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OXFORD CITY COUNCIL

2021 Air Quality Annual Status Report (ASR)

In fulfilment of Part IV of the Environment Act 1995

Local Air Quality Management

Date: June, 2022

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Executive Summary

The negative health impacts of air pollution and the new WHO guidelines

Air pollution is a major cause of premature death and disease, and is considered the single largest environmental health risk in Europe[1].

New research,[2] published in late 2021 from Harvard University and in collaboration with the Universities of Birmingham, Leicester and the University College London, found that more than 8 million people died in 2018 from fossil fuel pollution - meaning that air pollution from burning fossil fuels like coal and diesel was responsible for about 1 in 5 deaths worldwide.

In recent years, several studies seemed to indicate the existence of harmful effects of air pollution at levels below air quality standards previously considered to be safe. However, it was only on the 22nd September 2021, when the World Health Organization (WHO)[3] updated its global air quality guidelines for outdoor air pollution, that clear evidence was finally provided of the damage air pollution inflicts on human health at much lower concentrations than previously understood.

The new WHO guidelines establish a much more stringent set of concentrations (called guideline values) for several pollutants, which highlight the value at which the pollutant become health impacting. The WHO has also set a number of interim targets for pollutant concentrations aimed at promoting a gradual shift from high to lower levels of air pollution. If these interim targets are achieved, significant reductions in risks from acute and chronic health effects from air pollution can be expected. However our ultimate aim should be to achieve the guideline values or lowest levels possible for all pollutants.

1 https://www.eea.europa.eu/themes/air/health-impacts-of-air-pollution

2 https://www.hsph.harvard.edu/c-change/news/fossil-fuel-air-pollution-responsible-for-1-in-5-deaths-worldwide/

3 https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health

Tables 17 and 18 in Appendix E show a summary of the current UK Air Quality Objectives, and of the new recommended WHO guidelines for the main pollutants of interest.

Air Pollution and Social Inequality

Several studies show a strong correlation between poor air quality and social inequality issues. According to a 2018 study[4] from the University of Edinburgh, air pollution tends to cause most harm to people in more socially deprived groups, with major sources and higher concentrations of air, light and noise pollution being typically found in more socially disadvantaged areas.

However, whilst nationally, levels of air pollution are often highest in areas of deprivation, this same pattern is not seen in Oxford, mainly due to the majority of these areas being located away from high levels of traffic. Nevertheless, despite areas of deprivation not correlating with areas of high pollution in Oxford, this does not mean that air pollution does not disproportionally impact some of the most vulnerable members of our community in those areas, such as those from minority backgrounds, the young, old and those experiencing health issues.

In fact, and according to a research study commissioned by DEFRA on air quality and social deprivation in the UK[5], susceptibility to air pollution effects can be determined by a number of different factors:

Exposure patterns - The exposure pattern is determined by daily activity patterns, i.e. how we travel to work or school, the environment in which we work or study, and how we spend leisure time. These exposure patterns, driven by daily activities, will determine the exposure to air pollution – either to peak air pollution concentrations or as a cumulative daily dose and may be different in deprived communities (e.g. which may require greater travel time to get to work, a different indoor to outdoor level of exposure, etc.);

Individual lifestyle factors - such as diet, smoking, and level of exercise have an impact on human health. Poorer general health as a result of lifestyle factors could lead to greater susceptibility to air pollution impacts and certain lifestyle factors may be more prevalent

4 Pollution has higher impact in deprived areas, University of Edinburgh

5 Air Quality and Social deprivation in the UK

amongst certain socio-economic groups (e.g. the relationship between diet and income, or smoking and socioeconomic group);

Age of population and state of health - including both physical and mental health, could have some bearing on the level of immune response to air pollution exposure. There is significant evidence that deprived communities experience poorer health than less deprived communities, and also that there seems to be a disproportionate number of the most vulnerable living in these areas if you take elderly, children and those with underlying health conditions[6] together. These are known as sensitive receptors, as they are the ones who suffer the most with exposure to air pollutants. The Office for National Statistics (ONS) also acknowledges in a recent study[7] that air pollution to be one of many factors that may be driving disproportionate outcomes for black, Asian and minority ethnic (BAME) people, showing that ethnicity is strongly correlated with pollution exposure in England, with ethnic minorities more likely to live in polluted areas.

In 2019, a research study[8] led by academics at the Air Quality Management Resource Centre (AQMRC) at the University of the West of England, Bristol, found that social inequalities in traffic related pollution exposure are *'clearer and stronger'* than ever before. The study, which updates a 2003 analysis of environmental justice in the UK, found that while young children, young adults and households in poverty have the highest levels of exposure to air pollution, it is the richer households who are more responsible for it.

The Environment Act 2021

A new Environment Act[9] was approved by the UK parliament and became law in November 2021, replacing the old Environment Act of 1995.

The new Act was presented as an opportunity for the UK to enshrine better environmental protection into law, as it provides the Government with powers to set new binding targets, including for air quality, water, biodiversity, and waste reduction.

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6 Independent Inquiry into Inequalities report

7 Coronavirus (COVID-19) related mortality rates and the effects of air pollution in England

8 Emissions vs exposure: Increasing injustice from road traffic-related air pollution in the United Kingdom

9 https://www.legislation.gov.uk/ukpga/2021/30/contents/enacted

This new Act introduces changes to Part IV of the Environment Act 1995, which relates to air quality. In particular:

- The Secretary of State is now required to review the National Air Quality Strategy at least every 5 years. Reports must also be made annually to Parliament on the progress made to deliver air quality objectives in relation to England;
- It strengthens the local air quality management (LAQM) framework, with the intent of enabling greater cooperation at local level and broadening the range of organisations that play a role in improving local air quality - Responsibility for tackling local air pollution is now to be shared between designated relevant public authorities, all tiers of local government and neighbouring authorities.
- The Act will create at least two new legally binding targets for one of the most harmful pollutants, fine particulate matter ($PM_{2.5}$). From March to the end of June 2022, the government launched a national consultation seeking views on the first suite of Environment Act 2021 targets (including two proposed $PM_{2.5}$ targets). The future proposed targets need to be laid as draft Statutory Instruments by 31st October 2022 and they are expected to come into force once approved by Parliament.

The Act also established a new environmental watchdog, the Office for Environmental Protection (OEP), which will hold the Government and other public bodies to account, and ensure that the proposed air quality targets and all environmental laws are complied with.

Oxford's air pollution sources and current air pollution levels

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 (NO_2) is still the pollutant of most concern, and the entire city of Oxford has been a designated Air Quality Management Area (AQMA) for NO_2 since 2010.

According to Oxford's most recent source apportionment study[10], the transport sector continues to be by far the largest contributor (68%) to total emissions of Nitrogen Oxides (NO_x) in the city, followed by domestic combustion (19%), combustion from industry and services (12%) and others: waste, agriculture, solvents, nature (<1%).

10 Oxford City Council's Source Apportionment study, July 2020

The city's recent Air Quality Action Plan (AQAP)[11] sets out a 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 in the city. The city's action plan seeks to go further than the legal annual mean limit value for NO_2 of 40 µg/m^3, by establishing a much more stringent local annual mean NO_2 target of 30 µg/m^3 to be achieved by 2025 in recognition that there's no safe level of air pollution.

Throughout 2021, air quality was monitored at 88 sites across the city. Of those, 20 are new monitoring locations and the remaining 68 locations are sites where air quality had been monitored in the previous year. For the second consecutive time since recording began, no legal breaches of the UK's NO_2 annual mean limit value were observed in the city of Oxford at the locations were air quality was monitored. Ten locations within the city however measured NO_2 levels which are above the city's own new local annual mean target for this pollutant, a target to be met by 2025. The sites which registered breaches of the local NO_2 target were located on the following streets: Cutteslowe Roundabout; St Aldates; High Street; Long Wall St; St Clements; Speedwell St (corner with St Aldates); Hollow Way Rd; Wolvercote Roundabout; and Garsington Road (approaching the Eastern bypass).

In 2021, we saw an average increase in NO_2 levels in the city of 14%, when compared with the previous monitoring year of 2020, following the UK's national trend[12] for this pollutant. The increase in NO_2 levels were largely a result of Covid restrictions coming to an end and traffic levels increasing[13]. However, despites this increase, NO_2 levels still remain on average 17% below the levels obtained in 2019, which represents the last pre-pandemic year. The highest NO_2 annual mean concentration measured in Oxford in 2021 was 39 µg/m^3 at our highest historic air pollution hotspot –St Clements.

Analysis of data obtained in 2021 for Particulate Matter in all the city locations where these pollutants are being monitored shows the following:

Annual mean $PM_{2.5}$ levels were of 7 µg/m^3, which is the same value measured in 2020 and represents the lowest consecutive measured value since $PM_{2.5}$ monitoring began in 2011.

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11 Oxford City Council's Air Quality Action Plan (2021-2025)

12 Please refer to Figure 26 on Appendix F: UK's Annual Mean Concentrations of NO_2 in the UK (1990-2021).

13 According to Oxfordshire County Council, there was a 14% increase in the Annual Average Daily Traffic (AADT) levels in Oxford from 2020 to 2021.

This value is well within compliance with the UK's annual mean target value of 25 µg/m^3, and only slightly above the 5 µg/m^3 guideline value recommended by the recently published WHO guidelines, for this pollutant.

Annual mean PM_{10} levels remained at 11 µg/m^3 at AURN St Ebbes, and saw a minor reduction of 2 µg/m^3 at Oxford High Street where the annual mean in 2021 was 14 µg/m^3. Both values are well within compliance with the UK's annual mean limit value of 40 µg/m^3, and with the 15 µg/m^3 guideline value recommended by the recently published WHO guidelines, for this pollutant.

According to the city's most recent source apportionment study, road transport accounts for only 10% of total local emissions of PM_{10} and $PM_{2.5}$. Domestic combustion is, by far the largest contributor to PM_{10} and $PM_{2.5}$ emissions in Oxford –this can help explain why the increase in traffic levels observed during 2021 as a result of easing /lifting of imposed movement restrictions due to Covid 19, did not result in any increase in the levels of particulate pollution measured.

Ozone is measured at one site in Oxford and levels exceeded the AQS daily objective 60 times over a total of 12 days during the year. This represents a significant decrease in the number of exceedances (92 fewer) and days (14 fewer), when compared with 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 and its partners have taken over the last reporting year (from July 2021 to June 2022) to improve air quality in the city. The list below is presented in chronological order:

1) July 2021 – Oxford City council commissioned a city focussed Electric Vehicle (EV) Infrastructure Strategy which will complement the already published Oxfordshire EV Infrastructure Strategy. Its objective is to address how the city can respond to the rapidly rising demand for additional EV charging capacity. The final version of the

strategy is expected to go to Oxford City Council's Cabinet in July 2022 for approval - link to press release;

2) September 2021 – Oxford City Council delivered, in partnership with Green TV, edition [third/fourth] year of the EV Summit. The 2021 event took place at Said Business School. Oxford's EV Summit brought together business leaders and key players working on electric vehicles, energy, information technology and charging infrastructure, to explore how we advance full e-mobility - link to press release;
3) November 2021 – Oxford City Council published its Urban Forest Strategy, in an effort to increase Oxford's current on-street canopy cover and urban forest, to respond to the challenges faced by the current climate emergency. It is expected that this new strategy will contribute to an increase in the number of ecosystem services that urban trees deliver, such as clean air, spaces for recreation and carbon storage – link to press release;
4) December 2021 – Oxford City Council launched a new phase of our e-cargo bike trial in the Covered Market, entering into a partnership with local delivery company Pedal & Post. The partnership involves fully trained Pedal and Post riders making deliveries for Covered Market traders on our EAV electric cargo bikes. The partnership allows all Covered Market traders to make same day and next day zero emission deliveries and will offer practical support to traders as they transition their deliveries to zero emission vehicles –link to press release;

Photo description: e-Cargo Bikes "Atlas" and "Aria" in action at the Covered Market.

5) January 2022 – Oxford City Council introduced a change in the emission standards for Hackney carriage drivers, who will now be required to drive vehicles of at least Euro 4 standard to renew their licence; and Euro 4, Euro 6 or zero-emission capable to receive a new licence. This is part of a phased approach to see Hackney carriages

in Oxford become zero emission capable between 2020 and 2025, with drivers only able to get a licence in 2025 if they have a zero-emission vehicle – link to press release;

6) February 2022 – Oxford City and Oxfordshire County councils launched the UK's first ZEZ pilot in a small area of Oxford's city centre, with the registration system for exemptions and discounts going live in December 2021. A zero-emission zone (ZEZ) is an area where vehicles that are fully zero-emission can be driven free of charge. Other vehicles that rely on fossil fuels need to pay a charge for driving in the area. Funds raised by the ZEZ will be used to support the transition to zero-emission transport in the city. The pilot will allow councils to gain useful insights before introducing a larger ZEZ covering most of Oxford city centre next year, subject to further public consultation –link to press release;

Photo description: Streets covered by Oxford's ZEZ Pilot.

7) March 2022 - Oxfordshire County Council was been awarded £32.8 million from the Zero Emission Bus Regional Areas (ZEBRA) scheme. Along with £6m from the council itself and £43.7m from bus companies Stagecoach and the Go-Ahead Group, which includes the Oxford Bus Company, Thames Travel, and City Sightseeing Oxford, the scheme will deliver 159 electric buses and the infrastructure to charge them in a package worth £82.5m and with an estimated saving of 9,200 tonnes of carbon dioxide emissions each year – the equivalent of taking more than 6,000 cars off the road – link to press release;
8) March 2022 - Oxford City and Oxfordshire County councils have been awarded £970,700 from this year's air quality DEFRA grant to help support the expansion of Oxford's Zero Emission Zone – link to press release;

9) March 2022 – Oxfordshire County Council has decided to extend Oxford's e-scooter trial to November 2022. There are currently 656 trial Voi e-scooters available for hire in the city, which have taken nearly 210,000 journeys and travelled more than 310,000 miles to date. These trips have saved approximately 130 tonnes of carbon emissions – link to press release;
10) March 2022 - Oxfordshire County Council secured £71,000 of funding to expand the number of electric cargo (e-cargo) bikes used to deliver goods in an ultra-low emission way across Oxford. The county council was one of 14 local authorities to secure investment from the government's e-cargo bike fund and will use the money to finance the ECO bike (Electric Cargo Oxford) project, managed by local cargo bike courier service Pedal & Post –link to press release;
11) April 2022 – As part of the Go Ultra Low Oxford (GULO) project, Oxford City Council installed 70 EV chargers in the city – these are a mix of on-street slow, fast chargers and Taxi/public rapid (50Kw) chargers. During 2021, 23 GUL-e cable gullies were installed for use for home charging which were part of a County-wide innovation project. In April 2022 - A County-wide bid for the 1st Phase of the Local EV Infrastructure (LEVI) funding was submitted by Oxford City and Oxfordshire County Councils, for a mix of EV GULe and Hub solutions. The bid outcomes will be released in July/Aug 2022 and delivery is expected (if successful) by the end of financial year 2024 – link to press release;
12) April 2022 - Oxford City Council and bus operators finalised delivery of the £2.3 million Clean Bus Technology Fund project for the retrofitting of three 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;
13) May 2022 – Oxfordshire County Council announced a six month trial of three low traffic neighbourhoods (LTNs) in Oxford, covering Divinity Road, St Clements, and St Mary's areas. An LTN is an area where motorised traffic is prevented from taking shortcuts through a residential area by means of traffic filters. The trial will last for at least six months as part of an experimental traffic regulation order (ETRO). In 2021 LTNs were already trialled in Cowley as a mechanism for reducing traffic - their air quality impacts will be reported by Oxfordshire County Council by September 2022. – link to press release;
14) May 2022 – Oxford City Council progressed to phase 2 of the delivery of the new air quality website for Oxfordshire. This is a DEFRA air quality grant project worth £162,500 with the aim of raising awareness of air pollution across Oxfordshire,

working in partnership with neighbouring district councils. Phase 1 of the project was delivered in December 2021 and included a public consultation, and a series of phone interviews targeted at specific groups to understand the public wants and needs from the new website (social research element) – link to press release;

15) May 2022 – Oxford City Council has made significant progress with the delivery of Oxford Super Hub, a project to install an EV Charging Super Hub at Redbridge Park and Ride. Installation commenced in July 2020 of the world's largest hybrid battery and private wire which is supporting a 42 Charge point Super hub at Redbridge Park and Ride. The site will open to the public in June 2022 and it is estimated to save 10,000 tonnes of carbon dioxide emissions in its first year. This is the equivalent of taking 2,000 petrol or diesel cars off the road, rising to 25,000 tonnes per year by 2032 - link to press release;

16) May 2022 – Oxford City Council and Oxford Direct Services (ODS) jointly operate a fleet of electric vehicles including 21 cars, 30 vans and 8 specialist EVs (including sweepers, a digger and a refuse collection vehicle). Other EV vehicles are on order and if they are delivered in time, Oxford City Council will see 27% of their fleet being fully electric by March 2023 – This is ahead of the City Council's original AQAP commitment of having 25% of its fleet fully electric by the end of 2023.

Photo description: Examples of some of the EVs within ODS fleet.

Conclusions and Priorities

Oxford's 2021 air quality monitoring results show the following:

- Air quality was monitored at 88 sites across the city in 2021. Of those, 20 locations were new monitoring sites and the remaining 68 sites were sites where air quality had been monitored in the previous year;
- NO_2 levels in the city increased by 14% (on average), when compared with the previous monitoring year of 2020, following what was the UK's national trend[14] for this pollutant. The increased seen is largely a result of Covid lockdowns coming to an end and traffic levels increasing. However, despites this increase, NO_2 levels on average remain 17% below the ones obtained in 2019 which represents the last pre-pandemic year;
- No exceedances to the short and long term NO_2 UK limit values were registered at any of the 88 locations where this pollutant was monitored; and only 10 of those locations showed to be above the city's own local annual mean target for this pollutant - a value of 30 µg/m^3, which is expected to be achieved across the city by 2025;
- The monitoring location with the highest annual mean for NO_2 in 2021 continues to be DT55 - St. Clements Street/The Plain - with a value of 39 µg/m^3 - only 1 µg/m^3 below the UK's annual mean limit value for this pollutant.
- Annual mean PM_{10} levels remained at 11 µg/m^3 at AURN St Ebbes, and saw a minor reduction of 2µg/m^3 at Oxford High Street where the annual mean in 2021 was 14 µg/m^3. Both values are well within compliance with the UK's annual mean limit value of 40 µg/m^3, and with the 15 µg/m^3 guideline value recommended by the recently published WHO guidelines, for this pollutant.
- Annual mean $PM_{2.5}$ levels were of 7 µg/m^3, which is the same value measured in 2020 and represents the lowest consecutive measured value since $PM_{2.5}$ monitoring began in 2011. This value is in compliance with the UK's annual mean target value of 25 µg/m^3, and only slightly above the 5 µg/m^3 guideline value recommended by the recently published WHO guidelines, for this pollutant.
- Levels exceeded the AQS daily objective 60 times over a total of 12 days during the year. This represents a significant decrease in the number of exceedances (92 fewer) and days (14 fewer), when compared with 2020. However, despites the clear improvements observed, Oxford has not met the AQ objectives for this pollutant in 2021. Peak O_3 episodes are strongly linked to typical summer weather conditions

14 Please refer to Figure 26 on Appendix F: UK's Annual Mean Concentrations of NO_2 in the UK (1990-2021).

(high temperatures and stagnant high pressure systems). This makes O_3 an area wide pollutant, where a single monitoring site may represent the ozone concentrations that hundreds of thousands of people have been exposed to). For this reason, local measures alone are not enough to tackle the problem and actions at different levels of governance (i.e. regionally and internationally) are required;

- Over the last 2 years we have increased air quality monitoring in areas of the city with the highest levels of social deprivation such as the Rose Hill and Black Bird Leys in order to better understand any inequality linked to air pollution. The monitoring results show that annual mean NO_2 levels in those areas were within the range 18-20 µg/m^3. These figures are well below the UK's annual mean limit value of 40 µg/m^3 and even of Oxford's annual mean target for this pollutant (30 µg/m^3) which is positive. Whilst nationally, levels of air pollution are often higher in areas of deprivation, this same pattern is not seen in Oxford, mainly due to the majority of these areas being located away from high levels of traffic. However, this does not mean that air pollution does not disproportionally impact some of the most vulnerable members of our community, such as those from minority backgrounds, the young, old and those experiencing health issues.

Oxford City Council's priorities for the next reporting year are well defined. We will continue our partnership work with Oxfordshire County Council to progress the delivery of the transport and air pollution management schemes which we have already committed to: The implementation of traffic filters on some key routes, the introduction of a Workplace Parking Levy for employers with more than 10 parking places for their workforce, and the expansion of our current Zero Emission Zone. Collectively these are known as the "*Core Transport Proposals"* for Oxford.

Overall, during the course of the next reporting year, Oxford City Council and its partners will continue to progress delivery of the air quality measures committed to in on our recent Air Quality Action Plan 2021-2025.

Local engagement and how to get involved

One key to changing the current threat of air pollution is educating the communities most impacted by it, providing them with the knowledge that allows them to make informed choices on how they can reduce their personal exposure to air pollution, and how they can contribute to the reduction of air pollution levels in the city.

Oxford City Council has taken significant action in recent years in raising air quality awareness in our communities and in primary schools, with several projects being delivered with that purpose, such as an air quality anti-idling campaign, banner competition and STOP, and others currently planned; such as the launch of a city-wide awareness raising campaign on the negative impacts of wood burning and the launch of a new air quality website for Oxfordshire. Oxford City Council's communication team regularly publishes press releases and social media contents which relate with air quality news and projects that are being delivered in the city in order to raise awareness. We seek to ensure that the implementation of any major air quality management scheme in the city provides the public with opportunity to have their say and contribute with their own ideas and suggestions.

However, air pollution is not a problem that the City Council and its partners can solve alone - 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. Some of the questions to ask ourselves are:

- Do I burn inappropriate fuels or use inappropriate appliances at home?
- Do I take the car when I could have cycled or used public transport?
- Do I drive my children to school when I 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 of wellbeing of all those who live, work and visit Oxford.

Do you want to get involved?

- If you are a science teacher or responsible for running an environment club at your primary school, please have a look at our Air Quality Toolkit with contains a series of interesting scientific air quality activities, (linked with the national curricula), and which promote understanding of the causes and impacts of air pollution and aims to reduce children's exposure to air pollutants, within the school and through their travel;
- If you are have concerns about idling, please have a look at the design resources that Oxford City Council has made available to the general public, and which you can download and use to run anti-idling campaigns in your local area;
- Look out within your local communities for active groups which have specific interest in air quality matters;

- You can also contact Oxford City Council's air quality team directly at any time for any air quality related matter via the following email: airquality@oxford.gov.uk;

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 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 on the city council's website: https://www.oxford.gov.uk/info/20052/air_quality.

Local Responsibilities and Commitment

This ASR was prepared by members of the Environmental Sustainability Team of Oxford City Council with the support of Oxfordshire County Council colleagues. This ASR has been approved by:

Cllr Imogen Thomas

(Oxford City Council's Cabinet Member for Zero Carbon Oxford and Climate Justice)

Rosie Rowe

(Healthy Place Shaping Lead for Oxfordshire with the responsibility within the Public Health Team for Air Quality).

