those used in previous years.

Table C.5 – Bias Adjustment Factor

Monitoring Year	Local or National	If National, Version of National Spreadsheet	Adjustment Factor
2022	Local	N/A	0.86

2021	Local	N/A	0.87
2020	Local	N/A	0.85
2019	Local	N/A	0.82
2018	Local	N/A	0.92

Table C.6 - Local Bias Adjustment Calculation

	Local Bias Adjustment Input 1 – Site 203	Local Bias Adjustment Input 2 – Site 215	Local Bias Adjustment Input 3 – Site 270	Local Bias Adjustment Input 4 – Site 452	Local Bias Adjustment Input 5 – Site 463	Local Bias Adjustment Input 6 – Site 500	Local Bias Adjustment Input 7 – Site 501	Local Bias Adjustment Input 8 – Site 672
Periods used to calculate bias	12	12	12	10	12	12	9	11
Bias Factor A	0.86 (0.82 - 0.91)	0.92 (0.84 – 1.03)	0.67 (0.62 – 0.73)	1.01 (0.91 – 1.14)	0.95 (0.88 - 1.03)	0.87 (0.83 - 0.92)	1.05 (0.96 – 1.17)	0.72 (0.65 – 0.81)
Bias Factor B	16% (10% - 22%)	8% (-3% - 19%)	50% (37% - 62%)	-1% (-13% - 10%)	6% (-3% - 14%)	15% (9% - 21%)	-5% (-14% - 4%)	39% (23% - 54%)
Diffusion Tube Mean (µg/m^3)	24	32	34	20	29	36	65	40
Mean CV (Precision)	2.3%	4%	4%	6%	4%	4%	5%	4%
Automatic Mean (µg/m^3)	21	24.1	23	20	27	31	69	29
Data Capture	99%	98%	99%	98%	99%	97%	100%	98%
Adjusted Tube Mean (µg/m^3)	21 (20 - 22)	29 (27 - 33)	23 (21 - 25)	20 (18 - 23)	27 (25 - 30)	31 (30 - 33)	68 (62 - 76)	28 (26 - 32)

The precision and accuracy details from the 8 co-location sites that have been used to calculate the local bias adjustment factor are shown in Figure C.10 to Figure C.17.

Figure C.10 - Brislington Co-Location Precision and Accuracy

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

	Diffusion Tubes Measurements									Automatic Method		Data Quality Check	
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 µgm⁻³	Tube 2 µgm⁻³	Tube 3 µgm⁻³	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
1	04/01/2022	02/02/2022	35.66881	35.13474	36.02486	36	0.4	1	1.1	31.445527	99.42611191	Good	Good
2	02/02/2022	03/03/2022	21.60496	23.44454	22.49508	23	0.9	4	2.3	18.835621	99.28263989	Good	Good
3	03/03/2022	31/03/2022	24.09746	25.44959	26.0642	25	1.0	4	2.5	23.701952	98.95988113	Good	Good
4	31/03/2022	05/05/2022	20.77817	20.08362	21.42642	21	0.7	3	1.7	19.551847	99.76218787	Good	Good
5	05/05/2022	08/06/2022	19.48267	19.43501	18.14804	19	0.8	4	1.9	15.008005	99.3880049	Good	Good
6	08/06/2022	06/07/2022	18.73776	20.99507	21.22659	20	1.4	7	3.4	14.715943	99.25705795	Good	Good
7	06/07/2022	03/08/2022	22.35069	20.21019	22.29123	22	1.2	6	3.0	18.248134	99.55423477	Good	Good
8	03/08/2022	31/08/2022	22.52906	22.64798	22.05339	22	0.3	1	0.8	19.245149	99.55423477	Good	Good
9	31/08/2022	29/09/2022	24.10592	25.08186	24.22074	24	0.5	2	1.3	19.800144	99.42611191	Good	Good
10	29/09/2022	02/11/2022	21.54969	21.59834	22.52274	22	0.5	3	1.4	17.716441	99.3880049	Good	Good
11	02/11/2022	01/12/2022	26.23485	25.03699	24.01025	25	1.1	4	2.8	22.177128	99.42611191	Good	Good
12	01/12/2022	04/01/2023	27.92318	28.02049	27.97183	28	0.0	0	0.1	26.819178	99.59072306	Good	Good
13													

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

Overall survey --> Good precision | Good Overall DC

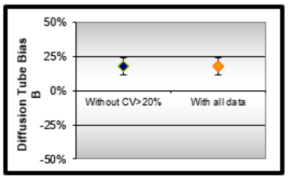
Site Name/ ID: 203 Brislington

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

(Check average CV & DC from Accuracy calculations)

Accuracy (with 95% confidence interval)
without periods with CV larger than 20%
Bias calculated using 12 periods of data
Bias factor A 0.86 (0.82 - 0.91)
Bias B 16% (10% - 22%)
Diffusion Tubes Mean: 24 µgm⁻³
Mean CV (Precision): 3
Automatic Mean: 21 µgm⁻³
Data Capture for periods used: 99%
Adjusted Tubes Mean: 21 (20 - 22) µgm⁻³

Accuracy (with 95% confidence interval)
WITH ALL DATA
Bias calculated using 12 periods of data
Bias factor A 0.86 (0.82 - 0.91)
Bias B 16% (10% - 22%)
Diffusion Tubes Mean: 24 µgm⁻³
Mean CV (Precision): 3
Automatic Mean: 21 µgm⁻³
Data Capture for periods used: 99%
Adjusted Tubes Mean: 21 (20 - 22) µgm⁻³



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Version 04 - February 2011

Figure C.11 - Parsons Street Co-Location Precision and Accuracy

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

	Diffusion Tubes Measurements									Automatic Method		Data Quality Check	
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 µgm⁻³	Tube 2 µgm⁻³	Tube 3 µgm⁻³	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
1	05/01/2022	02/02/2022	42.2283	41.85954	42.84291	42	0.5	1	1.2	35.375	98.66270431	Good	Good
2	02/02/2022	03/03/2022	29.61602	29.7347	30.92152	30	0.7	2	1.8	24.204622	85.36585366	Good	Good
3	03/03/2022	31/03/2022	37.80315	32.64047	35.95933	35	2.6	7	6.5	38.804054	98.95988113	Good	Good
4	31/03/2022	05/05/2022	26.1494	28.74241	30.17782	28	2.0	7	5.1	26.557556	99.76218787	Good	Good
5	05/05/2022	08/06/2022	25.3932	26.72784	27.63348	27	1.1	4	2.8	19.669613	99.63280294	Good	Good
6	08/06/2022	06/07/2022	27.07243	27.24607	29.09821	28	1.1	4	2.8	22.030224	99.55423477	Good	Good
7	06/07/2022	03/08/2022	30.08026	32.93426	29.42622	31	1.9	6	4.6	24.906483	99.70282318	Good	Good
8	03/08/2022	31/08/2022	34.71801	35.96664	33.64776	35	1.2	3	2.9	33.889387	99.40564636	Good	Good
9	31/08/2022	29/09/2022	30.01895	30.70785	29.15783	30	0.8	3	1.9	24.261922	99.28263989	Good	Good
10	29/09/2022	02/11/2022	28.89623	26.75552	27.82588	28	1.1	4	2.7	24.622495	99.75520196	Good	Good
11	02/11/2022	01/12/2022	33.93538	34.22059	33.19385	34	0.5	2	1.3	37.990981	99.42611191	Good	Good
12	01/12/2022	04/01/2023	29.52872	31.81539	31.62078	31	1.3	4	3.1	37.743836	99.59072306	Good	Good
13													

