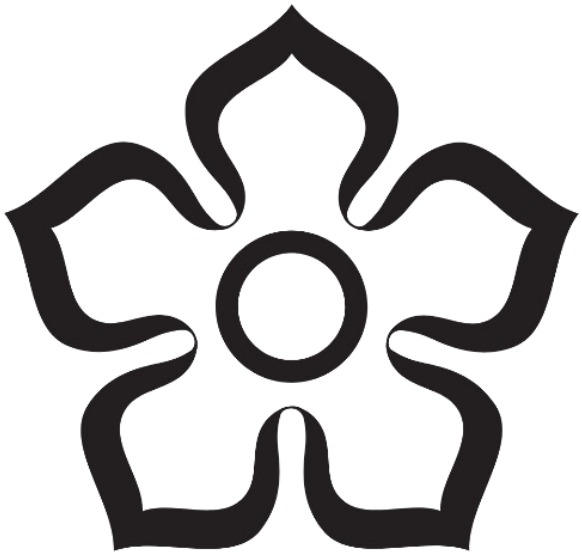


2023 Air Quality Annual Status Report (ASR)

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

Date: 30th June 2023

Information	Leicester City Council Details
Local Authority Officer	[redacted]
Department	Transport Strategy
Address	City Hall, 2nd Floor, 115 Charles Street Leicester, LE1 1FZ
Telephone	0116 454 1000
E-mail	air.quality@leicester.gov.uk
Report Reference Number	LCC ASR 2023
Date	30th June 2023

Executive Summary: Air Quality in Our Area

Air Quality in Leicester City

Air pollution is associated with a number of adverse health impacts. It is recognised as a contributing factor in the onset of heart disease and cancer. Additionally, air pollution particularly affects the most vulnerable in society: children, the elderly, and those with existing heart and lung conditions. There is also often a strong correlation with equalities issues because areas with poor air quality are also often less affluent areas[1,2].

The mortality burden of air pollution within the UK is equivalent to 29,000 to 343,000 deaths at typical ages[3], with a total estimated healthcare cost to the NHS and social care of £157 million in 2017[4].

Leicester currently has one Air Quality Management Area (AQMA) covering a large section of the City Centre, along a number of radial roads, and sections of the ring road. It was declared on grounds of NO_2 exceedance in 2000 and later amended in 2007. Leicester City Council operate five air quality monitoring stations located within the AQMA, monitoring NO_2 and PM_{10}. A total of 44 NO_2 diffusion tube locations were monitored in 2022, with an additional network of over 20 low cost 'Zephyr' sensors which monitor NO_2, PM_{10}, and $PM_{2.5}$.

A summary of the main results for 2022:

- None of the air quality monitoring stations reported an exceedance of the NO_2 annual mean AQO, with a maximum concentration of 38.0 µg/m^3 measured at Vaughan Way.
- No exceedances were reported in the diffusion tube network where samplers are located at relevant exposure. The greatest concentration recorded was on Vaughan

[1] Public Health England. Air Quality: A Briefing for Directors of Public Health, 2017

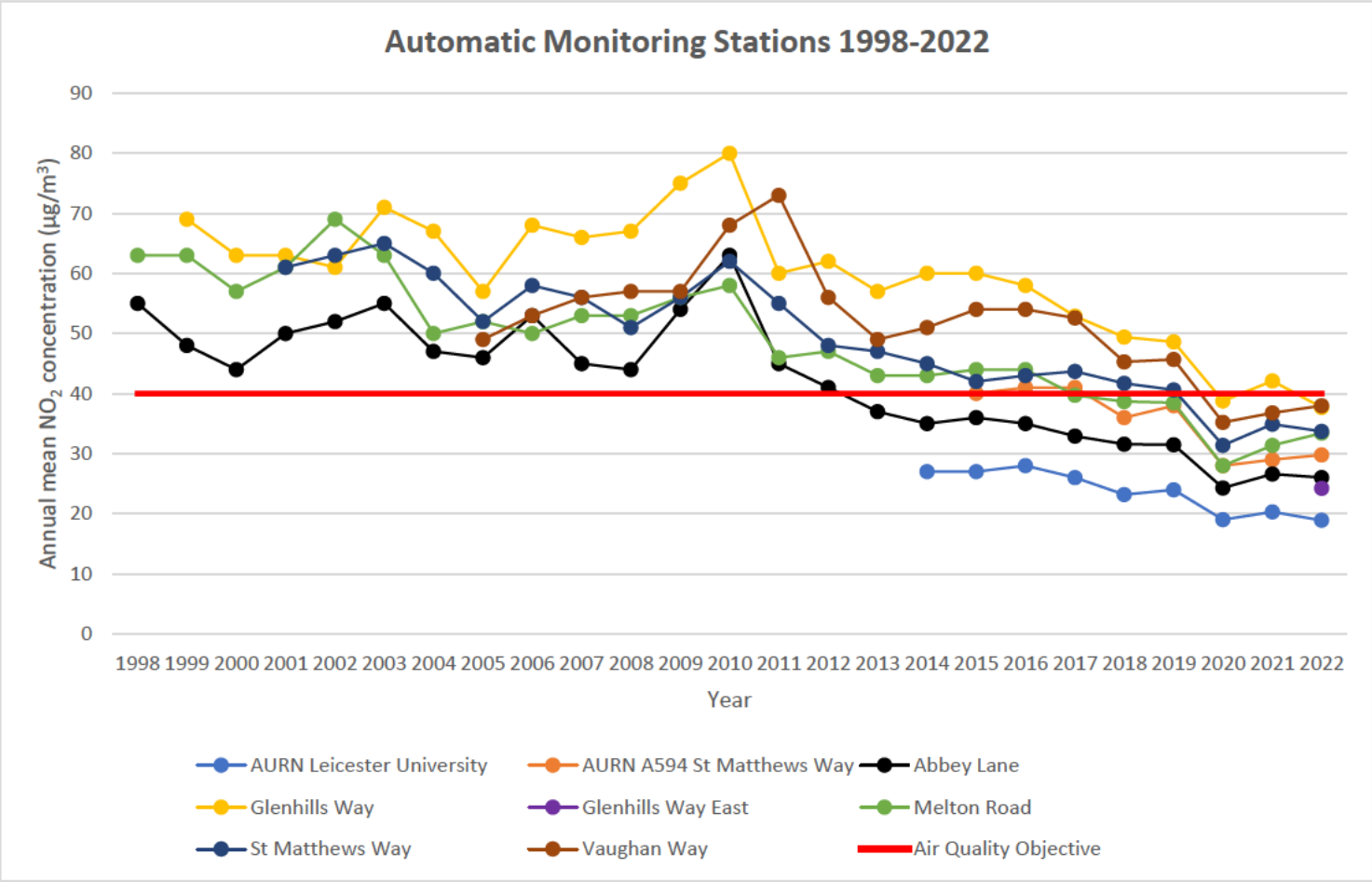
[2] Defra. Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006

[3] Defra. Air quality appraisal: damage cost guidance, January 2023

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

Way (LCC36) within the AQMA at 45.7 µg/m^3, although after seeking LAQM Helpdesk and consultancy advice, the tube is considered unsuitable for assessment against the annual mean objective.

- Vaughan Way and Melton Road monitoring stations recorded slight increases in NO_2 concentration compared to 2021, thought to be due to a gradual return to traffic volumes post-pandemic, as confirmed by local traffic count data.
- Other stations, such as Abbey Lane, St Matthews Way, and Glenhills Way have all seen decreases in NO_2 concentration when compared to the previous monitoring year.
- There were no reported exceedances of the NO_2 1-hourly objective at any monitoring location within Leicester, and no annual mean concentrations greater than 60 µg/m^3 that may indicate an exceedance of this objective.
- Overall, NO_2 concentrations remain lower than pre-pandemic figures in Leicester, although further intervention(s) and compliance in monitoring will be required before considering revocation of the AQMA, either partially or fully.
- Vehicular traffic remains the dominant source of NO_2 emissions in Leicester, with diesel vehicles thought to be the biggest contributor.
- No exceedances of the PM_{10} annual mean AQO were recorded at any location in Leicester in 2022, with a maximum concentration of 20.5 µg/m^3 measured at the Vaughan Way air quality monitoring station.
- PM_{10} concentrations have increased slightly compared to 2021 values (1.1 µg/m^3 on average), but remain significantly lower than pre-pandemic figures and continue to decrease in Leicester.
- There were no measured exceedances of the 24-hour objective for PM_{10} at any monitoring location in Leicester in 2022.
- Estimated $PM_{2.5}$ concentrations (derived from measured PM_{10} values) report no exceedances of the $PM_{2.5}$ annual mean AQO in 2022.
- Leicester City Council also continue to monitor $PM_{2.5}$ through the use of low cost ‘Zephyr’ sensors, with a maximum annual mean concentration of 9.6 µg/m^3 measured on Knighton Church Road.
- The majority of $PM_{2.5}$ pollution in Leicester is sourced from outside of the city, primarily as transboundary agricultural and industrial emissions. $PM_{2.5}$ derived in Leicester itself is minimal and can be mostly attributed to domestic sources (e.g. woodburning stoves), with a smaller contribution from transport by vehicle resuspension, brake, and tyre wear.



NO_2 annual mean concentrations have declined since 1998, although there is a notable period of increase between 2009 and 2011 which may be partially attributed to meteorological conditions (e.g. cold winters). Since then, all stations have steadily declined to values below the national air quality objectives for the first time in 2020, largely due to reduced traffic volumes associated with the COVID-19 pandemic. NO_2 concentrations have increased slightly since 2020 and in some cases remain on an upward trend. This will be closely monitored in the coming years, with the continued implementation of measures to improve air quality and reduce NO_2 concentrations as much as possible.

Leicester City Council continue to implement the measures outlined in the ‘Healthier Air for Leicester’: Leicester’s Air Quality Action Plan 2015-2026, with priorities to reduce single car journeys and encourage the uptake of sustainable methods of transport. The authority will progress a new Leicester Transport Plan (LTP 4) in 2023, with air quality considerations embedded within. In light of the new National Air Quality Strategy published in April 2023, the authority intends conduct a hotspot and source apportionment exercise during the following monitoring year, realigning its air quality priorities post-pandemic.

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.

The Environmental Improvement Plan[5] sets out actions that will drive continued improvements to air quality and to meet the new national interim and long-term $PM_{2.5}$ targets. The National Air Quality Strategy, due to be published in 2023, will provide more information on local authorities' responsibilities to work towards these new targets and reduce $PM_{2.5}$ in their areas. The Road to Zero[6] details the approach to reduce exhaust emissions from road transport through a number of mechanisms; this is extremely important given that the majority of Air Quality Management Areas (AQMAs) are designated due to elevated concentrations heavily influenced by transport emissions.

Leicester City Council continue to implement the measures outlined in the ‘Healthier Air for Leicester’ Air Quality Action Plan 2015-2026, with a particular emphasis on reducing single car journeys and improving uptake of sustainable methods of transport.

Some of the key measures implemented in 2022 to improve air quality are:

- A range of schemes under Connecting Leicester Public Realm Improvements including pedestrianisation and cycle lanes, to encourage more sustainable methods of transport in Leicester.
- Public transport improvements through the Enhanced Bus Partnership including:

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

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

  - Roll out of a smart integrated ticketing system on buses and provision of real time information at bus stops in 2022.
  - Completion of the new St Margaret's Bus Station, a net zero building with provision for electric buses and is a dedicated cycle hub.
  - Introduction of 13 electric buses to operator fleets in 2022, with more planned for 2023 and beyond.
  - Installation of 11 living roof and 203 solar bus shelters in 2022.
  - Development of new bus priority lanes.
- Continued replacement of Council fleet vehicles (primarily diesel vans) with ULEVs, in which 2022/23 saw the total rise to 30 electric vehicles (EVs) purchased.
- Facilitation of schemes to install a total of 22 slow, 100+ fast, and 1 rapid EV chargers for public use to date. Some of which are sited in Council owned car parks.
- Retrofitting of 11 buses to further reduce emissions from public transport, with a total of 250+ retrofits completed to date.
- Implementation of 20 mph zones along 86 streets covering 25km in 2022. The total now stands at 1,471 streets, stretching over 300km of highway since the scheme began.
- Promotion of the e-bike cycle hire scheme which saw 350+ e-bikes in circulation, over 130,000 rides taken, and a peak of 500+ riders per day in 2022.
- Engagement with schools in 2022 – Walk to School programmes delivered to 15 schools, with a further 11 scheduled for 2023. Clean Air Day activities conducted at 3 schools in 2022, involving road closures and 'play streets'.

Image 1 – Proposed School Street, Knighton

Image 2 – Living Roof Bus Shelter, Leicester City Centre

Leicester City Council continues to work closely with internal colleagues in Public Health, Traffic Management, Walking and Cycling, and Planning to implement projects to improve air quality and ensure new development does not hinder this progress. The authority also

proactively works with external partners including Leicestershire County Council, National Highways, and neighbouring local authorities through the Air Quality Forum, sharing best practice and discussing local air quality issues.

Conclusions and Priorities

Overall, pollutant concentrations have remained consistent with values reported in 2021 and no exceedances of the NO_2 annual mean AQO are reported at the five automatic air quality monitoring stations operated by Leicester City Council. Some sites, such as Vaughan Way and Melton Road, have seen annual mean NO_2 increases of up to 2 µg/m^3. The most likely explanation for this is a return of traffic volumes since the pandemic, as confirmed by traffic counts conducted by the authority. On the contrary, Abbey Lane, St Matthews Way, and Glenhills Way have reported decreases in annual mean NO_2 concentration, which may be attributed to fleet upgrades, a shift in working patterns due to the pandemic, and also the wide range of schemes implemented to improve access to sustainable transport and reduce car usage. Leicester City Council continued its diffusion tube network at 44 locations in 2022, with one located on Vaughan Way reporting a value greater than 40 µg/m^3. However, this sampler is located at roadside with no relevant receptor and is considered unsuitable for assessment against the national air quality objective. No exceedances of the NO_2 1-hourly objective were reported at any monitoring location in Leicester in 2022. Overall, NO_2 concentrations are still below pre-pandemic levels, but further work is required to ensure maintained compliance and that pollutant levels continue to fall. Further compliance will be required before revocation (partial or full) can be considered in Leicester, particularly as NO_2 concentrations have increased in some areas since 2021 and a ‘full return’ to traffic levels and patterns post-pandemic have not yet been realised.

With regards to PM_{10}, no exceedances of either the annual mean or 24-hourly mean AQOs are reported at any monitoring location in Leicester in 2022. A maximum annual mean concentration of 20.5 µg/m^3 was recorded at the Vaughan Way monitoring station, significantly below the AQO. Concentrations of PM_{10} have increased marginally across the monitoring stations (1.1 µg/m^3 on average) when compared to 2021, but remain almost 10% lower on average than pre-pandemic values.

Leicester City Council deploy a number of low cost ‘Zephyr’ sensors across the city which monitor NO_2, PM_{10}, and $PM_{2.5}$. Whilst these are not strictly recommended for the purposes of assessing national AQOs, they are useful for identification of trends. $PM_{2.5}$

concentrations are reported at below the national AQO at all monitoring locations, with a maximum value of 9.6 µg/m^3 seen on Knighton Church Road. This value is thought to relate to the use of woodburning stoves and open fires in this more affluent ward of the city.

In terms of priorities, Leicester City Council continue to monitor air pollutants throughout the city and in the latter half of 2022 extended their monitoring capabilities until at least 2028. The authority will be publishing a new Leicester Transport Plan (LTP), which will have air quality considerations embedded within, with progress expected to be made in 2023. The authority does not consider it the correct time to restrict or revoke the AQMA, as concentrations in some areas have increased and further compliance will be required before this can be considered. The revised National Air Quality Strategy 2023 has a greater emphasis on actions to reduce $PM_{2.5}$ emissions and therefore the Council may require a realignment of its air quality priorities in this regard.

Local Engagement and How to get Involved

Our Councillors and Officers sit on many business-related boards and forums to discuss transport matters and give latest briefings. These include:

- The Leicester Business Improvement District
- Leicester & Leicestershire Local Enterprise Partnership
- GoTravel Solutions Business Forum on Transport
- City Centre Business Group
- Chamber of Commerce

In terms of public engagement, air quality has a high profile in Leicester with ward meetings often having a slot on the agenda. Updates are provided regularly on the latest monitoring results, any pollution episodes, and local traffic schemes that may impact air quality.

Residents and local businesses are consulted on all transport and air quality schemes as standard, giving citizens a chance to have their say. The authority provides statutory planning consultation responses with regards to air quality, ensuring that development is assessed for its impact on local air quality and that proportionate mitigation is applied where necessary.

We work with many action groups such as Friends of the Earth, UK100, Healthier Air for Leicester Campaign, and Extinction Rebellion to promote public understanding of air quality.

The Council hosts a number of transport citizen groups such as Public Transport User Group and Bicycle User Group to help inform our future air quality and transport strategies. As a result of these, two action plans are expected to be developed in late 2023 or early 2024 regarding Walking and Cycling.

The following websites and documents provide information on the various schemes the authority has deployed to promote sustainable transport and improve air quality. If you would like to read more and get involved, please follow the below links.

Leicester City Council Air Quality Webpage and Air Quality Action Plan: https://www.leicester.gov.uk/your-council/policies-plans-and-strategies/environment-and-waste/air-quality

Leicester City Council Public Health:

http://www.leicester.gov.uk/health-and-social-care/public-health

Leicester City Council Environment and Sustainability Policy:

https://www.leicester.gov.uk/your-council/policies-plans-and-strategies/environment-and-sustainability/

Choose How You Move (CHYM) – Public planning of sustainable journeys:

http://www.choosehowyoumove.co.uk/

Leicester Cycle City Action Plan 2015-2024:

https://www.leicester.gov.uk/media/179027/leicester-cycle-city-action-plan.pdf

Leicester City Council Consultation Hub:

https://consultations.leicester.gov.uk/

Local Responsibilities and Commitment

This ASR was prepared by the Transport Strategy Team of Leicester City Council, with the support and agreement of the following officers and departments:

Matthew Mace – Group Manager, Transport Strategy, Leicester City Council

Anthea Anderson – Transport Strategy Officer, Transport Strategy, Leicester City Council

Rob Howard – Consultant in Public Health, Leicester City Council

Jolanta Obszynska – Traffic Operations, Leicester City Council

This ASR has been approved by:

Councillor Adam Clarke – Deputy City Mayor, Climate, Economy and Culture, Leicester City Council

Daniel Pearman – City Transport Director, Leicester City Council

This ASR was sent to National Highways for comment but unfortunately no response was received prior to submission.

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

Transport Strategy, City Hall, 2nd Floor, 115 Charles Street, Leicester, LE1 1FZ.

air.quality@leicester.gov.uk

Table of Contents

Figures

Tables

1 Local Air Quality Management

This report provides an overview of air quality in Leicester City during 2022. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995), as amended by the Environment Act (2021), and the relevant Policy and Technical Guidance documents.

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

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

2 Actions to Improve Air Quality

2.1 Air Quality Management Areas

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

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

- NO_2 annual mean

Table 2.1 – Declared Air Quality Management Areas

AQMA Name	Date of Declaration	Pollutants and Air Quality Objectives	One Line Description	Is air quality in the AQMA influenced by roads controlled by Highways England?	Level of Exceedance: Declaration	Level of Exceedance: Current Year	Number of Years Compliant with Air Quality Objective	Name and Date of AQAP Publication	Web Link to AQAP
Leicester AQMA	Declared 2000, Amended 2007	NO_2 Annual Mean	A large section of the City Centre and along a number of radial roads and sections of the ring road.	NO	52.1 µg/m^3	38.0 µg/m^3	3	Healthier Air for Leicester: Leicester's Air Quality Action Plan (2015-2026), 2015	https://www.leicester.gov.uk/media/180653/air-quality-action-plan.pdf

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

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

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

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

1. The AQAP spans the period 2015-2026 and is therefore greater than the recommended 5-year timeframe. Whilst not inappropriate, it is important that the Council continue to demonstrate that the AQAP is subject to regular review and that development and implementation of new measures as appropriate is considered a priority.
   Response: Leicester City Council intend to conduct hotspot identification and source apportionment exercises during the next monitoring year. Having regard for release of the National Air Quality Strategy in 2023, these exercises will enable a realignment of the authority's air quality priorities with respect to actions within the current AQAP.

2. Trend graphs have been provided and depict changes in NO2 concentrations within and outside of the Council's AQMA. Presentation of data in this way is beneficial, and clearly demonstrates temporal trends in pollutant concentrations. The Council are encouraged to continue to present their data graphically in future reports.
   Response: Noted and similar graphs are presented in ASR 2023.

3. The Council have included detailed discussion on PM2.5 and have drawn links to the public health outcomes framework and fraction of mortality attributable to emissions of PM2.5. Comparisons to the regional fraction, and to England as a whole, have additionally been presented. This is commended.
   Response: Noted and this theme has continued in ASR 2023.

4. Diffusion tube mapping is sufficient, with sites labelled in accordance with the IDs listed in the results tables. This is commended, and encouraged for future reports.
   Response: Noted and these maps are presented in ASR 2023.

5. Appendix F – Summary of Zephyr Monitoring, is a welcome addition. The inclusion of these data are encouraged in future reports.
   Response: Noted and these results are presented in ASR 2023.

6. The scheduled review of monitoring locations at the end of 2022 is welcomed. Consideration of additional monitoring in locations identified by the Zephyr network as having elevated concentrations is encouraged.
   Response: Noted. An exercise to identify current hotspot areas and inform future monitoring locations will take place in the following monitoring year.

Leicester City Council has taken forward a number of direct measures during the current reporting year of 2022 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2. 45 measures are included within Table 2.2, with the type of measure and the progress Leicester City Council have made during the reporting year of 2022 presented. Where there have been, or continue to be, barriers restricting the implementation of the measure, these are also presented within Table 2.2.

Further details on these measures can be found in their respective Action Plans, including 'Healthier Air for Leicester': Leicester's Air Quality Action Plan (2015-2026), Leicester draft Transport Plan (2021-2036), and Leicester Climate Emergency Strategy (2020-2023).

Key completed or progressed measures are:

- A range of schemes under Connecting Leicester Public Realm Improvements including pedestrianisation and cycle lanes, to encourage more sustainable methods of transport in Leicester.
- Public transport improvements through the Enhanced Bus Partnership including:
  - Roll out of a smart integrated ticketing system on buses and provision of real time information at bus stops in 2022.
  - Completion of the new St Margaret's Bus Station, a net zero building with provision for electric buses and is a dedicated cycle hub.
  - Introduction of 13 electric buses to operator fleets in 2022, with more planned for 2023 and beyond.
  - Installation of 11 living roof and 203 solar bus shelters in 2022.
  - Development of new bus priority lanes.

- Continued replacement of Council fleet vehicles (primarily diesel vans) with ULEVs, in which 2022/23 saw the total rise to 30 electric vehicles (EVs) purchased.
- Facilitation of schemes to install a total of 22 slow, 100+ fast, and 1 rapid EV chargers for public use to date. Some of which are sited in Council owned car parks.
- Retrofitting of 11 buses to further reduce emissions from public transport, with a total of 250+ retrofits completed to date.
- Implementation of 20 mph zones along 86 streets covering 25km in 2022. The total now stands at 1,471 streets, stretching over 300km of highway since the scheme began.
- Promotion of the e-bike cycle hire scheme which saw 350+ e-bikes in circulation, over 130,000 rides taken, and a peak of 500+ riders per day in 2022.
- Engagement with schools in 2022 – Walk to School programmes delivered to 15 schools, with a further 11 scheduled for 2023. Clean Air Day activities conducted at 3 schools in 2022, involving road closures and ‘play streets’.