This ASR has not been signed off by a Director of Public Health. If you have any comments on this ASR please send them to the Environmental Sustainability Team at:

St Aldate's Chambers - 109 St Aldate's Oxford - OX1 1DS

01865 249811 or email us at: airquality@oxford.gov.uk

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1 Local Air Quality Management

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

The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where an exceedance is considered likely the local authority must declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan 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 and its partners to improve air quality and any progress that has been made.

The statutory air quality objectives applicable to LAQM in England are presented in Table 17.

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 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 1. The table presents a description of the AQMA that is currently designated within Oxford City Council. The Appendix D provides maps of the city's AQMA and of the air quality monitoring locations in relation to the AQMA. The air quality objectives pertinent to the current AQMA designation are as follows:

- NO_2 annual mean;
- NO_2 hourly mean.

Table 1 – Declared Air Quality Management Areas

AQMA Name	Date of Declaration	Pollutants and Air Quality Objectives	One Line Description	Is air quality in the AQMA influenced by roads controlled by National Highways?	Level of Exceedance: Declaration	Level of Exceedance: Current Year	Name and Date of AQAP Publication	Web Link to AQAP
The city of Oxford	Declared 2010	NO_2 annual and hourly mean	The whole of the administrative area of Oxford City Council	YES	78µg/m^3	39µg/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.**

Progress and Impact of Measures to address Air Quality in Oxford

Defra's appraisal of last year's ASR concluded that the report was very well written, structured, with enough level of detail and had provided all the information specified in the Guidance. No comments were made that needed addressing in time for submission of ASR 2022.

Oxford City Council has taken forward a number of direct measures during the current reporting year of 2021 in pursuit of improving local air quality. A complete list of thirty measures is included in Table 2, together with an update on the progress Oxford City Council and its partners have made during the reporting year of 2021 to deliver them. Where there have been, or continue to be, barriers restricting the implementation of the measure, these are also presented within this Table. More detail on these measures can also 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 can be found in more detail in this report's section "Actions to Improve Air Quality" (pages iv-vii) above.

Oxford City Council and its partners expect the following measures to be completed over the course of the next reporting year:

- 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 District Councils in Oxfordshire;
- To fully deliver a £45,000 DEFRA Air Quality Grant funded project for a city-wide awareness raising campaign, specifically addressing the use of wood burning and inappropriate fuels; highlighting the negative health impacts caused by the use of these energy sources;
- To continue the roll out of EV chargers across the city, as part of the GULO project;
- To progress 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;
- To progress with the development of Zero Emission Zone expansion and of Oxford's Core Transport Scheme proposals, as well as modelling, design and a

comprehensive engagement programme with a wide range of stakeholders and resident groups across the city;

Oxford City Council's priorities for the next reporting year are well defined. We will continue our partnership work with Oxfordshire County Council to progress the delivery of the two transport and air pollution management schemes which we have already committed to: The expansion of our current Zero Emission Zone, and the acceleration of several traffic schemes known as "*Core Transport Proposals*" for Oxford.

Oxford City Council has worked to implement the above actions in partnership with the following stakeholders during 2021:

- Neighbouring local authorities (South and Vale, Cherwell, and West Oxfordshire; District Councils;
- Oxfordshire County Council (The Highways Authority);
- Local Friends of the Earth;
- Canal & River Trust;
- University of Birmingham;
- University of Oxford;
- University of Oxford Brookes;
- Oxford Direct Services;
- Local bus operators;
- Green TV.

Progress of some of the air quality measures in the city's AQAP has been slower than expected in 2021, due to:

- The lack of human resources, which were caused by:
  - Sick leave associated with COVID-19 disease;
  - Team's internal restructuring and maternity cover (which led to officers having to take on additional responsibility);
- The war in Ukraine, the rise in Energy prices and shortage of raw materials;
- Government's lockdown and restrictions of movements which were still in place in early 2021.

The principal challenges and barriers to implementation that Oxford City Council and its partners anticipate facing are:

- Any potential issues still arising from the COVID-19 pandemic (future lockdowns and restrictions of movement);
- The war in Ukraine leading to supply issues;
- Cost of living crisis due to raising energy, food and commodity prices.

Table 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	Not progressed in 2021	Delivery of most of schools events and activities planned throughout 2021 had to be put on hold due to the COVID Pandemic and self-isolation rules
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	Implementation	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	The 2021 event took place at Said Business school in Oxford in September 2021 and was organised by Oxford City Council and Green TV Next EV Summit is scheduled for 18th-19th October 2022. The event will be relocated to London.
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/Innovation Teams)	Several types of funding possible (Innovate UK, DEFRA AQ Grant, UKRI)	NO	Partially funded	Not estimated (Successful bids and projects will be added on a regular basis)	Implementation	Not directly applicable – NOx reduction not estimated	Total amount of partnerships created; amount of AQ/health studies delivered	Implementation on-going	Oxford City and County Councils continue to be an active partners of the Transition Clean air Network, undertaking innovative research to address emerging indoor/outdoor air quality challenges across UK surface transport The network has already contributed to the delivery of several air quality research projects such as: 3D Modelling of Pollutant Dispersion and Exposure around Bus Stop Shelters, a project delivered by Oxford Brookes Oxford City and County Councils are also partners of OxAria - a Natural Environmental Research Council funded collaboration between the University of Birmingham and University of Oxford. Research papers developed with the input of Oxford City and Oxfordshire County councils include: Impacts of emergency health protection measures upon air quality, traffic and public health: evidence from Oxford, UK (published) Impacts of COVID-19 lockdown on traffic flow, active travel and gaseous pollutant concentrations; implications for future emissions control measures in Oxford, UK (currently under review) The impact of COVID-19 public health restrictions on particulate matter pollution measured by a validated low-cost sensor network in Oxford, UK (To be submitted)
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	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	Implementation on-going	Engagement with NHS professionals and public health has started during phase 1 of the Oxfordshire air quality website – a series of phone interviews were conducted to NHS professionals and public health colleagues as part of the social user research to inform the type of tools that would be useful to see included in the website

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															Engagement with NHS professionals will continue throughout the development of the website, and we also anticipate to be organising meetings and workshops to explain the new tools and functionalities of the website and how they can be useful to COPD patients.
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	Q1 2023	Oxford City Council + all other DCs in Oxfordshire + Oxfordshire County Council	DEFRA AQ Grant	YES	Fully Funded	£162,500	Implementation	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) Starting Phase 2 (May 2022)	Phase 1 of the project was delivered in 2021 and involved the conduction of a city council public consultation, and a series of phone interviews targeted at specific groups to gain insight into the needs of the public the social research element to inform the development of the new air quality website
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 has published its Urban Forest Strategy in November 2021	Defra acknowledges that vegetation can help to reduce air pollution in cities. However, they state this is primarily by affecting how these pollutants are dispersed and not by the removal of pollution. The delivery of the Urban Forest Strategy for Oxford, is likely to bring opportunities for the use of vegetation as air quality buffer which will contribute to a reduction of human exposure to air pollution.
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 to reduce burning of inappropriate fuel	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	Campaign materials have been developed and the campaign was expected to be launched in early 2022 Unfortunately, given what is happening in Ukraine and the fast rise in energy prices as a consequence, it was decided that it was not the moment to launch this campaign. It is highly likely that many people will decide to stop using/or reduce usage of their gas/electricity heating systems for a while, as they will not be able to afford this rise in prices, and move to wood burners out of necessity as they are cheaper to run Pending understanding of the cost of living crisis, we expect to be launching this campaign in September 2022 – in time for the Winter wood burning season
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	All the 4 District Councils in Oxfordshire together with Oxfordshire County have worked together on a public consultation to obtain that to inform the development of a new air quality website for Oxfordshire – this publication was developed with the specific input of all air quality officers in Oxfordshire and it was widely advertised by the comms teams of all DCs	The Air Quality Officers of all the DCs in Oxfordshire already met regularly to discuss air quality projects and opportunities for future partnership work and will continue to do so in 2022 as and when required
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	On hold	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	Scheme has been on hold since March 2020	Due to ongoing bus industry challenges post Covid-19 and the success of the Oxfordshire ZEBRA bid, this project is likely to be superseded with a shift to zero emission buses.
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	Implementation	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. From January 2022, all Hackney carriage taxi drivers are being required to have at least Euro 4 standard to renew their licence, and are required to have zero-emission capable vehicles if they are to receive a new licence.
11	Delivery of Zero Emission Zone (measures to incentivise zero emission vehicles or	Promoting Low Emission Transport/	Low Emission Zone (LEZ) or Clean Air Zone (CAZ) /	2021	2021-2030	Oxford City Council + Oxfordshire County Council	LAs annual budget, DEFRA AQ Grant and other	YES	Partially Funded	ZEZ Pilot - £267,400 ZEZ - £921,480	Implementation (ZEZ Pilot) Planning (ZEZ expansion)	By 2035 (after full implementation), up to 66% reduction in city-wide transport NOx emissions and of 100%	Behavioural responses, AQ monitoring, ANPR counts	The city centre ZEZ Pilot was finally launched on 28th February 2022. Details of this now active	The pilot will allow both City and County councils to gain useful insights before introducing a larger ZEZ covering most of Oxford city centre next year, subject to further public consultation.

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	place restrictions on other vehicles in Oxford)	Traffic Management	Road User Charging (RUC)/ Congestion charging				sources of funding					transport NOx emissions in the city centre are expected		scheme can be found here Oxford City and Oxfordshire County councils have also been awarded in March 2022 £970,700 from this year's air quality DEFRA grant to help support the expansion of Oxford's Zero Emission Zone	
12	Increase the amount of EV charging infrastructure in the City	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emissio 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	Implementation	NOx reduction not estimated	Number of EV Chargers Installed	Delivery in Progress Currently under the GULO project Oxford City Council has installed 70 chargers – these are a mix of on-street slow, fast chargers and Taxi/public rapid (50Kw) chargers. During 2021, 23 GUL-e able gullies installed for use for home charging which were part of a County-wide innovation project. In April 2022 - A County-wide bid for the 1st Phase of the Local EV Infrastructure (LEVI) funding was submitted for a mix of EV GULe and Hub solutions. The bid outcomes will be released in July/Aug 2022 and delivery is expected (if successful) by End of FY 2024	A map of all EV charging point locations in Oxford can be found here The EST case study for the Gul-e project 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	Implementation	NOx reduction not estimated	Number of Electric vehicles purchased	Delivery in Progress Oxford City Council and ODS together operates a fleet of 21 cars, 30 vans and 8 specialist EVs.	If all the EV vehicles that have been ordered arrive in time, by March 2023 Oxford City Council would have reached 27% electrification of their fleet
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	Implementation	NOx reduction not estimated	Publication of EV strategy and adoption of Strategy by all District Councils	Oxfordshire EV Infrastructure Strategy (OEVIS) was adopted and published in March 2021 by Oxfordshire County Council, Cherwell DC, South Oxon DC, Vale of Wite Horse DC and West Oxfordshire DC. Oxford City Council has not yet adopted the OEVIS, as it was decided that it was more appropriate to create a city-focussed specific EV Strategy for Oxford	Oxford City is in the process of creating a city-focussed Electric Vehicle Infrastructure Strategy which will complement the already published Oxfordshire EV Infrastructure Strategy The Oxford City EV Infrastructure Strategy goes to Oxford City Council's Cabinet in July 2022
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	Department for Transport + Oxfordshire County Council + local bus operators	Zero Emissions Buses Regional Area (ZEBRA) scheme: £32.8m Bus operators: £43.7m Oxfordshire CC: £6m	NO	Partly funded	No specific scheme estimate for complete electrification. ZEBRA: £82.5m	Planning	Up to 32% of the city's total road NOx emissions (Ricardo's Source Apportionment Study)	% of bus fleet ZEV	DfT funding awarded March 2022. Preparatory work underway (bus operators leading)	Final decision to proceed linked to Core Transport Schemes (measure no. 24)
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 Emissio Vehicles, EV recharging	2021	2022	Oxford City Council + Partners	Innovate UK	NO	Fully Funded	£41 million	Completed	10,000 tonnes of CO2 per year saving by 2021, rising to 25,000 tonnes per year by 2032 + up to 22% reduction of NO2 emissions from transport by 2032	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 and private wire. The private wire is supporting a 42 Charge point Super hub at Redbridge Park and Ride. There are 3 charge point operators, Tesla &	All relevant updates can be found at the ESO website here

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	for more than 300 homes)		Replacement of combustion sources											Fastened (providing rapid charging) and Gamma Energy (AC charging). The site will open to the public in June '22.	
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	Implementation	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 in delivery through Oxford's new Local Plan (2016-2036). 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 Emissio Vehicles, EV recharging, Replacement of combustion sources	2021	2025	Oxford City Council + Oxfordshire County 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	A Feasibility study has been commissioned by Oxfordshire County Council Study, supported by Transport Innovation grant Fund (TRIG) that is looking at the Electrification of the Oxford Canal between Oxford and Banbury. This study will be delivered in September 2022	Funding required Looking for opportunities for air quality grant submissions that could help delivering this measure
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	Implementation	NOx and PM reductions not estimated	Number of boiler upgrades, insulations and high efficiency storage heaters installed per year	Implementation on-going	In 2021, we had : 51 tariff advices given 18 Loft top ups 5 Heating programmes adjusted 36 Warm Home Discount Applications Traditional Storage Heaters to Gas Central Heating 16 Water help applications, etc.
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	Implementation	NOx and PM reductions not estimated	Total amount of home visits and of energy savings per year	A total of 570 House visits were made in 2021/2022, with 1835 recommendations made. This work represented a total of £67,237 of energy savings delivered	The team is made up of two energy advice officers (1 full-time, 1 part-time) plus a part-time admin support officer. In the year 2021-2022 the team was operating with one full time EA Officer for a period of 4 months – this was due to the gap between the departure of the part-time EAO and the start of a new member of the team. The project costs (including NI & pension contributions) are normally around £80,000 a year
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	Implementation	NOx and PM reductions not estimated	Total amount of households being granted with energy efficiency improvements	Implementation on-going During the period April 21 to March 22, a total of 335 Oxford households struggling to pay their bills received home energy advice. 41 home energy efficiency measures were installed (ECOFlex and LAD1b) with estimated value of works of c.£150k).	It's been an incredibly difficult year to offer energy advice: as a result of the energy crisis we still cannot offer switching advice. Furthermore, a lot of our referral schemes (LEAP & ECHO) had to close early in January due to a lack of funding and increased demand for their services. Our installers also ran out of ECO funding in January for large energy saving measures and we are now waiting for ECO4 funding to become available.
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	Internal conversations will occur in June 2022 with several internal enforcement teams to discuss the implications of the new Environment Act The amendments to Smoke Control Area enforcement under the Environment Act 2021 came into effect on 1st May	The Government's new Environment Act 2021 was formally approved by parliament in November 2021. With it, new changes were made to SCA legislation. In particular: The introduction of financial penalties to those emitting substantial amounts of smoke from their chimney in a SCA. The introduction of abatement notices for smoke emissions that are harmful to human health or a nuisance in a SCA. The requirement for LAs to check that solid fuel retailers are notifying potential customers that it is illegal to buy unauthorised fuel for use in a SCA unless used in an exempt appliance. Moored vessels such as canal boats can now be brought into scope of SCAs, but

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															only after a public consultation on the matter has been carried out
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	Implementation	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 and Planning System	
24	Delivery of Oxford Core Transport Schemes (explore opportunities for implementation of Workplace Paring levy + introduction of Traffic Filters)	Traffic Management	Workplace Parking Levy/ Traffic Filters	2021	2023-2024	Oxford City Council + Oxfordshire County Council	LAs own budgets, Bus Service Improvement Plan (BSIP), future income raised by the WPL	NO	Partially funded	£5-8m (excludes funding for complimentary bus and walking and cycling improvements)	Planning	NOx and PM reductions not estimated	Traffic counts, numbers of people travelling by bus, cycling, or walking, number of businesses enrolled, enforcement stats. Reduction of NOx, PM_{10} and $PM_{2.5}$ concentrations	All relevant updates can be found at the Oxford core transport schemes webpage	The core transport schemes are currently being developed and assessed ahead of public consultation planned later in 2022. Before that, extensive engagement with businesses and other organisations is being carried out.
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	DfT Active Tranche 2 & Growth Deal	NO	Fully funded	£44m approx. for sustainable transport schemes on three Oxford radial routes and other locations	Implementation	NOx and PM reductions not estimated	Local cycling and walking infrastructure plans (LCWIP) 50% increase by 2030 (Active Lives Survey)	Under tranche 2 funding, Oxfordshire County are delivering the LCWIP scheme. Quickway schemes along in (OXR B) Donnington Bridge Road, (OXR 17) Rose Hill-Iffley Road, (OXR 14) Oxford Road-Cowley Road, (OXR 7) Marston Road and St Clements. These include continuous cycle lanes and 20 mph speed limits Quietway schemes via Cowley LTN and East Oxford LTN (OXR 16) from Cowley Road Littlemore – Rymers Lane, plus E2, E3, E4, E5, E6, E7 – these are low traffic roads and 2 way on Magdalen Road and Howard St Quietway scheme E9 Boundary Brook Way – path widening and resurfacing	Further improvements expected to be rolled out within the next few months/years, following the recommendations of the 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 Council in late 2020
26	Roll-out of Controlled Parking Zones (CPZ) and Low Traffic Neighbourhoods (LTN)	Traffic Management	Traffic reduction	2021	2021-2023	Oxfordshire County Council	Department for Transport (Emergency Active Travel Fund); LAs own budget	NO	Fully Funded	£1m approx. for remaining CPZs £311,000 for LTNs	Implementation and Planning	NOx and PM reductions not estimated within 1st Cowley LTNs, but being measured for East Oxford. NOx being measured on boundary routes surrounding LTNs	Implementation of the new CPZs and LTNs	Cowley LTNs rolled out; interim evaluation undertaken on NO_2 in boundary roads, but not within LTNs; final evaluation planned for cabinet in July '22. East Oxford LTNs being planned to be rolled out May '22	Strong public interest in LTNs with polarised opinion, means greater scrutiny and potential delays with future roll-out and making ETROs permanent.
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	Implementation	NOx and PM reductions not estimated	Number of businesses adopting sustainable travel modes	Exploring opportunities (On-going) In March 2022 Oxfordshire County Council has secured £71,000 of funding to expand the number of electric cargo (e-cargo) bikes used to deliver goods in an ultra-low emission way across Oxford. A new trial on the use of e-cargo bikes from covered market traders was put in place in December 2021 – running until June 2022, in partnership with local company Pedal & Post	
28	Explore opportunities for implementation of	Freight and Delivery Management	Freight Consolidation Centre	2021	2025	Oxfordshire County Council +	LAs annual budget, and other	NO	Not funded yet	Not estimated (pending feasibility)	Planning	NOx reduction not estimated	Number of businesses enrolled	Exploring opportunities	Finding an adequate space within the city's outskirts that could be viable for this, lack of funding

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	consolidation centre to address city centre freight emissions					Oxford City Council+ Oxford University	sources of funding							(On-going)	
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	Due to support from the school and parents, three of the pilot schools in Oxford City have sustained the School Street beyond the initial trial period and consultation is due to commence in summer 2022 on making the ETRO's a permanent Traffic Regulation Order enforced by signage and cameras.	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. The school streets trial resulted in increasing active travel to school by 6.3% with 74.7% of pupils feeling safer. Trial schools showed a 6.9% reduction in students being driven to school and 22.1% of parents, residents and teachers who drive reported they were driving less. More information is available at Oxfordshire school streets website here
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	Partially funded	Not estimated	Implementation	NOx reduction not estimated	Number of schools enrolled	Implementation (On-going) From April 2021 to March 2022, a total of 4366 children were trained under the Bikeability programme in Oxford – this number is slightly below expected numbers, but return following lockdown was slow to pick up to expected.	On 9th 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 $PM_{2.5}$ emissions (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, and information on good practice and advice, please visit the Council's air quality page. An interactive map of all the UK's existing Smoke Control Areas (including Oxford) can be found at DEFRA's UK-air website.

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. April 2021), 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 (DCs) in Oxfordshire and for England.

Oxford's performance is, in general, worse when compared with the other DCs in Oxfordshire for these type of indicators, which is not a surprise, given the higher levels of

domestic combustion and traffic in the city when in comparison with the rest of Oxfordshire which is much more rural in nature.

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

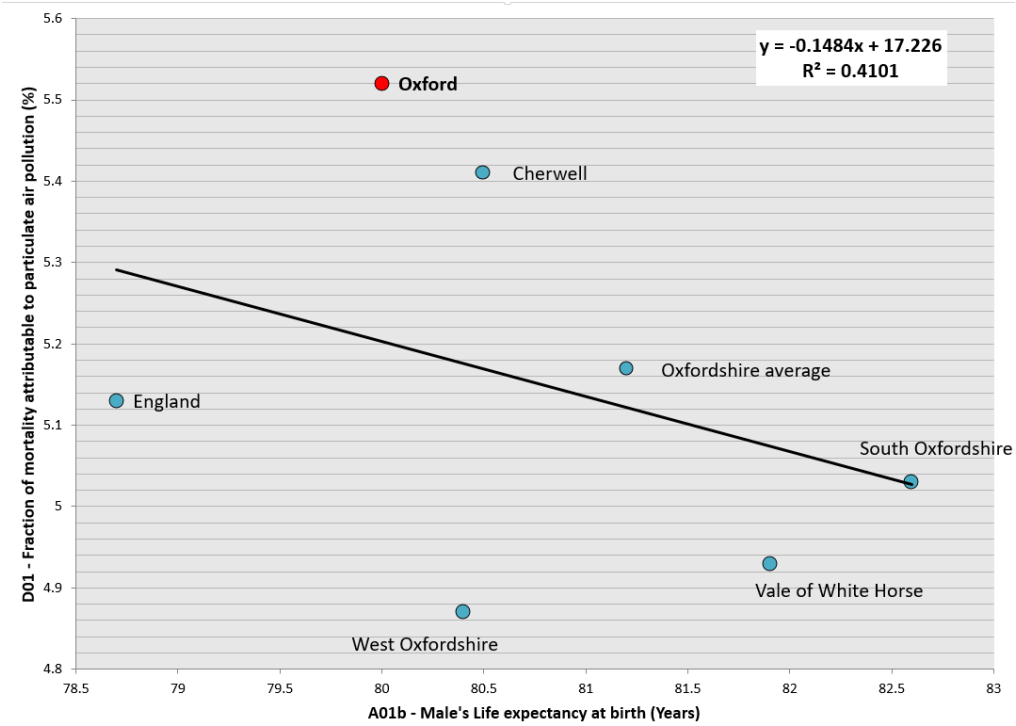
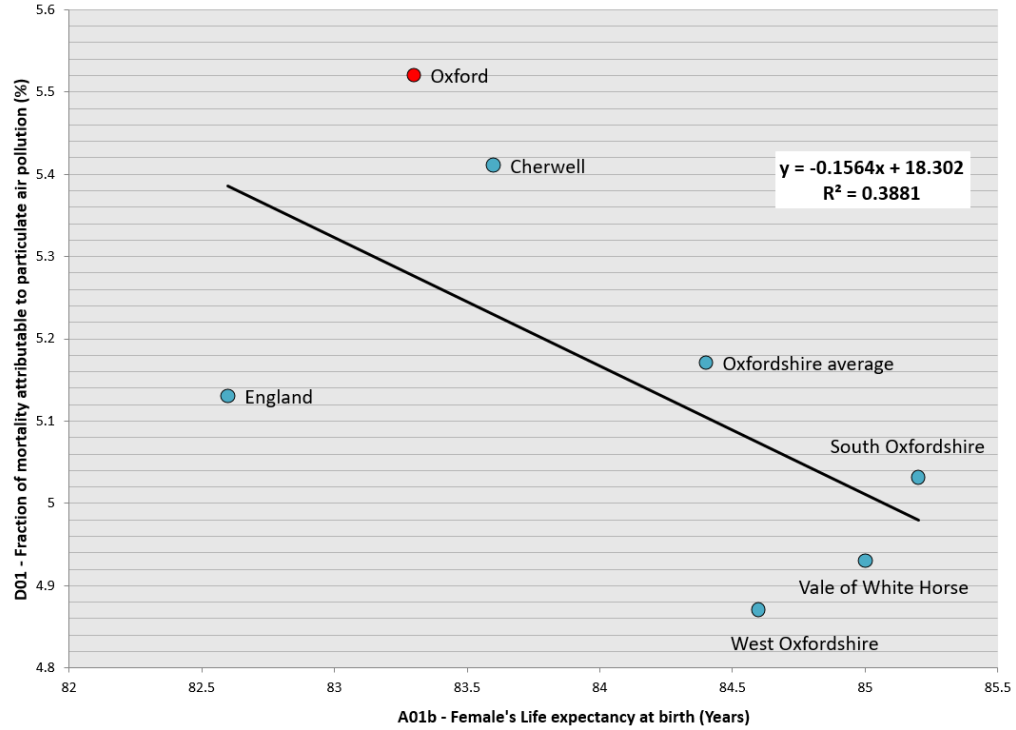


Figure 2 - Relationship between Mortality attributable to $PM_{2.5}$ and Female's life expectancy at birth.