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

Overall survey --> Good precision | Good Overall DC

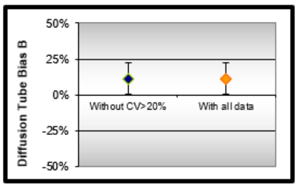
Site Name/ ID: 215 Parson Street

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

(Check average CV & DC from Accuracy calculations)

Accuracy (with 95% confidence interval)
without periods with CV larger than 20%
Bias calculated using 12 periods of data
Bias factor A 0.92 (0.84 - 1.03)
Bias B 8% (-3% - 19%)
Diffusion Tubes Mean: 32 µgm⁻³
Mean CV (Precision): 4
Automatic Mean: 29 µgm⁻³
Data Capture for periods used: 98%
Adjusted Tubes Mean: 29 (27 - 33) µgm⁻³

Accuracy (with 95% confidence interval)
WITH ALL DATA
Bias calculated using 12 periods of data
Bias factor A 0.92 (0.84 - 1.03)
Bias B 8% (-3% - 19%)
Diffusion Tubes Mean: 32 µgm⁻³
Mean CV (Precision): 4
Automatic Mean: 29 µgm⁻³
Data Capture for periods used: 98%
Adjusted Tubes Mean: 29 (27 - 33) µgm⁻³



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Version 04 - February 2011

Figure C.12 - Wells Road Co-Location Precision and Accuracy

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

	Diffusion Tubes Measurements									Automatic Method		Data Quality Check	
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 µgm^{-3}	Tube 2 µgm^{-3}	Tube 3 µgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
1	05/01/2022	02/02/2022	42.65852	44.5638	47.69828	45	2.5	6	6.3	30.460837	96.43387816	Good	Good
2	02/02/2022	03/03/2022	38.75455	32.049		35	4.7	13	42.6	18.939326	99.42611191	Good	Good
3	03/03/2022	31/03/2022	35.28327	37.86461	36.08225	36	1.3	4	3.3	26.706124	95.39375929	Good	Good
4	31/03/2022	05/05/2022	28.92762	28.09415	29.39066	29	0.7	2	1.6	20.747252	99.52437574	Good	Good
5	05/05/2022	08/06/2022	29.30178	27.58582	29.49244	29	1.1	4	2.6	17.179528	99.51040392	Good	Good
6	08/06/2022	06/07/2022	32.16583	30.08217	31.93431	31	1.1	4	2.8	18.402549	99.10846954	Good	Good
7	06/07/2022	03/08/2022	31.68564	33.70722	32.69643	33	1.0	3	2.5	19.18012	99.40564636	Good	Good
8	03/08/2022	31/08/2022	30.85322	30.55593		31	0.2	1	1.9	19.121833	99.70282318	Good	Good
9	31/08/2022	29/09/2022	32.48749	31.7986	31.39674	32	0.6	2	1.4	21.330692	99.56958393	Good	Good
10	29/09/2022	02/11/2022	37.6537	33.56688	33.0317	35	2.5	7	6.3	23.387966	99.51040392	Good	Good
11	02/11/2022	01/12/2022	38.61274	37.12968	35.98886	37	1.3	4	3.3	27.777174	98.99569584	Good	Good
12	01/12/2022	04/01/2023	34.92916	38.5781	35.51299	36	2.0	5	4.9	30.44528	99.7271487	Good	Good
13													

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

Overall survey --> Good precision | Good Overall DC

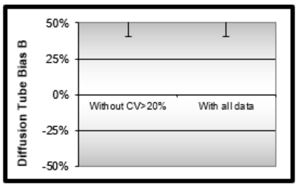
Site Name/ ID: 270 Wells Road

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

(Check average CV & DC from Accuracy calculations)

Accuracy (with 95% confidence interval)
without periods with CV larger than 20%
Bias calculated using 12 periods of data
Bias factor A 0.67 (0.62 - 0.73)
Bias B 50% (37% - 62%)
Diffusion Tubes Mean: 34 µgm^{-3}
Mean CV (Precision): 4
Automatic Mean: 23 µgm^{-3}
Data Capture for periods used: 99%
Adjusted Tubes Mean: 23 (21 - 25) µgm^{-3}

Accuracy (with 95% confidence interval)
WITH ALL DATA
Bias calculated using 12 periods of data
Bias factor A 0.67 (0.62 - 0.73)
Bias B 50% (37% - 62%)
Diffusion Tubes Mean: 34 µgm^{-3}
Mean CV (Precision): 4
Automatic Mean: 23 µgm^{-3}
Data Capture for periods used: 99%
Adjusted Tubes Mean: 23 (21 - 25) µgm^{-3}



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Version 04 - February 2011

Figure C.13 - St Pauls Co-Location Precision and Accuracy

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

	Diffusion Tubes Measurements									Automatic Method		Data Quality Check	
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 µgm^{-3}	Tube 2 µgm^{-3}	Tube 3 µgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
1	05/01/2022	03/02/2022	33.7699	29.67536	33.41385	32	2.3	7	5.6	33.47047	98.99569584	Good	Good
2	03/02/2022	04/03/2022	13.77193	24.6907	16.44228	18	5.7	31	14.1	15.863003	99.71305595	Poor Precision	Good
3	04/03/2022	31/03/2022	23.20533	23.14159	26.32843	24	1.8	8	4.5	25.178198	99.8459168	Good	Good
4	31/03/2022	06/05/2022	18.62539	18.08518	17.45493	18	0.6	3	1.5	18.209526	95.95375723	Good	Good
5	06/05/2022	09/06/2022	13.71514	14.00113	9.329906	12	2.6	21	6.5	11.645896	79.19216646	Poor Precision	Good
6	09/06/2022	07/07/2022	16.71198	16.19106	15.03347	16	0.9	5	2.1	11.955213	99.70282318	Good	Good
7	07/07/2022	04/08/2022	15.15623	15.75082	15.98865	16	0.4	3	1.1	12.744393	98.81129272	Good	Good
8	04/08/2022	02/09/2022	14.92064	14.40397	14.28916	15	0.3	2	0.8	13.275264	99.85652798	Good	Good
9	02/09/2022	30/09/2022	15.51298	19.55615	19.1994	18	2.2	12	5.6	17.064679	96.13670134	Good	Good
10	30/09/2022	03/11/2022	17.025	15.71138	17.60883	17	1.0	6	2.4	18.394075	99.87760098	Good	Good
11	03/11/2022	02/12/2022	18.6484	22.01382	20.93004	21	1.7	8	4.3	23.754987	87.08751793	Good	Good
12	02/12/2022	05/01/2023	25.63651	26.31764	25.29594	26	0.5	2	1.3	30.599944	99.85875706	Good	Good
13													