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

- Development of the Leicester Transport Plan (LTP 4), with considerations for air quality embedded within.
- Further Connecting Leicester Public Realm Improvements including an additional 6km of dedicated cycle lanes (e.g. Saffron Lane), 4km of bus priority lanes/enforcement (e.g. Melton Road and Abbey Lane), City Centre Hopper electric buses, and continued implementation of real time information stands at bus stops.
- Completion of Transforming Cities Fund (TCF) programme to limit vehicles using Braunstone Gate.
- Continued electrification of public transport in Leicester, with over 100 additional electric buses to be deployed by the end of 2023.
- A commitment from all registered bus operators to be using either electric or Euro VI vehicles by April 2023, as part of the Leicester Enhanced Partnership Scheme 2022-2025.
- Ongoing promotion and delivery of sustainable travel alternatives and personalised travel planning through various schemes such as Leicester Car Sharing Club, Choose How You Move Journey Planner, Wheels 2 Work, Bikeability, and Tusker salary sacrifice.

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

- Writing and implementation of Leicester Transport Plan (LTP 4).
- Identification of post-pandemic pollution hotspots, leading to an updated source apportionment exercise and new monitoring locations.
- To consider further measures to reduce sources of $PM_{2.5}$ pollution in the city, with a particular focus on emissions from woodburning stoves and open fires.
- Development of a new EV strategy in 2023, to include a route of delivering a set number of chargers by years 2025 and 2030.
- Delivery of an ECOStars scheme aiming to improve fleet operator efficiency whilst also improving local air quality.
- Implementation of further anti-idling campaigns, with a focus around schools and known pollutant hotspots. Consideration for the enforcement of idling through the issue of Fixed Penalty Notices (FPNs).
- To work more closely with neighbouring local authorities and key air quality partners, namely Highways England, to enact duties outlined in the Environment Act 2021.
- Continued replacement of Council fleet vehicles to EVs, delivering on net zero commitments and reducing pollutant emissions from local authority vehicles.
- Continued implementation of various Connecting Leicester and TCF schemes to improve traffic flows and encourage sustainable methods of transport for residents of Leicester.
- Continue to develop ongoing and new measures to improve air quality across the city, with a focus on sustainable modes of transport and reducing single occupancy vehicle use.

Leicester City Council worked to implement these measures in partnership with the following stakeholders during 2022:

- Leicestershire County Council
- Neighbouring District and Borough authorities
- Developers
- Joint Air Quality Unit (JAQU)
- Tusker
- Sustrans
- Bikeability

- Santander
- Job Centre Plus
- Leicester Car Sharing Club
- Local bus and taxi operators
- Local schools and educational groups

The principal challenges and barriers to implementation that Leicester City Council anticipates facing are changes to staffing and the financial pressures associated with budget constraints. Additionally, some uncertainty remains after the pandemic with regards to transport recovery and adjusted ways of working.

Whilst the measures stated above and in Table 2.2 have helped to contribute towards compliance, Leicester City Council anticipates that further additional measures not yet prescribed will be required in subsequent years to maintain compliance and enable amendments to the Leicester AQMA. It is considered that further years of compliance, followed by an assessment to ensure air quality does not deteriorate in the future, will be required before any amendments can be considered.

Historic measures adopted by Leicester City Council to improve air quality can be found in Appendix G of ASR 2022, available on our website or at request using the contact information provided. These provide a record of the types of measures adopted and demonstrate a continued approach to improving air quality for the residents of Leicester.

Table 2.2 – Progress on Measures to Improve Air Quality

Measure No.	Measure	Category	Classification	Year Measure Introduced in AQAP	Estimated / Actual Completion Date	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
1	Local Transport Plan 4 (Leicester Transport Plan)	Policy Guidance and Development Control	Other policy	2021	2036	Leicester City Council	LCC and others to be identified	NO	Partially Funded	> £10 million	Planning	>25%	Approved plan	Consultation concluded autumn 2021. Awaiting DfT guidance.	The new LTP to be written in accordance with revised DfT guidance and is expected to be completed by November 2024.
2	Workplace Parking Levy (WPL)	Traffic Management	Workplace Parking Levy, Parking Enforcement on highway	2021	2036	Leicester City Council	LCC	NO	Fully Funded	£500k - £1 million	Aborted	>25%	Implemented scheme	Full consultation launched in December 2021. Cost of living crisis (2022) means WPL will not be implemented at this time.	Scheme would generate £450m in first 10 years. WPL also acts as demand management tool to deter single car use.
3	AQAP – measures to improve air quality 2015-2026	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	2015	2026	Leicester City Council	LCC	NO	Partially Funded	> £10 million	Implementation	>20%	Implemented schemes	Hotspot identification taking place in 2023 to inform possible new AQAP.	Various schemes implemented to reduce pollutant concentrations and comply with AQS objective.
4	Leicester Direction for NO2 Plan	Policy Guidance and Development Control	Low Emissions Strategy	2018	2024	Leicester City Council	JAQU	NO	Funded	£1 million - £10 million	Implementation	10%	Report delivered	Interventions implemented and compliance achieved before expected timescale. Removal of passive monitoring.	A set of schemes to bring NO2 concentrations to compliance in the shortest possible time.
5	Connecting Leicester Public Realm Improvements	Transport Planning and Infrastructure	Other	2011	2030	Leicester City Council	LCC, TCF, Active Travel Fund, ERDF	NO	Partially Funded	> £10 million	Implementation	>1%	Implemented schemes	10km of cycle lanes delivered to date, with a further 6km planned.	On-going implementation of various transport schemes subject to funding/workloads.
6	Procurement of ULEVs to replace diesel vans	Promoting Low Emission Transport	Company Vehicle Procurement - Prioritising uptake of low emission vehicles	2015	2040	Leicester City Council	LCC	NO	Partially Funded	£1 million - £10 million	Implementation	<0.1%	Number of vehicles purchased	A total of 30 electric vans and 5 electric mopeds purchased to date.	Lack of charging infrastructure, materials (chips/tungsten), high market demand for parts/vehicles, home charging policies required.
7	Procurement of slow, fast, and rapid EV chargers	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	2015	2030	Leicester City Council	OZEV, LCC, European Regional Development Fund (ERDF)	NO	Partially Funded	£1 million - £10 million	Implementation	<0.1%	Number of chargers installed	22 slow (3.3kW), 100+ fast (22kW), 1 rapid (50kW) chargers installed to date.	A new EV strategy is being developed in 2023, including revised KPIs and a route map for delivering a specific number of chargers by 2025 and 2030.

Measure No.	Measure	Category	Classification	Year Measure Introduced in AQAP	Estimated / Actual Completion Date	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
8	TUSKER – ULEV salary sacrifice for employees	Promoting Low Emission Transport	Company Vehicle Procurement - Prioritising uptake of low emission vehicles	2016	2040	Leicester City Council	LCC	NO	Partially Funded	£500k - £1 million	Implementation	<0.1%	Number of vehicles purchased or leased	E-bikes delivered in 2022: 4 (14 in total). EV vehicles leased in 2022: 7 (23 in total). ULEVs delivered in 2022: 29 (103 in total).	Salary sacrifice scheme for LCC employees to purchase or lease electric cars and bicycles.
9	Bus retrofitting	Promoting Low Emission Transport	Public Vehicle Procurement - Prioritising uptake of low emission vehicles	2015	2030	Leicester City Council	Bus operators	NO	Partially Funded	£1 million - £10 million	Implementation	<0.1%	Number of buses retrofitted	11 buses retrofitted in 2022, with a total of 250 completed to date.	DfT are investigating the effectiveness of bus retrofit technology to reduce NOx, hence numbers are lower than expected.
10	20mph zones	Traffic Management	Reduction of speed limits, 20mph zones	1999	2040	Leicester City Council	LCC	NO	Partially Funded	£1 million - £10 million	Implementation	<0.1%	Number of schemes implemented	86 streets (covering 25km of highway) implemented in 2022	1,471 streets covering 317.7 km of highway since the scheme began
11	Local Plan 2020-2036	Policy Guidance and Development Control	Other policy	2020	2036	Leicester City Council	LCC	NO	Funded	< £10k	Planning	>1%	Air quality to be embedded within the plan	Public consultation started late 2022.	
12	Choose How You Move - Sustainable Travel Website and Brand	Promoting Travel Alternatives	Intensive active travel campaign & infrastructure	2007	2040	Leicester City Council and Leicestershire County Council	Access Fund	NO	Partially Funded	£1 million - £10 million	Implementation	<0.1%	Page views, new users, and journeys planned	120,694 new users to date, 25,625 returning users to date. 297,344 page views during 2022.	New users up 25%, returning users up 38%, and page views up 18% on 2021.
13	Car Clubs	Promoting Travel Alternatives	Personalised Travel Planning	2015	2040	Leicester City Council, Leicester Car Sharing Club, Developers	LCC, Car Club, and Developers	NO	Partially Funded	£10k - 50k	Implementation	<0.1%	Car Club usage	LCC awarded £5k to Leicester Car Sharing Club to part fund purchase of an electric vehicle. This has replaced the existing fossil fuelled vehicle and is now in use for car sharing.	
14	Choose How You Move - Journey Planner	Promoting Travel Alternatives	Personalised Travel Planning	2012	2040	Leicester City Council	Access Fund, JAQU	NO	Partially Funded	£50k - £100k	Implementation	<0.1%	Continual development of Journey Planner services	Web and app based Journey Planner launched in 2022. Development of a comms campaign to raise awareness. Identification of extra functionality to improve user experience.	
15	Personalised Travel Planning	Promoting Travel Alternatives	Personalised Travel Planning	2018	2022	Leicester City Council and Leicestershir	ERDF	NO	Partially Funded	£50k - £100k	Completed	<0.1%	Engagement with households	2,600 households (of 10,500) participated. 23% reduction in single occupancy car journeys	Work was completed in 2021, but final report presented in 2022.

Measure No.	Measure	Category	Classification	Year Measure Introduced in AQAP	Estimated / Actual Completion Date	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
						e County Council									
16	Wheels to Work - Fleet of electric bikes	Promoting Travel Alternatives	Personalised Travel Planning	2014	2040	Leicester City Council	Capability Fund, E-Cycle Extension Fund	NO	Partially Funded	£50k - £100k	Implementation	<0.1%	Number of e-bike users	2021/22: 4 bikes loaned to businesses and 13 individuals joined the scheme. Of those, 9 continued under Loan to Own. 2022/23: 1 bike loaned to businesses and 11 individuals joined the scheme. Of those, 7 continued under Loan to Own.	In-house delivery since 2017. The scheme has grown to include Loan to Own and 4-week Loan To Business. E-Cycle Extension Funding has further grown the scheme with loans for schools' staff and hard to reach communities. which are available for loan by those who live and/or work in Leicester City and struggle to get to work, including apprentices and young people. Staff turnover has hindered progress with this service in 2022.
17	Car share	Promoting Travel Alternatives	Personalised Travel Planning	2010	2040	Leicester City Council, Melton Borough Council, and Leicestershire County Council	Access Fund	NO	Partially Funded	£50k - £100k	Implementation	<0.1%	1,000 new members per year	Not yet resumed since break due to pandemic	
18	Freight Quality Partnership	Freight and Delivery Management	Delivery and Service plans	2000	2025	Leicester City Council	LTP/LCC	NO	Funded	< £10k	Planning	<0.1%	Engagement with Leicester freight businesses	Active forum meetings to restart in 2023. An ECO stars Fleet Recognition Scheme to improve local air quality and a Freight related study has been commissioned, for completion by end of 2023.	The ECO Stars work and freight study will help inform the consideration of a new Freight Plan and associated action plan.

Measure No.	Measure	Category	Classification	Year Measure Introduced in AQAP	Estimated / Actual Completion Date	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
19	Air Quality Forum (AQF)	Policy Guidance and Development Control	Regional Groups Co-ordinating programmes to develop Area wide Strategies to reduce emissions and improve air quality	2018	2040	Leicester City Council and neighbouring local authorities	LCC	NO	Funded	< £10k	Implementation	<0.1%	Forum meetings	Continued AQF meetings	Forum to discuss issues of pollution across Leicestershire attended by all local authorities and other relevant bodies (e.g., National Highways). Exchange of knowledge, development, and adoption of best practice techniques.
20	Business Travel Plans	Promoting Travel Alternatives	Intensive active travel campaign & infrastructure	2012	2040	Leicester City Council, but delivered through Go Travel Solutions and grants from JAQU	Access Fund, JAQU	NO	Partially Funded	< £10k	Implementation	<0.1%	Number of businesses engaged with	500+ businesses/organisations engaged in Travel Plans and associated monitoring to date.	
21	Travel Plans secured through statutory planning conditions	Policy Guidance and Development Control	Other policy	2002	2040	Leicester City Council	LCC, local businesses, and developers	NO	Partially Funded	< £10k	Implementation	<0.1%	Number of Travel Plans secured	Formal Travel Plan conditions attached to 25 decision notices in 2022.	
22	Bikeability Schools Programme	Promoting Travel Alternatives	Promotion of cycling	2010	2025	Leicester City Council and Job Centre Plus	Access Fund	NO	Partially Funded	£50k - £100k	Implementation	<0.1%	Number of pupils worked with	Worked with 1,500 pupils to deliver intensive training during 2022	
23	Bike Parks	Promoting Travel Alternatives	Promotion of cycling	2010	2025	Leicester City Council and British Cycling	Access Fund/ TCF	NO	Partially Funded	£50k - £100k	Implementation	<0.1%	Number of Bike Parks operational	Town hall Bike Park currently caters for approximately 120+ cycles per day (365 days per year). 20+ mobile bike parks were provided at festivals and events in 2022.	Preparations continue to provide new cycle hubs at St Margaret's Bus Station – due to be completed in 2023.
24	Bike Share Cycle Hire	Promoting Travel Alternatives	Promotion of cycling	2016	2025	Leicester City Council	TCF, LCC, Bike Share operator	NO	Partially Funded	£500k - £1 million	Implementation	<0.1%	Number of bikes in circulation and number of riders/rides	350 e-bikes in circulation. End of 2022 saw 34k+ registrations and 130k+ rides taken.	44 stations for electric bikes deployed around Leicester. Peak of over 500 riders per day.

Measure No.	Measure	Category	Classification	Year Measure Introduced in AQAP	Estimated / Actual Completion Date	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
25	Walking Programmes	Promoting Travel Alternatives	Promotion of walking	2015	2040	Leicester City Council	Access Fund / Capability Fund	NO	Partially Funded	£50k - £100k	Implementation	<0.1%	Number of walks delivered	Number of new walkers this period: 213. Number of new self-guided routes (PDFs on website): 1. Number of led group walks delivered: 72	Focus for 2022 was on group walk delivery, leaving little time for digital content creation. Training conducted for newer staff in Autumn 2022 to increase walk capabilities.
26	Walk to School Programmes	Promoting Travel Alternatives	Promotion of walking	2011	2040	Leicester City Council	Capability Fund	NO	Partially Funded	£50k - £100k	Implementation	<0.1%	Engage with 50+ schools in Leicester	Delivered to a further 15 schools in 2022. A further 11 scheduled for 2023.	Park and Stride schemes set up around some schools and are supported within the community. St John the Baptist Primary – trialled Park and Stride (looking to make permanent) and walking bus independently and will be the only scheme in the city run solely by parents.
27	Clean Air Day	Public Information	Other	2018	2040	Leicester City Council	LCC, DfT's Capability Fund, and JAQU	NO	Partially Funded	£50k - £100k	Implementation	<0.1%	Annual occurrence and school involvement	Three schools took part in Leicester in 2022 – road closures and 'play streets'.	Several other schools implemented road closures and clean air day activities with support of LCC.
28	Leicester City Council social media channels	Public Information	Via the Internet	2015	2040	Leicester City Council	LCC	NO	Partially Funded	£50k - £100k	Implementation	<0.1%	Continual use of social media channels	Messages sent as and when required, linking to various campaigns and Defra AQ grant projects	Promotion of air quality issues, events, and offering of support available from the Council via Twitter and Facebook.
29	Legible Leicester Wayfinding	Public Information	Other	2015	2026	Leicester City Council	LCC	NO	Partially Funded	£50k - £100k	Implementation	<0.1%	Number of signs deployed	2 new monoliths and 4 fingerposts installed in 2022.	Signs can be updated with relevant information. A total of 90 signs have been installed to the end of 2022.
30	Bus routes, cycle routes, bus timetables	Public Information	Via leaflets	2018	2040	Leicester City Council	LCC, Bus Operators, County Council	NO	Partially Funded	£50k - £100k	Implementation	<0.1%	Publication of maps	Maps produced and updated several times a year throughout 2022.	

Measure No.	Measure	Category	Classification	Year Measure Introduced in AQAP	Estimated / Actual Completion Date	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
31	Electric buses	Promoting Low Emission Transport	Public Vehicle Procurement - Prioritising uptake of low emission vehicles	2021	2025	Leicester City Council	TCF	NO	Partially Funded	£1 million - £10 million	Implementation	<0.1%	Number of electric buses introduced	13 additional electric buses introduced in 2022	86 electric buses on Firstbus and 24 electric buses on Arriva routes planned by December 2023. All registered operators in Leicester to be using either Euro VI or electric buses from April 2023 as part of Leicester Enhanced Partnership Scheme 2022-2025.
32	Living Roof & Solar Bus Shelters	Other	Other	2021	2030	Leicester City Council	TCF	NO	Partially Funded	£1 million - £10 million	Implementation	<0.1%	Number of shelters implemented	11 living roof shelters installed in 2022 - total now stands at 30.	203 solar bus shelters also installed in 2022.
33	Traffic Sensitive Streets	Traffic Management	Other	1991	2030	Leicester City Council	LTP/LCC	NO	Partially Funded	£50k - £100k	Completed	<0.1%	Quarterly Network Management Scorecard reports	Regulations in place	Any work carried out on the city highways has to be agreed as not to impede the traffic i.e. avoidance of rush hour. Permit scheme in place.
34	Transforming Cities Fund (TCF)	Transport Planning and Infrastructure	Other	2018	2030	Leicester City Council	TCF	NO	Partially Funded	> £10 million	Implementation	<20%	Continued implementation of various highway schemes (Themes 1-4) throughout 2022 and beyond.	Theme 1: Free city centre electric bus to be launched 2023. Theme 2: Electrification of existing park and ride buses. New schemes proposed at Beaumont Leys, Soar Valley Way, and Glenfield Hospital. Theme 3: North West Green Growth Corridor – bus lane and highway improvements scheduled for 2023. Bus lanes and red routes on Beaumont Leys Lane/A6 planned 2023. Works to Saffron Lane to create larger dedicated cycleway commenced summer 2022. Theme 4: City Connectivity: real time bus information and bus stop improvements	

Measure No.	Measure	Category	Classification	Year Measure Introduced in AQAP	Estimated / Actual Completion Date	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
														delivered in 2022. Smart integrated ticketing system rollout complete March 2022.	
35	Anti-idling campaigns	Public Information	Other	2018	2025	Leicester City Council	LCC	NO	Partially Funded	£10k - 50k	Implementation	<0.1%	Annual schemes/campaigns	Business engagement anti-idling campaign launched 2021-22. Internal training launched for LCC fleet drivers – training provided.	'No idling' highways signage also piloted in Rushey Mead area (6 signs). Anti-idling campaign outside Herrick Primary School planned for 2023.
36	Safer Streets Healthier Neighbourhoods (SSHNs) - Various Locations	Traffic Management	Other	2021	2025	Leicester City Council	LCC	NO	Partially Funded	£50k - £100k	Completed	<1%	Scheme(s) introduced	Rushey Mead: introduction of bus gates, one way streets, and school zones. Knighton: Creation of school street and further control of streets using planters and parking permit schemes.	Evington: one way systems and road closures introduced on 6 month trial basis. Follow up survey conducted winter 2022 and residents disliked. Traffic counts and vehicle speeds did reduce compared to 2019 data. Clarendon Park: scheme under development.
37	Taxi spot checks	Promoting Low Emission Transport	Taxi Licensing conditions	2000	2040	Leicester City Council	LCC	NO	Not Funded	< £10k	Implementation	<0.1%	Number of spot checks and vehicles inspected	2 spot checks conducted in 2022 – June and December – 57 vehicles in total	Joint operation with City of Wolverhampton Council in 2022
38	Taxi vehicle tests	Promoting Low Emission Transport	Taxi Licensing conditions	2000	2040	Leicester City Council	LCC	NO	Not Funded	< £10k	Implementation	<0.1%	Twice yearly testing	All licensed taxis continue to have 2 tests per year, including emission testing	2011 vehicle testing brought in house to ensure consistent application of standards
39	Bike Maintenance Training	Promoting Travel Alternatives	Promotion of cycling	2011	2024	Leicester City Council	Access Fund	NO	Partially Funded	£50k - £100k	Implementation	<0.1 %	Delivering of training to adults and young people	Cycle maintenance training is currently being reviewed as part of considerations for Cycle City Action Plan 2015-2024.	

Measure No.	Measure	Category	Classification	Year Measure Introduced in AQAP	Estimated / Actual Completion Date	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
40	Employment Adviser Training	Promoting Travel Alternatives	Personalised Travel Planning	2012	2040	Leicester City Council	Capability Fund	NO	Partially Funded	£50k - £100k	Completed	<0.1%	Training of Work Coaches	Training ongoing, Wheels 2 Work leaflets circulated to employment agencies and 3x pop up banners relocated to JobCentrePlus in 2021/22. During 2022/23, presentations given to staff/clients at several recruitment fairs with approx. 150 engagements.	The training includes advice on smart ticketing and sustainable travel, so it can be passed to people who come to Job Centre Plus, training agencies and employment agencies for work advice.
41	FACE – internal newsletter	Public Information	Via the Internet	2012	Ongoing	LCC	LCC	NO	Partially Funded	£50k - £100k	Ongoing	<0.1%	Weekly newsletter	Delivered to all employees at LCC	Information includes relevant air quality schemes or programmes, e.g. salary sacrifice for electric bikes/cars.
42	Bus Lanes	Traffic Management	Strategic highway improvements, Re-prioritising road space away from cars, including Access management, Selective vehicle priority, bus priority, high vehicle occupancy lane	2012	2040	Leicester City Council	Transport Improvement Works Programme, S106, S278, National Productivity Investment Fund, TCF.	NO	Partially Funded	£1 million - £10 million	Implementation	<0.1%	Continue to implement bus lanes as required	Several schemes implemented in 2022 (including some with enforcement): London Road, Anstey Lane, Groby Road, Melton Road, and Abbey Park Road. 4km of bus priority measures scheduled.	First bus lanes adopted in 1973. A total of 75 bus lanes deployed to the end of 2021.
43	SCOOT Sites	Traffic Management	UTC, Congestion management, traffic reduction	1970	2040	Leicester City Council	LTP, Connecting Leicester, LCC	NO	Partially Funded	£100k - £500k	Implementation	<0.1%	Further install of sites	268 sites active	
44	Mova UTC System	Traffic Management	UTC, Congestion management, traffic reduction	1980	2040	Leicester City Council	LTP Connecting Leicester, LCC	NO	Partially Funded	£100k - £500k	Implementation	<0.1%	Further install of sites	113 sites active	36 sites are dual, both SCOOT and Mova
45	A2 Permit Installations	Environmental Permits	Introduction/increase of environment charges through permit systems and economic instruments	2019	2040	Leicester City Council and Leicestershire County Council	LCC	NO	Not Funded	< £10k	Implementation	<0.1%	Annual permit inspection and fee collection	2 permits – £3,056 collected	Figures provided are for 2022/23.

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

As detailed in Policy Guidance LAQM.PG22 (Chapter 8), local authorities are expected to work towards reducing emissions and/or concentrations of $PM_{2.5}$ (particulate matter with an aerodynamic diameter of 2.5µm or less). There is clear evidence that $PM_{2.5}$ has a significant impact on human health, including premature mortality, allergic reactions, and cardiovascular diseases.

PM_{10} concentrations are currently monitored at all but one of the automatic stations managed by Leicester City Council, whilst $PM_{2.5}$ is monitored directly at the AURN University of Leicester site. It is understood that an additional $PM_{2.5}$ analyser is to be sited in Leicester as part of the AURN, in accordance with the national requirements outlined in the Environment Act 2021.

It has been possible to estimate $PM_{2.5}$ concentrations at the stations operated by the Council through calculation of a PM_{Coarse} fraction, in accordance with LAQM.TG22 and LAQM Helpdesk advice. This was then applied to the 2022 PM_{10} annual mean concentrations at the following monitoring stations: AURN A594, Abbey Lane (AL / LC1), Glenhills Way (GW / LC2), Melton Road (MR / LC3), St Matthews Way (SM / LC4), Vaughan Way (VW / LC6), and Glenhills Way East (GWE / LE1). Following this calculation, all $PM_{2.5}$ concentrations were below the annual mean AQO for this pollutant and the results are presented in Table A.9.