Oxford City Council measures $PM_{2.5}$ at AURN St Ebbes urban background site. In 2021 the annual mean concentration was 7 µg/m^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 will contribute to a reduction of $PM_{2.5}$ emissions in the city.

Measure	Reduces $PM_{2.5}$ emissions
Introducing Ultra Low emission standards for Hackney Carriage Vehicles	☑
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	☑
Increase the amount of EV charging infrastructure in the City	☑
Expansion of City Council's EV Fleet (Electrification of 25% of vehicle fleet by 2023)	☑
Development of an EV Strategy for Oxford City	☑
Work with bus operators on the delivery of ZEBRA (electrification of Oxford's Bus fleet)	☑
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)	☑
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)	☑
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	☑
Review of Smoke Controlled Zones and implementation of revised government legislation for smoke nuisance	☑
Encourage the development of local heat networks	☑
Delivery of sustainable transport measures such as cycling improvements and bus priority lanes	☑

Roll-out of Controlled Parking Zones (CPZ) and Low Traffic Neighbourhoods (LTN)	☑
Work with businesses to explore the inclusion of innovative sustainable travel modes into their current business models	☑
Explore opportunities for implementation of consolidation centre to address city centre freight emissions	☑
Work with schools to reduce exposure to air pollution by reducing the need to travel during drop off/ pick up times (ex: School Streets)	☑
Support Bikeability (free cycling lessons provided to pupils)	☑

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 result in the biggest reduction of air pollution levels in the city:

a) A Zero Emission Zone (ZEZ) in Oxford, to be rolled out in phases. The first phase of which was introduced 2022. The overall aim of this *'journey to zero'* is to largely eliminate transport *'tailpipe'* emissions in Oxford by 2035;

b) Oxford's Core Transport Schemes, 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. As well as the introduction of traffic filters to reduce the number of private cars moving around the city and allowing buses priority;

The Core Transport Schemes aim (amongst other things) to reduce motorised traffic levels; the ZEZ aims to minimise emissions from the traffic that remains, and therefore both are expected to contribute to the reduction of $PM_{2.5}$ emissions.

Oxford City Council have also decided to increase the $PM_{2.5}$ monitoring capacity in the city in 2022, in order to better assess compliance with the UK's future $PM_{2.5}$ targets, which were introduced by the Environment Act 2021, and which are expected to come into force in late 2022. As such, on in May 2022 a new FIDAS instrument was installed at the monitoring roadside site of Oxford High Street site, which allows us to monitor automatic $PM_{2.5}$ at a roadside site for the first time.

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

This section sets out the monitoring undertaken in 2021 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 2017 and 2021 to allow for monitoring trends to be identified and discussed.

Maps showing the locations of the air quality monitoring (continuous and passive) conducted in 2021 and the levels measured can be found in Appendix D. Maps covering current and historic air quality monitoring locations are also provided on the Oxfordshire Air Quality 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 in 2021. Table 4 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 NO_2 at 87 sites in 2021. Table 5 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 NO_2 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 new recommended guideline levels can be found in Appendix E.

3.1.3 Nitrogen Dioxide (NO_2)

Combustion processes emit a mixture of nitrogen oxides – NO and NO_2 - 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 NO_2.

b) NO_2 has a primary (directly emitted) component and a secondary component, formed by oxidation of NO. NO_2 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.

NO_2 has been monitored at three locations in Oxford in 2021 by the use of automatic continuous monitors and at 87 locations using passive monitoring (diffusion tubes).

The annual mean AQ objective for NO_2 is 40 µg/m^3. In 2021, Oxford High Street measured annual mean for NO_2 was 30 µgm^{-3} and AURN Oxford Centre Roadside 33 µg/m^3. At AURN St. Ebbes, the NO_2 annual mean was 11 µg/m^3. This objective was therefore met at all automatic monitoring stations in 2021.

Table 6 in Appendix A compares the ratified and adjusted automatic monitored NO_2 annual mean concentrations for the past five years with the air quality objective of 40µg/m^3. Note that the concentration data presented represents the concentration at the location of the monitoring site, following the application of bias adjustment and annualisation, as required (i.e. the values are exclusive of any consideration of fall-off with distance adjustment).

Figure 3 (below) shows the 17 year long term trend for levels of measured NO_2 at Oxford's three automatic monitoring stations. The results are expressed in µg/m^3.

Figure 26 on Appendix F shows the historic annual mean concentrations of NO_2 in the UK, between 1990 and 2021 for comparison purposes with Figure 3.

Figure 3 - Long term trends of Annual Mean NO_2 ($\mu g/m^3$) at Oxford's continuous monitoring stations, 2004-2021

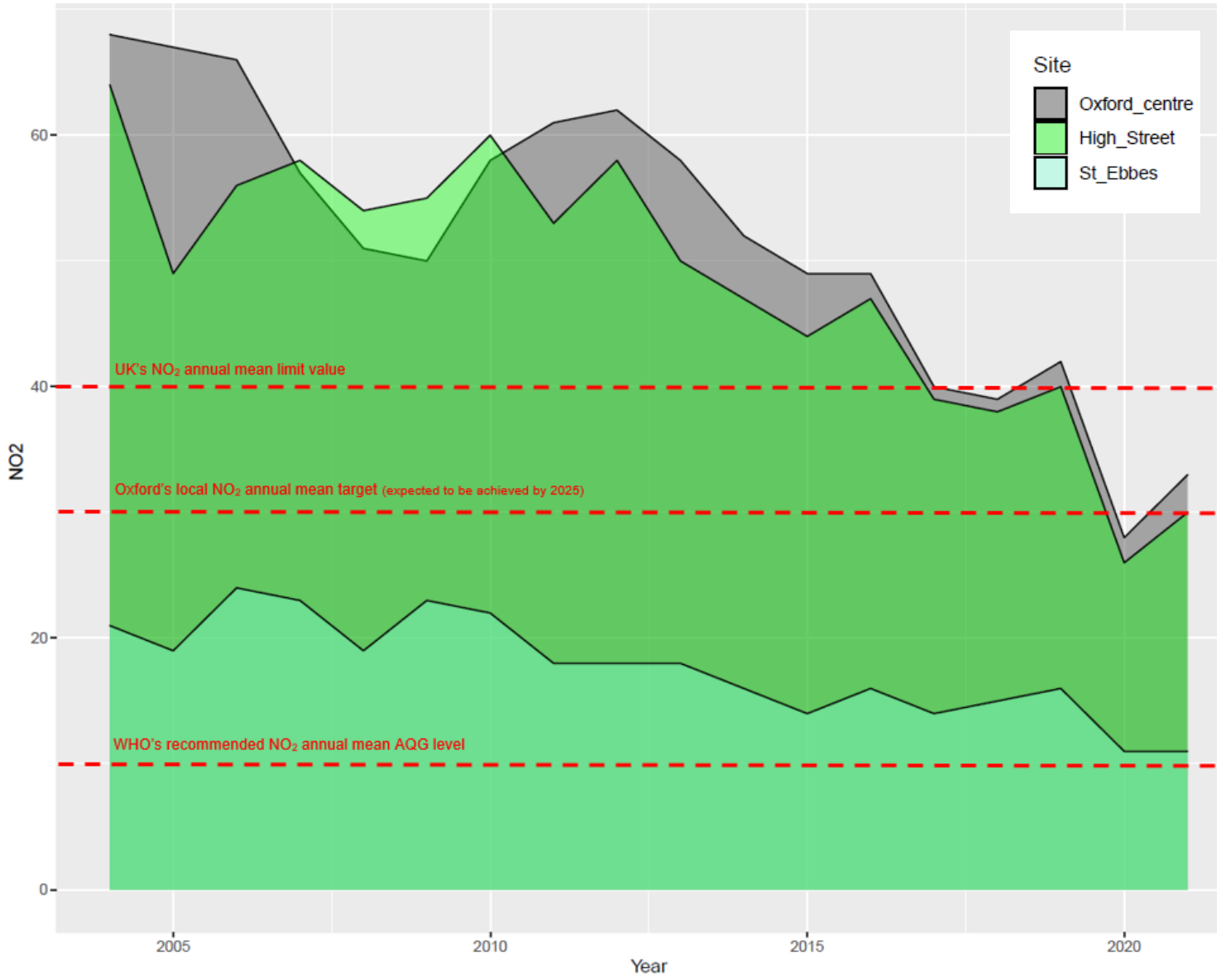


Figure 3 shows that NO_2 levels measured in Oxford at the locations of our automatic monitoring sites have decreased significantly since 2004.

In 2020 we experienced a significant reduction of NO_2 levels at all our automatic monitoring stations. The reasons for these reductions were down to successive restrictions of movements caused by the COVID-19 pandemic, which had a direct effect on the reduction of traffic levels in the city. 2021 was a year characterised by a significant ease of movement restrictions, in favor of economic recovery.

It is therefore with no surprise that 2021 saw an increase of NO_2 concentrations at our 3 automatic stations (11% on average) when compared with the previous year – this increase is in line the UK's national trend for this pollutant in 2021 (Please refer to Figure 26 on Appendix F).

However, it is important to highlight that despite an increase in NO_2 levels in 2021, the levels in 2021 at the three stations are still significantly lower (by 26% on average) than the ones measured in 2019 (the last pre-pandemic year). Significant changes in the way people work, such as the widespread implementation of remote working, coupled with increases in e-commerce and automation are the most likely reasons explaining why we have been able to maintain air pollution at levels below pre-pandemic levels.

For detailed information on time variations, daily means, and basic statistics of NO_2 at Oxford's three automatic monitoring stations please refer to Appendix F.

The AQ objective for hourly mean NO_2 concentration is 200 $\mu g/m^3$, and may be exceeded up to 18 times per calendar year. The time series of hourly averaged concentrations of NO_2 for the 3 automatic monitoring sites is compared against the UK's hourly mean limit value (dashed red line) in Figure 4 below. The results are expressed in $\mu g/m^3$.

Table 8 in Appendix A compares the ratified continuous monitored NO_2 hourly mean concentrations for the past five years with the air quality objective of 200 $\mu g/m^3$, not to be exceeded more than 18 times per year.

Figure 4 - Time series of hourly averaged concentrations of NO_2 (µg/m^3) at automatic monitoring sites, 2021.

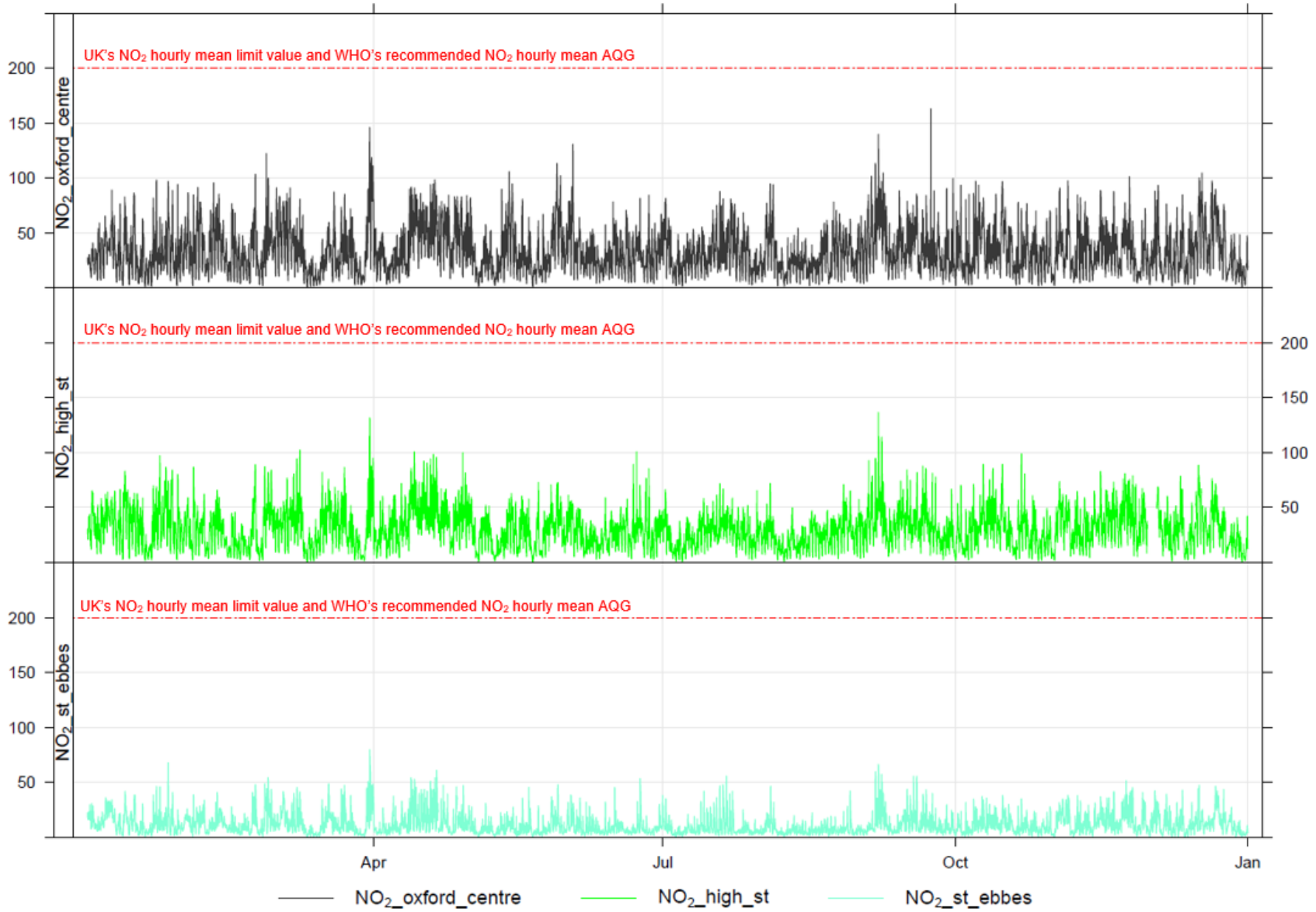


Figure 4 shows that there were no hourly mean NO_2 measurements exceeding 200 µg/m^3 in 2021. The highest hourly mean NO_2 measured was of 163 µg/m^3 and was registered on the 23rd September 07:00 at AURN Oxford Centre Roadside.

The threshold of the *"Moderate"* air quality band as set out by DEFRA for the NO_2 hourly mean ranges from 201 to 400 µgm^{-3}. NO_2 levels at all 3 sites were recorded within the DEFRA *"Low"* band in 2021. As none of the automatic monitoring sites have registered more than 18 exceedances of the AQ hourly objective for NO_2, this objective was therefore fully met at all automatic monitoring sites in 2021.

Non-automatic monitoring using diffusion tubes took place at 87 Oxford locations in 2021. Approximately half of this number was exposed within central Oxford, at locations where we believe relevant exposure is most likely. The remaining tubes were used outside of the central area, again prioritising locations where relevant exposure is most likely. All the 2021 diffusion tube monitoring locations are within the existing AQMA. The main observations of the monitoring carried out in 2021 using non-automatic monitoring are as follow:

- 87 locations in the city of Oxford formed part of the air quality diffusion tube monitoring network in 2021. Of those, 20 locations correspond to new monitoring sites and the remaining 67 sites were sites where air quality had been monitored in the previous year;
- The monitoring results obtained in 2021 show that for the second consecutive year, the annual mean AQ objective of 40 µg/m^3 for NO_2 specified by DEFRA was not exceeded at any monitoring location in the city;
- For the fifth consecutive year, none of the city's NO_2 diffusion tube monitoring sites presented an annual mean NO_2 equal or above 60 µg/m^3. According to LAQM (TG16), this is an indication that exceedances of the hourly mean objective for NO_2 are also not likely to have occurred in the city in 2021;
- In 2021, NO_2 levels increased on average by 14% at all the diffusion tube monitoring sites where air quality had been monitored in the previous year. This was due to an initial ease and then (later in the year) complete lift of all movement restrictions

associated with the Covid 19 pandemic. This led to an increase of traffic levels[15] in the city, which in turn led to an increase in air pollution levels.

- Despites the 14% increase in average NO_2 levels in the city in 2021, current levels are still 17% lower (on average) when compared with the year 2019 (the last pre-pandemic year);
- From the 87 locations where NO_2 levels were monitored using diffusion tubes, only 10 were shown to be above Oxford's local annual mean target of 30 µg/m^3 for NO_2 (a commitment laid out in the city's recent AQAP, and which is expected to be achieved across the city by 2025). Those locations are: Cutteslowe Round abound; St Aldates; High Street (2x); Long Wall St; St Clements; Speedwell St (corner with St Aldates); Hollow Way Rd; Wolvercote Roundabound; and Garsignton Road (approaching Eastern bypass);
- 2021 was the fourth full year of air quality monitoring around the Westgate shopping centre. In total, air quality was measured at 8 locations. None of the previous historic monitoring at these locations has ever shown any exceedances of the annual mean NO_2. In 2021, all these sites have continued to show clear compliance with the UK annual mean limit value as well as with the city's local annual mean target for this pollutant;
- The monitoring location with the highest annual mean for NO_2 in 2021 was DT55 - St. Clements Street/The Plain - with a value of 39 µg/m^3, immediately followed by DT56 High Street (close to intersection with Oriel St) with 38 µg/m^3;
- All 20 new diffusion tube locations that were monitored in 2021 showed annual means of NO_2 far below Oxford's local target of 30 µg/m^3- 16 µg/m^3 was the annual mean average for all these sites, with the exception of DT91 - Garsington Rd (Premier Place), which had an annual mean of 36 µg/m^3;
- Air quality monitors located in areas with a high index of social deprivation such as Rose Hill and Black Bird Leys, show that annual mean NO_2 levels in those areas were within the range 18-20 µg/m^3. These figures are well below the UK's annual

15 According to Oxfordshire County Council, there was a 14% increase in the Annual Average Daily Traffic (AADT) levels in Oxford from 2020 to 2021.

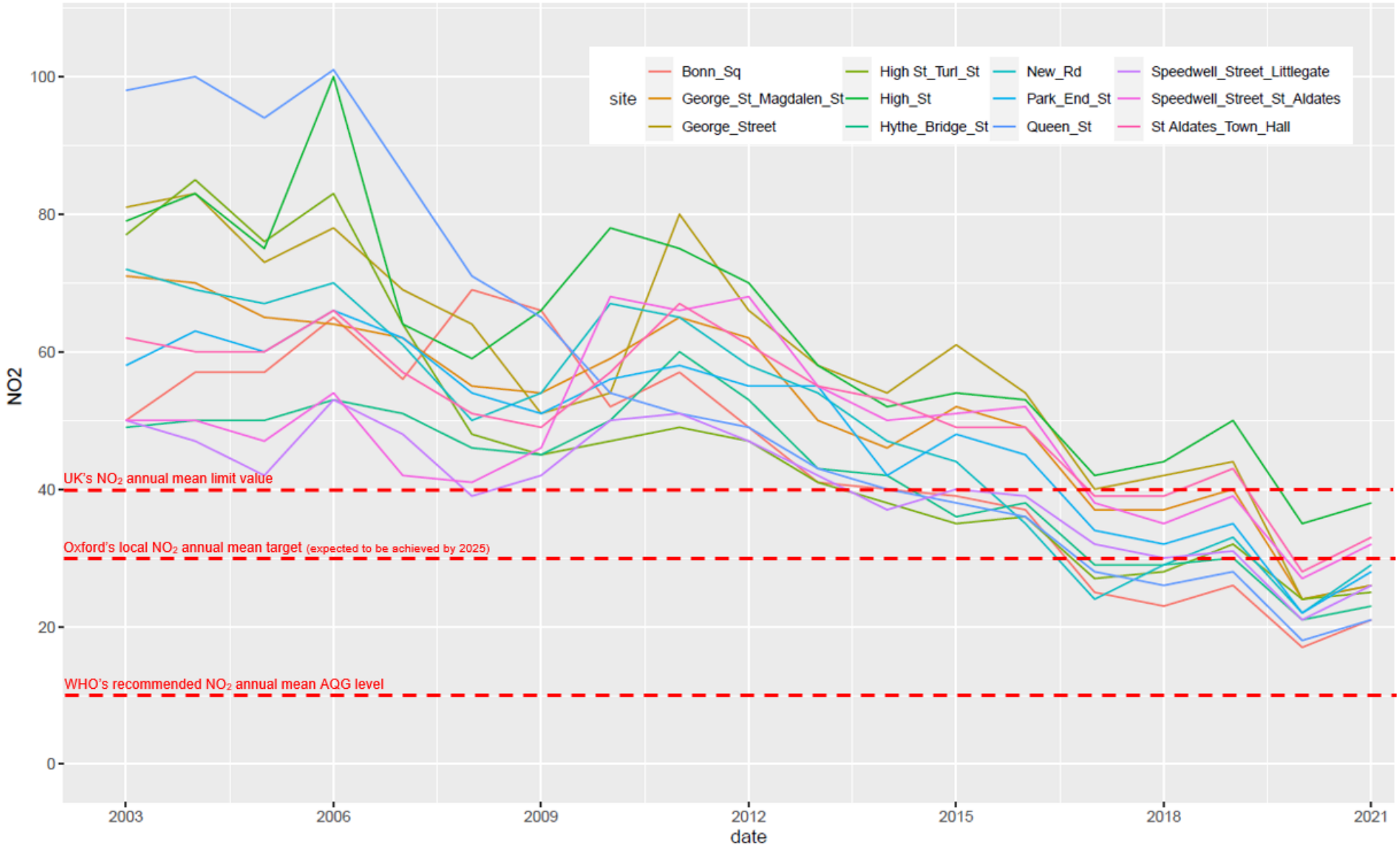
mean limit value of 40 µg/m^3 and of Oxford's annual mean target for this pollutant (30 µg/m^3).

