



2024 Air Quality Annual Status Report (ASR)

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

Date: June 2024

Information	Worcester City Council
Local Authority Officer	Phil Brookes
Department	Technical Pollution Team
Address	Wyre Forest House Finepoint Way Kidderminster DY11 7WF
Telephone	01905 822799
E-mail	enquiries@worcsregservices.gov.uk
Report Reference Number	WCC/ASR/2024
Date	June 2024

Executive Summary: Air Quality in Our Area

Air Quality in Worcester City

Breathing in polluted air affects our health and costs the NHS and our society billions of pounds each year. Air pollution is recognised as a contributing factor in the onset of heart disease and cancer and can cause a range of health impacts, including effects on lung function, exacerbation of asthma, increases in hospital admissions and mortality. In the UK, it is estimated that the reduction in healthy life expectancy caused by air pollution is equivalent to 29,000 to 43,000 deaths a year¹ in addition to the loss of quality of life, and financial cost to the NHS and Social Care.

Air pollution particularly affects the most vulnerable in society, children, the elderly, and those with existing heart and lung conditions. Additionally, people living in less affluent areas are most exposed to dangerous levels of air pollution².

Table ES 1 provides a brief explanation of the key pollutants relevant to Local Air Quality Management and the kind of activities they might arise from.

Table ES 1 - Description of Key Pollutants

Pollutant	Description
Nitrogen Dioxide (NO ₂)	Nitrogen dioxide is a gas which is generally emitted from high-temperature combustion processes such as road transport or energy generation.
Sulphur Dioxide (SO ₂)	Sulphur dioxide (SO ₂) is a corrosive gas which is predominantly produced from the combustion of coal or crude oil.
Particulate Matter (PM ₁₀ and PM _{2.5})	<p>Particulate matter is everything in the air that is not a gas.</p> <p>Particles can come from natural sources such as pollen, as well as human made sources such as smoke from fires, emissions from industry and dust from tyres and brakes.</p> <p>PM₁₀ refers to particles under 10 micrometres. Fine particulate matter or PM_{2.5} are particles under 2.5 micrometres.</p>

¹ UK Health Security Agency. Chemical Hazards and Poisons Report, Issue 28, 2022.

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

Due to historic concentration levels of Nitrogen Dioxide (NO₂), the entire Worcester City district has been declared an Air Quality Management Area. Areas of poor air quality within Worcester City district typically coincide with the strategic road network in and around the city centre, in proximity to sensitive residential receptors. Whilst the air quality in outer Worcester falls below the national objective, there are areas in central Worcester where NO₂ concentration levels are significantly higher and at several locations, exceed the national objective, or have in the past. These generally relate to areas in proximity to The Butts / All Saints Road / Bridge Street strategic road one way system, The Tything (A38) to The Foregate Street corridor, Lowesmoor / Rainbow Hill / Astwood Road (B4850) corridor, St Johns Bull Ring (A44) and London Road (A44).

Like many parts of the UK, poor air quality in Worcester City is linked to areas with high volumes of traffic, congestion and 'street canyon' landscapes (where height of the building is greater than width of road). Worcestershire County Council has responsibility for strategic transport issues in the county and published the fourth Local Transport Plan (LTP4) in 2017.

Worcestershire Regulatory Services (WRS) is a shared service formed from the Environmental Health and Licensing departments of the six Worcestershire District Councils. Responsibility for managing (monitoring and reporting of) local air quality transferred from the partnership councils to WRS in April 2011.

Actions to Improve Air Quality

Whilst air quality has improved significantly in recent decades, there are some areas where local action is needed to protect people and the environment from the effects of air pollution.

Air pollution is associated with a variety of adverse health impacts. It is recognised as a contributing factor in the onset of heart disease and cancer. Additionally, air pollution particularly affects the most vulnerable in society: children, the elderly, and those with

existing heart and lung conditions. There is also often a strong correlation with equalities issues because areas with poor air quality are also often less affluent areas^{3,4}.

The Environmental Improvement Plan⁵ sets out actions that will drive continued improvements to air quality and to meet the new national interim and long-term targets for fine particulate matter (PM_{2.5}), the pollutant of most harmful to human health. The Air Quality Strategy⁶ provides more information on local authorities' responsibilities to work towards these new targets and reduce fine particulate matter in their areas.

The Road to Zero⁷ details the Government's approach to reduce exhaust emissions from road transport through a number of mechanisms, in balance with the needs of the local community. This is extremely important given that cars are the most popular mode of personal travel and the majority of Air Quality Management Areas (AQMA) are designated due to elevated concentrations heavily influenced by transport emissions.

On 11th June 2019 Worcester City Council formally declared the Worcester City AQMA (Worcester City (Political Boundary)) which encompasses the whole district area as an AQMA, for likely breach of the nitrogen dioxide annual mean. Prior to 2019, there were 3 separate AQMA's declared in Worcester City district due to exceedances of the annual average objective for nitrogen dioxide (NO₂). Following further assessment, it was concluded that there were several additional areas that should be subject to an AQMA and the decision was made for a districtwide AQMA to be declared.

Worcester City Council AQMA's Variation Order 2019 consolidated the existing 2009 and 2014 AQMA's, as detailed above, into the Worcester City AQMA (Worcester City (Political Boundary)) as of 11th June 2019.

Details of declaration and plans of the AQMA's can be found on the following pages of WRS website: [Air Quality Management Area Declarations | Worcestershire Regulatory Services \(worcsregsites.gov.uk\)](https://www.worcsregsites.gov.uk/Air-Quality-Management-Area-Declarations)

³ Public Health England. Air Quality: A Briefing for Directors of Public Health, 2017

⁴ Defra. Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006

⁵ Defra. Environmental Improvement Plan 2023, January 2023

⁶ Defra. Air Quality Strategy – Framework for Local Authority Delivery, August 2023

⁷ DfT. The Road to Zero: Next steps towards cleaner road transport and delivering our Industrial Strategy, July 2018

There have been no changes to the monitoring network across Worcester City during 2023. The data collected during the past 5 years includes 2020/21, a period impacted by significant disruption to everyday life caused by restrictions and lockdowns affecting social and commercial activity imposed due to Covid-19. The data collected during this period shows an exaggerated reduction in levels of NO₂ greater than would have been expected and is highlighted by the subsequent increase in the following year's data. It appears that the trend in recent history of a small but steady decline in NO₂ concentration levels has resumed.

Monitoring data shows an overall decrease in average recorded annual mean NO₂ concentrations of 1.01 µg/m³ (3.2%) between 2022 (31.21 µg/m³) and 2023 (30.20 µg/m³) across the Worcester City area.

During 2023, 29 of the 37 sites recorded a reduction in NO₂ levels from 2022, in contrast to 2022, where just one location registered a decrease in annual mean NO₂ concentrations between 2021 and 2022. Given the disruptions of 2020/21, it is difficult to draw any short-term conclusions from the data. However, over the longer period the trend remains downward and during the most recent 5-year period, 2019 to 2023, 26 of the 37 sites recorded a further reduction in NO₂ levels.

The most significant impact upon NO₂ concentration levels of the Covid restrictions, and subsequent cessation of restrictions, is likely to have been caused by the decrease and increase in traffic over the 5-year period. Interim traffic data from County Council indicates traffic increased by approximately 9 - 14% between 2021 – 2022 and returned to 98% of pre-pandemic levels across the County by the beginning of 2023.

It is unclear if some enforced behaviours during the pandemic that led to a decrease in the number of journeys made, such as virtual meetings replacing face to face and an increase in working from home, will continue to have the beneficial impact on reducing concentrations of NO₂ now and in the future.

In 2023, the highest recorded concentration of NO₂ across Worcester City was 44.3 µg/m³ at But2 (located in The Butts). This location has recorded the highest concentration across the city for the last 5 years with a measured concentration of 39.1 µg/m³ in 2021 and 52.43 µg/m³ in 2018. One further diffusion tube monitoring location recorded an exceedance of the AQS objective for annual average NO₂, 42.2µg/m³ at location Ast3 (Astwood Road, Rainbow Hill), though this is reduced to 31.3 µg/m³ when calculating back to the nearest relevant receptor.

A further 5 diffusion tube monitoring locations recorded concentrations within -10% of the AQS objective for annual average NO₂, although only 1 location (GS at George Street) recorded concentrations above 36 µg/m³ when calculating back to the nearest relevant receptor. All concentrations are shown in Table B.1.

Given the current data and trends recorded in 2023 no amendments to the Worcester City AQMA are proposed at this time.

Key Developments in 2023 are:

Steering Group work towards production of a draft Worcester City AQAP 2024-29. At the time of writing the draft Worcester City AQAP has been prepared and is progressing through the required review committee process allowing for newly elected council members to be consulted on the plan following local elections in May 2024. The plan will be published for statutory and public consultation in July 2024. An update on progress with measures will be reported in the Annual Status Report 2025.

Construction of a new walking and cycling bridge across the River Severn in Worcester from Gheluvelt Park to the Kepax site in St John's, due for completion in late 2024.

Installation of Electric Vehicle (EV) charge points at more locations, including 10 dual chargers within King Street and Tallow Hill car parks.

Progression of a draft Air Quality Supplementary Planning Document (SPD) in collaboration with Malvern Hills District Council and Wychavon District Council and Worcestershire County Council as part of the [South Worcestershire Development Plan](#) (SWDP). The SPD is designed to support to improvements in air quality within South Worcestershire through areas of decision and plan making in respect of new development.

Progression of a bike hire and bike share scheme: A bike share scheme was planned during 2023 and in June 2024, Worcester City Council are introducing the scheme across Worcester comprising 225 bicycles - 175 of them electric bikes – available to hire, from over 50 parking stations across the city.

Worcester City Centre Transport Strategy (2023): In this [strategy](#) the council sets out proposals and a delivery plan for improving transport and streets in the City Centre in support of the [Worcester City Centre Masterplan](#). The strategy has been shared with Worcestershire County Council for development and implementation of those elements

that fall under the control of the county council as part of the next county-wide Local Transport Plan (LTP5).

Electric Vehicle Charging Strategy (2023 - 2025): This strategy sets out Worcester City Council's approach to encouraging and accelerating the transition to electric vehicles in the city [Electric Vehicle Charging Strategy 2023-2025](#).

Active Travel Action Plan (2023 – 2025): In June 2023 Worcester City Council published their first ever Active Travel plan to increase rates of active travel in Worcester City.

Air Quality Actions Plan and Air Quality Strategy

The timeline for the various stages and delivery of a revised countywide AQAP, and establishment of a new countywide Air Quality Strategy, were set out in the ASR 2023. However, following the introduction of new enforcement policy by Defra in June 2023, it has been necessary to amend the previously published framework to prioritise production of a standalone AQAP for each district with an existing AQMA.

Following discussions with Defra LAQM Team in September 2023, Worcester City Council were granted an extension to the timeline for delivery of the draft AQAP until 1st July 2024. It is anticipated the countywide Air Quality Strategy will be developed in 2025 following completion of these priority works.

At the time of writing, the draft Worcester City AQAP has been prepared and is progressing through the required review committee process allowing for newly elected council members to be consulted on the plan following the local elections held in May 2024.

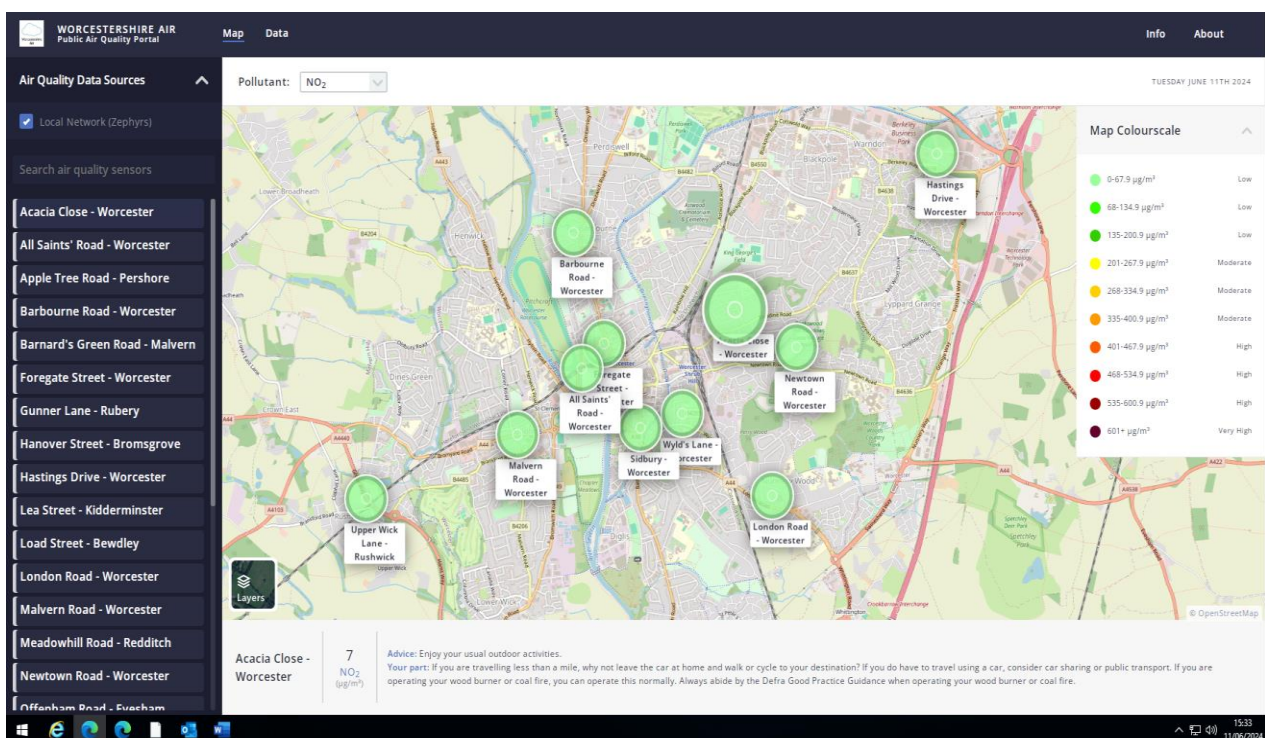
Real-time Air Quality Monitoring Project

In February 2023, WRS were successful in a bid to the Defra Air Quality Grant Scheme 2022/23 to establish an enhanced real-time air quality monitoring network across Worcestershire.

The scope of the bid was to establish a real-time air quality monitoring network across the main areas of air quality concern in Worcestershire for purposes of providing enhanced monitoring data on a range of pollutants. Additionally, the proposal included informing the public and vulnerable groups of the status of air pollution in real time to encourage behaviour change.

The sum of £248,400 was awarded to WRS from the AQ Grant Scheme. An additional 10% of funds was provided by each district council in Worcestershire, in accordance with the match-funding requirement of the scheme, which equates to £27,600. This produced a total sum of £276,000 for the project. The scheme has involved the installation and operation of 26 'low-cost Air Quality Monitors' which measure NO₂, PM₁₀, PM_{2.5} across the county for a period of 3 years (with EA MCERTS standard accreditation as indicative ambient particulate matter devices). The results of monitoring will be used to inform decision making and requirements for further action as necessary.

In 2023, the experienced sensor provider, Earthsense, were appointed as the successful supplier following a rigorous procurement process. The sensors (known as 'Zephyrs') are supplied, operated and serviced by Earthsense who also provide data access. Appropriate monitoring locations were determined by WRS in collaboration with Public Health, Worcestershire County Council Street Lighting team and Earthsense taking into consideration the requirements of Malvern Hills District Council. The locations have been chosen to maximise data capture within locations proximal to vulnerable communities and/or a range of sources of air pollution including transport, solid fuel burning, industry and agriculture. Ten of the monitors have been deployed within the Worcester City Council area since January 2024. Earthsense and WRS have designed a publicly accessible portal to the real time monitoring data which launched in May 2024. Public access to the portal is available at: [Earthsense - WRS Real-time Air Quality Monitors](#)



Above is an image from the website showing the 10 locations of monitors in Worcestershire. One of the sites visible below is not within the Worcester City district.

Worcestershire County Council Highways Department have completed the following major schemes in or around the Worcester City district during 2023:

Southern Link Road A4440 improvements – Work to complete dualling of carriageway between the Ketch and Powick roundabouts, capacity improvements to those junctions, an additional bridge over River Severn, and new foot/cycle bridges has been completed and link road reopened in autumn 2022. Increase in journey time reliability and reduction in congestion on the major route linking Worcester to the strategic road network and to south Worcestershire and Herefordshire is expected. The county recently completed a survey to evaluate whether this scheme met objectives. The survey closed in April 2024 and the results are currently pending.