Additionally, Leicester City Council continue to deploy a network of low cost 'Zephyr' sensors which monitor $PM_{2.5}$ across the city, the results of which are presented in Appendix F. This network has now completed its third year of operation and will continue into 2023.

Defra 2022 background maps (based on 2018 reference data) for Leicester City show that all 1 x 1km grid squares are compliant with the 20µg/m^3 annual mean AQO for $PM_{2.5}$. The highest concentration can be found at reference 460500, 305500 with a concentration of 10.4 µg/m^3. The area lies in the northeast of the city, containing commercial and industrial development, as well as a railway line in proximity. There are also numerous terraced properties which may contain woodburning stoves and open fires, with a contribution to $PM_{2.5}$ concentrations. It is important to note that as these concentrations are predictions

only and are based on 2018 reference data, meaning there is unlikely to be consideration for any impacts associated with the pandemic.

The Public Health Outcomes Framework is a data tool compiled by Public Health England and quantifies the mortality burden of $PM_{2.5}$ within England at various local scales. This is achieved by dispersion modelling Defra background concentrations, using background AURN $PM_{2.5}$ concentrations as verification. Local authority boundaries and census data can then be applied to provide a population weighted $PM_{2.5}$ concentration. The latest data available (2021) attributes a 5.5% fraction of mortality to $PM_{2.5}$ in England. A regional average and slightly higher figure of 5.6% is applicable to the East Midlands, whilst Leicester City reported a 6.2% fraction of mortality attributable to $PM_{2.5}$ in 2021.

Leicester City Council is taking the following measures to address $PM_{2.5}$:

- Declaration of a city wide Smoke Control Area (SCA) in June 2018, after consolidation of several smaller areas dating back as early as 1958.
- Securing of an Air Quality Grant (2018/19) to model locally based $PM_{2.5}$ pollution, including monitoring using low cost 'Zephyr' sensors, to form an initial network of 10 units which has now increased to 20+ deployed across the city until at least December 2024. This project aims to assist in the mapping and monitoring of both PM_{10} and $PM_{2.5}$ using near real time data, promoting public engagement in $PM_{2.5}$ and its health impacts through smart device applications and leaflets.
- Securing and delivery of an Air Quality Grant (2019/20) to identify transboundary sources of $PM_{2.5}$ in Leicester using state of the art modelling and satellite data.
- Securing of an Air Quality Grant (2020/21) to implement a traffic intervention and quantify any reduction in both $PM_{2.5}$ and NO_2. It will also address the issue of discrepancies between near real time modelling and in-situ monitoring. Furthermore, it will allow the authority to identify the best approach to create a model scheme for the purpose of reducing air pollutant concentrations that may be applicable to other parts of the city.
- Due to the pandemic, the 2020/21 Grant projects were significantly delayed and did not resume until 2022. A public health campaign on woodburning stoves and open fires was planned for Winter 2022, aiming to raise awareness around the health impacts of $PM_{2.5}$ from woodburning, Leicester's Smoke Control Area (SCA), and to encourage a reduction in the use of polluting equipment and fuels.

Actions to promote sustainable travel and reduce traffic emissions:

- Building on lessons from the pandemic, including the promotion and facilitation of homeworking, cutting out the need for transport.
- To continue to bring electric vehicles and bicycles into the Council's fleet.
- To continue the Connecting Leicester programme, making the city more accessible and promoting sustainable modes of transport, such as walking and cycling.
- To continue to deliver our programme of walking and cycling initiatives, including the Ride Leicester Festival, led rides and walks, the "Wheels to Work" scheme, and cycle training programmes for children and adults.
- To continue the introduction of bus priority schemes, including the use of bus gate cameras and enforcement during appropriate times of the day.
- To continue improving the city's traffic management system and address 'pinch points' or areas of congestion within the highway network.
- To continue delivering the programme of 20 mph zones, particularly around schools and in residential areas.

Collaborations:

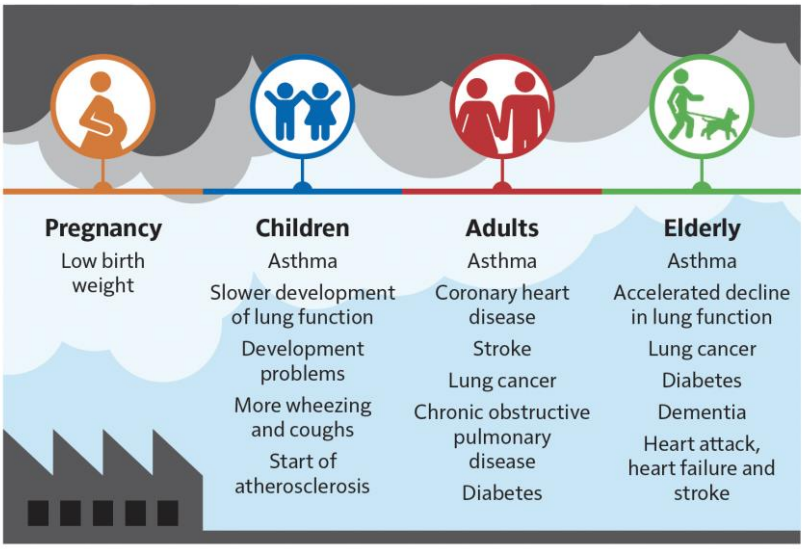
- Working closely with Defra as part of a Local Authorities advisory group.
- To continue to lobby and work with Central Government to introduce national measures to reduce polluting emissions from vehicles and woodburning stoves, including work with UK100 and the Local Government Association (LGA).
- To work with other local authorities and agencies at regional steering groups, such as the Leicester and Leicestershire Air Quality Forum.
- Working closely with neighbouring authorities of Blaby and Oadby & Wigston on transboundary sources of $PM_{2.5}$, the latter through a Defra Air Quality Grant project on monitoring of $PM_{2.5}$ with a low cost sensor located on A6 London Road.
- To work with the Office for Zero Emission Vehicles (OZEV) and introduce low emission taxis to Leicester.
- To continue an effective partnership with bus operators (Leicester Bus Enhanced Partnership 2022-2025), exploring the full potential of the Bus Services Act 2017, improving the quality and accessibility of bus services to promote modal shift and reduce emissions from transport.

Monitoring:

- To continue developing the monitoring network, through the purchase of additional equipment and/or the extension of existing services, and relocating of equipment with consideration for regular pollutant hotspot exercises.
- To ensure air quality considerations are embedded within Leicester's new Local Transport Plan (LTP 4), which will be developed in 2023.

Public Health:

- Leicester City Council colleagues in Public Health work closely with one another and various departments across the authority, recognising the importance of reducing $PM_{2.5}$ emissions and the associated public health benefits.
- Public Health reference a January 2022 update from Committee on the Medical Effects of Air Pollutants (COMEAP) titled advice on health evidence relevant to setting $PM_{2.5}$ targets, stating: "...on health grounds, we would strongly support a reduction of $PM_{2.5}$ concentrations, ideally to (or below) the WHO guideline value of 5 µg/m^3."
- It is also noted that the Chief Medical Officer's Annual Report for 2022 was written on Air Pollution, with a section regarding Air Pollution and Health stating: "Air pollution affects people's health throughout their lives, including before birth, in the very young, through to older adults. Exposure to air pollution, indoors and outdoors, over a long period of time, reduces people's life expectancy. There is clear evidence that air pollution contributes to the initiation and development of cardiovascular and respiratory diseases, and can cause lung cancer. Evidence of links between exposure to air pollution and a wider range of health effects, such as intra-uterine impacts, adverse birth outcomes, poor early life organ development, diabetes, reduced cognitive performance, and increased dementia risk continues to build, with varying strengths of evidence".



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

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

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

Leicester City Council undertook automatic (continuous) monitoring at five sites during 2022. A further two sites that form part of the AURN are located within the authority's area. Table A.1 in Appendix A shows the details of the automatic monitoring sites. NB. Local authorities do not have to report annually on the following pollutants: 1,3 butadiene, benzene, carbon monoxide and lead, unless local circumstances indicate there is a problem. The Leicester City Council Air Quality page presents automatic monitoring results for the five stations operated by Leicester City Council, with results for the two AURN sites available through the Defra UK-Air website.

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

Leicester City Council also deploy a network of continuous monitors in the form of low cost 'Zephyr' sensors, monitoring NO_2, PM_{10}, and $PM_{2.5}$ concentrations. Although these cannot strictly be used in assessment of AQOs, they provide an important indication of potential hotspot areas in Leicester. The results are presented in Appendix F.

3.1.2 Non-Automatic Monitoring Sites

Leicester City Council undertook non-automatic (i.e. passive) monitoring of NO_2 at 44 sites during 2022. It was proposed (and subsequently agreed with JAQU) that 2022 would be the final monitoring year for the diffusion tube network, as these were funded as part of the

Secretary of State NO_2 Direction in order to verify an air quality model. Table A.2 in Appendix A presents the details of the non-automatic sites.

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

3.2 Individual Pollutants

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

3.2.1 Nitrogen Dioxide (NO_2)

Table A.3 and Table A.4 in Appendix A compare the ratified and adjusted monitored NO_2 annual mean concentrations for the past five years with the air quality objective of 40µg/m^3. Note that the concentration data presented represents the concentration at the location of the monitoring site, following the application of bias adjustment and annualisation, as required (i.e. the values are exclusive of any consideration to fall-off with distance adjustment).

For diffusion tubes, the full 2022 dataset of monthly mean values is provided in Appendix B. Note that the concentration data presented in Table B.1 includes distance corrected values, only where relevant. It should be noted that the collection and processing of the diffusion tube network monitoring data was conducted by an external consultancy, who later consulted with Leicester City Council to aid interpretation of the monitoring results.

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

All NO_2 monitoring data, from both diffusion tubes and air quality monitoring stations, has been properly ratified in accordance with procedures outlined in LAQM.TG22.

There were no recorded exceedances of the annual mean NO_2 objective at any of the automatic monitoring stations within Leicester City for 2022. The highest concentration of 38.0 µg/m^3 was reported at Vaughan Way (VW / LC6) and marks a slight increase (1.2

µg/m^3) on the value in 2021. It is likely that increases in concentration are the result of a return to traffic volumes since the pandemic, as confirmed by data gathered by Transport Strategy. It should be noted that this location historically (pre-pandemic) exceeds the AQO due to it being located on the inner ring road in Leicester, with multiple lanes of traffic that queue regularly throughout the day. Other locations which have seen marginal increases on 2021 values include Melton Road (MR / LC3) and AURN A594 St Matthews Way, with an increase of 2 µg/m^3 and 0.8 µg/m^3 respectively.

Some monitoring stations have recorded a decrease in NO_2 annual mean since 2021, namely St Matthews Way (SM / LC4) and Glenhills Way (GW / LC2). The latter was subject to relocation in May 2022 due to not being sited in accordance with current LAQM guidance. Figures for both sites (including GWE / LE1) have been annualised and are presented in this report. It should be noted that prior to relocation, the GW / LC2 station recorded an exceedance of 42.1 µg/m^3 (before distance correction) in 2021 due to being sited on a major crossroads junction. The station recorded a value of 37.7 µg/m^3 in 2022, following a similarly decreasing trend with other locations in Leicester. This can be mainly attributed to fleet upgrades with a higher proportion of Euro engine standards (over 70% of vehicles in Leicester now at least Euro 5) and a change in working habits associated with the pandemic.

As none of the automatic monitoring stations (either within or outside of the AQMA) reported an annual mean concentration greater than 60 µg/m^3, it is unlikely than any exceedance of the 1-hourly objective would have been present in 2022.

One location within the diffusion tube network (LCC36 on Vaughan Way) reported an annual mean concentration of 45.7 µg/m^3. This tube is located on the inner ring road in Leicester, where multiple lanes of traffic are common during rush hour periods. It should be noted that this location is commercial in nature (vacant ground floor), with no typical sensitive receptor or exposure in proximity. In consultation with LAQM.TG22 and LAQM Helpdesk advice, the location is considered unrepresentative for assessment against the annual mean national air quality objective. The shorter term 1-hourly objective is more appropriate, but as the concentration is less than 60 µg/m^3, it is considered unlikely to exceed this objective.

However, as the sampler is within the AQMA, it is important to acknowledge that NO_2 concentrations may be elevated in some parts of the city, despite the previous years of compliance. LCC36 was previously monitored in 2019 and 2020, reporting concentrations of 49.7 µg/m^3 and 37.4 µg/m^3 respectively. Further information regarding this tube and

location can be found in Appendix C. The next nearest diffusion tube (LCC47ABC) is the triplicate set affixed to the Vaughan Way (VW / LC6) monitoring station which reported a concentration of 37.8 µg/m^3, showing good agreement between the monitoring techniques and highlighting the elevated NO_2 concentrations on this section of the inner ring road. The area will be closely monitored in 2023, with a low cost 'Zephyr' sensor in proximity to improve on the lack of temporal resolution associated with diffusion tubes and to identify the reasons behind the elevated concentration.

All other diffusion tube locations have reported compliance with the annual mean AQO in 2022, with the majority of samplers below 30 µg/m^3. Areas of elevated concentration remain within the AQMA, predominantly the inner ring road (LCC37 at 31.5 µg/m^3) and main radials of Uppingham Road (LCC32 at 35 µg/m^3), London Road (LCC27 at 32.4 µg/m^3), Narborough Road (LCC15 at 30.9 µg/m^3), and Welford Road (LCC23 at 34.2 µg/m^3). Sections of the outer ring road, primarily in the northwest of Leicester, despite being located at distance from the city centre and outside of the AQMA, also report elevated concentrations, namely LCC1, LCC3, LCC5, and LCC6 at 30.4 µg/m^3, 31.9 µg/m^3, 34.7 µg/m^3, and 34.9 µg/m^3 respectively.

Other areas of Leicester, such as the eastern and southern extents have consistently reported concentrations between 20-29 µg/m^3 over the last three years, with some of these samplers being located within the AQMA. It is plausible that with further compliance in these areas, the authority may consider a restriction of the AQMA boundary here.

As none of the passive samplers (either within or outside of the AQMA) reported an annual mean concentration greater than 60 µg/m^3, it is unlikely than any exceedance of the 1-hourly objective would have been present in 2022.

With regards to the low cost 'Zephyr' sensors, an exceedance of the annual mean AQO was measured at Z361 on Charles Street (47.8 µg/m^3). This location was chosen due to its location within the AQMA and its adjacency to a bus station. The street is traffic restricted at this section, with idling buses the likely cause of elevated NO_2 concentrations. The Zephyr is kerbside with residential accommodation set back at distance and height, meaning pollutant concentrations are likely to be below the objective value at the building façade. An additional exceedance for 2022 is reported at Troon Way (Z409, 40.4 µg/m^3) which forms part of the outer ring road in Leicester. However, it should be noted that the data capture for this sensor was 66.3% due to analyser downtime and a lack of solar gain, so this result should be treated with caution. Additionally, the concentration measured here was compliant in 2021, suggesting no history of exceedance. All other low cost 'Zephyr'

sensor locations reported compliance with the annual mean AQO and with concentrations less than 60 µg/m^3, it is unlikely that an exceedance of the 1-hourly objective would have been present in 2022.

3.2.2 Particulate Matter (PM_{10})

Table A.6 in Appendix A: Monitoring Results compares the ratified and adjusted monitored PM_{10} annual mean concentrations for the past five years with the air quality objective of 40µg/m^3.

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

PM_{10} is currently monitored at four of the five stations managed by Leicester City Council, both of the AURN stations, and at all but one of the low cost 'Zephyr' sensors. Full details of the Zephyr monitoring data are presented in Appendix F.

None of the automatic monitoring stations recorded an exceedance of the annual mean objective value, with the highest concentration of 20.5 µg/m^3 reported at Vaughan Way (VW / LC6). It should be noted that the concentrations at the Council operated sites have increased marginally on average (1.1 µg/m^3 or 6%) compared to 2021 values, likely attributed to an increase in vehicle movements seen. When comparing concentrations to 2019 however, results are on average 2 µg/m^3 or 9.8% lower than pre-pandemic figures. No exceedances of the daily mean objective are reported across the stations. This trend has been present for several years in Leicester and the concentrations reported are amongst the lowest the city has seen, with no particular area highlighted as a PM_{10} hotspot. The current AQMA is not declared for reasons of PM_{10} exceedance, and it is considered very unlikely that Leicester will declare on this basis. All monitoring data used in the calculation of concentrations with respect to both the annual mean and daily objectives for PM_{10} has been conducted in accordance with the procedures outlined LAQM.TG22.

3.2.3 Particulate Matter ($PM_{2.5}$)

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

$PM_{2.5}$ is monitored by Leicester City Council in the form of low cost 'Zephyr' sensors and whilst these monitors are not strictly applicable to assessment of national air quality

objectives, they are useful for providing indicative trends and potential hotspot locations. All of the Zephyr monitoring locations are compliant with the national air quality objective for $PM_{2.5}$ (20 µg/m^3), with the highest concentration of 9.6 µg/m^3 recorded at Z393 on Knighton Church Road. This area is considered a more affluent ward of Leicester and a likely source of fine particulates from the use of woodburning stoves and open fires. University of Leicester research indicates the main sources of $PM_{2.5}$ impacting Leicester are transboundary in nature, with the vast majority from agricultural emissions which act to form secondary $PM_{2.5}$ through reactions in the atmosphere, before being transported into the city. A second transboundary proportion is sourced from regional and international emissions. Smaller sources of $PM_{2.5}$ can be attributed to the use of woodburning stoves and open fires in Leicester itself, which is thought to have increased in recent years due to the cost of living and energy crises. Transport is considered a minor contributor of total $PM_{2.5}$ emissions in Leicester, primarily from resuspension of particles by vehicle movement and the wear of brake and tyre parts. There are no large industrial processes in Leicester or the surrounding local authority areas.

$PM_{2.5}$ has been monitored at the AURN Leicester University site since 2013, with annual mean concentrations no greater than 13 µg/m^3 over that period. The value reported for 2022 was 7.9 µg/m^3, consistent with that of many of the low cost ‘Zephyr’ sensors located across the city.

$PM_{2.5}$ concentrations have also been estimated from measured PM_{10} values, the results of which are available in Table A.9 and presented in Figure A.6. The estimated concentrations are below the relevant annual mean air quality objective (20 µg/m^3) for $PM_{2.5}$ at all monitoring stations. Further information on the process to calculate estimated $PM_{2.5}$ concentrations can be found in Appendix C.

All monitoring data used in the calculation of concentrations with respect to the annual mean objective for $PM_{2.5}$ has been conducted in accordance with the procedures outlined LAQM.TG22.

Appendix A: Monitoring Results

Table A.1 – Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Monitoring Technique	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Inlet Height (m)
AURN LU	AURN Leicester University	Urban Background	459186	302817	NO_2, PM_{10}, $PM_{2.5}$	NO	Chemiluminescent, FDMS	N/A	30	4
AURN A594	AURN Leicester A594 Roadside	Roadside	459358	304915	NO_2, PM_{10}	YES, Leicester AQMA	Chemiluminescent, FDMS	33.5	3	2.5
AL (LC1)	Abbey Lane	Roadside	458575	306888	NO_2, PM_{10}	YES, Leicester AQMA	Chemiluminescent, BAM	4.5	7	2
GW (LC2)	Glenhills Way	Roadside	457085	300158	NO_2, PM_{10}	YES, Leicester AQMA	Chemiluminescent, BAM	14	3	2
MR (LC3)	Melton Road	Roadside	459528	306316	NO_2, PM_{10}	YES, Leicester AQMA	Chemiluminescent, BAM	0	3	2
SM (LC4)	St Matthews Way	Roadside	459210	305052	NO_2	YES, Leicester AQMA	Chemiluminescent	10	2	2
VW (LC6)	Vaughan Way	Roadside	458507	304906	NO_2, PM_{10}	YES, Leicester AQMA	Chemiluminescent, BAM	0	4	2
GWE (LE1)	Glenhills Way East	Roadside	457803	300090	NO_2, PM_{10}	YES, Leicester AQMA	Chemiluminescent, BAM	38	3	2

Notes:

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

(2) N/A if not applicable

Table A.2 – Details of Non-Automatic Monitoring Sites

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube Co-located with a Continuous Analyser?	Tube Height (m)
LCC1	A563 Krefeld Way	Roadside	456672	307669	NO_2	NO	2	3	NO	2
LCC2	A563 Asquith Way	Roadside	459165	300271	NO_2	YES, Leicester AQMA	0	3	NO	2
LCC3	A563 Red Hill Way	Roadside	458260	307900	NO_2	NO	0	3	NO	2
LCC4	A50 Groby Road	Roadside	457244	305572	NO_2	NO	0	3	NO	2
LCC5	A50 Groby Road	Roadside	455578	306395	NO_2	NO	0	3	NO	2
LCC6	A5630 Anstey Lane	Roadside	455825	307676	NO_2	NO	0	3	NO	2
LCC7	A563 New Parks Way	Roadside	455647	305825	NO_2	YES, Leicester AQMA	0	3	NO	2
LCC8	Glenfield Road	Roadside	455917	304892	NO_2	YES, Leicester AQMA	0	3	NO	2
LCC9	A563 New Parks Way	Roadside	455082	304761	NO_2	YES, Leicester AQMA	0	3	NO	2
LCC11	A47 Hinckley Road	Roadside	456230	304273	NO_2	YES, Leicester AQMA	0	3	NO	2
LCC12	A426 Aylestone Road	Roadside	457474	301061	NO_2	YES, Leicester AQMA	0	3	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)
LCC14	Stretton Road	Roadside	457210	304276	NO_2	YES, Leicester AQMA	0	3	NO	2
LCC15	A5460 Narborough Road	Roadside	457690	303780	NO_2	YES, Leicester AQMA	4	1	NO	2
LCC16	A563 Palmerston Way	Roadside	461014	301043	NO_2	YES, Leicester AQMA	19.5	0.5	NO	2
LCC17	Braunstone Lane	Roadside	456380	302193	NO_2	YES, Leicester AQMA	0	3	NO	2
LCC18	A5460 Narborough Road	Roadside	456754	302259	NO_2	YES, Leicester AQMA	0	3	NO	2
LCC19	Upperton Road	Roadside	457667	303460	NO_2	YES, Leicester AQMA	4	0.5	NO	2
LCC20	A594 Waterloo Way	Roadside	459196	303882	NO_2	YES, Leicester AQMA	0	3	NO	2
LCC21	A594 St Georges Way	Roadside	459431	304564	NO_2	YES, Leicester AQMA	0	3	NO	2
LCC22	A563 Glenhills Way	Roadside	457869	300085	NO_2	YES, Leicester AQMA	0	3	NO	2
LCC23	A5199 Welford Road	Roadside	459367	302117	NO_2	YES, Leicester AQMA	0	3	NO	2
LCC24	B5366 Saffron Lane	Roadside	458542	302023	NO_2	YES, Leicester AQMA	0	3	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)
LCC25	A5199 Welford Road	Roadside	459703	301072	NO_2	YES, Leicester AQMA	0	3	NO	2
LCC26	A6 London Road	Roadside	461307	301478	NO_2	YES, Leicester AQMA	0	3	NO	2
LCC27	A6 London Road	Roadside	460134	303093	NO_2	YES, Leicester AQMA	0	3	NO	2
LCC28	A47 Uppingham Road	Roadside	463282	304552	NO_2	YES, Leicester AQMA	0	3	NO	2
LCC29	A563 Colchester Road	Roadside	462891	305329	NO_2	YES, Leicester AQMA	0	3	NO	2
LCC30	A47 Uppingham Road	Roadside	461806	305323	NO_2	YES, Leicester AQMA	0	3	NO	2
LCC31	A6030 Coleman Road	Roadside	461596	304989	NO_2	NO	0	3	NO	2
LCC32	Forest Road	Roadside	460441	305322	NO_2	YES, Leicester AQMA	0	3	NO	2
LCC33	A6 Abbey Lane	Roadside	458749	307184	NO_2	YES, Leicester AQMA	0	3	NO	2
LCC34	A607 Melton Road	Roadside	460010	307324	NO_2	YES, Leicester AQMA	0	3	NO	2
LCC35	A50 Frog Island	Roadside	458099	305184	NO_2	YES, Leicester AQMA	0	3	NO	2
LCC36	A594 Vaughan Way	Roadside	458272	304630	NO_2	YES, Leicester AQMA	0	3	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)
LCC37	St Nicholas Circle	Roadside	458182	304400	NO_2	YES, Leicester AQMA	0	3	NO	2
LCC38	A6030 Victoria Road East	Roadside	461558	306508	NO_2	YES, Leicester AQMA	0	3	NO	2
LCC40	A607 Melton Road	Roadside	460460	308234	NO_2	NO	0	3	NO	2
LCC41	A563 Troon Way	Roadside	460865	307949	NO_2	NO	0	3	NO	2
LCC43	Loughborough Road	Roadside	459304	307385	NO_2	YES, Leicester AQMA	0	3	NO	2
LCC45	Leicester Road	Roadside	457596	310078	NO_2	YES, Leicester AQMA	0	3	NO	2
LCC46	Scraptoft Lane	Roadside	464058	305532	NO_2	NO	0	3	NO	2
LCC47ABC	Vaughan Way AQMS Triplicate Set	Roadside	458507	304904	NO_2	YES, Leicester AQMA	0	4	YES	2
LCC49	Hogarth Road	Roadside	457472	310229	NO_2	YES, Leicester AQMA	0	3	NO	2
LCC50	B5327 Anstey Lane	Roadside	456269	307062	NO_2	NO	0	3	NO	2

Notes:

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

(2) N/A if not applicable.