The full 2021 dataset of diffusion tube monthly mean values is provided in Appendix B. Figure 5 below shows the long term trend for levels of measured NO_2 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 historic downward trend in measured levels of NO_2 at most of these locations since monitoring began in 2003. In 2021, we can see the slight increase in NO_2 levels caused by the factors described above.

Overall, and on average, NO_2 levels have increased by 14% at all the diffusion tube monitoring locations in the city in 2021 when compared to 2020, but these results still represent a 17% decrease in levels when compared with pre-pandemic times.

Figure 5 - Long Term Trends in Annual Mean NO_2 ($\mu g/m^3$) at Oxford's diffusion tube monitoring locations, 2003-2021.



3.1.4 Particulate Matter (PM_{10} and $PM_{2.5}$)

Airborne particulate matter varies widely in its physical and chemical composition, source and particle size. The terms PM_{10} 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 2021, PM_{10} data was monitored by automatic continuous monitors at AURN St. Ebbes and Oxford High Street. $PM_{2.5}$ was monitored at AURN St. Ebbes.

The annual mean AQ objective for PM_{10} is 40 µg/m^3. Table 9 in Appendix A compares the ratified and adjusted monitored PM_{10} annual mean concentrations for the past five years with the air quality objective of 40 µg/m^3. In 2021, Oxford High Street registered a PM_{10} annual mean of 14 µgm^{-3}. AURN St. Ebbes of 11 µg/m^3. This objective was therefore fully met in 2021.

The short term AQ objective for PM_{10} is a maximum of 50 µg/m^3 for any 24h mean period, not to be exceeded more than 35 days a year. Table 10 in Appendix A compares the ratified continuous monitored PM_{10} daily mean concentrations for the past five years with the air quality objective of 50 µg/m^3, not to be exceeded more than 35 times per year. The result of PM_{10} measurements in 2021 show no exceedances of the 50 µg/m^3 24h mean on High Street and AURN St Ebbes. The AQ objective for 24-hour mean PM_{10} was therefore fully met at Oxford's High Street and AURN St Ebbes in 2021.

No AQ objective exists for $PM_{2.5}$; however there is a non-mandatory compliance target of 25 µg/m^3 to be met by 2020 for this pollutant. The monitored annual mean of $PM_{2.5}$ was of 7 µg/m^3 at AURN St. Ebbes. Table 11 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 11 year long term trend for levels of measured PM_{10} at continuous monitoring stations in Oxford, along with the current recommended WHO guideline values, which are significantly lower for PM_{10} 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/m^3.

Figure 6 - Long term trends of Annual Mean PM_{10} ($\mu g/m^3$) at Oxford's continuous monitoring stations, 2011-2021.

Figure 7 - Long term trends of Annual Mean $PM_{2.5}$ ($\mu g/m^3$) at Oxford's continuous monitoring stations, 2009-2021.

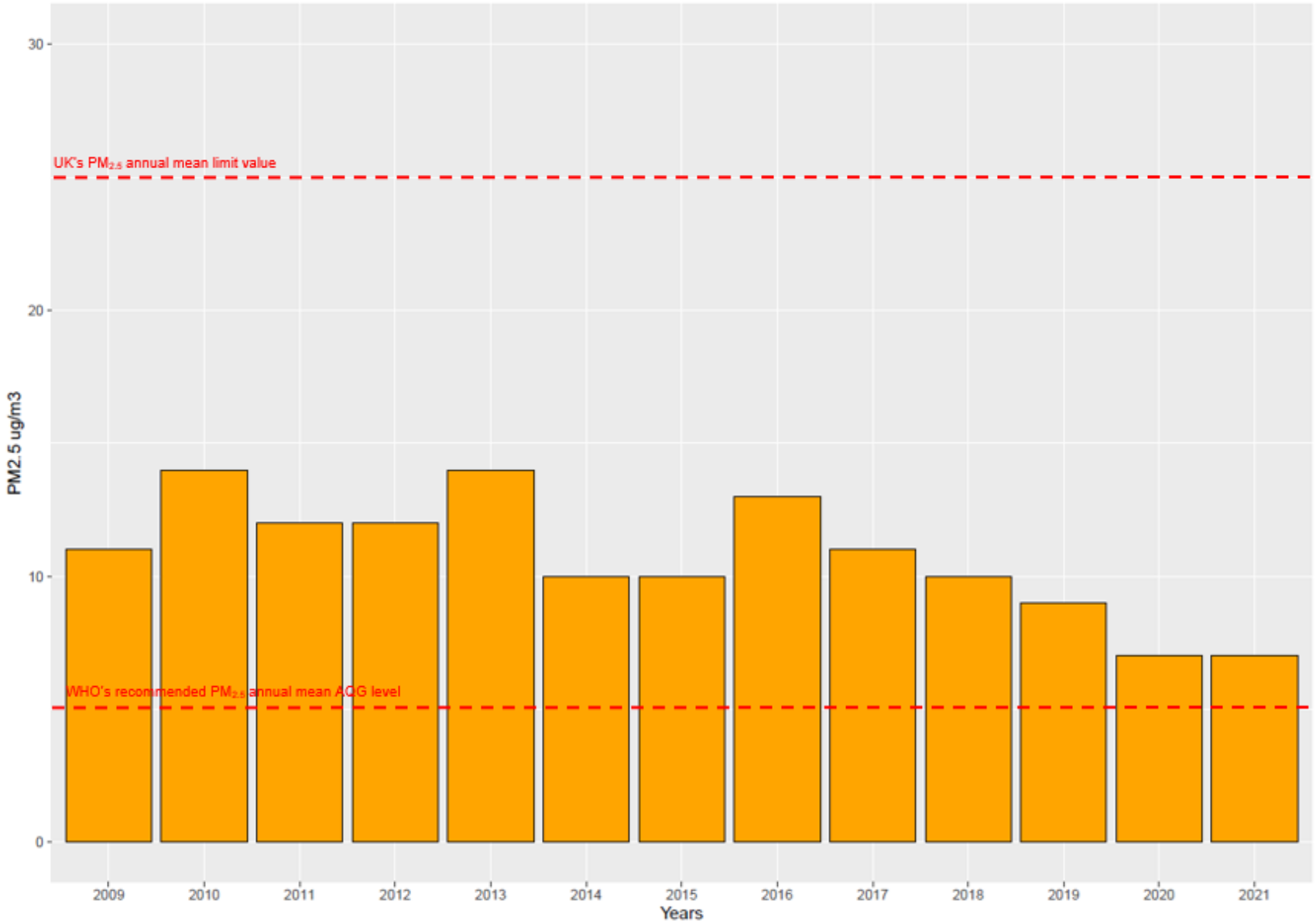


Figure 6 shows that the overall trend of PM_{10} levels that were measured at our 2 automatic monitoring sites has been going downward since 2011, and seem to have stabilised at urban background level in 2021, with only a minor reduction (of 2 µg/m^3) observed at Oxford High street roadside site . Figure 6 also shows that both automatic monitoring sites are in compliance with the annual mean UK limit value for PM_{10} 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%.

Figure 7 shows that in 2021, Oxford AURN St Ebbes registered the lowest consecutive $PM_{2.5}$ annual mean since $PM_{2.5}$ monitoring began at this site in 2011. The annual mean obtained (7 µg/m^3) is in compliance with the annual mean UK limit value and only slightly above the annual mean of the 5 µg/m^3 recommended by the recently published WHO guidelines, for this pollutant. The same plateauing effect that was observed in 2021 for PM_{10} can be seen for $PM_{2.5}$.

According to the city's most recent source apportionment study, road transport only accounts for 10% of total local emissions of PM_{10} and $PM_{2.5}$. Domestic combustion is, by far the largest contributor to PM_{10} and $PM_{2.5}$ emissions in Oxford – this can help explain the reason why the increase in traffic levels observed during 2021 as a result of easing /lifting of imposed movement restrictions due to Covid 19 did not result in any substantial increase in the levels of measured particulate pollution.

3.1.5 Ozone (O_3)

Ozone (O_3) is not emitted directly into the atmosphere in significant quantities, but is a secondary pollutant produced by reaction between nitrogen dioxide (NO_2) and hydrocarbons, in the presence of sunlight. Whereas NO_2 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.

Peak O_3 episodes are strongly linked to typical summer weather conditions (high temperatures, sunny weather and stagnant high pressure systems), giving rise to the so called "*summer smog*". Ozone is an area wide pollutant, and whilst monitoring sites are relatively sparse compared to those monitoring NO_2, they represent wider population exposure, so a single site may represent the ozone concentrations that hundreds of thousands of people have been exposed to. For this reason, local measures alone are not enough to tackle the problem and actions at different levels of governance (i.e. regionally and internationally) are required.

In Oxford, O_3 is measured at AURN St. Ebbes. The AQ 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.

The data capture of O_3 at AURN St. Ebbes in 2021 was of 96.4%. In 2021, this site exceeded the AQ daily objective for ozone 60 times, during a total of 12 days during the year. This represents a significant decrease in the number of exceedances (92 less) and days (14 less), when compared with the results from 2020. Despites the clear improvements observed, AURN St. Ebbes has not met the AQ objectives for this pollutant in 2021.

Appendix A: Monitoring Results

Table 4 – 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	NO_2	YES/Oxford city-wide AQMA	Chemiluminescence	1	3	2.5
CM2	Oxford High Street	Roadside	451677	206272	NO_2;PM_{10}	YES/Oxford city-wide AQMA	Chemiluminescence Gravimetric analysis	1	2	1.5
CM3	AURN St Ebbes	Urban Background	451118	205353	NO_2;PM_{10}; $PM_{2.5}$;O_3	YES/Oxford city-wide AQMA	Chemiluminescence Mass spectrometry UV Absorption	10	2	2.5

Notes:

(1) 0m if the monitoring site is at a location of exposure (e.g. installed on the façade of a residential property).

(2) N/A if not applicable

Table 5 – 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
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

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)
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 3 Summers Place	RS	450389	210189	NO2	YES/Oxford city-wide AQMA	1	2	NO	3
DT27	Wolvercote 78 Sunderland Ave.	RS	449824	210198	NO2	YES/Oxford city-wide AQMA	1	1	NO	3
DT28	Wolvercote 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
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

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)
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
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

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)
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
DT55	St Clements	RS	452326	205992	NO2	YES/Oxford city-wide AQMA	2	0.5	NO	3
DT56	High St.	RS	451576	206232	NO2	YES/Oxford city-wide AQMA	2.5	0.2	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

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)
DT60	New Butterwyke P./ 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
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
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

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)
DT77	St Clements 2	RS	452451	205999	NO2	YES/Oxford city-wide AQMA	0	1	NO	3
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
DT88	St Michaels St	RS	451205	206341	NO2	YES/Oxford city-wide AQMA	0	0.5	NO	2

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? 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)
DT89	Turl St/Market St	RS	451439	206330	NO2	YES/Oxford city-wide AQMA	1	0.5	NO	2
DT90	Rose Hill (Ashhurst Way)	RS	453368	203323	NO2	YES/Oxford city-wide AQMA	7	2	NO	2.5
DT91	Garsington Rd (Premier Place)	RS	455267	203719	NO2	YES/Oxford city-wide AQMA	2	0.5	NO	2
DT92	BB Leys (Cuddesdon Way)	RS	455702	203062	NO2	YES/Oxford city-wide AQMA	6	3	NO	2.5
DT93	Marston Ferry Rd	RS	451363	208785	NO2	YES/Oxford city-wide AQMA	15	1	NO	2.5
LT1	26 Prince St	RS	452786	205860	NO2	YES/Oxford city-wide AQMA	4	0.5	NO	2.5
LT2	1A Woodlands Rd	RS	453927	207068	NO2	YES/Oxford city-wide AQMA	2	0.5	NO	2.5
LT3	47 Quarry Rd	RS	455310	206681	NO2	YES/Oxford city-wide AQMA	4	2	NO	2.5
LT4	138-146 Morrel Av	RS	453575	206037	NO2	YES/Oxford city-wide AQMA	4	2	NO	2.5
LT5	189 Divinity Rd	RS	453576	205938	NO2	YES/Oxford city-wide AQMA	2	1	NO	2.5
LT6	St Christophers school	UB	454473	204588	NO2	YES/Oxford city-wide AQMA	4	3	NO	2.5

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)
LT7	126 The slade	RS	454930	206287	NO2	YES/Oxford city-wide AQMA	3	0.5	NO	2.5
LT8	East Oxford Primary School	UB	452903	205776	NO2	YES/Oxford city-wide AQMA	3	12	NO	2.5
LT9	4 Quarry school	RS	455447	206966	NO2	YES/Oxford city-wide AQMA	4	1	NO	2.5
LT10	23 Gladstone Rd	RS	455243	207170	NO2	YES/Oxford city-wide AQMA	6	1	NO	2.5
LT11	19 Wharton Rd	RS	454918	207054	NO2	YES/Oxford city-wide AQMA	6	2.5	NO	2.5
LT12	Ruskin Hall	RS	454260	207741	NO2	YES/Oxford city-wide AQMA	0	1	NO	2.5
LT13	21 Latimer Rd	RS	454221	206796	NO2	YES/Oxford city-wide AQMA	6	2	NO	2.5
LT14	94 Howard St	RS	453138	204917	NO2	YES/Oxford city-wide AQMA	3	1	NO	2.5
LT15	96 Valentia Rd	RS	454013	206437	NO2	YES/Oxford city-wide AQMA	3	1	NO	2.5
LT16	103-139 Hurst St	RS	452985	205185	NO2	YES/Oxford city-wide AQMA	4	1	NO	2.5

Notes:

(1) 0m if the monitoring site is at a location of exposure (e.g. installed on the façade of a residential property).

(2) N/A if not applicable.

Table 6 – Annual Mean NO_2 Monitoring Results: Automatic Monitoring (µg/m^3)

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2021 (%) (2)	2017	2018	2019	2020	2021
CM1	451359	206157	Roadside	99.7	99.7	40	39	42	28	33
CM2	451677	206272	Roadside	98.8	98.8	39	38	40	26	30
CM3	451118	205353	Urban Background	99.7	99.7	14	15	16	11	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/m^3.

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

All means have been "annualised" as per LAQM.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 7 – Annual Mean NO_2 Monitoring Results: Non-Automatic Monitoring (µg/m^3)

Diffusion Tube ID	Site name	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2021 (%) [2]	2017	2018	2019	2020	2021
DT1	St Ebbe's	451118	205353	UB	100	100	14	15	16	11	11
DT2	Weirs Lne./Abingdon Rd. LP1	451904	204215	RS	100	100	28	27	29	23	25
DT3	LP 52 Abingdon Rd.	451914	204154	RS	100	100	31	29	34	26	27
DT4	Boundary Brook Rd/ Iffley Rd	452961	204662	RS	100	100	28	27	28	23	26
DT5	Lenthall Rd Allotments	452818	203448	UB	100	100	10	14	14	10	11
DT7	Oxford Rd/ Between Towns Rd	454472	204246	RS	100	100	31	28	32	27	30
DT8	Oxford Rd(Cowley) LP13	454355	204296	RS	100	100	29	27	31	24	29
DT14	Windmill Rd. W	454554	207102	RS	100	100	33	32	35	28	30
DT15	London Rd./BHF	454433	207058	RS	100	100	26	25	27	21	23
DT16	Headley Way/London Rd. LP2	453982	206817	RS	100	100	27	25	27	19	22
DT18	The Roundway	455596	207367	RS	100	100	23	26	28	22	24
DT20	Barton Lane LP2	454999	207759	RS	100	100	25	27	28	22	23
DT25	Cuttleslowe Rbout 3 Elsfield Rd.	450419	210256	RS	100	100	35	35	35	26	28
DT26	Cuttleslowe 3 Summers Place	450389	210189	RS	91.6	91.6	**41**	**41**	**40**	31	34
DT27	Wolvercote 78 Sunderland Ave.	449824	210198	RS	100	100	29	29	29	22	22
DT28	Wolvercote 51 Sunderland Ave	449856	210162	RS	100	100	26	27	26	22	24
DT29	Pear Tree P&R N Gateway	449530	210734	RS	100	100	28	25	26	20	21
DT30	Osney Lne/Hollybush Row	450668	206053	RS	100	100	27	28	27	19	22
DT31	Beckett St.	450566	206227	RS	100	100	29	31	32	21	25
DT32	Royal Oxford Hotel	450674	206273	RS	100	100	32	31	32	24	27
DT33	Botley RD/ Mill St	450409	206224	RS	100	100	23	26	24	19	22
DT35	Botley Rd /Hillview Rd	450029	206207	RS	100	100	34	32	34	23	26
DT36	Botley Rd N (Prestwich Place)	449657	206245	RS	100	100	27	27	25	17	19
DT39	St Aldate's	451359	206157	RS	100	100	39	39	**43**	28	33
DT40	Queen St.	451270	206144	RS	83.3	83.3	28	26	28	18	21
DT41	Bonn Square	451216	206133	RS	100	100	25	23	26	17	21
DT42	New Rd.	451073	206191	RS	100	100	24	29	33	22	29
DT43	Park End St.	450885	206275	RS	100	100	34	32	35	22	28
DT44	Hythe Bridge St.	450795	206343	RS	100	100	29	29	30	21	23
DT45	Worcester St.	450942	206424	RS	91.6	91.6	38	37	**40**	26	29
DT46	Beaumont St.	451167	206519	RS	91.6	91.6	31	31	31	20	24
DT47	George St. / Magdalen St.	451222	206387	RS	91.6	91.6	37	37	**40**	24	26
DT48	George St.	450981	206344	RS	83.3	83.3	**40**	**42**	**44**	24	26
DT49	Cornmarket St.	451322	206242	RS	91.6	91.6	23	24	26	18	21

Diffusion Tube ID	Site name	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2021 (%) [2]	2017	2018	2019	2020	2021
DT50	High St. / Turl St.	451467	206222	RS	100	100	27	28	32	24	25
DT51	50 High St.	451900	206250	RS	91.6	91.6	34	33	37	25	35
DT52	Longwall St.	451972	206283	RS	100	100	38	38	**41**	30	34
DT53	Magdalen Bridge	452099	206117	RS	100	100	22	23	23	16	19
DT54	York Place	452325	206015	RS	100	100	23	23	26	18	20
DT55	St Clements	452326	205992	RS	91.6	91.6	**47**	**46**	**53**	36	39
DT56	High St.	451576	206232	RS	91.6	91.6	**42**	**44**	**50**	35	38
DT57	Speedwell St. / St. Aldate's	451407	205807	RS	100	100	38	35	39	27	32
DT58	Folly Bridge	451437	205529	RS	100	100	31	33	34	24	27
DT59	Thames St.	451353	205643	RS	100	100	25	27	26	18	22
DT60	New Butterwyke P./ Thames St.	451248	205710	RS	100	100	29	30	33	22	27
DT61	Friars Wharf	451219	205707	RS	100	100	20	19	20	14	17
DT64	Thames St. / Oxpens Rd.	450887	205825	RS	100	100	25	23	23	15	18
DT65	Speedwell St. / Littlegate	451206	205780	RS	100	100	32	30	31	21	26
DT68	Norfolk St.	451030	205962	RS	100	100	23	24	27	19	24
DT69	Paradise Square	450982	205973	RS	100	100	26	24	26	18	20
DT70	Castle St.	451062	206067	RS	100	100	28	29	29	22	27
DT71	BP City Motors	449617	210216	RS	100	100	**41**	38	**40**	28	28
DT72	Cowley Rd./ James Street	452761	205745	RS	100	100	29	29	31	22	20
DT73	Walton Street LP18	450960	206590	RS	100	100	27	26	24	15	18
DT76	St Gilles	451226	206504	RS	100	100	NM	33	35	23	24
DT77	St Clements 2	452451	205999	RS	91.6	91.6	NM	36	**42**	28	30
DT79	Old Abingdon Rd.	451908	203919	RS	100	100	NM	NM	24	17	20
DT80	Hollow way Road	454651	204270	RS	100	100	NM	NM	37	31	35
DT81	Cowley Rd/ Union Street	452805	205731	RS	83.3	83.3	NM	NM	22	19	30
DT82	Summertown Parade	450806	208978	RS	100	100	NM	NM	27	20	21
DT83	A44 Woodstock Rd.	449681	210263	RS	100	100	NM	NM	**40**	30	32
DT84	226 Botley Rd.	449273	206274	RS	91.6	91.6	NM	NM	27	18	20
DT85	St Clements 3	452625	206068	RS	91.6	91.6	NM	NM	36	26	29
DT86	72 Blackbird Leys	455134	202841	RS	91.6	91.6	NM	NM	NM	16	18
DT87	New Inn Hall St	451164	206246	RS	100	100	NM	NM	NM	15	17
DT88	St Michaels St	451205	206341	RS	100	100	NM	NM	NM	15	17
DT89	Turl St/Market St	451439	206330	RS	83.3	83.3	NM	NM	NM	17	19
DT90	Rose Hill (Ashhurst Way)	453368	203323	RS	91.6	91.6	NM	NM	NM	NM	20
DT91	Garsington Rd (Premier Place)	455267	203719	RS	91.6	91.6	NM	NM	NM	NM	36

Diffusion Tube ID	Site name	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2021 (%) [2]	2017	2018	2019	2020	2021
DT92	BB Leys (Cuddesdon Way)	455702	203062	RS	100	100	NM	NM	NM	NM	19
DT93	Marston Ferry Rd	451363	208785	RS	100	100	NM	NM	NM	NM	15
LT1	26 Prince St	452786	205860	RS	66.7	66.7	NM	NM	NM	NM	17
LT2	1A Woodlands Rd	453927	207068	RS	50	50	NM	NM	NM	NM	12
LT3	47 Quarry Rd	455310	206681	RS	66.7	66.7	NM	NM	NM	NM	15
LT4	138-146 Morrel Av	453575	206037	RS	66.7	66.7	NM	NM	NM	NM	16
LT5	189 Divinity Rd	453576	205938	RS	58.3	58.3	NM	NM	NM	NM	18
LT6	St Christophers school	454473	204588	UB	66.7	66.7	NM	NM	NM	NM	13
LT7	126 The slade	454930	206287	RS	50	50	NM	NM	NM	NM	26
LT8	East Oxford Primary School	452903	205776	UB	75	75	NM	NM	NM	NM	15
LT9	4 Quarry school	455447	206966	RS	75	75	NM	NM	NM	NM	13
LT10	23 Gladstone Rd	455243	207170	RS	75	75	NM	NM	NM	NM	13
LT11	19 Wharton Rd	454918	207054	RS	75	75	NM	NM	NM	NM	13
LT12	Ruskin Hall	454260	207741	RS	75	75	NM	NM	NM	NM	18
LT13	21 Latimer Rd	454221	206796	RS	75	75	NM	NM	NM	NM	13
LT14	94 Howard St	453138	204917	RS	75	75	NM	NM	NM	NM	16
LT15	96 Valentia Rd	454013	206437	RS	75	75	NM	NM	NM	NM	16
LT16	103-139 Hurst St	452985	205185	RS	75	75	NM	NM	NM	NM	16

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

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

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

Notes:

The annual mean concentrations are presented as µg/m^3.

