



2020 Air Quality Annual Status Report (ASR)

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

Date: June, 2021

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Report Reference Number	ASR2020
Date	June 2021

Executive Summary

Health impacts of air pollution in the context of COVID-19

The year 2020 brought the most defining global health crisis of our time. Since it emerged in Asia in late 2019, the COVID pandemic has been responsible for more than 3 million¹ deaths worldwide. The coronavirus (SARS-CoV-2) is responsible for causing acute respiratory syndrome, and the symptoms can be highly variable, ranging from none to life-threateningly severe.

It is widely understood that long term exposure to air pollution is historically associated with a number of adverse health impacts and is linked with increased morbidity. Air pollution can cause health problems like cardiovascular disease, respiratory system disease, strokes, diabetes, increasing obesity and high blood pressure, all of which have been identified as the pre-existing medical conditions² that raise the chances of death from COVID-19 infection.

Emerging research, including a study from Harvard T.H. Chan School of Public Health³, found that breathing more polluted air over many years may itself worsen the effects of COVID-19. These authors found an association between air pollution over many years with an 11% increase in mortality from COVID-19 infection for every 1 microgram/cubic meter increase in air pollution, and whilst the study does not show that air pollution directly affects an individual's likelihood of dying from COVID-19 (because individual-level COVID data is not yet publicly available), it does show an association between long term exposure to air pollution and higher COVID-19 mortality rates.

Here in the UK, the Air Quality Expert Group (AQEG) issued, in June 2020, a rapid review⁴ on the estimation of changes in air pollution emissions, concentrations and exposure during the COVID-19 outbreak in the UK. The document also acknowledges that there is some evidence to suggest that nitrogen dioxide (NO₂), particulate matter (PM) and ozone

1 Data obtained from [Worldometers](#), on the 4th June 2021

2 [International Journal of Infectious diseases](#)

3 [Air pollution and COVID-19 mortality in the United States](#)

4 [Air Quality Expert Group](#), Rapid evidence review June 2020

(O₃) may increase susceptibility to respiratory infections or worsen disease prognosis, although it recognises that there are still insufficient studies or mixed evidence for specific combinations of endpoints, infection types, age groups or pollutants.

The mortality burden of air pollution within the UK was equivalent to 28,000 to 36,000 deaths at typical ages⁵, with a total estimated healthcare cost to the NHS and social care of £157 million in 2017⁶.

Action on air pollution has therefore never been more important. In addition to the annual burden of disease and deaths caused by air pollution, it also looks to be making us more [vulnerable to the impacts of COVID-19](#).

Oxford's air pollution sources and the city's new AQAP

The city of Oxford, as with many urban areas throughout the United Kingdom, is subject to poor air quality, particularly in areas with high levels of road traffic. Nitrogen dioxide (NO₂) is still the pollutant of most concern, and the entire city of Oxford has been a designated [Air Quality Management Area](#) (AQMA) for NO₂ since 2010.

According to Oxford's most recent source apportionment study⁷, the transport sector continues to be by far the largest contributor (68%) to total emissions of Nitrogen Oxides (NO_x), followed by domestic combustion (19%), combustion from industry and services (12%) and others: waste, agriculture, solvents, nature (<1%).

In January 2021, Oxford City Council's cabinet approved the adoption of a new Air Quality Action Plan (AQAP) for the city, replacing the old plan which expired in December 2020. The new AQAP, which is available at the city county's [website](#), sets out the list of actions that the city council and its partners have committed to deliver during the period 2021-2025 in pursuit of an improvement of air quality levels in the city and, more importantly, sets out what is believed to be the UK's first localised air pollution target for NO₂.

The action plan, which was developed by Oxford City Council together with Oxfordshire County Council's Localities, Public Health and Innovation teams, seeks to go further than the legal annual mean limit value for NO₂ of 40 µg/m³, by establishing a new local annual

5 Defra. [Air quality appraisal: damage cost guidance](#), July 2020

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

7 Oxford City Council's [Source Apportionment study](#), July 2020

mean NO₂ target of 30 µg/m³ to be achieved by 2025 in recognition that there's no safe level for air pollution.

Oxford's air pollution levels and lockdown impacts

This annual status report outlines the result of air quality monitoring undertaken across the city of Oxford in 2020. Data for a full year of monitoring is required in order to report on the complete set of NO₂ air quality objectives, and Oxford City Council annually publishes all air quality data on its [website](#) as well as on <https://oxfordshire.air-quality.info/>

Results from the air quality monitoring conducted during 2020 indicate significant decreases of NO₂, PM₁₀ and PM_{2.5} levels in all the places where these pollutants are being monitored in the city. This is directly linked to the onset of the COVID-19 pandemic and ensuing Government lockdowns.

During the first couple of months of the first lockdown, Oxford saw reductions of up to 60%⁸ in Nitrogen Dioxide (NO₂), primarily from a significant reduction in traffic, with levels at the lowest ever recorded in the city since 1996, the year air quality monitoring began.

During 2020, due to the lockdowns and in response to the impacts of the COVID-19 pandemic, millions of people have changed their routines in ways that reduced air pollution by working from home and walking and cycling more. The significant shift that we have all experienced towards active travel during this period has seen more people than ever enjoying our streets with lower levels of motorised traffic, which has translated into significant positive changes in air pollution levels and likely improvements in public health.

[Recent surveys](#) of Oxford residents showed clear support for action to reduce motorised traffic to make the city more cycle and walking friendly. People have indicated that they have noticed and appreciated cleaner air and safer streets.

Throughout 2020, Oxford City Council operated an air quality monitoring network that consists of a total of 71 sites using passive monitoring (diffusion tubes) and three sites using automatic (continuous) monitoring. In 2019, before the COVID-19 pandemic, we were experiencing NO₂ levels above the annual mean legal limit for this pollutant at six locations in the city. In 2020, we have witnessed a reduction in NO₂ levels at all 71 monitored locations of between 14-45% (depending on the location).

⁸ Ricardo Energy & Environment – [Blog update](#) on COVID-19 and changes in air pollution

The average reduction of NO₂ levels across the entire city was of 29% in 2020. This figure is consistent with the 20-30% reductions in NO₂ levels which were observed across the UK, as highlighted on the AQEG [report](#) on the estimation of changes in air pollution emissions, concentrations and exposure during the COVID-19 outbreak in the UK.

The highest NO₂ annual mean concentration measured in Oxford in 2020 was 36 ug/m³ at our highest historic air pollution hotspot – St Clements. This figure is 10% below the current limit value of 40ug/m³, and represents a reduction of 32% with regards to the measurement obtained in 2019. Overall, this means that in 2020 all monitoring sites were, for the first time since air quality monitoring began in the city, in full compliance with the UK air quality objectives for this pollutant.

But NO₂ was not the only pollutant experiencing significant reductions in 2020 as a consequence of the COVID-19 impacts. Analysis of the annual means obtained for Particulate Matter show an average 19% reduction of PM₁₀ levels, and a 22% reduction of PM_{2.5} levels, in all the city locations where these pollutants are being monitored.

These reductions were less pronounced than those observed for NO₂ due to the closer association of these pollutants to long-range transport and to the fact that the biggest contributor to local emissions of these pollutants is not the transport sector (contrary to what is seen for NO₂), but domestic combustion instead. During lockdown, people have remained in their homes, and continued to use their heating systems, hence they have continued to generate PM emissions via this emission source.

Whilst the impacts of the pandemic seem to have been largely positive in reducing local levels of NO₂, PM₁₀, and PM_{2.5}, the same cannot be said with regards to ozone (O₃). Overall, the concentrations of ozone measured at AURN St Ebbes were significantly higher in 2020 when in comparison with the previous monitoring year. Nitric oxide (NO) - largely emitted from vehicles, destroys ozone and therefore acts as a local sink. For this reason, ozone levels are typically never as high in urban areas as in rural areas.

The significant reductions in traffic⁹ caused by the pandemic restrictions have led to a decrease in NO levels, which in turn caused general increases of ozone levels in Oxford, and generally throughout the UK.

⁹ Oxfordshire County Council (the Highways authority) have estimated an average 35% reduction in traffic levels in Oxford City Centre, during the period that goes from 23rd March to the 31st December 2020.

Actions to Improve Air Quality

Oxford's new Air Quality Action Plan 2021-2025 focusses on measures the City Council has the ability to address, but also includes measures that we can influence, or work in partnership with others to deliver. Effective action requires co-operation from all sectors including transport, construction, business and commerce, and daily choices made by every single transport user. Oxford's AQAP recognises that the City Council cannot act in isolation in order to deliver a comprehensive package of measures without engagement and delivery from a wide range of stakeholders.

The following are actions that Oxford City Council has taken over the last reporting year (from July 2020 to June 2021) to improve air quality in the city despite the impact of the COVID-19 pandemic in disrupting plans. The list below is presented in chronological order:

- 1) Agreed, in July 2020 and together with Oxfordshire County Council, for work to be accelerated, where feasible, on Connecting Oxford, the Zero Emission Zone and the wider sustainable and active travel programme.
- 2) Announced in September 2020, the winning primary school for the school banner competition to raise awareness of air pollution. Schools across Oxford were invited in March 2020 to take part in a competition, organised by the City Council and Oxford Friends of the Earth to create a banner raising awareness about the effects of air pollution, and to promote sustainable transport on the school run. The competition is part of the City Council's STOP (Schools Tackling Oxford's Air Pollution) project which aims to raise awareness of the main sources and health effects of air pollution emissions among the school community ([link to press release](#));
- 3) Supported Oxfordshire County Council's successful delivery of the new Street Tag app in October 2020. The app forms part of County Council's active travel plans to increase exercise and improve air quality in Oxfordshire. Street Tag is aimed at children, parents' schools, leisure venues and community groups. It will also involve the use of outdoor spaces and school staff. ([link to press release](#));
- 4) Organised and hosted Oxford's first youth climate summit in November 2020. The meeting has supported participating young people to learn more about climate breakdown and its impacts on the Global South, explore the topic of lobbying for change and inform the council's plans on climate action. The development of a

- youth climate summit was one of Oxford City Council's commitments, made as a result of 2019's Citizens Assembly on Climate Change ([link to press release](#));
- 5) Supported the delivery of the 3rd edition of Oxford's EV summit in December 2020. The 2020 panel line up was focused on UK Charging Infrastructure, International Charging Infrastructure, Original Equipment Manufacturers (OEMs), Two Wheels, Investment, Electric Buses, Sustainability and Research. The event was delivered remotely due to the COVID-19 pandemic, and was hosted by Oxford University at the Said Business School ([link to website](#)).
 - 6) Developed and delivered a [new Air Quality Action Plan](#) for the City of Oxford, which was approved at cabinet meeting in January 2021. The new AQAP outlines the complete list of 30 actions that will be delivered by the City and its partners to improve air quality in Oxford City from 2021 to 2025. It also voluntarily sets a new lower target for NO₂, one which is tighter than the Government's own. ([link to press release](#));
 - 7) Organised and delivered, in February 2021, several online show and tell sessions to try to understand city centre businesses' needs, to help them adapt to the Zero Emission Zone Pilot which will be launched in August. These activities are part of on-going work with *Futuregov* on user research to build a qualitative understanding of businesses operations and the challenges they experience to reduce their emissions following a user-centred design process. This project forms part of the £122,500 from DEFRA Air Quality Fund that was secured specifically to work with businesses in the city centre on how to adopt zero emission delivery and servicing solutions for their business ([link to press release](#));
 - 8) Secured in March 2021 £162,500 from the Department for Environment, Food, and Rural Affairs (DEFRA) Air Quality Fund for the delivery of a new Air Quality community website to help raise awareness of air pollution across Oxfordshire, working in partnership with neighbouring district councils - Cherwell, West Oxfordshire, South Oxfordshire and Vale of White Horse, along with Oxfordshire County Council. ([link to press release](#));
 - 9) Secured in March 2021 £45,000 from the Department for Environment, Food, and Rural Affairs (DEFRA) Air Quality Fund for the delivery of a citywide behaviour change campaign that will draw attention to the importance of the domestic combustion sector and how it contributes to air pollution levels in Oxford. ([link to press release](#));

- 10) Introduced in March 2021 the first purpose built, fully integrated electric refuse collection vehicle (eRCV) on the streets of Oxford, providing emission free waste collection services across the city. The vehicle is the latest in its 339-strong fleet to be converted to electric, thanks to funding from [Energy Superhub Oxford](#). The project is helping Oxford Direct Services (ODS) to convert 25% of its fleet to electric by 2023. It is already well on its way to meeting this target, with 51 electric vehicles in operation and a further eight vehicles on order. ([link to press release](#));
- 11) Saw in March 2021 the approval by City and County Council's cabinets of the final proposal for a [ZEZ pilot](#) in Oxford City centre, which will start in August 2021. The ZEZ pilot will be based on a road user charging scheme where Zero emission vehicles will be able to drive in the zone free of charge. The work was developed in partnership with the Local Transport Authority – Oxfordshire County Council. Throughout 2020/2021, both councils have also continued to develop work towards the expansion of the ZEZ to the entire city, which is expected to occur in full by 2030 ([link to press release](#));
- 12) In March 2021, supported in principle Oxfordshire County Council's trial of new Low Traffic Neighbourhoods (LTNs) within the Cowley area in Oxford and worked with the transport authority to improve their implementation. A Low Traffic Neighbourhood is an area where through traffic is prevented by the use of "*traffic filters*" which can be either planters or bollards, so that residents can enjoy a quieter neighbourhood and feel safer when they walk, cycle or go by wheelchair. ([link to press release](#));
- 13) Supported Oxfordshire County Council's trial in March 2021 of various experimental school streets schemes with the aim to improve road safety to help boost cycling and walking and improve air quality. The schemes made use of temporary barriers, some signs and a few volunteers, to close the road outside a school to motor vehicles for a short period of time either side of the start and end of the school day. Anyone walking or cycling can pass through the barriers, while drivers are advised of alternative routes. Emergency vehicles, blue badge holders and anyone who lives within the School Street are also allowed through. ([link to press release](#));
- 14) Presented Oxford's first Action Plan for bringing about a net zero carbon city by 2040 or earlier in March 2021 — ten whole years ahead of the Government's national legal target. The Net Zero Oxford Action Plan sets out the actions the City Council will be taking directly, as well as those in which it is seeking to partner with others. It references how it will engage residents, businesses and other

organisations to eliminate Oxford's contributions to climate change, and how it will use its influence with Government. The Action Plan is accompanied by the Council's new Carbon Management Plan that sets out how it will achieve zero carbon emissions across its estate and operations by 2030 or earlier. The Plan feeds into the conclusion of a new Sustainability Strategy set to take place in 2021. ([link to press release](#));

- 15) Initiated the development of Oxford's first Urban Tree Strategy in March 2021, which will be created to maximise the benefits trees have on the local environment and communities. The new strategy will also play a part in helping the city reduce air pollution levels and achieve net zero carbon by 2040. ([link to press release](#))
- 16) Submitted to DEFRA, in April 2021, the final report of a DEFRA funded air quality project involving the testing of low cost innovative Air Quality sensors to map air pollution and human exposure in Oxford. This project was delivered in partnership with local group [Ox-Air](#) ([link to press release](#));
- 17) Started a pilot project in June 2021 to test and demonstrate the effectiveness of e-cargo bikes for deliveries in Oxford's covered market and to support and expedite their uptake ([link to press release](#));
- 18) Developed , in June 2021, a green recovery plan with measures for the city and that included the delivery of: Pedestrianisation trials at St Michaels and George Streets; Allowing for parking at Oxford's five park and rides to be free throughout August; Introducing a one way pedestrian flow system in Oxford city to help maintain social distancing; Installed 130 new bike parking at the park and rides and in the city centre; Freed up pavement space and created designated rest areas to keep pedestrians moving in the city centre's busy and narrow streets.

Conclusions and Priorities

The results of the monitoring work carried out by Oxford City Council in 2020 show the following:

- Average reductions of Nitrogen Dioxide (NO₂) and Particulates (PM₁₀ and PM_{2.5}) in the city of Oxford of 29%, 19% and 22% respectively. All of these reductions can be directly attributable to the several lockdown restrictions that ended up affecting traffic levels and were imposed on the city of Oxford and its residents throughout 2020;

- Significant increases of ozone (O₃) levels in the city in 2020. Overall, Oxford has exceeded the AQS daily objective for ozone 152 times, during a total of 26 days during the year. This represents a significant increase in the number of exceedances (+112) and days (+16) when compared with the results from 2019 and is directly related to the significant reductions in traffic during the lockdown;
- For the first time since air quality monitoring started in Oxford, the city is fully compliant with all (short and long term) air quality objectives for NO₂, PM₁₀, and PM_{2.5}. Hence, no air quality hotspot was identified in 2020;
- In 2020, all the monitoring sites have experienced significant reductions of NO₂ levels. The biggest NO₂ reductions were seen at DT48 and DT47, both located at George St (45% and 40% reduction). The lowest reductions were seen at DT81 (Cowley Road/Union St) and DT28 (51 Sunderland Avenue), with 14% and 15% reduction respectively.
- The monitoring location with the highest annual mean for NO₂ in 2020 was DT55 - St. Clements Street/The Plain - with a value of 36 µgm⁻³. This represents a decrease of 32% of the NO₂ levels at this location when compared with data from the previous year (53 µgm⁻³).
- In 2020, the third full year of monitoring was completed since the opening of the Westgate Shopping Centre. Air quality was monitored at a total of 12 locations around the Westgate Centre. None of the previous historic monitoring at these locations has ever shown any exceedances of the annual mean NO₂. In 2020, all these sites showed decreases of NO₂ levels measured between 5-12 µgm⁻³. Overall, the results of the monitoring around the Westgate indicate an average NO₂ annual mean reduction of 30% in 2020, which is a positive change in NO₂ levels when compared with the previous year;

Oxford City Council's priorities for the coming year will be to try to progress as much as possible with the complete list of actions that were agreed for delivery by Oxford City Council and its partners under the City's recently approved Air Quality Action Plan (2021-2025) and which fall under the following agreed four key areas of intervention:

- Developing partnerships and public education;
- Support for the uptake of Low and Zero emission vehicles;
- Reducing emissions from domestic heating, industry and services;

- Reduce the need to travel, explore opportunities for mode shift and increase the uptake of sustainable transport.

Specifically, the City Council is expecting:

- To deliver the ZEZ pilot scheme in August 2021 and progress plans for the introduction of the wider ZEZ in Oxford, working in partnership with the Local Transport Authority – Oxfordshire County Council;
- To fully deliver a £162,500 DEFRA Air Quality Grant funded project for a new Air Quality Website for Oxfordshire, working in partnership with all the other District Councils in Oxfordshire;
- To fully deliver a £45,000 DEFRA Air Quality Grant funded project for a city-wide raising awareness campaign, specifically addressing the use of wood burning and inappropriate fuels, and highlighting the negative health impacts caused to residents by the use of these energy sources;
- To continue the roll out of 100 EV chargers across the city, as part of the GULO project;
- To progress with the delivery of a £122,500 DEFRA Air Quality Grant funded project aimed at the development of a communication and engagement plan, to inform and work with businesses in the city centre on how to adopt zero emission delivery and servicing solutions for their businesses;
- To progress with the delivery of a £200,000 DEFRA Air Quality Grant funded project aimed at facilitating Oxford's historic Covered Market to go electric through the provision of electric charging points, electric delivery vehicles and the delivery of an e-cargo bike pilot study to facilitate sustainable deliveries;
- To continue the expansion of the City Council's fleet of electric vehicles which currently stands at 51 full electric vehicles with a further 8 electric vehicles on order;
- To continue to deliver the STOP project, in partnership with the local Friends of the Earth group, working with local primary schools and raising awareness of air pollution and promoting active travel;
- To progress with the delivery of a £40 million central Government funded project for the development of an innovative new Energy Superhub Oxford project in Redbridge park and ride site;
- To introduce a new Euro VI LEZ for buses in Oxford in December 2021;
- To fully deliver Oxford's Urban Tree Strategy;

- To progress with the development of a detailed business case for the Connecting Oxford proposals, as well as modelling, design and a comprehensive engagement programme with a wide range of stakeholders and resident groups across the city;
- To initiate, the second phase of new emission standards for hackney carriages in Oxford. In January 2021, hackney carriage taxi drivers will be required to have at least Euro 4 standard to renew their licence, and zero-emission capable vehicles to receive a new licence;
- To continue developing work for the provision of electric vehicle charging infrastructure for the use of hackney carriages and private hire taxis in the city, using £370,000 of funding awarded by the Government's Office for Low Emissions Vehicles (GOLEV)
- To finalise the delivery of £2.3 million CBTF project for the retrofitting of five of the city's open-top sightseeing buses to become fully electric, and the retrofitting of 115 local buses to euro VI standards, using Selective Catalytic Reduction (SCR) technology;

Local engagement and how to get involved

From the 10th September 2020 to the 1st November 2020 Oxford City Council ran a consultation on the proposed new Air Quality Action plan (2021-2025). The results of this public consultation have allowed the city council to gain a better understanding of the level of interest and understanding of our local residents on air quality matters.

The results of the public consultation were positive and in general supportive of the key priority areas of intervention and air quality actions developed in the proposed AQAP. At the same time, the following statistics were gathered as a result:

- 60% of the consultees have rated "Air Quality" in Oxford to be either "Poor" or "Very poor";
- 86% of the consultees have rated "Traffic Congestion" in Oxford to be either "Poor" or "Very poor" and 63% believe that traffic has become worse in the city over the past 5 years;
- 68% of the consultees have rated "Adequate space for cycling" in Oxford as either "Poor" or "Very Poor";

- 68% of the consultees feel moderately informed about air quality issues in Oxford, and 84% said they would like to feel more informed about air quality.

The results of this public consultation were very useful in terms of making the City Council aware of how much Oxford's residents value clean air, have a good understanding of most of the issues that need to be tackled in the city, and of how much they want to be informed about air quality issues.

Everyone deserves to breathe clean air, but it is important to highlight that everyone also has a role to play in improving air quality levels, as our everyday decisions can have an impact on the air we breathe.

- Do you burn inappropriate fuels or use inappropriate appliances at home?
- Do you take the car when you could have cycled?
- Do you drive your children to school when you could have walked?

We all have a huge role to play and we can all be part of the solution. Encouraging walking and cycling in the city not only has a positive impact on air quality levels, but it also has multiple other benefits, including increasing the health and wellbeing of all those who live, work and visit Oxford.

Full details of Oxford's air quality monitoring results, including real time data on pollutant levels and reference to the city's daily Air Quality Index (AQI), a metric on the daily levels of air pollution, together with recommended actions and health advice is available on the Oxfordshire Air Quality Group (OAQG) website <https://oxfordshire.air-quality.info/> or alternatively on [AQ England](#) and [UK-Air](#) websites.

Relevant information with regards to Oxford city Council's air quality projects, current air quality management and other relevant air quality information can be found at the city council's website: https://www.oxford.gov.uk/info/20052/air_quality.

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1 Local Air Quality Management

This report provides an overview of air quality in Oxford during 2020. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995) and the relevant Policy and Technical Guidance documents.

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

2 Actions to Improve Air Quality

Air Quality Management Areas

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

A summary of AQMAs declared by Oxford City Council can be found in Table 2.1. The table presents a description of the only AQMA that is currently designated within Oxford City Council. Appendix D: Map(s) of Monitoring Locations and AQMAs provides a map of this AQMA and also the air quality monitoring locations in relation to the AQMA. Currently, the only air quality objective pertinent to the current AQMA designation is:

- NO₂ annual 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	Name and Date of AQAP Publication	Web Link to AQAP
The city of Oxford	Declared 2010	NO2 annual and hourly mean	The whole of the administrative area of Oxford City Council	YES	78µg/m ³	36µg/m ³	AQAP (2021-2025) January 2021	Visit the AQAP for Oxford's city-wide AQMA here

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

Oxford City Council confirm that all current AQAPs have been submitted to Defra.

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Progress and Impact of Measures to address Air Quality in Oxford

Defra's appraisal of last year's ASR concluded that overall, the report was well written, structured and detailed, and provided all the information specified in the LAQM guidance. However, a few comments were made with regards to the identification of actions for improvement of future versions of the report:

- *It would be useful for the report to include a map with the AQMA extent;*
- *The city's AQAP would need to be updated for next year's ASR as the existing plan was mapped out to run from 2013 – 2020;*
- *Distance correction using the LAQM calculator should be applied in future and the corresponding calculations should be included as annex;*
- *Further details on the calculation of the local bias adjustment factors should also be included as annex.*
- *The report included excellent detail from local PM_{2.5} monitoring but could supplement this information with reference to the Public Health Outcomes Framework.*
- *The feedback from DEFRA's last year appraisal was not included or commented upon. The council should look to include this in future years.*

Oxford City Council has carefully reviewed the suggestions made and have decided to incorporate the complete list of DEFRA's suggestions into this year's ASR.