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

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022
AURN LU	459186	302817	Urban Background	99.1	99.1	23.2	24	19	20.3	18.9
AURN A594	459358	304915	Roadside	95.8	95.8	36	38	28	29	29.8
AL (LC1)	458575	306888	Roadside	98.7	98.7	31.6	31.5	24.3	26.6	26
GW (LC2)	457085	300158	Roadside	97	34.3	**49.4**	**48.6**	38.8	**42.1**	37.7
MR (LC3)	459528	306316	Roadside	97.8	97.8	38.7	38.5	28	31.4	33.4
SM (LC4)	459210	305052	Roadside	97.9	97.9	**41.7**	**40.6**	31.4	34.9	33.7
VW (LC6)	458507	304906	Roadside	90.5	90.5	**45.3**	**45.7**	35.2	36.8	38
GWE (LE1)	457803	300090	Roadside	99.4	64.1	-	-	-	-	24.2

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

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

Notes:

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

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

All means have been "annualised" as per LAQM.TG22 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

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

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

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

Table A.4 – Annual Mean NO_2 Monitoring Results: Non-Automatic Monitoring (µg/m^3)

Diffusion Tube ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2022 (%) [2]	2018	2019	2020	2021	2022
LCC1	456672	307669	Roadside	100	100	-	32.6	23.3	29.9	30.4
LCC2	459165	300271	Roadside	100	100	-	24.9	20.3	24.4	23.5
LCC3	458260	307900	Roadside	100	100	-	34.1	25.0	31.7	31.9
LCC4	457244	305572	Roadside	83	83	-	32.2	-	32.2	28.4
LCC5	455578	306395	Roadside	75	75	-	36.0	25.4	35.2	34.7
LCC6	455825	307676	Roadside	92	92	-	35.3	24.6	33.5	34.9
LCC7	455647	305825	Roadside	100	100	-	31.5	24.7	28	27.8
LCC8	455917	304892	Roadside	67	67	-	21.6	17.7	17.8	19.4
LCC9	455082	304761	Roadside	100	100	-	30.1	21.4	24.3	24.3
LCC11	456230	304273	Roadside	100	100	-	28.2	21.0	26.6	25.2
LCC12	457474	301061	Roadside	100	100	-	28.9	19.8	24.7	22.8
LCC14	457210	304276	Roadside	83	83	-	23.6	17.3	21.9	23.0
LCC15	457690	303780	Roadside	83	83	-	38.3	26.9	-	37.5
LCC16	461014	301043	Roadside	100	100	-	32.0	22.3	34.7	37.3
LCC17	456380	302193	Roadside	100	100	-	25.6	20.1	24.4	24.0
LCC18	456754	302259	Roadside	92	92	-	31.4	22.1	27.6	28.9
LCC19	457667	303460	Roadside	100	100	-	39.6	30.8	39.9	37.1
LCC20	459196	303882	Roadside	100	100	-	27.1	21.8	24.1	23.9
LCC21	459431	304564	Roadside	75	75	-	30.3	24.7	27.1	25.9
LCC22	457869	300085	Roadside	92	92	-	27.8	21.8	27.9	27.4
LCC23	459367	302117	Roadside	83	83	-	35.6	28.5	32.4	34.2
LCC24	458542	302023	Roadside	92	92	-	25.3	21.5	25	24.3
LCC25	459703	301072	Roadside	100	100	-	21.9	16.9	20.6	20.6
LCC26	461307	301478	Roadside	100	100	-	27.5	20.5	25.7	25.9
LCC27	460134	303093	Roadside	100	100	-	34.1	25.6	31.8	32.4
LCC28	463282	304552	Roadside	100	100	-	19.6	15.8	18.8	17.7
LCC29	462891	305329	Roadside	100	100	-	24.7	21.1	22.7	22.7
LCC30	461806	305323	Roadside	75	75	-	35.2	27.1	35.2	27.8
LCC31	461596	304989	Roadside	92	92	-	27.6	21.3	25.8	24.9
LCC32	460441	305322	Roadside	67	67	-	35.0	28.5	33.4	35.0
LCC33	458749	307184	Roadside	92	92	-	32.5	25.5	27.5	25.5
LCC34	460010	307324	Roadside	100	100	-	25.6	18.5	23.3	24.6
LCC35	458099	305184	Roadside	83	83	-	33.7	25.1	27.2	27.7
LCC36	458272	304630	Roadside	67	67	-	**49.7**	37.5	-	**45.7**
LCC37	458182	304400	Roadside	100	100	-	38.0	25.0	31.9	31.5

Diffusion Tube ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022
LCC38	461558	306508	Roadside	92	92	-	24.6	15.0	21.9	20.7
LCC40	460460	308234	Roadside	100	100	-	30.8	23.5	27.9	27.9
LCC41	460865	307949	Roadside	83	83	-	31.2	24.4	27.8	29.3
LCC43	459304	307385	Roadside	100	100	-	30.5	18.6	28.8	30.2
LCC45	457596	310078	Roadside	100	100	-	17.7	15.4	14.8	15.9
LCC46	464058	305532	Roadside	92	92	-	19.0	15.8	17.7	17.8
LCC47ABC	458507	304904	Roadside	92	92	-	**42.8**	33.1	36.8	37.8
LCC49	457472	310229	Roadside	100	100	-	18.0	13.6	14.6	13.9
LCC50	456269	307062	Roadside	100	100	-	22.4	17.4	21	19.6

☒ **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/m^3.

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

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

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

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

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

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

Figure A.1 – Trends in Annual Mean NO_2 Concentrations at Automatic Stations within the AQMA

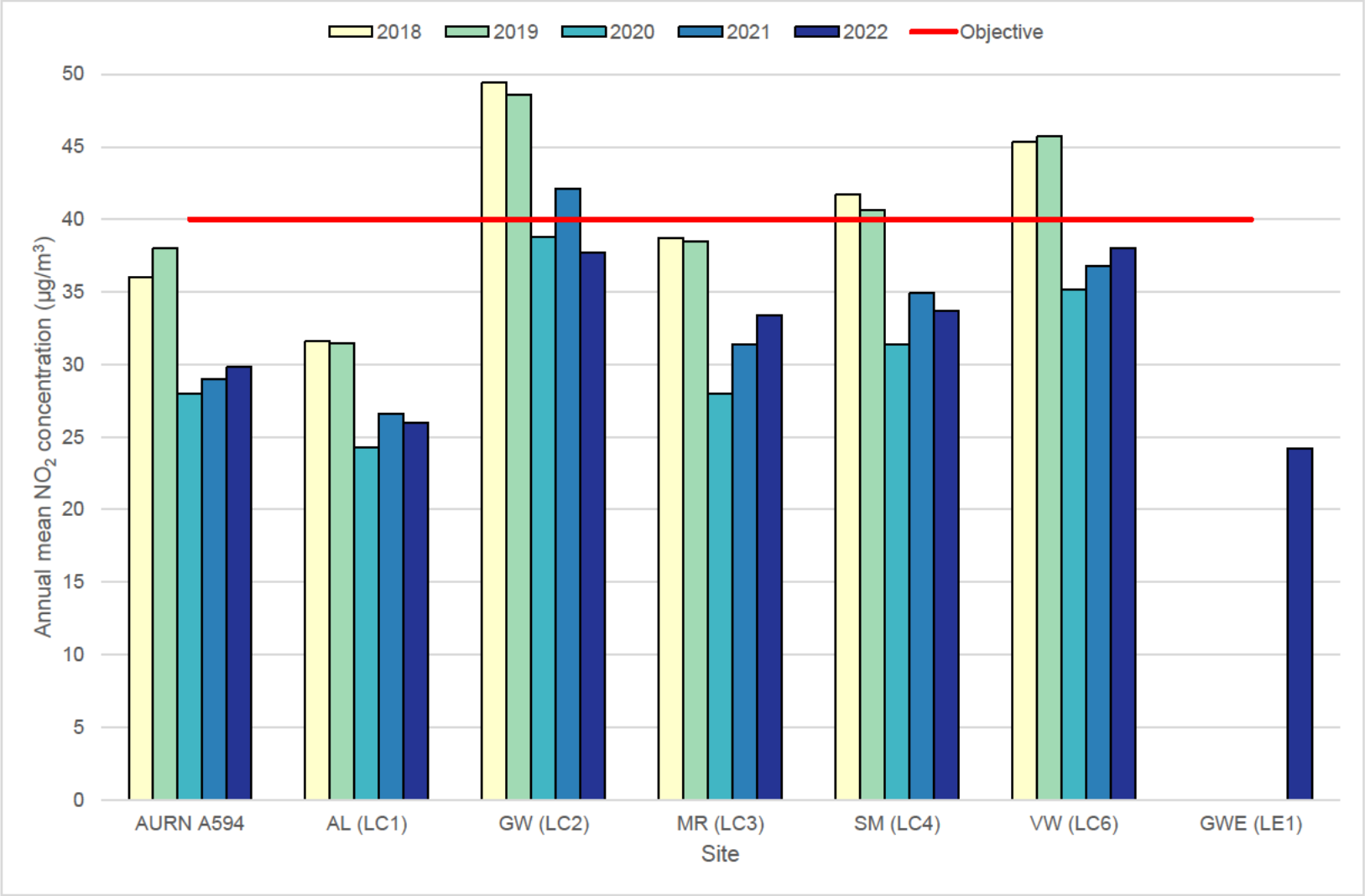


Figure A.2 – Trends in Annual Mean NO_2 Concentrations at Diffusion Tubes within the AQMA

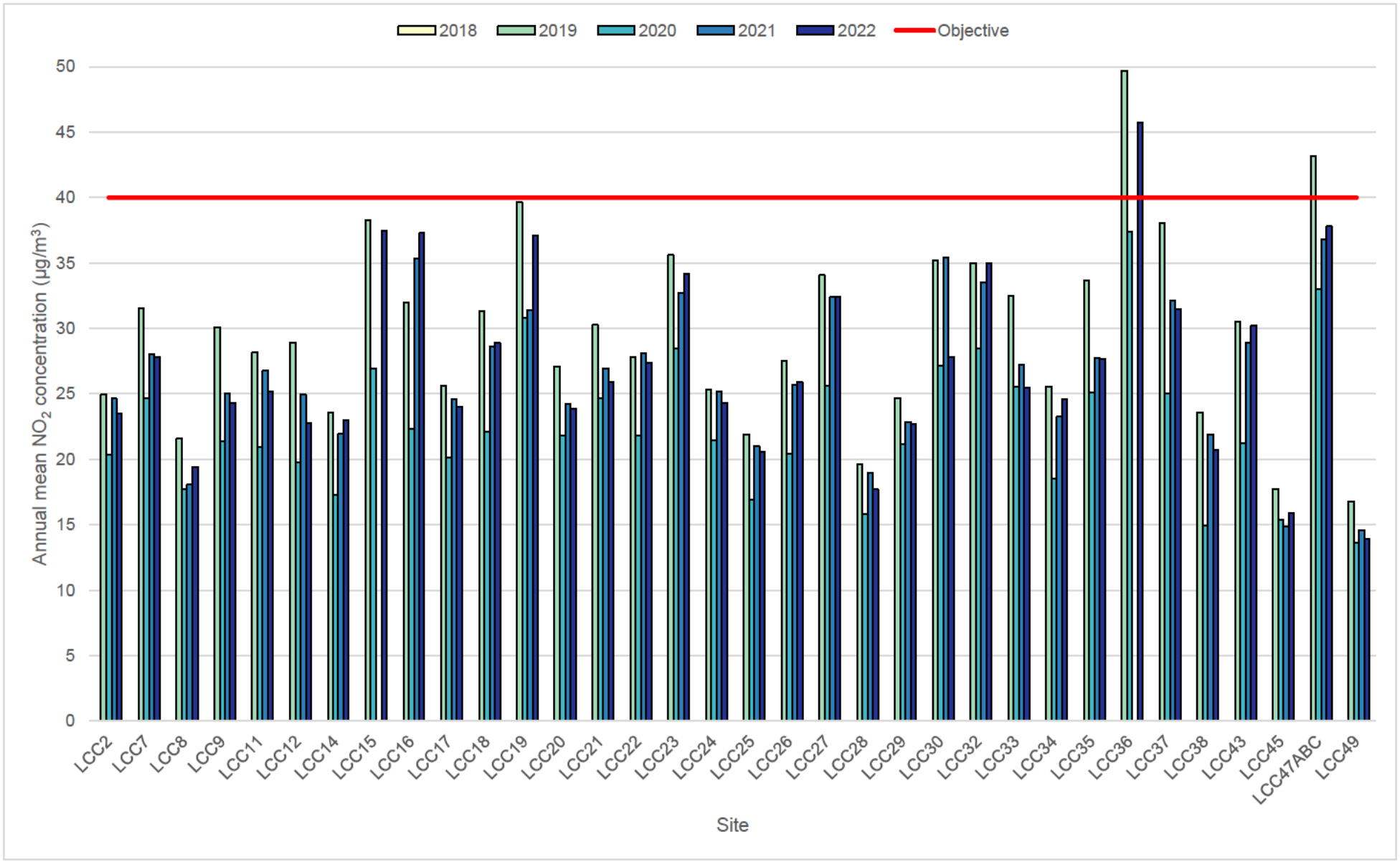


Figure A.3 – Trends in Annual Mean NO_2 Concentrations outside the AQMA

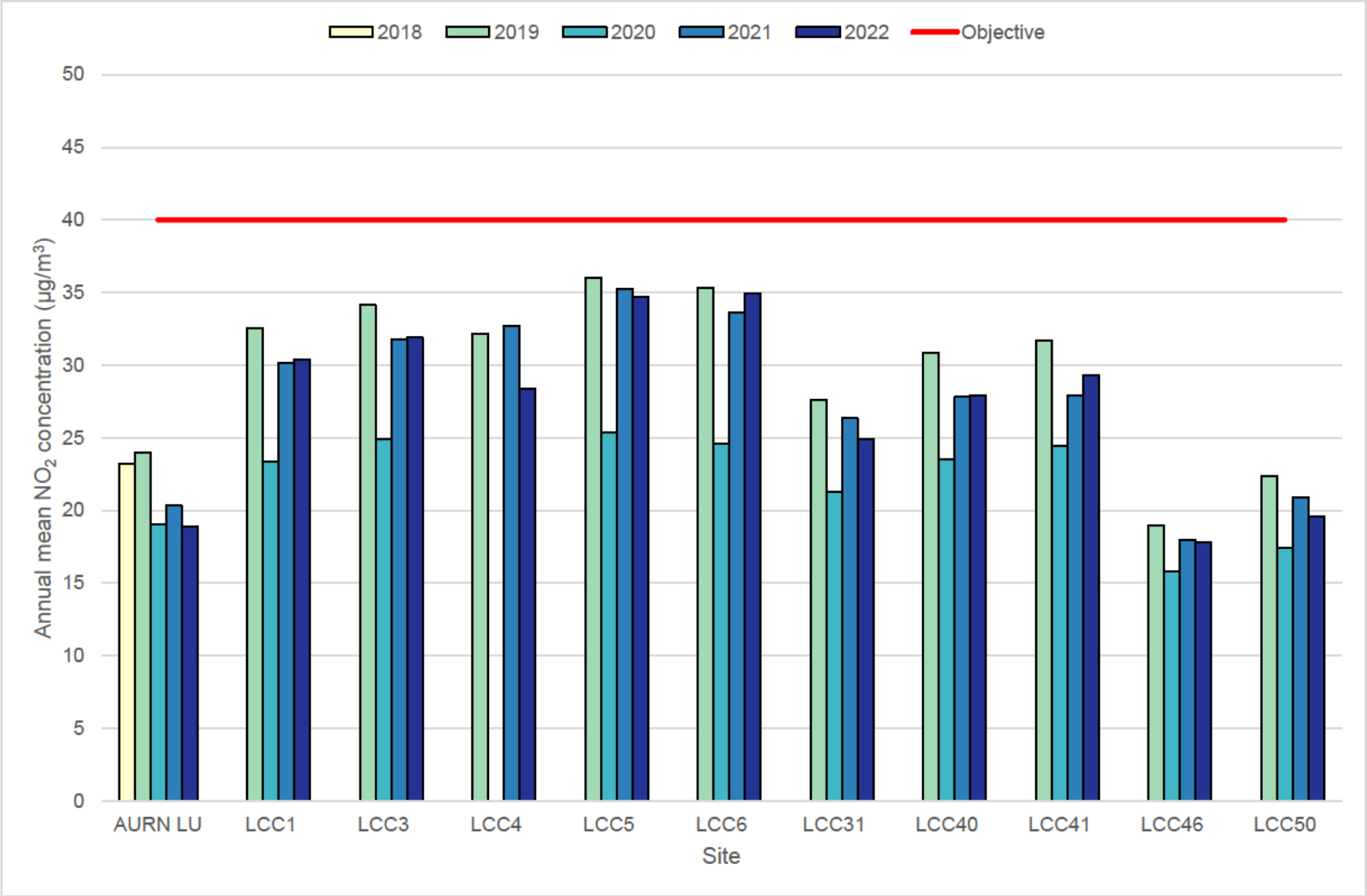


Table A.5 – 1-Hour Mean NO_2 Monitoring Results, Number of 1-Hour Means > 200µg/m^3

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022
AURN LU	459186	302817	Urban Background	99.1	99.1	0	0	0	0	0
AURN A594	459358	304915	Roadside	95.8	95.8	0	0	0	0	0
AL (LC1)	458575	306888	Roadside	98.7	98.7	0	0	0	0	0
GW (LC2)	457085	300158	Roadside	97	34.3	0	0	0	0	0 (127.5)
MR (LC3)	459528	306316	Roadside	97.8	97.8	0	0	0	0	0
SM (LC4)	459210	305052	Roadside	97.9	97.9	0	0	0	0	0
VW (LC6)	458507	304906	Roadside	90.5	90.5	0	0	0	0	0
GWE (LE1)	457803	300090	Roadside	99.4	64.1	-	-	-	-	0 (80.8)

Notes:

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

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

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

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

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

Table A.6 – Annual Mean PM_{10} Monitoring Results ($\mu g/m^3$)

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022
AURN LU	459186	302817	Urban Background	99.7	99.7	-	-	13	12.2	12.9
AURN A594	459358	304915	Roadside	96.7	96.7	23	23	17	18.1	19
AL (LC1)	458575	306888	Roadside	94.6	94.6	19	18	19	18.8	19
GW (LC2)	457085	300158	Roadside	98.2	34.6	22	22	18	17.3	18
MR (LC3)	459528	306316	Roadside	97.8	97.8	21	21	16	13.8	15.5
VW (LC6)	458507	304906	Roadside	95.4	95.4	20	20	20	18.9	20.5
GWE (LE1)	457803	300090	Roadside	99.3	64.1	-	-	-	-	16.5

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

Notes:

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

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

All means have been "annualised" as per LAQM.TG22 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

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

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

Figure A.4 – Trends in Annual Mean PM_{10} Concentrations

Table A.7 – 24-Hour Mean PM_{10} Monitoring Results, Number of PM_{10} 24-Hour Means > 50µg/m^3

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022
AURN LU	459186	302817	Urban Background	99.7	99.7	-	-	0	0	2
AURN A594	459358	304915	Roadside	96.7	96.7	4	15	3	5	5
AL (LC1)	458575	306888	Roadside	94.6	94.6	10	5	0	0	5
GW (LC2)	457085	300158	Roadside	98.2	34.6	8	11	2	1	3 (18.6)
MR (LC3)	459528	306316	Roadside	97.8	97.8	8	10	0	2	1
VW (LC6)	458507	304906	Roadside	95.4	95.4	9	8	2	1	3
GWE (LE1)	457803	300090	Roadside	99.3	64.1	-	-	-	-	0 (23.8)

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%).