Further information is available via the following link: -

[The A4440 Worcester Southern Link Road improvements | Worcestershire County Council](#)

A new walking and cycling bridge across the River Severn in Worcester from Gheluvelt Park to the Kepax site in St John's began construction in 2023 and is due for completion in late 2024. The scheme will link to existing cycle routes (park/racecourse/Waterworks Roads/ Severn Path), increase connectivity between east and west banks of the river and allows future expansion to walking and cycling routes. Further information is available here:

[Kepax walking and cycling bridge | Worcestershire County Council](#)

Worcester Future High Streets - The scheme will deliver a high quality public realm using sustainable, maintainable and appropriate surfacing materials alongside surfacing materials alongside lighting, traffic signals and street furniture which will complement the surrounding space. The project is split into 6 phases. Phase 1, 2, 3, 4 and 5 are complete, subject to minor snagging works for phases 2, 4 and 5. Phase 6 is currently in progress with works on the north footway substantially complete.

[Worcester City Future High Street](#)

Worcester Local Cycling and Walking Infrastructure Plan (LCWIP) funded by Active Travel England is due to complete in 2025.

[Local cycling and walking infrastructure plans \(LCWIPs\) | Worcestershire County Council](#)

Worcestershire County Council are collaborating with the Malvern Hills and Wychavon districts to review the South Worcestershire Development Plan, which includes detailed policy to address the impact of air pollution from new development including prioritisation of active travel and corridor improvements. The plan was submitted to the Secretary of State for Department for Levelling Up, Housing and Communities (DLUHC) in September 2023.

Active Travel Schemes

Diglis to Norton Active Travel Corridor - The corridor includes traffic calming measures along Waverley Street / Toucan Crossing over A38 Bath Rd and additional improvements along Norton Road. The St Peter's Drive Zebra Crossing upgraded to a Toucan Crossing and shared use cycle facility along Old Norton Road.

Under design - Bath Road Toucan due to construct July 2024

Worcester Towns Fund 2022 to 2024

Scheme	Brief Description	Current status (feasibility, development, delivery, complete)	Notes
ATC – Worcester to Ketch	Creation of a cohesive cycle link between Diglis Bridge and Ketch roundabout.	Phase 1 - Diglis Bridge to St Marks Close complete	Phase 1 has secure funding from Worcester Towns Fund allocation.
Worcester Towns Fund – Diglis to Sixways	To improve the canal towpath. To accommodate shared use by widening and creating improved connectivity.	Constructed July 2023. Monitoring stations to be installed.	Funding secured as part of Worcester Towns Fund allocation.
Worcester Towns Fund – Diglis Bridge to St Marks Close	To improve the existing Severn Way alignment by widening and introducing a sealed surface up to 3m wide and upgrading the bridge over Duck Brook.	Construction completed Spring 23.	

New cycle infrastructure delivered between March 2022 and March 2024

Scheme	Brief Description	Current status (feasibility, development, delivery, complete)	Notes
Woodgreen Drive, Worcester	Toucan Crossing, linking to off-road cycle routes	Constructed June 2023	
Lower Wick, Worcester	Traffic calming applied to roundabout to protect an uncontrolled pedestrian crossing	Constructed July 2023	
23/24 Dropped kerbs various location	Package of 31 pedestrian dropped kerbs with tactile paving, county wide	Constructed between April 2023 and March 2024	
Cornmeadow Rd, Worcester	Footpath resurfacing and new lighting	Constructed October 2023	

Conclusions and Priorities

The ASR highlights the specific areas (hotspots) in the Worcester City district where NO₂ concentration levels exceed the national objective and should be the focus of future efforts to improve air quality. These are typically in the areas around the city centre, proximal to residential and retail receptors and coinciding with the strategic road network i.e. The Butts / All Saints Road / Bridge Street strategic road one way system, The Tything (A38) to The Foregate Street corridor, Lowesmoor / Rainbow Hill / Astwood Road (B4850) corridor, St Johns Bull Ring (A44) and London Road (A44).

The general trend over the most recent 5-year period (2019-2023) shows a gentle decrease in NO₂ concentrations. During this period, it is clear that there was a substantial decrease during the period of 'lockdowns' caused by the response to Covid-19, a subsequent increase following the end of restrictions and a return to the long term trend in 2022/2023.

The entire district is covered by an AQMA so all exceedances are within the AQMA. There were fewer exceedances of the national objective in 2023 but several exceedances were observed in certain areas highlighted above. In light of this, there is no intention to seek the revocation of the AQMA at this time.

An AQAP is presently in the process of being finalised and this will be the focal point of the next steps in the drive to improve air quality across Worcester City district.

Local Engagement and How to get Involved

There are a number of ways members of the public can help to improve local air quality:

- **Walk or cycle, leave your car at home:** Leaving your car at home and walking or cycling instead will benefit in three ways - increased exercise, reduced pollution exposure and will reduce individual's pollution emissions;
- **Turn off your engine when stationary or parked,** don't 'idle', particularly outside sensitive receptors such as schools, hospitals, care homes and residential properties.
- General travel planning advice is available on [Worcestershire County Council's website](#) (including walking, cycling, bus maps and timetables, community transport and travel to school).
- **Hold meetings by Conference Call** by phone or video conference via Teams, Zoom, Skype or Facetime rather than driving to meetings. This reduces fuel and other travel costs, vehicle maintenance and hire cost, increases productivity through reduction in hours lost through unnecessary travel;
- Facilitate **Flexible Working Arrangements** for non-front-line staff to **work remotely from home** or nearer home facilities for one or more days a week thus removing or reducing any journey to work. This reduces congestion which has beneficial impacts for delivery times, reduced business costs and thus economic benefits. Additionally, provides social benefits through improved work life balance for employees, reduces local air quality and reduced emergency vehicle response times.
- **Switch Fleet to Low Emission Vehicles:** The government is currently providing grants for up to 75% of Electric Vehicle (EV) charging points, up to 40 charge points:

[Workplace Charging Scheme: guidance for applicants - GOV.UK \(www.gov.uk\)](#)

- If you have to drive follow fuel efficient driving advice, often known as '**Smarter Driving Tips**', to save on fuel and reduce your emissions. A number of websites promote such advice including:

<http://www.theaa.com/driving-advice/fuels-environment/drive-smart>

[Maximise fuel economy through efficient driving - Energy Saving Trust](#)

[How to save fuel - the ultimate guide | RAC Drive](#)

- **Reduce air pollution from open fires and wood-burning stoves:** Advice is available from Defra on choosing the right stove, using the right fuels and maintenance, enabling householders to reduce the impact on their health and air quality from open fires and wood burning stoves. Further information is available on the [Smokeless Zones](#) and [Public Advice](#) pages on WRS website.

Air pollution can affect all of us over our lifetime, however certain groups will be more sensitive to the effects of air pollution. Vulnerable groups include adults and children with lung or heart conditions such as asthma, chronic bronchitis, emphysema and chronic obstructive lung disease (COPD)^{8,9}. Senior citizens are more likely to be affected by respiratory diseases and children are more likely to be affected by air pollution due to relatively higher breathing and metabolic rates as well as a developing lung and immune system.

Vulnerable individuals and groups can keep informed of:

- Current levels and forecasts of air pollution from Defra at: [UK AIR](#)
- If you are sensitive to the effects of air pollution, it may be appropriate to limit the length of time spent in areas of local poor air quality – see advice from Defra at [UK AIR](#)
- WRS real-time air quality monitoring information [Earthsense - WRS Real-time Air Quality Monitors](#)
- If you are on social media, sign up to the WRS X (formerly Twitter) feed. WRS tweet when pollution is forecast by Defra to be moderate to very high.

Further information for the general public on reducing your family's exposure to poor air quality in Worcestershire and how individuals, business and schools can assist with reducing their impact on local air quality is available at [Protecting Me and Others from Air Pollution | Worcestershire Regulatory Services \(worcsregservices.gov.uk\)](#)

⁸ <http://www.breathelondon.org/>

⁹ <https://www.londonair.org.uk/LondonAir/guide/MyActionsForMe.aspx>

Local Responsibilities and Commitment

This ASR was prepared by the Worcestershire Regulatory Services for Worcester City Council with the support and agreement of the following officers and departments:

- Worcestershire Regulatory Services
- Worcester City Council
- Worcestershire County Council Highways Department

This ASR has been submitted to the Director of Public Health for comment. No comments have been received for inclusion in this report prior to the deadline for submission.

If you have any comments on this ASR, please send them to:

Technical Pollution Team
Worcestershire Regulatory Services
Wyre Forest House
Finepoint Way
Kidderminster
Worcestershire
DY11 7WF
Telephone - 01905 822799
Email - enquiries@worcsregservices.gov.uk

Table of Contents

Executive Summary: Air Quality in Our Area	ii
Air Quality in Worcester City	ii
Actions to Improve Air Quality	iii
Conclusions and Priorities	xi
Local Engagement and How to get Involved	xii
Local Responsibilities and Commitment	xiv
1 Local Air Quality Management	1
2 Actions to Improve Air Quality	2
2.1 Air Quality Management Areas	2
2.2 Progress and Impact of Measures to address Air Quality in Worcester City	4
2.3 PM_{2.5} – Local Authority Approach to Reducing Emissions and/or Concentrations	14
3 Air Quality Monitoring Data and Comparison with Air Quality Objectives and National Compliance	16
3.1 Summary of Monitoring Undertaken	16
3.1.1 Automatic Monitoring Sites	16
3.1.2 Non-Automatic Monitoring Sites	16
3.2 Individual Pollutants	16
3.2.1 Nitrogen Dioxide (NO ₂)	17
3.2.2 Particulate Matter (PM ₁₀)	18
3.2.3 Particulate Matter (PM _{2.5})	18
3.2.4 Sulphur Dioxide (SO ₂)	18
Appendix A: Monitoring Results	19
Appendix B: Full Monthly Diffusion Tube Results for 2023	28
Appendix C: Supporting Technical Information / Air Quality Monitoring Data QA/QC	31
New or Changed Sources Identified Within Worcester City Council During 2023	31
Additional Air Quality Works Undertaken by Worcester City Council During 2023	31
QA/QC of Diffusion Tube Monitoring	31
Diffusion Tube Annualisation	32
Diffusion Tube Bias Adjustment Factors	32
NO ₂ Fall-off with Distance from the Road	34
QA/QC of Automatic Monitoring	34
Appendix D: Map(s) of Monitoring Locations and AQMA	35
Appendix E: Summary of Air Quality Objectives in England	43
Glossary of Terms	44
References	45

Figures

Figure A.1 – Trends in Annual Mean NO ₂ Concentrations for Worcester City District	24
Figure A.2 – Trends in Annual Mean NO ₂ Concentrations by regions	25
Figure D.1 – Map of Non-Automatic Monitoring Site.....	35
Figure D.2 – Dolday and The Butts.....	36
Figure D.3 – Foregate Street and The Tything	37
Figure D.4 – Foregate Street to Saint Swithins Street	38
Figure D.5 – Lowesmoor-Astwood Road and Tallow Hill	39
Figure D.6 – Henwick & St Johns	40
Figure D.7 – St. Johns	40
Figure D.8 – London Road and Sidbury.....	41
Figure D.9 – Ronkswood and Red Hill	41
Figure D.10 – St. Peters	42

Tables

Table 2.1 – Declared Air Quality Management Areas.....	3
Table 2.2 – Progress on Measures to Improve Air Quality.....	13
Table A.1 – Details of Non-Automatic Monitoring Sites	19
Table A.2 – Annual Mean NO ₂ Monitoring Results: Non-Automatic Monitoring (µg/m ³)	22
Table B.1 – NO ₂ 2023 Diffusion Tube Results (µg/m ³)	28
Table C.1 – Bias Adjustment Factor	33
Table C. 2 – Local Bias Adjustment Calculation	33
Table C.3 – Non-Automatic NO ₂ Fall off With Distance Calculations (concentrations presented in µg/m ³)	34
Table E.1 – Air Quality Objectives in England	43

1 Local Air Quality Management

This report provides an overview of air quality in Worcester City during 2023. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995), as amended by the Environment Act (2021), and the relevant Policy and Technical Guidance documents.

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

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

2 Actions to Improve Air Quality

2.1 Air Quality Management Areas

Air Quality Management Areas (AQMA) are declared when there is an exceedance or likely exceedance of an air quality objective. After declaration, the authority should prepare an Air Quality Action Plan (AQAP) within 18 months. The AQAP should specify how air quality targets will be achieved and maintained, and provide dates by which measures will be carried out.

A summary of AQMA declared by Worcester City Council can be found in Table 2.1. The table presents a description of the AQMA that is currently designated within Worcester City.

Appendix D: Map(s) of Monitoring Locations and AQMA - provides a map of the AQMA and also the air quality monitoring locations in relation to the AQMA. The air quality objectives pertinent to the current AQMA designation is the NO₂ annual mean concentration.

Table 2.1 – Declared Air Quality Management Areas

AQMA Name	Date of Declaration	Pollutants and Air Quality Objectives	One Line Description	Is air quality in the AQMA influenced by roads controlled by Highways England?	Level of Exceedance: Declaration	Level of Exceedance: Current Year	Number of Years Compliant with Air Quality Objective	Name and Date of AQAP Publication	Web Link to AQAP
Worcester City AQMA (Political Boundary)	11.06.2019	NO ₂ Annual Mean	AQMA encompasses whole district within political boundary of Worcester City.	NO	55	44.3	Not compliant	Draft Action Plan 2024-29 due July 2024	Not yet published

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

☒ Worcester City Council confirm that all current AQAPs have been submitted to Defra

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

Defra's appraisal of last year's ASR concluded that the report *was accepted for all sources and pollutants*. *Following the completion of this report, Worcester City Council should submit an Annual Status Report in 2024.*

Defra welcomed and appreciated:

- the fact the ASR 2022 was signed off by the Director of Public Health.
- the detailed summary with trend graphs of the monitoring results.
- inclusion of the 2022 Source Apportionment study.
- the detailed measures in place to reduce PM_{2.5} pollution in the area and reference to the Public Health Outcome Framework relating to air quality.
- the provision of the D01 indicator with a comparison to the national average.
- the high standard of QA/QC procedures.

The references to former AQMAs in ASR 2022 have been omitted from the headings in Appendix D but remain highlighted in the maps to identify their locations.

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

Overall, the report is detailed and concise, providing a good overview of the work the Council is undertaking to improve air quality within their area, and satisfies the criteria of the relevant reporting standard. The Council should continue their good work.

Worcester City Council has taken forward a number of direct measures during the current reporting year of 2023 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2. Worcester City district measures are included within Table 2.2, with the type of measure and the progress Worcester City Council have made during the reporting year of 2023 presented. Where there have been, or continue to be, barriers restricting the implementation of the measure, these are also presented within Table 2.2. Measures reported in previous years relating to earlier action plans have been removed from Table 2.2 in this ASR as they are superseded by the Draft AQAP 2024 – 2029, see below for further information.

Key Developments in 2023 are:

Steering Group work towards production of a draft Worcester City AQAP 2024-29. At the time of writing the draft Worcester City AQAP has been prepared and is progressing through the required review committee process allowing for newly elected council members to be consulted on the plan following local elections in May 2024. The plan will be published for statutory and public consultation in July 2024. An update on progress with measures will be reported in the Annual Status Report 2025.

Construction of a new walking and cycling bridge across the River Severn in Worcester from Gheluvelt Park to the Kepax site in St John's, due for completion in late 2024.

Installation of Electric Vehicle (EV) charge points at more locations, including 10 dual chargers within King Street and Tallow Hill car parks.

Progression of a draft Air Quality Supplementary Planning Document (SPD) in collaboration with Malvern Hills District Council and Wychavon District Council and Worcestershire County Council as part of the [South Worcestershire Development Plan](#) (SWDP). The SPD is designed to support to improvements in air quality within South Worcestershire through areas of decision and plan making in respect of new development.

Progression of a bike hire and bike share scheme: Worcester City Council are introducing a bike share scheme across Worcester comprising 225 bicycles - 175 of them electric bikes – available to hire, from over 50 parking stations across the city. In 2023, the contract to deliver a bike share scheme was awarded to experienced operator [Beryl](#) with the scheme launching in June 2024.

Worcester City Centre Transport Strategy (2023): In this [strategy](#) the council sets out proposals and a delivery plan for improving transport and streets in the City Centre in support of the [Worcester City Centre Masterplan](#). The strategy has been shared with Worcestershire County Council with a request for them to give priority to progressing development and implementation of the final strategy in order to shape future transport decisions and assist in meeting the responsibilities of local government in improving air quality, development and the implementation of those elements that fall under the control of the county council as part of the next county-wide Local Transport Plan (LTP5).

Electric Vehicle Charging Strategy (2023 - 2025): This strategy sets out Worcester City Council's approach to encouraging and accelerating the transition to electric vehicles in the city, published in June 2023 [Electric Vehicle Charging Strategy 2023-2025](#).

Active Travel Action Plan (2023 – 2025): In June 2023 Worcester City Council published their first ever Active Travel plan to increase rates of active travel in Worcester City.

Air Quality Actions Plan and Air Quality Strategy

In 2013, WRS produced a countywide Air Quality Action Plan (AQAP) for Worcestershire which was adopted by Worcester City Council. WRS have produced two updates to the AQAP, the latest in September 2016.