Oxford City Council has taken forward a number of direct measures during the reporting year of 2020 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2. A complete list of 30 measures is included within Table 2.2, with the type of measure and the progress Oxford City Council have made during the reporting year of 2020 presented. Where there have been, or continue to be, barriers restricting the implementation of the measure, these are also presented within Table 2.2.

More detail on these measures can be found in Oxford City Council's recent [Air Quality Action Plan 2021-2025](#)

Oxford City Council's key completed measures since last year's ASR include:

- Agreed, in July 2020 and together with Oxfordshire County Council, for work to be accelerated, where feasible, on Connecting Oxford, the Zero Emission Zone and the wider sustainable and active travel programme.
- Announced in September 2020, the winning primary school for the school banner competition to raise awareness of air pollution. Schools across Oxford were invited in March 2020 to take part in a competition, organised by the City Council and Oxford Friends of the Earth to create a banner raising awareness about the effects of air pollution, and to promote sustainable transport on the school run. The competition is part of the City Council's STOP (Schools Tackling Oxford's Air Pollution) project which aims to raise awareness of the main sources and health effects of air pollution emissions among the school community ([link to press release](#));
- Supported Oxfordshire County Council's successful delivery of the new Street Tag app in October 2020. The app forms part of County Council's active travel plans to increase exercise and improve air quality in Oxfordshire. Street Tag is aimed at children, parents' schools, leisure venues and community groups. It will also involve the use of outdoor spaces and school staff. ([link to press release](#));
- Organised and hosted Oxford's first youth climate summit in November 2020. The meeting has supported participating young people to learn more about climate breakdown and its impacts on the Global South, explore the topic of lobbying for change and inform the council's plans on climate action. The development of a youth climate summit was one of Oxford City Council's commitments, made as a result of 2019's Citizens Assembly on Climate Change ([link to press release](#));
- Supported the delivery of the 3rd edition of Oxford's EV summit in December 2020. The 2020 panel line up was focused on UK Charging Infrastructure, International Charging Infrastructure, Original Equipment Manufacturers (OEMs), Two Wheels, Investment, Electric Buses, Sustainability and Research. The event was delivered remotely due to the COVID-19 pandemic, and was hosted by Oxford University at the Said Business School ([link to website](#)).
- Developed and delivered a [new Air Quality Action Plan](#) for the City of Oxford, which was approved at cabinet meeting in January 2021. The new AQAP outlines the complete list of 30 actions that will be delivered by the City and its partners to improve air quality in Oxford City from 2021 to 2025. It also voluntarily sets a new lower target for NO₂, one which is tighter than the Government's own. ([link to press release](#));

- Organised and delivered, in February 2021, several online show and tell sessions to try to understand city centre businesses' needs, to help them adapt to the Zero Emission Zone Pilot which will be launched in August. These activities are part of on-going work with *Futuregov* on user research to build a qualitative understanding of businesses operations and the challenges they experience to reduce their emissions following a user-centred design process. This project forms part of the £122,500 from DEFRA Air Quality Fund that was secured specifically to work with businesses in the city centre on how to adopt zero emission delivery and servicing solutions for their business ([link to press release](#));
- Secured in March 2021 £162,500 from the Department for Environment, Food, and Rural Affairs (DEFRA) Air Quality Fund for the delivery of a new Air Quality community website to help raise awareness of air pollution across Oxfordshire, working in partnership with neighbouring district councils - Cherwell, West Oxfordshire, South Oxfordshire and Vale of White Horse, along with Oxfordshire County Council. ([link to press release](#));
- Secured in March 2021 £45,000 from the Department for Environment, Food, and Rural Affairs (DEFRA) Air Quality Fund for the delivery of a citywide behaviour change campaign that will draw attention to the importance of the domestic combustion sector and how it contributes to air pollution levels in Oxford. ([link to press release](#));
- Introduced in March 2021 the first purpose built, fully integrated electric refuse collection vehicle (eRCV) on the streets of Oxford, providing emission free waste collection services across the city. The vehicle is the latest in its 339-strong fleet to be converted to electric, thanks to funding from [Energy Superhub Oxford](#). The project is helping Oxford Direct Services (ODS) to convert 25% of its fleet to electric by 2023. It is already well on its way to meeting this target, with 51 electric vehicles in operation and a further eight vehicles on order. ([link to press release](#));
- Saw in March 2021 the approval by City and County Council's cabinets of the final proposal for a [ZEZ pilot](#) in Oxford City centre, which will start in August 2021. The ZEZ pilot will be based on a road user charging scheme where Zero emission vehicles will be able to drive in the zone free of charge. The work was developed in partnership with the Local Transport Authority – Oxfordshire County Council. Throughout 2020/2021, both councils have also continued to develop work towards the expansion of the ZEZ to the entire city, which is expected to occur in full by 2030 ([link to press release](#));

- In March 2021, supported in principle Oxfordshire County Council's trial of new Low Traffic Neighbourhoods (LTNs) within the Cowley area in Oxford and worked with the transport authority to improve their implementation. A Low Traffic Neighbourhood is an area where through traffic is prevented by the use of "*traffic filters*" which can be either planters or bollards, so that residents can enjoy a quieter neighbourhood and feel safer when they walk, cycle or go by wheelchair. ([link to press release](#));
- Supported Oxfordshire County Council's trial in March 2021 of various experimental school streets schemes with the aim to improve road safety to help boost cycling and walking and improve air quality. The schemes made use of temporary barriers, some signs and a few volunteers, to close the road outside a school to motor vehicles for a short period of time either side of the start and end of the school day. Anyone walking or cycling can pass through the barriers, while drivers are advised of alternative routes. Emergency vehicles, blue badge holders and anyone who lives within the School Street are also allowed through. ([link to press release](#));
- Presented Oxford's first Action Plan for bringing about a net zero carbon city by 2040 or earlier in March 2021 — ten whole years ahead of the Government's national legal target. The Net Zero Oxford Action Plan sets out the actions the City Council will be taking directly, as well as those in which it is seeking to partner with others. It references how it will engage residents, businesses and other organisations to eliminate Oxford's contributions to climate change, and how it will use its influence with Government. The Action Plan is accompanied by the Council's new Carbon Management Plan that sets out how it will achieve zero carbon emissions across its estate and operations by 2030 or earlier. The Plan feeds into the conclusion of a new Sustainability Strategy set to take place in 2021. ([link to press release](#));
- Initiated the development of Oxford's first Urban Tree Strategy in March 2021, which will be created to maximise the benefits trees have on the local environment and communities. The new strategy will also play a part in helping the city reduce air pollution levels and achieve net zero carbon by 2040. ([link to press release](#))
- Submitted to DEFRA, in April 2021, the final report of a DEFRA funded air quality project involving the testing of low cost innovative Air Quality sensors to map air pollution and human exposure in Oxford. This project was delivered in partnership with local group [Ox-Air](#) ([link to press release](#));

- Started a pilot project in June 2021 to test and demonstrate the effectiveness of e-cargo bikes for deliveries in Oxford's covered market and to support and expedite their uptake ([link to press release](#))
- Developed , in June 2021, a green recovery plan with measures for the city and that included the delivery of: Pedestrianisation trials at St Michaels and George Streets; Allowing for parking at Oxford's five park and rides to be free throughout August; Introducing a one way pedestrian flow system in Oxford city to help maintain social distancing; Installed 130 new bike parking at the park and rides and in the city centre; Freed up pavement space and created designated rest areas to keep pedestrians moving in the city centre's busy and narrow streets.

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

- To Launch and operate a ZEZ pilot in Oxford city centre, and to progress with the develop of work towards the expansion of the ZEZ to the entire city, which is expected to occur in full by 2030;
- Continue to run anti-idling campaigns across the city in partnership with Friends of the Earth (FoE) Oxford and continue to work with local schools via STOP Project and with Oxfordshire County Council on the subjects of air quality and sustainable travel;
- To roll out a further 100 EV chargers across the city by the end of 2021, as part of the [GULO project](#);
- To deliver a new Air Quality community website to help raise awareness of air pollution across Oxfordshire, working in partnership with neighbouring district councils - Cherwell, West Oxfordshire, South Oxfordshire and Vale of White Horse, along with Oxfordshire County Council, and to deliver a citywide behaviour change campaign that will draw attention to the importance of the domestic combustion sector and how it contributes to air pollution levels in Oxford (both projects are being funded by DEFRA's Air Quality Grant 2021/2022);
- To finalise covered market's cargo bike pilot, evaluate performance of the scheme and agree and decide on next steps;
- To finalise delivery of Oxford's first Urban Tree Strategy
- To introduce next phase of Ultra Low Emission Standards for Hackney carriage vehicles. From January 2022 Hackney carriage taxi drivers will be required to have

at least Euro 4 standard to renew their licence, and zero-emission capable vehicles to receive a new licence;

- To continue the expansion of Oxford City Council's EV fleet and progress with the delivery of Energy Super Hub;
- For Oxford City Council to approve full adoption of Oxfordshire's EV Strategy;
- To finalise the delivery of £2.3 million CBTF project for the retrofitting of five of the city's open-top sightseeing buses to become fully electric, and the retrofitting of 115 local buses to euro VI standards, using Selective Catalytic Reduction (SCR) technology.

Oxford City Council's priorities for the coming year (2022) are:

- To fully deliver the £122,500 DEFRA Air Quality Grant funded project aimed at the development of a communication and engagement plan, to inform and work with businesses in the city centre on how to adopt zero emission delivery and servicing solutions for their business;
- To deliver a public consultation on the wider ZEZ scheme, after having learned from the experience of the ZEZ Pilot and having commissioned a new feasibility study to inform on the real air quality and economic impacts of the future scheme;
- To deliver further work on the Connecting Oxford Plans, which will also include the delivery of a new public consultation on the final versions of the scheme;
- To introduce a Euro VI LEZ for buses in Oxford

The principal challenges and barriers to implementation that Oxford City Council anticipates facing are:

- Any potential issues still arising from the COVID-19 pandemic (future lockdowns and restrictions of movement) that may still occur in 2021 and that may significantly end up impacting the delivery of several projects.

Progress on the following measures has been slower than expected:

- The official launch of the ZEZ Pilot was moved from December 2020 to August 2021, due to the impacts of the COVID-19 pandemic, and in recognition that businesses and residents across the city, including those directly impacted by the scheme, would need to focus all of their attention on managing the current and potential impacts on their trade and way of life;

- The delivery of the covered market's cargo bike pilot has suffered significant delays due to the restrictions of movements affecting the delivery of essential cargo bike parts, which were needed by the supplier to build the e-cargo bikes;
- The delivery of the communication plan to engage and support businesses with the transition to the ZEZ has suffered significant delays due to businesses being shut during the several lockdowns imposed throughout 2020;
- The delivery of the STOP Project and continuous engagement with primary schools in Oxford to raise awareness of air pollution and promote active travel was put on hold due to schools being closed for long periods of time in 2020 and due to restrictions of movements and on public gatherings;
- The introduction of a new city wide Euro VI LEZ for buses was moved from December 2020 to December 2021, also due to the impacts of the COVID-19 pandemic.

Table 2.2 – Progress on Measures to Improve Air Quality

Measure No.	Measure	Category	Classification	Year Measure Introduced	Estimated / Actual Completion Year	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
1	Work with schools, vulnerable groups and hard to reach communities to raise awareness of air pollution and promote Active Travel	Public Information/ Promoting Travel Alternatives	Student Assemblies/ Air Quality campaigns/ Promotion of Cycling and Walking	2021	Annually 2021-2025	Oxford City Council + Oxfordshire County Council + Friends of the Earth	Active Travel Fund, LAs annual budget	NO	Fully Funded	< 5k (per year)	Implementation	NOx reduction not estimated, but increase of up to 23% in walking rates and reduction of up to 30% car journeys was observed with the delivery of the active travel programme WOW + communication campaigns can increase awareness of up to 12% and behaviour change of up to 6% (Clean Air Day)	Number of walking, cycling, scooting, car, and park & stride trips, Number of participating schools and deprived areas and of activities delivered	Implementation on-going	Delivery of most of schools events and activities planned throughout 2020 had to be put on hold due to the COVID Pandemic and self-isolation duties
2	Support city wide events that aim to accelerate the uptake of sustainable transport	Public Information/ Promoting Low Emission Transport/ Freight and Delivery Management	Webinars/ Summits Physical Events	2021	Annually 2021-2025	Oxford City Council + Other Partners (ex:Green TV)	Sponsorship	NO	Fully Funded	Not estimated	Planning	NOx reduction not estimated, but communication campaigns can increase awareness of up to 12% and behaviour change of up to 6% (Clean Air Day)	Total amount of attendees and Businesses participating, number of business adopting sustainable delivery options, number of business compliant with the ZEZ	Implementation on-going	Next edition of Oxford's EV Summit scheduled for September 2021 Previous edition took place virtually in December 2020 due to the COVID-19 pandemic
3	Support projects that increase Oxford's Air Quality/AQ & Health evidence base	Public Information	Other	2021	Annually 2021-2025	Oxford City Council + Oxfordshire County Council (Public Health Team)	Several types of funding possible (Innovate UK, DEFRA AQ Grant, UKRI)	YES	Partially funded	Not estimated (Successful bids and projects will be added on a regular basis)	Planning	Not directly applicable – NOx reduction not estimated	Total amount of partnerships created; amount of AQ/health studies delivered	Implementation on-going	OxAir + OxAria + In March 2021 Oxford Brookes have won via Transition – Discovery and Innovation Fund an air quality project, with the support of Oxford City Council and Oxfordshire County Council for the development of a 3D Modelling of Pollutant Dispersion and Exposure
4	Develop partnership work with NHS, commissioners, and providers to increase awareness of air pollution amongst patients and reduce their personal exposure to air pollution	Public Information	Via the Internet/ Via other mechanisms	2021	2021-2025	Oxford City Council + Oxfordshire County Council (Public Health Team)	LAs annual budget	NO	Not funded yet	Not estimated (Successful bids and projects will be added on a regular basis)	Planning	NOx reduction not estimated, but communication campaigns can increase awareness of up to 12% and behaviour change of up to 6% (Clean Air Day)	Number of workshops /training sessions delivered, reduction in number of hospital admissions for COPD patients	Not started	
5	Improve air quality communication on our website and associated websites to assist the public in accessing reliable information about air pollution	Public Information	Via the Internet	2021	2022	Oxford City Council + all other DCs in Oxfordshire + Oxfordshire County Council	DEFRA AQ Grant	YES	Fully Funded	£162,500	Planning	NOx reduction not estimated, but communication campaigns can increase awareness of up to 12% and behaviour change of up to 6% (Clean Air Day)	Number of website visitors, Number of website downloads, Reduction of public requests for AQ information,	Funding secured (AQ Defra Grant - March 2021) Planning phase	
6	Explore opportunities to use green infrastructure to reduce exposure to poor AQ levels	Public Information	Other	2021	2021-2025	Oxford City Council + Oxfordshire County Council + Highways England	LA annual budget + Other sources of funding (still to be identified)	NO	Partially funded	Not estimated (Successful bids and projects will be added on a regular basis)	Planning	Reduction of up to 50% in exposure to air pollution levels where green infrastructure is installed (Greater London Authority)	Air Quality data, number of species planted	Oxford City Council is currently developing its Urban Forest Strategy	It is expected that Oxford City Council's Urban Forest Strategy will go to Cabinet in July 2021 following public consultation in May.
7	Delivery of city-wide campaign on how to implement DEFRA's best practice on the use of open fires and wood burning stoves, and on how	Public Information	Via Leaflets/ Via the Internet/ Via other mechanisms	2021	2022	Oxford City Council + Friends of the Earth+ River Trust	DEFRA AQ Grant	YES	Fully Funded	£45,000	Planning	NOx reduction not estimated, but communication campaigns can increase awareness of up to 12% and behaviour change of up to 6% (Clean Air Day)	Reduction of nuisance complaints, Reduction of NOx, PM ₁₀ and PM _{2.5} concentrations	Funding secured (AQ Defra Grant - March 2021) Planning phase	According to the city's latest Source apportionment study , combustion emissions from domestic settings accounts for 48% and 66% of the city's PM ₁₀ and PM _{2.5} emissions

Measure No.	Measure	Category	Classification	Year Measure Introduced	Estimated / Actual Completion Year	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
	to reduce burning of inappropriate fuel														
8	Work with the District and County Councils on a co-ordinated approach to public awareness and education	Public Information	Via Leaflets/ Via the Internet/ Via other mechanisms	2021	Annually 2021-2025	Oxford City Council + all other DCs in Oxfordshire + Oxfordshire County Council	LAs annual budget + Other sources of funding if required	NO	Fully Funded	Not estimated	Planning	NOx reduction not estimated, but communication campaigns can increase awareness of up to 12% and behaviour change of up to 6% (Clean Air Day)	Number of comms and other campaigns run together between all the District Councils in Oxfordshire	Successful submission of a DEFRA AQ Grant , supported by all DCs, for the development of an Oxfordshire Air Quality website that will serve all residents of Oxfordshire	The Air Quality Officers of all the DCs in Oxfordshire already meet regularly to discuss air quality projects and opportunities for future partnership work
9	Introducing a Euro VI LEZ for buses in Oxford	Promoting Low Emission Transport	Low Emission Zone (LEZ) or Clean Air Zone (CAZ)	2021	2022	Oxford City Council + Oxfordshire County Council + local bus operators	LAs annual budget, CBTF	NO	Fully Funded	Staff time only	Planning	Estimated reductions of between 5% to 12.8% of total city Road NOx emissions (Ricardo's Source Apportionment Study)	LEZ Euro VI Approved bus database	Delivery planned and already in progress	Start date delayed from 1 Dec 2020 to 1 Dec 2021 due to COVID-19. Scheme currently under review in light of national bus strategy and ZEBRA funding opportunities
10	Introducing Ultra Low emission standards for Hackney Carriage Vehicles	Promoting Low Emission Transport	Taxi Licensing conditions	2021	2025	Oxford City Council	LAs annual budget	NO	Fully Funded	Staff time only	Planning	Up to 0.2% total city Road NOx emissions (Ricardo's Source Apportionment Study)	Amount of New HCV Applications, enforcement stats	Delivery planned and already in progress	The new standards will be introduced using a phased approach with future important deliverables occurring in January 2022 and 2025
11	Delivery of Zero Emission Zone (measures to incentivise zero emission vehicles or place restrictions on other vehicles in Oxford)	Promoting Low Emission Transport/ Traffic Management	Low Emission Zone (LEZ) or Clean Air Zone (CAZ) / Road User Charging (RUC)/ Congestion charging	2021	2021-2030	Oxford City Council + Oxfordshire County Council	LAs annual budget, DEFRA AQ Grant and other sources of funding	YES	Partially Funded	ZEZ Pilot - £267,400 ZEZ - £921,480	Implementation (ZEZ Pilot) Planning (ZEZ)	By 2035 (after full implementation), up to 66% reduction in city-wide transport NOx emissions and of 100% transport NOx emissions in the city centre are expected	Behavioural responses, AQ monitoring, ANPR counts	Launch of city centre ZEZ Pilot approved for August 2021, with public consultation on the wider ZEZ expected later in the year	The Councils began a final consultation on the ZEZ pilot in March 2020, but this was suspended due to the COVID-19 pandemic. An updated final consultation on the ZEZ ran from 20 November 2020 to 17 January 2021
12	Increase the amount of EV charging infrastructure in the City	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging,	2021	2021-2025	Oxford City Council + Oxfordshire County Council	Innovate UK, AQ DEFRA Grant, OLEV Grant scheme, LAs budget	YES	Fully Funded	Not estimated	Planning	NOx reduction not estimated	Number of EV Chargers Installed	Delivery in Progress In July 2020 Oxford saw the installation of 38 electric vehicle chargers and the city's first 50kW rapid electric charger for ODS' electric vehicle fleet at the ODS depot Preparation for "Go Ultra Low Oxford (GULO) Project Phase 2 "	A map of all EV charging point locations in Oxford can be found here
13	Expansion of City Council's EV Fleet (Electrification of 25% of vehicle fleet)	Promoting Low Emission Transport	Company Vehicle Procurement -Prioritising uptake of low emission vehicles	2021	2023	Oxford City Council	Innovate UK, LAs annual budget	NO	Fully Funded	Not estimated	Planning	NOx reduction not estimated	Number of Electric vehicles purchased	Delivery in Progress Oxford City Council operates at the moment a fleet of 51 electric vehicles, with further 8 vehicles on order	
14	Development of an EV Strategy for Oxfordshire	Policy Guidance and Development Control	Other Policy	2021	2021	Oxfordshire County Council + other DCs	LAs own budget	NO	Fully Funded	Not estimated	Planning	NOx reduction not estimated	Publication of EV strategy and adoption of Strategy by all District Councils	Approval of the adoption of the Oxfordshire Electric Vehicle Infrastructure Strategy and its policies was granted at County Cabinet meeting of 16th March 2021 - details here	Cherwell DC has adopted the strategy on 6th April 2021 and West Oxfordshire DC on 23rd March 2021. Other districts to follow
15	Work with bus operators on the electrification of Oxford's Bus fleet	Promoting Low Emission Transport	Company Vehicle Procurement -Prioritising uptake of low emission vehicles	2021	2030 or sooner	Oxfordshire County Council + local bus operators	All-electric bus town scheme; Zero Emissions Buses Regional Area (ZEBRA) scheme	NO	Not funded yet	No specific scheme estimated. Approx £42m to fund difference between 150 electric buses and 150 diesel buses	Planning	Up to 32% of the city's total road NOx emissions (Ricardo's Source Apportionment Study)	% of bus fleet ZEV	In January 2021 Oxford and Coventry developed a proposal to become the first part of the UK to run all-electric bus services Discussions are continuing with DfT re AEBT and ZEBRA schemes	Completion year 2030 or sooner (depending on successful funding)
16	Delivery of Oxford's Energy Super Hub (installation of more than 20 ultra-rapid + 30 fast vehicle EV chargers for the public use + provision of ground source heat pumps	Promoting Low Emission Transport/ Promoting Low Emission Plant	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging Replacement of combustion sources	2021	2021-2032	Oxford City Council + Partners	Innovate UK	NO	Fully Funded	£41 million	Planning	20,000 tonnes of CO2 per year saving by 2021, rising to 44,000 tonnes per year by 2032 + up to 22% reduction of NO2 emissions from transport by 2032 (Oxford City Council)	Number of EV chargers and Ground Source Heat Pumps (GSHP) installed, number of EVs purchased, AQ monitoring	Installation commenced in July 2020 of the world's largest hybrid battery. This battery is supporting a 50 plus Charge point Super hub at Redbridge Park and Ride. Contracts were awarded to three CPNO's in July 2020	All relevant updates can be found at the ESO website here