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

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

Means for diffusion tubes have been corrected for bias. All means have been "annualised" as per LAQM.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%).

NM – Not Monitored

Table 8 – 1-Hour Mean NO_2 Monitoring Results, Number of 1-Hour Means > 200µg/m^3

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2021 (%) (2)	2017	2018	2019	2020	2021
CM1	451359	206157	Roadside	99.7	99.7	0	1	3	0	0
CM2	451677	206272	Roadside	98.8	98.8	0	0 (106)	2	1	0
CM3	451118	205353	Urban Background	99.7	99.7	0	0	0	0	0

Notes:

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

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

If the period of valid data is less than 85%, the 99.8th percentile of 1-hour means is provided in brackets.

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

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

Table 9 – Annual Mean PM_{10} Monitoring Results (µg/m^3)

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2021 (%) (2)	2017	2018	2019	2020	2021
CM2	451677	206272	Roadside	99.6	99.6	18	18	19	16	14
CM3	451118	205353	Urban Background	99.9	99.9	13	12	14	11	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/m^3.

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

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

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

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

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

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2021 (%) (2)	2017	2018	2019	2020	2021
CM2	451677	206272	Roadside	99.6	99.6	2	0 (30)	7	0	0
CM3	451118	205353	Urban Background	99.9	99.9	2	1	5	0	1

Notes:

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

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

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

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

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

Table 11 – Annual Mean $PM_{2.5}$ Monitoring Results (µg/m^3)

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2021 (%) (2)	2017	2018	2019	2020	2021
CM3	451118	205353	Urban Background	99.9	99.9	11	10	9	7	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/m^3.

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

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

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

Appendix B: Full Monthly Diffusion Tube Results for 2021

Table 12 – NO_2 2021 Diffusion Tube Results ($\mu g/m^3$)

DT ID	Site name	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 (0.98)	Annual Mean: Distance Corrected to Nearest Exposure*
DT1	St Ebbe's	451118	205353	14	14	11	12	8	9	9	8	13	10	17	14	11.6	11	*
DT2	Weirs Lne./Abingdon Rd. LP1	451904	204215	22	28	21	28	25	24	23	23	29	26	32	28	25.6	25	*
DT3	LP 52 Abingdon Rd.	451914	204154	28	28	27	24	23	26	25	25	30	35	30	26	27.3	27	*
DT4	Boundary Brook Rd/ Iffley Rd	452961	204662	29	27	28	22	22	25	20	20	30	30	37	27	26.3	26	*
DT5	Lenthall Rd Allotments	452818	203448	13	14	10	11	6	8	9	6	12	10	14	14	10.8	11	*
DT7	Oxford Rd/ Between Towns Rd	454472	204246	37	29	27	27	31	28	22	24	35	36	36	30	30.3	30	*
DT8	Oxford Rd(Cowley) LP13	454355	204296	32	27	28	31	25	24	25	23	36	31	40	33	29.5	29	*
DT14	Windmill Rd. W	454554	207102	42	31	32	25	29	28	23	23	37	33	40	28	30.9	30	*
DT15	London Rd./BHF	454433	207058	26	25	26	22	23	19	18	18	29	24	28	29	24.0	23	*
DT16	Headley Way/London Rd. LP2	453982	206817	23	22	24	24	17	22	21	18	22	22	30	19	22.0	22	*
DT18	The Roundway	455596	207367	30	25	25	23	21	26	22	20	27	25	30	23	24.8	24	*
DT20	Barton Lane LP2	454999	207759	27	26	23	29	22	22	19	20	28	23	24	22	23.7	23	*
DT25	Cuttleslowe Rbout 3 Elsfield Rd.	450419	210256	32	28	28	26	29	27	21	21	36	30	33	31	28.5	28	*
DT26	Cuttleslowe 3 Summers Place	450389	210189	37	35	31	NR	38	32	32	29	46	34	38	33	35.0	34	*
DT27	Wolvercote 78 Sunderland Ave.	449824	210198	27	23	24	20	20	19	18	18	27	23	29	25	22.9	22	*
DT28	Wolvercote 51 Sunderland Ave	449856	210162	25	24	24	27	21	23	19	21	28	26	28	27	24.2	24	*
DT29	Pear Tree P&R N Gateway	449530	210734	24	19	22	19	18	18	18	18	25	25	33	23	21.8	21	*
DT30	Osney Lne/Hollybush Row	450668	206053	25	23	21	24	19	21	21	18	33	23	25	22	22.9	22	*
DT31	Beckett St.	450566	206227	27	24	23	29	24	27	25	22	27	27	31	23	25.7	25	*
DT32	Royal Oxford Hotel	450674	206273	27	28	23	27	30	24	25	21	34	29	31	27	27.2	27	*
DT33	Botley RD/ Mill St	450409	206224	23	26	20	28	18	22	21	20	26	14	24	24	22.1	22	*
DT35	Botley Rd /Hillview Rd	450029	206207	30	26	22	27	22	25	24	25	36	28	31	26	26.9	26	*
DT36	Botley Rd N (Prestwich Place)	449657	206245	24	22	20	19	15	15	12	12	20	21	25	22	18.9	19	*
DT39	St Aldate's	451359	206157	32	37	28	36	32	32	31	28	39	37	36	32	33.3	33	*
DT40	Queen St.	451270	206144	22	23	18	25	23	22	22	14	NR	24	NR	24	21.8	21	*
DT41	Bonn Square	451216	206133	24	23	20	21	20	19	19	16	25	20	27	23	21.5	21	*
DT42	New Rd.	451073	206191	33	31	24	32	27	28	25	27	34	26	34	32	29.3	29	*
DT43	Park End St.	450885	206275	33	26	26	25	28	25	22	26	31	30	46	27	28.7	28	*
DT44	Hythe Bridge St.	450795	206343	26	20	21	22	21	22	21	20	26	22	32	23	23.0	23	*
DT45	Worcester St.	450942	206424	28	30	24	27	26	28	30	26	39	NR	37	28	29.4	29	*
DT46	Beaumont St.	451167	206519	23	29	20	23	24	19	NR	16	29	24	29	28	24.1	24	*
DT47	George St. / Magdalen St.	451222	206387	31	32	27	29	26	25	22	15	NR	20	36	25	26.2	26	*
DT48	George St.	450981	206344	28	27	23	26	26	21	NR	17	30	NR	35	28	26.2	26	*
DT49	Cornmarket St.	451322	206242	23	27	19	23	19	16	16	15	24	26	26	NR	21.0	21	*
DT50	High St. / Turl St.	451467	206222	28	28	24	29	25	23	24	21	29	22	28	26	25.4	25	*
DT51	50 High St.	451900	206250	31	32	NR	35	29	39	34	32	43	36	44	33	35.4	35	*
DT52	Longwall St.	451972	206283	37	33	32	28	31	33	35	31	41	37	49	36	35.2	34	*
DT53	Magdalen Bridge	452099	206117	21	20	18	21	16	17	18	17	24	13	25	20	19.2	19	*
DT54	York Place	452325	206015	24	25	18	17	19	15	15	13	25	23	26	23	20.2	20	*
DT55	St Clements	452326	205992	39	36	38	36	40	37	34	NR	49	48	46	39	40.1	39	32
DT56	High St.	451576	206232	42	38	38	36	39	34	39	34	44	NR	45	40	38.9	38	28
DT57	Speedwell St. / St. Aldate's	451407	205807	36	28	32	31	30	31	31	28	35	32	42	33	32.4	32	*
DT58	Folly Bridge	451437	205529	28	26	25	27	25	24	26	24	36	30	34	24	27.5	27	*
DT59	Thames St.	451353	205643	23	25	23	28	19	20	18	17	25	20	30	23	22.6	22	*
DT60	New Butterwyke P./ Thames St.	451248	205710	28	26	25	29	24	25	23	25	33	25	34	28	27.1	27	*
DT61	Friars Wharf	451219	205707	24	20	20	21	13	14	14	12	20	14	22	18	17.6	17	*

DT ID	Site name	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 (0.98)	Annual Mean: Distance Corrected to Nearest Exposure*
DT64	Thames St. / Oxpens Rd.	450887	205825	17	17	17	21	16	16	19	15	22	16	25	20	18.5	18	*
DT65	Speedwell St. / Littlegate	451206	205780	30	26	22	25	24	19	21	19	32	33	35	28	26.1	26	*
DT68	Norfolk St.	451030	205962	29	27	23	24	21	20	22	20	24	23	29	25	24.0	24	*
DT69	Paradise Square	450982	205973	22	24	18	20	18	17	17	16	23	22	26	24	20.6	20	*
DT70	Castle St.	451062	206067	31	27	28	28	26	27	23	23	31	26	30	27	27.1	27	*
DT71	BP City Motors	449617	210216	30	28	27	28	30	27	27	26	38	28	29	27	28.8	28	*
DT72	Cowley Rd./ James Street	452761	205745	27	22	20	18	16	16	11	14	24	17	32	22	19.9	20	*
DT73	Walton Street LP18	450960	206590	20	22	14	16	14	14	17	15	24	22	24	21	18.6	18	*
DT76	St Gilles	451226	206504	28	22	24	24	23	24	14	20	31	27	34	26	24.7	24	*
DT77	St Clements 2	452451	205999	37	29	26	29	29	29	25	25	37	NR	42	32	30.8	30	*
DT79	Old Abingdon Rd.	451908	203919	22	23	17	20	16	19	18	14	24	23	25	21	20.1	20	*
DT80	Hollow way Road	454651	204270	41	29	37	31	34	34	29	30	45	43	47	34	36.1	35	*
DT81	Cowley Rd/ Union Street	452805	205731	29	37	27	31	28	28	28	NR	33	NR	34	29	30.3	30	*
DT82	Summertown Parade	450806	208978	25	22	21	20	19	23	17	16	22	22	27	23	21.4	21	*
DT83	A44 Woodstock Rd.	449681	210263	35	30	33	28	35	33	24	23	34	35	45	33	32.3	32	*
DT84	226 Botley Rd.	449273	206274	27	25	NR	20	17	14	14	14	22	20	25	22	20.1	20	*
DT85	St Clements 3	452625	206068	33	30	26	NR	27	33	26	25	37	26	38	30	30.1	29	*
DT86	72 Blackbird Leys	455134	202841	25	20	18	20	15	NR	13	12	19	20	24	21	18.9	18	*
DT87	New Inn Hall St	451164	206246	22	20	15	18	14	12	13	11	18	19	21	20	17.0	17	*
DT88	St Michaels St	451205	206341	20	20	18	19	11	15	12	10	19	18	23	19	16.9	17	*
DT89	Turl St/Market St	451439	206330	23	22	23	21	14	15	NR	13	23	NR	24	20	19.7	19	*
DT90	Rose Hill (Ashhurst Way)	453368	203323	23	23	22	22	NR	19	15	14	22	21	23	27	20.9	20	*
DT91	Garsington Rd (Premier Place)	455267	203719	43	37	43	35	36	36	31	32	NR	38	43	36	37.2	36	*
DT92	BB Leys (Cuddesdon Way)	455702	203062	22	21	23	19	16	18	16	14	20	19	26	23	19.7	19	*
DT93	Marston Ferry Rd	451363	208785	21	15	17	13	10	14	13	10	16	15	20	16	14.8	15	*
LT1	26 Prince St	452786	205860	NM	NM	NM	17	14	NR	12	9	18	18	22	21	16.3	17	*
LT2	1A Woodlands Rd	453927	207068	NM	NM	NM	14	15	12	11	12	17	16	19	20	15.1	12	*
LT3	47 Quarry Rd	455310	206681	NM	NM	NM	18	NR	17	12	12	19	14	21	14	16.0	15	*
LT4	138-146 Morrel Av	453575	206037	NM	NM	NM	18	NR	NR	16	12	23	18	23	18	18.4	16	*
LT5	189 Divinity Rd	453576	205938	NM	NM	NM	16	11	9	9	9	15	14	20	18	13.4	18	*
LT6	St Christophers school	454473	204588	NM	NM	NM	14	13	9	9	7	16	14	20	16	13.1	13	*
LT7	126 The slade	454930	206287	NM	NM	NM	14	13	10	7	8	11	14	20	18	12.8	26	*
LT8	East Oxford Primary School	452903	205776	NM	NM	NM	20	17	16	13	14	20	20	26	20	18.4	15	*
LT9	4 Quarry school	455447	206966	NM	NM	NM	13	9	11	NR	NR	11	11	NR	17	12.1	13	*
LT10	23 Gladstone Rd	455243	207170	NM	NM	NM	14	11	10	12	9	14	13	19	18	13.3	13	*
LT11	19 Wharton Rd	454918	207054	NM	NM	NM	14	11	8	8	7	13	16	NR	16	11.5	13	*
LT12	Ruskin Hall	454260	207741	NM	NM	NM	18	14	14	12	11	18	17	23	19	16.3	18	*
LT13	21 Latimer Rd	454221	206796	NM	NM	NM	16	14	12	9	9	NR	15	21	18	14.2	13	*
LT14	94 Howard St	453138	204917	NM	NM	NM	12	12	11	8	7	11	13	19	19	12.6	16	*
LT15	96 Valentia Rd	454013	206437	NM	NM	NM	19	14	17	12	10	17	18	23	21	16.7	16	*
LT16	103-139 Hurst St	452985	205185	NM	NM	NM	NM	NM	NM	19	20	28	27	30	25	24.8	16	*

☒ **All erroneous data has been removed from the NO_2 diffusion tube dataset presented in Table B.1.**

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

☒ **Local bias adjustment factor used.**

☐ **National bias adjustment factor used.**

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

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

Notes:

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

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

See Appendix C for details on bias adjustment and annualisation.

NR – Not Recovered (Lost/damaged/Erroneous data)

NM – Not Monitored

(*) 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 NO_2 annual mean objective (i.e. > 36 ugm^{-3}), to account for the inherent uncertainty in diffusion tube monitoring concentration data. In 2021, only 2 of the diffusion tube monitoring results were showing NO_2 concentration levels > 36 ugm^{-3}, so distance corrections were only made for those.

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

New or Changed Sources Identified Within Oxford During 2021

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

Additional Air Quality Works Undertaken by Oxford City Council During 2021

Oxford City Council has increased diffusion tube monitoring capability in 2021. Sixteen (16) new monitoring locations were added to the network, in order to increase our knowledge of air quality baseline levels across the city, which will allow us to better estimate the impacts of future traffic related interventions.

QA/QC of Diffusion Tube Monitoring

Oxford's diffusion tubes were supplied and analysed in 2021 by an accredited laboratory (South Yorkshire Air Quality Samplers), using the 50% Triethanolamine (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 2021 monitoring campaign were replaced according to DEFRA's 2021 diffusion tube monitoring calendar and within the ± 2 days due date tolerance.

Diffusion Tube Annualisation

Seven diffusion tube monitoring locations had an annual data capture below 75% in 2021. As such, annualisation was required at those sites. The annualisation procedures used were the ones detailed on LAQM TG16 Box 7.10 for NO_2 monitoring diffusion tube data. Two AURN Urban background sites were used for annualisation purposes: AURN St Ebbes and

AURN Reading New Town. These two sites were chosen as each one of them have a percentage of data capture > 85% and also because they are both located at less than 50 miles away from our monitoring sites, as per the annualisation requirements. Table 14 (below) provides the summary of the annualisation procedure for these sites.

Diffusion Tube Bias Adjustment Factors

The diffusion tube data presented within the 2021 ASR have been corrected for bias using an adjustment factor. Bias represents the overall tendency of the diffusion tubes to under or over-read relative to the reference chemiluminescence analyser. LAQM.TG16 provides guidance with regard to the application of a bias adjustment factor to correct diffusion tube monitoring. Triplicate co-location studies can be used to determine a local bias factor based on the comparison of diffusion tube results with data taken from NO_x/NO_2 continuous analysers. Alternatively, the national database of diffusion tube co-location surveys provides bias factors for the relevant laboratory and preparation method.

In 2021, Oxford City Council has conducted 2 local co-location studies. One at roadside AURN Oxford Centre, other at Urban background AURN St Ebbes. The bias adjustment factor that was obtained from these two studies was the same: **0.98**.

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 version 03/22 was of **0.82** in 2021.

Oxford City Council decided to use its local bias adjustment factor, instead of the national bias adjustment factor due to the following:

- The bias adjustment factor of our local studies is slightly higher than the one that was obtained nationally. Using the calculated local bias to adjust Oxford's NO_2 diffusion tube results therefore represents a much more conservative approach;
- For a question of methodology and consistency with previous Air Quality Annual Status Reports;
- Due to the fact that our local co-location studies have presented *"good"* precision for the diffusion tubes in 2021, 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 St Ebbes.

A summary of bias adjustment factors used by Oxford City Council over the past five years is presented in Table 13 below.

Table 15 (below) shows the accuracy of the local bias adjustment factors used in 2021, as well as the most relevant figures resulting for the calculation of the bias adjustment factor, and which have been obtained using DEFRA's approved bias adjustment factor spread sheet.

A print screen of this spread sheet, showing in detail the calculations of the bias adjustment factor at AURN Oxford Centre Roadside can also be found on Figure 8 (below).

Table 13 – Bias Adjustment Factors

Monitoring Year	Local or National	If National, Version of National Spreadsheet	Adjustment Factor
2021	Local	NA	0.98/0.98
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

NO_2 Fall-off with Distance from the Road

Wherever possible, monitoring locations are representative of exposure. However, where this is not possible, the NO_2 concentration at the nearest location relevant for exposure has been estimated using the Diffusion Tube Data Processing Tool/NO_2 fall-off with distance calculator available on the LAQM Support website.

According to paragraph 7.78 of the LAQM TG16, 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 36µg/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 2021, there were only two monitoring sites in Oxford that have shown NO_2 concentrations greater than 36 µg/m^3, and hence where real exposure estimation would be required. Those sites were DT55 –St Clements and DT56 –High Street. Table 16 (below) presents the annual mean NO_2 concentrations corrected for distance at those sites.

QA/QC of Automatic Monitoring

Oxford City Council currently operates three automatic monitoring sites. All routine calibration and maintenance is carried out by members of Oxford City Council's Environmental Quality team, and performed 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 reference standards for each pollutant;
- every six months an audit of instrument response is carried out by an external organization using independent 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 2021 and presented within this ASR has been fully ratified by Ricardo Energy & Environment, following in full all the national AURN QA/QC procedures[16]. Live and Historic data from our 3 automatic monitoring sites can be found on the following websites:

- UK-Air
- AQ England
- Oxfordshire AQ website

16 QA/QC Procedures for the UK Automatic Urban and Rural Air Quality Monitoring Network (AURN)

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

The instrument used at AURN St Ebbes to measure PM_{10} and $PM_{2.5}$ data (FIDAS), do not require the application of any correction factor. The PM_{10} data measured at Oxford High Street was 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 2021.

Automatic Monitoring Annualisation

All automatic monitoring locations within Oxford City Council recorded data capture of greater than 75% therefore it was not required to annualise any monitoring data. In addition, any sites with a data capture below 25% do not require annualisation.

NO_2 Fall-off with Distance from the Road

No automatic NO_2 monitoring locations within Oxford City Council required distance correction during 2021.

Table 14 – Annualisation Summary (concentrations presented in µg/m^3)

Site ID	Annualisation Factor AURN AURN St Ebbes	Annualisation Factor AURN Reading New Town	Average Annualisation Factor	Raw Data Annual Mean	Annualised Annual Mean	Comments
LT1	1.03	1.03	1.03	16.4	16.9	* A bias adjustment factor of 0.98 will still need to be applied to the column "Annualised Annual Mean" in order to arrive to the final annual mean concentration value for each site.
LT2	1.02	1.02	1.02	12.0	12.2	
LT4	1.04	1.05	1.05	15.9	16.6	
LT5	1.01	1.00	1.00	18.3	18.4	
LT6	1.11	1.12	1.11	11.6	12.9	
LT7	1.04	1.06	1.05	24.8	26.1	
LT9	1.09	1.10	1.09	14.3	15.5	

Table 15 – Local Bias Adjustment Calculation

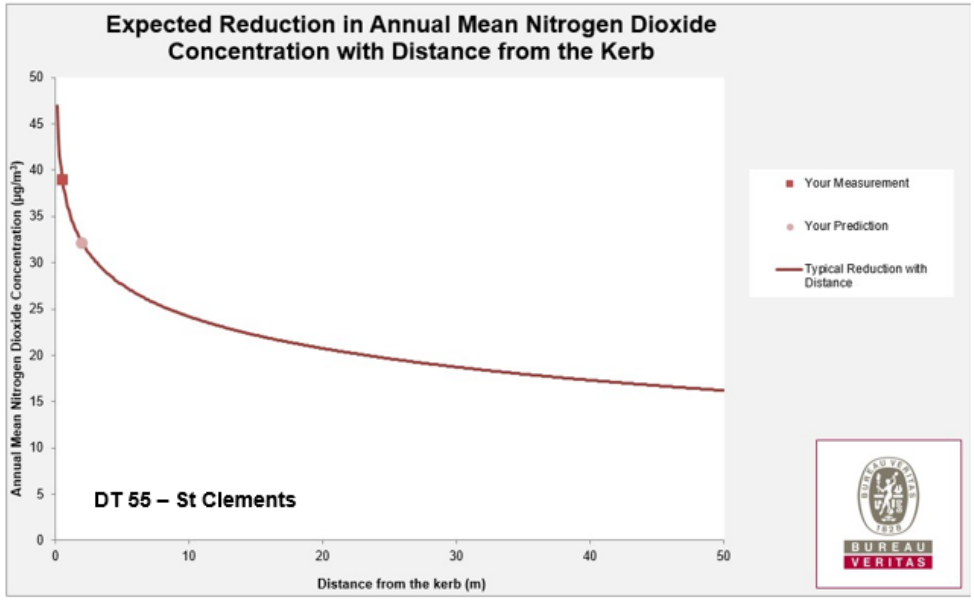
	Local Bias Adjustment 1 (AURN Oxford Centre roadside)	Local Bias Adjustment 2 (AURN Oxford St Ebbes urban background)
Periods used to calculate bias	12	12
Bias Factor A	0.98 (0.94-1.04)	0.98 (0.91 – 1.07)
Bias Factor B	2% (-3% -7%)	2% (-6% -10%)
Diffusion Tube Mean (µg/m^3)	33	12
Mean CV (Precision)	7	9
Automatic Mean (µg/m^3)	33	11
Data Capture	100%	100%
Adjusted Tube Mean (µg/m^3)	33 (31-35)	11 (10-12)

Notes:

A single local bias adjustment factor has been used to bias adjust the 2021 diffusion tube results, as the 2 local co-location studies had the same bias adjustment factor: 0.98 .