For details of all measures completed, in progress or planned, please refer to the 'Air Quality Action Plan Progress Report for Worcestershire April 2015-2016'. A copy of this, the previous update, and the AQAP, is available to view or download at: [Worcester City Council | Worcestershire Regulatory Services \(worcsregservices.gov.uk\)](http://Worcester City Council | Worcestershire Regulatory Services (worcsregservices.gov.uk))

Due to the suspension of many activities during the response to Covid-19, several of the air quality improvement plans were delayed and existing action groups were suspended. After emerging from the impacts of Covid, WRS has re-engaged with existing and new colleagues with a view to further improving air quality in Worcester City and across the County.

The timeline for the various stages and delivery of a revised countywide AQAP, and establishment of a new countywide Air Quality Strategy, were set out in the ASR 2023. However, following the introduction of new enforcement policy by Defra in June 2023, it has been necessary to amend the previously published framework to prioritise production of a standalone AQAP for each district with an existing AQMA.

Following discussions with Defra LAQM Team in September 2023, Worcester City Council were granted an extension to the timeline for delivery of the draft AQAP until 1st July 2024. It is anticipated the countywide Air Quality Strategy will be developed further in 2025 following completion of these priority works.

The table below provides a summary revised timetable.

Date	Phase
1st July 2024	Submission of Draft Worcester City AQAP to DEFRA
1st Nov 2024	Submission of Draft Bromsgrove and Wyre Forest District AQAPs to DEFRA
12th Dec 2024	Publication of Final Worcester City AQAP and submission to DEFRA
Jan – Feb 2025	Progress revocation of Lickey End and Redditch Road, Bromsgrove AQMAs
1st April 2025	Publication of Final Bromsgrove and Wyre Forest District AQAPs and submission to DEFRA
April – May 2025	Review of Wychbold, Wychavon AQMA - consideration of revocation or progress to AQAP if appropriate.
30th June 2025	Publication of Annual Status Report 2025 and submission to DEFRA
2025	Develop and publish draft of Worcestershire Air Quality Strategy

At the time of writing, the draft Worcester City AQAP has been prepared and is progressing through the required review committee process to enable the newly elected council members to be consulted on the plan following local elections in May 2024.

Real-time Air Quality Monitoring Project

In February 2023, WRS were successful in a bid to the Defra Air Quality Grant Scheme 2022/23 to establish an enhanced real-time air quality monitoring network across Worcestershire. The scope of the bid was to establish a real-time air quality monitoring network across the main areas of air quality concern in Worcestershire for purposes of providing enhanced monitoring data on a range of pollutants. Additionally, the proposal included informing the public and vulnerable groups of the status of air pollution in real time to encourage behaviour change.

The sum of £248,400 was awarded to WRS from the AQ Grant Scheme. An additional 10% of funds was provided by a contribution from each district council in Worcestershire, in accordance with the match-funding requirement of the scheme, which equates to £27,600. This produced a total sum of £276,000 for the project.

The scheme has involved the installation and operation of 26 'low-cost Air Quality Monitors' which measure NO₂, PM₁₀, PM_{2.5} across the county for a period of 3 years (with EA MCERTS standard accreditation as indicative ambient particulate matter devices). The results of monitoring will be used to inform decision making and requirements for further action as necessary.

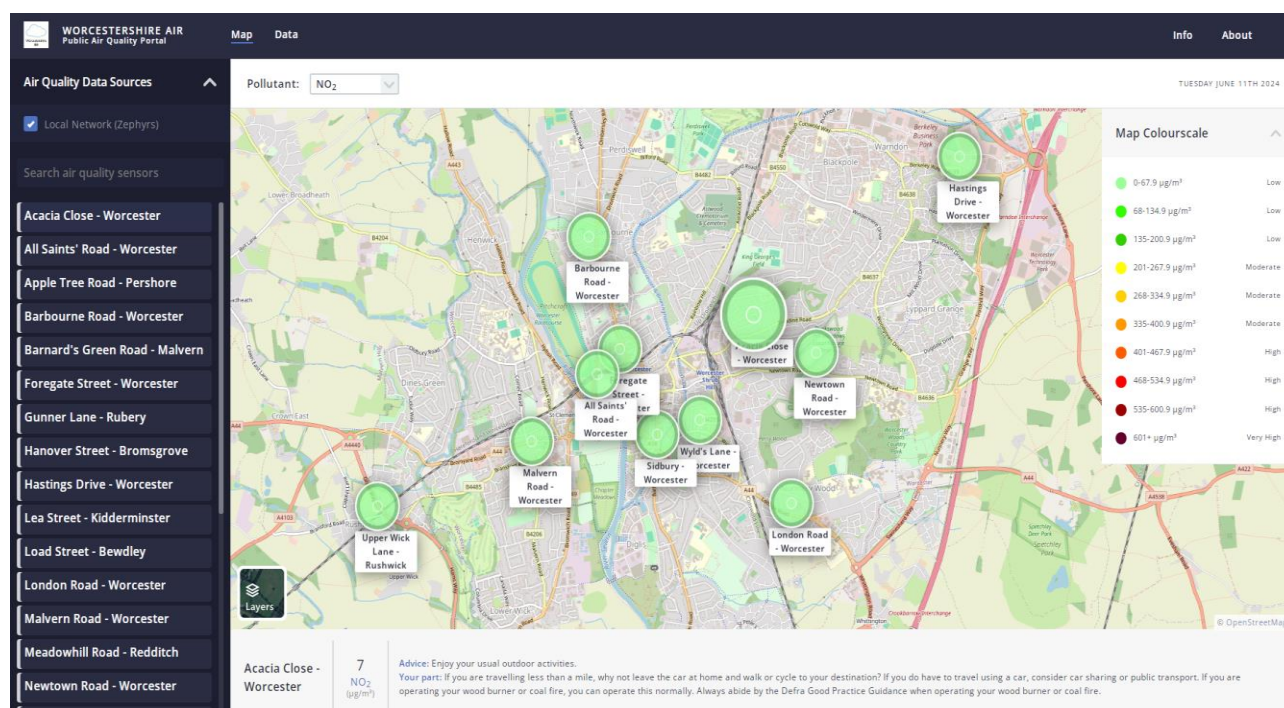
In 2023, the experienced sensor provider, Earthsense, were appointed as the successful supplier following a rigorous procurement process. The sensors (known as 'Zephyrs') are supplied, operated and serviced by Earthsense who also provide data access. Appropriate monitoring locations were determined by WRS in collaboration with Public Health, Worcestershire County Council Street Lighting team and Earthsense taking into consideration the requirements of Worcester City Council.

The locations have been chosen to maximise data capture within locations proximal to vulnerable communities and/or a range of sources of air pollution including transport, solid fuel burning, industry and agriculture.

Ten of the monitors have been deployed within the Worcester City Council area in January 2024. Earthsense has designed a publicly accessible portal to the real time monitoring data and public access to the portal is expected to be available from July 2024 at:

[Earthsense - WRS Real-time Air Quality Monitors](#)

The image below is from the portal showing the locations of the 10 monitors in Worcester City district (and one across the district border).



Worcestershire County Council Highways Department have completed the following major schemes in or around the Worcester City district during 2023:

Southern Link Road A4440 improvements – Work to complete dualling of carriageway between the Ketch and Powick roundabouts, capacity improvements to those junctions, an additional bridge over River Severn, and new foot/cycle bridges has been completed and link road reopened in autumn 2022. Increase in journey time reliability and reduction in congestion on the major route linking Worcester to the strategic road network and to south Worcestershire and Herefordshire is expected. The county recently completed a survey to evaluate whether this scheme met objectives. The survey closed in April 2024 and the results are currently pending.

Further information is available via the following link: -

[The A4440 Worcester Southern Link road improvements | Worcestershire County Council](#)

A new walking and cycling bridge across the River Severn in Worcester from Gheluvelt Park to the Kepax site in St John's began construction in 2023 and is due for completion in late 2024. The scheme will link to existing cycle routes (park/racecourse/Waterworks Roads/ Severn Path), increase connectivity between east and west banks of the river and allows future expansion to walking and cycling routes. Further information is available here:

[Kepax walking and cycling bridge | Worcestershire County Council](#)

Worcester Future High Streets - The scheme will deliver a high quality public realm using sustainable, maintainable and appropriate surfacing materials alongside surfacing materials alongside lighting, traffic signals and street furniture which will complement the surrounding space. The project is split into 6 phases. Phase 1, 2, 3, 4 and 5 are complete, subject to minor snagging works for phases 2, 4 and 5. Phase 6 is currently in progress with works on the north footway substantially complete.

[Worcester City Future High Streets](#)

Worcester Local Cycling and Walking Infrastructure Plan (LCWIP) funded by Active Travel England is due to complete in 2025 subject to public consultation.

[Local cycling and walking infrastructure plans \(LCWIPs\) | Worcestershire County Council](#)

Worcestershire County Council are collaborating with the Malvern Hills and Wychavon districts to review the South Worcestershire Development Plan, which includes detailed policy to address the impact of air pollution from new development including prioritisation

of active travel and corridor improvements. The plan was submitted to the Secretary of State for Department for Levelling Up, Housing and Communities (DLUHC) in September 2023.

Active Travel Schemes - The Diglis to Norton Active Travel Corridor includes traffic calming along Waverley Street with a Toucan Crossing over A38 Bath Road and improvements along Norton Road.

The St Peter's Drive Zebra Crossing was upgraded to a Toucan Crossing shared use cycle facility along Old Norton Road. In 2023 the Bath Road Toucan Crossing was under design and due to construct in July 2024.

Worcester Towns Fund 2022 to 2024

Scheme	Brief Description	Current status (feasibility, development, delivery, complete)	Notes
ATC – Worcester to Ketch	Creation of a cohesive cycle link between Diglis Bridge and Ketch roundabout.	Phase 1 - Diglis Bridge to St Marks Close complete	Phase 1 has secure funding from Worcester Towns Fund allocation.
Worcester Towns Fund – Diglis to Sixways	To improve the canal towpath. To accommodate shared use by widening and creating improved connectivity.	Constructed July 2023. Monitoring stations to be installed.	Funding secured as part of Worcester Towns Fund allocation.
Worcester Towns Fund – Diglis Bridge to St Marks Close	To improve the existing Severn Way alignment by widening and introducing a sealed surface up to 3m wide and upgrading the bridge over Duck Brook.	Construction completed Spring 23.	

New cycle infrastructure delivered between March 2022 and March 2024

Scheme	Brief Description	Current status (feasibility, development, delivery, complete)	Notes
Woodgreen Drive, Worcester	Toucan Crossing, linking to off-road cycle routes	Constructed June 2023	
Lower Wick, Worcester	Traffic calming applied to roundabout to protect an uncontrolled pedestrian crossing	Constructed July 2023	

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

- Publication of final AQAP 2024 – 2029 following statutory and public consultation and required updates to draft.
- Implementation of a bike hire and bike share scheme
- Activation of Public EV charge points in Tallow Hill
- Installation of 10 low-cost sensors in Worcester City and activation of a public access portal to real time data on a range of air pollutants
- Fulfilment of a Behavioural Change Officer (BCO) post at WRS for up to 3 years. The post was advertised at beginning of 2024 and is funded from s106 contributions from new planning developments to provide air quality improvements.
- Publication of a draft Air Quality Supplementary Planning Document for public consultation

Worcester City Council's priorities for the coming year are:

- Publication of draft AQAP 2024 – 2029 for statutory and public consultation
- Publication of final AQAP 2024 – 2029 following consideration of statutory and public consultation outcomes and amendments as required.
- Installation of 10 (Zephyr) low-cost sensors in Worcester City monitoring NO₂ and particulate matter to inform future decisions and actions
- Development and activation of a public access portal to real time data on a range of air pollutants to enhance public knowledge and encourage behavioural change
- Developing closer working ties with Public Health colleagues on a variety of work streams: AQAP measures progression, campaigns such as Clean Air Day 2023 and supporting the development of an Air Quality Strategy for Worcestershire
- Implementation of a bike hire and bike share scheme in Worcester City to be launched in June 2024.
- Publication of a draft Air Quality Supplementary Planning Document for public consultation in July 2024
- Continue monitoring of air pollutants at key locations across the district.
- Ensure proportionate mitigation measures are included within new developments where air quality is a relevant concern.

- Supporting the WRS Behavioural Change Officer (BCO) focussing on working with schools and other community settings across the county, providing information and advice about local air quality, and encouraging sustainable behaviours, such as switching from short car journeys to active travel modes of transport.
- The principal challenges and barriers to implementation that Worcester City Council anticipates facing are:
- Availability of funding for potential AQAP measures to improve air quality.

Whilst the measures stated above and in Table 2.2 will help to contribute towards compliance, Worcester City Council anticipates that further additional measures not yet prescribed will be required in subsequent years to achieve compliance and enable the revocation of Worcester City AQMA (Political Boundary).

Table 2.2 – Progress on Measures to Improve Air Quality

Measure No.	Measure Title	Category	Classification	Year Measure Introduced in AQAP	Estimated / Actual Completion Date	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
NAWC1	Develop and implement Worcester City Centre Masterplan	Traffic Management	UTC. Congestion management, traffic reduction	2019	2032	Worcester City Council and others for the various measures	TBC as various measures progress	No	Not Funded	> £10 million	Planning	Not quantifiable at this time	Masterplan - potentially reduced vehicle movements in some key areas through car parking provision strategy (e.g. uptake of EV), realm enhancements supporting walking and cycling.	Masterplan adopted 16th July 2019. Plan to be implemented over the next 20+ years.	Long time to implementation. Pre COVID-19 plans subjected to delay.
	Electric Vehicle Infrastructure in Residential Streets	Promoting Low Emission Transport	Procuring alternative refuelling infrastructure to promote Low Emission Vehicles, EV recharging, gas fuel recharging	2019	2026	Worcester City Council, Worcestershire County Council	Possible funding streams available	No	Partially Funded	£1 million - £10 million	Planning	0 - 8 %	Implementation of EV charging points in local residential areas, uptake of ULEV	EV Charging Strategy has been produced and approved by Environmental Committee June 2023	22% of residents have no access to off road parking. Significant funding required to provide all with access to EV charge points.
	AQ in Car Parking (Masterplan) Proposals	Transport Planning and Infrastructure	Other	2019	ongoing	Worcester City Council	Unknown at this time	No	Not Funded		Planning	Unknown	Design and location of multi storeys to replace multiple single level car parking and limit AQ impact e.g. promote ULEV	Worcester City Centre Transport Strategy in development. Public consultation completed in 2022	Long timeline of 20+ years for implementation of Masterplan strategy.
	Provide link to real time air quality information to include NO ₂ and particulate matter	Public Information	Via the internet	2022	2024	WRS WCC PHE	Officer time (WRS)	YES	Funded	£100k - £500k	Planning	Informative	Increase in WRS website hits	10 low cost AQ sensors installed across Worcester for 3 years. Link to live feed of monitoring on website due to go live imminently.	Real-time AQ monitoring completed and public access due to go live imminently.
	Make air quality information more available and accessible	Public Information	Via the internet	2013	2017	WRS	Officer time (WRS)	No	Not Funded	£10k - 50k	Completed	0	Website hits and enquiries for information	All existing LAQM reports and details of AQMAs are available to public on WRS website. WRS use Twitter account to release information.	Ongoing and updated regularly
	Produce Air Quality Supplementary Planning Document	Policy Guidance and Development Control	Air quality planning and policy guidance	2013	2022	Worcestershire County Council Strategic Planner, WRS and South Worcestershire Councils	Worcestershire County Council Strategic Planner, WRS and South Worcestershire Councils (Resources)	No	Funded		Implementation	Reduces emissions from new developments	Formal adoption and utilised by Worcester City Council planning authority	WRS 'Technical Guidance Note for Planning' Updated AQ SPD for SWDP in development.	SPD presented for public consultation in July 2024.
	Forge closer links with local health agencies	Other	Other	2013	ongoing	WRS WCC PHE	DoPH, Officer time (WRS)	No	Not Funded	< £10k	Implementation	0	Increase participation of Public Health in Worcestershire Air Quality issues and action groups	County Air Quality Partnership set up May 2019 by DoPH supported by WRS	Re-engagement between WRS and PH in 2023
	AQAP to be completed	Policy guidance	Air quality planning	2022	2024-2029	WRS, WCC	Officer time (WRS)	No	Funded		Implementation	TBA	Formal adoption and utilised by Worcester City Council planning authority	Drafted and presented for statutory and public consultation.	AQAP drafted and pending consultation

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

As detailed in Policy Guidance LAQM.PG22 (Chapter 8) and the Air Quality Strategy¹⁰, local authorities are expected to work towards reducing emissions and/or concentrations of fine particulate matter (PM_{2.5}). There is clear evidence that PM_{2.5} (particulate matter smaller than 2.5 micrometres) has a significant impact on human health, including premature mortality, allergic reactions, and cardiovascular diseases.