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

Overall survey --> Good precision | Good Overall DC

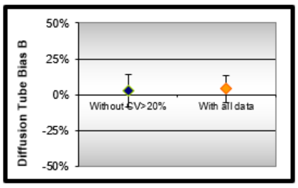
Site Name/ ID: 452 AURN St. Pauls

Precision 10 out of 12 periods have a CV smaller than 20%

(Check average CV & DC from Accuracy calculations)

Accuracy (with 95% confidence interval)
without periods with CV larger than 20%
Bias calculated using 10 periods of data
Bias factor A 1.01 (0.91 - 1.14)
Bias B -1% (-13% - 10%)
Diffusion Tubes Mean: 20 µgm^{-3}
Mean CV (Precision): 6
Automatic Mean: 20 µgm^{-3}
Data Capture for periods used: 98%
Adjusted Tubes Mean: 20 (18 - 23) µgm^{-3}

Accuracy (with 95% confidence interval)
WITH ALL DATA
Bias calculated using 12 periods of data
Bias factor A 1 (0.91 - 1.1)
Bias B 0% (-9% - 10%)
Diffusion Tubes Mean: 19 µgm^{-3}
Mean CV (Precision): 9
Automatic Mean: 19 µgm^{-3}
Data Capture for periods used: 96%
Adjusted Tubes Mean: 19 (18 - 21) µgm^{-3}



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Version 04 - February 2011

Figure C.14 - Fishponds Co-Location Precision and Accuracy

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 μgm^{-3}	Tube 2 μgm^{-3}	Tube 3 μgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
	Diffusion Tubes Measurements									Automatic Method		Data Quality Check	
1	03/01/2022	31/01/2022	43.88773	45.91593	45.67009	45	1.1	2	2.7	40.785075	99.55423477	Good	Good
2	31/01/2022	28/02/2022	34.54574	29.87475	31.53418	32	2.4	7	5.9	25.903502	99.70282318	Good	Good
3	28/02/2022	28/03/2022	30.85811	28.21531	28.89138	29	1.4	5	3.4	31.571482	99.25705795	Good	Good
4	28/03/2022	03/05/2022	26.00825	26.32338	24.79278	26	0.8	3	2.0	28.33343	99.76878613	Good	Good
5	03/05/2022	06/06/2022	24.43989	23.91557	25.01188	24	0.5	2	1.4	25.324507	99.3880049	Good	Good
6	06/06/2022	04/07/2022	29.09821	24.46784	26.08847	27	2.3	9	5.8	25.206343	99.55423477	Good	Good
7	04/07/2022	01/08/2022	22.11285	23.77768	22.70744	23	0.8	4	2.1	23.592399	99.70282318	Good	Good
8	01/08/2022	30/08/2022	21.0633	21.17812	21.46516	21	0.2	1	0.5	23.97114	99.42611191	Good	Good
9	30/08/2022	26/09/2022	22.68521	22.00694	22.25358	22	0.3	2	0.9	21.303876	99.38366718	Good	Good
10	26/09/2022	31/10/2022	27.50348	26.74728	25.7075	27	0.9	3	2.2	23.211934	96.31391201	Good	Good
11	31/10/2022	29/11/2022	31.08333	30.39884	30.22772	31	0.5	1	1.1	23.176513	99.56958393	Good	Good
12													
13													

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

Overall survey --> Good precision | Good Overall DC

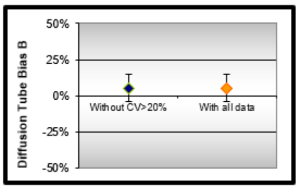
Site Name/ ID: 463 Fishponds

Precision: 11 out of 11 periods have a CV smaller than 20%

(Check average CV & DC from Accuracy calculations)

Accuracy (with 95% confidence interval)
without periods with CV larger than 20%
Bias calculated using 11 periods of data
Bias factor A: 0.95 (0.87 - 1.05)
Bias B: 5% (-4% - 14%)
Diffusion Tubes Mean: 28 μgm^{-3}
Mean CV (Precision): 4
Automatic Mean: 27 μgm^{-3}
Data Capture for periods used: 99%
Adjusted Tubes Mean: 26 (24 - 29) μgm^{-3}

Accuracy (with 95% confidence interval)
WITH ALL DATA
Bias calculated using 11 periods of data
Bias factor A: 0.95 (0.87 - 1.05)
Bias B: 5% (-4% - 14%)
Diffusion Tubes Mean: 28 μgm^{-3}
Mean CV (Precision): 4
Automatic Mean: 27 μgm^{-3}
Data Capture for periods used: 99%
Adjusted Tubes Mean: 26 (24 - 29) μgm^{-3}



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Version 04 - February 2011

Figure C.15 - Temple Way Co-Location Precision and Accuracy

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 μgm^{-3}	Tube 2 μgm^{-3}	Tube 3 μgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
	Diffusion Tubes Measurements									Automatic Method		Data Quality Check	
1	05/01/2022	03/02/2022	46.64692	46.23154	43.56119	45	1.7	4	4.2	40.001051	96.98708752	Good	Good
2	03/02/2022	04/03/2022	32.7611	30.98086	32.28637	32	0.9	3	2.3	23.088297	76.47058824	Good	Good
3	04/03/2022	31/03/2022	41.81647	39.64942	42.3901	41	1.4	4	3.6	40.874862	99.8459168	Good	Good
4	31/03/2022	06/05/2022	36.6774	38.70318	40.09872	38	1.7	4	4.3	35.560079	99.07514451	Good	Good
5	06/05/2022	09/06/2022	29.5401	27.68115	24.91655	27	2.3	8	5.8	25.316108	99.75520196	Good	Good
6	09/06/2022	07/07/2022	30.08217	27.4197	30.8346	29	1.8	6	4.5	25.147304	99.70282318	Good	Good
7	07/07/2022	04/08/2022	31.68564	31.09106	27.70193	30	2.1	7	5.3	24.896123	98.81129272	Good	Good
8	04/08/2022	02/09/2022	36.50605	39.95054	38.2857	38	1.7	5	4.3	32.123328	99.28263989	Good	Good
9	02/09/2022	30/09/2022	38.64226	37.39363	39.17738	38	0.9	2	2.3	31.376333	97.32540862	Good	Good
10	30/09/2022	03/11/2022	31.71808	30.93964	30.55042	31	0.6	2	1.5	29.260964	99.51040392	Good	Good
11	03/11/2022	02/12/2022	33.70722	34.27763	35.58957	35	1.0	3	2.4	29.233229	99.56958393	Good	Good
12	02/12/2022	05/01/2023	43.2974	42.95684	44.51372	44	0.8	2	2.0	37.911598	99.15254237	Good	Good
13													