Table 16 – NO_2 Fall off With Distance Calculations (concentrations presented in µg/m^3)

Site ID	Distance (m): Monitoring Site to Kerb	Distance (m): Receptor to Kerb	Monitored Concentration (Annualised and Bias Adjusted	Background Concentration	Concentration Predicted at Receptor	Comments
DT55	0.5	2	39	11	32.1	The Urban Background concentration value used for this correction was obtained from AURN St Ebbes
DT56	0.2	2.5	38	11	27.6	



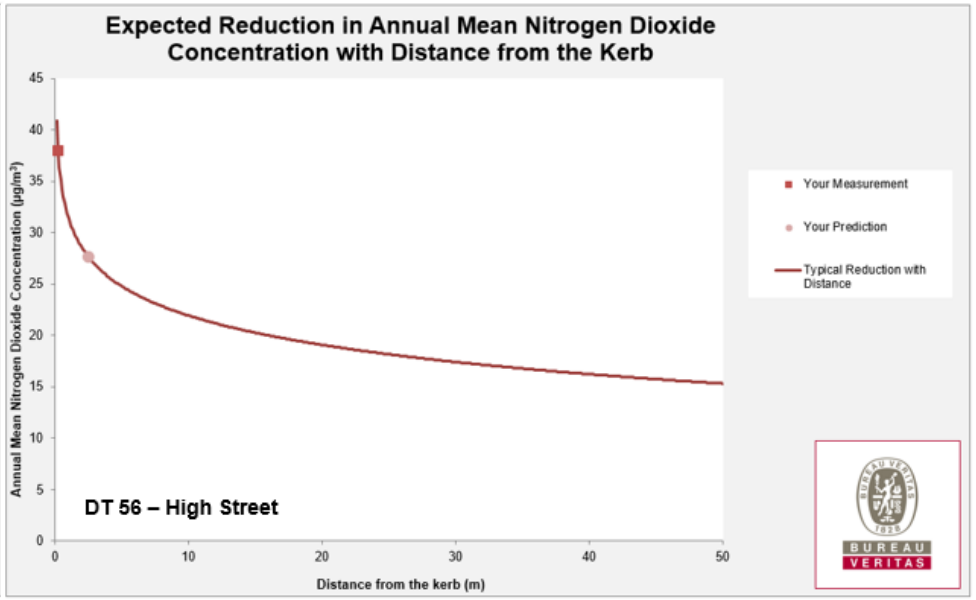


Figure 8 – Calculation of local bias adjustment at AURN Oxford Centre Roadside

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements										Automatic Method		Data Quality Check	
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 μgm^{-3}	Tube 2 μgm^{-3}	Tube 3 μgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
1	06/01/2021	03/02/2021	33	32	31	32	1.0	3	2.5	31.7	99.3	Good	Good
2	03/02/2021	03/03/2021	38	41	32	37	4.6	12	11.4	35.5	99.9	Good	Good
3	03/03/2021	31/03/2021	30	28	27	28	1.5	5	3.8	30.8	99.1	Good	Good
4	31/03/2021	05/05/2021	39	39	29	36	5.8	16	14.3	40.3	99.5	Good	Good
5	05/05/2021	02/06/2021	35	29	33	32	3.1	9	7.6	33.2	99.7	Good	Good
6	02/06/2021	30/06/2021	32	33	33	33	0.6	2	1.4	29.5	99.6	Good	Good
7	30/06/2021	03/08/2021	29	32	31	31	1.5	5	3.8	30.8	99.5	Good	Good
8	03/08/2021	01/09/2021	26	28	30	28	2.0	7	5.0	27.0	100	Good	Good
9	01/09/2021	29/09/2021	35	37	43	38	4.2	11	10.3	39.0	99.9	Good	Good
10	29/09/2021	04/11/2021	39	36	36	37	1.7	5	4.3	32.2	100	Good	Good
11	04/11/2021	01/12/2021	39	35	35	36	2.3	6	5.7	33.1	99.8	Good	Good
12	01/12/2021	05/01/2022	32	31	33	32	1.0	3	2.5	31.0	100	Good	Good
13													
											Overall survey -->	Good precision	Good Overall DC

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

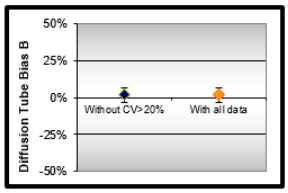
(Check average CV & DC from Accuracy calculations)

Site Name/ ID:	St Aldate's

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

Accuracy (with 95% confidence interval) without periods with CV larger than 20%	
Bias calculated using 12 periods of data	
Bias factor A	0.98 (0.94 - 1.04)
Bias B	2% (-3% - 7%)
Diffusion Tubes Mean:	33 μgm^{-3}
Mean CV (Precision):	7
Automatic Mean:	33 μgm^{-3}
Data Capture for periods used:	100%
Adjusted Tubes Mean:	33 (31 - 35) μgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 12 periods of data	
Bias factor A	0.98 (0.94 - 1.04)
Bias B	2% (-3% - 7%)
Diffusion Tubes Mean:	33 μgm^{-3}
Mean CV (Precision):	7
Automatic Mean:	33 μgm^{-3}
Data Capture for periods used:	100%
Adjusted Tubes Mean:	33 (31 - 35) μgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

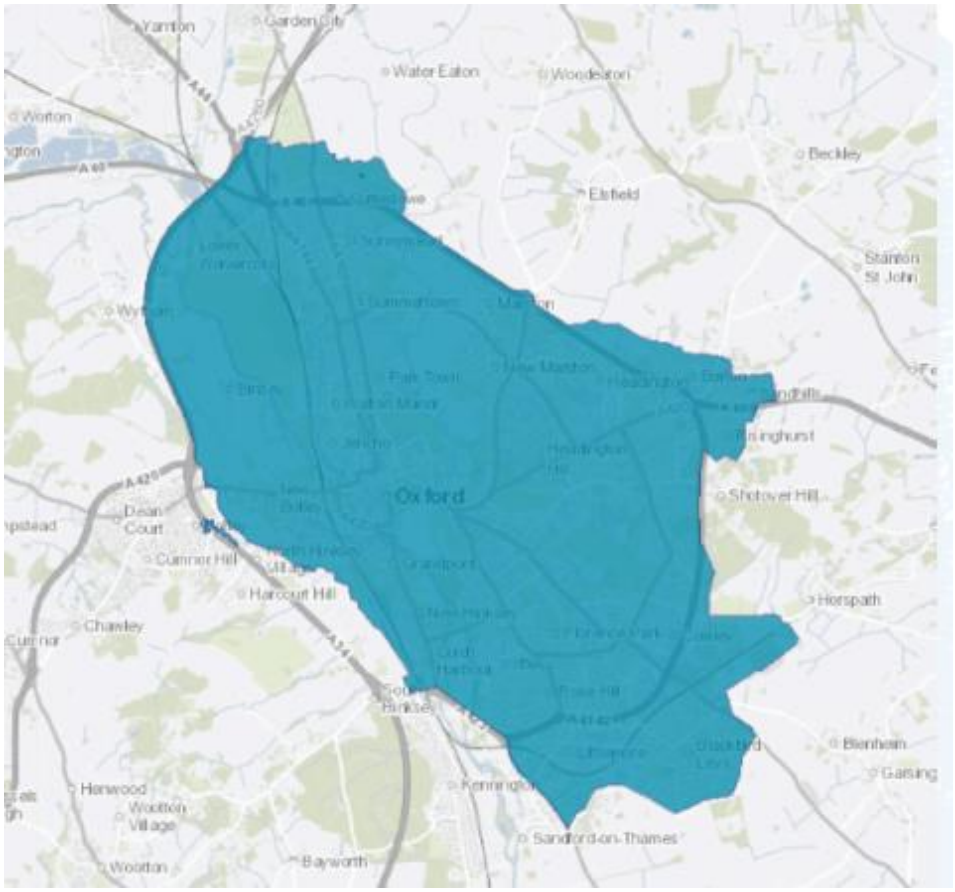
If you have any enquiries about this spreadsheet please contact the LAQM Helpdesk at: LAQMHelpdesk@uk.bureauveritas.com

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 NO_2. Figure 9 below shows (in blue) the area of the city covered by the current AQMA for NO_2 and its boundaries. Figures 10 to 20 show the maps of the locations where air quality monitoring was conducted throughout 2021 and the levels of NO_2 measured. All the monitoring locations are within the current AQMA.

Figure 9 – Oxford's current city-wide AQMA for NO_2



Source: DEFRA's national AQMA Interactive map

Figure 10 - Oxford's automatic and passive monitoring locations, 2021

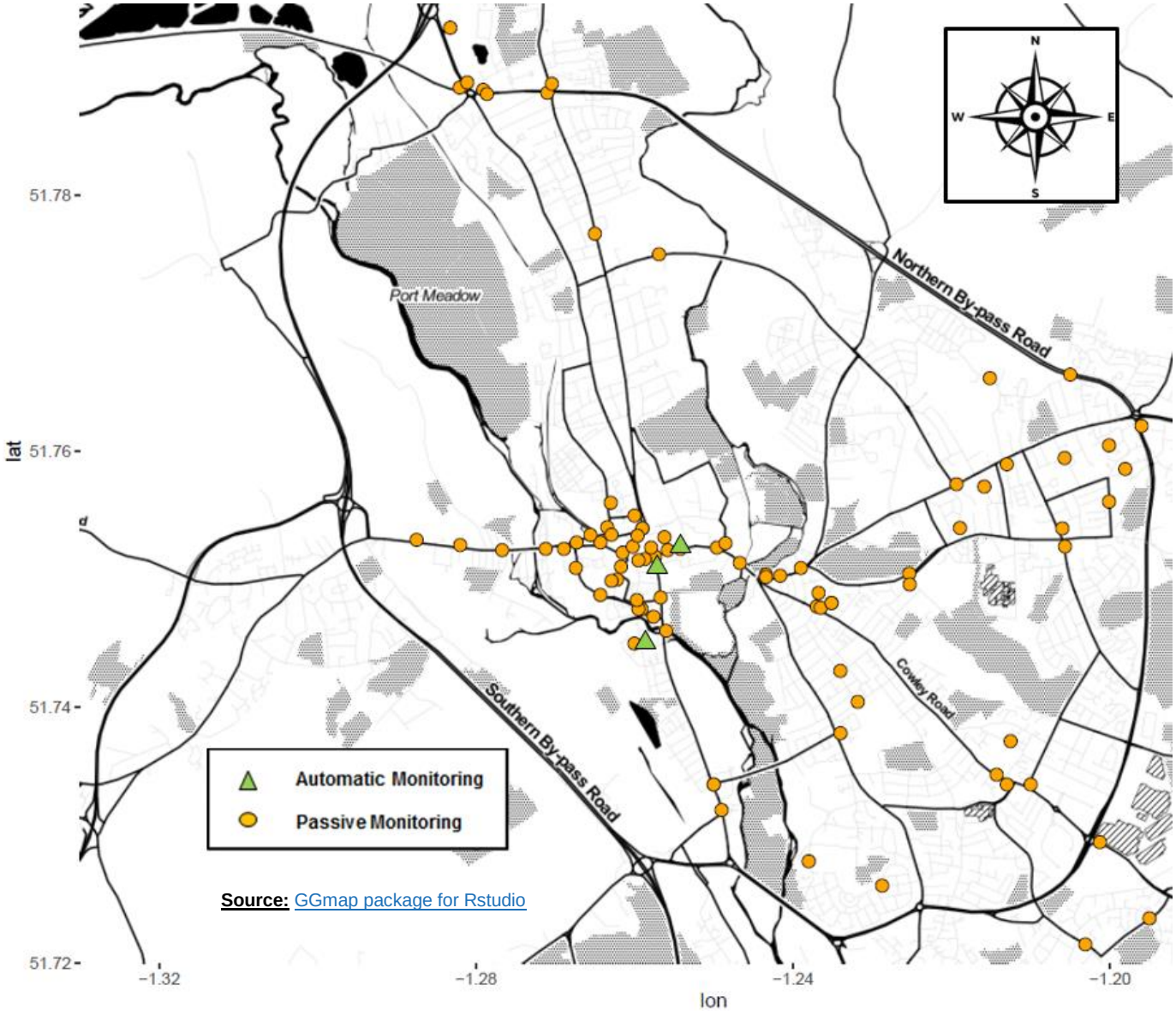


Figure 11 - Oxford's diffusion tube locations by level of NO_2, 2021

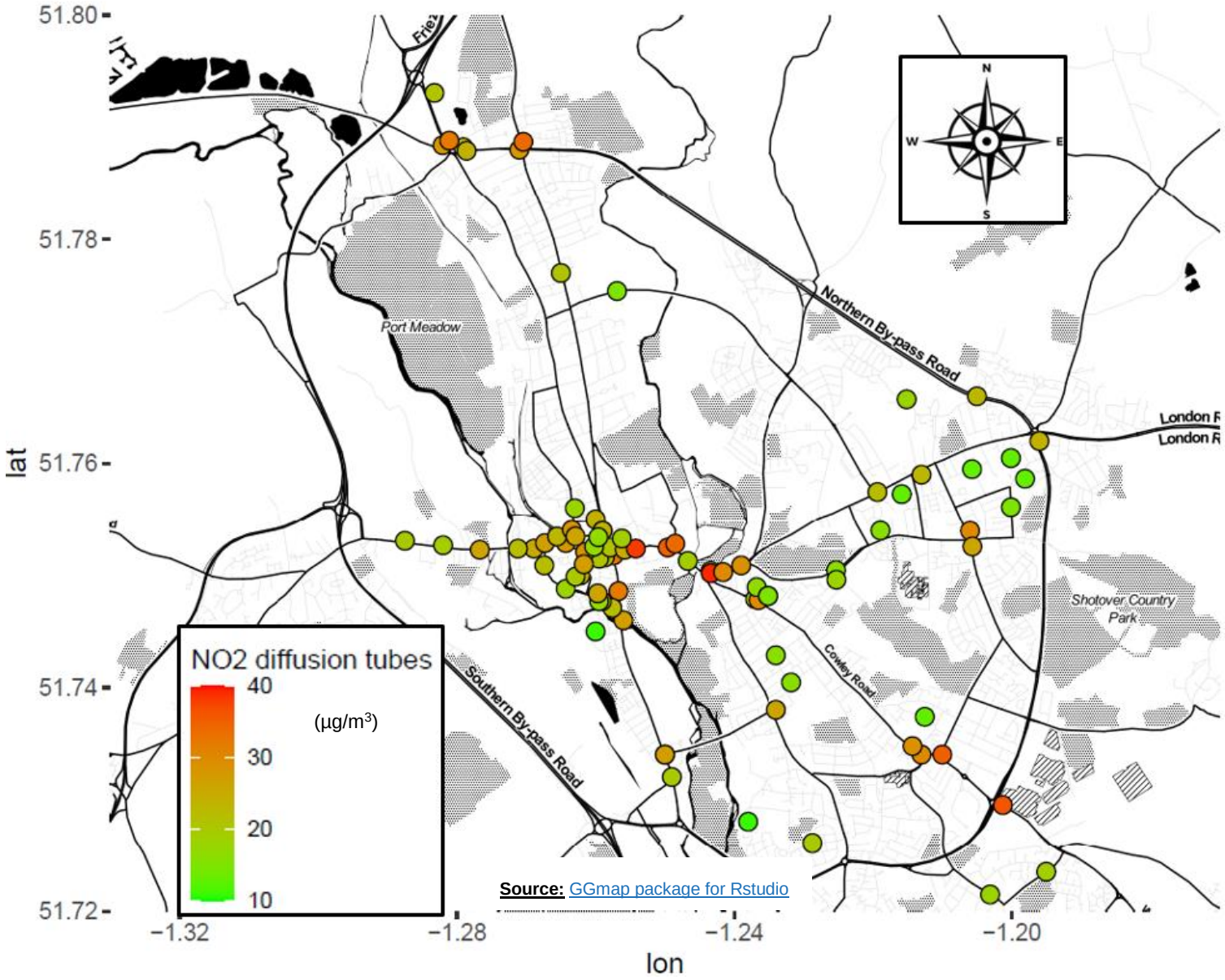


Figure 12 - Oxford city centre area: diffusion tube locations by level of NO_2, 2021