There are currently no automatic PM_{2.5} monitoring stations in Worcestershire that are recognised by Defra for measuring against ambient air quality directives. The nearest AURN PM_{2.5} monitoring station is the Birmingham Ladywood site approximately 46 kilometres to the north-east of Worcester City. However, WRS have assisted the Defra AURN expansion project team with potential locations for two PM_{2.5} monitors in Worcestershire, including one within Worcester City district, and it is hoped these will be in place within the next 6 to 12 months. The proposed AURN site in Worcester City district is provisionally planned to be located in the Tolladine area of Worcester. The precise date for installation has not yet been confirmed.

Following success of the bid for funding from the Defra Air Quality Grant 2022/23, WRS have progressed the implementation of 10 low-cost Air Quality Monitors in Worcester City. The sensors have been installed and data for PM_{2.5} will be publicly available from July 2024.

WRS has reviewed the DEFRA national background maps to determine projected PM_{2.5} concentrations across Worcester City area for the 2023 calendar year. The annual average total PM_{2.5} at 32 locations (centre points of 1km x 1km grids) across Worcester City is 8.11 (2022 – 8.22) µg/m³, with a minimum concentration of 7.61 (2022 - 7.71) µg/m³ and a maximum concentration of 9.17 (2022 - 9.28) µg/m³. This indicates that PM_{2.5} concentrations within the Worcester City are generally below the annual average limit value for PM_{2.5} target of 10µg/m³ to be met across England by 2040.

WRS has reviewed the fraction of mortality attributable to particulate air pollution (indicator D01) as published by Public Health England as part of the Public Health Outcomes

¹⁰ Defra. Air Quality Strategy – Framework for Local Authority Delivery, August 2023

Framework. The fraction of mortality attributable to particulate emissions in Worcester City in 2022 (the most recent year available) was 5.1% (2021 - 5.2%) WCC. This falls below the national figure for England (5.8% in 2022) and below the figure for the West Midlands region (5.7% in 2022). Recent trend data is not available for the district due to a lack of data points with valid values.

The Public Health Outcomes Framework examines statistics and indicators that helps explain trends in public health. More information can be found at: [Public Health Outcomes Framework - PHE](#)

The whole district area of Worcester City Council is a Smoke Control Area. More information, maps and guides on the type of fuels that can be used can be found at:

[Smoke Control Areas | Worcestershire Regulatory Services \(worcsregservices.gov.uk\)](#)

WRS hold 7 records of complaints of nuisance from smoke attributable to wood burning stoves in residential developments in Worcester City in 2023 which were either unsubstantiated, not pursued or advice was offered.

In light of the above, no additional actions are currently planned by Worcester City in relation to the reduction of PM_{2.5} levels. However, it is anticipated that any actions taken to improve NO₂ levels across the District as part of the updated Worcester City AQAP will likely result in a linked improvement in PM_{2.5} levels. Following the completion of the new AQAP for Worcester City, WRS intend to complete a local air quality strategy for all Worcestershire districts which will have due regard for the new responsibilities on local authority for PM_{2.5} outlined within the revised national Air Quality Strategy (28 April 2023). The draft AQAP is unpublished at the time of producing this report. It is expected that the investment in real-time monitoring of air quality (including particulate matter) by the new sensors will further inform the decision process of future reviews of local air quality.

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

This section sets out the monitoring undertaken within 2023 by Worcester City Council and how it compares with the relevant air quality objectives. In addition, monitoring results are presented for a five-year period between 2019 and 2023 to allow monitoring trends to be identified and discussed.

Trend graphs are provided in the appendices below, [Appendix A: Monitoring Results](#).

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

Worcester City Council did not undertake any automatic monitoring during 2023.

3.1.2 Non-Automatic Monitoring Sites

Worcester City Council undertook non-automatic (i.e. passive) monitoring of NO₂ at 37 sites during 2023. Table A.1 in Appendix A presents the details of the non-automatic sites.

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

3.2 Individual Pollutants

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

3.2.1 Nitrogen Dioxide (NO₂)

Table A.2 in Appendix A compares the ratified and adjusted monitored NO₂ annual mean concentrations for the past five years with the air quality objective of 40µg/m³. Note that the concentration data presented represents the concentration at the location of the monitoring site, following the application of bias adjustment and annualisation, as required (i.e. the values are exclusive of any consideration to fall-off with distance adjustment).

For diffusion tubes, the full 2023 dataset of monthly mean values is provided in Appendix B. Note that the concentration data presented in Table B.1 includes distance corrected values, only where relevant.

There have been no changes to the monitoring network across Worcester City during 2023. The data collected during the past 5 years includes 2020/21, a period impacted by significant disruption to everyday life caused by restrictions and lockdowns affecting social and commercial activity imposed due to Covid-19. The data collected during this period shows an exaggerated reduction in levels of NO₂ greater than would have been expected and is highlighted by the subsequent increase in the following year's data. It appears that the trend in recent history of a small but steady decline in NO₂ concentration levels has resumed.

Monitoring data shows an overall decrease in average recorded annual mean NO₂ concentrations of 1.01 µg/m³ (3.2%) between 2022 (31.21 µg/m³) and 2023 (30.20 µg/m³) across the Worcester City area.

During 2023, 29 of the 37 sites recorded a reduction in NO₂ levels from 2022, in contrast to 2022, where just one location registered a decrease in annual mean NO₂ concentrations between 2021 and 2022. Given the disruptions of 2020/21, it is difficult to draw any short-term conclusions from the data. However, over the longer period the trend remains downward and during the most recent 5-year period, 2019 to 2023, 26 of the 37 sites recorded a further reduction in NO₂ levels.

The most significant impact upon NO₂ concentration levels of the Covid restrictions, and subsequent cessation of restrictions, is likely to have been caused by the decrease and increase in traffic over the 5 year period. Interim traffic data from County Council indicates traffic increased by approximately 9 - 14% between 2021 – 2022 and returned to 98% of pre-pandemic levels across the County by the beginning of 2023.

It is unclear if some enforced behaviours during the pandemic that led to a decrease in the number of journeys made, such as virtual meetings replacing face to face and an increase in working from home, will continue to have the beneficial impact on reducing concentrations of NO₂ now and in the future.

In 2023, the highest recorded concentration of NO₂ across Worcester City was 44.3 µg/m³ at But2 (located in The Butts). This location has recorded the highest concentration across the city for the last 5 years with a measured concentration of 39.1 µg/m³ in 2021 and 52.43 µg/m³ in 2018. One further diffusion tube monitoring location recorded an exceedance of the AQS objective for annual average NO₂, 42.2µg/m³ at location Ast3 (Astwood Road, Rainbow Hill), though this is reduced to 31.3 µg/m³ when calculating back to the nearest relevant receptor.

A further 5 diffusion tube monitoring locations recorded concentrations within -10% of the AQS objective for annual average NO₂, although only 1 location (GS at George Street) recorded concentrations above 36 µg/m³ when calculating back to the nearest relevant receptor. All concentrations are shown in Table B.1.

Given the current data and trends recorded in 2023 no amendments to the Worcester City AQMA are proposed at this time.

No annual means greater than 60 µg/m³ have been recorded indicating that it is very unlikely that there have been any exceedances of the 1-hour mean objective for NO₂ at any diffusion tube monitoring sites.

3.2.2 Particulate Matter (PM₁₀)

Worcester City Council did not undertake PM₁₀ monitoring in 2023.

3.2.3 Particulate Matter (PM_{2.5})

Worcester City Council did not undertake PM_{2.5} monitoring in 2023.

3.2.4 Sulphur Dioxide (SO₂)

Worcester City Council does not undertake SO₂ monitoring.

Appendix A: Monitoring Results

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

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) ⁽¹⁾	Distance to kerb of nearest road (m) ⁽²⁾	Tube Co-located with a Continuous Analyser?	Tube Height (m)
But1	Magdala Court, The Butts	Roadside	384776	255107	NO ₂	Worcester City AQMA	0.0	1.2	No	2.5
But2	Magdala Court, The Butts	Roadside	384724	255086	NO ₂	Worcester City AQMA	0.0	1.7	No	2.4
Dd1	Dolday 1 opposite bus station	Roadside	384652	254986	NO ₂	Worcester City AQMA	0.0	2.2	No	2.2
DDASH	Lamppost opposite All Saints House	Roadside	384682	254924	NO ₂	Worcester City AQMA	2.0	2.3	No	2.1
BrS	Bridge Street lamppost outside John Gwen House	Kerbside	384666	254818	NO ₂	Worcester City AQMA	2.0	0.7	No	2.2
BrS2	Bridge Street sign opposite John Gwynne House	Roadside	384695	254840	NO ₂	Worcester City AQMA	1.0	2.0	No	2.1
Tyn3	No 26 Upper Tything (Lp opp Kwik Fit)	Roadside	384679	255998	NO ₂	Worcester City AQMA	0.1	2.0	No	2.2
Tyn2	Lamb & Flag PH Upper Tything (LP934)	Roadside	384767	255606	NO ₂	Worcester City AQMA	2.6	2.3	No	2.2
Tyn	925 - HAMMERCHILDS, Upper Tything	Roadside	384833	255461	NO ₂	Worcester City AQMA	2.1	1.6	No	2.2
Fos2	Hewitt Recruitment, 35 Foregate Street (downpipe)	Roadside	384866	255367	NO ₂	Worcester City AQMA	3.5	3.2	No	2.1
Fos3	Café Mela, 22 Foregate Street (downpipe)	Roadside	384899	255329	NO ₂	Worcester City AQMA	2.4	2.2	No	2.5
Fos	Foregate Street at junction with Shaw Street (Traffic lights)	Kerbside	384941	255140	NO ₂	Worcester City AQMA	1.9	1.0	No	2.5
Crs1	My Coffee, 29 The Cross (downpipe)	Roadside	384967	255012	NO ₂	Worcester City AQMA	3.6	3.4	No	2.2
Swth1	Scope Shop, St Swithins Street	Roadside	385013	254987	NO ₂	Worcester City AQMA	2.5	2.1	No	2.2

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)
Lwm2	Lowesmoor 2 Town End. Adj private shop	Roadside	385164	255134	NO ₂	Worcester City AQMA	2.1	1.9	No	2.5
Lwm1	Lowesmoor 1 Rainbow Hill End outside 4 Seasons	Roadside	385268	255191	NO ₂	Worcester City AQMA	1.7	1.4	No	2.6
StJ1	Scott of Tattoo, 1A St. John's (downpipe)	Roadside	384137	254510	NO ₂	Worcester City AQMA	3.1	2.7	No	2.0
Brm	10 Bromyard Road (downpipe)	Roadside	383967	254481	NO ₂	Worcester City AQMA	0.0	8.8	No	1.9
KCP	King Charles Place outside bakery Lamppost 5372	Roadside	384016	254399	NO ₂	Worcester City AQMA	2.6	2.2	No	2.1
StJ2	The Fortune House, 65 St Johns	Roadside	384013	254356	NO ₂	Worcester City AQMA	2.7	2.2	No	2.0
StJ3	The Bell, 35 St Johns	Roadside	384046	254424	NO ₂	Worcester City AQMA	2.6	2.1	No	2.0
Mcl	McIntyre Road lamppost outside last house before cemetery	Suburban	383454	254606	NO ₂	Worcester City AQMA	4.5	1.2	No	2.3
Ast4	246 Astwood Road	Roadside	386097	256565	NO ₂	Worcester City AQMA	0.0	9.9	No	2.0
AST1b	LP5129 outside 170/172 Astwood Road	Roadside	386022	256401	NO ₂	Worcester City AQMA	5.5	3.5	No	2.1
Ast3	Astwood Road 3 Rainbow Hill	Roadside	385764	255968	NO ₂	Worcester City AQMA	6.6	1.7	No	2.3
OAK	22 Oaklands on drainpipe	Roadside	387810	254993	NO ₂	Worcester City AQMA	0.0	7.0	No	1.9
LRW	within vicinity of London Road Waitrose	Kerbside	386654	253761	NO ₂	Worcester City AQMA	4.0	0.5	No	1.9
LR1	London Road Lamppost 6569 by Bargain Booze	Roadside	385636	254158	NO ₂	Worcester City AQMA	2.9	1.6	No	2.1
LR2	London Road Lamppost 6561 by Royal Court	Roadside	385428	254238	NO ₂	Worcester City AQMA	3.0	1.5	No	2.2
LR3	London Road traffic sign 572 for A58(City)	Roadside	385357	254272	NO ₂	Worcester City AQMA	0.5	1.8	No	2.3
LR5	London rd Bus stop SL6554 opp Bath rd	Roadside	385325	254329	NO ₂	Worcester City AQMA	0.3	1.5	No	2.2

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)
LR4	London Rd SL6565 adj no65	Roadside	385525	254219	NO ₂	Worcester City AQMA	3.1	1.9	No	2.1
SidFG	Sidbury Street sign o/s Fisher German Agents	Roadside	385146	254474	NO ₂	Worcester City AQMA	6.2	2.3	No	2.2
BG2	Near 17 Broomhall Green, Broomhall, WR5 2PG	Roadside	386165	252146	NO ₂	Worcester City AQMA	5.3	5.1	No	2.3
RH	Nursery Rainbow Hill LP5196, WR3 8LX	Roadside	385420	255413	NO ₂	Worcester City AQMA	7.8	1.5	No	2.4
BkC	Façade of Berkeley Court, Foregate Street, Worcester	Roadside	384948	255111	NO ₂	Worcester City AQMA	0.2	4.1	No	2.5
GS	54 George Street	Roadside	385358	254969	NO ₂	Worcester City AQMA	0.0	2.0	No	2.3

Notes:

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

(2) N/A if not applicable.

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

Diffusion Tube ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2023 (%) ⁽²⁾	2019	2020	2021	2022	2023
But1	384776	255107	Roadside	100	100.0	33.5	27.3	31.0	35.7	35.0
But2	384724	255086	Roadside	90.38461538	90.4	42.1	35.9	39.1	43.9	44.3
Dd1	384652	254986	Roadside	92.30769231	92.3	29.7	23.2	25.3	29.9	29.8
DDASH	384682	254924	Roadside	100	100.0	36.8	29.0	30.5	35.9	34.3
BrS	384666	254818	Kerbside	100	100.0	31.0	24.9	29.4	31.7	31.4
BrS2	384695	254840	Roadside	90.38461538	90.4	38.6	35.6	33.8	39.1	37.1
Tyn3	384679	255998	Roadside	100	100.0	29.5	23.4	26.2	31.0	28.6
Tyn2	384767	255606	Roadside	100	100.0	39.9	31.3	34.6	38.8	37.6
Tyn	384833	255461	Roadside	100	100.0	41.8	31.1	34.3	38.7	36.8
Fos2	384866	255367	Roadside	100	100.0	30.7	22.8	25.6	30.0	26.8
Fos3	384899	255329	Roadside	92.30769231	92.3	27.6	21.3	24.3	29.4	27.3
Fos	384941	255140	Kerbside	100	100.0	37.3	27.5	33.1	37.6	35.6
Crs1	384967	255012	Roadside	92.30769231	92.3	29.1	22.0	22.9	26.2	25.6
Swth1	385013	254987	Roadside	100	100.0	23.4	17.8	19.0	21.5	21.3
Lwm2	385164	255134	Roadside	100	100.0	29.5	23.1	24.5	29.2	28.0
Lwm1	385268	255191	Roadside	100	100.0	33.9	31.8	31.6	36.2	35.8
StJ1	384137	254510	Roadside	100	100.0	36.0	22.7	28.0	34.6	34.5
Brm	383967	254481	Roadside	82.69230769	82.7	27.8	19.1	22.0	24.9	25.0
KCP	384016	254399	Roadside	100	100.0	27.9	22.0	24.5	28.1	27.4
StJ2	384013	254356	Roadside	80.76923077	80.8	23.5	17.5	21.1	24.8	25.1
StJ3	384046	254424	Roadside	100	100.0	27.9	19.9	25.0	29.2	28.0
Mcl	383454	254606	Suburban	90.38461538	90.4	11.9	10.1	12.7	10.9	11.1

Diffusion Tube ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2023 (%) ⁽²⁾	2019	2020	2021	2022	2023
Ast4	386097	256565	Roadside	100	100.0	21.6	16.9	19.8	21.3	22.1
AST1b	386022	256401	Roadside	100	100.0	28.9	23.9	27.2	29.7	30.8
Ast3	385764	255968	Roadside	100	100.0	40.0	31.3	38.1	41.5	42.2
OAK	387810	254993	Roadside	100	100.0	16.7	13.1	13.1	15.6	15.2
LRW	386654	253761	Kerbside	100	100.0	35.7	25.0	30.4	34.5	33.1
LR1	385636	254158	Roadside	100	100.0	29.3	22.8	25.1	27.4	26.4
LR2	385428	254238	Roadside	100	100.0	34.5	25.1	32.3	32.5	31.0
LR3	385357	254272	Roadside	100	100.0	33.7	26.5	31.0	34.0	32.0
LR5	385325	254329	Roadside	100	100.0	35.0	27.5	30.5	33.2	30.4
LR4	385525	254219	Roadside	100	100.0	29.7	24.7	27.8	32.4	28.9
SidFG	385146	254474	Roadside	100	100.0	34.3	25.9	29.7	35.6	33.6
BG2	386165	252146	Roadside	92.30769231	92.3	22.8	16.8	20.7	22.3	23.6
RH	385420	255413	Roadside	100	100.0	30.1	21.6	27.8	30.5	28.2
BkC	384948	255111	Roadside	100	100.0	38.4	29.4	32.9	38.8	36.0
GS	385358	254969	Roadside	82.69230769	82.7	36.3	29.4	32.5	38.3	37.6

- ☐ Annualisation has been conducted where data capture is <75% and >25% in line with LAQM.TG22.
- ☒ Diffusion tube data has been bias adjusted.
- ☒ Reported concentrations are those at the location of the monitoring site (bias adjusted and annualised, as required), i.e. prior to any fall-off with distance correction.