Measure No.	Measure	Category	Classification	Year Measure Introduced	Estimated / Actual Completion Year	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
	for more than 300 homes)													and October 2020, providing both AC and DC chargepoints for the site in addition to transformers and a solar canopy. Planning approval for the entire Superhub was granted in February 2021.	
17	Delivery of Air Quality Benefits through Planning System (Reduce amount of car parking in the city + increase EV charging infrastructure + require more efficient/less pollutant domestic heating technologies)	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance/ Other Policy	2021	Annually 2021-2036	Oxford City Council	LAs own budget	NO	Fully Funded	Not estimated	Planning	NOx and PM reductions not estimated	Number of developments with EV chargers /number of EV chargers installed, number of Planning conditions discharged	Already being delivered through Oxford's Local Plan	This specific air quality action is already being delivered since the 8th June 2020, date on which Oxford's new Local Plan (2016-2036) was formally adopted. Relevant policies within the plan that contribute to the delivery of this measure are policies RE1 , RE6 , M3 and M4 .
18	Explore opportunities for the delivery of electric infrastructure that could accelerate the uptake of electric boats and reduce their reliance on fossil fuel use for domestic heating	Promoting Low Emission Transport/ Promoting Low Emission Plant	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Replacement of combustion sources	2021	2025	Oxford City Council + River trust + Environment Agency	DEFRA Air Quality Grant or other	YES	Not funded yet	Not estimated	Planning	NOx and PM reductions not estimated	Number of installations delivered, number of boats relying on energy sources that are locally emissions free	Not started	Funding required
19	Upgrade Energy Efficiency of City Council's Housing stock	Promoting Low Emission Plant	Other Policy	2021	Annually 2021-2025	Oxford City Council	LAs own budget	NO	Partially funded	Not estimated	Planning	NOx and PM reductions not estimated	Number of boiler upgrades, insulations and high efficiency storage heaters installed per year	Implementation on-going	
20	Provide Energy advice services: employ Energy advice Officers to visit Council homes and advise tenants, whilst also identifying energy saving improvements to the properties	Promoting Low Emission Plant	Other Policy	2021	Annually 2021-2025	Oxford City Council	LAs own budget	NO	Fully Funded	Not estimated	Planning	NOx and PM reductions not estimated	Total amount of home visits and of energy savings per year	Implementation on-going	
21	Use of central government's ECO Flexible Eligibility funding to identify and designate households as eligible under the Affordable Warmth Scheme	Promoting Low Emission Plant	Other Policy	2021	Annually 2021-2025	Oxford City Council	ECO Flexible Eligibility funding	NO	Partially funded	Not estimated	Planning	NOx and PM reductions not estimated	Total amount of households being granted with energy efficiency improvements	Implementation on-going	
22	Review of Smoke Controlled Zones and implementation of revised government legislation for smoke nuisance	Promoting Low Emission Plant	Other Policy	2021	2021-2025	Oxford City Council	LAs own budget	NO	Not funded yet	Not estimated	Planning	NOx and PM reductions not estimated	Implementation of new enforcement methods/ reduction of the amount of nuisance complaints	Not started	Potential delay in the implementation of Government's future Environment Bill, and which are expected to include: a) extension of existing SCA's smoke emission standards to the whole of England b) provision of new powers for local to respond to instances of nuisance smoke pollution from boats with improvement and enforcement action
23	Encourage the development of local heat networks	Promoting Low Emission Plant	Other Policy	2021	Annually 2021-2025	Oxford City Council	LAs own budget	NO	Fully Funded	Not estimated	Planning	NOx and PM reductions not estimated	Number of planning applications using heat networks	Already being encouraged and delivered (when feasible) through Oxford's Local Plan	

Measure No.	Measure	Category	Classification	Year Measure Introduced	Estimated / Actual Completion Year	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
24	Delivery of Connecting Oxford (explore opportunities for implementation of Workplace Parking Levy + introduction of access restrictions)	Traffic Management	Workplace Parking Levy/ Selective vehicle priority	2021	2021-2025	Oxford City Council + Oxfordshire County Council	LAs own budgets	NO	Partially funded	£170m Capital £25m revenue	Planning	NOx and PM reductions not estimated	Traffic counts, numbers of people travelling by bus, cycling, or walking, number of businesses enrolled, enforcement stats	All relevant updates can be found at the Connecting Oxford website here	The next steps for Connecting Oxford's introduction involve developing a detailed business case as well as modelling, design and a comprehensive engagement programme with a wide range of stakeholders and resident groups across the city.
25	Delivery of sustainable transport measures such as cycling improvements and bus priority lanes	Transport Planning and Infrastructure/ Traffic management	Cycle network/ Bus priority	2021	2021-2025	Oxford City Council + Oxfordshire County Council	Department for Transport (Emergency Active Travel Fund); LAs own budget	NO	Partially funded	£44m approx. for sustainable transport schemes on three Oxford radial routes and other locations	Implementation and Planning	NOx and PM reductions not estimated	Scheme delivery Transport monitoring (e.g. cycle counts)	Access to Headington largely completed Major improvement works have been completed in late 2020 on the traffic-free walking and cycling path at Kennington + at Oxford Junction on George Street Major works on Botley Road are underway and due for completion in autumn 2021	Further improvements expected to be rolled out within the next few months/years, following the recommendations of the recently published Oxford Local Cycling & Walking Infrastructure Plan and using part of the 2.98 million of the emergency active travel fund that was won by Oxfordshire County in late 2020
26	Roll-out of Controlled Parking Zones (CPZ) and Low Traffic Neighbourhoods (LTN)	Traffic Management	Traffic reduction	2021	2021	Oxfordshire County Council	Department for Transport (Emergency Active Travel Fund); LAs own budget	NO	Fully Funded	£340k approx. for controlled parking zones £311,000 for LTNs	Implementation and Planning	NOx and PM reductions not estimated	Implementation of the new CPZs and LTNs	Oxfordshire County Council won in November 2020 £2.98 million to transform active travel in the County, with part of that funding being allocated for the development of LTNs in Oxford	3 LTNs are being tested in Cowley area since March 2021, using an Experimental Traffic Regulation Order (ETRO)
27	Work with businesses to explore the inclusion of innovative sustainable travel modes into their current business models	Freight and Delivery Management	Delivery and Service plans/ Freight Partnerships for city centre deliveries	2021	Annually 2021-2025	Oxfordshire County Council + Oxford City Council	DEFRA AQ Grant; LAs own budget	YES	Partially funded	Not estimated	Planning	NOx and PM reductions not estimated	Number of businesses adopting sustainable travel modes	Exploring opportunities (On-going) Considering submitting a bid together with Oxfordshire County council via the next round of the e-cargo bike fund	Eventual COVID-19 impacts still impacting business throughout 2021, which may limit investment
28	Explore opportunities for implementation of consolidation centre to address city centre freight emissions	Freight and Delivery Management	Freight Consolidation Centre	2021	2025	Oxfordshire County Council + Oxford City Council	LAs annual budget, and other sources of funding	NO	Not funded yet	Not estimated	Planning	NOx reduction not estimated	Number of businesses enrolled	Exploring opportunities (On-going)	Finding an adequate space within the city's outskirts that could be viable for this, lack of funding
29	Work with schools to reduce exposure to air pollution by reducing the need to travel during drop off/pick up times (ex: School Streets)	Alternatives to private vehicle use/ Promoting Travel Alternatives	Other	2021	2025	Oxfordshire County Council	Active Travel fund for LAs in England	NO	Partially funded	£60,000 approx. for School Streets	Implementation and Planning	NOx reduction not estimated	Number of streets closed, schools enrolled	An experimental order to prohibit access for motor vehicles at school drop-off and/or pick-up times was issued on the 22nd March 2021 and will continue to run until a decision is made on whether it becomes permanent	8 schools in Oxford are involved in this pilot. Exempt motorists include emergency services, residents and visitors, blue badge holders, emergency vehicles, school buses/transports, deliveries.
30	Support Bikeability (free cycling lessons provided to pupils)	Promoting Travelling alternatives	Promotion of Cycling	2021	2021-2025	Oxfordshire County Council	DfT via The Bikeability Trust charity	NO	Not funded yet	Not estimated	Planning	NOx reduction not estimated	Number of schools enrolled	Not started	On 9 th April 2021, Transport Secretary has announced £18m for cycle training across the country to ensure children and their families have the confidence to choose active travel

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

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

In Oxford, and according to the city's latest source apportionment [study](#), domestic combustion is the biggest contributor to the local fraction of PM_{2.5} levels (66%), followed by transport (21%), with remaining contributors spread between production processes (4%) and 9% Others (nature, waste, solvents, agriculture).

Oxford also currently has 23 active smoke control areas (SCAs). In a smoke control area you can generally only burn fuel on the list of [authorised fuels](#), unless you're using an [exempt appliance](#). For detailed information about all SCAs in Oxford, including an interactive map showing the areas of the city currently covered by SCA legislation, and information on good practice and advice, please visit the Council's air quality page [here](#).

The Public Health Outcomes is a framework developed by Public Health England to set out a vision for public health. The framework develops a list of indicators that provide useful insight on how well public health is being improved and protected and concentrates on two high-level outcomes (healthy life expectancy and differences in life expectancy and healthy life expectancy between communities) to be achieved across the public health system.

According to the latest version of this framework (i.e. 2019), 5.52% of deaths from all causes in those aged 30+ are attributable to PM_{2.5} alone in Oxford.

Figures 1 and 2 below show the existing relationship between the level of mortality attributed to PM_{2.5} and life expectancy at birth for males and females in Oxford. A comparison is also made in Figures 1 and 2, between Oxford's data and the data obtained for other District Councils in Oxfordshire and for England.

Oxford's performance is, in general, the worst when compared with the other DCs for these type of indicators, which is not a surprise, given the levels of traffic and air pollution that can be found in a city when compared with what is found in other parts of the

Oxfordshire, where rural areas tend to prevail and where population and urban density levels are often less pronounced.

Figure 1 - Relationship between Mortality attributable to PM_{2.5} and Male's life expectancy at birth.

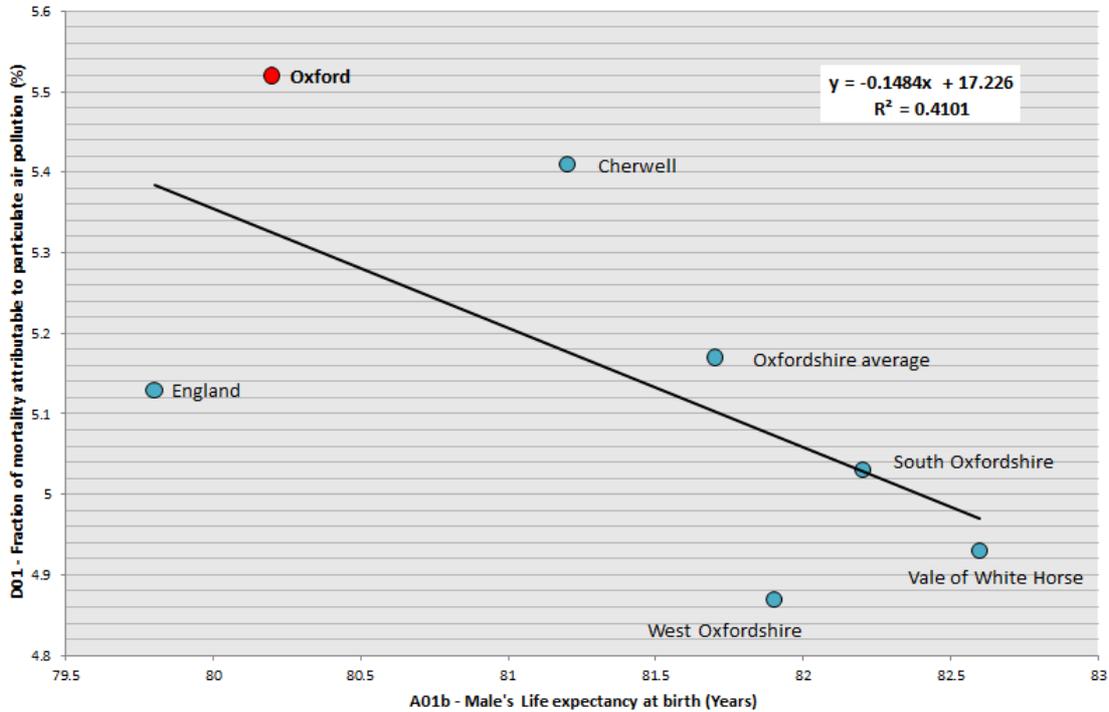
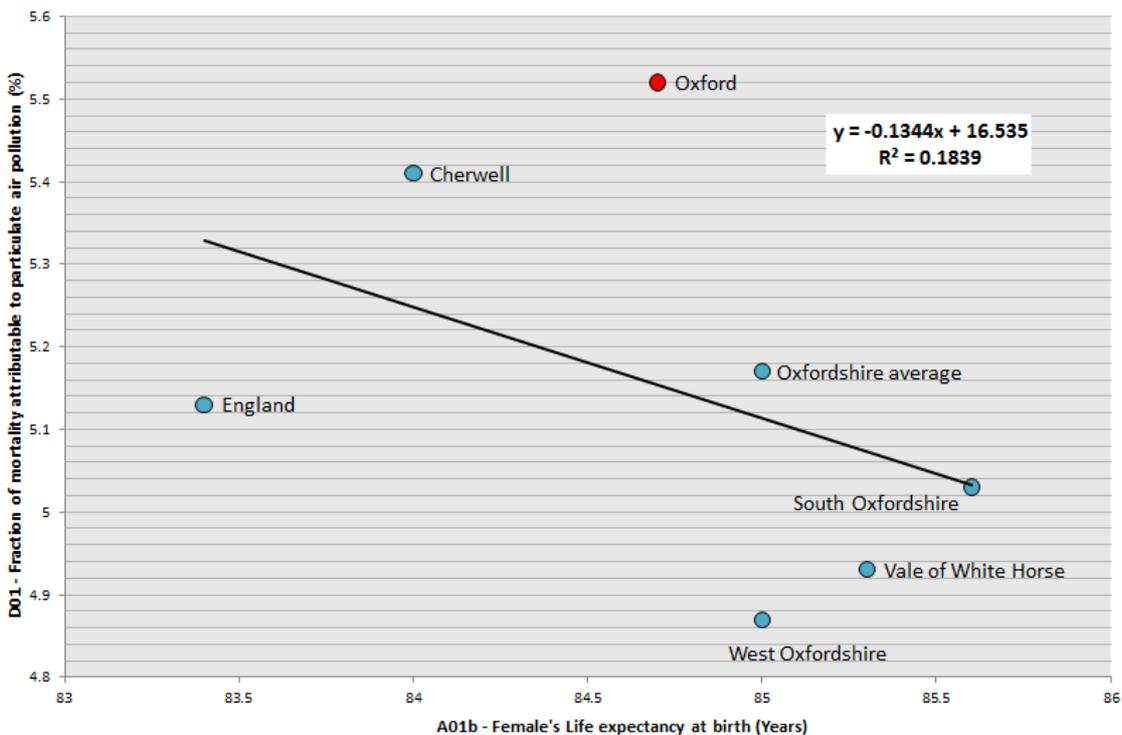


Figure 2 - Relationship between Mortality attributable to PM_{2.5} and Female's life expectancy at birth.



Oxford City Council measures PM_{2.5} at AURN St Ebbes' urban background site. In 2020 the annual mean concentration was 7 µgm⁻³. Oxford City Council considers that many of the measures designed to reduce levels of nitrogen dioxide set out in the city's recent AQAP will also contribute to reducing levels of PM_{2.5}. Table 3 below shows the current list of actions set out in the action plan which we believe to also contribute positively for the reductions of PM_{2.5} levels in the city.

Table 3 - List of measures included in Oxford City Council's new Air Quality Action Plan (2021-2025) that (in)directly target PM_{2.5} emissions.

Measure	Reduces PM _{2.5} emissions
Introducing a Euro VI LEZ for buses in Oxford	<input checked="" type="checkbox"/>
Introducing Ultra Low emission standards for Hackney Carriage Vehicles	<input checked="" type="checkbox"/>
Delivery of city-wide campaign on how to implement DEFRA's best practice on the use of open fires and wood burning stoves, and on how to reduce burning of inappropriate fuel	<input checked="" type="checkbox"/>
Increase the amount of EV charging infrastructure in the City	<input checked="" type="checkbox"/>
Expansion of City Council's EV Fleet (Electrification of 25% of vehicle fleet)	<input checked="" type="checkbox"/>
Development of an EV Strategy for Oxfordshire and adoption of strategy by all DCs	<input checked="" type="checkbox"/>
Work with bus operators on the electrification of Oxford's Bus fleet	<input checked="" type="checkbox"/>
Delivery of Oxford's Energy Super Hub (installation of more than 20 ultra-rapid + 30 fast vehicle EV chargers for the public use + provision of ground source heat pumps for more than 300 homes)	<input checked="" type="checkbox"/>
Delivery of Air Quality Benefits through Planning System (Reduce amount of car parking in the city + Increase EV charging infrastructure + require more efficient/less pollutant domestic heating technologies)	<input checked="" type="checkbox"/>
Upgrade Energy Efficiency of City Council's Housing stock and provision of energy advice services to city council's tenants, whilst identifying energy saving improvements to the properties	<input checked="" type="checkbox"/>
Review of Smoke Controlled Zones and implementation of revised government legislation for smoke nuisance	<input checked="" type="checkbox"/>
Encourage the development of local heat networks	<input checked="" type="checkbox"/>

Delivery of sustainable transport measures such as cycling improvements and bus priority lanes	<input checked="" type="checkbox"/>
Roll-out of Controlled Parking Zones (CPZ) and Low Traffic Neighbourhoods (LTN)	<input checked="" type="checkbox"/>
Work with businesses to explore the inclusion of innovative sustainable travel modes into their current business models	<input checked="" type="checkbox"/>
Explore opportunities for implementation of consolidation centre to address city centre freight emissions	<input checked="" type="checkbox"/>
Work with schools to reduce exposure to air pollution by reducing the need to travel during drop off/ pick up times (ex: School Streets)	<input checked="" type="checkbox"/>
Support Bikeability (free cycling lessons provided to pupils)	<input checked="" type="checkbox"/>

In addition to the list of measures above, we are working in partnership with Oxfordshire County Council on the delivery of two major transport management projects which are expected to produce the biggest impact on the reduction of air pollution levels in the city:

- a) [A Zero Emission Zone \(ZEEZ\)](#) in Oxford, to be rolled out in phases over 15 years, starting in August 2021. The overall aim of this *'journey to zero'* is to largely eliminate transport *'tailpipe'* emissions in Oxford city centre by 2035
- b) [Connecting Oxford](#), a set of proposals that will deliver a number of traffic restrictions in Oxford, such as the introduction of a Workplace Parking Levy (WPL), which is an annual charge paid by employers for each parking space they provide, on or off-site, that is used for employee (commuter) car parking, or the introduction of bus gates to reduce the number of private cars moving around the city and allowing bus priority.

Connecting Oxford aims to (amongst other things) reduce motorised traffic levels; the ZEEZ aims to minimise emissions from the traffic that remains, and therefore both are expected to hugely contribute to the reduction of PM_{2.5} emissions.

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

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

Oxford City Council undertook automatic (continuous) monitoring of Nitrogen Oxides (NO_x) at three sites, Particulate Matter (PM₁₀ and PM_{2.5}) at two sites and Ozone (O₃) at one site in 2020. Non-automatic (passive) monitoring of Nitrogen Dioxide (NO₂) was carried out at seventy one locations in 2020.

Oxford City Council is pleased to inform that none of the two main impacts arising from the LAQM COVID 19 survey (and which are referenced in the [supplementary guidance](#) provided by Defra for Local Air Quality Management Reporting in 2021 due to COVID-19) have occurred in 2020. In Oxford, the COVID 19 pandemic didn't cause any impact on the collection of monitoring data neither in the conduction of general LAQM duties throughout 2020, mainly due to adequate level of planning, flexibility, and commitment demonstrated by the small team of Environmental Sustainability Officers who were responsible for operating the Council's Air Quality Network.

Maps showing the location of the air quality monitoring (continuous and passive) conducted in 2020 can be found in Appendix D. Maps covering current and historic locations of air quality monitoring locations are also provided in the Oxfordshire Air Quality Group website (<https://oxfordshire.air-quality.info/>). Further details on Quality Assurance/Quality Control (QA/QC), how the monitors are calibrated, how the data has been adjusted and the bias adjustment factors used for the diffusion tubes are included in Appendix C.

Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

Oxford City Council undertook automatic (continuous) monitoring at three sites during 2020. Table A.1 in Appendix A shows the details of the sites. National monitoring results

and annual statistics of those sites are available at <https://uk-air.defra.gov.uk/> and <http://www.airqualityengland.co.uk/>.

3.1.2 Non-Automatic Monitoring Sites

Oxford City Council undertook non-automatic (passive) monitoring of NO₂ at 71 sites in 2020. Table A.2 in Appendix A shows the details of those sites.

For the purposes of deciding which locations to monitor, the City Council considers in the first instance locations where there is relevant public exposure. It is important that assessments focus on locations where members of the public are likely to be regularly present for a period of time appropriate to the averaging period of the objective. Monitoring is carried out in line with DEFRA's Technical Guidance LAQM.TG (16)

Approximately half of the monitoring locations are within central Oxford at locations where the City Council believes relevant exposure is most likely to be significant. The remaining locations are outside of the central area, again prioritised by locations where relevant exposure is most likely.

Monitoring of NO₂ cannot be undertaken at every location on a continuous basis. The City Council therefore makes the most efficient use of available resources by implementing a rotational system on a percentage of monitoring sites every year, ensuring such sites are covered on average every 2 to 3 years.

One important aspect of monitoring is to be able to demonstrate trends in air quality over long time periods. In order to do so, the City Council continues monitoring at a number of the same sites year on year, so that the results reported can provide a strong basis for showing trends that are independent of location.

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. Details of the UK air quality objectives for protection of human health, as well as of WHO's recommended limit values for comparison with the 2020 monitoring results can be found in Appendix E.

3.1.3 Nitrogen Dioxide (NO₂)

Combustion processes emit a mixture of nitrogen oxides – NO and NO₂ - collectively termed NO_x.

- a) NO is described as a primary pollutant (meaning it is directly emitted from source). NO is not known to have any harmful effects on human health at ambient concentrations. However, it undergoes oxidation in the atmosphere to form the secondary pollutant NO₂.
- b) NO₂ has a primary (directly emitted) component and a secondary component, formed by oxidation of NO. NO₂ is a respiratory irritant and is toxic at high concentrations. It is also involved in the formation of photochemical smog and acid rain and may cause damage to crops and vegetation.

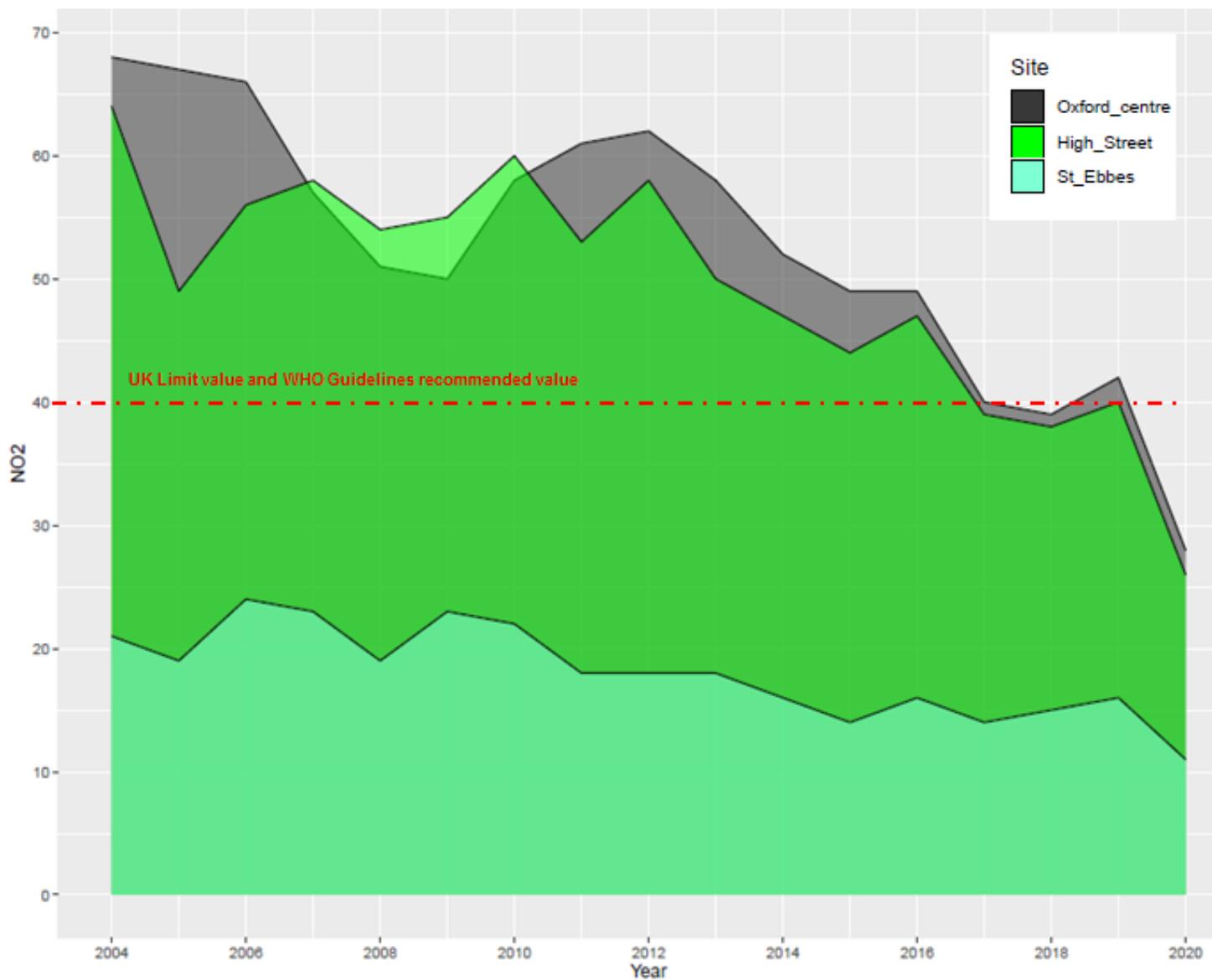
NO₂ data has been monitored in 2020 at three locations in Oxford by the use of automatic continuous monitors and at 71 locations using passive monitoring (diffusion tubes).