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

Overall survey --> Good precision | Good Overall DC

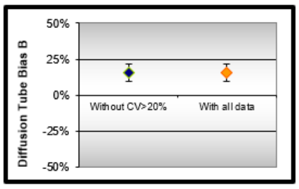
Site Name/ ID: 500 Temple Way

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

(Check average CV & DC from Accuracy calculations)

Accuracy (with 95% confidence interval)
without periods with CV larger than 20%
Bias calculated using 12 periods of data
Bias factor A: 0.87 (0.83 - 0.92)
Bias B: 15% (9% - 21%)
Diffusion Tubes Mean: 36 μgm^{-3}
Mean CV (Precision): 4
Automatic Mean: 31 μgm^{-3}
Data Capture for periods used: 97%
Adjusted Tubes Mean: 31 (30 - 33) μgm^{-3}

Accuracy (with 95% confidence interval)
WITH ALL DATA
Bias calculated using 12 periods of data
Bias factor A: 0.87 (0.83 - 0.92)
Bias B: 15% (9% - 21%)
Diffusion Tubes Mean: 36 μgm^{-3}
Mean CV (Precision): 4
Automatic Mean: 31 μgm^{-3}
Data Capture for periods used: 97%
Adjusted Tubes Mean: 31 (30 - 33) μgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

Figure C.16 - Colston Avenue Co-Location Precision and Accuracy

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 μgm^{-3}	Tube 2 μgm^{-3}	Tube 3 μgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean	Automatic Method: Period Mean	Automatic Method: Data Capture (% DC)	Data Quality Check: Tubes Precision Check	Data Quality Check: Automatic Monitor Data
1	04/01/2022	01/02/2022	89.61432	81.00985	80.45671	84	5.1	6	12.8	97.41791	99.55423477	Good	Good
2	29/03/2022	04/05/2022	65.35353	59.72634	57.20536	61	4.2	7	10.4	62.258711	99.53757225	Good	Good
3	04/05/2022	07/06/2022	52.32424	31.25606		42	14.9	36	133.8	61.724414	99.26560588	Poor Precision	Good
4	07/06/2022	05/07/2022	66.8936	67.06724	68.51423	67	0.9	1	2.2	64.830477	99.70282318	Good	Good
5	05/07/2022	03/08/2022	61.1915	63.94708	60.21556	62	1.9	3	4.8	56.928365	99.13916786	Good	Good
6	03/08/2022	31/08/2022	59.33374	58.62025	62.66341	60	2.2	4	5.4	58.822653	99.70282318	Good	Good
7	31/08/2022	29/09/2022	57.45998	60.67483	62.85633	60	2.7	4	6.7	67.574315	99.42611191	Good	Good
8	29/09/2022	01/11/2022	67.16656	70.17418	60.29917	66	5.1	8	12.6	66.006118	99.62168979	Good	Good
9	01/11/2022	30/11/2022	75.34714	71.29723	72.43805	73	2.1	3	5.2	69.059249	99.28263989	Good	Good
10	30/11/2022	03/01/2023	57.11474	48.21132		53	6.3	12	56.6	74.943634	99.60369881	Good	Good
11													
12													
13													

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

Overall survey --> Good precision | Good Overall DC

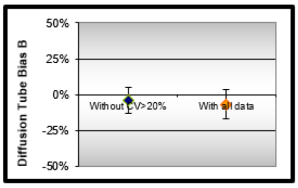
(Check average CV & DC from Accuracy calculations)

Site Name/ ID: 501 Colston Avenue

Precision 9 out of 10 periods have a CV smaller than 20%

Accuracy (with 95% confidence interval)
without periods with CV larger than 20%
Bias calculated using 9 periods of data
Bias factor A 1.05 (0.96 - 1.17)
Bias B -5% (-14% - 4%)
Diffusion Tubes Mean: 65 μgm^{-3}
Mean CV (Precision): 5
Automatic Mean: 69 μgm^{-3}
Data Capture for periods used: 100%
Adjusted Tubes Mean: 68 (62 - 76) μgm^{-3}

Accuracy (with 95% confidence interval)
WITH ALL DATA
Bias calculated using 10 periods of data
Bias factor A 1.08 (0.97 - 1.22)
Bias B -8% (-18% - 3%)
Diffusion Tubes Mean: 63 μgm^{-3}
Mean CV (Precision): 8
Automatic Mean: 68 μgm^{-3}
Data Capture for periods used: 99%
Adjusted Tubes Mean: 68 (61 - 77) μgm^{-3}



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Version 04 - February 2011

Figure C.17 - Marlborough Street Co-Location Precision and Accuracy

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 μgm^{-3}	Tube 2 μgm^{-3}	Tube 3 μgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean	Automatic Method: Period Mean	Automatic Method: Data Capture (% DC)	Data Quality Check: Tubes Precision Check	Data Quality Check: Automatic Monitor Data
1	05/01/2022	03/02/2022	50.5041	50.86015	53.41181	52	1.6	3	3.9	37.376081	99.56958393	Good	Good
2	03/02/2022	04/03/2022	43.1458	38.93258	40.65347	41	2.1	5	5.3	23.966547	99.71305595	Good	Good
3	04/03/2022	31/03/2022	42.07142	44.111	44.68463	44	1.4	3	3.4	36.775194	99.38366718	Good	Good
4	31/03/2022	06/05/2022	39.64855	39.96367	37.2176	39	1.5	4	3.7	32.469056	94.33526012	Good	Good
5	06/05/2022	09/06/2022	32.63837	32.40004	34.78332	33	1.3	4	3.3	21.685276	99.75520196	Good	Good
6	09/06/2022	08/07/2022	38.10014	34.74499	33.51555	35	2.4	7	5.9	21.322254	99.28263989	Good	Good
7	08/07/2022	04/08/2022	33.84575	37.05209	39.39519	37	2.8	8	6.9	23.787682	95.06933744	Good	Good
8	04/08/2022	02/09/2022	37.82644	37.82644	39.03201	38	0.7	2	1.7	30.58049	96.70014347	Good	Good
9	02/09/2022	30/09/2022	42.1503	46.60967	46.134	45	2.4	5	6.1	25.607463	99.55423477	Good	Good
10	30/09/2022	03/11/2022	33.56688	33.17766	32.44787	33	0.6	2	1.4	25.904131	99.26560588	Good	Good
11	03/11/2022	02/12/2022	38.84091	39.18315	15.56819	31	13.5	43	33.6	30.311871	99.71305595	Poor Precision	Good
12	02/12/2022	05/01/2023	37.84831	37.79966	37.99427	38	0.1	0	0.3	34.29303	99.15373766	Good	Good
13													