Notes:

The annual mean concentrations are presented as µg/m³.

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

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

Means for diffusion tubes have been corrected for bias. All means have been “annualised” as per LAQM.TG22 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

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

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

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

Figure A.1 – Trends in Annual Mean NO₂ Concentrations for Worcester City District

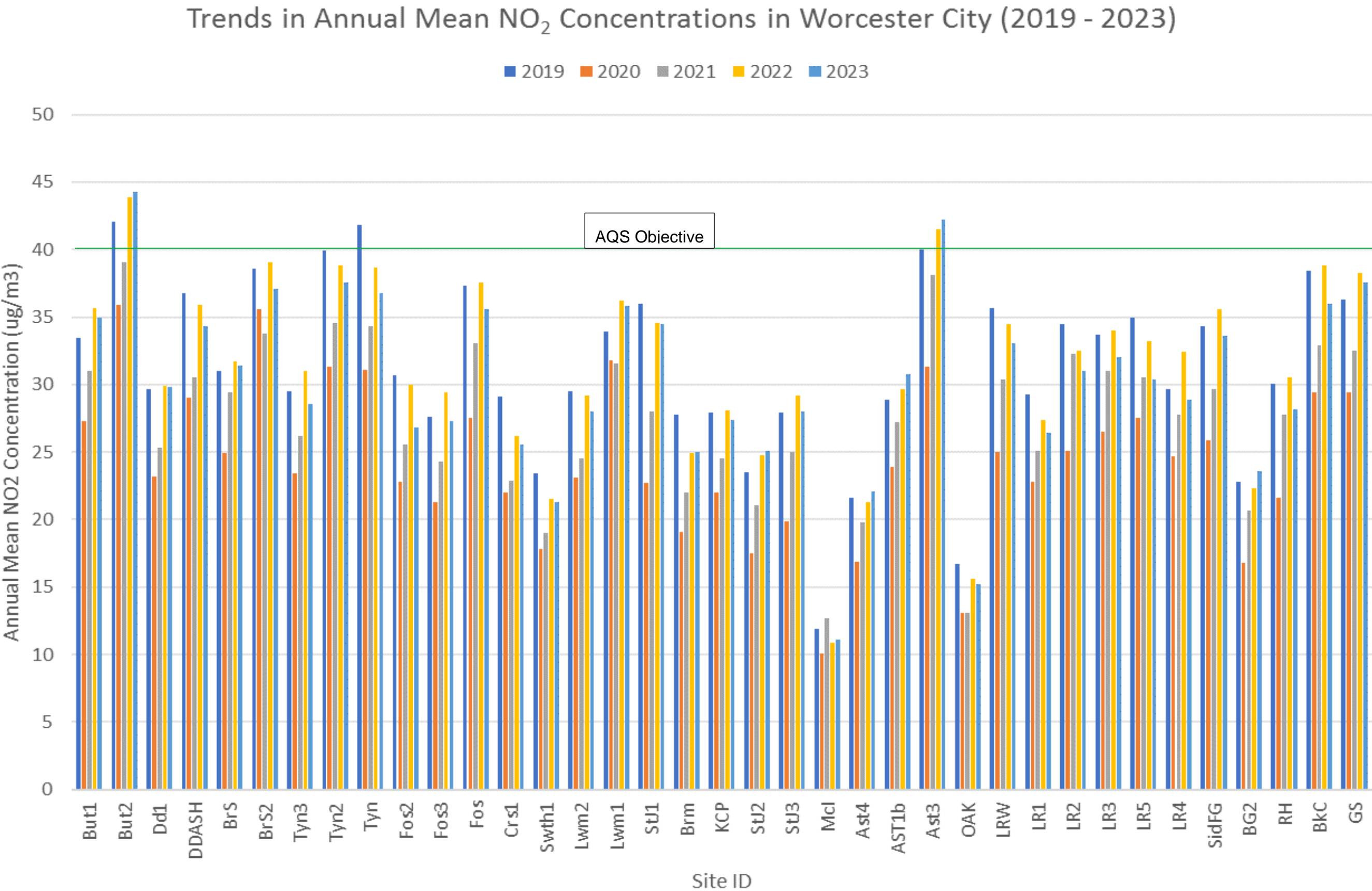
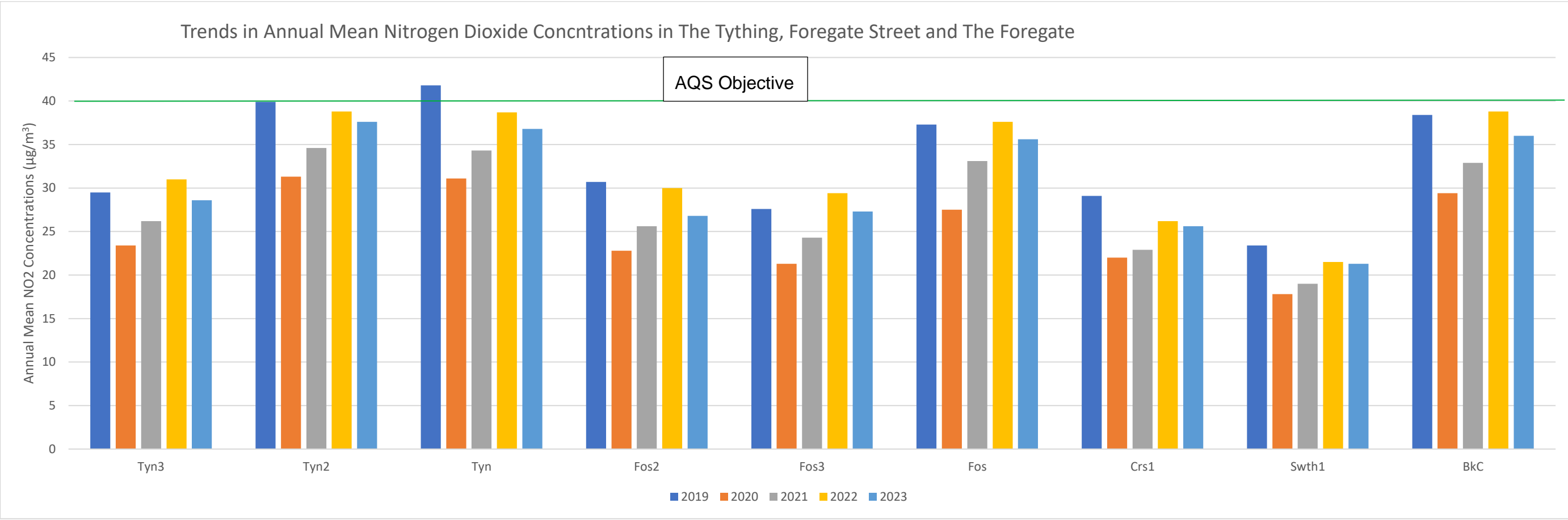
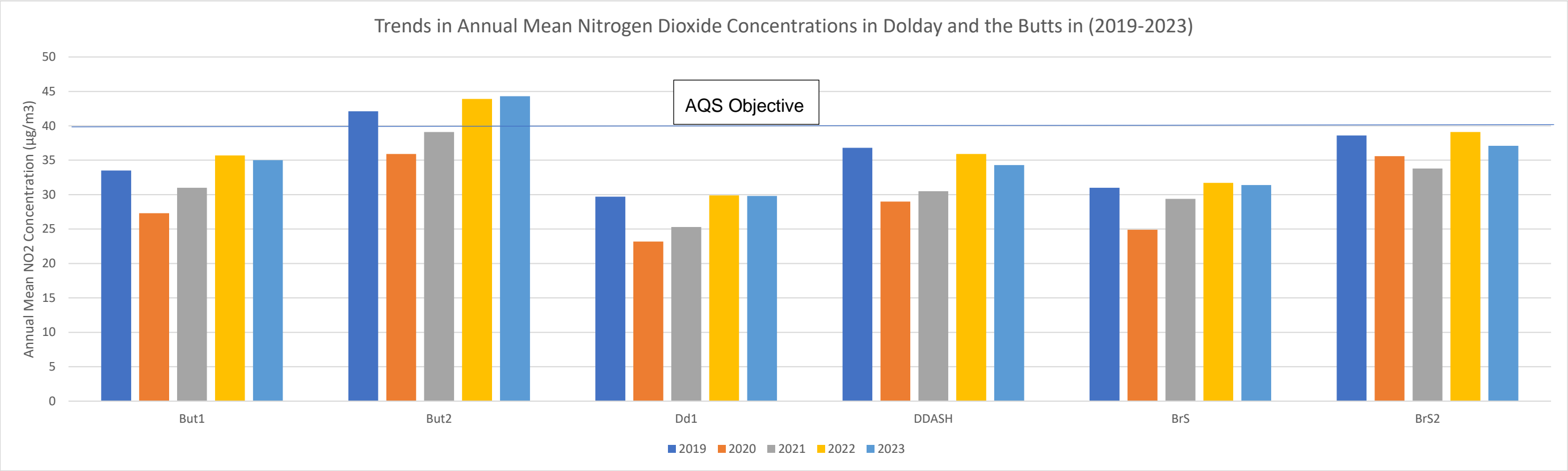
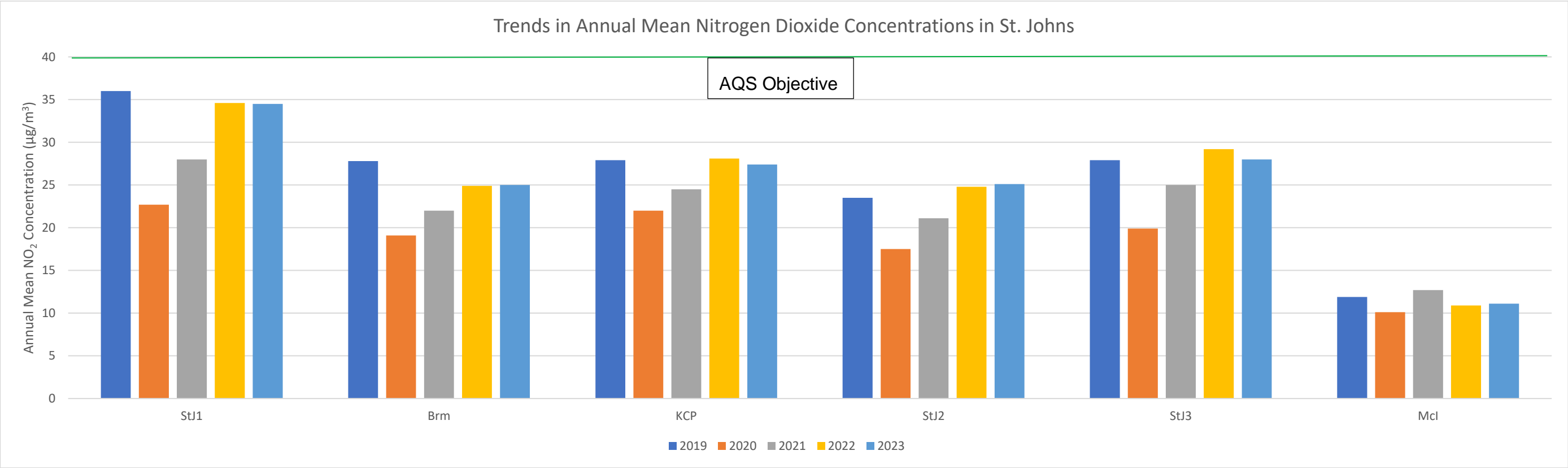
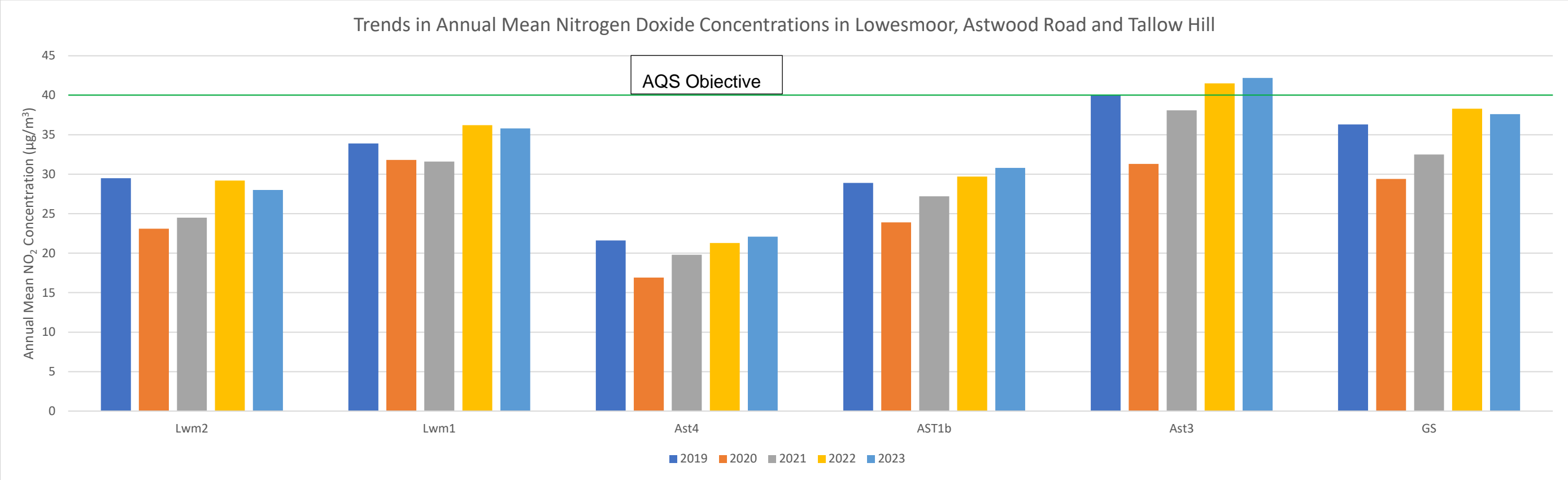
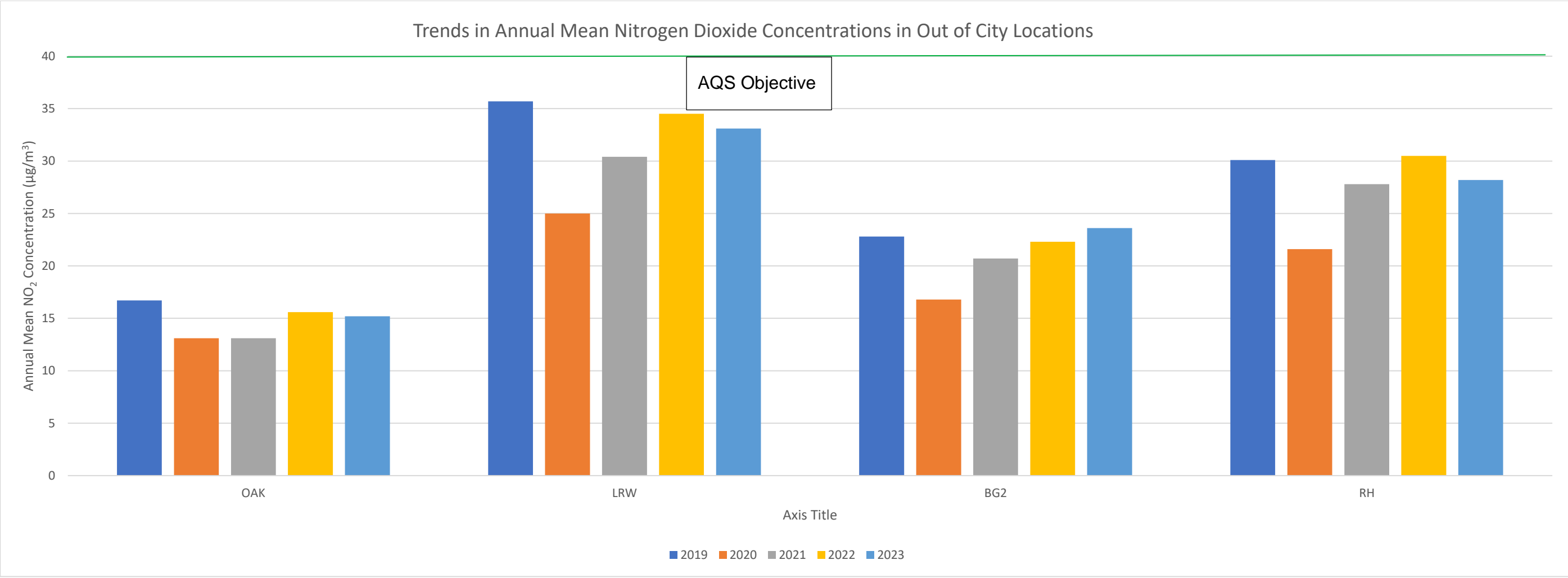
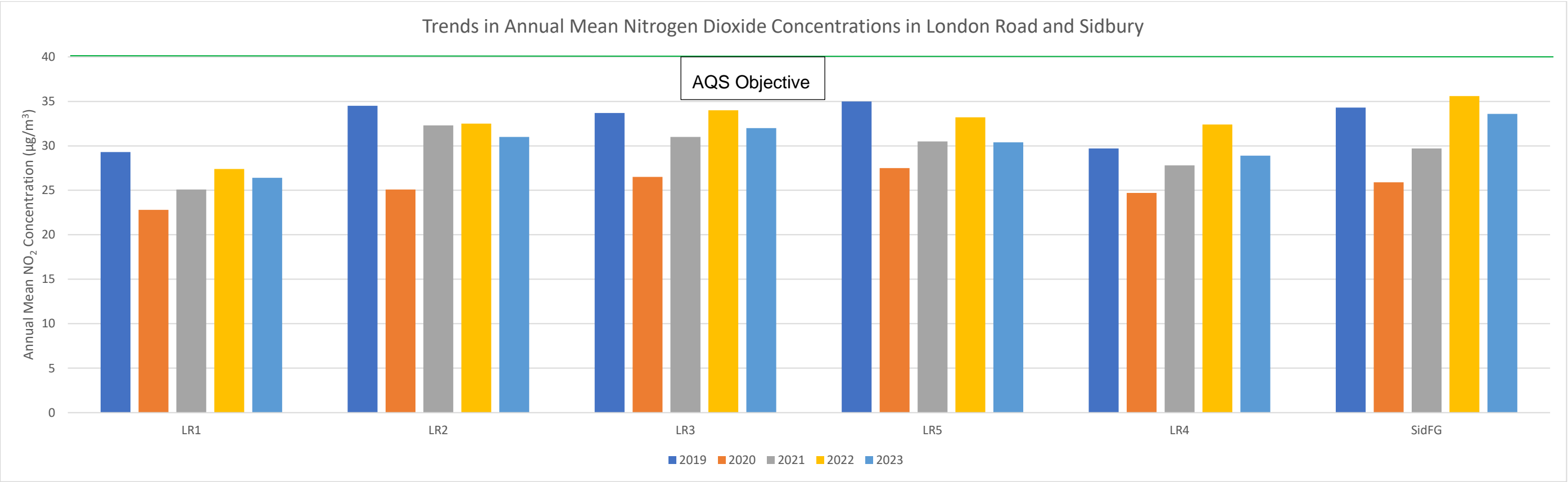