The annual mean AQS objective for NO₂ is 40 µgm⁻³. In 2020, Oxford High Street annual mean for NO₂ was 26 µgm⁻³ and AURN Oxford Centre Roadside 28 µgm⁻³. At AURN St. Ebbes, the NO₂ annual mean was 11 µgm⁻³. This objective was therefore largely met at all the automatic monitoring stations in 2020.

Table A.3 in Appendix A compares the ratified and adjusted automatic monitored NO₂ annual mean concentrations for the past five years with the air quality objective of 40µg/m³. 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 of fall-off with distance adjustment).

Figure 3 (below) shows the 16 year long term trend for levels of measured NO₂ at Oxford's three automatic monitoring stations. The results are expressed in µgm⁻³.

Figure 3 - Long term trends of Annual Mean NO₂ (µgm⁻³) at Oxford's continuous monitoring stations, 2004-2020.



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Figure 3 shows that the NO₂ levels measured in Oxford at the locations of our automatic monitoring sites have decreased significantly in 2020.

Whilst in previous years we saw the NO₂ levels at our automatic monitoring stations plateauing slightly above the current annual mean limit value of 40 µg m⁻³, in 2020 we have seen a considerable reduction (33% on average) of NO₂ concentrations at these stations, to values way below the current annual mean objective, and even slightly below the Oxford's new local NO₂ annual mean target of 30 µg m⁻³ (a commitment laid out in the city's recently approved [AQAP](#)).

Although the reasons behind these reductions are quite well known (the successive lockdown restrictions of movements motivated by the COVID19 pandemic which had a direct effect on the reduction of traffic levels), they provide us with a sense of hope, as they show that it is possible to achieve reductions of this magnitude in the city centre and reach compliance with our new AQAP NO₂ local target, as long as the City and County council's major plans for the reduction of polluting traffic in the city ([ZEE](#) and [Connecting Oxford](#)) become a reality.

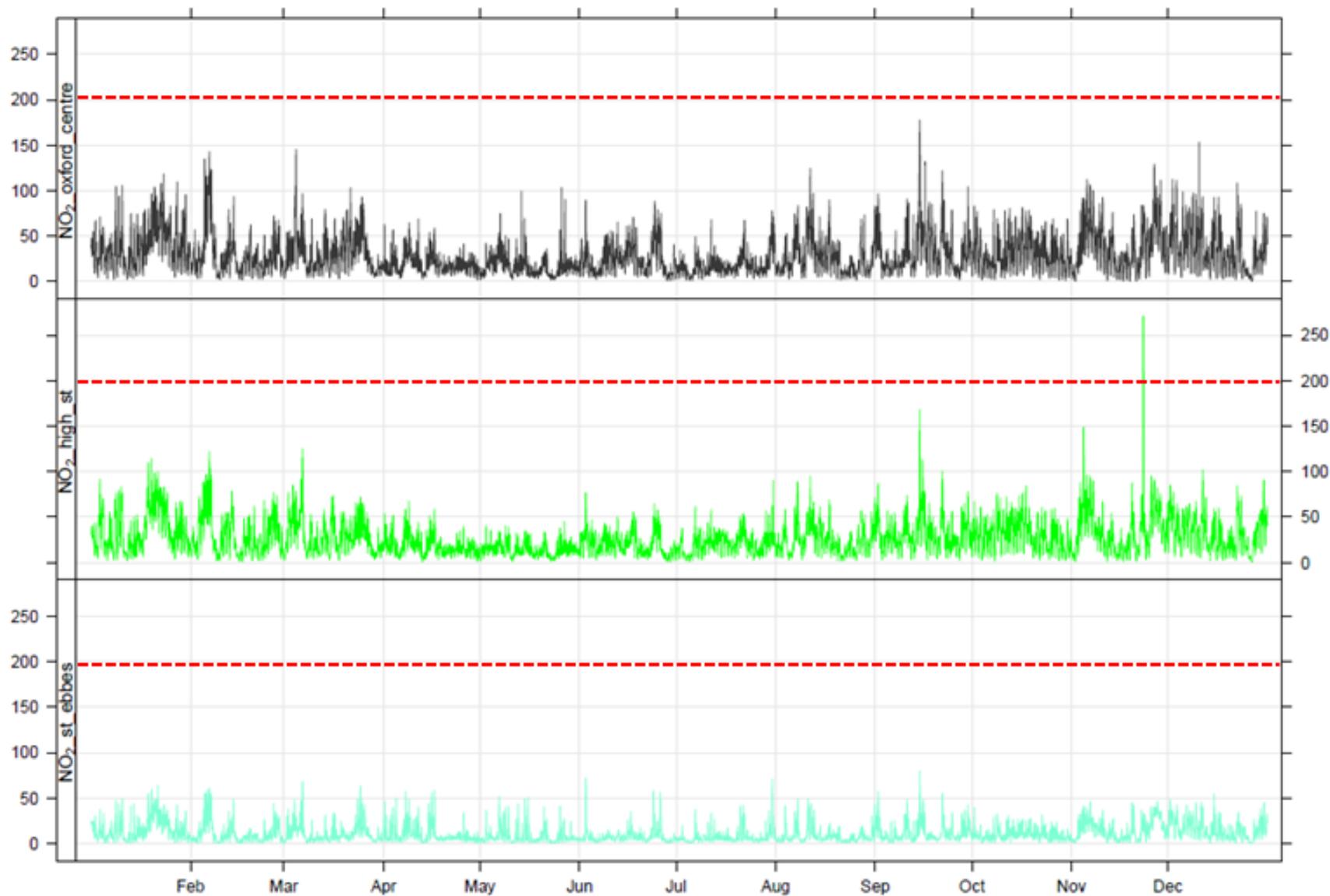
For detailed information on time variations and daily means of NO₂ at Oxford's three automatic monitoring stations please refer to Appendix G.

The AQS objective for hourly mean NO₂ concentration is 200 µg m⁻³, and may be exceeded up to 18 times per calendar year. The time series of hourly averaged concentrations of NO₂ for the 3 automatic monitoring sites is compared against the hourly mean objective (dashed red line) in Figure 4 below. The results are expressed in µg m⁻³.

Table A.5 in Appendix A compares the ratified continuous monitored NO₂ hourly mean concentrations for the past five years with the air quality objective of 200 µg/m³, not to be exceeded more than 18 times per year.

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Figure 4 - Time series of hourly averaged concentrations of NO₂ (µg^m⁻³) at automatic monitoring sites, 2020.



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Figure 4 shows that in 2020 there was only one hourly mean NO₂ measurement exceeding 200 µg^m⁻³. The highest hourly mean NO₂ measured was of 271 µg^m⁻³ and was registered on the 23rd November 09:00 at Oxford High Street.

The threshold of the “*Moderate*” air quality band as set out by DEFRA for the NO₂ hourly mean ranges from 201 to 400 µg^m⁻³. NO₂ levels at all 3 sites were always recorded within the DEFRA “*Low*” band in 2020, with the exception of the one exceedance mentioned above. As none of the automatic monitoring sites have registered more than 18 exceedances of the AQS hourly objective for NO₂, this objective was therefore met in all automatic monitoring sites in 2020.

Non-automatic monitoring using diffusion tubes took place at 71 locations in 2020. Approximately half of this number was exposed within central Oxford, rotated between the locations where we believe relevant exposure is most likely. The remaining tubes were used outside of the central area, again prioritised by locations where relevant exposure is most likely. All the 2020 diffusion tube monitoring locations are within the existing AQMA. The main observations of the monitoring carried out in 2020 using non-automatic monitoring are as follow:

- 71 locations in the City of Oxford were part of the 2020 air quality diffusion tube monitoring campaign. Of those, 4 locations correspond to new monitoring sites (New Inn St, St Michaels St, Market St, Blackbird Leys), and the remaining 67 sites were sites where air quality had been monitored in the previous year;
- The diffusion tube results show that the annual mean AQS objective of 40 µg^m⁻³ for NO₂ specified by DEFRA was for the first time not exceeded at any of the 71 monitoring locations where NO₂ levels were measured in 2020;
- For the fourth consecutive year, none of the City’s NO₂ diffusion tube monitoring sites presented an annual mean NO₂ equal or above 60 µg^m⁻³. According to LAQM (TG16), this is an indication that exceedances of the hourly mean objective for NO₂ are not likely to have occurred in the city in 2020;
- In 2020, NO₂ levels have reduced on average by 29% at all the 71 diffusion tube monitoring sites, due to the effects of the COVID19 pandemic. The biggest reductions were seen at DT48 and DT47, both located at George St (45% and 40% reduction). The lowest reductions were seen at DT81 (Cowley Road/Union St) and DT28 (51 Sunderland Avenue), with 14% and 15% reduction respectively.

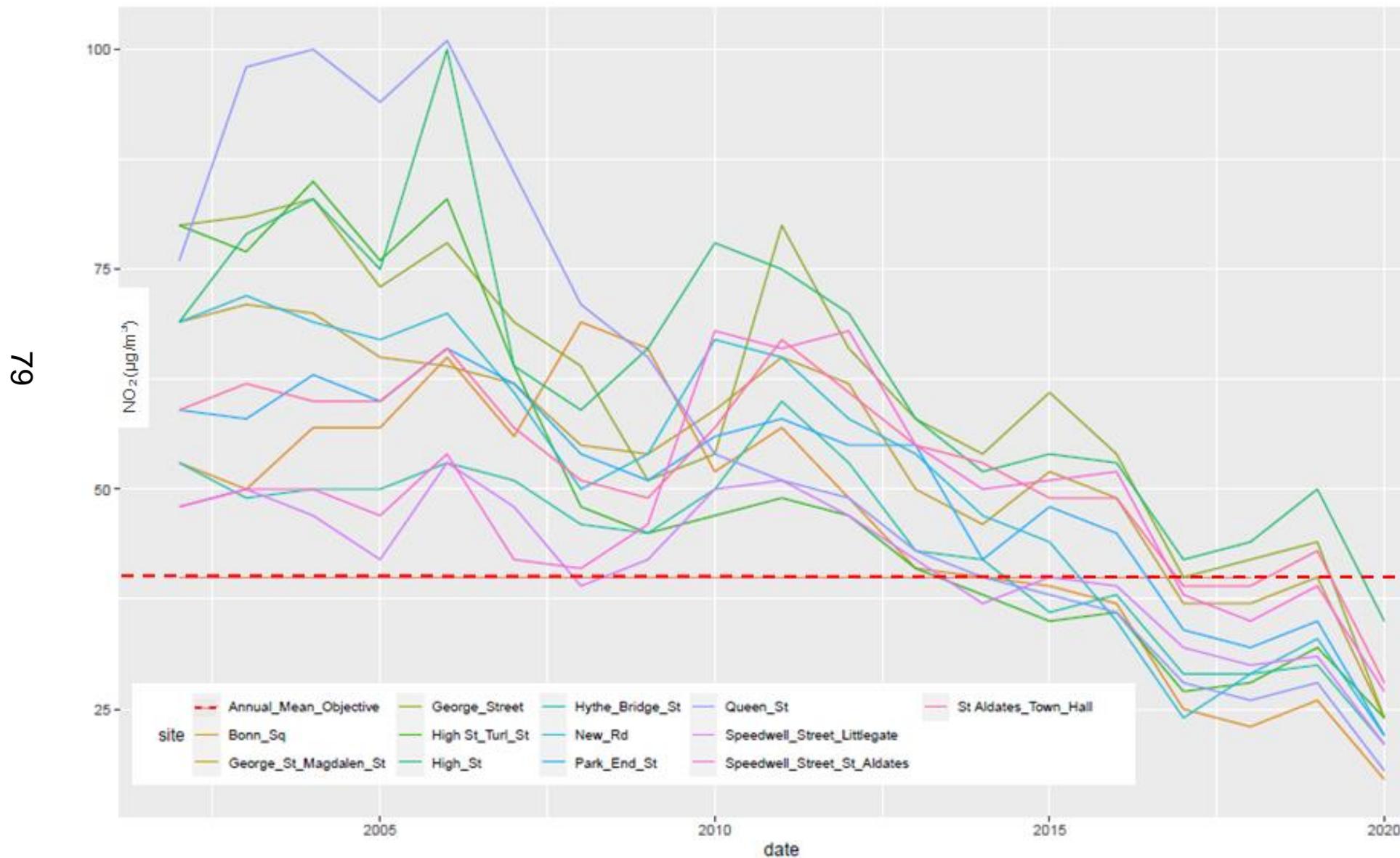
- In 2020, the third full year of monitoring was completed since the opening of the Westgate Shopping Centre. Air quality was monitored at a total of 12 locations around the Westgate Centre. None of the previous historic monitoring at these locations has ever shown any exceedances of the annual mean NO₂. In 2020, all these sites showed decreases of NO₂ levels measured between 5-12 µg m⁻³. Overall, the results of the monitoring around the Westgate indicate an average NO₂ annual mean reduction of 30% in 2020, which is a positive change in NO₂ levels when compared with the previous year;
- All the 2019 city centre air quality hotspots identified in the previous ASR (George Street, St Clements (2x), High Street, Long wall St and St Aldates) are now in compliance with the annual mean objective for NO₂;
- The monitoring location with the highest annual mean for NO₂ in 2020 was DT55 - St. Clements Street/The Plain - with a value of 36 µg m⁻³. This represents a decrease of 32% of the NO₂ levels at this location, when compared with data from the previous year (53 µg m⁻³).

The full 2020 dataset of diffusion tube monthly mean values is provided in Appendix B. (Table B.1). Figure 5 below shows the long term trend for levels of measured NO₂ at a number of historic diffusion tube monitoring stations. The results are expressed in µg m⁻³.

It is quite clear that there has been a significant downward trend in measured levels of NO₂ at most of these locations since historic monitoring began in 2003. In 2020, we can all see the positive effect that the successive lockdown restrictions had on the city's air quality levels.

Overall, and on average, the annual mean objective for NO₂ has reduced by 29% at all the 71 diffusion tube monitoring locations in 2020.

Figure 5 - Long Term Trends in Annual Mean NO₂ (µg/m³) at Oxford's diffusion tube monitoring locations, 2003-2020.



3.1.4 Particulate Matter (PM₁₀ and PM_{2.5})

Airborne particulate matter varies widely in its physical and chemical composition, source and particle size. The terms PM₁₀ and PM_{2.5} are used to describe particles with an effective size less than 10 and 2.5 µm respectively. These are of concern with regard to human health, as they are small enough to penetrate deep into the lungs. They can cause inflammation and a worsening of the condition of people with heart and lung diseases. In addition, they may carry surface absorbed carcinogenic compounds into the lungs. Larger particles, meanwhile, are not readily inhaled, and are removed relatively efficiently from the air by sedimentation.

In 2020, PM₁₀ data was monitored by automatic continuous monitors at Oxford St. Ebbes and Oxford High Street. PM_{2.5} was monitored at Oxford St. Ebbes.

The annual mean AQS objective for PM₁₀ is 40 µg/m³. Table A.6 in Appendix A: Monitoring Results compares the ratified and adjusted monitored PM₁₀ annual mean concentrations for the past five years with the air quality objective of 40µg/m³.

In 2020, Oxford High Street registered a PM₁₀ annual mean of 16 µg/m³. Oxford St. Ebbes of 11µg/m³. This objective was therefore fully met in 2020.

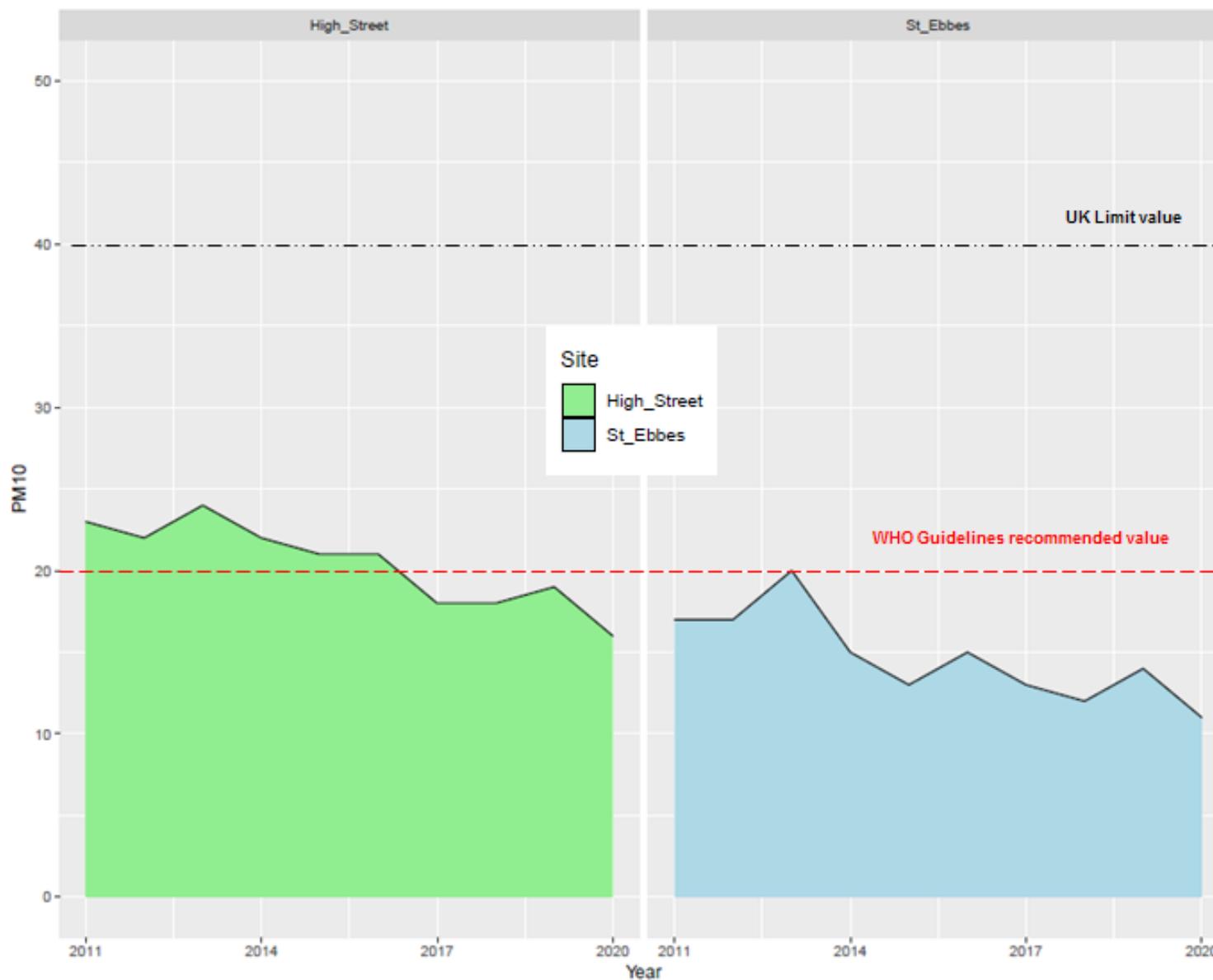
The short term AQS objective for PM₁₀ is a maximum of 50 µg/m³ for any 24h mean period, not to be exceeded more than 35 days a year. Table A.7 in Appendix A compares the ratified continuous monitored PM₁₀ daily mean concentrations for the past five years with the air quality objective of 50µg/m³, not to be exceeded more than 35 times per year.

The result of PM₁₀ measurements in 2020 show no exceedances of the 50 µg/m³ 24h mean on High Street and St Ebbes. The AQS objective for 24-hour mean PM₁₀ was therefore fully met at Oxford High Street and Oxford St Ebbes in 2020.

No AQS objective exists for PM_{2.5}; however a non-mandatory compliance target of 25 µg/m³ to be met by 2020 exists. The monitored annual mean for this pollutant was 7 µg/m³ at Oxford St. Ebbes. Table A.8 in Appendix A presents the ratified and adjusted monitored PM_{2.5} annual mean concentrations for the past five years.

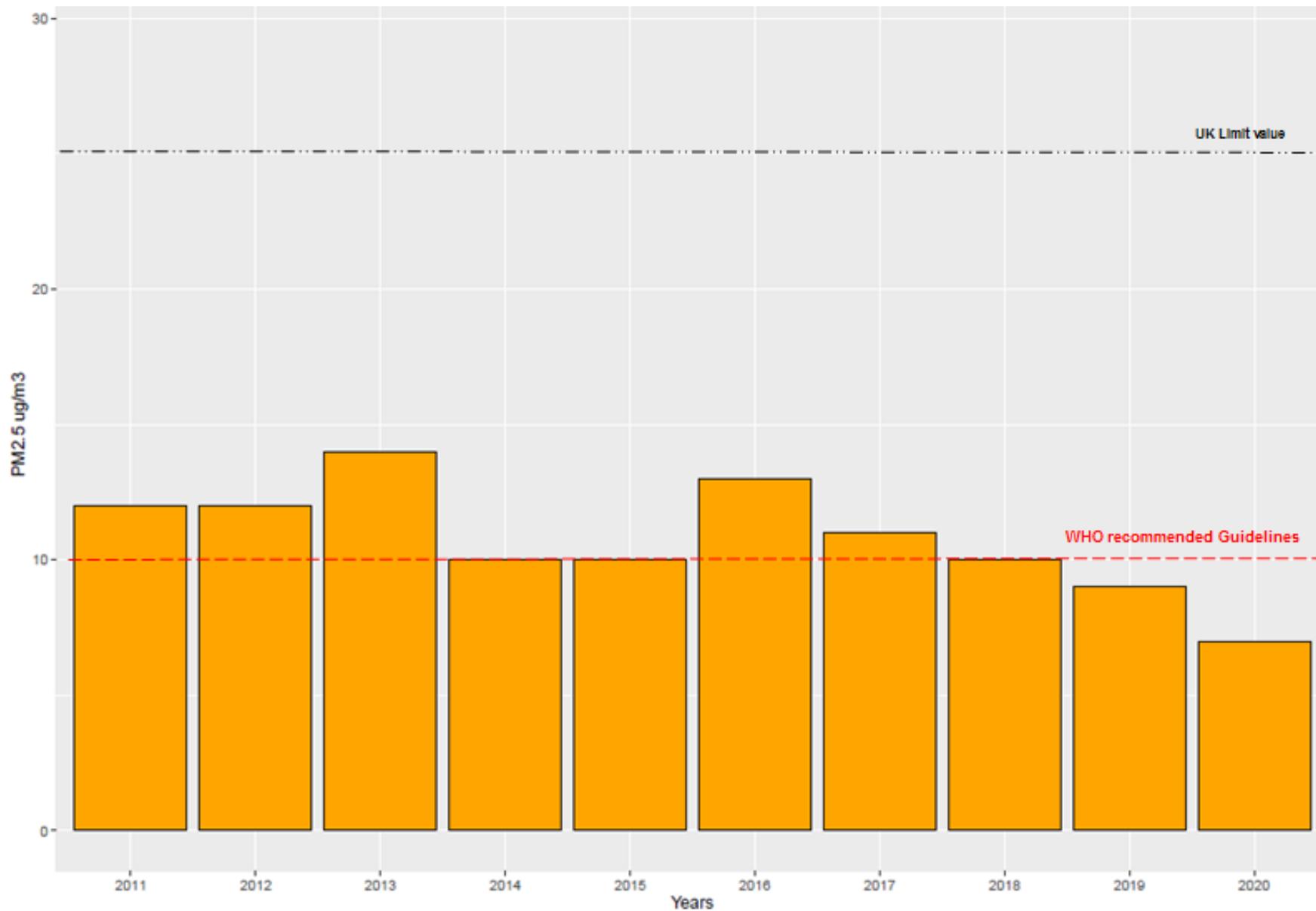
Figure 6 below show the 10 year long term trend for levels of measured PM₁₀ at continuous monitoring stations in Oxford, along with the current recommended WHO guideline values, which are significantly lower for PM₁₀ and PM_{2.5} than the UK limit values. Figure 7 shows the same analysis but for PM_{2.5}. All the results are expressed in µg/m³.