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

Overall survey --> Good precision | Good Overall DC

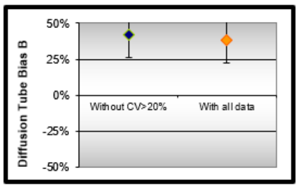
(Check average CV & DC from Accuracy calculations)

Site Name/ ID: 672 Marlborough Street

Precision 11 out of 12 periods have a CV smaller than 20%

Accuracy (with 95% confidence interval)
without periods with CV larger than 20%
Bias calculated using 11 periods of data
Bias factor A 0.72 (0.65 - 0.81)
Bias B 39% (23% - 54%)
Diffusion Tubes Mean: 40 μgm^{-3}
Mean CV (Precision): 4
Automatic Mean: 29 μgm^{-3}
Data Capture for periods used: 98%
Adjusted Tubes Mean: 28 (26 - 32) μgm^{-3}

Accuracy (with 95% confidence interval)
WITH ALL DATA
Bias calculated using 12 periods of data
Bias factor A 0.74 (0.66 - 0.84)
Bias B 35% (20% - 51%)
Diffusion Tubes Mean: 39 μgm^{-3}
Mean CV (Precision): 7
Automatic Mean: 29 μgm^{-3}
Data Capture for periods used: 98%
Adjusted Tubes Mean: 29 (26 - 33) μgm^{-3}



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Version 04 - February 2011

A combined local bias adjustment factor of 0.86 has been used to bias adjust the 2022 diffusion tube results.

NO_2 Fall-off with Distance from the Road

Wherever possible, monitoring locations are representative of exposure. However, where this is not possible, the NO_2 concentration at the nearest location relevant for exposure has been 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. with the information used in the calculations shown in Table C.7.

Table C.7 – NO_2 Fall off With Distance Calculations (concentrations presented in µg/m^3)

Site ID	Distance (m): Monitoring Site to Kerb	Distance (m): Receptor to Kerb	Monitored Concentration (Annualised and Bias Adjusted	Background Concentration	Concentration Predicted at Receptor	Comments
175	2.0	15.0	38.7	12.6	26.4	
239	0.7	9.0	48.6	13.9	31.9	
242	0.5	5.5	36.6	13.9	26.9	
261	3.0	8.0	39.3	15.7	33.3	
405	1.0	2.0	38.0	15.2	34.8	
487	5.0	9.0	36.8	17.8	33.5	
502_1, 502_2, 502_3	2.0	5.0	54.1	20.3	**46.9**	*Predicted concentration at Receptor above AQS objective.*
512	3.0	5.0	36.2	15.6	33.5	
567	1.5	3.0	43.2	13.9	*38.7*	*Predicted concentration at Receptor within 10% the AQS objective.*
586	0.1	4.0	41.8	20.3	31.0	
593	1.0	4.0	36.3	20.3	31.8	
602	2.0	2.3	42.7	18.1	**41.9**	*Predicted concentration at Receptor above AQS objective.*
608	0.4	3.0	38.4	18.9	31.8	
624	2.0	10.0	48.4	13.9	35.4	
652	1.0	4.5	37.0	15.3	30.4	
665	2.0	4.0	37.1	20.3	34.3	
667	0.5	5.0	45.3	18.1	34.3	
670	3.0	4.5	38.8	12.0	*36.0*	*Predicted concentration at Receptor within 10% the AQS objective.*

QA/QC of Automatic Monitoring

The Council's monitoring network is operated and run by officers trained in all aspects of the monitoring processes including routine site operations, field calibrations and data ratification. The QA/QC for the AURN Bristol St Pauls and Temple Way sites is carried out by Ricardo-AEA. Live and historic air quality data can be found on the Bristol City Council open data portal. This is a new portal, which replaced the old system. During 2023 the portal will be developed to improve the functionality.

Routine Site Operations

The Council's monitoring sites have a programme of routine operational checks and programmed fortnightly site visits including:

- Daily communications checks on lines, data transfer and analyser operation;
- Daily checks of data quality;
- Repairs of faulty equipment under arrangements with outside contractors;
- Fortnightly site inspections of equipment operational status, site safety, security, and calibration checks; and
- Planned six monthly servicing and re-calibration of analysers by equipment suppliers under contract to the Council.

The Temple Way site is an affiliate site which is owned and maintained by Bristol City Council but also incorporated in the Defra AURN network. This site is maintained in accordance with the QA/QC processes as required for sites that form part of the National AURN network.

Equipment Servicing and Maintenance Regimes

BCC analysers have planned maintenance schedules that broadly follow those assigned to the AURN and affiliated site network. All analysers are maintained following manufacturers' instructions and have a six-monthly full service and re-calibration conducted under the servicing contract. Until November 2022 the Equipment Support Services were carried out by ESU1 Ltd. From November 2022 these were carried out by Enviro Technology Ltd when a new contract was awarded through a competitive process.

BCC's internal data ratification procedures have been used to ensure that the reported data is valid and meets the required standards. Results of the servicing, calibrations and repairs that were carried out by ESU1 Ltd and Enviro Technology are fully documented and stored centrally. BCC staff carry out routine maintenance during regular fortnightly site visits where all associated equipment such as sample lines, modem, and electrical system are examined, and sample inlet filters are changed. Any faults, repairs or changes made to the equipment are also recorded and stored centrally and at analyser locations.

Calibration Methods

The calibration procedures are the same for all the Council's continuous analysers, with a two point zero/span calibration check being performed at regular intervals of two weeks. The methodology for the calibration procedure being derived from the manufacturers' instruction handbooks and from the AURN Site Operator's Manuals, as follows:

- Pre-calibration check - the site condition and status of the analyser is recorded prior to the zero/span check being conducted;
- Zero check – the response of the analyser to the absence of the gas being monitored;
- Span check – the response of the analyser to the presence of the gas of a known concentration; and
- Post calibration check - the site condition and status of the analyser upon completion of all checks.

Each analyser zero/span check is fully documented with records being kept centrally using Google Sheets. Diagnostics data is recorded automatically through Envista ARM. Calibration factors are calculated in Google Sheets and are used in the scaling and ratification process.

Analyser Calibration

A two-point calibration is conducted on Bristol City Council analysers with a reference NO mixture at a concentration of approximately 470ppb. Gases are supplied and certified by BOC.