Figure A.2 – Trends in Annual Mean NO₂ Concentrations by regions







Appendix B: Full Monthly Diffusion Tube Results for 2023

Table B.1 – NO₂ 2023 Diffusion Tube Results (µg/m³)

DT ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Annualised and Bias Adjusted (0.96)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
But1	384776	255107	36.2	40.9	34.5	47.2	38.4	37.6	26.9	30.5	36.3	36.0	41.5	27.5	36.1	35.0	-	
But2	384724	255086	46.9	53.7	45.8	38.0	49.1		41.7	41.1	48.4	48.7	51.9	37.4	45.7	44.3	-	
Dd1	384652	254986	29.0	35.5	30.9	38.1		37.9	20.5	25.0	32.2	32.2	32.4	24.0	30.7	29.8	-	
DDAS H	384682	254924	39.0	42.1	30.9	34.5	29.7	32.4	32.9	29.1	38.8	39.0	41.0	35.6	35.4	34.3	-	
BrS	384666	254818	33.5	42.0	29.5	34.1	39.8	41.1	20.6	26.5	31.1	30.3	37.1	23.0	32.4	31.4	-	
BrS2	384695	254840	37.6	43.4	38.0	43.3	39.7		28.0	33.1	42.8	43.4	41.5	30.3	38.3	37.1	34.6	
Tyn3	384679	255998	30.2	37.0	31.8	35.1	30.7	27.2	17.6	23.0	29.5	33.8	35.5	22.8	29.5	28.6	-	
Tyn2	384767	255606	41.6	50.5	40.4	38.8	32.7	30.4	33.3	30.5	39.3	40.1	47.5	40.2	38.8	37.6	32.8	
Tyn	384833	255461	42.1	44.0	40.2	38.8	32.7	30.7	33.6	35.0	38.6	39.3	44.4	36.5	38.0	36.8	32.2	
Fos2	384866	255367	32.1	34.1	30.0	26.3	22.2	20.8	23.2	23.4	29.7	23.9	36.4	29.5	27.6	26.8	-	
Fos3	384899	255329	34.8	32.3	28.9	30.3	25.0	25.2	18.2	22.3	27.4	30.9	34.2		28.1	27.3	-	
Fos	384941	255140	41.3	43.1	37.5	41.1	40.6	36.5	25.3	30.5	35.6	36.3	42.8	29.7	36.7	35.6	-	
Crs1	384967	255012	30.1	31.2	23.9	25.9	25.0	19.5		21.9	25.1	27.0	32.8	28.2	26.4	25.6	-	
Swth1	385013	254987	24.6	26.8	22.6	22.3	23.4	20.5	12.5	18.4	22.1	23.3	28.1	18.7	21.9	21.3	-	
Lwm2	385164	255134	30.9	33.5	31.3	32.3	28.6	29.3	19.3	23.2	29.5	31.4	32.4	24.5	28.9	28.0	-	
Lwm1	385268	255191	41.3	44.1	38.2	36.5	36.1	37.6	29.1	29.8	35.5	36.0	42.4	36.7	36.9	35.8	-	
StJ1	384137	254510	36.8	38.5	38.6	35.8	27.6	34.1	32.5	29.9	38.2	39.8	38.1	36.8	35.6	34.5	-	
Brm	383967	254481	31.5	31.8	29.4	27.2	17.1		21.4	18.1	25.3		30.9	25.5	25.8	25.0	-	
KCP	384016	254399	31.0	34.8	28.8	28.6	25.1	25.3	21.0	22.0	30.3	30.8	33.6	27.4	28.2	27.4	-	

DT ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Annualised and Bias Adjusted (0.96)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
StJ2	384013	254356	27.1	29.9	27.3	27.5	22.9		21.5		26.2	28.3	27.8	20.2	25.9	25.1	-	
StJ3	384046	254424	27.9	34.0	30.2	33.5	28.3	29.7	16.5	23.3	31.8	35.6	31.4	23.6	28.8	28.0	-	
Mcl	383454	254606	13.4	16.5		11.6	8.4	7.9	7.0	7.6	11.2	15.9	17.0	9.7	11.5	11.1	-	
Ast4	386097	256565	25.8	28.1	23.9	22.4	19.0	21.3	16.5	18.2	25.2	25.9	27.0	19.8	22.7	22.1	-	
AST1b	386022	256401	32.3	38.6	36.8	34.6	30.3	32.0	23.1	23.9	32.4	35.3	33.4	28.6	31.8	30.8	-	
Ast3	385764	255968	47.1	51.7	46.6	45.2	39.4	42.9	35.6	37.4	43.7	45.7	46.1	41.0	43.5	42.2	31.3	
OAK	387810	254993	20.0	20.4	16.2	14.3	10.9	10.8	10.8	12.1	17.2	19.7	21.2	14.1	15.6	15.2	-	
LRW	386654	253761	33.0	36.2	35.6	36.6	34.4	35.2	27.8	30.3	36.6	38.4	39.0	26.0	34.1	33.1	-	
LR1	385636	254158	30.9	35.8	27.2	27.3	21.9	23.2	20.2	22.0	26.4	29.7	33.8	27.7	27.2	26.4	-	
LR2	385428	254238	36.5	38.4	33.4	31.7	25.6	28.2	27.4	27.7	32.9	33.7	36.7	31.0	31.9	31.0	-	
LR3	385357	254272	34.3	40.3	35.7	32.8	28.8	30.5	26.8	28.2	35.6	36.6	36.9	29.8	33.0	32.0	-	
LR5	385325	254329	33.6	37.5	33.4	39.2	31.7	34.2	21.1	27.9	31.8	29.8	38.8	17.3	31.4	30.4	-	
LR4	385525	254219	33.3	36.5	28.1	31.3	37.8	26.9	19.3	23.8	29.4	33.6	35.7	22.1	29.8	28.9	-	
SidFG	385146	254474	41.1	41.3	32.8	37.8	31.9	31.8	27.3	29.6	34.8	37.5	40.9	29.4	34.7	33.6	-	
BG2	386165	252146	22.4	28.8	24.9	27.4	24.3	26.3	17.0	12.8	28.5	30.1	25.2		24.3	23.6	-	
RH	385420	255413	32.7	33.4	32.9	30.1	22.9	27.0	25.5	24.3	29.1	33.5	30.5	27.3	29.1	28.2	-	
BkC	384948	255111	36.8	42.5	38.6	41.0	38.7	33.4	28.7	32.6	38.5	38.8	41.3	34.6	37.1	36.0	35.8	
GS	385358	254969	40.1	43.4	36.8	42.0	39.1		31.1	32.6	38.2	41.5	43.2		38.8	37.6	-	

- ☒ All erroneous data has been removed from the NO₂ diffusion tube dataset presented in Table B.1.
- ☐ Annualisation has been conducted where data capture is <75% and >25% in line with LAQM.TG22.
- ☒ Local bias adjustment factor used.
- ☐ National bias adjustment factor used.
- ☒ Where applicable, data has been distance corrected for relevant exposure in the final column.

 **Worcester City Council confirm that all 2023 diffusion tube data has been uploaded to the Diffusion Tube Data Entry System.**

Notes:

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

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

See Appendix C for details on bias adjustment and annualisation.

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

A local bias adjustment factor has been determined by WRS. This has been calculated using the 'Diffusion Tube Data Processing Tool spreadsheet' which has been uploaded to the Defra LAQM portal. All calculations and data are presented within the relevant sections of the spreadsheet. The calculation details have also been provided in 'Table C.2 – Local Bias Adjustment Calculation' within the 2023 ASR. Further details are set out below under the heading Diffusion Tube Bias Adjustment Factors.

New or Changed Sources Identified Within Worcester City Council During 2023

Worcester City Council has not identified any new sources relating to air quality within the reporting year of 2023 save for application received for four developments of housing in excess of 100 homes, the largest of which is for 469 dwellings under construction (or planned) in the Sheriff Gate area of Worcester. Further significant developments include 175 properties near Oak View Way, 120 properties at the University Park Development and 106 properties at Mount Battenhall, Worcester.

Additional Air Quality Works Undertaken by Worcester City Council During 2023

Worcester City Council completed a Source Apportionment Assessment in 2022 of background and local sources to inform the development of an Air Quality Action Plan. A copy of the full document was provided in Appendix F of the ASR for 2022. The AQAP has been drafted and presented for statutory and public consultation. It is expected to be finalised for publication in December 2024.

QA/QC of Diffusion Tube Monitoring

The following UKAS accredited company provided Worcester City Council with nitrogen dioxide diffusion tubes and analysis in 2023:

Gradko International Limited of St. Martins House, 77 Wales Street, Winchester,
SO23 0RH

diffusion@gradko.com

The 20% Triethanolamine (TEA) / De-ionised Water preparation method is used.

Gradko International Limited participate in the AIR NO₂ Proficiency Testing Scheme (AIR-PT). All monitoring undertaken has been completed in accordance with the 2023 Diffusion Tube Monitoring Calendar, i.e. on or within ± 2 days of the specified date.

Diffusion Tube Annualisation

All diffusion tube monitoring locations within Worcester City recorded data capture of 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.

Diffusion Tube Bias Adjustment Factors

The diffusion tube data presented within the 2024 ASR have been corrected for bias using an adjustment factor. Bias represents the overall tendency of the diffusion tubes to under or over-read relative to the reference chemiluminescence analyser. LAQM.TG22 provides guidance with regard to the application of a bias adjustment factor to correct diffusion tube monitoring. Triplicate co-location studies can be used to determine a local bias factor based on the comparison of diffusion tube results with data taken from NO_x/NO₂ continuous analysers. Alternatively, the national database of diffusion tube co-location surveys provides bias factors for the relevant laboratory and preparation method.

Worcester City Council have applied a local bias adjustment factor of 0.97 to the 2023 monitoring data. A summary of bias adjustment factors used by Worcester City Council over the past five years is presented in Table C.1.

A local bias adjustment factor has been calculated using the 'Diffusion Tube Data Processing Tool spreadsheet' which has been uploaded to the Defra LAQM portal. All calculations and data are presented within the relevant sections of the spreadsheet as set out above.

The factor has been derived from the automatic monitoring station installed at Wyre Forest House, Finepoint Way, Kidderminster which is the head office for WRS. The installation is collocated with three diffusion tubes and is largely run and managed for the purpose of undertaking a local bias adjustment factor for the county. WRS are responsible for

maintaining the monitoring network across the six district councils within Worcestershire and therefore the handling and processing of the diffusion tubes is the same for each area. The station is less than 15km north-north-west of Worcester City district.

A decision was made during the preparation of the 2023 ASR to utilise the bias adjustment factor of 0.97 compared to the national bias adjustment factor of 0.83 as this represented a much more conservative value and therefore is more protective of public health. The same decision has been made in relation to the 2024 ASR as again the local bias adjustment factor is more conservative than the national factor.

Table C.1 – Bias Adjustment Factor

Monitoring Year	Local or National	If National, Version of National Spreadsheet	Adjustment Factor
2023	Local	-	0.97
2022	Local	-	0.97
2021	National	03/21	0.84
2020	National	03/21	0.81
2019	National	03/20	0.78

Table C. 2 – Local Bias Adjustment Calculation

	Local Bias Adjustment Input 1
Periods used to calculate bias	12
Bias Factor A	0.97 (0.93 - 1.01)
Bias Factor B	4% (-1% - 8%)
Diffusion Tube Mean ($\mu\text{g}/\text{m}^3$)	12.4
Mean CV (Precision)	1.9%
Automatic Mean ($\mu\text{g}/\text{m}^3$)	11.9
Data Capture	99%
Adjusted Tube Mean ($\mu\text{g}/\text{m}^3$)	12 (11-12)

Notes:

A single local bias adjustment factor has been used to bias adjust the 2023 diffusion tube results.

NO₂ Fall-off with Distance from the Road

Wherever possible, monitoring locations are representative of exposure. However, where this is not possible, the NO₂ concentration at the nearest location relevant for exposure has been estimated using the Diffusion Tube Data Processing Tool/NO₂ fall-off with distance calculator available on the LAQM Support website. Where appropriate, non-automatic annual mean NO₂ concentrations corrected for distance are presented in Table B.1 and the calculation is shown below in Table C.3.