Figure 6 - Long term trends of Annual Mean PM₁₀ (µgm⁻³) at Oxford's continuous monitoring stations, 2011-2020.



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Figure 7 - Long term trends of Annual Mean PM_{2.5} (µg/m³) at Oxford's continuous monitoring stations, 2011-2020.



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Figure 6 shows that the overall trend of PM₁₀ levels that were measured at our 2 automatic monitoring sites has been going downward since 2011. Figure 6 also shows that both automatic monitoring sites are well in compliance with the annual mean UK limit value and the annual mean recommended by the WHO guidelines. The more pronounced step-change in 2013 can be attributed to the Low Emission Zone, which banned high-emission buses (i.e. buses with engines older than Euro V) from the City Centre. Bus companies began converting their vehicles in the run-up to the zone's introduction in 2014. All Euro V and Euro VI bus diesels are fitted with a Diesel Particulate Filter (DPF), which reduce the amount of Particulate Matter that is released from exhaust into the atmosphere by more than 80%. On average, PM₁₀ levels have reduced by 19% in the city in 2020.

Figure 7 shows that in 2020 Oxford St Ebbes registered the lowest PM_{2.5} annual mean since PM_{2.5} monitoring began at this site in 2011. The annual mean obtained (7ug/m³) is well in compliance with the annual mean UK limit value and with the annual mean recommended by the WHO guidelines for this pollutant, and corresponds to a reduction of 22% in the levels for this pollutant, when compared with the previous year.

The reductions observed on these pollutants have also occurred due to the impacts of COVID-19, although to a lesser extent than the reductions observed for NO₂. This can be explained by two factors:

- PM₁₀ and PM_{2.5} have a much higher dependency from non-local emission sources than NO₂. The fact that these particulates are very small in size, allows them to stay in the air the longest, facilitating their movement by winds over larger areas. For example, in the UK, it is estimated that 65% of the contribution to the annual mean ambient PM_{2.5} concentrations at Urban Background monitoring sites (such as AURN St Ebbes) are of non-local emission sources (45% - regional, and 20% - International), with only 35% being directly attributed to the local Urban environment¹⁰. Although the consequences of the pandemic occurred nationally and globally, it is important to take into account that the severity of those impacts might have been different for each country, affecting the different sectors of activity in a different way. Some areas of the globe could have been less impacted, and hence could have contributed with their PM emissions from the most various sources and activities (via long range transport) to the levels measured in Oxford.

¹⁰ [DEFRA: Public Health – Sources and Effects of PM_{2.5}](#)

- The transport sector (contrary to what happens with NO₂) is not the main source of local emissions for these pollutants. According to the city's latest source apportionment [study](#), domestic combustion is the biggest contributor to local emissions of PM₁₀ and PM_{2.5}. This is important to emphasize, as during the lockdown, transport was the most impacted of these two sectors, given the need to impose restriction of movements and restrict all unnecessary travelling. During lockdown, people have remained in their homes, and continued to use their heating systems, hence generating PM emissions via this emission source.

3.1.5 Ozone

Ozone (O₃) is not emitted directly into the atmosphere in significant quantities, but is a secondary pollutant produced by reaction between nitrogen dioxide (NO₂) and hydrocarbons, in the presence of sunlight. Whereas NO₂ contributes to ozone formation, nitrogen oxide (NO) destroys ozone and therefore acts as a local sink. For this reason, ozone levels are not as high in urban areas (where NO is emitted from vehicles) as in rural areas. Ozone levels are usually highest in rural areas, particularly in hot, still, sunny weather conditions giving rise to "*summer smog*".

It is important to remember that ozone is an area wide pollutant, and whilst monitoring sites are relatively sparse compared to those monitoring NO₂, they represent the wider population exposure, so a single site may represent the ozone concentrations that hundreds of thousands of people have been exposed to.

In Oxford, O₃ is measured at AURN St. Ebbes. The AQS objective for daily maximum on an 8 hour running mean is 100 µg m⁻³ not to be exceeded more than 10 days a year.

Oxford St. Ebbes data capture of O₃ was of 99.8 % in 2020. In 2020, this site exceeded the AQS daily objective for ozone 152 times, during a total of 26 days during the year. This represents a significant increase in the number of exceedances (+112) and days (+16), when compared with the results from 2019.

AURN St. Ebbes has not met the AQS objectives for this pollutant in 2020.

Whilst some of the exceedances correspond to typical ozone episodes that are normally already expected to occur during the summer months - according to the Imperial College

(London)¹¹, there were several registered moderate to high ozone episodes in June, August and September 2020 - the truth is that the overall increase in ozone levels in 2020 is more directly related with the significant reductions of traffic in urban areas (one of the main consequences of the successive lockdown restrictions). Less traffic equals less production of NO, which in turn means less consumption of O₃ by NO.

¹¹ London Air – King’s college Air Quality website: LAQN Pollution episodes

Appendix A: Monitoring Results

Table A.1 – Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Monitoring Technique	Distance to Relevant Exposure (m) ⁽¹⁾	Distance to kerb of nearest road (m) ⁽²⁾	Inlet Height (m)
CM1	AURN Oxford Centre	Roadside	451359	206157	NO2	YES/Oxford city-wide AQMA	Chemiluminescence	1	3	2.5
CM2	Oxford High Street	Roadside	451677	206272	NO2;PM10	YES/Oxford city-wide AQMA	Chemiluminescence Gravimetric analysis	1	2	1.5
CM3	AURN St Ebbes	Urban Background	451118	205353	NO2;PM10; PM2.5;O3	YES/Oxford city-wide AQMA	Chemiluminescence Mass spectrometry UV Absorption	10	2	2.5

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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? Which AQMA?	Distance to Relevant Exposure (m) ⁽¹⁾	Distance to kerb of nearest road (m) ⁽²⁾	Tube Co-located with a Continuous Analyser?	Tube Height (m)
DT1	St Ebbe's	UB	451118	205353	NO2	YES/Oxford city-wide AQMA	10	2	YES	2.5
DT2	Weirs Lne./Abingdon Rd. LP1	RS	451904	204215	NO2	YES/Oxford city-wide AQMA	2	2	NO	3
DT3	LP 52 Abingdon Rd.	RS	451914	204154	NO2	YES/Oxford city-wide AQMA	3	2	NO	3
DT4	Boundary Brook Rd/ Iffley Rd	RS	452961	204662	NO2	YES/Oxford city-wide AQMA	3	2	NO	3
DT5	Lenthall Rd Allotments	UB	452818	203448	NO2	YES/Oxford city-wide AQMA	5	N/A	NO	1.5
DT7	Oxford Rd/ Between Towns Rd	RS	454472	204246	NO2	YES/Oxford city-wide AQMA	3	2	NO	3
DT8	Oxford Rd(Cowley) LP13	RS	454355	204296	NO2	YES/Oxford city-wide AQMA	3	1	NO	3
DT14	Windmill Rd. W	RS	454554	207102	NO2	YES/Oxford city-wide AQMA	0	2.5	NO	3
DT15	London Rd./BHF	RS	454433	207058	NO2	YES/Oxford city-wide AQMA	0	2.5	NO	3

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Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) ⁽¹⁾	Distance to kerb of nearest road (m) ⁽²⁾	Tube Co-located with a Continuous Analyser?	Tube Height (m)
DT16	Headley Way/London Rd. LP2	RS	453982	206817	NO2	YES/Oxford city-wide AQMA	1	2	NO	3
DT18	The Roundway	RS	455596	207367	NO2	YES/Oxford city-wide AQMA	0	5	NO	3
DT20	Barton Lane LP2	RS	454999	207759	NO2	YES/Oxford city-wide AQMA	3	1	NO	3
DT25	Cuttleslowe Rbout 3 Elsfield Rd.	RS	450419	210256	NO2	YES/Oxford city-wide AQMA	5	2	NO	3
DT26	Cuttleslowe Rbout 3 Summers Place	RS	450389	210189	NO2	YES/Oxford city-wide AQMA	1	2	NO	3
DT27	Wolvercote Rbout 78 Sunderland Ave.	RS	449824	210198	NO2	YES/Oxford city-wide AQMA	1	1	NO	3
DT28	Wolvercote Rbout 51 Sunderland Ave	RS	449856	210162	NO2	YES/Oxford city-wide AQMA	1	1	NO	3
DT29	Pear Tree P&R N Gateway	RS	449530	210734	NO2	YES/Oxford city-wide AQMA	10	4	NO	3
DT30	Osney Lne/Hollybush Row	RS	450668	206053	NO2	YES/Oxford city-wide AQMA	2	2	NO	3
DT31	Beckett St.	RS	450566	206227	NO2	YES/Oxford city-wide AQMA	5	2	NO	3

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) ⁽¹⁾	Distance to kerb of nearest road (m) ⁽²⁾	Tube Co-located with a Continuous Analyser?	Tube Height (m)
DT32	Royal Oxford Hotel	RS	450674	206273	NO2	YES/Oxford city-wide AQMA	0	2.5	NO	3
DT33	Botley RD/ Mill St	RS	450409	206224	NO2	YES/Oxford city-wide AQMA	1	1	NO	3
DT35	Botley Rd /Hillview Rd	RS	450029	206207	NO2	YES/Oxford city-wide AQMA	1	2	NO	3
DT36	Botley Rd N (Prestwich Place)	RS	449657	206245	NO2	YES/Oxford city-wide AQMA	1	2	NO	3
DT39	St Aldate's	RS	451359	206157	NO2	YES/Oxford city-wide AQMA	0	2	YES	2.5
DT40	Queen St.	RS	451270	206144	NO2	YES/Oxford city-wide AQMA	0	2	NO	3
DT41	Bonn Square	RS	451216	206133	NO2	YES/Oxford city-wide AQMA	0	2	NO	3
DT42	New Rd.	RS	451073	206191	NO2	YES/Oxford city-wide AQMA	2	3.5	NO	3
DT43	Park End St.	RS	450885	206275	NO2	YES/Oxford city-wide AQMA	2	1	NO	3
DT44	Hythe Bridge St.	RS	450795	206343	NO2	YES/Oxford city-wide AQMA	0	2	NO	3

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) ⁽¹⁾	Distance to kerb of nearest road (m) ⁽²⁾	Tube Co-located with a Continuous Analyser?	Tube Height (m)
DT45	Worcester St.	RS	450942	206424	NO2	YES/Oxford city-wide AQMA	2	2	NO	3
DT46	Beaumont St.	RS	451167	206519	NO2	YES/Oxford city-wide AQMA	2	1	NO	3
DT47	George St. / Magdalen St.	RS	451222	206387	NO2	YES/Oxford city-wide AQMA	2	0.5	NO	3
DT48	George St.	RS	450981	206344	NO2	YES/Oxford city-wide AQMA	1	0.5	NO	3
DT49	Cornmarket St.	RS	451322	206242	NO2	YES/Oxford city-wide AQMA	0	2	NO	3
DT50	High St. / Turl St.	RS	451467	206222	NO2	YES/Oxford city-wide AQMA	1	2.5	NO	3
DT51	50 High St.	RS	451900	206250	NO2	YES/Oxford city-wide AQMA	0	2.5	NO	3
DT52	Longwall St.	RS	451972	206283	NO2	YES/Oxford city-wide AQMA	1	1	NO	3
DT53	Magdalen Bridge	RS	452099	206117	NO2	YES/Oxford city-wide AQMA	10	2	NO	3
DT54	York Place	RS	452325	206015	NO2	YES/Oxford city-wide AQMA	2	2	NO	3

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Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) ⁽¹⁾	Distance to kerb of nearest road (m) ⁽²⁾	Tube Co-located with a Continuous Analyser?	Tube Height (m)
DT55	St Clements	RS	452326	205992	NO2	YES/Oxford city-wide AQMA	1	1	NO	3
DT56	High St.	RS	451576	206232	NO2	YES/Oxford city-wide AQMA	2	1	NO	3
DT57	Speedwell St. / St. Aldate's	RS	451407	205807	NO2	YES/Oxford city-wide AQMA	1	3	NO	3
DT58	Folly Bridge	RS	451437	205529	NO2	YES/Oxford city-wide AQMA	1	1	NO	3
DT59	Thames St.	RS	451353	205643	NO2	YES/Oxford city-wide AQMA	1	3	NO	3
DT60	New Butterwyke Place/ Thames St.	RS	451248	205710	NO2	YES/Oxford city-wide AQMA	5	2	NO	3
DT61	Friars Wharf	RS	451219	205707	NO2	YES/Oxford city-wide AQMA	3	3	NO	3
DT63	Thames St. / Trinity St.	RS	450926	205797	NO2	YES/Oxford city-wide AQMA	2	10	NO	3
DT64	Thames St. / Oxpens Rd.	RS	450887	205825	NO2	YES/Oxford city-wide AQMA	5	1	NO	3
DT65	Speedwell St. / Littlegate	RS	451206	205780	NO2	YES/Oxford city-wide AQMA	1	2	NO	3

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Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) ⁽¹⁾	Distance to kerb of nearest road (m) ⁽²⁾	Tube Co-located with a Continuous Analyser?	Tube Height (m)
DT66	36 Faulkner St.	UB	451149	205859	NO2	YES/Oxford city-wide AQMA	1	20	NO	3
DT67	Old Greyfriars St	RS	451149	205947	NO2	YES/Oxford city-wide AQMA	5	5	NO	3
DT68	Norfolk St.	RS	451030	205962	NO2	YES/Oxford city-wide AQMA	0	1.5	NO	3
DT69	Paradise Square	RS	450982	205973	NO2	YES/Oxford city-wide AQMA	0	1	NO	3
DT70	Castle St.	RS	451062	206067	NO2	YES/Oxford city-wide AQMA	0	1.5	NO	3
DT71	BP City Motors	RS	449617	210216	NO2	YES/Oxford city-wide AQMA	5	5	NO	3
DT72	Cowley Rd./ James Street	RS	452761	205745	NO2	YES/Oxford city-wide AQMA	1	1	NO	3
DT73	Walton Street LP18	RS	450960	206590	NO2	YES/Oxford city-wide AQMA	1	1	NO	3
DT76	St Gilles	RS	451226	206504	NO2	YES/Oxford city-wide AQMA	0	2	NO	3
DT77	St Clements 2	RS	452451	205999	NO2	YES/Oxford city-wide AQMA	0	1	NO	3

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Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) ⁽¹⁾	Distance to kerb of nearest road (m) ⁽²⁾	Tube Co-located with a Continuous Analyser?	Tube Height (m)
DT78	William Lucy Way	UB	450378	207135	NO2	YES/Oxford city-wide AQMA	3	20	NO	2
DT79	Old Abingdon Rd.	RS	451908	203919	NO2	YES/Oxford city-wide AQMA	5	1.5	NO	3
DT80	Hollow way Road	RS	454651	204270	NO2	YES/Oxford city-wide AQMA	4	1	NO	3
DT81	Cowley Rd/ Union Street	RS	452805	205731	NO2	YES/Oxford city-wide AQMA	0	2	NO	3
DT82	Summertown Parade	RS	450806	208978	NO2	YES/Oxford city-wide AQMA	2	1	NO	3
DT83	A44 Woodstock Rd.	RS	449681	210263	NO2	YES/Oxford city-wide AQMA	8	0.5	NO	2
DT84	226 Botley Rd.	RS	449273	206274	NO2	YES/Oxford city-wide AQMA	10	1.5	NO	3
DT85	St Clements 3	RS	452625	206068	NO2	YES/Oxford city-wide AQMA	2.5	1	NO	3
DT86	72 Blackbird Leys	RS	455134	202841	NO2	YES/Oxford city-wide AQMA	6	1.5	NO	2
DT87	New Inn Hall St	RS	451164	206246	NO2	YES/Oxford city-wide AQMA	0	0.5	NO	2

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Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) ⁽¹⁾	Distance to kerb of nearest road (m) ⁽²⁾	Tube Co-located with a Continuous Analyser?	Tube Height (m)
DT88	St Michaels St	RS	451205	206341	NO2	YES/Oxford city-wide AQMA	0	0.5	NO	2
DT89	Turl St/Market St	RS	451439	206330	NO2	YES/Oxford city-wide AQMA	1	0.5	NO	2

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 NO₂ Monitoring Results: Automatic Monitoring (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 2020 (%) ⁽²⁾	2016	2017	2018	2019	2020
CM1	451359	206157	Roadside	99.6	99.6	49	40	39	42	28
CM2	451677	206272	Roadside	99.3	99.3	47	39	38	40	26
CM3	451118	205353	Urban Background	99.5	99.5	16	14	15	16	11

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

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/m³.

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

50 All means have been “annualised” as per LAQM.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

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

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

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

Table A.4 – Annual Mean NO₂ Monitoring Results: Non-Automatic Monitoring (µg/m³)

Diffusion Tube ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2020 (%) ⁽²⁾	2016	2017	2018	2019	2020
DT1	451118	205353	UB	100	100	18	14	15	16	11
DT2	451904	204215	RS	100	100	34	28	27	29	23
DT3	451914	204154	RS	100	100	38	31	29	34	26
DT4	452961	204662	RS	83.3	83.3	34	28	27	28	23
DT5	452818	203448	UB	100	100	14	10	14	14	10
DT7	454472	204246	RS	100	100	36	31	28	32	27
DT8	454355	204296	RS	100	100	34	29	27	31	24
DT14	454554	207102	RS	100	100	43	33	32	35	28
DT15	454433	207058	RS	100	100	34	26	25	27	21
DT16	453982	206817	RS	100	100	35	27	25	27	19
DT18	455596	207367	RS	100	100	33	23	26	28	22
DT20	454999	207759	RS	100	100	29	25	27	28	22
DT25	450419	210256	RS	100	100	48	35	35	35	26
DT26	450389	210189	RS	100	100	40	41	41	40	31
DT27	449824	210198	RS	100	100	34	29	29	29	22
DT28	449856	210162	RS	100	100	32	26	27	26	22
DT29	449530	210734	RS	100	100	36	28	25	26	20
DT30	450668	206053	RS	83.3	83.3	33	27	28	27	19
DT31	450566	206227	RS	100	100	39	29	31	32	21
DT32	450674	206273	RS	75	75	38	32	31	32	24
DT33	450409	206224	RS	100	100	29	23	26	24	19
DT35	450029	206207	RS	100	100	40	34	32	34	23
DT36	449657	206245	RS	100	100	35	27	27	25	17
DT39	451359	206157	RS	100	100	49	39	39	43	28
DT40	451270	206144	RS	100	100	36	28	26	28	18
DT41	451216	206133	RS	100	100	37	25	23	26	17
DT42	451073	206191	RS	83.3	83.3	35	24	29	33	22
DT43	450885	206275	RS	100	100	45	34	32	35	22
DT44	450795	206343	RS	100	100	38	29	29	30	21
DT45	450942	206424	RS	91.7	91.7	51	38	37	40	26
DT46	451167	206519	RS	100	100	45	31	31	31	20
DT47	451222	206387	RS	91.7	91.7	49	37	37	40	24
DT48	450981	206344	RS	100	100	54	40	42	44	24
DT49	451322	206242	RS	100	100	30	23	24	26	18
DT50	451467	206222	RS	100	100	36	27	28	32	24

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Diffusion Tube ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2020 (%) ⁽²⁾	2016	2017	2018	2019	2020
DT51	451900	206250	RS	100	100	43	34	33	37	25
DT52	451972	206283	RS	100	100	49	38	38	41	30
DT53	452099	206117	RS	100	100	28	22	23	23	16
DT54	452325	206015	RS	100	100	28	23	23	26	18
DT55	452326	205992	RS	100	100	61	47	46	53	36
DT56	451576	206232	RS	100	100	53	42	44	50	35
DT57	451407	205807	RS	100	100	52	38	35	39	27
DT58	451437	205529	RS	100	100	41	31	33	34	24
DT59	451353	205643	RS	100	100	32	25	27	26	18
DT60	451248	205710	RS	100	100	39	29	30	33	22
DT61	451219	205707	RS	100	100	27	20	19	20	14
DT63	450926	205797	RS	100	100	23	16	20	19	14
DT64	450887	205825	RS	100	100	32	25	23	23	15
DT65	451206	205780	RS	100	100	39	32	30	31	21
DT66	451149	205859	UB	100	100	31	22	23	25	16
DT67	451149	205947	RS	100	100	30	21	20	20	15
DT68	451030	205962	RS	100	100	35	23	24	27	19
DT69	450982	205973	RS	100	100	27	26	24	26	18
DT70	451062	206067	RS	100	100	42	28	29	29	22
DT71	449617	210216	RS	100	100	NM	41	38	40	28
DT72	452761	205745	RS	91.7	91.7	NM	29	29	31	22
DT73	450960	206590	RS	100	100	NM	27	26	24	15
DT76	451226	206504	RS	100	100	NM	NM	33	35	23
DT77	452451	205999	RS	91.7	91.7	NM	NM	36	42	28
DT78	450378	207135	UB	100	100	NM	NM	22	23	17
DT79	451908	203919	RS	91.7	91.7	NM	NM	NM	24	17
DT80	454651	204270	RS	100	100	NM	NM	NM	37	31
DT81	452805	205731	RS	75	75	NM	NM	NM	22	19
DT82	450806	208978	RS	100	100	NM	NM	NM	27	20
DT83	449681	210263	RS	100	100	NM	NM	NM	40	30
DT84	449273	206274	RS	91.7	91.7	NM	NM	NM	27	18
DT85	452625	206068	RS	91.7	91.7	NM	NM	NM	36	26
DT86	455134	202841	RS	100	100	NM	NM	NM	NM	16
DT87	451164	206246	RS	100	100	NM	NM	NM	NM	15
DT88	451205	206341	RS	100	100	NM	NM	NM	NM	15
DT89	451439	206330	RS	100	100	NM	NM	NM	NM	17

- ☒ Annualisation has been conducted where data capture is <75% and >25% in line with LAQM.TG16.
- ☒ Diffusion tube data has been bias adjusted.
- ☒ Reported concentrations are those at the location of the monitoring site (bias adjusted and annualised, as required), i.e. prior to any fall-off with distance correction.

Notes:

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

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

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

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

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

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

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

Table A.5 – 1-Hour Mean NO₂ Monitoring Results, Number of 1-Hour Means > 200µg/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 2020 (%) ⁽²⁾	2016	2017	2018	2019	2020
CM1	451359	206157	Roadside	99.6	99.6	0	0	1	3	0
CM2	451677	206272	Roadside	99.3	99.3	0	0	0 (106)	2	1
CM3	451118	205353	Urban Background	99.5	99.5	0 (76)	0	0	0	0

Notes:

Results are presented as the number of 1-hour periods where concentrations greater than 200µg/m³ have been recorded.

Exceedances of the NO₂ 1-hour mean objective (200µg/m³ 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.

6 (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 PM₁₀ 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 2020 (%) ⁽²⁾	2016	2017	2018	2019	2020
CM2	451677	206272	Roadside	98.7	98.7	20	18	18	19	16
CM3	451118	205353	Urban Background	99.9	99.9	15	13	12	14	11

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

Notes:

The annual mean concentrations are presented as µg/m³.

Exceedances of the PM₁₀ annual mean objective of 40µg/m³ are shown in **bold**.

All means have been “annualised” as per LAQM.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

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

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

Table A.7 – 24-Hour Mean PM₁₀ Monitoring Results, Number of PM₁₀ 24-Hour Means > 50µg/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 2020 (%) ⁽²⁾	2016	2017	2018	2019	2020
CM2	451677	206272	Roadside	98.7	98.7	4	2	0 (30)	7	0
CM3	451118	205353	Urban Background	99.9	99.9	0 (24)	2	1	5	0

Notes:

Results are presented as the number of 24-hour periods where daily mean concentrations greater than 50µg/m³ have been recorded.

Exceedances of the PM₁₀ 24-hour mean objective (50µg/m³ 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 (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 2020 (%) ⁽²⁾	2016	2017	2018	2019	2020
CM3	451118	205353	Urban Background	99.9	99.9	13	11	10	9	7

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

Notes:

The annual mean concentrations are presented as µg/m³.