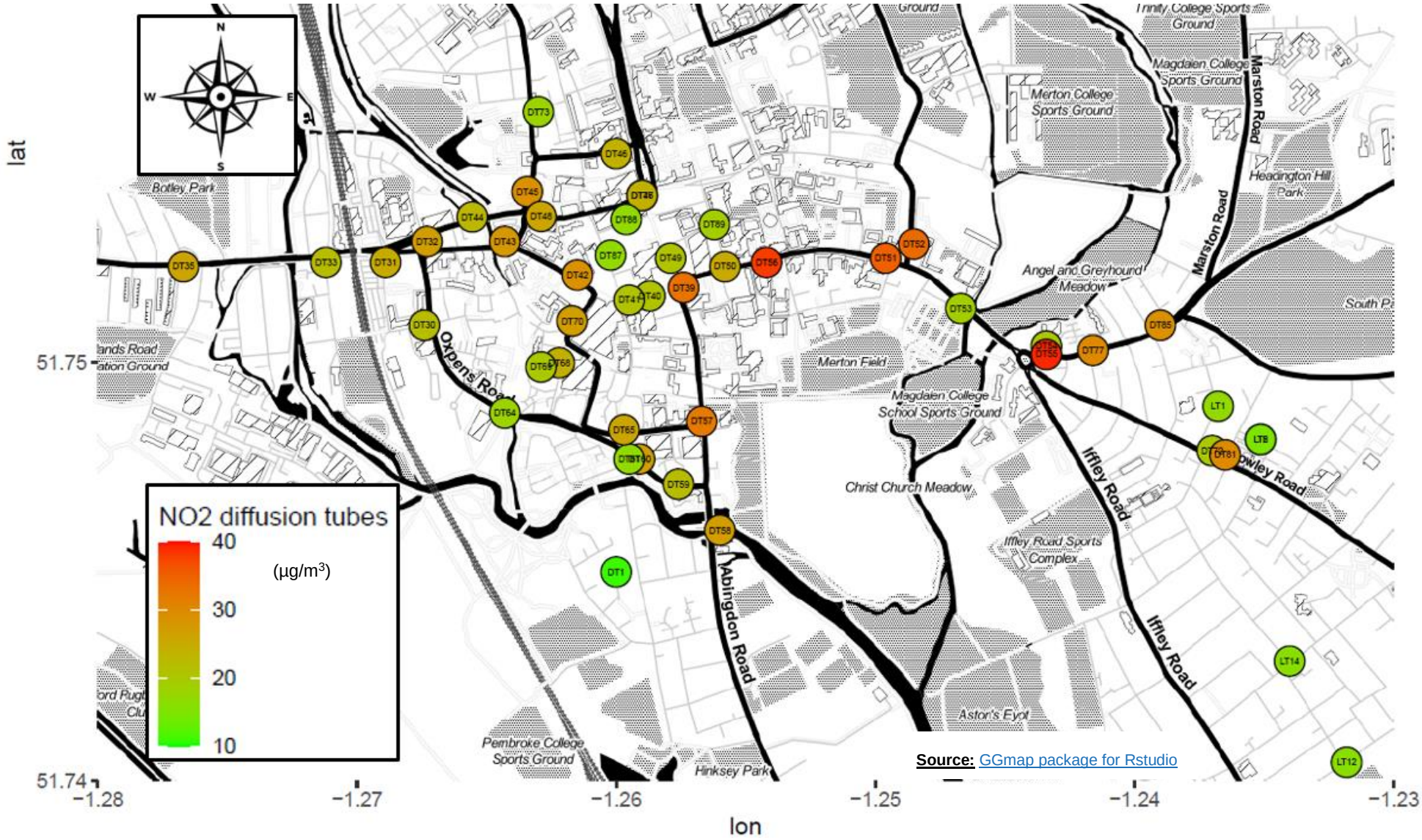


Figure 13 - Westgate area: diffusion tube locations by level of NO_2, 2021

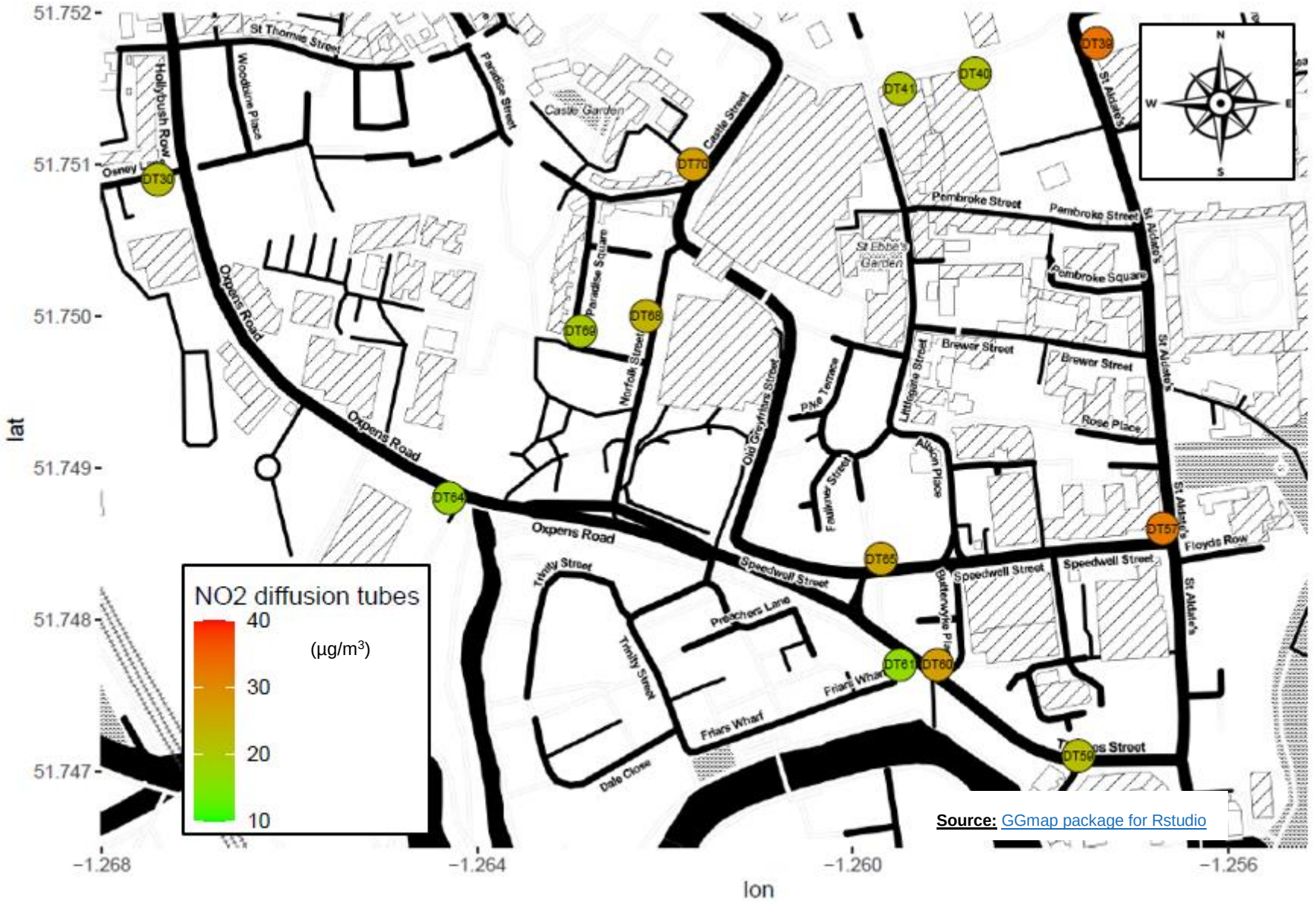
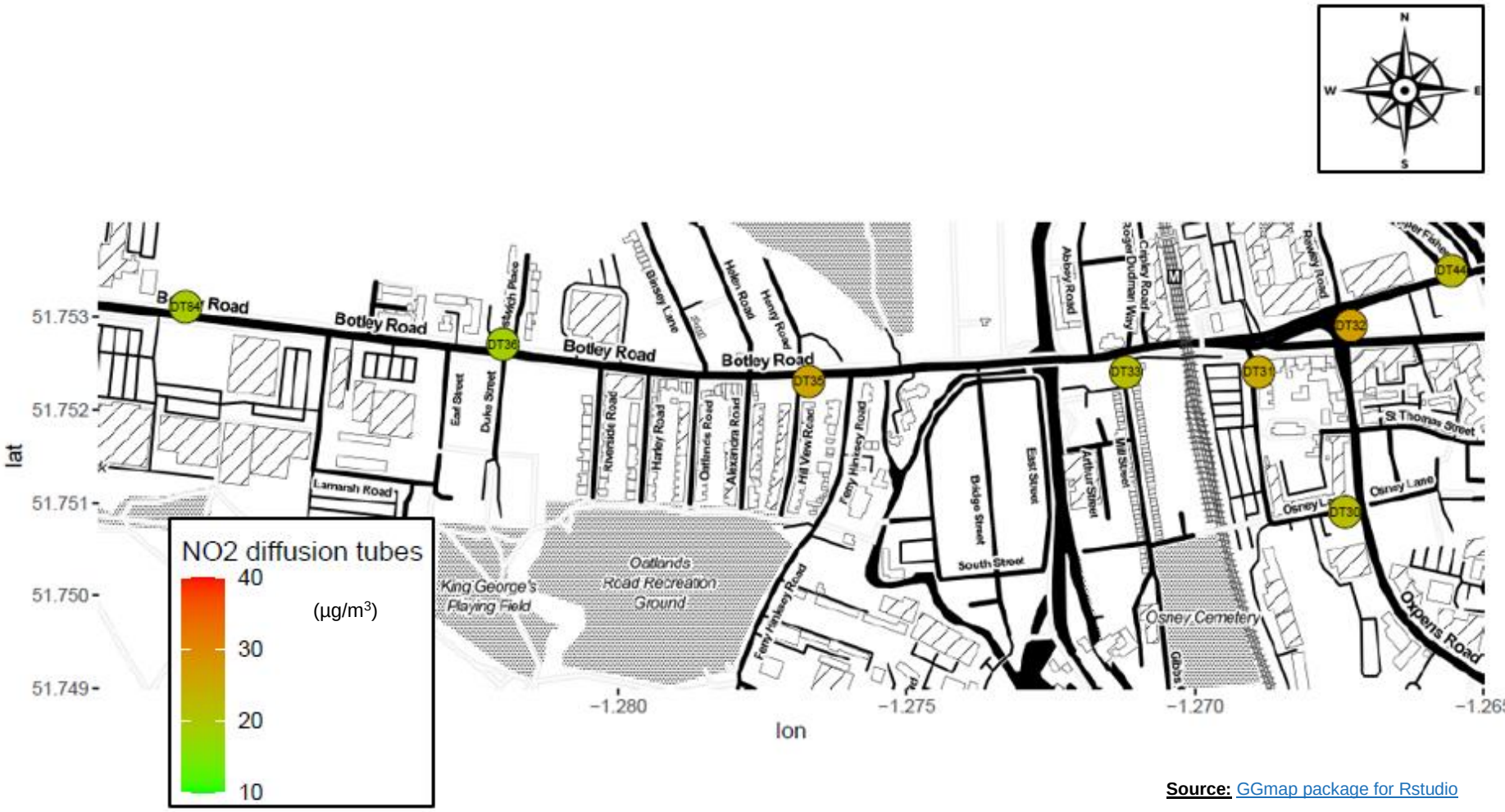


Figure 14 - Botley area: diffusion tube locations by level of NO_2, 2021



Source: GGmap package for Rstudio

Figure 15 - St Clements area: diffusion tube locations by level of NO_2, 2021

Figure 16 - George Street and Zero Emission Zone areas: diffusion tube locations by level of NO_2, 2021

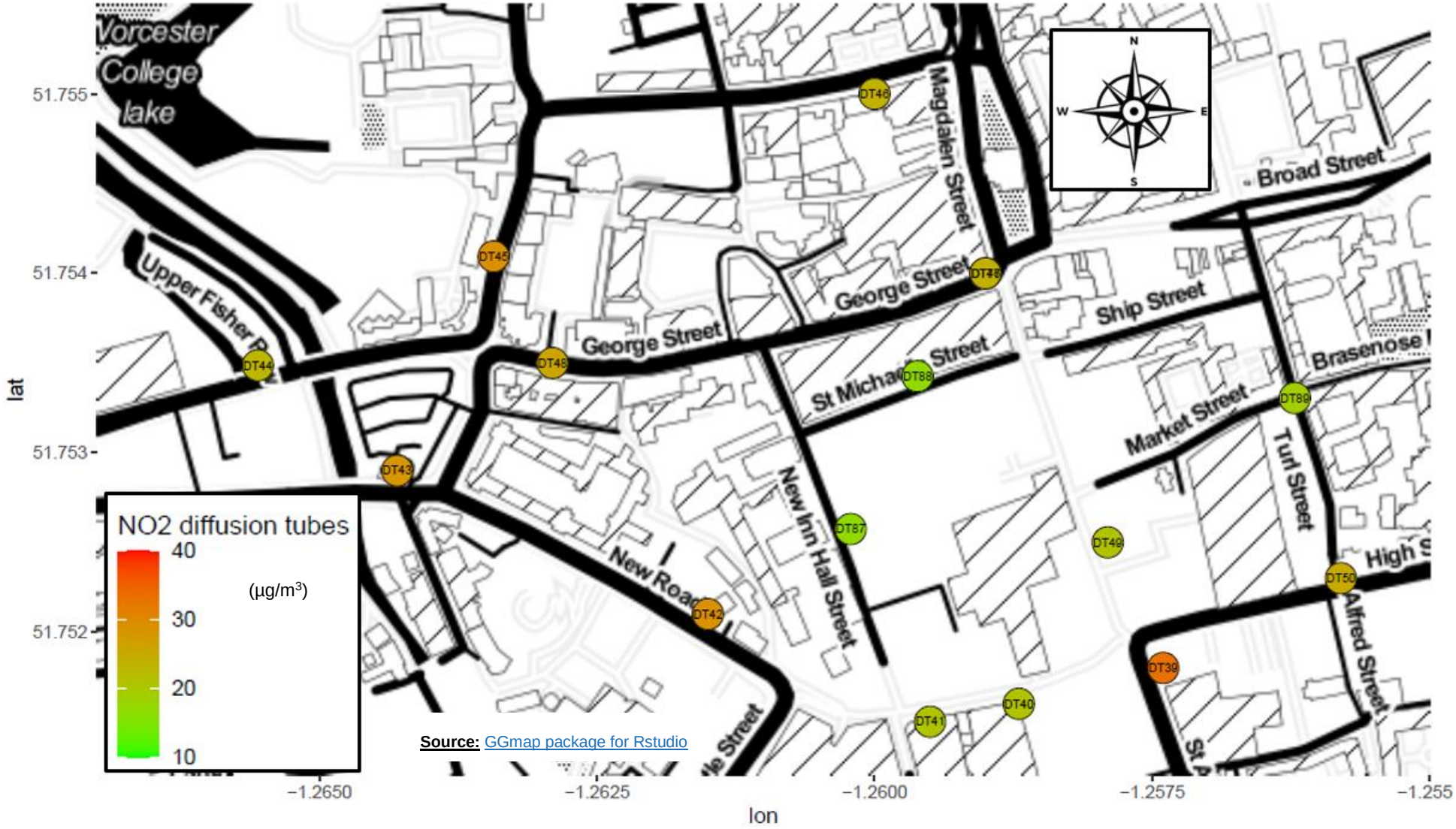


Figure 17 - High Street area: diffusion tube locations by level of NO_2, 2021

Figure 18 - Cutteslowe/Wolvercote area: diffusion tube locations by level of NO_2, 2021

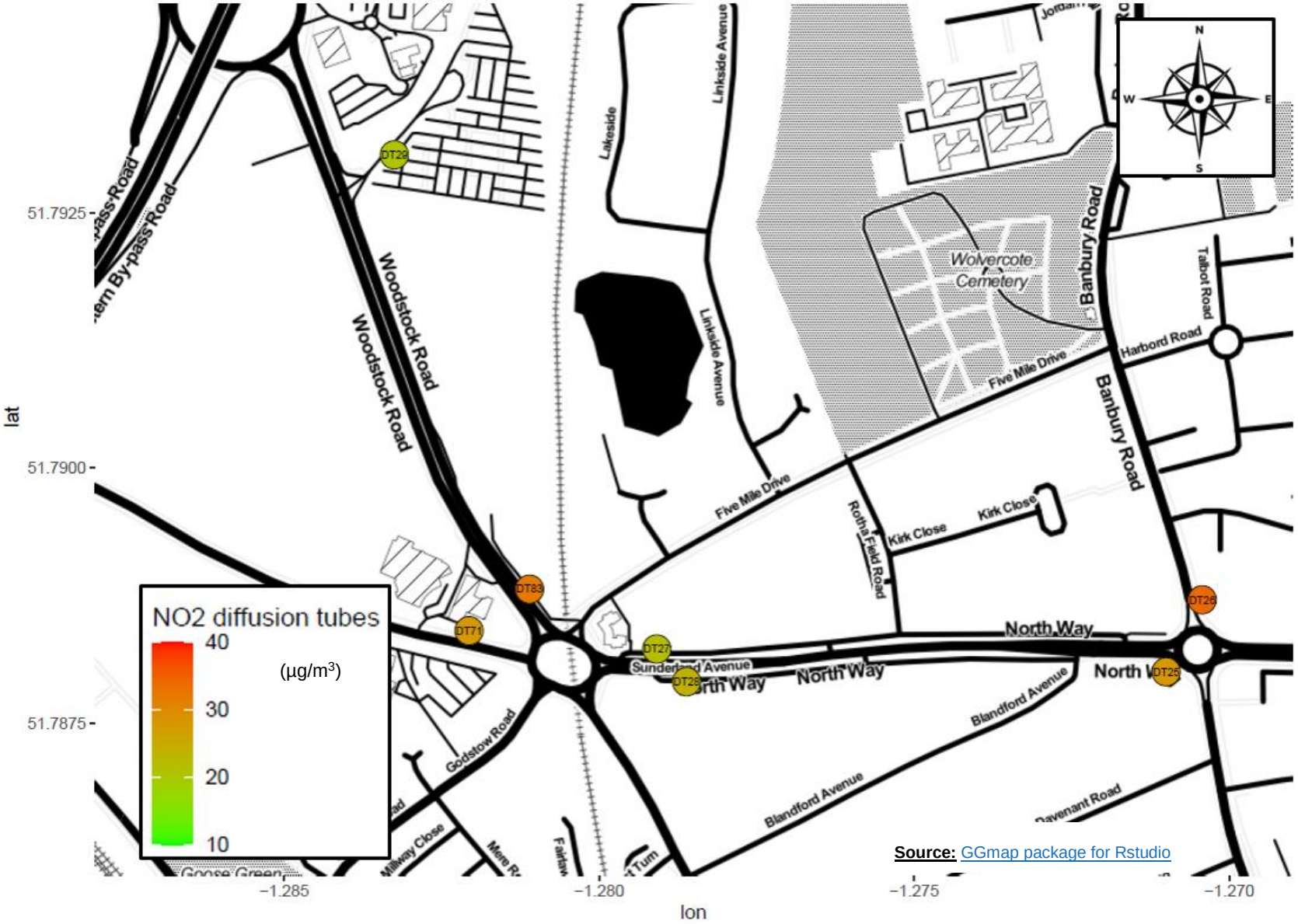
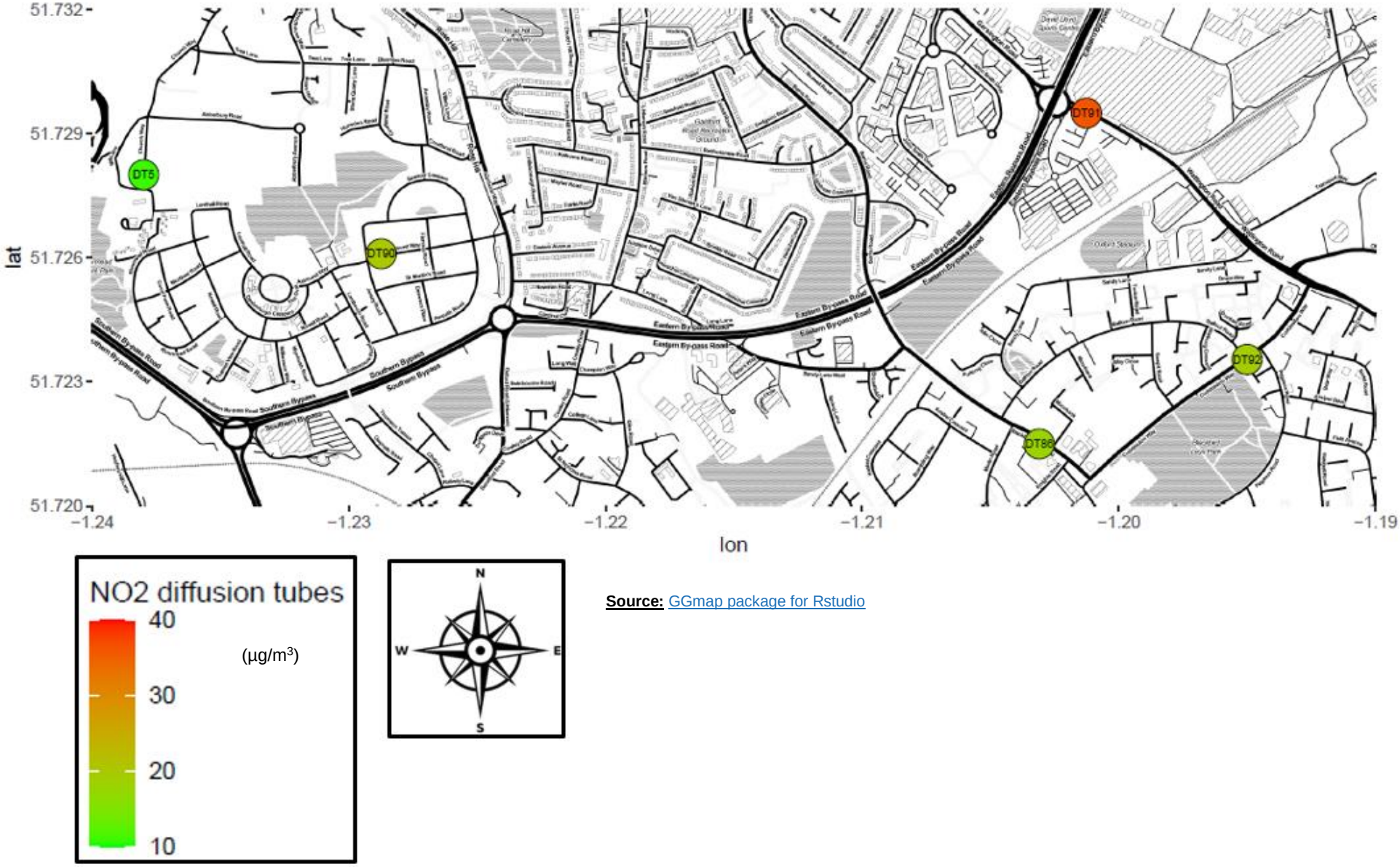
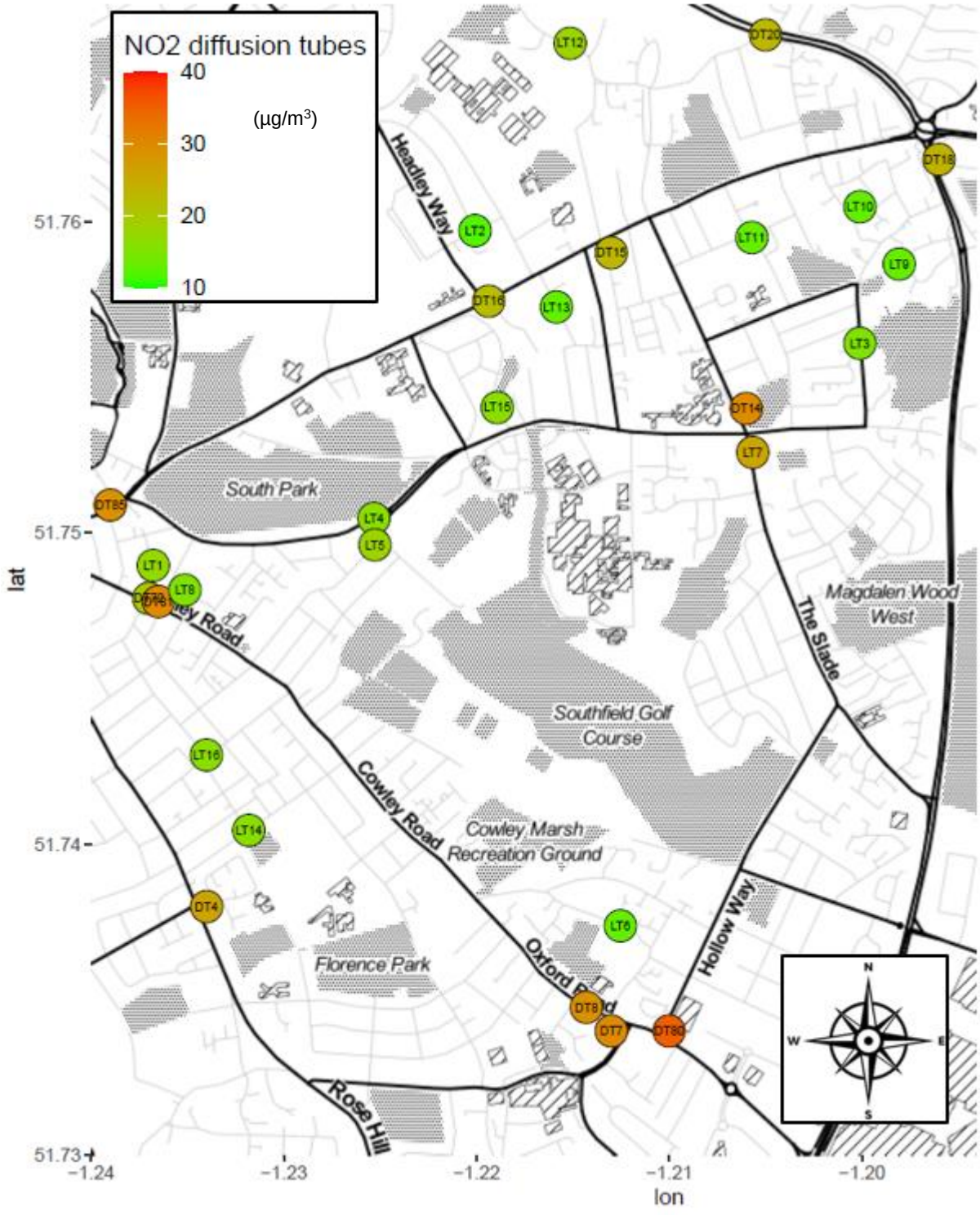


Figure 19 - Black Bird Leys/ Rose Hill area: diffusion tube locations by level of NO_2, 2021



Source: GGmap package for Rstudio

Figure 20 - East Oxford area: diffusion tube locations by level of NO_2, 2021



Source: GGmap package for Rstudio

Appendix E: Summary of Air Quality Objectives and WHO recommended guidelines in England

Table 17 – Air Quality Objectives in England[17]

Pollutant	Air Quality Objective: Concentration	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 ($PM_{2.5}$)[18]	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

Table 18 - New World Health Organisation recommended guidelines

Pollutant	Guidelines for each pollutant	
	Concentration	Measured as
Nitrogen Dioxide (NO_2)	200 µg/m^3	1-hour mean
	25 µg/m^3	24-hour mean
	10 µg/m^3	Annual mean
Particulate Matter (PM_{10})	45 µg/m^3	24-hour mean
	15 µg/m^3	Annual mean
Particulate Matter ($PM_{2.5}$)	15 µg/m^3	24-hour mean
	5 µg/m^3	Annual Mean
Ozone (O_3)	100 µg/m^3	8-hour mean
	60 µg/m^3	Peak season[19]

17 The units are in microgrammes of pollutant per cubic metre of air (µg/m^3).
18 Non-mandatory target value, to be achieved by 2020.

19 Average of daily maximum 8-hour mean O_3 concentration in the six consecutive months with the highest six-month running-average O_3 concentration.

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

Figure 21 - NO_2 time variations at Oxford's 3 automatic monitoring sites along calendar year 2021.