Table C.3 – Non-Automatic NO₂ Fall off With Distance Calculations (concentrations presented in µg/m³)

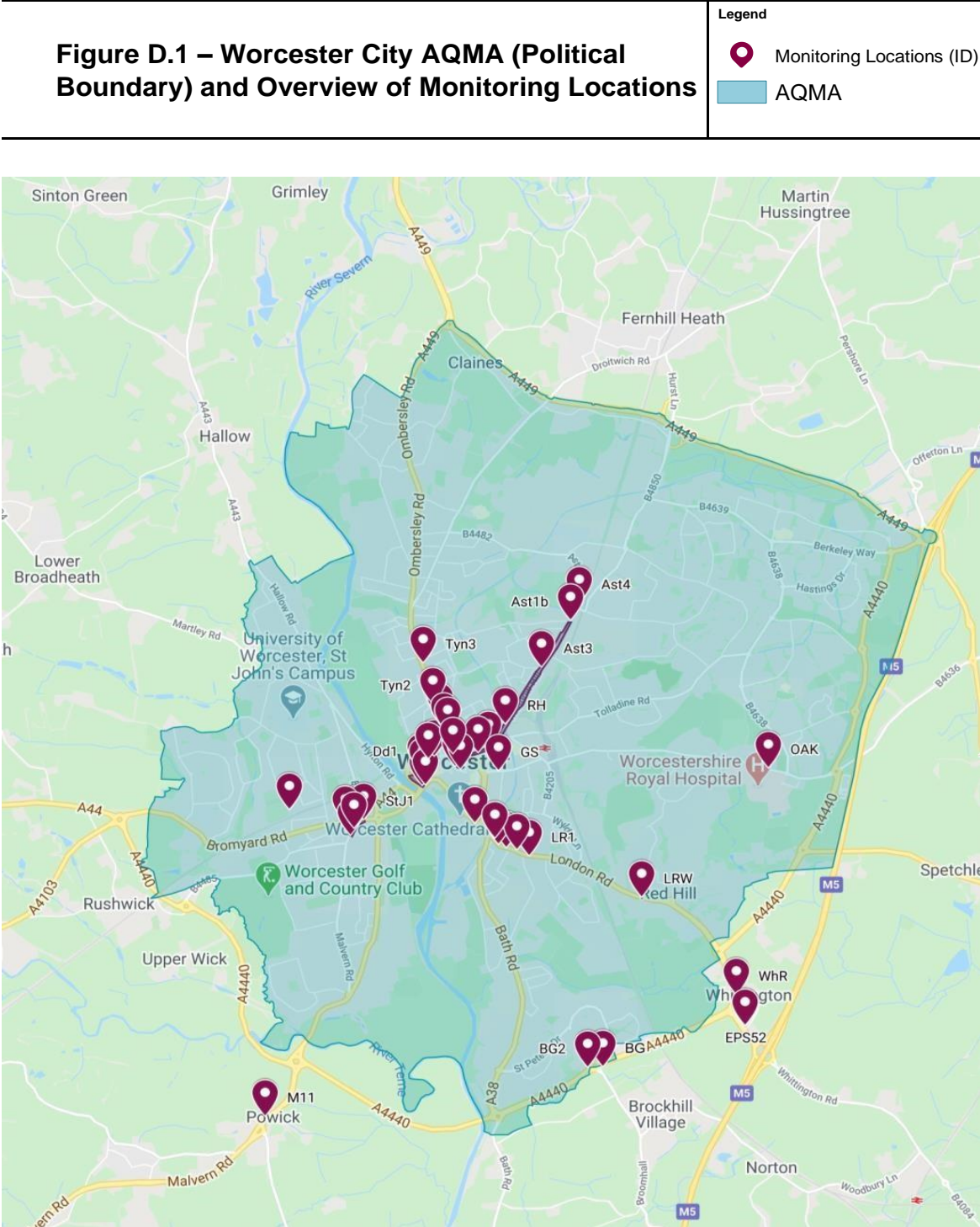
Site ID	Distance (m): Monitoring Site to Kerb	Distance (m): Receptor to Kerb	Monitored Concentration (Annualised and Bias Adjusted)	Background Concentration	Concentration Predicted at Receptor	Comments
BrS2	2.0	3.0	37.1	10.8	34.6	
Tyn2	2.3	4.9	37.6	11.3	32.8	
Tyn	1.6	3.7	36.8	11.3	32.2	
Ast3	1.7	8.3	42.2	11.7	31.3	
BkC	4.1	4.3	36.0	11.33	35.8	

QA/QC of Automatic Monitoring

Worcester City Council did not undertake any automatic monitoring in 2023.