Zero Air Generation

The contents of the portable scrubber (hopcalite, activated charcoal, purafil and drierite) are changed when necessary or at least every six months.

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

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

Automatic Monitoring Annualisation

All automatic NO_2 monitoring locations within Bristol recorded data capture of greater than 75% therefore it was not required to annualise any monitoring data.

Appendix D: Map(s) of Monitoring Locations and AQMAs

Figure D.1 – Extent of Air Quality Management Area

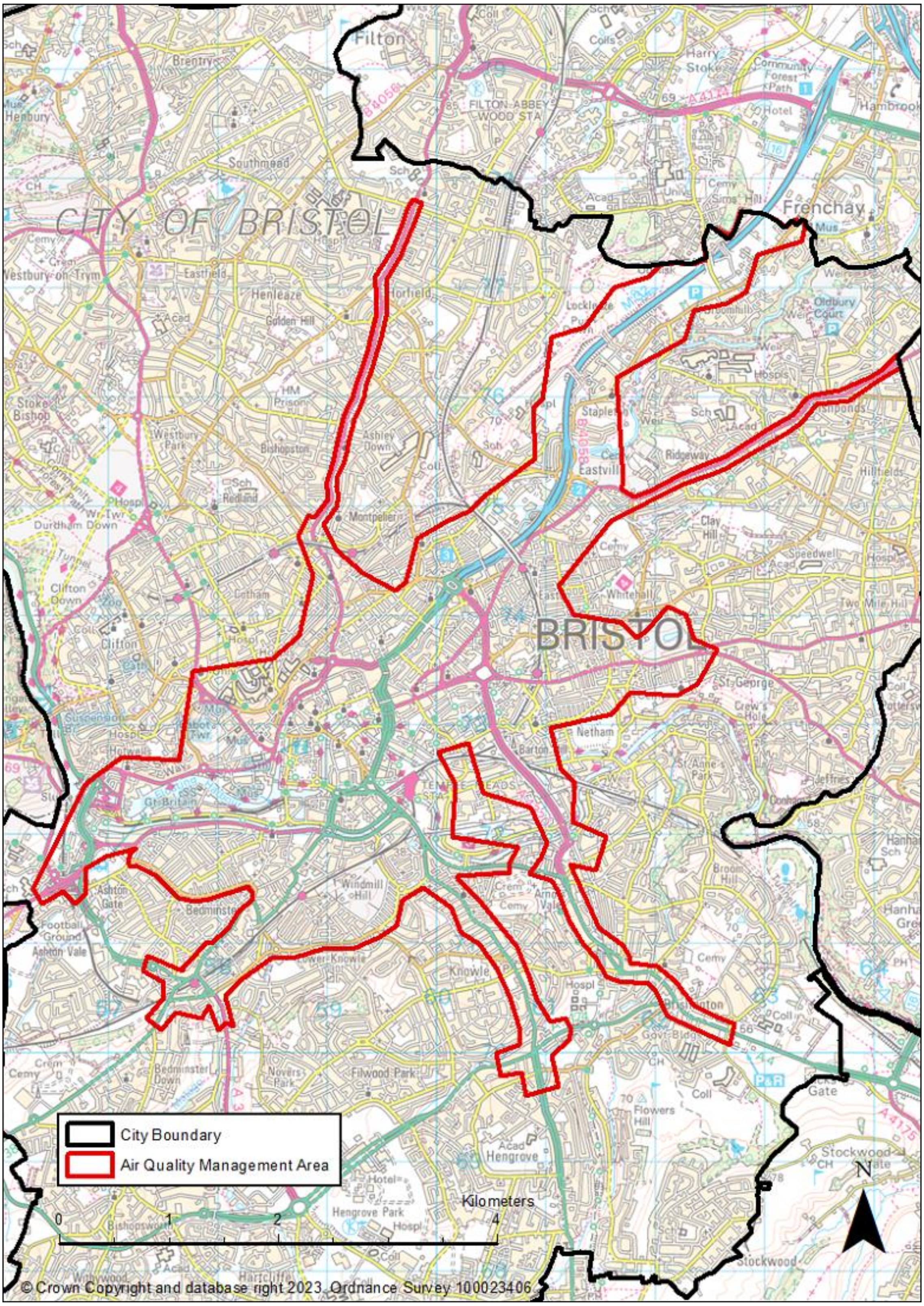


Figure D.2 - Central Monitoring Locations: 2022 Annual NO_2 Concentrations

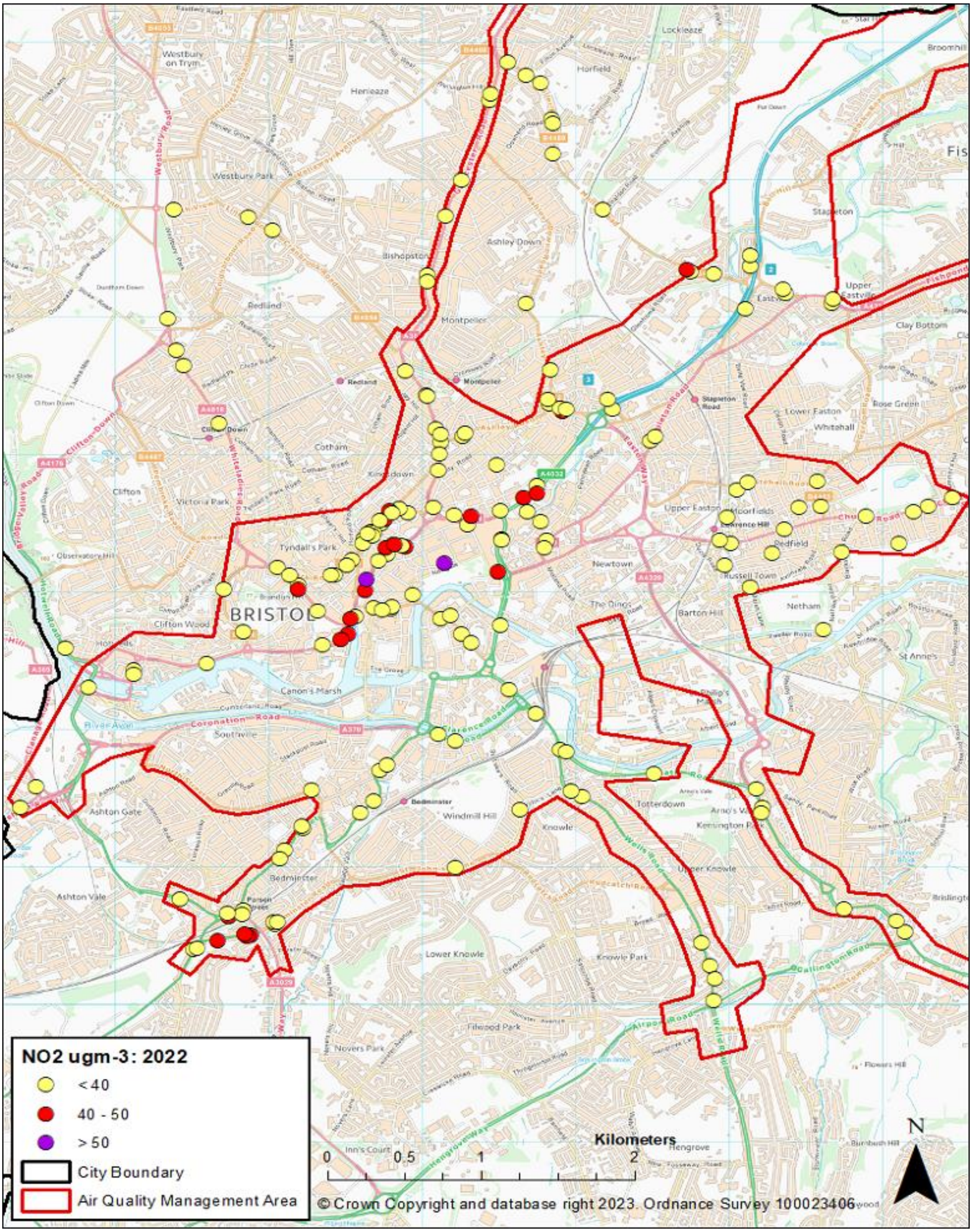


Figure D.3 - Central Monitoring Locations: 2022 Annual NO_2 Concentrations Distance Adjusted (where relevant)