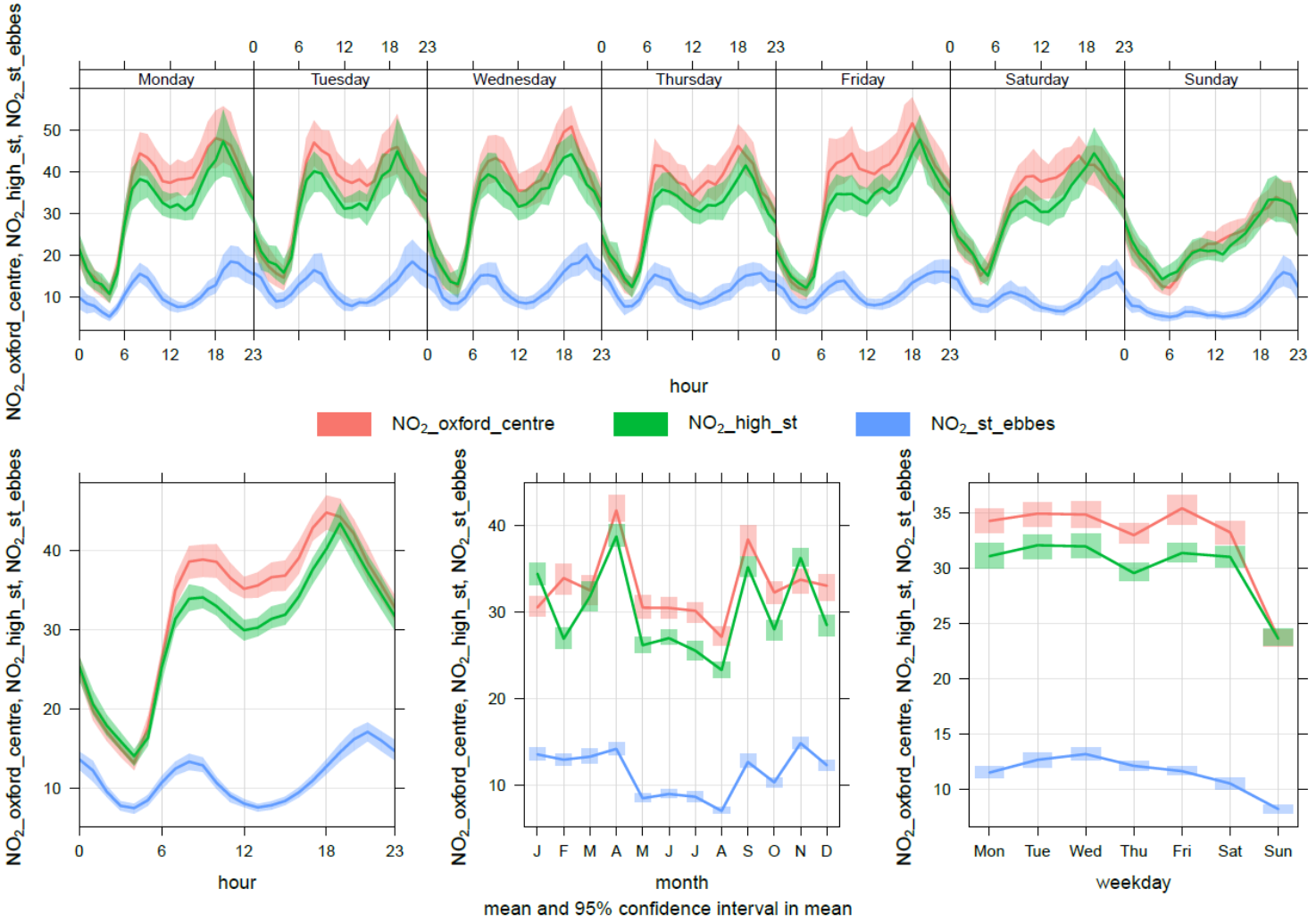


Figure 22 – Oxford's 3 automatic monitoring sites (basic statistics 2021)

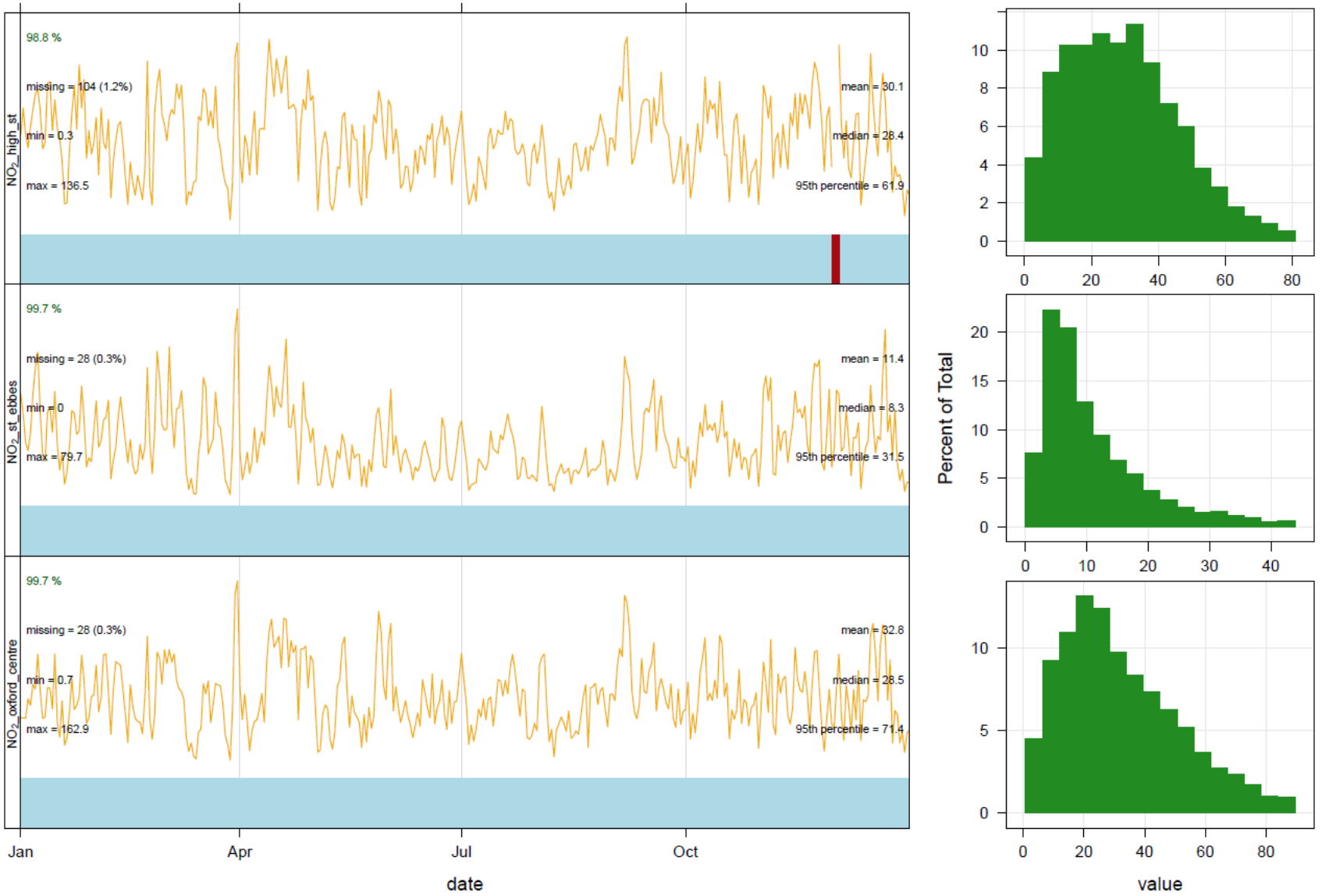


Figure 23 - Daily NO_2 averages at AURN automatic monitoring station of Oxford Centre roadside along calendar year 2021

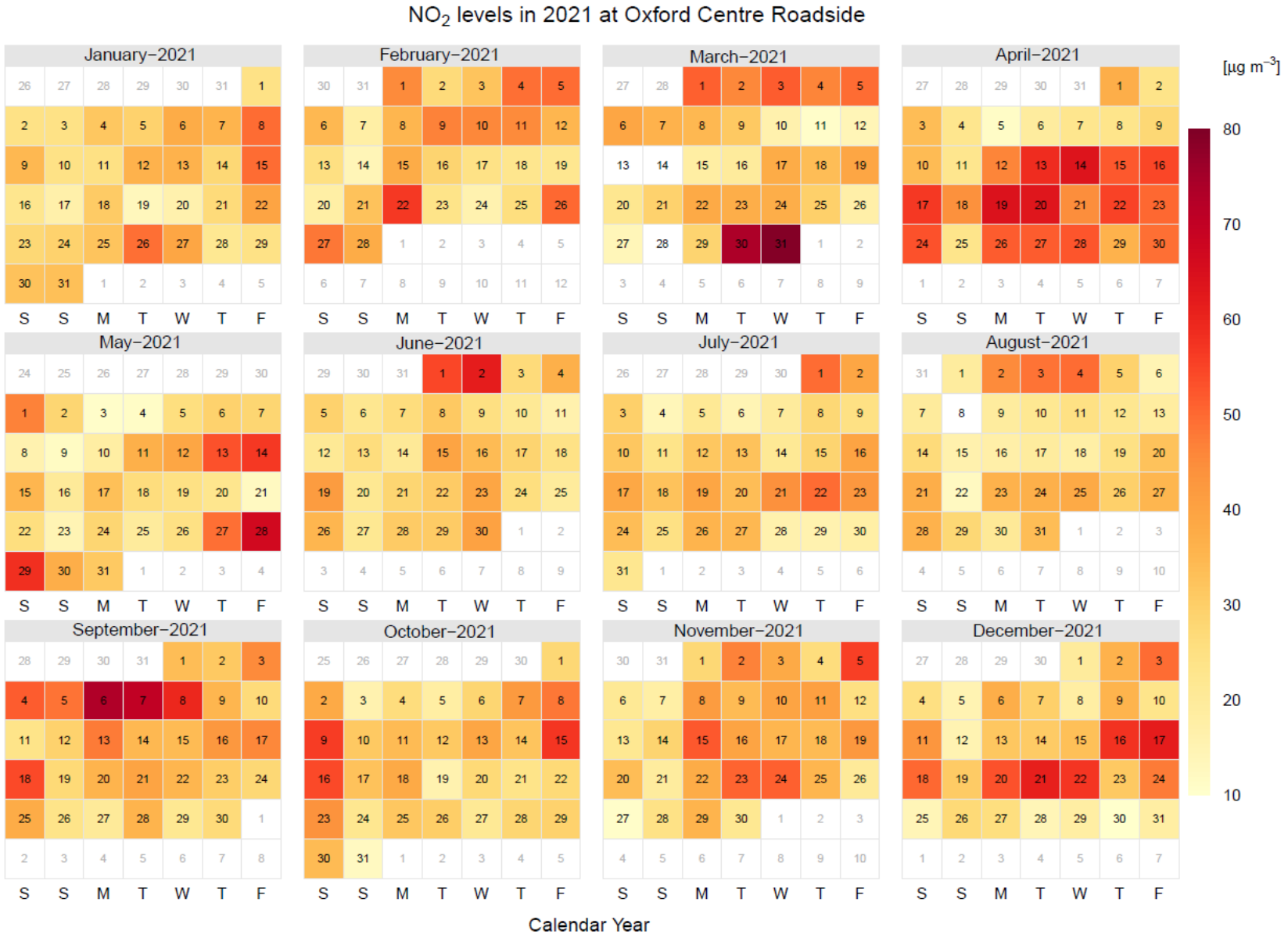


Figure 24 – Daily NO_2 averages at AURN automatic monitoring station of Oxford St Ebbes along calendar year 2021

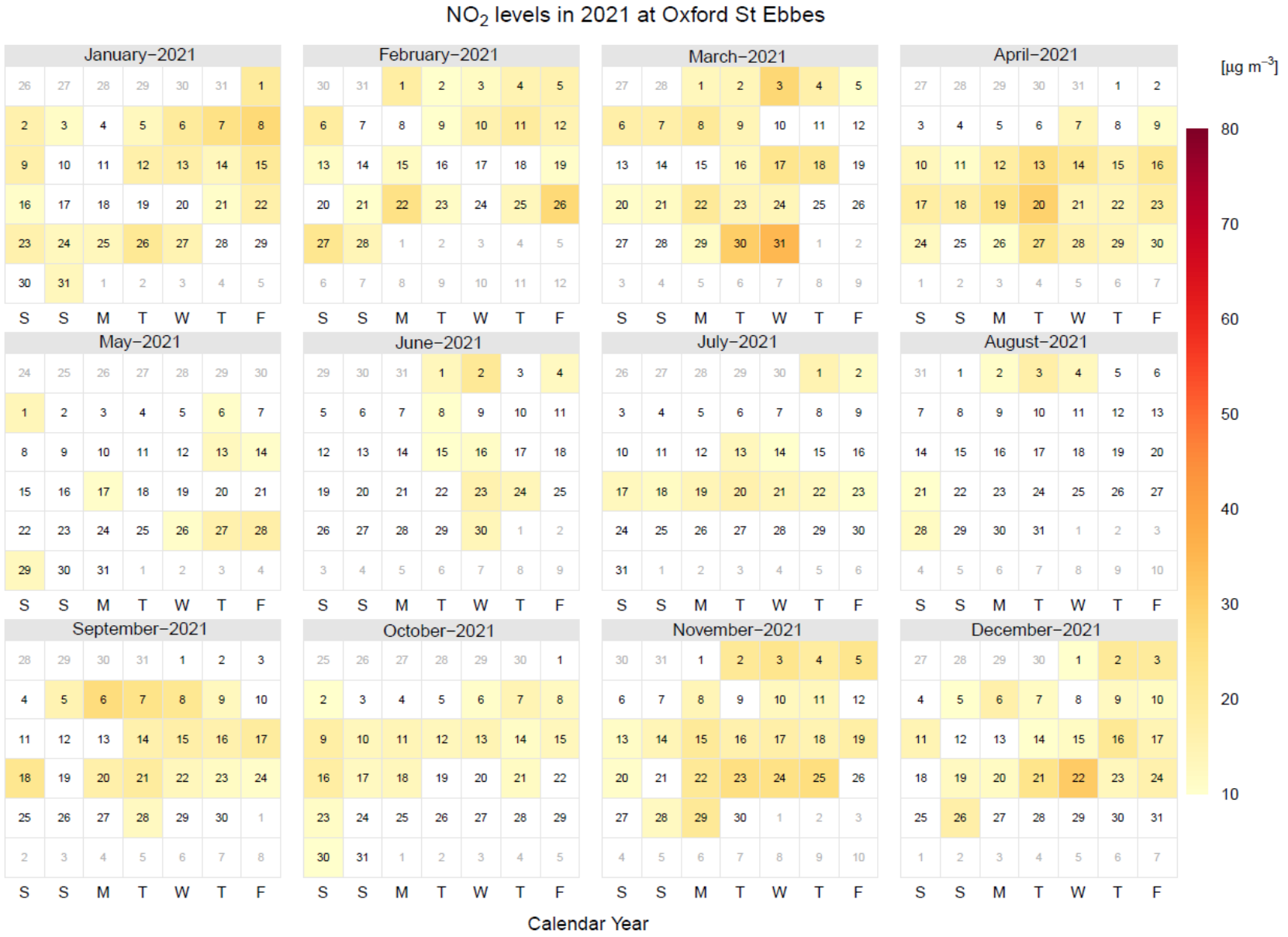


Figure 25 - Daily NO_2 averages at automatic monitoring station of Oxford High Street along calendar year 2021

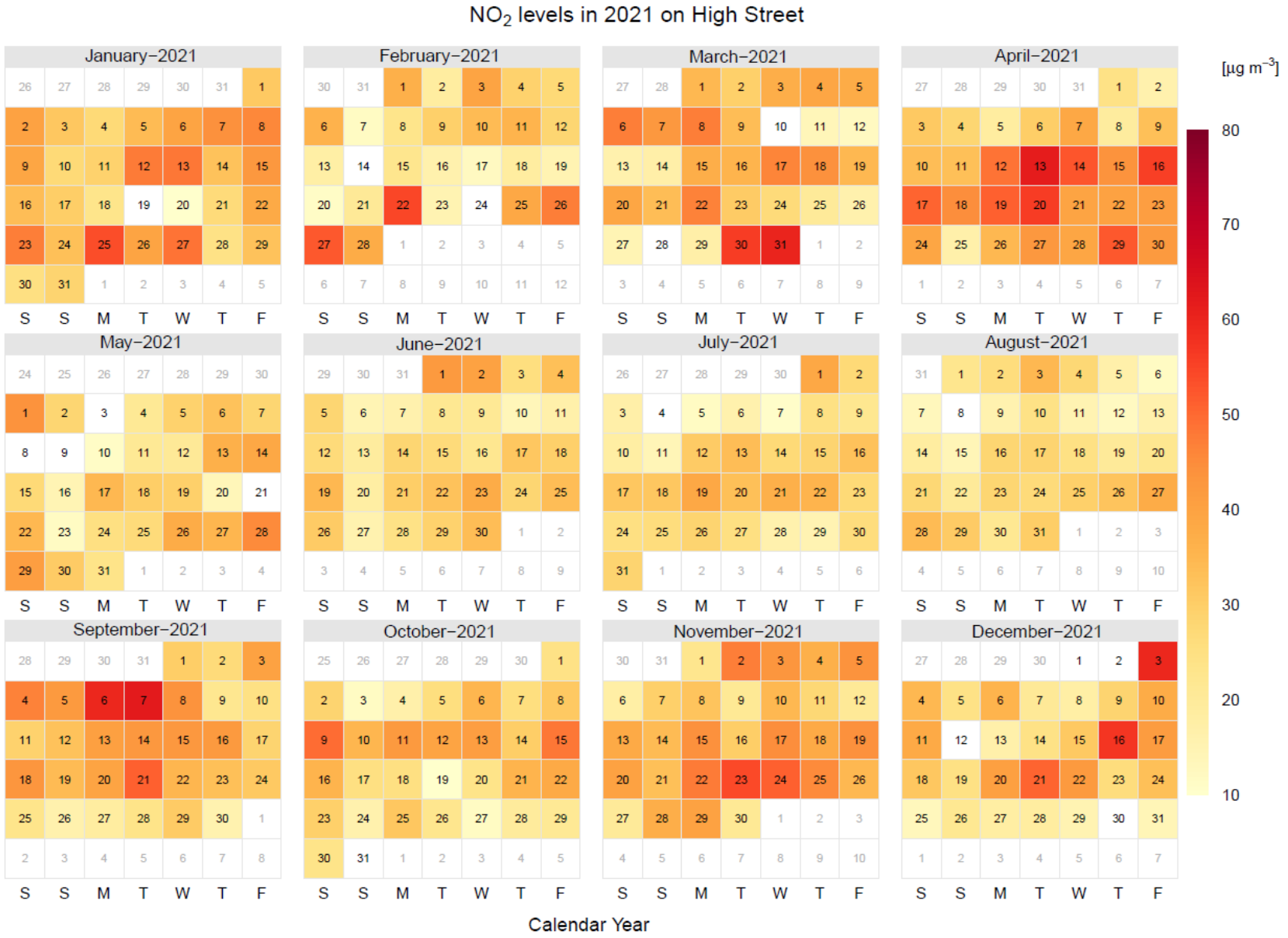
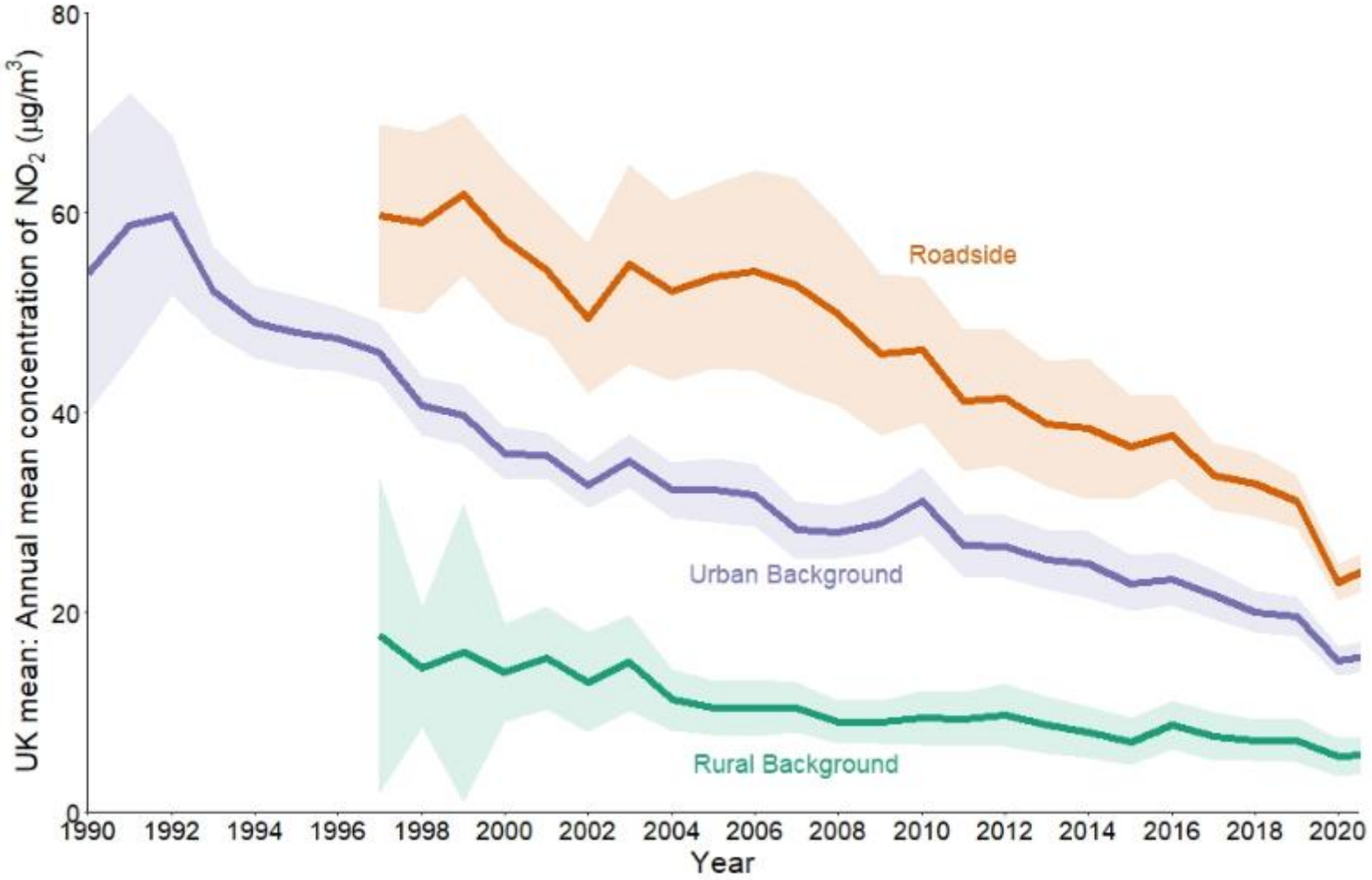


Figure 26 - Annual mean concentrations of NO_2 in the UK, 1990 to 2021



In 2021, average NO_2 concentrations at UK's AURN Roadside and Urban Background sites rose on average by 8% and 5% respectively, when compared with the measurements obtained in the previous year.

Glossary of Terms

Abbreviation	Description
AADT	Annual Average Daily Traffic - (AADT) is the total volume of vehicle traffic on a highway or road for a year divided by 365 days.
AIR-PT	Independent analytical Proficiency Testing Scheme that offers a number of test samples designed to test the proficiency of laboratories undertaking analysis of chemical pollutants in ambient indoor, stack and workplace air.
ANPR	Automatic Number Plate Recognition technology.
AQ	Air Quality
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.
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.
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.
COPD	Chronic obstructive pulmonary disease - a chronic inflammatory lung disease that causes obstructed airflow from the lungs. Symptoms include breathing difficulty, cough, mucus (sputum) production and wheezing.
COVID-19	Disease caused by a new strain of coronavirus. CO stands for corona, VI for virus, and D for disease.
CPZs	Controlled parking zones - areas where parking is only permitted in designated parking bays, and the rest of the kerbside space is restricted by yellow lines. Any illegally parked cars are issued with a parking ticket.
DCs	District Councils
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.

ESO	Energy Super Hub Oxford
Euro V/Euro VI	European emission standard for Heavy-Duty Truck and Bus engines.
EVs	Electric Vehicles.
FIDAS	Fine Dust Monitor System that uses optical light scattering to detect and measure aerosol particles.
FoE	Friends of the Earth.
GSHP	Ground Source Heat Pumps transfer heat from the ground into buildings.
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.
LCWIP	Local Cycling and Walking Infrastructure Plan.
LEVI	Local Electric Vehicle Infrastructure Strategy.
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

ODS	Oxford Direct Services Limited commenced trading on 1st April 2018 and is wholly owned by Oxford City Council. The company brings together the majority of Oxford City Council's front line operational services.
OEP	Office for Environmental Protection - new independent environmental watchdog for England, UK-wide reserved matters and for Northern Ireland. The OEP is established under powers in the Environment Act 2021.
OLEV	UK Government's Office for Low Emission Vehicles
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.
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.
SCR	Selective Catalytic Reduction - an advanced active emissions control technology system that reduces tailpipe emissions of nitrogen oxides (NOx) down to near-zero levels in newer generation diesel-powered vehicles and equipment.
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
$\mu g/m^3$	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.
UKRI	United Kingdom Research and Innovation.
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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