All means have been “annualised” as per LAQM.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

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

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

Appendix B: Full Monthly Diffusion Tube Results for 2020

Table B.1 – NO₂ 2020 Diffusion Tube Results (µg/m³)

DT ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Easting)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Annualised and Bias Adjusted (0.96)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
DT1	451118	205353	17	12	12	9	6	7	6	10	11	10	18	17	11.3	11(*)	NA	
DT2	451904	204215	33	24	22	19	18	23	17	25	27	23	33	29	24.4	23	NA	
DT3	451914	204154	38	29	25	16	17	25	20	27	28	30	33	34	27	26	NA	
DT4	452961	204662	33	NR	24	18	18	20	16	NR	26	25	33	28	24.1	23	NA	
DT5	452818	203448	19	12	13	7	5	9	6	8	8	5	18	14	10.3	10(*)	NA	
DT7	454472	204246	43	41	28	18	15	24	21	23	28	29	32	32	27.9	27	NA	
DT8	454355	204296	33	27	26	20	17	22	18	21	28	25	30	31	24.8	24	NA	
DT14	454554	207102	41	36	30	17	19	25	23	27	31	34	37	34	29.5	28	NA	
DT15	454433	207058	30	23	23	19	16	21	14	21	22	22	28	25	22	21	NA	
DT16	453982	206817	27	20	21	18	15	14	12	18	22	18	25	22	19.4	19	NA	
DT18	455596	207367	32	25	20	15	14	20	20	25	22	23	28	27	22.7	22	NA	
DT20	454999	207759	29	24	22	18	19	22	15	23	23	21	27	28	22.6	22	NA	
DT25	450419	210256	40	33	26	16	15	21	18	27	30	28	32	31	26.6	26	NA	
DT26	450389	210189	41	31	32	27	26	37	26	33	37	29	37	36	32.7	31	NA	
DT27	449824	210198	37	32	14	13	17	17	20	22	25	24	28	28	23.1	22	NA	
DT28	449856	210162	33	27	24	15	16	16	22	19	26	28	29	26	23.4	22	NA	
DT29	449530	210734	32	27	22	12	12	15	15	16	23	21	28	24	20.6	20	NA	
DT30	450668	206053	29	22	21	15	14	15	13	21	23	NR	28	NR	20.2	19	NA	
DT31	450566	206227	31	22	21	14	16	18	18	23	25	23	29	28	22.4	21	NA	
DT32	450674	206273	34	NR	25	NR	16	NR	17	26	28	25	30	27	25.3	24	NA	
DT33	450409	206224	26	17	25	21	16	16	11	20	19	18	25	25	19.9	19	NA	
DT35	450029	206207	35	26	23	17	14	22	15	26	28	25	30	29	24.2	23	NA	
DT36	449657	206245	28	19	17	13	11	13	12	17	17	17	22	25	17.5	17	NA	
DT39	451359	206157	40	35	33	21	18	28	16	30	31	32	34	37	29.6	28	NA	
DT40	451270	206144	31	24	24	13	11	14	11	16	22	10	22	22	18.5	18	NA	
DT41	451216	206133	29	24	22	12	12	11	10	16	20	14	26	19	18	17	NA	
DT42	451073	206191	34	25	27	16	13	18	14	NR	25	NR	34	26	23.2	22	NA	
DT43	450885	206275	34	31	27	12	12	16	17	21	25	23	31	28	23.1	22	NA	
DT44	450795	206343	36	26	23	14	14	15	13	21	26	15	28	25	21.4	21	NA	
DT45	450942	206424	41	NR	29	20	20	24	17	31	29	29	29	30	27.2	26	NA	
DT46	451167	206519	35	28	25	14	13	17	8	22	22	15	30	28	21.3	20	NA	
DT47	451222	206387	41	33	29	18	14	17	15	NR	21	26	30	35	25.3	24	NA	
DT48	450981	206344	39	36	29	17	15	17	18	21	27	27	26	29	25	24	NA	
DT49	451322	206242	29	20	20	13	9	13	8	17	19	17	28	27	18.4	18	NA	
DT50	451467	206222	39	39	29	16	13	19	16	23	24	22	29	26	24.5	24	NA	
DT51	451900	206250	42	31	31	18	15	20	17	26	31	21	33	31	26.5	25	NA	
DT52	451972	206283	50	41	32	20	19	23	24	24	32	32	38	38	30.9	30	NA	
DT53	452099	206117	21	18	18	12	11	13	11	19	19	17	23	23	17.2	16	NA	
DT54	452325	206015	31	23	22	13	11	13	9	16	17	19	28	26	18.9	18	NA	
DT55	452326	205992	59	47	36	20	20	28	26	35	47	43	48	44	37.8	36	NA	
DT56	451576	206232	56	47	41	22	18	32	23	36	35	37	46	42	36.2	35	NA	
DT57	451407	205807	45	34	31	15	16	22	20	28	33	32	31	30	27.9	27	NA	
DT58	451437	205529	40	27	25	15	15	21	17	25	28	26	32	33	25.4	24	NA	
DT59	451353	205643	27	16	20	15	13	12	10	18	18	15	28	26	18.3	18	NA	
DT60	451248	205710	35	23	24	15	14	14	14	22	26	25	27	30	22.5	22	NA	
DT61	451219	205707	23	14	16	13	9	10	8	14	17	14	21	21	14.9	14	NA	
DT63	450926	205797	21	13	15	11	10	10	8	14	16	14	21	18	14.2	14	NA	

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DT ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Easting)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Annualised and Bias Adjusted (0.96)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
DT64	450887	205825	23	15	16	13	10	12	11	17	17	15	21	19	15.8	15	NA	
DT65	451206	205780	37	25	23	14	11	15	14	20	24	24	31	30	22.2	21	NA	
DT66	451149	205859	28	20	18	11	8	10	9	15	18	17	27	21	16.9	16(*)	NA	
DT67	451149	205947	25	15	15	11	9	10	9	12	16	16	24	20	15.2	15	NA	
DT68	451030	205962	32	25	23	12	12	14	15	18	21	19	27	26	20.3	19	NA	
DT69	450982	205973	30	23	20	13	9	10	10	18	21	19	28	25	18.9	18	NA	
DT70	451062	206067	34	24	23	15	13	17	14	20	25	24	34	27	22.5	22	NA	
DT71	449617	210216	42	34	29	18	19	25	23	32	34	26	38	33	29.5	28	NA	
DT72	452761	205745	35	28	24	18	16	20	NR	16	18	21	29	22	22.6	22	NA	
DT73	450960	206590	26	17	18	11	8	10	8	14	14	12	23	21	15.2	15	NA	
DT76	451226	206504	41	35	26	13	10	15	21	22	27	25	32	26	24.4	23	NA	
DT77	452451	205999	51	NR	32	17	15	23	20	26	35	28	38	32	28.7	28	NA	
DT78	450378	207135	28	26	18	11	12	13	14	15	18	18	21	20	17.8	17(*)	NA	
DT79	451908	203919	28	NR	18	13	11	14	9	19	20	17	24	24	17.9	17	NA	
DT80	454651	204270	43	38	27	22	22	27	30	27	40	40	42	37	32.8	31	NA	
DT81	452805	205731	29	22	19	13	10	13	NR	18	25	NR	NR	29	19.7	19	NA	
DT82	450806	208978	32	24	20	12	13	15	13	19	23	21	27	25	20.4	20	NA	
DT83	449681	210263	47	43	30	15	21	28	29	28	33	28	37	33	31	30	NA	
DT84	449273	206274	30	NR	20	11	10	18	14	19	19	21	26	22	19	18	NA	
DT85	452625	206068	36	31	31	21	18	23	23	27	30	31	30	NR	27.5	26	NA	
DT86	455134	202841	27	20	18	14	13	12	6	15	17	15	24	21	16.8	16	NA	
DT87	451164	206246	25	20	18	12	9	12	9	13	16	15	22	21	16	15	NA	
DT88	451205	206341	24	18	18	11	10	9	10	13	15	16	20	22	15.4	15	NA	
DT89	451439	206330	32	22	18	12	10	11	11	14	15	18	27	24	17.9	17	NA	

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

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

Local bias adjustment factor used

National bias adjustment factor used

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

Oxford City Council confirm that all 2020 diffusion tube data has been uploaded to the Diffusion Tube Data Entry System

Notes:

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

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

See Appendix C for details on bias adjustment and annualisation.

(*) Tubes corrected using local bias adjustment obtained from urban background co-location study (details available in Appendix C)

(**) According to paragraph 7.78 of the LAQMTG(16), considerations should be given to distance correct all the diffusion tubes that are not representative of human exposure, and whose concentrations fall within 10% of the NO₂ annual mean objective (i.e. > 36 µg/m³), to account for the inherent uncertainty in diffusion tube monitoring concentration data. As in 2020, all diffusion tube monitoring results were ≤ 36 µg/m³, no distance corrections were made.

NA – Not Applicable

NR – Not Recovered (Lost/damaged)

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

New or Changed Sources Identified Within Oxford during 2020

Oxford City Council has not identified any new sources relating to air quality within the reporting year of 2020.

Additional Air Quality Works Undertaken by Oxford City Council during 2020

Oxford City Council has not completed any additional works within the reporting year of 2020.

QA/QC of Diffusion Tube Monitoring

Oxford's diffusion tubes were supplied and analysed in 2020 by an accredited laboratory (South Yorkshire Air Quality Samplers), using the 50% TEA in Acetone method.

The laboratory is subject to quality assurance testing as part of their accreditation. This involves an independent comparison to other laboratories, under the independent AIR-PT scheme. The results of these inter-comparisons are publicly available for [scrutiny](#).

All the diffusion tubes used in the 2020 monitoring campaign were replaced according to DEFRA's 2020 diffusion tube monitoring [calendar](#) and within the ± 2 days due date tolerance.

Diffusion Tube Annualisation

In 2020, none of the diffusion tubes of the monitoring campaign have presented annual data capture rates below 75%. Hence, and according to LAQM TG.16, diffusion tube annualisation was not required.

Diffusion Tube Bias Adjustment Factors

The diffusion tube data presented within the 2021 ASR have been corrected for bias using an adjustment factor. Bias represents the overall tendency of the diffusion tubes to under or over-read relative to the reference chemiluminescence analyser. LAQM.TG16 provides guidance with regard to the application of a bias adjustment factor to correct diffusion tube

monitoring. Triplicate co-location studies can be used to determine a local bias factor based on the comparison of diffusion tube results with data taken from NO_x/NO₂ continuous analysers. Alternatively, the national database of diffusion tube co-location surveys provides bias factors for the relevant laboratory and preparation method.

Oxford City Council carries out two co-location studies annually, and has used the results of these studies to calculate two locally derived bias adjustment factors.

In 2020, the following bias correction factors were derived from the following Oxford's AURN sites:

AURN Oxford Centre (Roadside) - 0.96

AURN Oxford St Ebbes (Urban Background) – 0.97

In March 2010, Local Air Quality management Helpdesk have issued a [briefing note](#) with regards to the influence of location on diffusion tube bias and whether roadside collocation studies should be used to adjust background diffusion tubes and vice versa. The document concludes the below:

“The value of a collocation study (and the subsequent bias adjustment) will be improved if the concentrations being measured are similar to those in the wider survey”.

“Care should be taken to avoid applying a bias adjustment factor derived from a local collocation study carried out for concentrations that are very different to those being measured in the wider survey”.

In other words, co-location results from a low concentration site (typically a background site) should not be used to derive a bias adjustment factor for survey results from high concentration sites (typically roadside sites) and vice versa.

In light of the above, Oxford City Council decided to apply both bias adjustment factors that were obtained locally in 2020 to correct the diffusion tube data from its air quality network, following the following approach:

- The local bias of 0.96 obtained from local AURN Oxford Centre roadside site was applied to adjust all monitoring roadside sites;
- The local bias of 0.97 obtained from local AURN St Ebbes urban background site was applied to adjust all monitoring urban background sites.

The average of the national bias correction factor for diffusion tubes that were tested using the same Acetone method (50% TEA) – considering the National Diffusion Tube Bias Adjustment Factor [Spreadsheet version3/21](#) from March 2021 was of **0.82** in 2020.

The two locally derived bias adjustment factors were used, instead of the national bias adjustment factor due to the following:

- a) The bias adjustment factors of our local studies are slightly higher than the one that was obtained nationally. Using the calculated local bias to adjust Oxford’s NO₂ diffusion tube results represents therefore a much more conservative approach;
- b) For a question of methodology and consistency with previous AQ AS reports;
- c) Due to the fact that our local co-location studies have both presented “good” precision for the diffusion tubes in 2020, together with high quality chemiluminescence results, and an extremely high data capture rate for NO_x (>99%) obtained from our AURN monitoring sites of Oxford Centre roadside and Oxford St Ebbes.

A summary of bias adjustment factors used by Oxford City Council over the past five years is presented in Table C1 below.

Table C2 shows the accuracy of the local bias adjustment factors used in 2020, and Figure C1 and C2 (below) show print screens of the DEFRA approved [spread sheet](#) used in the calculation of those factors.

Table C 1– Bias Adjustment Factor

Year	Local or National	If National, Version of National Spreadsheet	Adjustment Factor
2020	Local	NA	0.96/0.97
2019	Local	NA	0.94/1.05
2018	Local	NA	0.89/0.97
2017	Local	NA	0.83
2016	Local	NA	0.96

Table C 2 - Accuracy of Local Bias Adjustment factors

	Local Bias Adjustment 1 (AURN Oxford Centre Roadside)	Local Bias Adjustment 2 (AURN St Ebbes Urban Background)
Periods used to calculate bias	12	12
Bias Factor A	0.96 (0.91-1.02)	0.97 (0.92-1.03)
Bias Factor B	4% (-2%-10%)	3% (-3%-9%)
Diffusion Tube Mean ($\mu\text{g}/\text{m}^3$)	30	11
Mean CV (Precision)	5	6
Automatic Mean ($\mu\text{g}/\text{m}^3$)	28	11
Data Capture	100%	100%
Adjusted Tube Mean ($\mu\text{g}/\text{m}^3$)	28 (27-30)	11 (10-12)

Figure C 1– Calculation of local bias adjustment 1 (AURN Oxford Centre Roadside)

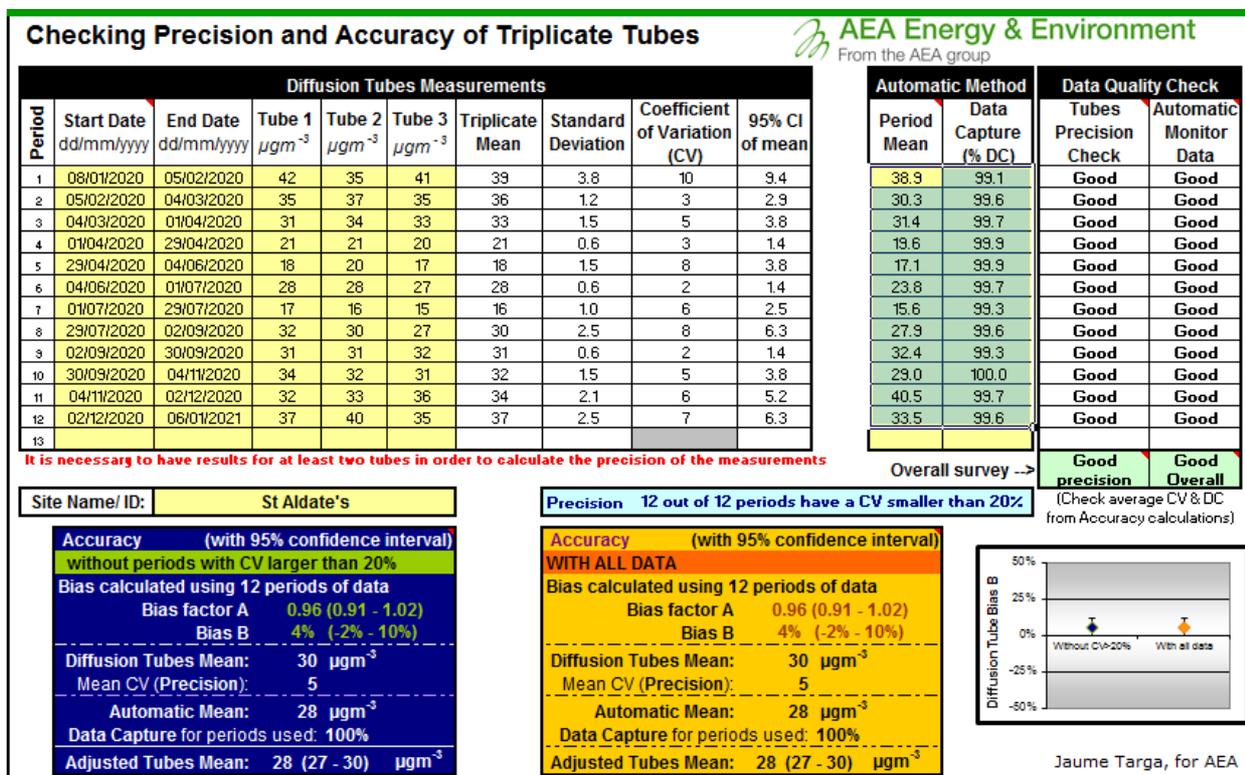
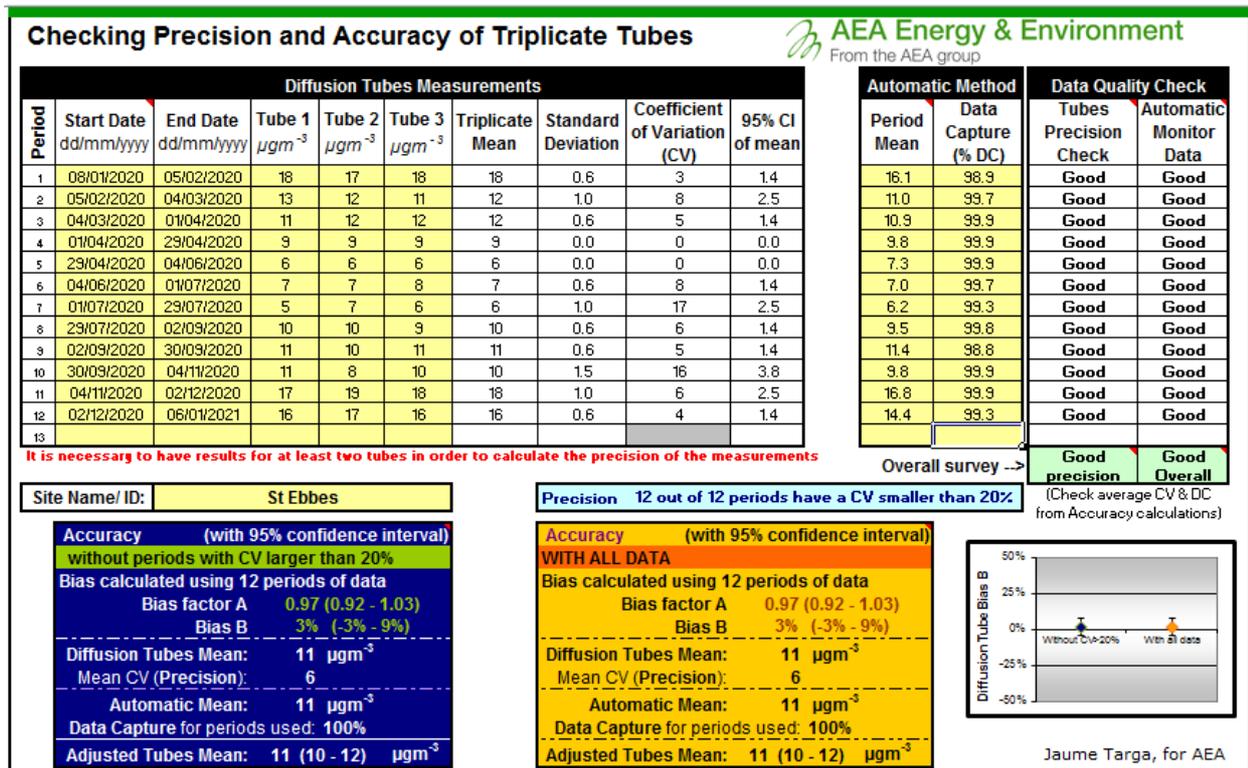


Figure C 2 - Calculation of local bias adjustment 2 (AURN St Ebbes Urban B.)



NO₂ Fall-off with Distance from the Road

Wherever possible, local authorities should ensure that monitoring locations are representative of exposure. However, where this is not possible, the NO₂ concentration at the nearest location relevant for exposure should be estimated using the Diffusion Tube Data Processing Tool/NO₂ fall-off with distance calculator available on the LAQM Support website. Where appropriate, non-automatic annual mean NO₂ concentrations corrected for distance are presented in Table B.1.

According to paragraph 7.78 of the LAQM TG (16), distance corrections should be considered at any monitoring site where the annual mean concentration falls within 10% of the annual mean objective (i.e. greater than 36 $\mu\text{g m}^{-3}$), and the monitoring site is not located at a point of relevant exposure, to account for the inherent uncertainty in diffusion tube monitoring concentration data.

In 2020, all diffusion tube monitoring results were $\leq 36 \mu\text{g m}^{-3}$, so no distance corrections to relevant human exposure were made.

QA/QC of Automatic Monitoring

Oxford City Council currently operates three continuous monitoring sites. All routine calibration and maintenance is carried out by Oxford City Council's Air Quality Officer and recorded in accordance with manufacturers' and Automated Urban Monitoring Network site operators' manual. Instrument drift is routinely checked by:

- a daily internal instrument calibration which is carried out automatically using an electronic calibration check;
- every two weeks a manual external instrument calibration is carried out by Oxford City Council using gas cylinders that can be traced back to NO₂ reference standards;
- every six months an audit of instrument response is carried out by an external organization using independent gas calibration standards, and which guarantees that data are traceable to UK national and international gas calibration standards.

The above checks enable data to be examined subsequently for instrument drift, which is expected, or for faulty data which is usually not expected. Before final publication of the air quality annual monitoring results, for comparison against current legislation, the air quality data needs to be ratified.

Data Ratification is a detailed manual check of the data set carried out on a quarterly basis in all our automatic monitoring stations covered by the full QA/QC process. It requires a longer-term view of the dataset incorporating the results from the independent QA/QC audits of the monitoring stations.

All the automatic monitoring data obtained in 2020 and presented within this ASR has been fully ratified by Ricardo Energy & Environment, following in full all the national AURN QA/QC procedures. Live and Historic data from our 3 automatic monitoring sites can be found on the following websites:

- [UK-Air](#)
- [AQ England](#)
- [Oxfordshire AQ website](#)

PM₁₀ and PM_{2.5} Monitoring Adjustment

The instrument used at AURN St Ebbes to measure PM₁₀ and PM_{2.5} data (FIDAS), do not require the application of any correction factor. The PM₁₀ data measured at Oxford High Street is obtained from a TEOM, and as such requires a VCM correction. However, Ricardo Energy & Environment applies the VCM correction factor automatically during ratification, and before presenting the final corrected annual dataset to Oxford City Council. We can therefore confirm that this was also the case in 2020.

Automatic Monitoring Annualisation

During the course of 2020, all Oxford City Council's automatic monitoring stations have registered data capture rates above 98% for all the monitored pollutants; therefore there was no need to follow LAQM TG.16 annualisation methodology to be used.

NO₂ Fall-off with Distance from the Road

Wherever possible, local authorities should ensure that monitoring locations are representative of exposure. However, where this is not possible, the NO₂ concentration at the nearest location relevant for exposure should be estimated using the NO₂ fall-off with distance calculator available on the LAQM Support website.

No automatic NO₂ monitoring locations within Oxford required distance correction during 2020.