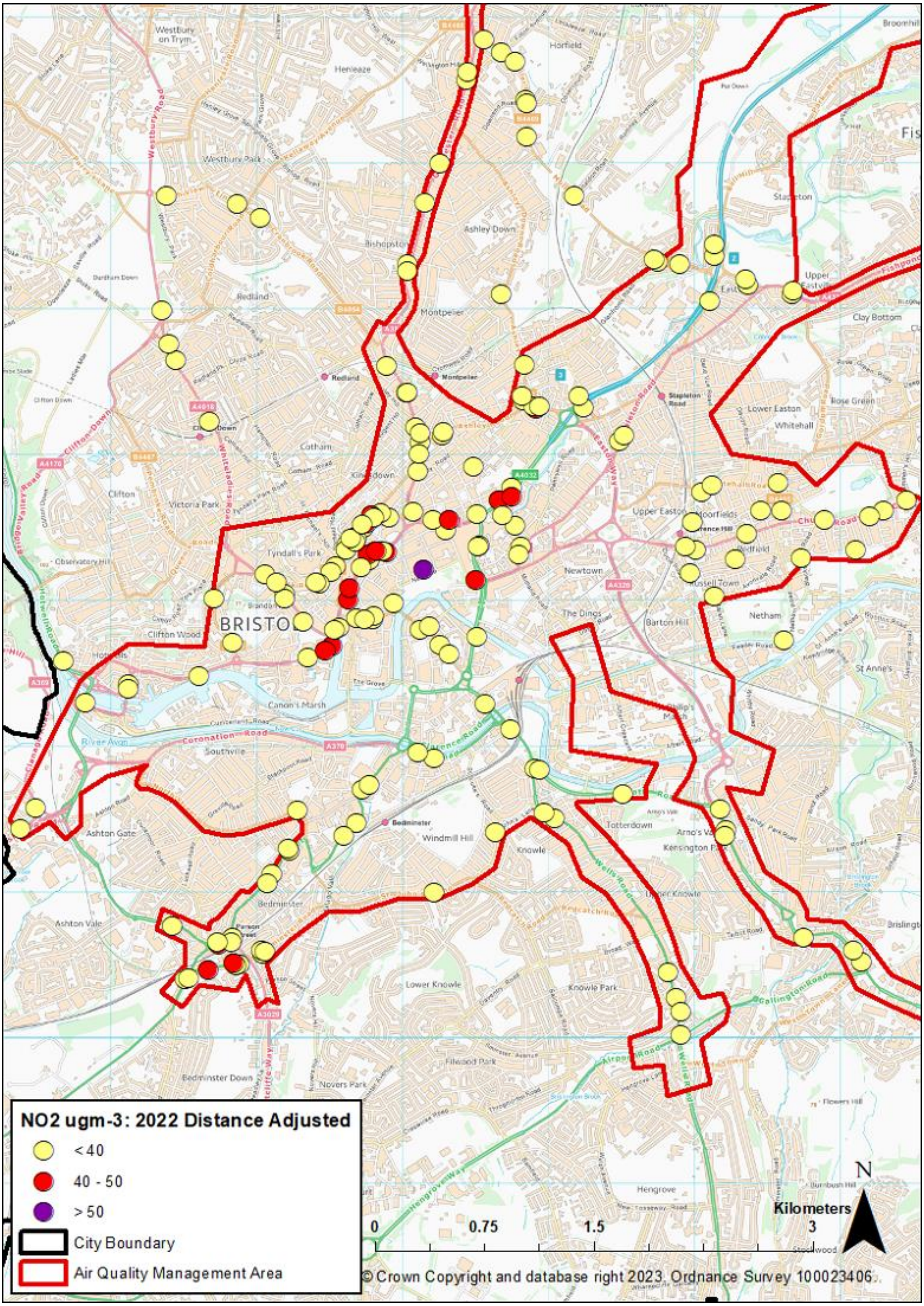


Figure D.4 – Avonmouth Monitoring Locations

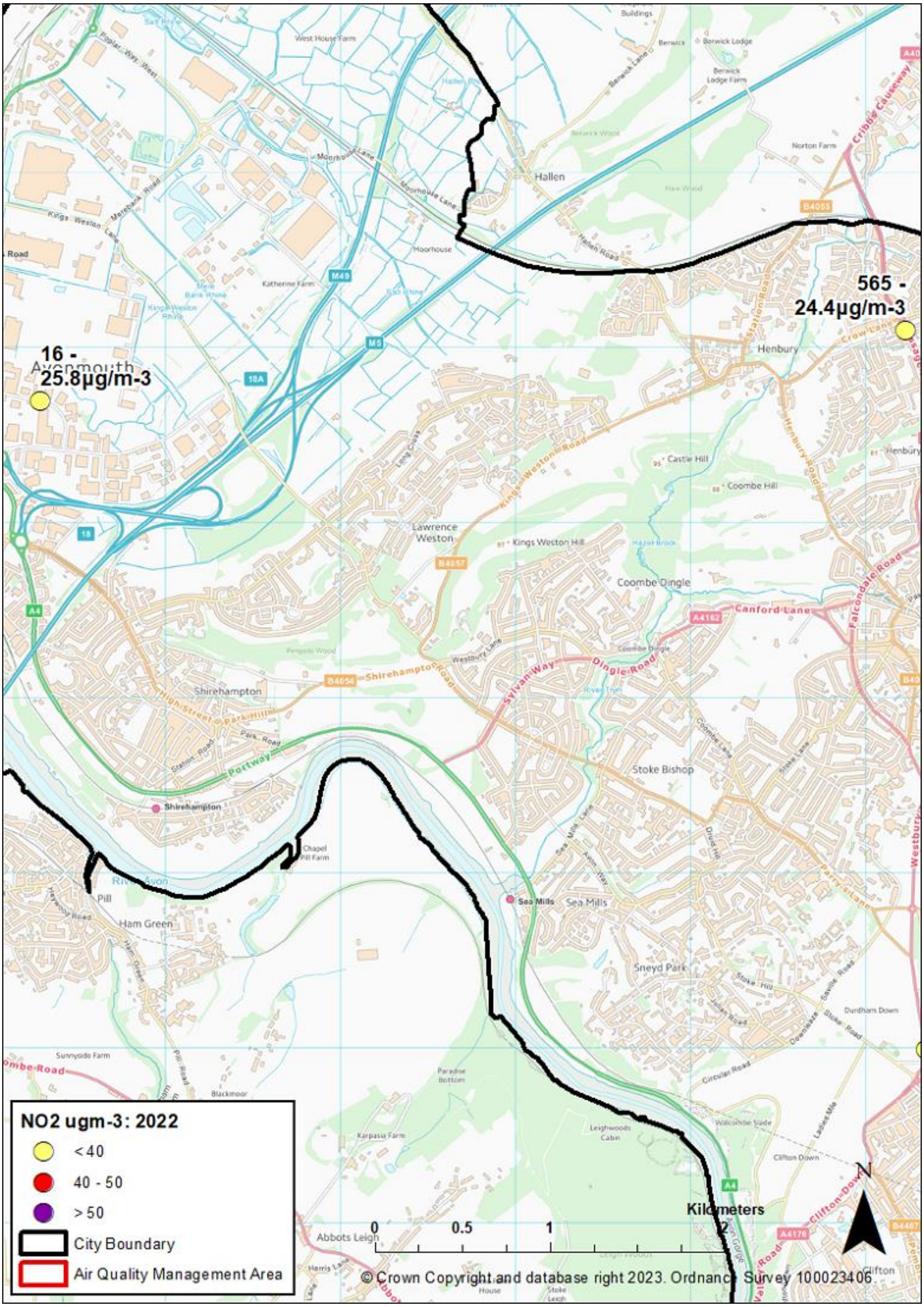
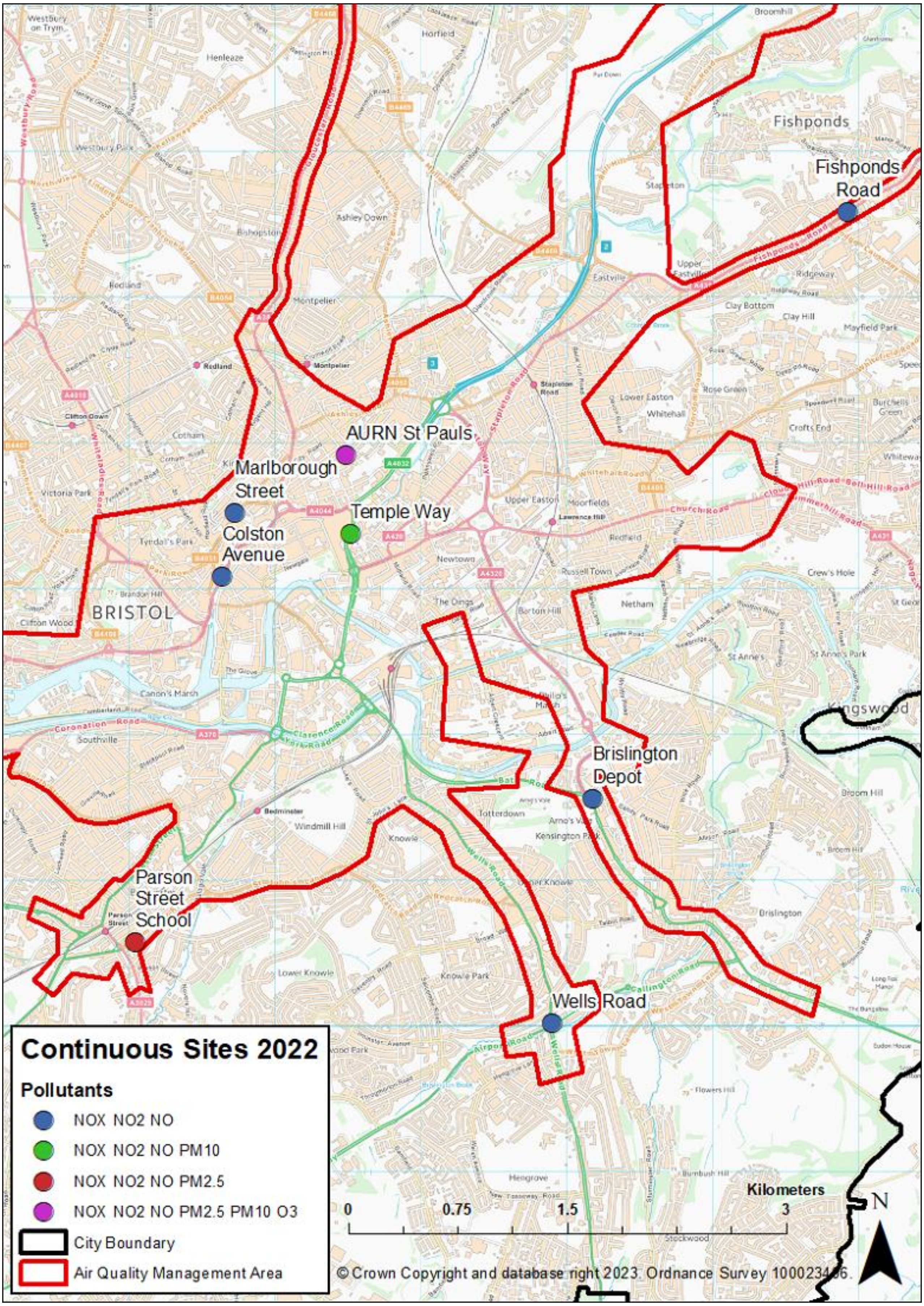


Figure D.5 - Continuous (real-time) Monitoring Locations in 2022



Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England[18]

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

[18] 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

- Local Air Quality Management Technical Guidance LAQM.TG22. August 2022. 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.PG22. August 2022. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.