Figure A.5 – Trends in Number of 24-Hour Mean PM_{10} Results > 50µg/m^3

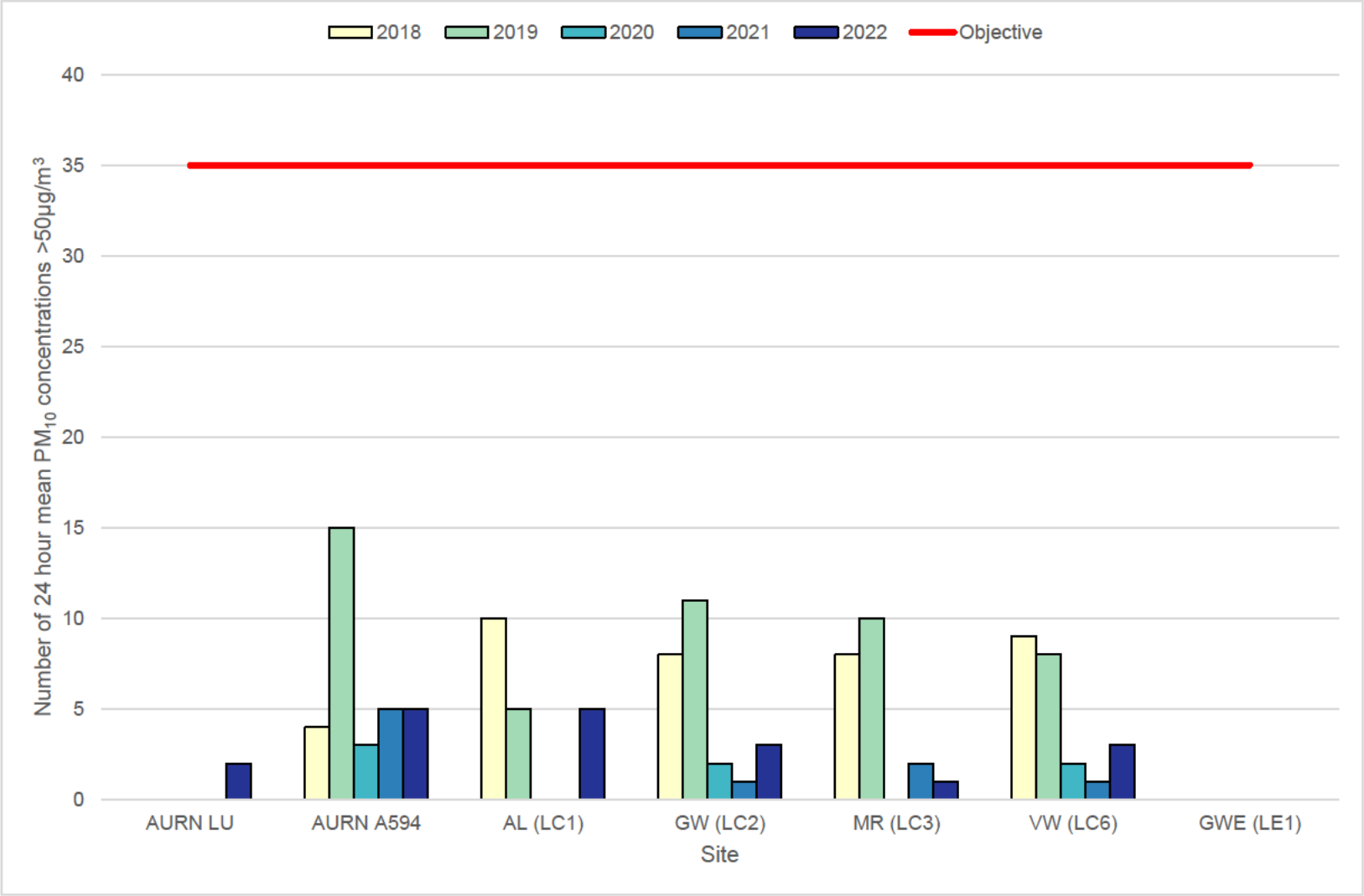


Table A.8 – Annual Mean $PM_{2.5}$ Monitoring Results (µg/m^3)

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022
AURN LU	459186	302817	Urban Background	99.7	99.7	10.0	11.0	8.0	7.5	7.9

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

Notes:

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

All means have been "annualised" as per LAQM.TG22 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

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

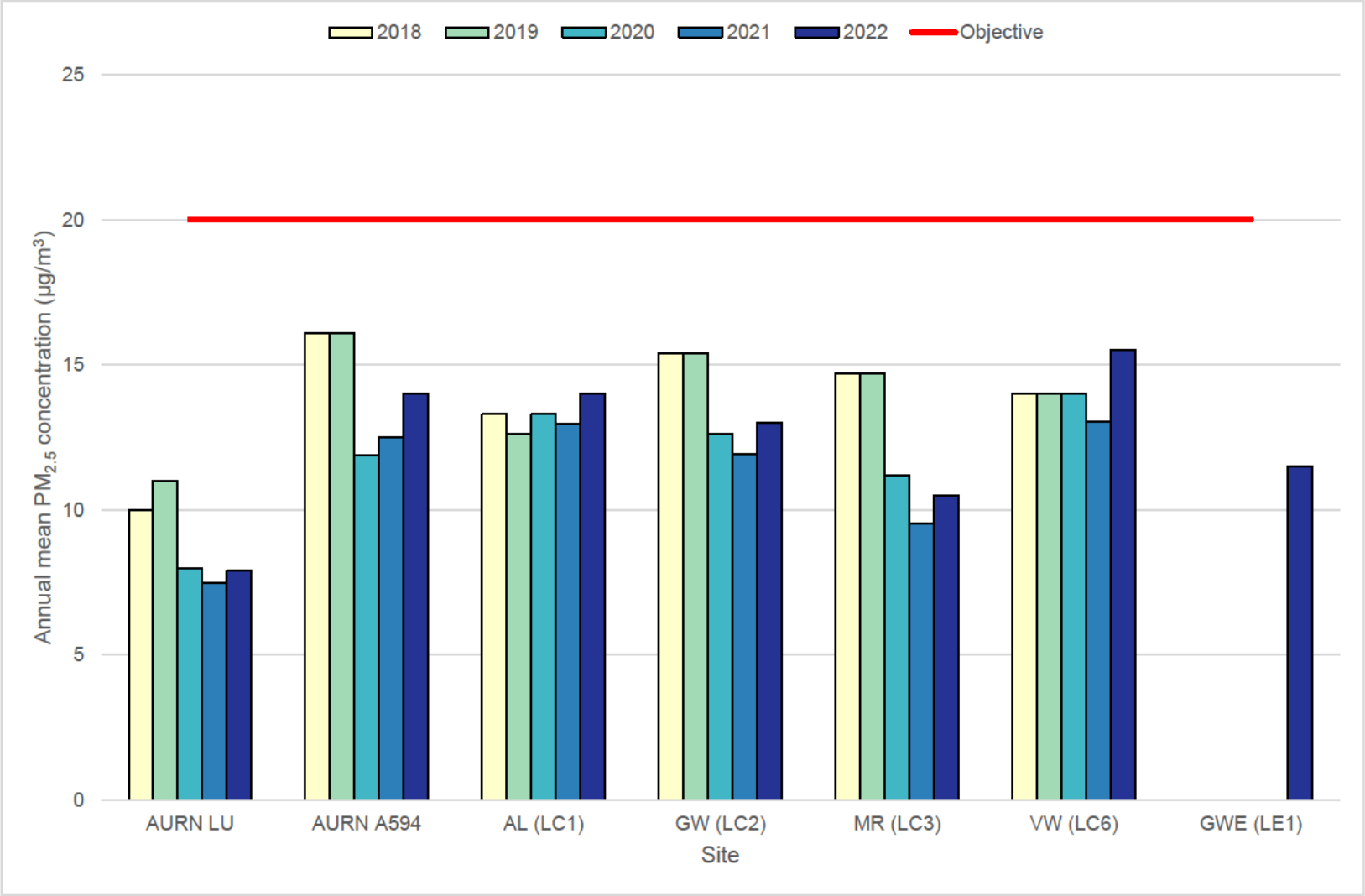
(2) Data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

For the six automatic monitoring sites that monitor PM_{10}, estimated annual mean $PM_{2.5}$ concentrations for 2022 were calculated subtracting the PM_{Coarse} fraction (5 µg/m^3), derived from AURN Leicester University, from the PM_{10} concentrations, in accordance with LAQM.TG22 and LAQM Helpdesk advice. It should be noted that the method of estimating $PM_{2.5}$ concentrations has varied since 2018 and therefore comparisons of the below values should be conducted carefully. Further information can be found in Appendix C.

Table A.9 – Estimated Annual Mean $PM_{2.5}$ Monitoring Results (µg/m^3)

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	2018	2019	2020	2021	2022
AURN A594	459358	304915	Roadside	16.1	16.1	11.9	12.5	14.0
AL (LC1)	458575	306888	Roadside	13.3	12.6	13.3	13.0	14.0
GW (LC2)	457085	300158	Roadside	15.4	15.4	12.6	11.9	13.0
MR (LC3)	459528	306316	Roadside	14.7	14.7	11.2	9.5	10.5
VW (LC6)	458507	304906	Roadside	14.0	14.0	14.0	13.0	15.5
GWE (LE1)	457803	300090	Roadside	-	-	-	-	11.5

Figure A.6 – Trends in Annual Mean $PM_{2.5}$ Concentrations



Appendix B: Full Monthly Diffusion Tube Results for 2022

Table B.1 – NO_2 2022 Diffusion Tube Results (µg/m^3)

DT ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Annualised and Bias Adjusted (0.84)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
LCC1	456672	307669	**44.2**	32.5	36.5	33.4	36.5	33.8	33.4	39.0	37.9	37.1	32.5	37.6	36.2	30.4	-	
LCC2	459165	300271	**43.5**	27.7	27.4	25.8	22.8	20.9	23.5	28.6	30.7	27.1	26.9	30.9	28.0	23.5	-	
LCC3	458260	307900	**46.6**	39.5	39.4	32.8	32.8	36.0	33.3	36.7	**40.8**	36.4	**40.4**	**41.6**	38.0	31.9	-	
LCC4	457244	305572	**43.6**	36.2	32.5	-	-	32.3	28.2	28.4	32.2	32.0	34.8	37.6	33.8	28.4	-	
LCC5	455578	306395	**46.0**	39.0	-	35.8	33.5	38.7	-	**40.4**	**45.2**	-	**42.5**	**47.7**	**41.0***	34.7	-	*TWA mean 41.3 µg/m^3
LCC6	455825	307676	**45.5**	34.9	37.9	**41.0**	**40.2**	-	39.1	**48.3**	**46.5**	**41.8**	39.8	**42.5**	**41.6**	34.9	-	
LCC7	455647	305825	**48.7**	**43.8**	28.3	25.6	25.3	27.2	28.6	33.1	33.9	28.3	34.9	39.8	33.1	27.8	-	
LCC8	455917	304892	30.7	23.7	-	17.0	-	22.7	-	16.7	-	24.0	25.2	29.3	23.7	19.4	-	
LCC9	455082	304761	**42.2**	29.2	23.2	26.7	23.7	23.7	23.9	28.2	30.6	29.9	29.9	35.3	28.9	24.3	-	
LCC11	456230	304273	**45.2**	32.0	25.0	25.4	27.6	24.7	24.4	27.7	30.6	30.5	31.4	35.4	30.0	25.2	-	
LCC12	457474	301061	**40.7**	27.9	20.7	22.4	21.8	23.1	23.2	27.0	28.2	27.2	29.0	34.2	27.1	22.8	-	
LCC14	457210	304276	34.1	27.9	-	**51.4**	19.6	-	18.9	23.6	25.9	27.2	25.0	30.8	28.4*	23.0	-	*TWA mean – 27.4 µg/m^3
LCC15	457690	303780	-	**43.1**	-	**41.9**	39.9	**44.9**	**41.9**	**46.4**	**43.8**	**44.5**	**48.5**	**51.6**	**44.7**	37.5	30.9	
LCC16	461014	301043	**57.9**	37.6	**42.9**	35.4	**40.7**	**44.3**	**46.3**	**44.9**	**48.1**	**42.2**	**43.6**	**49.0**	**44.4**	37.3	21.4	
LCC17	456380	302193	**41.8**	28.7	25.4	28.0	21.9	22.7	22.8	27.1	30.8	27.4	29.4	37.5	28.6	24.0	-	
LCC18	456754	302259	**55.2**	-	29.0	29.6	27.1	28.9	30.7	33.4	35.1	34.9	30.9	**43.8**	34.4	28.9	-	
LCC19	457667	303460	**61.1**	**43.2**	39.9	38.2	**41.4**	38.7	36.7	**41.0**	**42.8**	**48.0**	**52.4**	**47.1**	**44.2**	37.1	29.4	
LCC20	459196	303882	37.6	29.9	34.1	30.9	19.7	18.9	18.5	30.0	28.6	26.9	30.2	36.7	28.5	23.9	-	
LCC21	459431	304564	-	-	-	36.2	22.7	26.3	24.6	30.4	35.8	30.8	32.2	38.8	30.9	25.9	-	
LCC22	457869	300085	**43.1**	32.2	35.1	32.9	25.7	-	28.9	38.6	36.7	27.7	22.6	34.7	32.6	27.4	-	
LCC23	459367	302117	**62.7**	35.8	35.0	-	37.6	37.4	35.9	-	**42.0**	38.6	39.2	**43.1**	**40.7**	34.2	-	
LCC24	458542	302023	**40.5**	26.3	21.3	-	23.7	26.4	26.2	26.6	31.4	28.9	30.3	36.4	28.9	24.3	-	
LCC25	459703	301072	38.6	28.5	26.6	23.8	13.6	19.6	15.9	21.8	27.6	19.9	24.8	33.4	24.5	20.6	-	
LCC26	461307	301478	**46.2**	31.6	27.1	26.0	23.3	26.3	27.1	28.3	33.4	32.3	29.9	38.2	30.8	25.9	-	
LCC27	460134	303093	**53.0**	31.5	31.4	29.8	36.1	**40.3**	37.8	37.6	**44.5**	38.5	38.5	**43.4**	38.5	32.4	-	
LCC28	463282	304552	32.3	23.4	22.5	17.9	13.6	15.8	15.6	20.7	23.7	18.8	19.5	28.7	21.0	17.7	-	
LCC29	462891	305329	**40.8**	30.7	26.4	19.8	22.0	20.4	23.0	23.9	28.1	27.2	29.7	32.2	27.0	22.7	-	

DT ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Annualised and Bias Adjusted (0.84)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
LCC30	461806	305323	-	37.3	32.0	30.6	34.7	30.1	29.3	37.6	-	-	31.2	38.3	33.5*	27.8	-	*TWA mean – 33.1 µg/m^3
LCC31	461596	304989	**47.1**	31.6	27.9	-	23.8	25.2	22.6	27.7	32.9	30.0	29.3	33.5	30.1*	24.9	-	*TWA mean – 29.6 µg/m^3
LCC32	460441	305322	**50.7**	-	34.5	-	34.5	35.3	36.3	**41.4**	**44.1**	**40.6**	-	-	39.7	35.0	-	
LCC33	458749	307184	-	32.8	25.8	24.0	25.1	26.9	26.0	28.1	32.7	34.1	36.4	**41.9**	30.3	25.5	-	
LCC34	460010	307324	37.4	27.8	27.0	28.2	23.8	24.9	23.9	28.6	29.1	30.9	32.4	37.7	29.3	24.6	-	
LCC35	458099	305184	**46.3**	-	30.3	-	25.4	26.5	28.5	28.3	30.7	32.1	37.9	**43.6**	33.0*	27.7	-	*TWA mean – 33.0 µg/m^3
LCC36	458272	304630	-	**46.8**	**49.4**	**54.6**	-	**54.1**	-	**57.4**	**60.3**	-	**52.9**	**57.2**	**54.1**	**45.7**	-	Not representative of relevant exposure for AQS Objective.
LCC37	458182	304400	**48.2**	36.7	34.2	35.3	32.0	36.0	32.9	**41.6**	**40.7**	35.9	36.7	**40.2**	37.5	31.5	-	
LCC38	461558	306508	38.6	25.5	22.1	22.8	22.1	-	17.9	20.3	22.0	27.0	27.9	31.7	25.3*	20.7	-	*TWA mean – 24.7 µg/m^3
LCC40	460460	308234	**41.8**	34.5	30.8	27.3	26.3	27.0	27.6	33.1	30.7	37.0	38.9	**43.7**	33.2	27.9	-	
LCC41	460865	307949	**51.6**	35.3	27.5	-	32.8	32.3	32.7	26.3	31.9	-	39.5	39.1	34.9	29.3	-	
LCC43	459304	307385	**42.7**	30.5	33.5	38.9	30.1	32.9	32.0	39.8	38.4	35.2	34.7	**42.5**	35.9	30.2	-	
LCC45	457596	310078	30.4	20.2	17.2	13.9	14.3	20.4	11.4	15.1	18.1	20.0	21.6	23.9	18.9	15.9	-	
LCC46	464058	305532	38.0	23.1	18.8	15.4	17.7	16.7	-	19.6	21.1	17.8	18.9	26.2	21.2	17.8	-	
LCC47 A	458507	304904	**53.0**	**42.7**	39.8	31.1	**42.2**	**42.6**	**43.0**	38.6	**41.9**	-	**52.0**	**52.9**	**43.6***	37.8	-	*TWA mean – 45.0 µg/m^3
LCC47 B	458507	304904	**60.1**	**43.5**	32.5	33.8	**41.8**	**42.7**	37.9	**40.8**	39.9	-	**47.4**	**54.7**	**43.2***	37.8	-	*TWA mean – 45.0 µg/m^3
LCC47 C	458507	304904	**59.6**	**41.9**	38.0	36.2	**44.0**	39.2	**40.2**	**42.3**	**42.6**	-	**48.0**	**73.0**	**45.9***	37.8	-	*TWA mean – 45.0 µg/m^3
LCC49	457472	310229	27.7	19.1	18.8	12.7	12.4	12.6	12.5	14.9	16.5	20.0	5.4	25.4	16.5	13.9	-	
LCC50	456269	307062	29.3	22.8	27.3	23.6	18.5	18.1	15.5	26.1	25.9	20.9	21.6	31.1	23.4	19.6	-	

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

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

☒ **Local bias adjustment factor used.**

☐ **National bias adjustment factor used.**

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

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

Notes:

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

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

See Appendix C for details on bias adjustment and annualisation.

*Raw data annual means are provided, but in the case of these diffusion tubes, a Time Weighted Average (TWA) was calculated due to an increased exposure period(s) and is provided in the Comments column. Further information, including exposure periods, can be found in Appendix C.

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

New or Changed Sources Identified Within Leicester City During 2022

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

2022 was considered the year that traffic volumes began to return to 'normal' conditions after the pandemic, although it is understood that this did not take place until the Autumn. Traffic volumes were expected to have increased in 2022 compared to 2021. Data in the below table is taken from a Vivacity sensor located on Vaughan Way and reports an increase in all vehicle types. Of particular interest is cars (+10-12%) and Light Goods Vehicles (+2-7%), which may explain the increase in pollutant concentrations seen. Traffic volumes for 2022 remain lower than 2020 figures, consistent with the reduction in pollutant concentrations noted, and may be attributed to new ways of working associated with the pandemic. More sustainable methods of transport, such as cycling and walking, have also increased, particularly northbound at 62% and 172% respectively. It is plausible to consider that this has played some role in the reduced NO_2 concentrations seen at some monitoring locations in 2022.

Vehicle Type	Northbound 2021	Northbound 2022	Change	Southbound 2021	Southbound 2022	Change
Bus	3,793	2,970	*-22%*	2,678	2,893	*+8%*
Car	154,771	169,489	*+10%*	153,073	171,694	*+12%*
Cyclist	207	336	*+62%*	301	357	*+19%*
Light Goods Vehicle	14,672	15,756	*+7%*	17,660	17,948	*+2%*
Motorbike	950	991	*+4%*	746	904	*+21%*
Other Goods Vehicle 1	1,386	1,468	*+6%*	1,577	1,584	*0%*
Other Goods Vehicle 2	642	659	*+3%*	595	698	*+17%*
Pedestrian	58	158	*+172%*	466	531	*+14%*

Additional Air Quality Works Undertaken by Leicester City Council During 2022

Leicester City Council continue to maintain compliance within the AQMA and have now completed the NO_2 report as part of the Secretary of State Direction works. Monthly meetings are held with JAQU as part of this process, with an initial aim of reaching compliance with national air quality objectives by 2023. Progress on this goal was accelerated in recent years, largely due to the pandemic, and the authority must now continue to implement measures to improve air quality and ensure ongoing compliance.

The authority continues to monitor NO_2, PM_{10}, and $PM_{2.5}$ across the city through a range of monitoring techniques including diffusion tubes, air quality monitoring stations, and low cost 'Zephyr' sensors. During the latter half of 2022, a procurement exercise was initiated to secure an additional five years of air quality monitoring station LSO and maintenance visits, allowing monitoring to continue in this capacity until at least 2028. Additionally, an extension was funded to 10 low cost 'Zephyr' sensors located in the Rushey Mead area, supporting interventions around the local Primary and Secondary schools, improving air quality for local children and residents.

QA/QC of Diffusion Tube Monitoring

A network of NO_2 diffusion tubes were deployed during monitoring year 2022 in continuation of the 2019 network, where locations were selected in accordance with the methodology outlined in 'Diffusion Tubes for Ambient NO_2 Monitoring: Practical Guidance', and approved by the Department for Environment, Food & Rural Affairs (Defra), Department for Transport (DfT), and Joint Air Quality Unit (JAQU). It should be noted that diffusion tube locations for this study were selected in order to determine NO_2 concentrations across the city with the focus on covering major roads and to help verify Leicester City Council's Airviro air quality model. It follows that not all sites are representative of sensitive receptor locations and hence the AQO objective is not applicable at all locations.

Monitoring was undertaken at 44 locations across the city during 2022. At one location, a triplicate set of tubes were co-located with the automatic monitoring station on Vaughan Way (VW / LC6), allowing for a local bias adjustment factor to be calculated in accordance with LAQM.TG22.

All diffusion tubes utilised the preparation method of 20% triethanolamine (TEA) in water and were analysed by Staffordshire Highways Laboratory for the entirety of 2022. The laboratory is accredited by the United Kingdom Accreditation Survey (UKAS) and regularly contributes to the National Bias Adjustment Factors spreadsheet.

As the diffusion tube network was originally deployed for the purposes of a modelling assessment exercise, samplers were not exposed in accordance with the Defra Diffusion Tube Calendar dates. However, the advice of the Defra Practical Guidance has been followed which recommends an ideal two to four week exposure period, but will allow for up to five weeks providing the tubes are not oversaturated. Where exposure periods exceeded the recommended five week period, it is necessary to calculate a time-weighted average (TWA), in accordance with LAQM.TG22.

The following diffusion tubes required a TWA calculation in at least one of their exposure periods:

- LCC5, LCC14, LCC30, LCC31, LCC35, LCC38, and LCC47ABC.

Raw annual mean NO_2 diffusion tube concentrations have been annualised and bias adjusted in accordance with LAQM.TG22.

Diffusion Tube Annualisation

Where less than 75%, but greater than 25% of diffusion tube data is available, annual mean concentrations must be annualised in accordance with LAQM.TG22. The approach is based on the principle that patterns in pollutant concentrations are usually consistent across broad regions and therefore considers the relationship between period means and annual means at monitoring stations in the same region as the site of interest. The period mean is the period that the diffusion tube data is available for. The average of the ratios of the continuous monitor data annual mean to the period mean (Am/Pm) provides the annualisation factor. This annualisation factor is then applied to the diffusion tube period mean to provide an estimated annual average representative of a full calendar year. This procedure was required for three diffusion tubes in 2022, reporting a data capture of 67% each:

- LCC8, LCC32, and LCC36.

LAQM.TG22 stipulates that background sites should be used to avoid any local effects associated with roadside sites, and should, wherever possible lie within a radius of about

50 miles. Three Urban Background AURN stations with the requisite data capture were used for annualisation: Leicester University, Coventry Allesley, and Nottingham Centre.

It should be noted that the December 2022 diffusion tube exposure period ended on 5th January 2023 and therefore provisional continuous monitoring data from the first five days of 2023 were used during the annualisation process.

Details of the calculation method used for annualisation for these three monitoring sites are provided in Table C.1. An external consultancy was used to collect and process the diffusion tube results and therefore no annualisation factors for the individual stations utilised are provided in this table.

Table C.1 – Annualisation Summary (concentrations presented in µg/m^3)

Site ID	Annualisation Factor Leicester University	Annualisation Factor Coventry Allesley	Annualisation Factor Nottingham Centre	Annualisation Factor Site 4	Average Annualisation Factor	Raw Data Annual Mean	Annualised Annual Mean
LCC8	-	-	-	-	0.98	23.7	23.1
LCC32	-	-	-	-	1.05	39.7	41.7
LCC36	-	-	-	-	1.01	54.1	54.4
GW (LC2)	0.850	0.887	0.848	-	0.862	43.8	37.7
GWE (LE1)	1.097	1.068	1.098	-	1.088	22.3	24.2

Diffusion Tube Bias Adjustment Factors

The diffusion tube data presented within the 2022 ASR have been corrected for bias using an adjustment factor. Bias represents the overall tendency of the diffusion tubes to under or over-read relative to the reference chemiluminescence analyser. LAQM.TG22 provides guidance with regard to the application of a bias adjustment factor to correct diffusion tube monitoring. Triplicate co-location studies can be used to determine a local bias factor based on the comparison of diffusion tube results with data taken from NO_x/NO_2 continuous analysers. Alternatively, the national database of diffusion tube co-location surveys provides bias factors for the relevant laboratory and preparation method.

Leicester City Council have applied a local bias adjustment factor of 0.84 to the 2022 monitoring data, derived from the triplicate set of diffusion tubes co-located with the automatic monitoring station on Vaughan Way (VW / LC6). A local factor has been used for the previous three years and is considered more representative of conditions in Leicester compared to the national factor. It is also noted that the three previously calculated local bias adjustment factors are very similar (±0.03). A summary of bias

adjustment factors used by Leicester City Council over the past five years is presented in Table C.2.