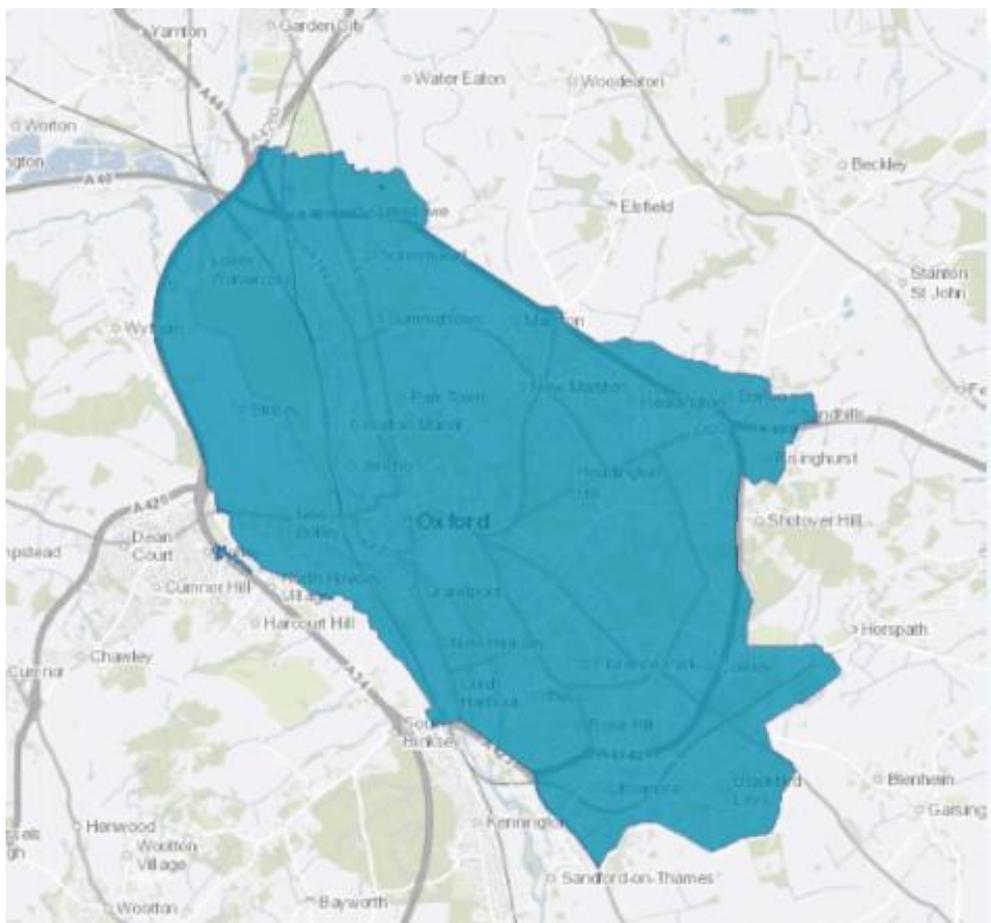
Appendix D: Map(s) of Monitoring Locations and AQMAs

The Council previously declared Air Quality Management Areas (AQMA's) in central Oxford (2003) and at Green Road roundabout (2005), as those were the locations where the UK nitrogen dioxide objectives were not being met at the time. Following further detailed assessments (2008 and 2009); several additional areas were identified where the nitrogen dioxide objectives were being breached.

As such, in September 2010 the City Council made an [Air Quality Management Order](#) declaring the whole city an AQMA for NO₂. Figure D1 below shows (in blue) the area of the city covered by the current AQMA for NO₂ and its boundaries. Figures D2 to D10 show the maps of the locations where air quality monitoring was conducted throughout 2020.

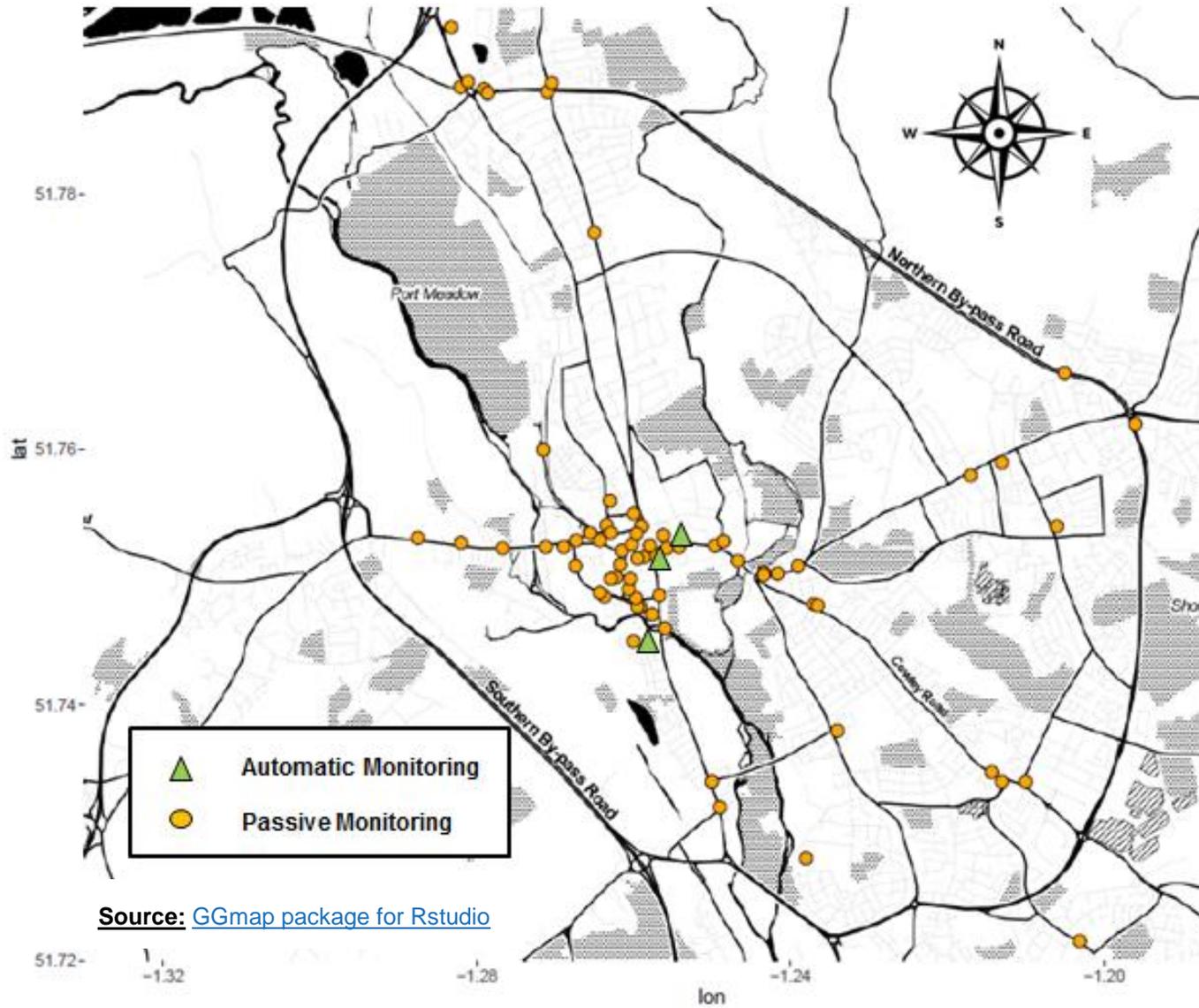
All the monitoring locations are within the current AQMA.

Figure D 1– Oxford's current city-wide AQMA for NO₂



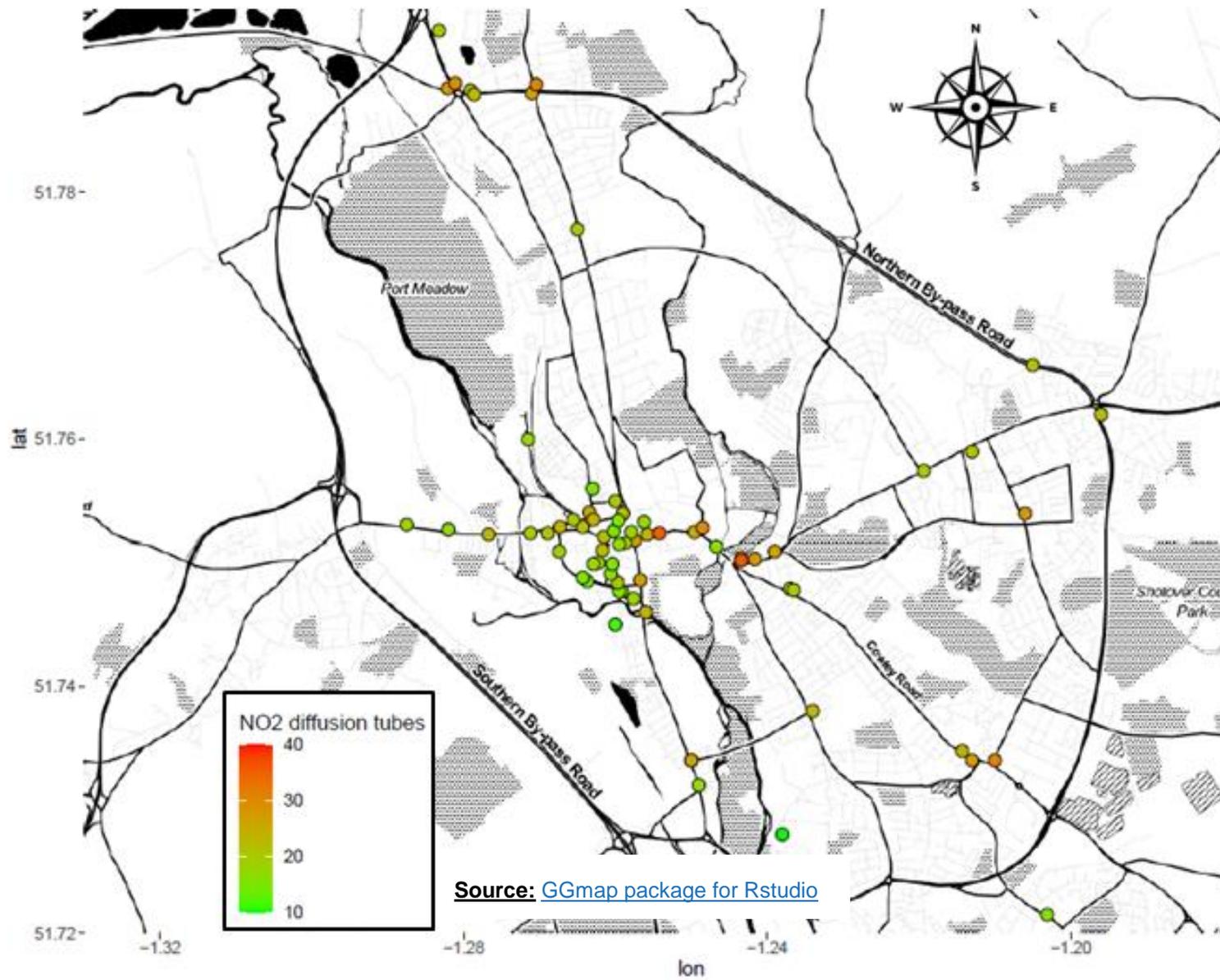
Source: DEFRA's national AQMA [Interactive map](#)

Figure D 2- Oxford's automatic and passive monitoring locations, 2020



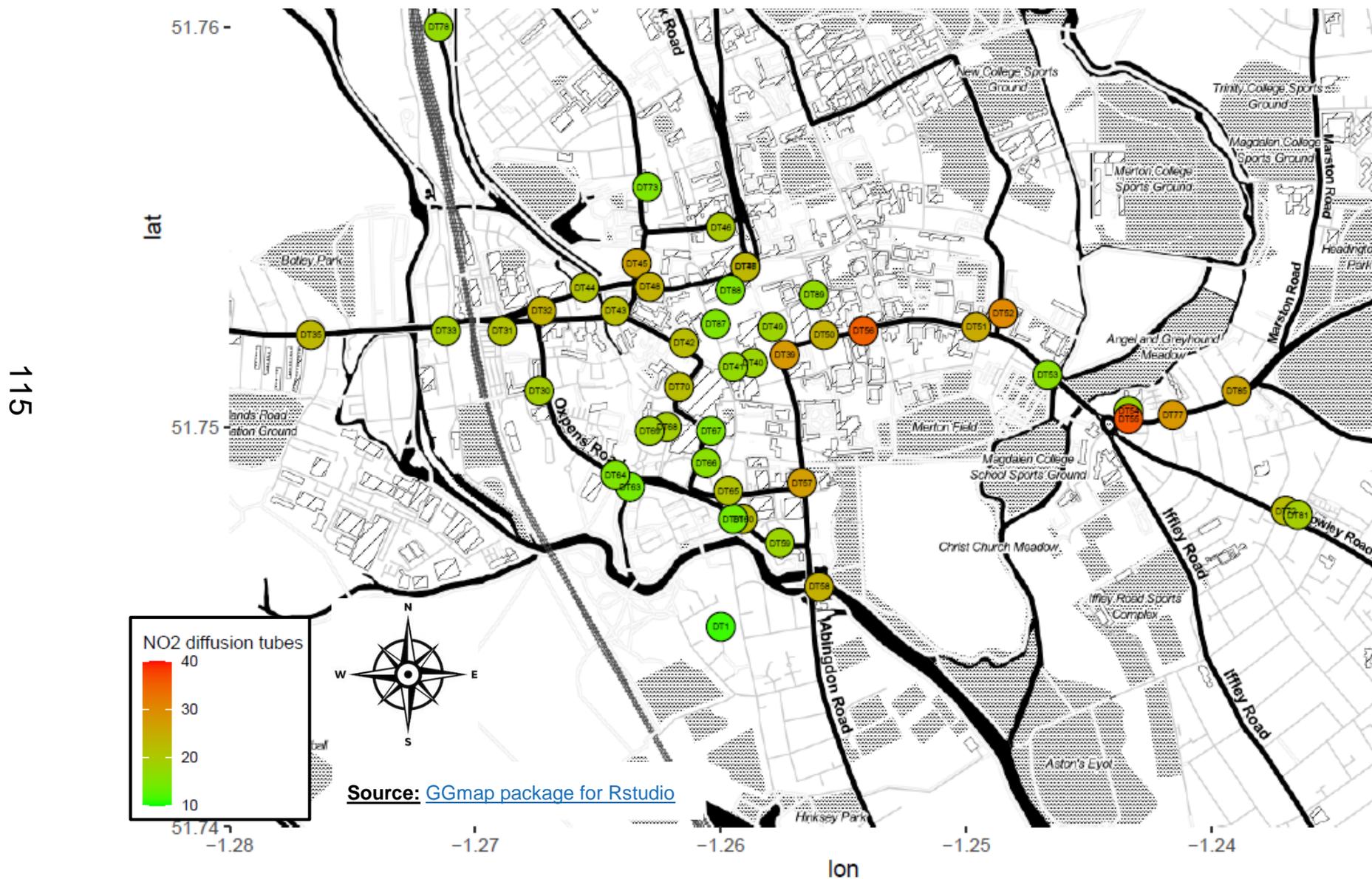
113

Figure D 3- Oxford's diffusion tube locations by level of NO₂, 2020



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Figure D 4- Oxford city centre area: diffusion tube locations by level of NO₂, 2020



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Figure D 5- Westgate area: diffusion tube locations by level of NO₂, 2020



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Figure D 6- Botley area: diffusion tube locations by level of NO₂, 2020



Source: [GGmap package for Rstudio](#)

Figure D 7- St Clements area: diffusion tube locations by level of NO₂, 2020



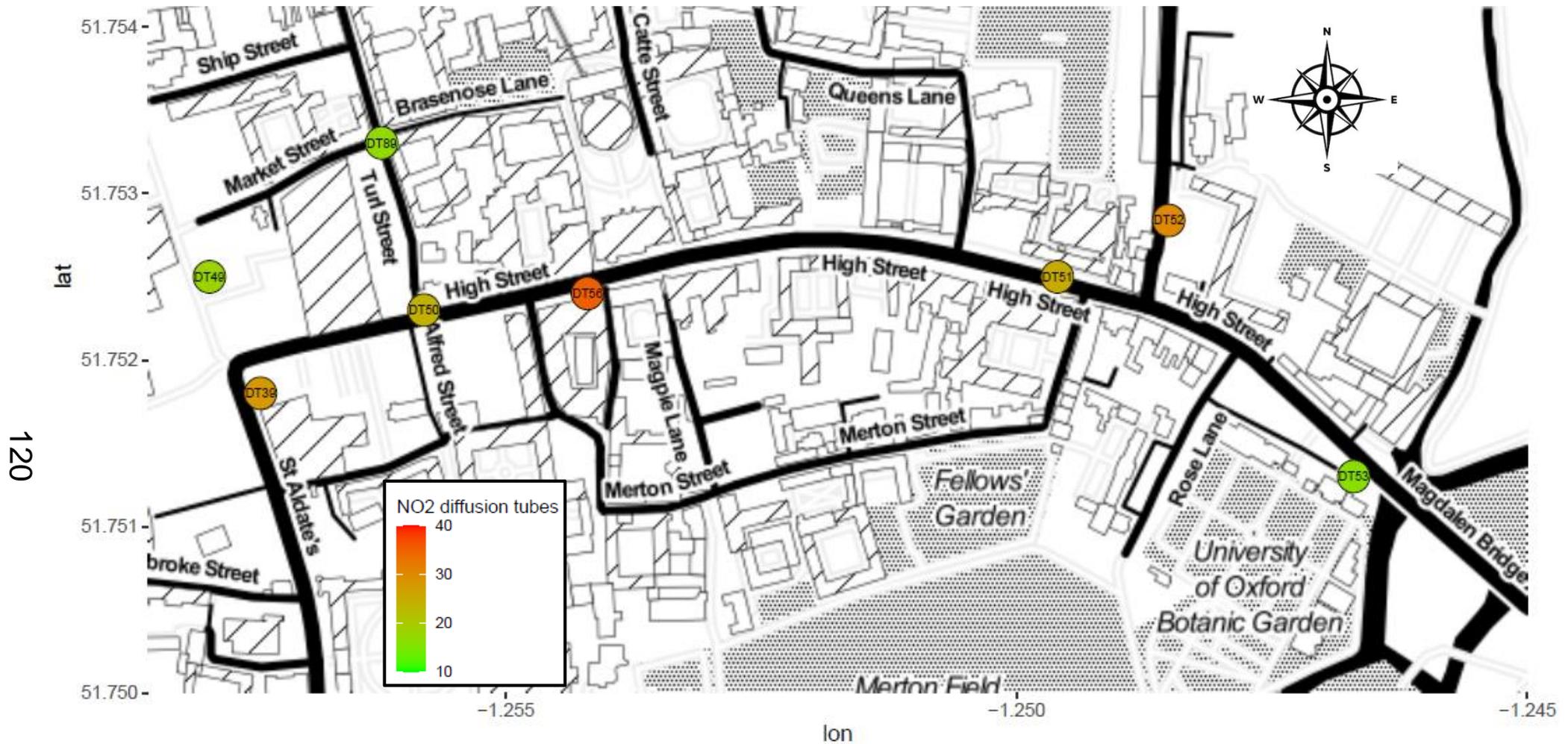
118

Figure D 8- George Street area: diffusion tube locations by level of NO₂, 2020



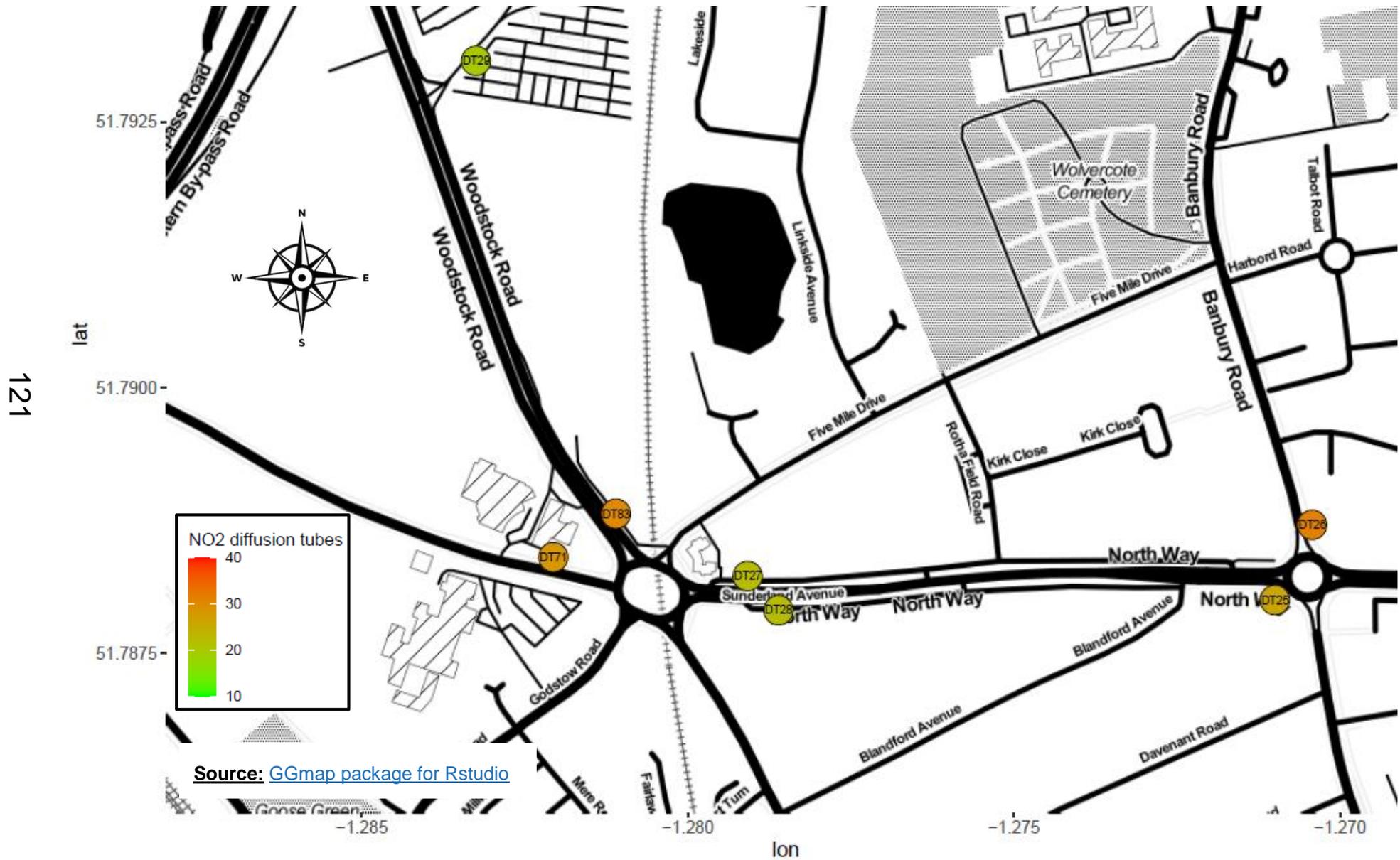
Source: [GGmap package for Rstudio](#)

Figure D 9- High Street area: diffusion tube locations by level of NO₂, 2020



Source: [GGmap package for Rstudio](#)

Figure D 10- Cutteslowe/Wolvercote area: diffusion tube locations by level of NO₂, 2020



Appendix E: Summary of Air Quality Objectives in England

Figure E 1 – Air Quality Objectives in England¹²

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
Particulate Matter (PM _{2.5}) ¹³	25 µg/m ³	Annual mean
Ozone (O ₃)	100 µg/m ³ not to be exceeded more than 10 times a year	8 hour mean

Figure E 2- World Health Organisation recommended guidelines

Pollutant	Guidelines for each pollutant	
	Concentration	Measured as
Nitrogen Dioxide (NO ₂)	200 µg/m ³	1-hour mean
	40 µg/m ³	Annual mean
Particulate Matter (PM ₁₀)	50 µg/m ³	24-hour mean
	20 µg/m ³	Annual mean
Particulate Matter (PM _{2.5})	25 µg/m ³	24-hour mean
	10 µg/m ³	Annual Mean
Ozone (O ₃)	100 µg/m ³	8-hour mean

¹² The units are in microgrammes of pollutant per cubic metre of air (µg/m³).

¹³ Non-mandatory target value, to be achieved by 2020.

Appendix F: Impact of COVID-19 upon LAQM

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

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

Impacts of COVID-19 on Air Quality within Oxford

The main impacts of COVID-19 on air quality within Oxford have already been considered and present in this report's "Executive Summary" section. Nevertheless, a short bulleted list summary of the main impacts is presented below:

- Ricardo Energy & Environment have presented two air quality analysis of COVID-19 lockdown on UK local air pollution throughout 2020:
 - a) [The first analysis](#) was focused in the first air quality changes already in March 2020, going through the period where the first social distancing was recommended (16th March), and also including the periods going from the start of the lockdown (23rd March). This preliminary analysis was already showing that NO₂ levels measured at AURN Oxford Centre roadside were experiencing a reduction of 44% due to those initial restrictions;
 - b) [The second analysis](#) extended the original analysis to early May, and showed that by then, NO₂ levels measured at AURN Oxford Centre roadside had already been reduced by 59% (when compared with a "Business as Usual scenario"). It's important to say that in both analysis, the impact of weather was removed from the equation, in order to allow proper quantification of COVID-19 impacts on air quality.
- A more detailed analysis on COVID-19 lockdown and its effects on air quality can also be found for Oxford High Street (NO_x) and AURN St Ebbes (O₃) on AQ England [website](#). The analysis covers the entire 2020 period.