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

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



Date: 18.05.2022

Copyright: Map data ©2020 Google United Kingdom

Figure D.2 – Dolday and The Butts

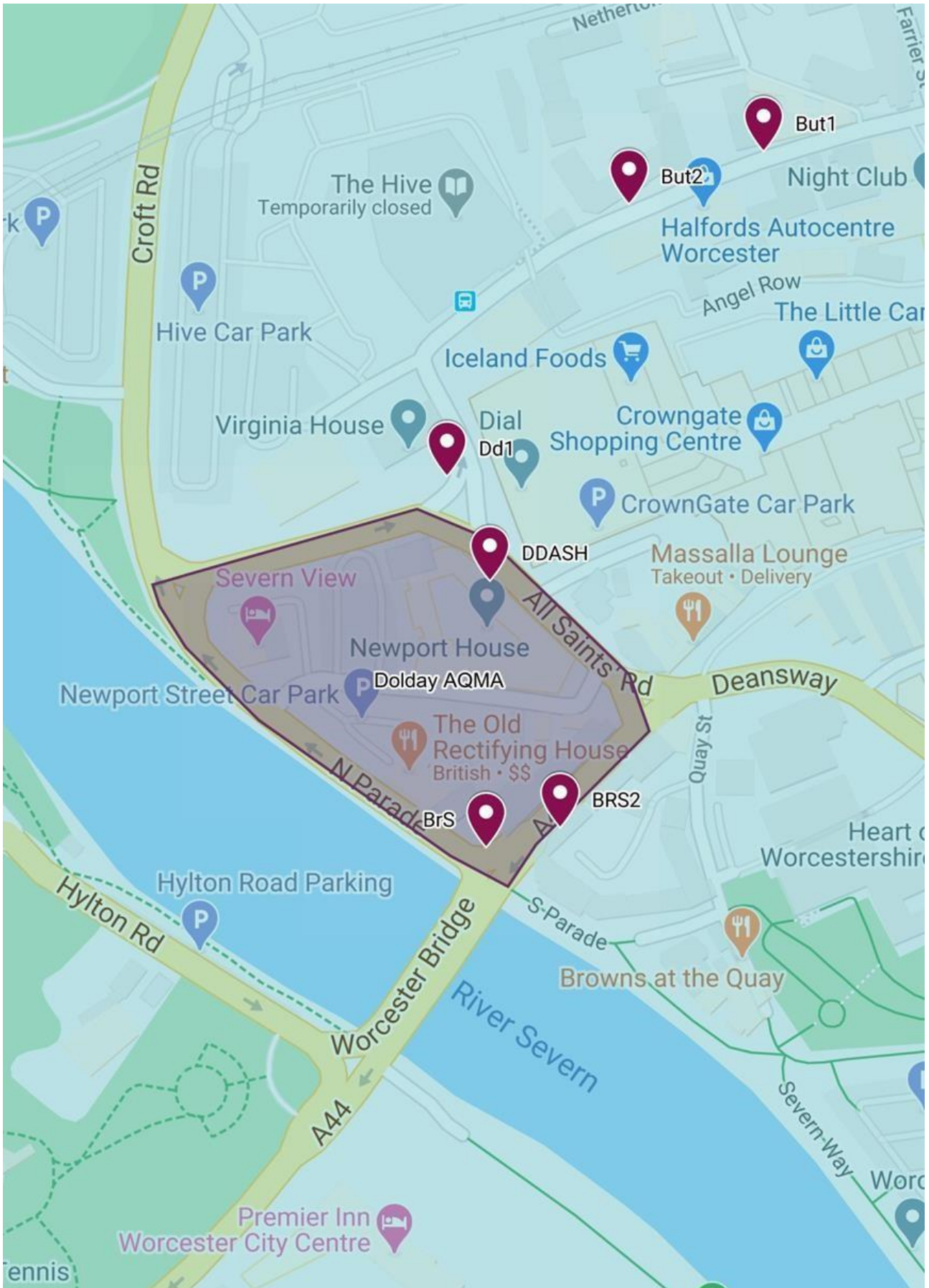


Figure D.3 – Foregate Street and The Tything

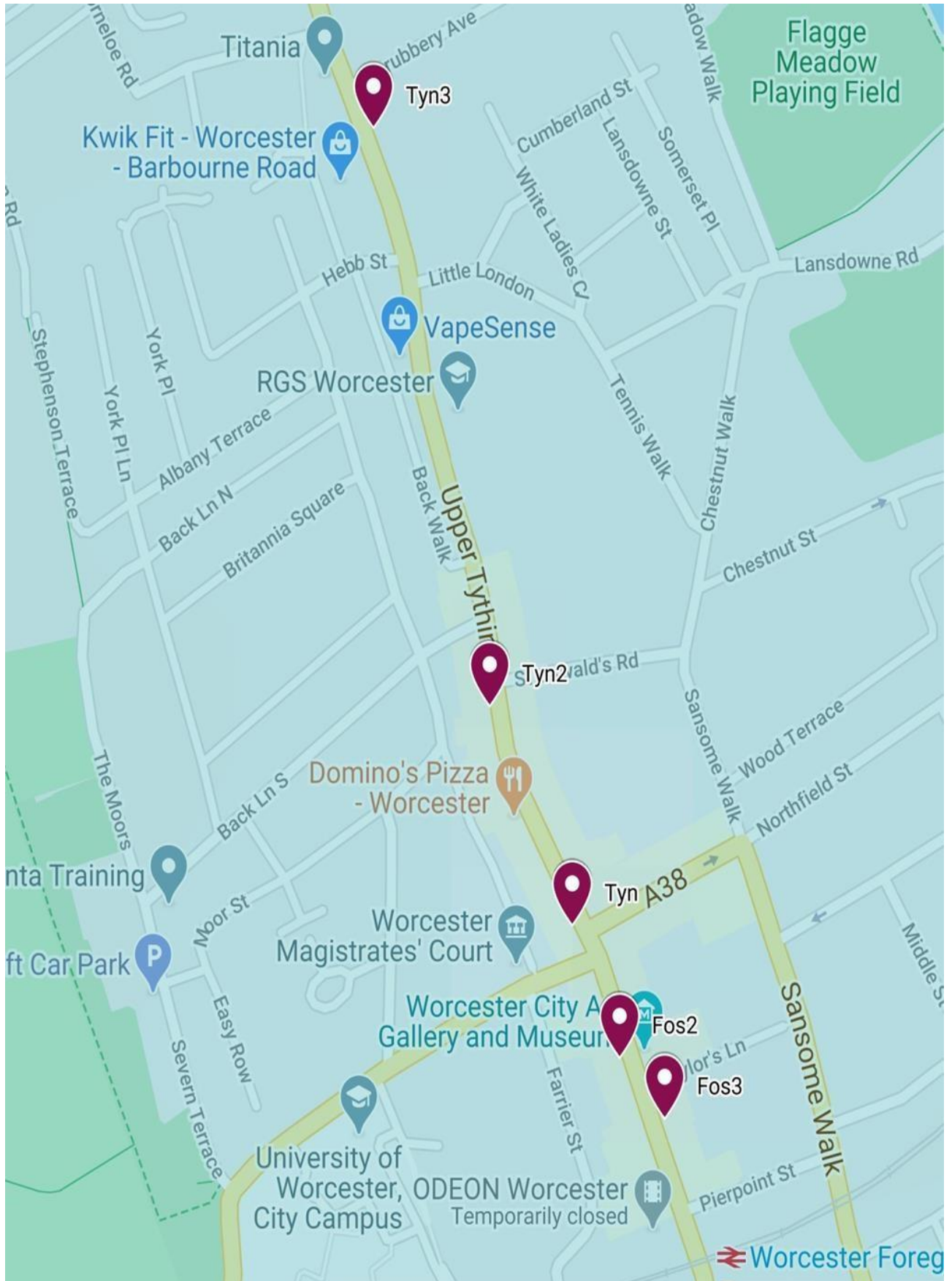


Figure D.4 – Foregate Street to Saint Swithins Street

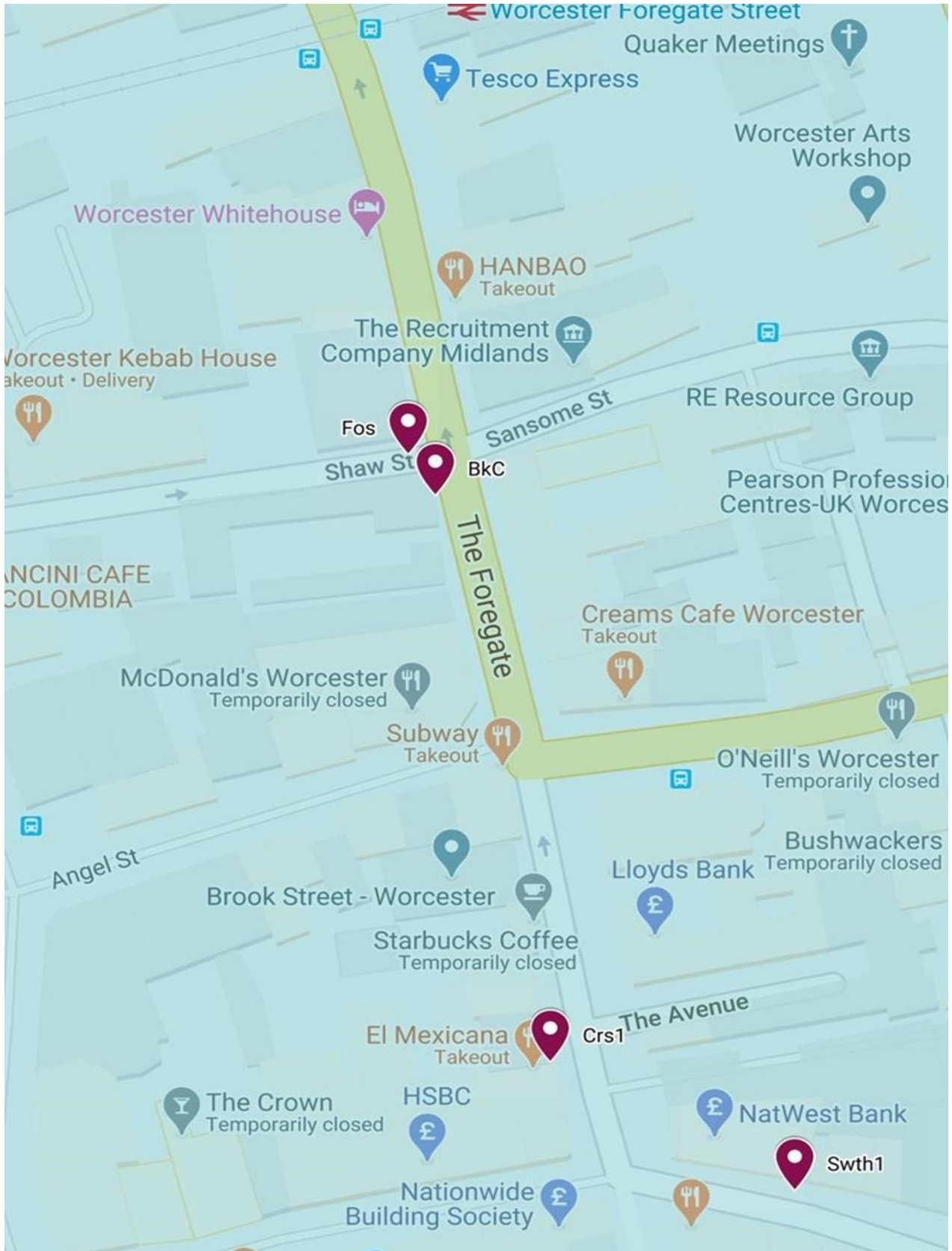


Figure D.5 – Lowesmoor-Astwood Road and Tallow Hill

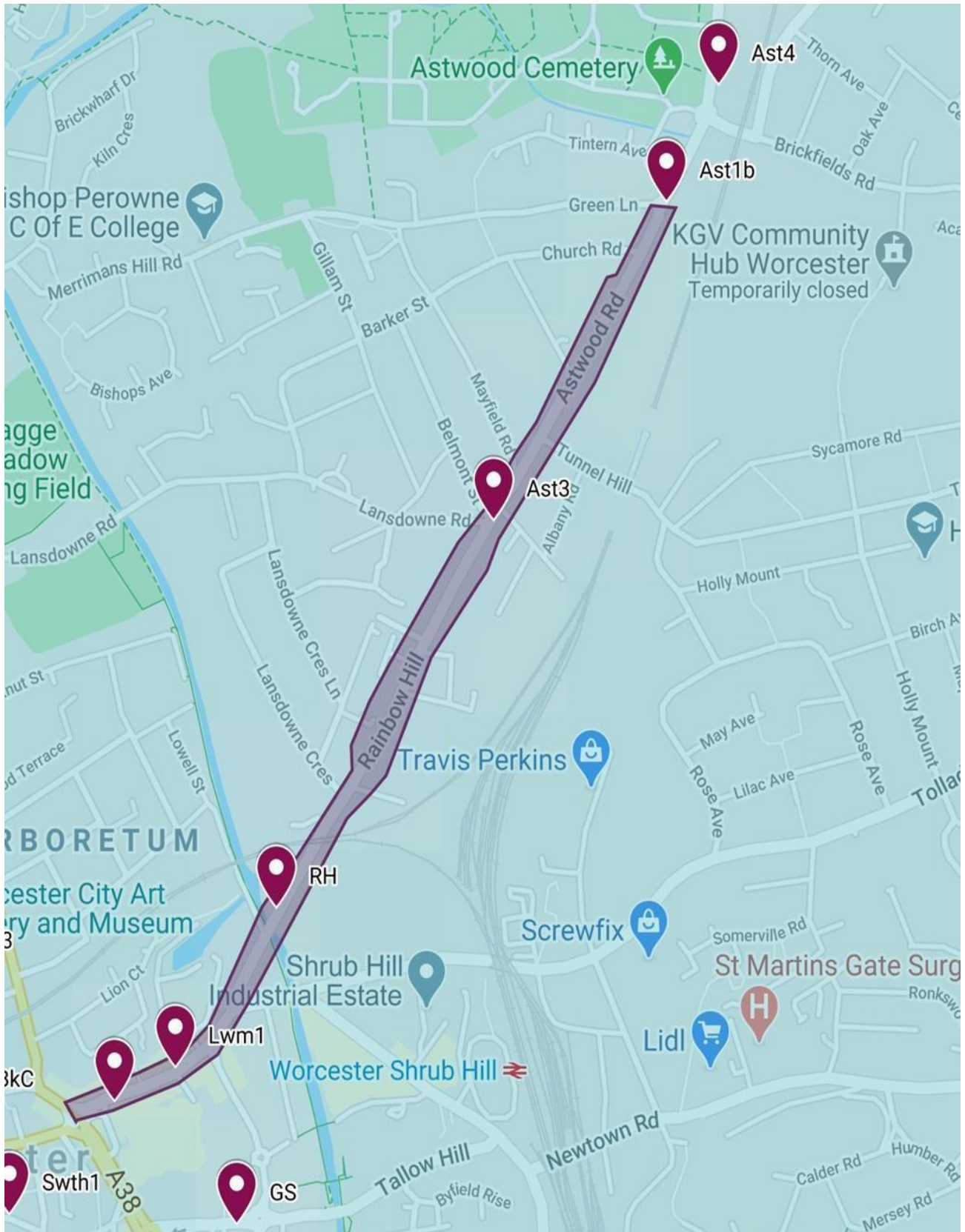


Figure D.6 – Henwick & St Johns



Figure D.7 – St. Johns

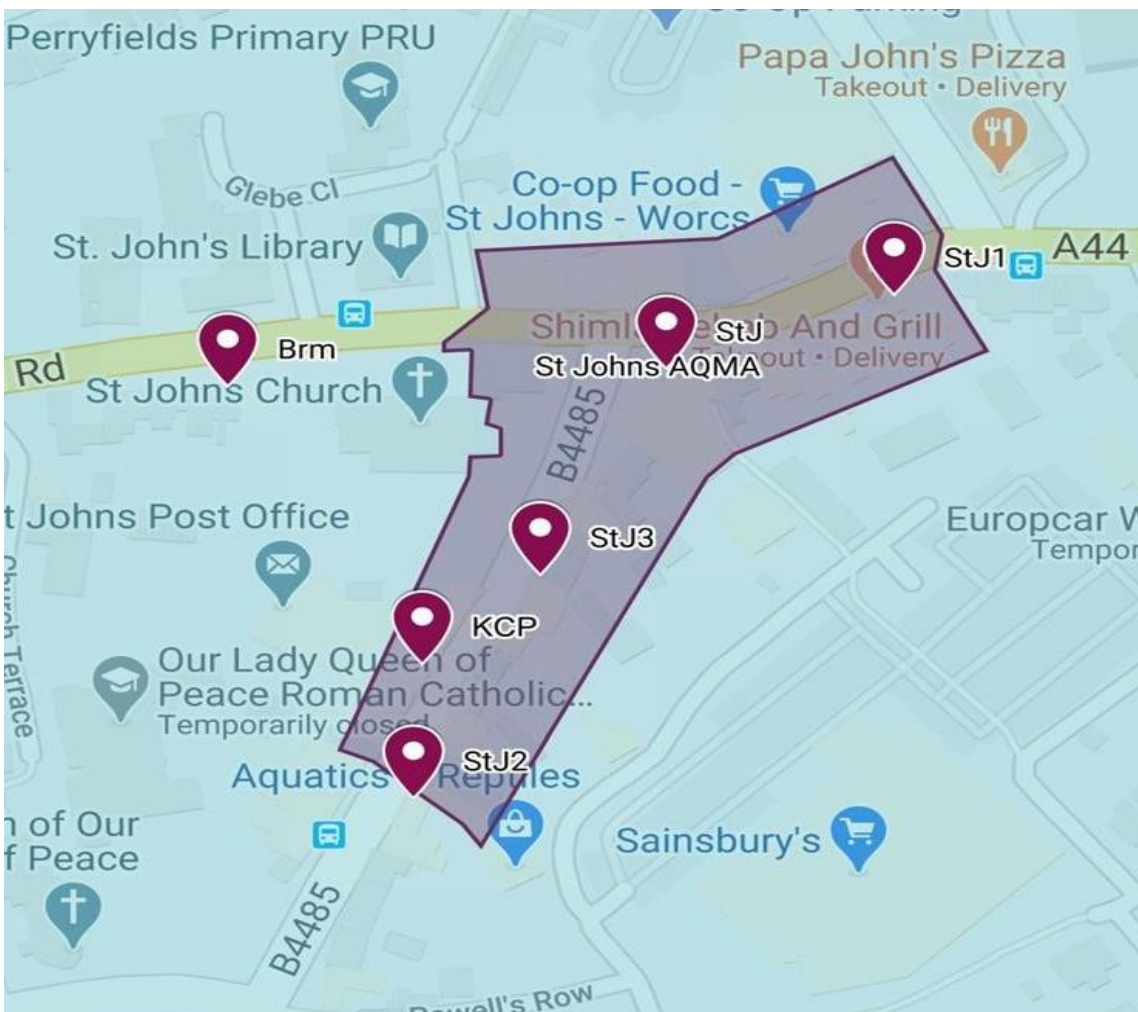


Figure D.8 – London Road and Sidbury

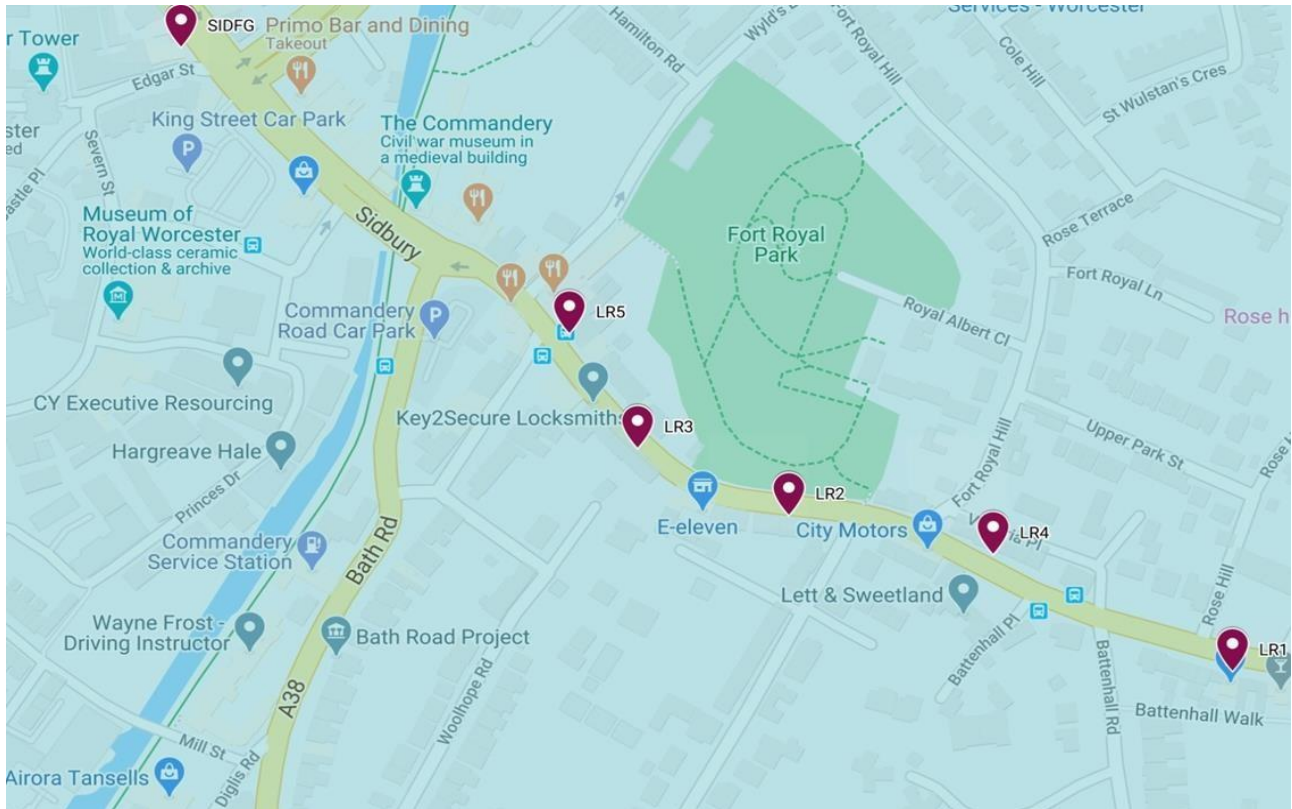


Figure D.9 – Ronkwood and Red Hill

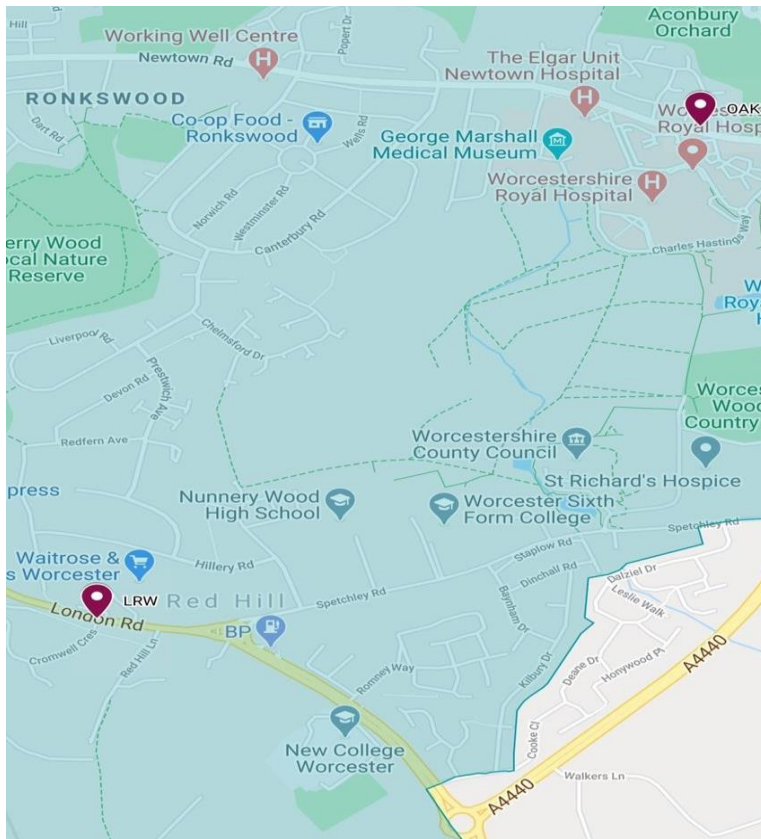
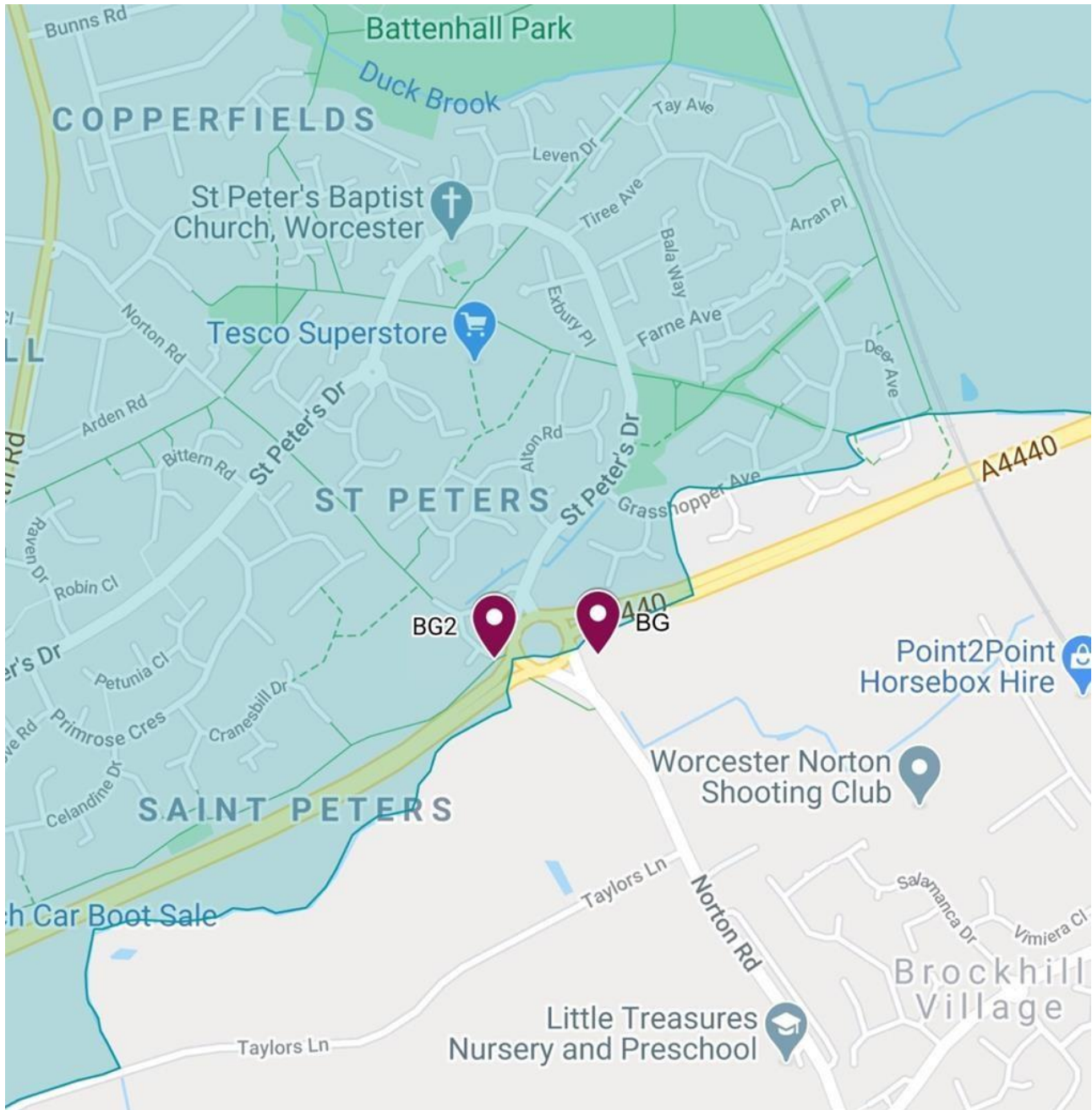


Figure D.10 – St. Peters



Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England¹¹

Pollutant	Air Quality Objective: Concentration	Air Quality Objective: Measured as
Nitrogen Dioxide (NO ₂)	200µg/m ³ not to be exceeded more than 18 times a year	1-hour mean
Nitrogen Dioxide (NO ₂)	40µg/m ³	Annual mean
Particulate Matter (PM ₁₀)	50µg/m ³ , not to be exceeded more than 35 times a year	24-hour mean
Particulate Matter (PM ₁₀)	40µg/m ³	Annual mean
Sulphur Dioxide (SO ₂)	350µg/m ³ , not to be exceeded more than 24 times a year	1-hour mean
Sulphur Dioxide (SO ₂)	125µg/m ³ , not to be exceeded more than 3 times a year	24-hour mean
Sulphur Dioxide (SO ₂)	266µg/m ³ , not to be exceeded more than 35 times a year	15-minute mean

¹¹ The units are in microgrammes of pollutant per cubic metre of air (µg/m³).

Glossary of Terms

Abbreviation	Description
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the local authority intends to achieve air quality limit values'
AQMA	Air Quality Management Area – An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives
AQS	Air Quality Strategy
ASR	Annual Status Report
Defra	Department for Environment, Food and Rural Affairs
DoPH	Director of Public Health
EU	European Union
LAQM	Local Air Quality Management
NO ₂	Nitrogen Dioxide
NO _x	Nitrogen Oxides
PM ₁₀	Airborne particulate matter with an aerodynamic diameter of 10µm or less
PM _{2.5}	Airborne particulate matter with an aerodynamic diameter of 2.5µm or less
QA/QC	Quality Assurance and Quality Control
SO ₂	Sulphur Dioxide

References

- Local Air Quality Management Technical Guidance LAQM.TG22. August 2022. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.
- Local Air Quality Management Policy Guidance LAQM.PG22. August 2022. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.
- Chemical hazards and poisons report: Issue 28. June 2022. Published by UK Health Security Agency
- Air Quality Strategy – Framework for Local Authority Delivery. August 2023. Published by Defra.
- Defra. Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006
- Public Health England. Air Quality: A Briefing for Directors of Public Health, 2017
- Defra. Environmental Improvement Plan 2023, January 2023
- The Road to Zero: Next steps towards cleaner road transport and delivering our Industrial Strategy, July 2018
- Air Quality Action Plan Progress Report for Worcestershire April 2015-2016
- The Public Health Outcomes Framework