Table C.2 – Bias Adjustment Factor

Monitoring Year	Local or National	If National, Version of National Spreadsheet	Adjustment Factor
2022	Local	-	0.84
2021	Local	-	0.83
2020	Local	-	0.85
2019	Local	-	0.82
2018	-	-	-

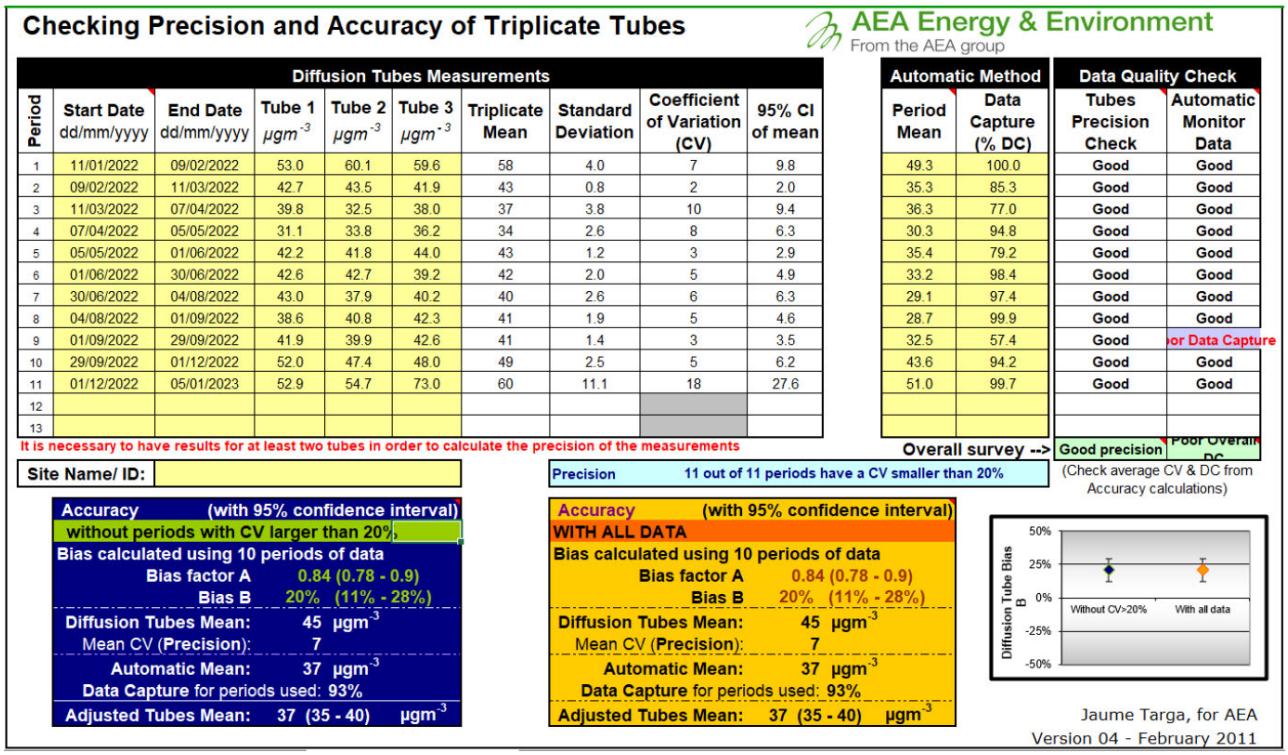
Table C.3 – Local Bias Adjustment Calculation

	Local Bias Adjustment Input 1	Local Bias Adjustment Input 2	Local Bias Adjustment Input 3	Local Bias Adjustment Input 4	Local Bias Adjustment Input 5
Periods used to calculate bias	11	-	-	-	-
Bias Factor A	0.84 (0.78 – 0.9)	-	-	-	-
Bias Factor B	20% (11% - 28%)	-	-	-	-
Diffusion Tube Mean (µg/m^3)	45	-	-	-	-
Mean CV (Precision)	7	-	-	-	-
Automatic Mean (µg/m^3)	37	-	-	-	-
Data Capture	93%	-	-	-	-
Adjusted Tube Mean (µg/m^3)	37 (35 – 40)	-	-	-	-

Notes:

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

Additionally, a completed Precision & Accuracy tab screenshot is provided below. The results of this assessment show a 'Good' overall precision for the triplicate set. For the automatic monitoring station, a 'Good' precision was reported for all but one of the monitoring periods, resulting in a 'Poor' overall data capture. It was still considered appropriate to use the local bias adjustment factor in this case, primarily for the aforementioned reasons.



Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements

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
1	11/01/2022	09/02/2022	53.0	60.1	59.6	58	4.0	7	9.8
2	09/02/2022	11/03/2022	42.7	43.5	41.9	43	0.8	2	2.0
3	11/03/2022	07/04/2022	39.8	32.5	38.0	37	3.8	10	9.4
4	07/04/2022	05/05/2022	31.1	33.8	36.2	34	2.6	8	6.3
5	05/05/2022	01/06/2022	42.2	41.8	44.0	43	1.2	3	2.9
6	01/06/2022	30/06/2022	42.6	42.7	39.2	42	2.0	5	4.9
7	30/06/2022	04/08/2022	43.0	37.9	40.2	40	2.6	6	6.3
8	04/08/2022	01/09/2022	38.6	40.8	42.3	41	1.9	5	4.6
9	01/09/2022	29/09/2022	41.9	39.9	42.6	41	1.4	3	3.5
10	29/09/2022	01/12/2022	52.0	47.4	48.0	49	2.5	5	6.2
11	01/12/2022	05/01/2023	52.9	54.7	73.0	60	11.1	18	27.6
12									
13									

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

Automatic Method		Data Quality Check	
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
49.3	100.0	Good	Good
35.3	85.3	Good	Good
36.3	77.0	Good	Good
30.3	94.8	Good	Good
35.4	79.2	Good	Good
33.2	98.4	Good	Good
29.1	97.4	Good	Good
28.7	99.9	Good	Good
32.5	57.4	Good	or Data Capture
43.6	94.2	Good	Good
51.0	99.7	Good	Good
	Overall survey -->	Good precision	Poor Overall DC

Site Name/ ID:

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

(Check average CV & DC from Accuracy calculations)

Accuracy (with 95% confidence interval) without periods with CV larger than 20%
Bias calculated using 10 periods of data
Bias factor A: 0.84 (0.78 - 0.9)
Bias B: 20% (11% - 28%)
Diffusion Tubes Mean: 45 µgm^{-3}
Mean CV (Precision): 7
Automatic Mean: 37 µgm^{-3}
Data Capture for periods used: 93%
Adjusted Tubes Mean: 37 (35 - 40) µgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA
Bias calculated using 10 periods of data
Bias factor A: 0.84 (0.78 - 0.9)
Bias B: 20% (11% - 28%)
Diffusion Tubes Mean: 45 µgm^{-3}
Mean CV (Precision): 7
Automatic Mean: 37 µgm^{-3}
Data Capture for periods used: 93%
Adjusted Tubes Mean: 37 (35 - 40) µgm^{-3}

Jaume Targa, for AEA
Version 04 - February 2011

NO_2 Fall-off with Distance from the Road

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

Three diffusion tube sites required fall-off with distance calculations: LCC15, LCC16, and LCC19, measuring 37.5µg/m^3, 37.3µg/m^3, and 37.1µg/m^3 respectively. The results after the correction are found in Table C.4 below.

Table C.4 – NO_2 Fall off With Distance Calculations (concentrations presented in µg/m^3)

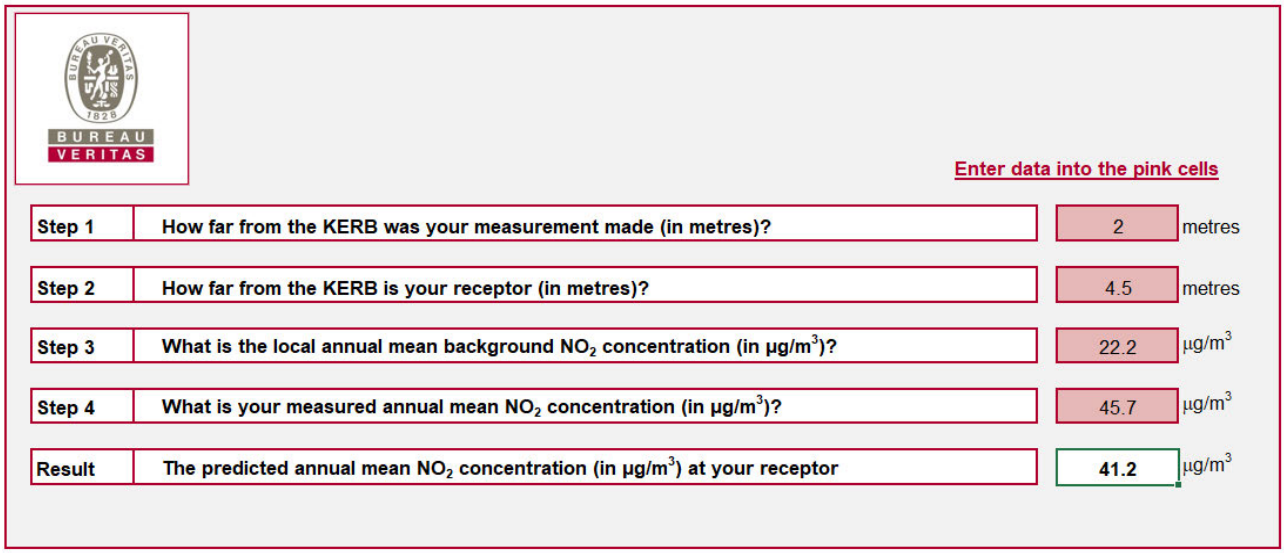
Site ID	Distance (m): Monitoring Site to Kerb	Distance (m): Receptor to Kerb	Monitored Concentration (Annualised and Bias Adjusted	Background Concentration	Concentration Predicted at Receptor	Comments
LCC15	1	5	37.5	17.3	30.9	
LCC16	0.5	20	37.3	13	21.4	
LCC19	0.5	4.5	37.1	17.2	29.4	
GW (LC2)	3	17	37.7	14.3	27.2	

Diffusion tube LCC36 recorded a NO_2 concentration of 45.7µg/m^3 after bias correction and is located on Vaughan Way, part of the inner ring road in Leicester, and an area that had previously been identified by Defra as one of the links with the highest NO_2 concentration in England. The location features six lanes of traffic and significant traffic flows (AADT >46,000), with idling common during rush hour periods. Additionally, prior to the monitoring location, a traffic light controlled junction is present where three lanes meet each other.

The sampler location was chosen for a modelling verification exercise as part of the Secretary of State's NO_2 Direction works and is considered unrepresentative of human exposure with regards to assessment of the annual mean objective. The tube is sited on a lighting column at the building façade, which itself is made up of vacant commercial units on the ground floor and temporary office accommodation from the first floor upwards. The nearest residential property is some distance away. However, as the location is within the AQMA, there is the presence of partial human exposure (i.e. some hours of the day), and evidence of a historical exceedance, a distance correction has been conducted independently of the results presented in the tables of this report. The distance from the kerb to receptor used was that of the first floor office accommodation with acknowledgement for Limitation 4 of the NO_2 Fall Off With Distance Calculator. A revised annual mean concentration after distance correction was 41.2 µg/m^3 and the calculation is presented below. Whilst this result is not strictly applicable for LAQM purposes and compliance has been largely achieved in Leicester, it is important to consider that NO_2 concentrations remain elevated in parts of the city (primarily within the AQMA) and should be closely monitored.

This approach to interpret the result was agreed via consultation with the LAQM Helpdesk, who added that the annual mean objective would generally not be applicable at the building façade of office buildings, and that the shorter term 1-hourly objective is more

relevant. As the bias corrected concentration does not exceed 60 µg/m^3, it is considered unlikely that there would be observed exceedances of the shorter term objective at this monitoring location.



Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	2	metres
Step 2	How far from the KERB is your receptor (in metres)?	4.5	metres
Step 3	What is the local annual mean background NO_2 concentration (in µg/m^3)?	22.2	µg/m^3
Step 4	What is your measured annual mean NO_2 concentration (in µg/m^3)?	45.7	µg/m^3
Result	The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor	41.2	µg/m^3

QA/QC of Automatic Monitoring

The data management for the automatic monitoring stations presented in this report was carried out by the Environmental Research Group (ERG) at Imperial College London (ICL). Data presented in the 2023 ASR has been ratified in accordance with procedures outlined in LAQM.TG22 and includes:

- Identification and removal of erroneous data, including negative and extreme values
- Analysis of data for drifts
- Application of data scaling, where required
- Consideration for data from other air quality monitoring stations
- Consideration for unusual weather patterns and traffic management incidents (e.g. lane closures)
- Noting of all Local Site Operators (LSO) visits and servicing, including the reports for each station
- Recording of data loss due to equipment malfunction

Historical ratified air pollutant concentrations are available on the Open Leicester website.

LSO duties are conducted by an external organisation on a monthly basis, including calibration of NO_X analysers and changing of the Beta Attenuation Monitors (BAM) tapes. After each LSO visit, a written report is provided and stored for data management purposes. A typical NO_X calibration procedure can be found below.

Teledyne API NOx Analyser Calibration Procedure

Zero Calibration

- Press the CALZ button to start the Zero calibration.
- Using the <TST TST> buttons, scroll to the NO_X STB parameter and wait until the NOX STB value drops below 1.0 PPB.
- Once stabilised, press ZERO followed by ENTER to confirm the new Zero offsets.
- Press EXIT to exit the Zero calibration mode.

Span Calibration

- For a span cylinder connected to the pressurised span port, press CALS, or for a cylinder connected to the sample inlet, press CAL or CALM and open the valve to output 2 Bar on the regulator.
- Using the <TST TST> buttons, scroll to the NOX STB parameter and wait until the NOX STB value drops below 1.0 PPB.
- Once stabilised, press SPAN followed by ENTER to confirm the new Span slopes.
- Press EXIT to exit the Span calibration mode (and if using a cylinder on sample inlet, close the regulator).

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

Leicester City Council deploy Smart Heated 1020 Beta Attenuation Monitors (BAMs) to monitor PM_{10} concentrations and a correction factor of 1.035 was applied to the data, in accordance with LAQM.TG22. All PM_{10} data within ASR 2023 has been corrected in this manner prior to publishing.

$PM_{2.5}$ concentrations were estimated from the PM_{10} concentrations at the automatic monitoring sites within Leicester. Two options are available for this calculation, either application of the Roadside national $PM_{2.5}$ factor or use of a PM_{Coarse} fraction derived from the AURN Leicester University site. After consultation with LAQM.TG22 and the LAQM Helpdesk, the decision was taken to adopt the 'worst-case' scenario, i.e. the option which would provide the highest estimated $PM_{2.5}$ concentration. A PM_{Coarse} fraction of 5 µg/m^3 was calculated and applied to the monitored PM_{10} concentrations, compared to a Roadside national factor of 6.4 µg/m^3 which would have resulted in lower estimates of $PM_{2.5}$.

It should be noted that the method of estimating $PM_{2.5}$ concentrations has varied since 2018 and therefore comparisons of the annual mean concentrations should be conducted with caution. From 2018 to 2020, a factor of 0.7 was applied to PM_{10} concentrations, whilst in 2021 a factor of 0.69 was applied based on the ratio of PM_{10}/$PM_{2.5}$ at the AURN Leicester University site.

Automatic Monitoring Annualisation

Where less than 75%, but greater than 25% of continuous monitoring station data is available, annual mean concentrations must be annualised in accordance with LAQM.TG22. The approach is based on the principle that patterns in pollutant concentrations are usually consistent across broad regions and therefore considers the relationship between period means and annual means at monitoring stations in the same region as the site of interest. The period mean is the period that the continuous monitoring station data is available for. The average of the ratios of the continuous monitor data annual mean to the period mean (Am/Pm) provides the annualisation factor. This annualisation factor is then applied to the monitoring station period mean to provide an estimated annual average representative of a full calendar year. This procedure was required for two automatic monitoring stations as the Glenhills Way site was relocated in May 2022:

- GW (LC2) and GWE (LE1) – 34.3% and 64.1% data capture rates, respectively.

LAQM.TG(22) stipulates that background sites should be used to avoid any local effects associated with roadside sites, and should, wherever possible lie within a radius of about 50 miles. Three Urban Background AURN stations with the requisite data capture were used for annualisation: Leicester University, Coventry Allesley, and Nottingham Centre. Despite being located closer to Leicester, the Burton-on-Trent Horninglow AURN station was dismissed due to poor data capture during monitoring year 2022. The results of the automatic monitoring station annualisation for NO_2 are presented in Table C.1.

Annualisation was also performed at GW (LC2) and GWE (LE1) for PM_{10} concentrations, due to data capture rates of 34.6% and 64.1% respectively. The same three Urban Background AURN stations were utilised, and Burton-on-Trent Horninglow was similarly dismissed. Screenshots for each calculation conducted in Excel can be seen below.

	LCC	Background Stations (>85% cap, within 50 mi)		
Station:	GW (LC2)	Leicester University	Coventry Allesley	Nottingham Centre
Jan	21.4	17.1	15.8	20.4
Feb	15.8	9.4	8.6	12.5
Mar	26.6	21.1	20.4	26.7
Apr	19.3	13.1	11.8	15.3
May	X	11.5	10.6	16.0
Jun	X	12.1	11.0	17.1
Jul	X	10.9	10.8	15.3
Aug	X	12.1	11.5	15.3
Sep	X	10.5	9.7	13.6
Oct	X	11.1	10.7	14.2
Nov	X	11.8	11.4	16.2
Dec	X	13.9	13.9	18.9
Annual mean (Am)		12.9	12.2	16.8
Period mean (Pm)		15.2	14.1	18.8
Ratio (Am/Pm)		0.848	0.860	0.897
Annualisation factor (Ra)		0.869		
Measured concentration at		GW (LC2)		20.8
Best estimate for annual mean of		GW (LC2)		**18.0**

	LCC	Background Stations (>85% cap, within 50 mi)		
Station:	GWE (LE1)	Leicester University	Coventry Allesley	Nottingham Centre
Jan	X	17.1	15.8	20.4
Feb	X	9.4	8.6	12.5
Mar	X	21.1	20.4	26.7
Apr	X	13.1	11.8	15.3
May	16.7	11.5	10.6	16.0
Jun	16.3	12.1	11.0	17.1
Jul	14.5	10.9	10.8	15.3
Aug	15.7	12.1	11.5	15.3
Sep	12.1	10.5	9.7	13.6
Oct	14.7	11.1	10.7	14.2
Nov	16.5	11.8	11.4	16.2
Dec	15.3	13.9	13.9	18.9
Annual mean (Am)		12.9	12.2	16.8
Period mean (Pm)		11.7	11.2	15.9
Ratio (Am/Pm)		1.098	1.088	1.061
Annualisation factor (Ra)		1.082		
Measured concentration at		GWE (LE1)		15.2
Best estimate for annual mean of		GWE (LE1)		**16.5**

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 NO_2 fall-off with distance calculator available on the LAQM Support website. Where appropriate, non-automatic annual mean NO_2 concentrations corrected for distance are presented in Table B.1.

The site that required a fall-off with distance calculation was LC2 (GW), with a monitored annual mean NO_2 concentration of 37.7 µg/m^3 after annualisation. After distance correction, the concentration at relevant exposure was 27.2 µg/m^3 and the calculation values are presented in Table C.4. It should be noted that this station was relocated to Glenhills Way East (GWE / LE1) in May 2022 due to being sited not in accordance with revised LAQM guidance.

QA/QC of Low Cost 'Zephyr' Sensors

Although not an official method of air quality monitoring in accordance with LAQM.TG22, the low cost 'Zephyr' sensors are useful to provide real time pollutant concentrations across the city, with the ease of portability not afforded to fully-fledged continuous (automatic) monitoring stations. Data capture loss for these sensors can be mainly attributed to analyser fault or downtime due to a lack of solar gain. Currently, no procedures exist to ratify raw low cost sensor data, but the following standard techniques were adopted before presentation of the data in this report:

- Removal of extraneous data points, including extremely high, zero, and negative values.
- Removal of data points reported at below the specified limit of detection for the sensors, enabling for calculation of more accurate (but greater overall) annual mean concentrations.
- Removal of any duplicate measurements for a given hourly period, ensuring data capture figures are as accurate as possible.
- Annualisation and distance correction calculations were not conducted on any of the low cost sensor datasets due to an absence of reference data and appropriate procedures.

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

The following maps are presented in Figures 1 to 4, displaying the monitoring locations for 2022, each with reference to the AQMA and Leicester City Council boundary:

- Air Quality Monitoring Stations
- Diffusion Tube network
- Low cost ‘Zephyr’ sensor network
- Combination of all three techniques and the complete monitoring network

Figure D.1 – Map of Air Quality Monitoring Stations

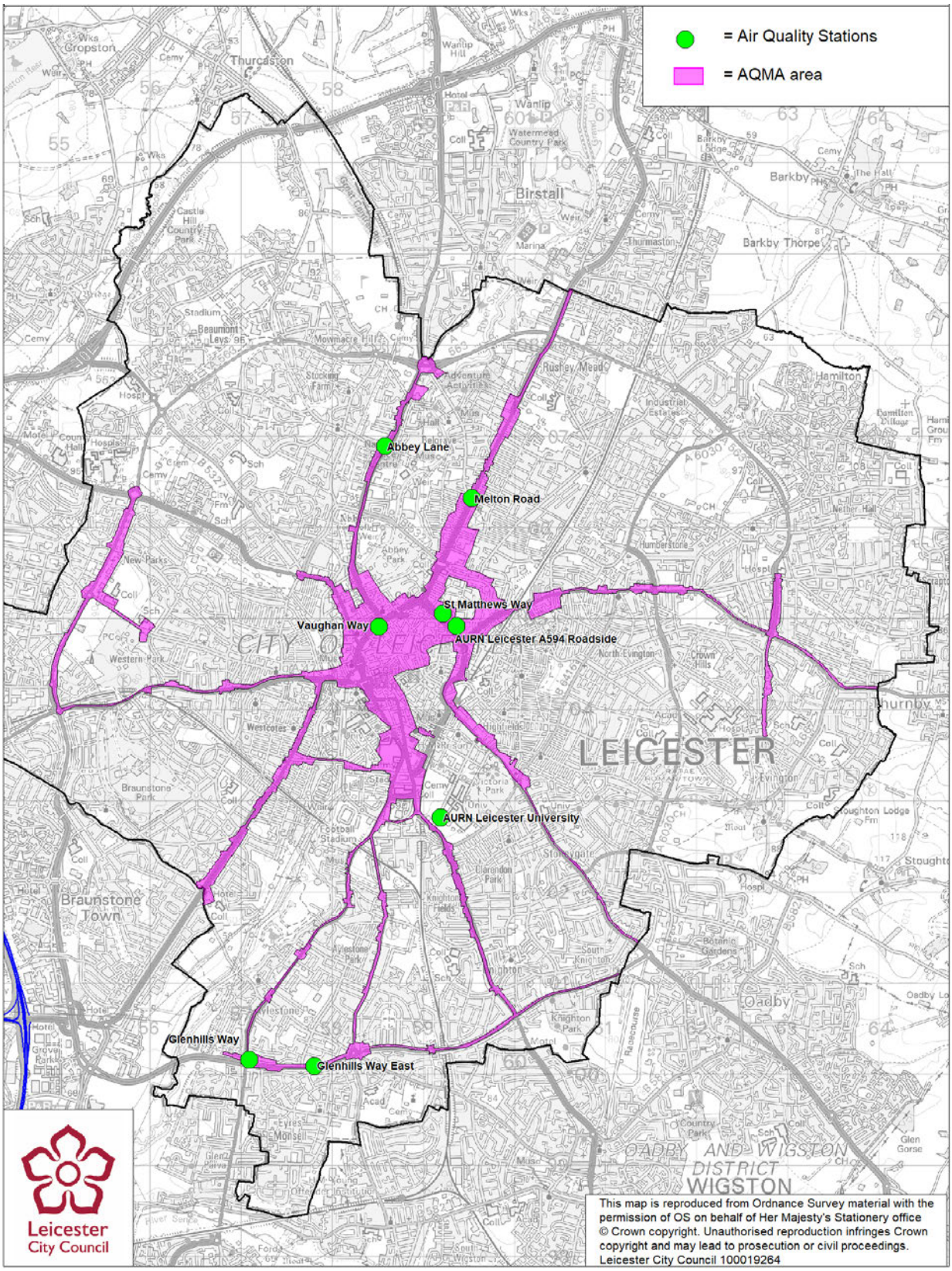


Figure D.1: Map of 2022 air quality monitoring station locations in Leicester, shown in green. Those labelled with the 'AURN' prefix form part of the national network and are not managed by Leicester City Council. The AQMA is shown in purple, and the local authority boundary in black. © Crown copyright – Leicester City Council 10019264.