- Analysis of the city's entire air quality monitoring dataset have shown average reductions of NO₂, PM₁₀ and PM_{2.5} of 29%, 19% and 22% respectively in 2020.
- Analysis of traffic data provided by Oxfordshire County Council show that during the period that goes from the start of the pandemic (23/03/2020) until the end of the year (31/12/2020), Oxford city centre's effective traffic reduction was of 35%.

Opportunities Presented by COVID-19 upon LAQM within Oxford

The reduction of traffic, noise, and air quality levels were not the only positive things that were brought about by COVID-19. This pandemic has also allowed people to start thinking more about the current system we have as a society, and to question whether some significant changes should be made to the way we currently live our lives. In March 2021, the UK Government, conscious of the need to come up with a strategy that could ensure the restoration of physical infrastructure, social systems and shelter, and the revitalization of livelihoods, economies, and the environment, have produced the [Build Back Better](#) plan. At local level, and throughout the pandemic, both City and County Councils have actively worked together towards the fast implementation of several active travel measures and opportunities to support businesses and to improve life quality in the city:

- The City Council have established an inclusive travel focus group in May 2020, which includes people with disabilities and those representing disability charities, to scrutinise changes to the city centre and make recommendations for an inclusive economic and city centre recovery post pandemic;
- Pedestrianisation trials were conducted in some streets in Oxford city centre in July and August 2020 such as [St Michael's street](#) and [George Street](#) to enable businesses to introduce outdoor dining and improve public realm;
- A two-way central cycle lane was also retained on George Street through the road closure, and bus stops were moved to nearby roads. The City Council and County Council have also made parking at Oxford's five Park and Ride sites free throughout August 2020;
- The City Council has introduced a one-way pedestrian flow system in Oxford city centre and the Cowley Road to help people maintain social distancing; installed new bike parking at Oxford's park and rides and in Oxford city centre; and created

designated rest areas to keep pedestrians moving in the city centre's busy and narrow streets;

- County Council, with the support of the City Council in principle, have introduced trials of new [Low Traffic Neighbourhoods](#) (LTNs) , [school street closures](#) and [e-scooter hiring scheme](#), in order to support and accelerate the Green recovery;
- The County Council successfully responded to the central government's emergency active travel fund, with £2.98 million being awarded to transform active travel in Oxfordshire. The funding [was announced](#) by the Secretary of State on 23 May 2020 as part of the work to combat the COVID-19 pandemic.

Figure F 1 – Pedestrianisation trials at George St (left) and St Michaels St (right)



Challenges and Constraints Imposed by COVID-19 upon LAQM within Oxford

In Oxford, the biggest challenges and/or constraints that have been experienced in relation to LAQM within 2020 that can be attributed to the pandemic, have mainly to do with delays on the implementation on a few projects that are linked with the delivery of some of the new actions to be delivered under the city's new AQAP. In particular:

- The official launch of the ZEZ Pilot which was moved from December 2020 to August 2021, due to the impacts of the COVID-19 pandemic, and in recognition that businesses and residents across the city, including those directly impacted by the scheme would need to focus all of their attention on managing the current and potential impacts on their trade and way of life – **Medium Impact**

- The launch of a new city wide LEZ for Euro VI buses was moved from December 2020 to December 2021 due to the impacts of the COVID-19 pandemic – **Medium Impact**;
- The delivery of the covered market's cargo bike pilot has suffered significant delays due to the restrictions of movements affecting not only the delivery of essential cargo bike parts, which were needed by the supplier to build the e-cargo bikes, but also covered market's capability to be open for business – **Small Impact**
- The delivery of the communication plan to engage and support businesses with the transition to the ZEZ has suffered significant delays due to businesses being shut during the several lockdowns imposed throughout 2020 – **Small Impact**
- The delivery of the STOP Project and continuous engagement with primary schools in Oxford to raise awareness of air pollution and promote active travel was put on hold due to schools being closed for long periods of time in 2020 and due to restrictions of movements and on public gatherings – **Medium Impact**

The impacts as presented above are aligned with the criteria as defined in Table F 1, with professional judgement considered as part of their application.

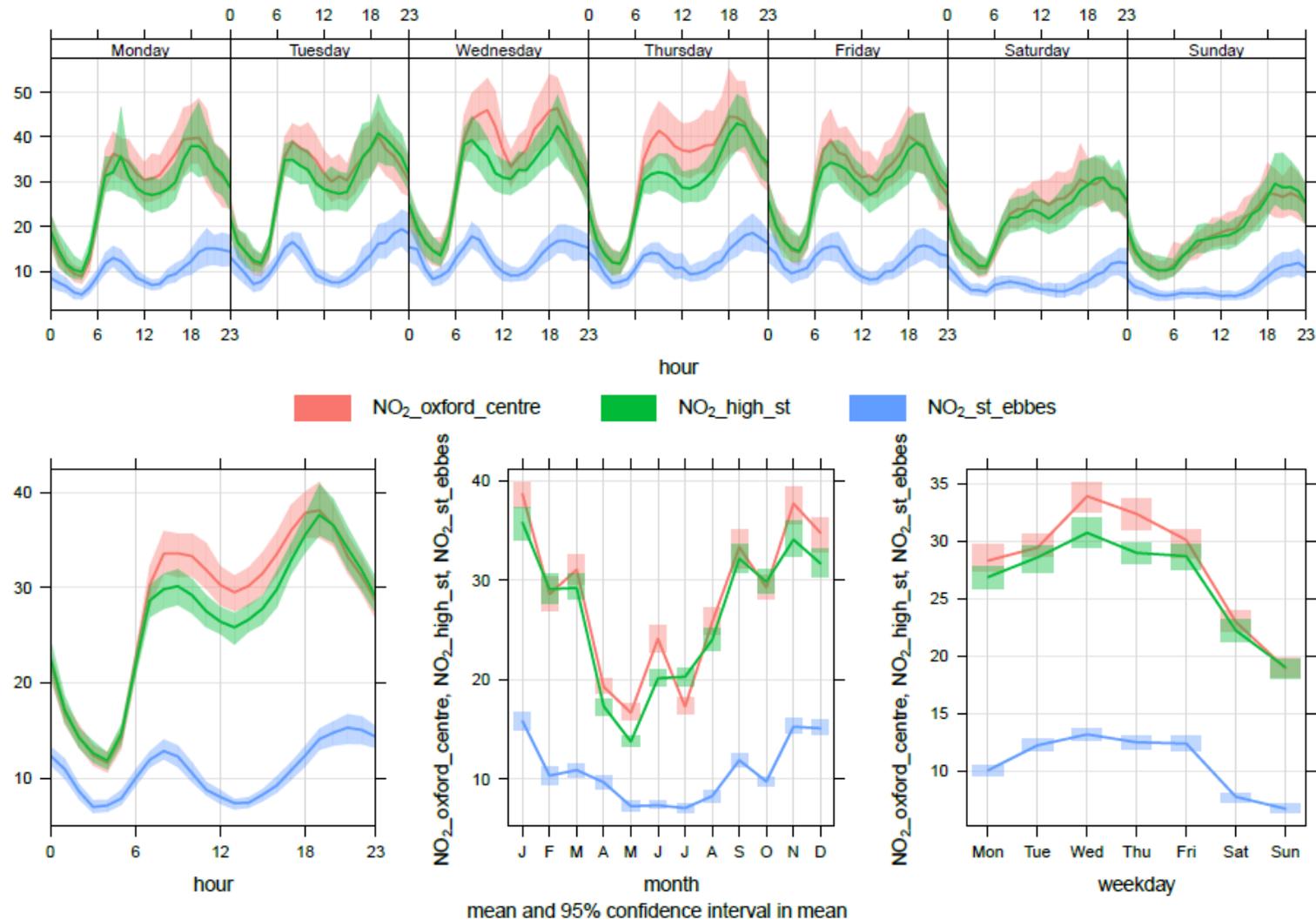
Table F 1 – Impact Matrix

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

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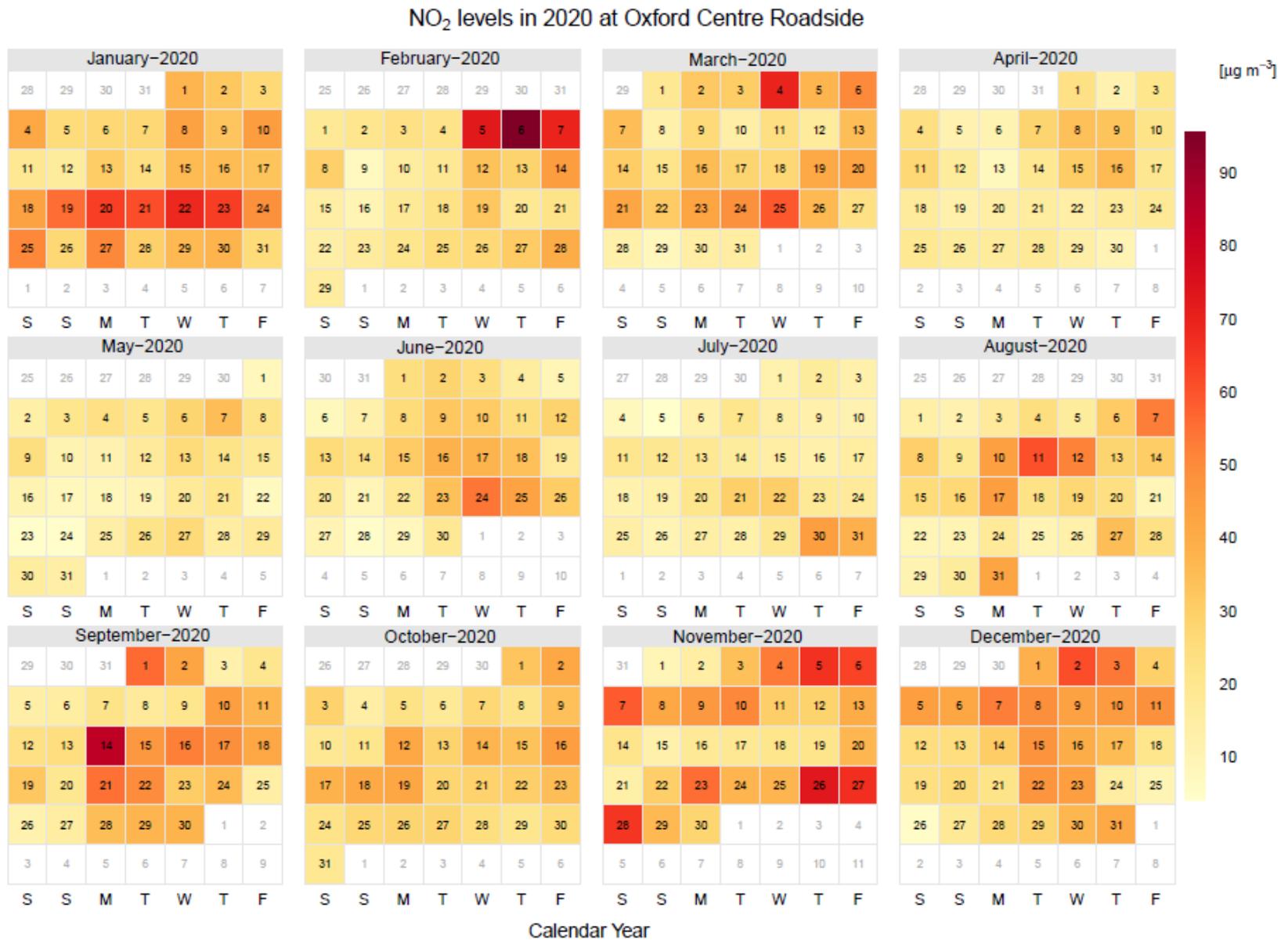
Appendix G: Time variations and calendar plots of Oxford's automatic monitoring

Figure G 1 - NO₂ time variations at Oxford's 3 automatic monitoring sites along calendar year 2020



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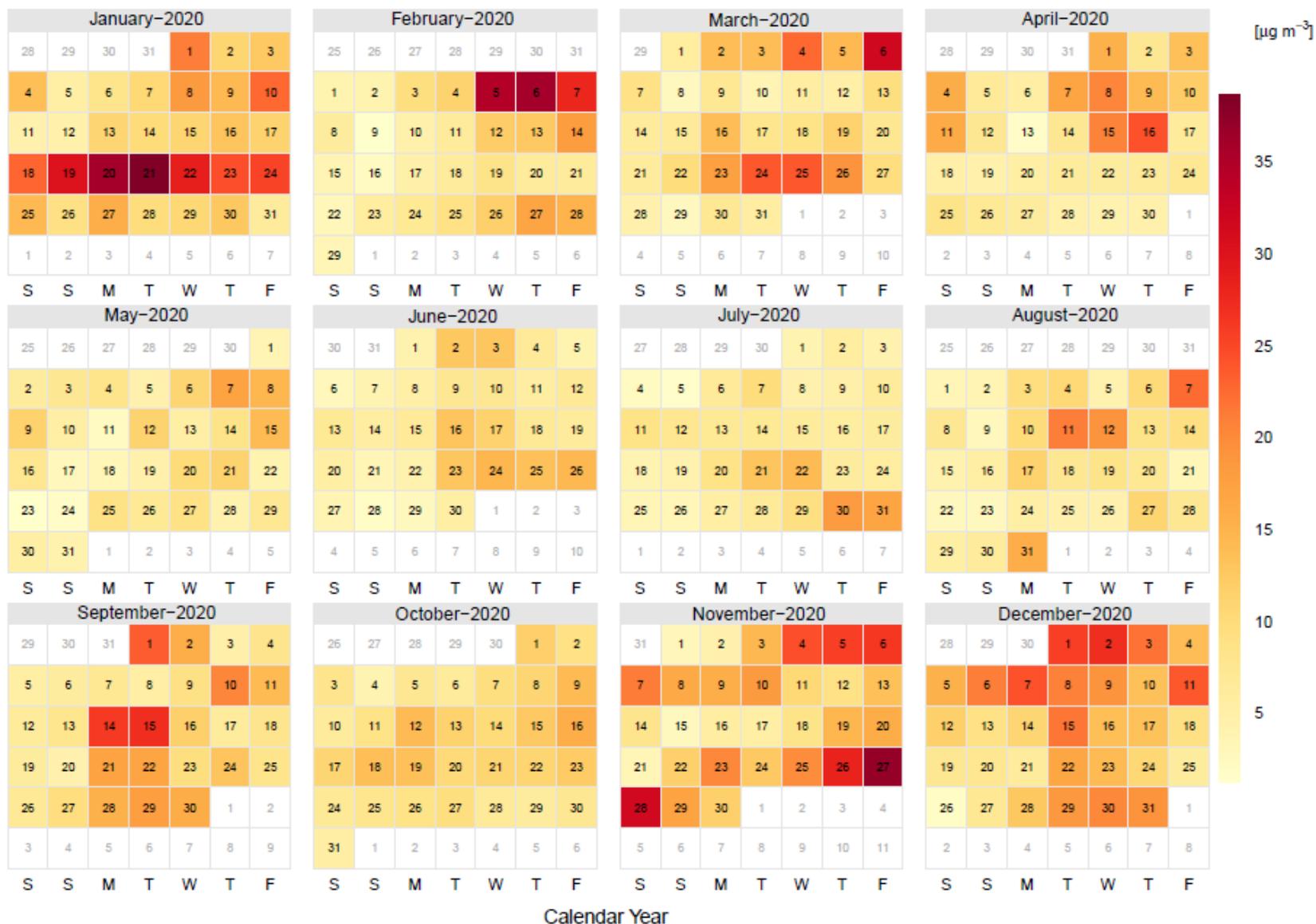
Figure G 2 - Daily NO₂ averages at AURN automatic monitoring station of Oxford Centre roadside along calendar year 2020



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Figure G 3 – Daily NO₂ averages at AURN automatic monitoring station of Oxford St Ebbes along calendar year 2020

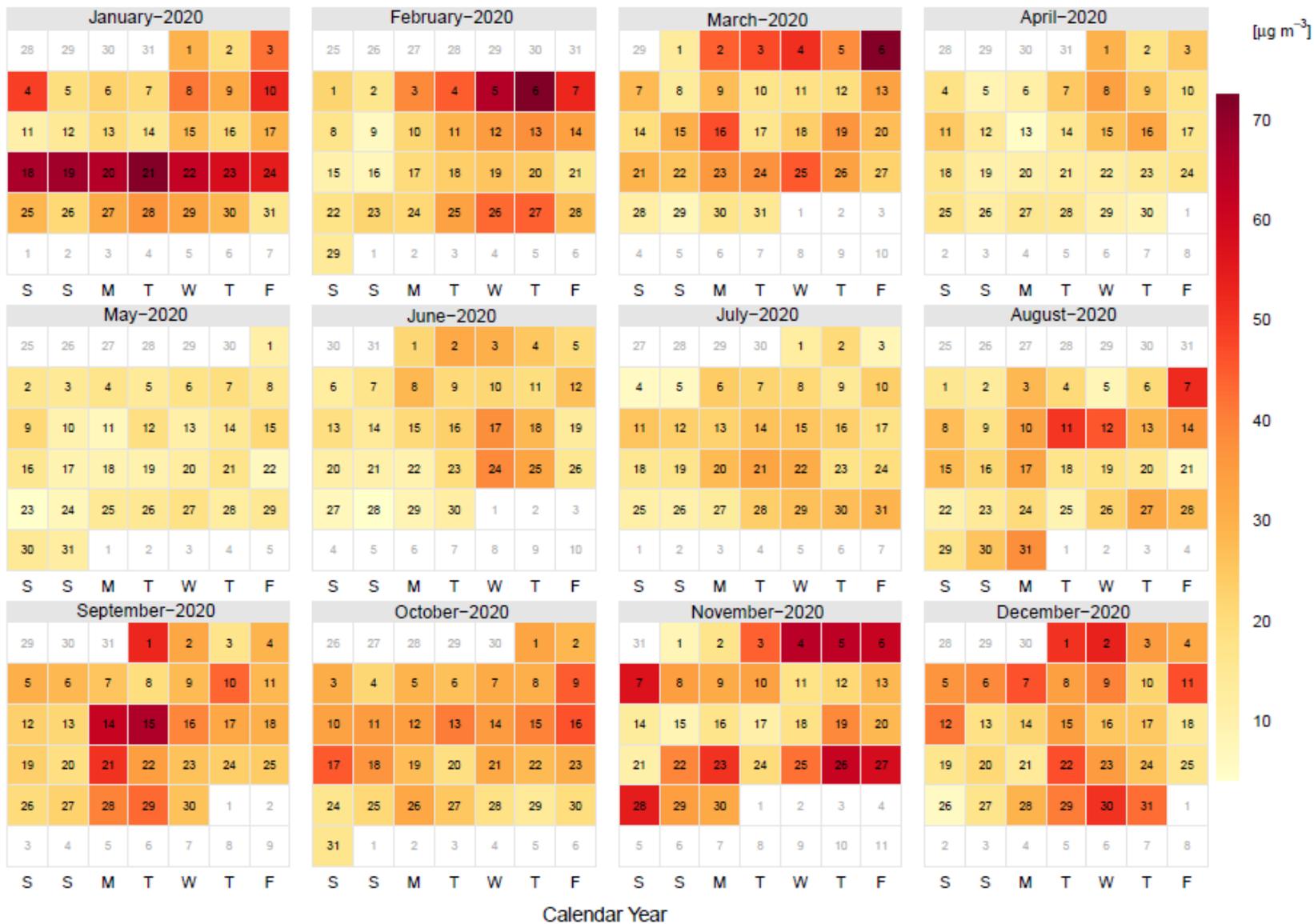
NO₂ levels in 2020 at Oxford St Ebbes



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Figure G 4 - Daily NO₂ averages at automatic monitoring station of Oxford High Street along calendar year 2020

NO₂ levels in 2020 on High Street



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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'
AQEG	Air Quality Expert Group
AQI	Air Quality Index – The AQI Tells you about levels of air pollution and provides recommended actions and health advice. The index is numbered 1-10 and divided into four bands, low (1) to very high (10)
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
AQS	Air Quality Strategy – Document produced by the UK Government that sets out all the national plans and policy options for dealing with all sources of air pollution in the UK from today into the long term
ASR	Annual Status Report –Document that reviews on an annual basis current and likely future air quality and assess whether air quality objectives are currently being achieved or are likely to be achieved
AURN	Automatic Urban & Rural Network
CAZ	Clean Air Zone
CBTF	Clean Bus Technology Fund
COVID-19	Disease caused by a new strain of coronavirus. CO stands for corona, VI for virus and D for disease
DEFRA	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DPF	Diesel Particulate Filter – Filter that captures and stores exhaust soot in order to reduce emissions from diesel cars
DT	Diffusion Tube
Euro VI	European emission standard for Heavy-Duty Truck and Bus engines
EVs	Electric Vehicles
eRCV	Electric Refuse Collection Vehicle
FIDAS	Fine Dust Monitor System that uses optical light scattering to detect and measure aerosol particles
FoE	Friends of the Earth
GOLEV	UK Government's Office for Low Emission Vehicles

Abbreviation	Description
GULO	Go Ultra Low Oxford project
LAQM	Local Air Quality Management – A UK Government policy framework that requires local authorities to periodically review and assess the current and future air quality in their areas
LAQM PG16	Local Air Quality Management Policy Guidance
LAQM TG16	Local Air Quality Management Technical Guidance
LAs	Local Authorities
LEZ	Low Emission Zone - defined area where access by some polluting vehicles is restricted or deterred with the aim of improving air quality. This may favour vehicles such as (certain) alternative fuel vehicles, hybrid electric vehicles, plug-in hybrids, and zero-emission vehicles such as all-electric vehicles.
LTNs	Low Traffic Neighbourhoods –residential areas where vehicles not stopping in the area are prevented or discouraged from driving through them
LV	Limit Value – Legally binding pollution levels that must not be exceeded. LVs are set for individual pollutants and are made up of a concentration value, an averaging time over which it is to be measured, the number of exceedances allowed per year, if any, and a date by which it must be achieved. Some pollutants have more than one limit value covering different endpoints or averaging times.
NHS	National Health System
NO	Nitric Oxide –Formed from nitrogen (N) in the atmosphere during high temperature combustion
NO ₂	Nitrogen Dioxide – Formed in small amounts in the atmosphere during high temperature combustion, but the majority is formed in the atmosphere through conversion of nitric oxide (NO) in the presence of ozone (O ₃)
NO _x	Nitrogen Oxides – collective term used to refer to nitric oxide (NO) and nitrogen dioxide (NO ₂). Nitrogen oxides are produced from fuel combustion in mobile (eg. cars) and stationary (eg power plants) sources.
O ₃	Ozone
OAQG	Oxfordshire Air Quality Group
ODS	Oxford Direct Services
OEMs	Original Equipment Manufacturers
OEVIS	Oxfordshire Electric Vehicle Infrastructure Strategy
PM	Particulate Matter
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

Abbreviation	Description
RUC	Road User Charging scheme
SCAs	Smoke Control Areas – legally defined area where only approved solid fuels or exempted appliances can be used within buildings
STOP	Schools Tackling Oxford's Air Pollution
TEA	Triethanolamine – Viscous organic compound that is used in diffusion tubes as an absorbent for NO ₂
TEOM	Tapered Element Oscillating Microbalance – Instrument used for real time detection of aerosol particles by measuring their mass concentration
µg	Microgramme – One millionth of a gram
µg/m ³	Microgrammes per cubic metre of air – A unit for describing the concentration of air pollutants in the atmosphere, as a mass of pollutant per unit volume of clean air
UK	United Kingdom
VCM	Volatile Correction Model – Model developed by Kings College to correct TEOM concentrations to Gravimetric Equivalent
WHO	World Health Organisation
WPL	Workplace Parking Levy – Charge that a local authority can place on private business commuter parking to both manage peak time traffic congestion, improve air quality, and generate revenue for transport investment
ZEBRA	Zero Emission Bus Regional Areas scheme
ZEZ	Zero Emission Zone – area designed to reduce traffic volumes, encourage the uptake of zero emission vehicles and lead to other positive behavioural changes; all of these would reduce vehicle emissions and hence air pollution whilst maintaining access for those who need it

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