Figure D.2 – Map of Diffusion Tube network

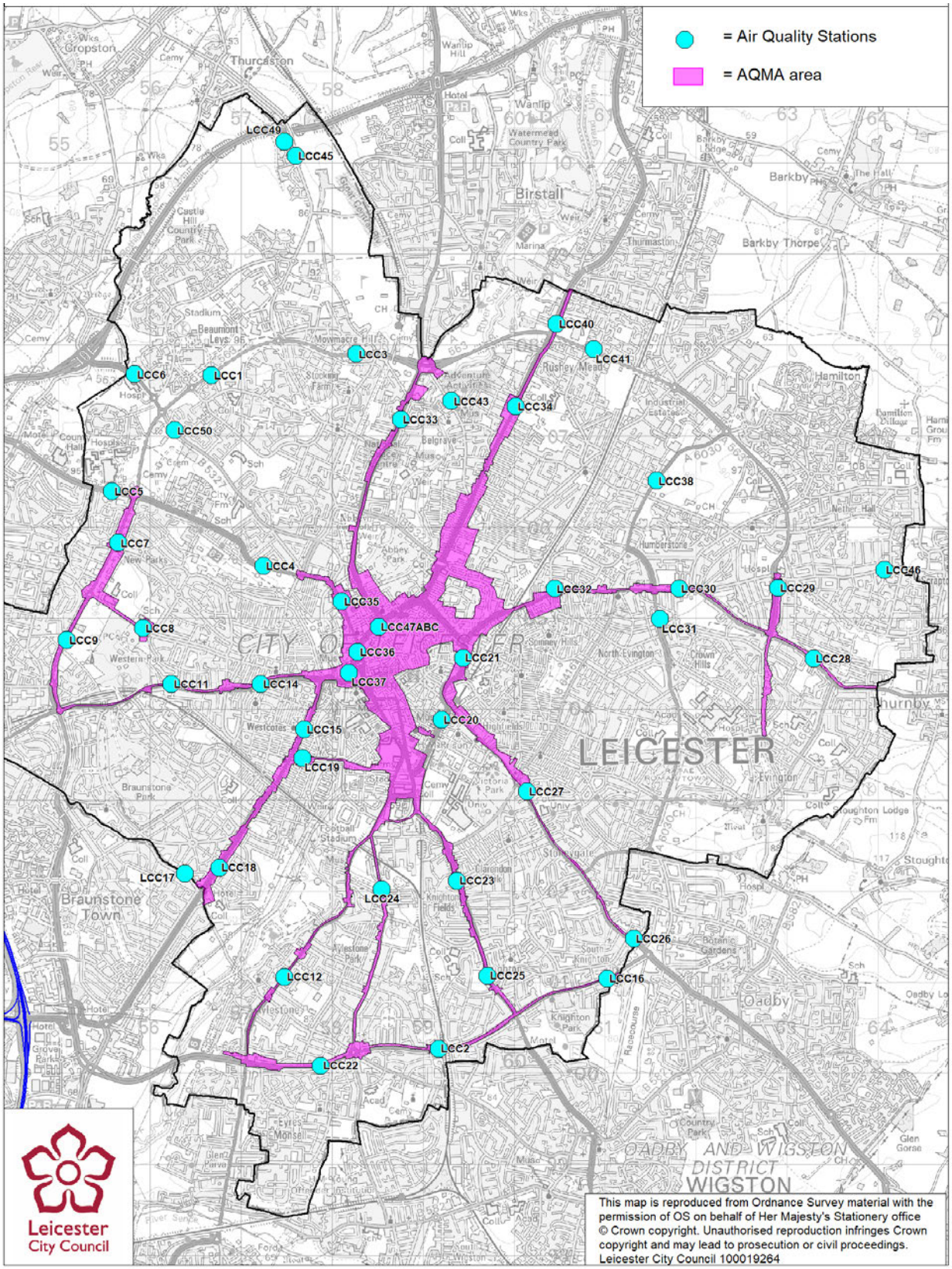


Figure D.2: Map of 2022 diffusion tube locations in Leicester, shown in blue. The AQMA is shown in purple, and the local authority boundary in black. © Crown copyright – Leicester City Council 10019264.

Figure D.3 – Map of Low Cost 'Zephyr' Sensor Network

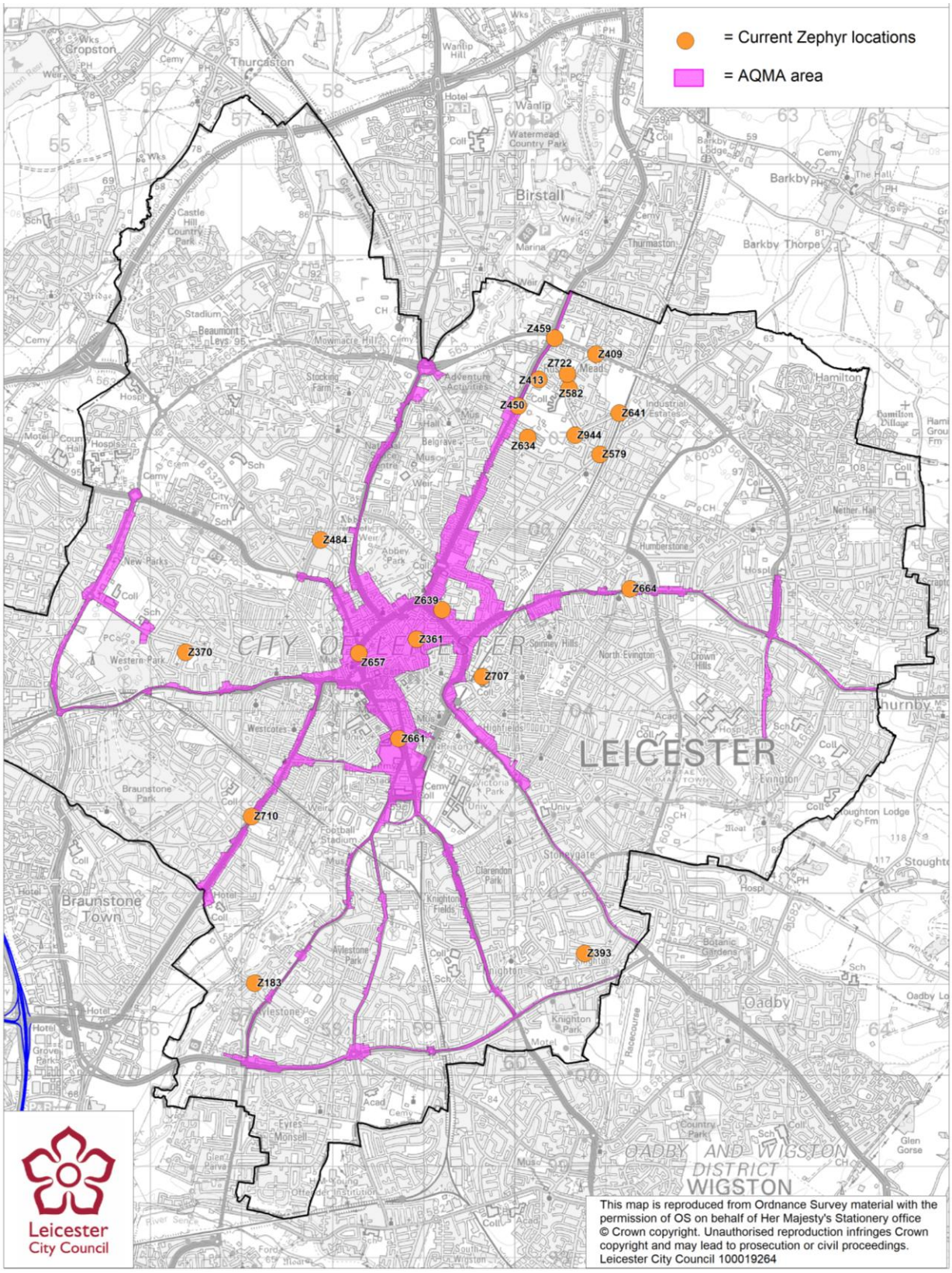


Figure D.3: Map of 2022 low cost 'Zephyr' sensor locations in Leicester, shown in orange. The AQMA is shown in purple, and the local authority boundary in black. © Crown copyright – Leicester City Council 10019264.

Figure D.4 – Map of Leicester City Council Monitoring Network

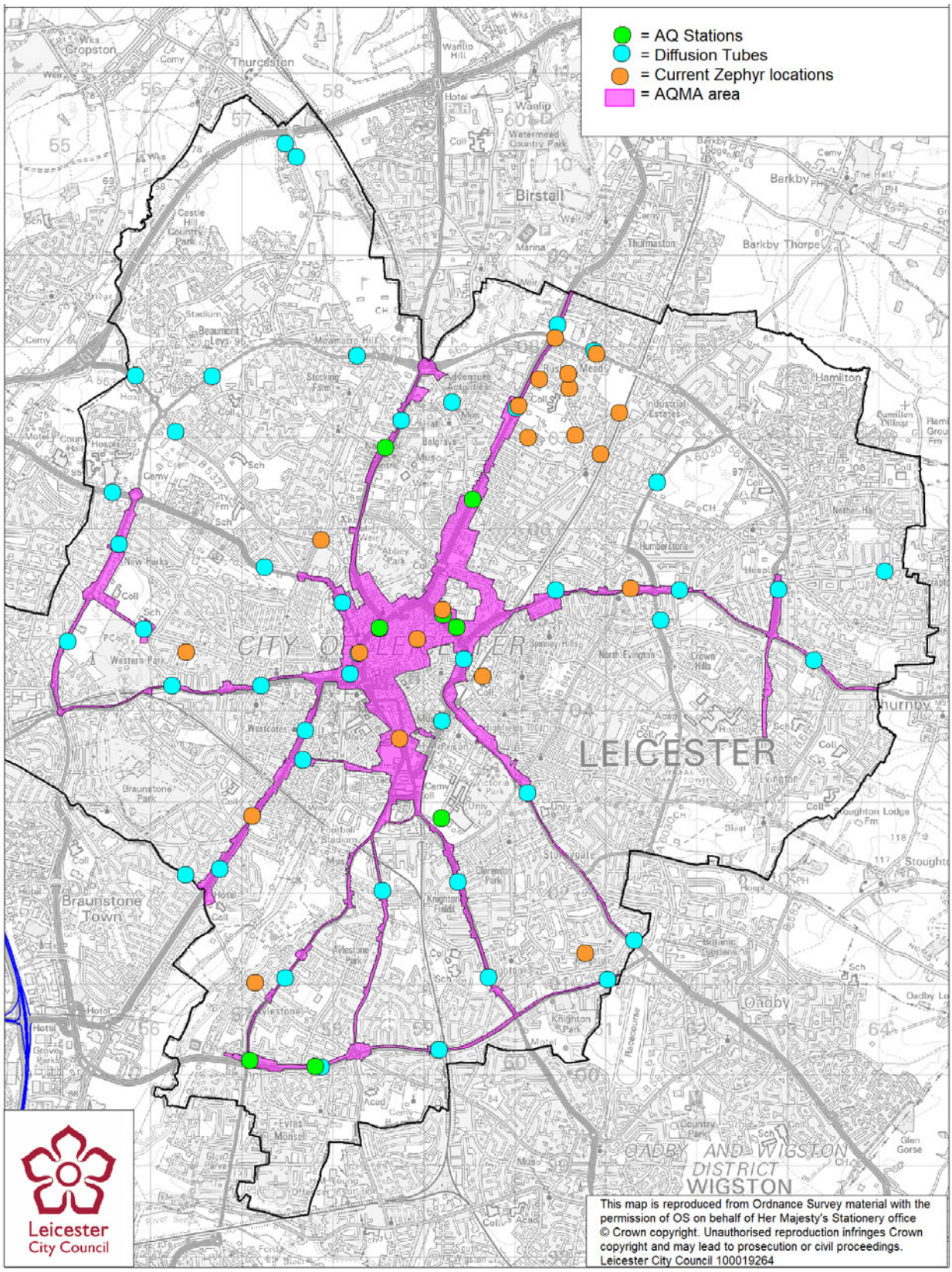


Figure D.4: Map of the entire air quality monitoring network in Leicester during 2022. Locations for air quality monitoring stations (green), diffusion tubes (blue), and low cost 'Zephyr' sensors (orange) are provided. The extent of the AQMA is shown in purple and the local authority boundary in black. © Crown copyright – Leicester City Council 10019264.

Appendix E: Summary of Air Quality Objectives in England

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

Pollutant	Air Quality Objective: Concentration	Air Quality Objective: Measured as
Nitrogen Dioxide (NO_2)	200µg/m^3, not to be exceeded more than 18 times a year	1-hour mean
Nitrogen Dioxide (NO_2)	40µg/m^3	Annual mean
Particulate Matter (PM_{10})	50µg/m^3, not to be exceeded more than 35 times a year	24-hour mean
Particulate Matter (PM_{10})	40µg/m^3	Annual mean
Sulphur Dioxide (SO_2)	350µg/m^3, not to be exceeded more than 24 times a year	1-hour mean
Sulphur Dioxide (SO_2)	125µg/m^3, not to be exceeded more than 3 times a year	24-hour mean
Sulphur Dioxide (SO_2)	266µg/m^3, not to be exceeded more than 35 times a year	15-minute mean

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

Appendix F: Summary of Zephyr Monitoring

As mentioned throughout ASR 2023, Leicester City Council undertake NO_2, PM_{10}, and $PM_{2.5}$ monitoring using the low cost 'Zephyr' sensors, both within and outside of the AQMA. The authority began using these sensors in 2020 and the network has now grown to over 20 units. Table F.1 below illustrates the details of the Zephyr monitoring sites, with Table F.2 to Table F.6 presenting the concentrations for NO_2, PM_{10}, and $PM_{2.5}$ with respect to their relevant national air quality objectives. Figure F.1 to Figure F.5 also present the trends graphically. It should be noted that data is ratified but not subject to annualisation. Further information can be found in Appendix C.

Table F.1 – Details of Zephyr Monitoring Sites

Site 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)	Distance to kerb of nearest road (m)	Inlet Height (m)
Z183	Middleton Street	Roadside	457145	301012	NO_2, PM_{10}, $PM_{2.5}$	NO	0	1	2.5
Z361	Charles Street	Roadside	458922	304785	NO_2, PM_{10}, $PM_{2.5}$	YES, Leicester AQMA	0	1	2.5
Z370	Westfield Road	Roadside	456386	304642	NO_2, PM_{10}, $PM_{2.5}$	NO	0	1	2.5
Z393	Knighton Church Road	Roadside	460766	301337	NO_2, PM_{10}, $PM_{2.5}$	NO	0	1	2.5
Z409	Troon Way	Roadside	460890	307916	NO_2, PM_{10}, $PM_{2.5}$	NO	0	1	2.5
Z413	Rushey Close	Roadside	460262	307639	NO_2, PM_{10}, $PM_{2.5}$	NO	0	1	2.5
Z450	Rushey Mead	Roadside	460037	307346	NO_2, PM_{10}, $PM_{2.5}$	YES, Leicester AQMA	0	1	2.5
Z459	Melton Road	Roadside	460437	308091	NO_2, PM_{10}, $PM_{2.5}$	YES, Leicester AQMA	0	1	2.5

Site 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)	Distance to kerb of nearest road (m)	Inlet Height (m)
Z484	Blackbird Road	Roadside	457868	305875	NO_2	NO	0	1	2.5
Z579	Barkby Road	Roadside	460933	306816	NO_2, PM_{10}, $PM_{2.5}$	NO	0	1	2.5
Z582	Gleneagles Avenue	Roadside	460595	307540	NO_2, PM_{10}, $PM_{2.5}$	NO	0	1	2.5
Z634	Harrison Road	Roadside	460142	307001	NO_2, PM_{10}, $PM_{2.5}$	NO	0	1	2.5
Z639	Wharf Street North	Roadside	459199	305108	NO_2, PM_{10}, $PM_{2.5}$	YES, Leicester AQMA	0	1	2.5
Z641	Roseneath Avenue	Roadside	461146	307268	NO_2, PM_{10}, $PM_{2.5}$	NO	0	1	2.5
Z657	Vaughan Way	Roadside	458288	304633	NO_2, PM_{10}, $PM_{2.5}$	YES, Leicester AQMA	0	1	2.5
Z661	Infirmary Road	Roadside	458725	303694	NO_2, PM_{10}, $PM_{2.5}$	YES, Leicester AQMA	0	1	2.5
Z664	Uppingham Road	Roadside	461264	305340	NO_2, PM_{10}, $PM_{2.5}$	YES, Leicester AQMA	0	1	2.5
Z707	Hutchinson Walk	Roadside	459642	304376	NO_2, PM_{10}, $PM_{2.5}$	NO	0	1	2.5
Z710	Narborough Road	Roadside	457110	302842	NO_2, PM_{10}, $PM_{2.5}$	YES, Leicester AQMA	0	1	2.5
Z722	Lockerbie Avenue	Roadside	460578	307698	NO_2, PM_{10}, $PM_{2.5}$	NO	0	1	2.5
Z944	Wyvern Avenue	Roadside	460660	307025	NO_2, PM_{10}, $PM_{2.5}$	NO	0	1	2.5

Table F.2 – Annual Mean NO_2 Monitoring Results ($\mu g/m^3$): Zephyrs

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2022 (%) [2]	2018	2019	2020	2021	2022
Z183	457145	301012	Roadside	86.8	86.8	-	-	21.5	17.8	21.1
Z361	458922	304785	Roadside	76.5	76.5	-	-	**43.6**	**53.7**	**47.8**
Z370	456386	304642	Roadside	62.2	62.2	-	-	6.2	11.3	12.4
Z393	460766	301337	Roadside	52.5	52.5	-	-	18.0	16.4	18.3
Z409	460890	307916	Roadside	66.3	66.3	-	-	-	29.4	**40.4**
Z413	460262	307639	Roadside	97.7	97.7	-	-	-	18.7	17.8
Z450	460037	307346	Roadside	95.5	95.5	-	-	-	23.7	19.7
Z459	460437	308091	Roadside	80	80	-	-	-	37.3	31.6
Z484	457868	305875	Roadside	100	100	-	-	-	35.7	33.7
Z579	460933	306816	Roadside	98.1	98.1	-	-	-	33.8	29.5
Z582	460595	307540	Roadside	98.4	98.4	-	-	-	19.7	20.5
Z634	460142	307001	Roadside	96.9	96.9	-	-	-	21.5	18.2
Z639	459199	305108	Roadside	96.7	96.7	-	-	-	22.2	25.9
Z641	461146	307268	Roadside	90.8	90.8	-	-	-	14.3	16.6
Z657	458288	304633	Roadside	98	98	-	-	-	33.8	34.1
Z661	458725	303694	Roadside	99.8	99.8	-	-	-	32.8	35.6
Z664	461264	305340	Roadside	99.6	99.6	-	-	-	23.4	24.1
Z707	459642	304376	Roadside	94.7	94.7	-	-	-	22.6	24.2
Z710	457110	302842	Roadside	93.4	93.4	-	-	-	21.4	20.5
Z722	460578	307698	Roadside	90	90	-	-	-	15.1	16.7
Z944	460660	307025	Roadside	75.1	75.1	-	-	-	**41.9**	31.7

Figure F.1 – Trends in Annual Mean NO_2 Concentrations at Zephyrs within the AQMA

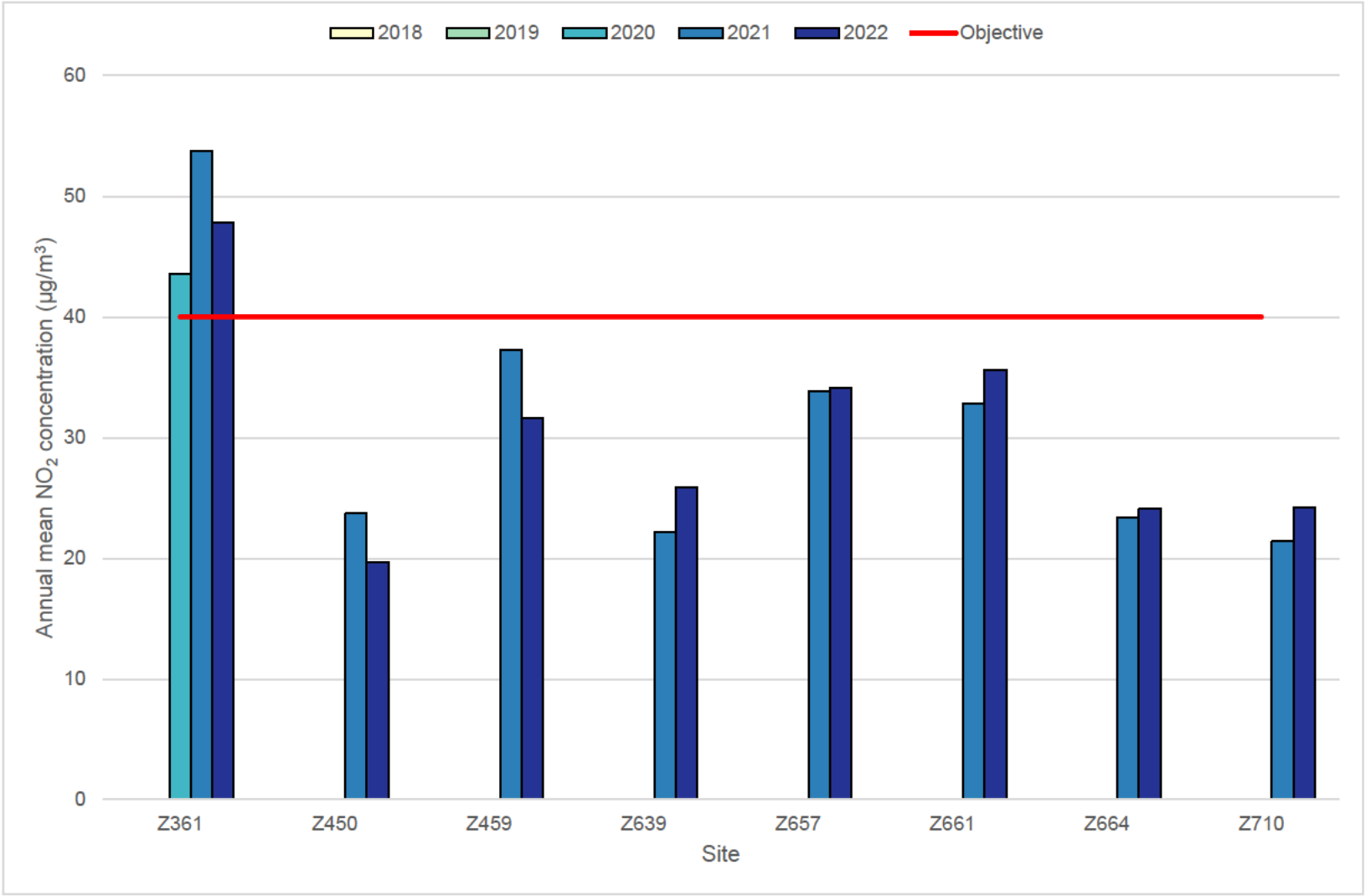


Figure F.2 – Trends in Annual Mean NO_2 Concentrations at Zephyrs outside the AQMA

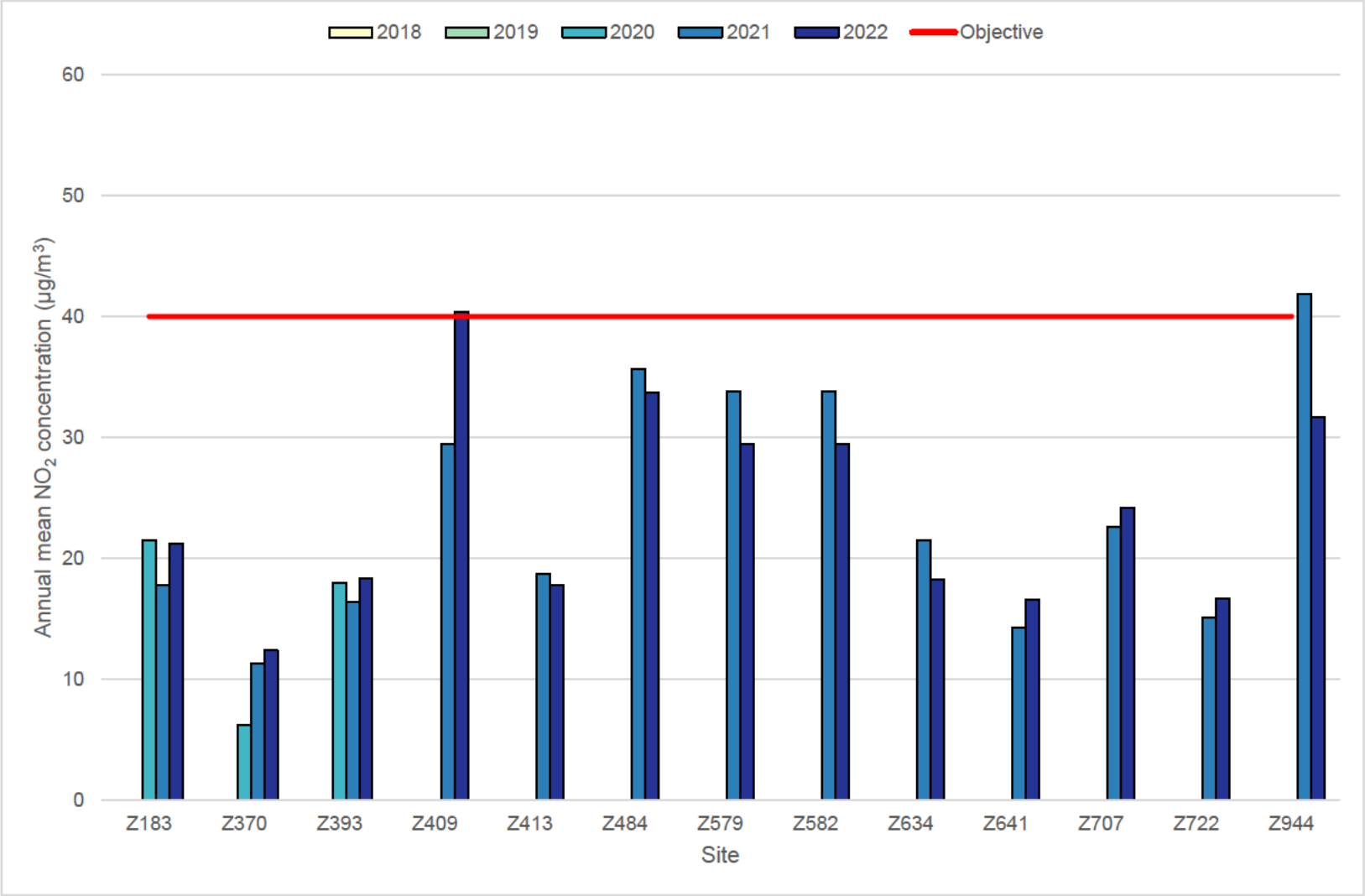


Table F.3 – 1-Hour Mean NO_2 Monitoring Results, Number of 1-Hour Means > 200µg/m^3: Zephyrs

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022
Z183	457145	301012	Roadside	86.8	86.8	-	-	1	0	0
Z361	458922	304785	Roadside	76.5	76.5	-	-	1	3	0 (156.0)
Z370	456386	304642	Roadside	62.2	62.2	-	-	0	9	0 (65.1)
Z393	460766	301337	Roadside	52.5	52.5	-	-	1	0	0 (66.3)
Z409	460890	307916	Roadside	66.3	66.3	-	-	-	1 (163.9)	0 (126.8)
Z413	460262	307639	Roadside	97.7	97.7	-	-	-	0 (60.0)	0
Z450	460037	307346	Roadside	95.5	95.5	-	-	-	7 (166.5)	0
Z459	460437	308091	Roadside	80	80	-	-	-	**22**	0 (107.0)
Z484	457868	305875	Roadside	100	100	-	-	-	0	0
Z579	460933	306816	Roadside	98.1	98.1	-	-	-	0 (115.8)	0
Z582	460595	307540	Roadside	98.4	98.4	-	-	-	0	0
Z634	460142	307001	Roadside	96.9	96.9	-	-	-	0	0
Z639	459199	305108	Roadside	96.7	96.7	-	-	-	18 (215.4)	0
Z641	461146	307268	Roadside	90.8	90.8	-	-	-	0 (57.3)	0
Z657	458288	304633	Roadside	98	98	-	-	-	0 (107.7)	0
Z661	458725	303694	Roadside	99.8	99.8	-	-	-	2	0
Z664	461264	305340	Roadside	99.6	99.6	-	-	-	0 (71.8)	0
Z707	459642	304376	Roadside	94.7	94.7	-	-	-	0	0
Z710	457110	302842	Roadside	93.4	93.4	-	-	-	6	0
Z722	460578	307698	Roadside	90	90	-	-	-	0	0
Z944	460660	307025	Roadside	75.1	75.1	-	-	-	-	0 (84.9)

Figure F.3 – Trends in Number of 1-Hour Mean NO_2 Concentrations >200µg/m^3 at Zephyrs

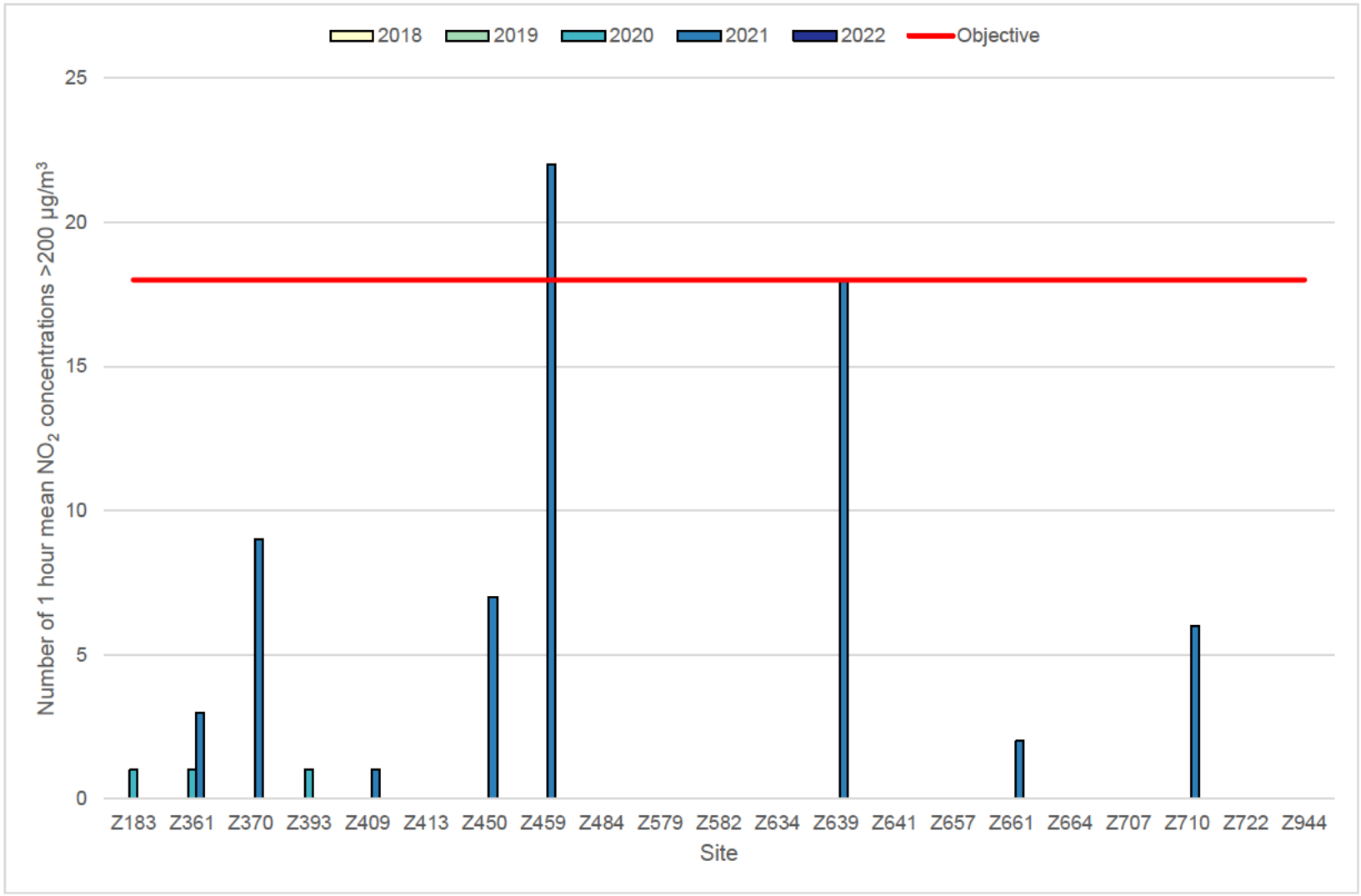


Table F.4 – Annual Mean PM_{10} Monitoring Results ($\mu g/m^3$): Zephyrs

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2022 (%) [2]	2018	2019	2020	2021	2022
Z183	457145	301012	Roadside	100	100	-	-	12.2	13.2	13.0
Z361	458922	304785	Roadside	77.8	77.8	-	-	11.2	12.0	12.1
Z370	456386	304642	Roadside	98.8	98.8	-	-	13.2	13.4	12.4
Z393	460766	301337	Roadside	51.8	51.8	-	-	13.8	12.0	14.7
Z409	460890	307916	Roadside	66.5	66.5	-	-	-	14.8	12.3
Z413	460262	307639	Roadside	100	100	-	-	-	11.7	11.9
Z450	460037	307346	Roadside	100	100	-	-	-	13.1	12.9
Z459	460437	308091	Roadside	82.7	82.7	-	-	-	12.8	10.9
Z579	460933	306816	Roadside	100	100	-	-	-	11.5	11.4
Z582	460595	307540	Roadside	100	100	-	-	-	12.0	13.3
Z634	460142	307001	Roadside	100	100	-	-	-	12.5	12.6
Z639	459199	305108	Roadside	98.7	98.7	-	-	-	14.6	14.0
Z641	461146	307268	Roadside	100	100	-	-	-	11.3	10.7
Z657	458288	304633	Roadside	98.3	98.3	-	-	-	17.8	13.3
Z661	458725	303694	Roadside	100	100	-	-	-	16.6	13.1
Z664	461264	305340	Roadside	100	100	-	-	-	17.2	13.2
Z707	459642	304376	Roadside	95.8	95.8	-	-	-	13.4	12.3
Z710	457110	302842	Roadside	93.6	93.6	-	-	-	12.4	10.6
Z722	460578	307698	Roadside	97.1	97.1	-	-	-	11.5	11.5
Z944	460660	307025	Roadside	76.2	76.2	-	-	-	-	11.6

Figure F.4 – Trends in Annual Mean PM_{10} Concentrations at Zephyrs

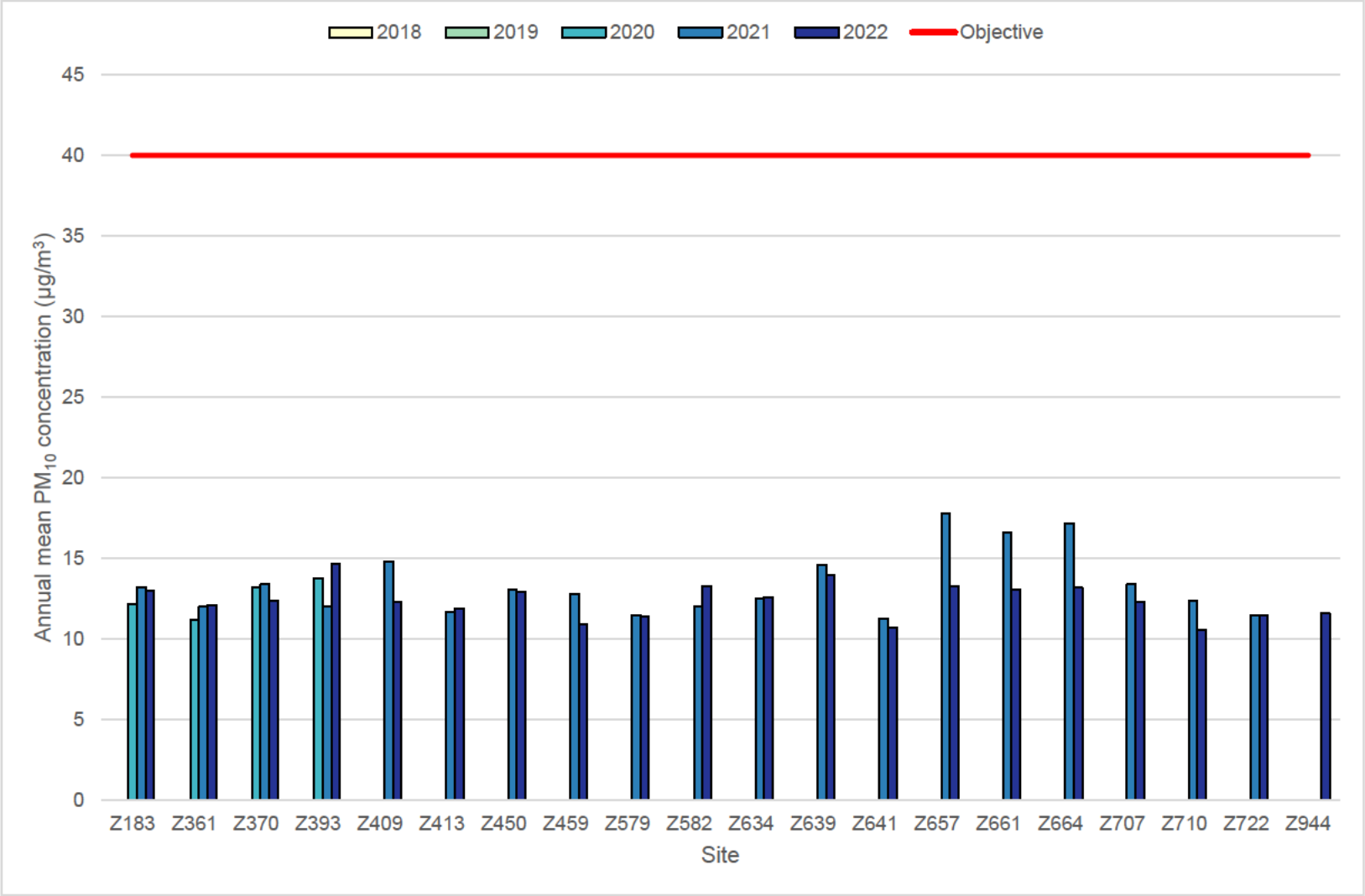


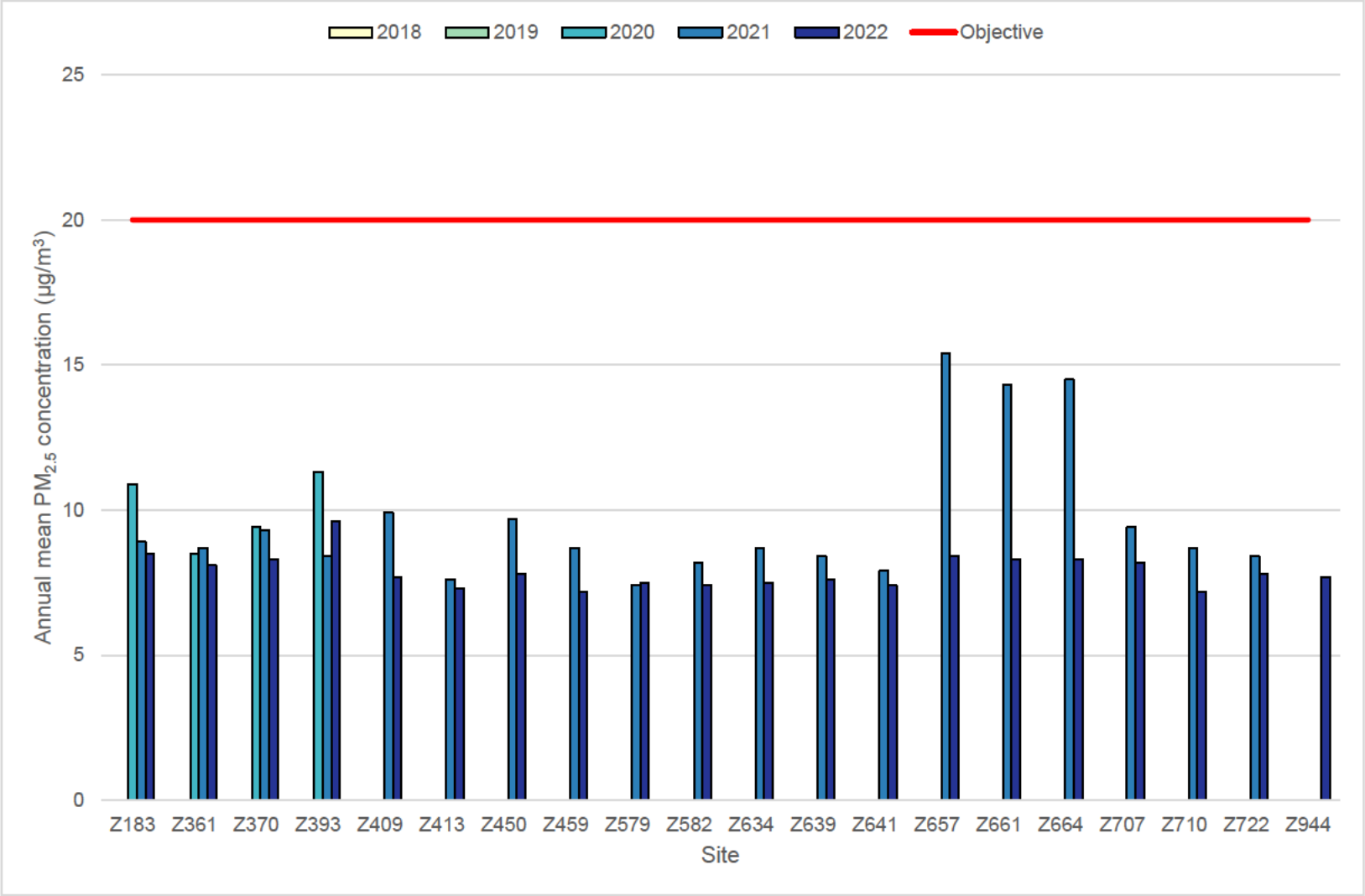
Table F.5 – 24-Hour Mean PM_{10} Monitoring Results, Number of PM_{10} 24-Hour Means > 50µg/m^3: Zephyrs

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022
Z183	457145	301012	Roadside	100	100	-	-	1	0	0
Z361	458922	304785	Roadside	77.8	77.8	-	-	-	0	0 (25.6)
Z370	456386	304642	Roadside	98.8	98.8	-	-	0	0	0
Z393	460766	301337	Roadside	51.8	51.8	-	-	0	0	0
Z409	460890	307916	Roadside	66.5	66.5	-	-	-	0 (46.1)	1 (24.5)
Z413	460262	307639	Roadside	100	100	-	-	-	0 (42.1)	0
Z450	460037	307346	Roadside	100	100	-	-	-	0 (47.5)	0
Z459	460437	308091	Roadside	82.7	82.7	-	-	-	0	0 (21.6)
Z579	460933	306816	Roadside	100	100	-	-	-	0 (36.5)	0
Z582	460595	307540	Roadside	100	100	-	-	-	0	0
Z634	460142	307001	Roadside	100	100	-	-	-	0	0
Z639	459199	305108	Roadside	98.7	98.7	-	-	-	0 (48.5)	0
Z641	461146	307268	Roadside	100	100	-	-	-	0 (38.1)	0
Z657	458288	304633	Roadside	98.3	98.3	-	-	-	0 (48.4)	1
Z661	458725	303694	Roadside	100	100	-	-	-	0	0
Z664	461264	305340	Roadside	100	100	-	-	-	0 (44.8)	0
Z707	459642	304376	Roadside	95.8	95.8	-	-	-	0	0
Z710	457110	302842	Roadside	93.6	93.6	-	-	-	0	0
Z722	460578	307698	Roadside	97.1	97.1	-	-	-	0	0
Z944	460660	307025	Roadside	76.2	76.2	-	-	-	-	0

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

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022
Z183	457145	301012	Roadside	98.2	98.2	-	-	10.9	8.9	8.5
Z361	458922	304785	Roadside	76.2	76.2	-	-	8.5	8.7	8.1
Z370	456386	304642	Roadside	96.9	96.9	-	-	9.4	9.3	8.3
Z393	460766	301337	Roadside	50.4	50.4	-	-	11.3	8.4	9.6
Z409	460890	307916	Roadside	65.9	65.9	-	-	-	9.9	7.7
Z413	460262	307639	Roadside	98	98	-	-	-	7.6	7.3
Z450	460037	307346	Roadside	98	98	-	-	-	9.7	7.8
Z459	460437	308091	Roadside	81	81	-	-	-	8.7	7.2
Z579	460933	306816	Roadside	96.8	96.8	-	-	-	7.4	7.5
Z582	460595	307540	Roadside	98.2	98.2	-	-	-	8.2	7.4
Z634	460142	307001	Roadside	97.2	97.2	-	-	-	8.7	7.5
Z639	459199	305108	Roadside	94	94	-	-	-	8.4	7.6
Z641	461146	307268	Roadside	97.5	97.5	-	-	-	7.9	7.4
Z657	458288	304633	Roadside	93.1	93.1	-	-	-	15.4	8.4
Z661	458725	303694	Roadside	99	99	-	-	-	14.3	8.3
Z664	461264	305340	Roadside	98.9	98.9	-	-	-	14.5	8.3
Z707	459642	304376	Roadside	94.3	94.3	-	-	-	9.4	8.2
Z710	457110	302842	Roadside	92	92	-	-	-	8.7	7.2
Z722	460578	307698	Roadside	95.6	95.6	-	-	-	8.4	7.8
Z944	460660	307025	Roadside	75.1	75.1	-	-	-	-	7.7

Figure F.5 – Trends in Annual Mean $PM_{2.5}$ Concentrations at Zephyrs



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
AQO	Air Quality Objective
AQF	Air Quality Forum
AQS	Air Quality Strategy
ASR	Annual Status Report
CO_2	Carbon Dioxide
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
EU	European Union
EV	Electric Vehicle
ERDF	European Regional Development Fund
FDMS	Filter Dynamics Measurement System
JAQU	Joint Air Quality Unit
LAQM	Local Air Quality Management
LCC	Leicester City Council
LTP	Leicester Transport Plan
MOVA	Microprocessor Optimised Vehicle Actuation
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
OZEV	Office for Zero Emission Vehicles
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

Abbreviation	Description
SCA	Smoke Control Area
SCOOT	Split Cycle Offset Optimisation Technique
SSHN	Safer Streets Healthier Neighbourhoods
TCF	Transforming Cities Fund
ULEV	Ultra Low Emission Vehicle
WPL	Workplace Parking Levy

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.
- Diffusion Tubes for Ambient NO_2 Monitoring: Practical Guidance for Laboratories and Users. February 2008. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland. https://laqm.defra.gov.uk/documents/0802141004_NO2_WG_PracticalGuidance_Issue1a.pdf
- Leicester City Council Air Quality Action Plan 2015-2026: https://www.leicester.gov.uk/media/180653/air-quality-action-plan.pdf
- Leicester City Council Air Quality webpage: https://www.leicester.gov.uk/your-council/policies-plans-and-strategies/environment-and-sustainability/air-quality/
- Leicester City Council published air quality data: https://data.leicester.gov.uk/explore/?q=air+quality
- Leicester Transport Plan 2021-2036: https://consultations.leicester.gov.uk/communications/ltp4/supporting_documents/Leicester%20Transport%20Plan.pdf
- Leicester Cycle City Action Plan 2015-2024: https://www.leicester.gov.uk/media/179027/leicester-cycle-city-action-plan.pdf
- Leicester Climate Emergency Strategy 2020-2023: https://www.leicester.gov.uk/media/kuuojdxw/leicester-climate-emergency-strategy-executive-summary-2020-2023.pdf