2022 Air Quality Annual Status Report (ASR)

In fulfilment of Part IV of the Environment Act 1995

Local Air Quality Management

Date: June 2022

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Executive Summary: Air Quality in Our Area

Air Quality in Wyre Forest District Council

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 28,000 to 36,000 deaths at typical ages[3], with a total estimated healthcare cost to the NHS and social care of £157 million in 2017[4].

Worcestershire Regulatory Services (WRS) have been responsible for managing (monitoring and reporting of) local air quality in the six Worcestershire District Councils since April 2011.

Monitoring across the Wyre Forest District area focuses on nitrogen dioxide (NO_2) via a network of passive diffusion tubes, the tubes are located in the main urban centres of Kidderminster, Stourport-on-Severn and Bewdley.

Two Air Quality Management Areas (AQMA's) were declared by Wyre Forest District Council for exceedances of the annual mean objective for nitrogen dioxide (NO_2):

- Welch Gate, Bewdley AQMA (Declared January 2003)
- Horsefair, Kidderminster AQMA (Declared January 2003, amended in July 2009 to include part of the Kidderminster Ring Road and Coventry Street)

[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, July 2021

[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

Details of the declarations and maps of the AQMAs can be found on the following pages of the WRS website: http://www.worcredservices.gov.uk/pollution/air-quality/air-quality-managementareas.aspx

Monitoring data from 2020 does not represent a standard year with the emergence of the COVID-19 pandemic, the first lockdown in March 2020 and subsequent lockdowns that followed which resulted in the lowest concentrations of nitrogen dioxide at all locations in Wyre Forest District area between 2017-2020[5]. As such, monitoring data shows an overall increase in average recorded annual mean NO_2 concentrations of 1.7 µg/m^3 (8.1%) between 2020 (21.4 µg/m^3) to 2021 (23.1 µg/m^3) across the Wyre Forest District area. 92% of monitoring stations in the Wyre Forest District area saw an increase in annual mean NO_2 concentrations between 2020 and 2021. This is likely to have been caused by the increase in traffic following the easing of 'lockdowns' in 2020 caused by the COVID-19 pandemic.

In 2021, the highest concentration of NO_2 recorded across the Wyre Forest District area was 35.1 µg/m^3 at '(F) 69COV' (located in the Horsefair/Coventry Street AQMA). This location was also the highest measured concentration in the area in 2020 (34.5 µg/m^3). No exceedances of the annual mean objective were recorded within the Wyre Forest District area during 2021, and all monitoring stations measured annual mean NO_2 concentrations under 10% below the exceedance threshold (36 µg/m^3). No annual means greater than 60 ug/m^3 have been recorded indicating that it is very unlikely that there have been any exceedances of the 1-hour mean objective for NO_2 at any monitoring sites.

Monitored concentrations overall in 2019 were much higher than that in 2021, as air quality levels is yet to return to the pre-covid levels.

In the previous ASR, it was announced that two additional diffusion tubes were deployed at the following locations in Kidderminster in January 2020 (**CRS1 and PL2**). This was to increase the monitoring of air quality in Chester Road South to further inform a detailed

[5] Worcestershire Regulatory Services, 2021 Air Quality Annual Status Report (ASR)

dispersion modelling assessment at the Junction of Comberton Road, Chester Road North and Chester Road South (Kidderminster) that was carried out in March 2021.

Actions to Improve Air Quality

Whilst air quality has improved significantly in recent decades and will continue to improve due to national policy decisions, there are some areas where local action is needed to improve air quality further.

The 2019 Clean Air Strategy[6] sets out the case for action, with goals to reduce exposure to harmful pollutants. The Road to Zero[7] sets out 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.

In 2013, WRS produced a countywide Air Quality Action Plan (AQAP) for Worcestershire which was adopted by Wyre Forest District Council (WFDC) on 24th October 2013. WRS have produced two updates to the AQAP, the latest in September 2016. For details of all measures completed, in progress or planned, please refer to the 'Air Quality Action Plan Progress Report for Worcestershire April 2015-2016'. A copy of this, the previous update, and the AQAP, is available to view or download at: http://www.worcsregservices.gov.uk/pollution/air-quality/air-quality-action-plan.aspx

WRS set up the Worcestershire Air Quality Steering Group to facilitate progressing the implementation of actions identified in the AQAP. At the inaugural Steering Group meeting, on 18th June 2014, it was agreed to establish a number of sub-groups. The Welch Gate Sub-Group covers the Welch Gate AQMA and the Horsefair Sub-Group covers the Horsefair/Coventry Street AQMA. The sub-groups currently comprise representatives of WRS, the Worcestershire County Council Air Quality Liaison Officer and local County and district Councillors.

Key Actions in 2021 were:

- **Kidderminster Ring Road (Horsefair / Coventry Street) AQMA**

[6] Defra. Clean Air Strategy, 2019

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

Proposals to develop a scheme to improve traffic flow at key junctions are included in the Infrastructure Delivery Plan for the Wyre Forest Local Plan[8], subject to adoption by Wyre Forest council. This will include active travel interventions and the provision of further car parking at train stations. A strategic outline business case is also being developed for the Northwest Worcestershire corridor (A456/491/450) to address congestion, improve traffic flow and mitigate the impact of development.

- **Welch Gate AQMA - alternative traffic rerouting**
  Proposals to develop a scheme to improve traffic flow in Welch Gate are included in the Infrastructure Delivery Plan for the Wyre Forest Local Plan[9], subject to adoption by Wyre Forest District Council.
- **Produce Air Quality Supplementary Planning Document (SPD)**
  Wyre Forest District Council are leading on producing SPD's, with their adoption linking to Local Plan review timetables. Worcestershire County Council and Worcestershire Regulatory Services are developing an air quality SPD with the intention that this is rolled out across the county in time.

Wyre Forest District Council carried out a detailed review[10] of NO_2 concentrations at the junction of Comberton Road (A448), Chester Road North (A449) and Chester Road South (A449), Kidderminster. This detailed review was undertaken to determine whether the declaration of an Air Quality Management Area (AQMA) is required and to determine the geographical extent of any predicted exceedances at relevant receptors. The modelled results showed that the air quality in the vicinity of the junction of Comberton Road, Chester Road North and Chester Road South is not exceeding the 40µg/m^3 annual mean air quality objective; therefore it does not meet the threshold for an Air Quality Management Area (AQMA) to be declared.

A new Air Quality Partnership led by the officers of the Director of Public Health (DoPH), and supported by WRS Land and Air Quality Team, was set up in 2019 to discuss potential actions to improve air quality across the County and determine an action plan for implementation. The group comprises officers from the County and District authorities from

[8] Wyre Forest Local Plan, 2019

[9] Wyre Forest Local Plan, 2019

[10] Worcestershire Regulatory Services, Junction of Comberton Road, Chester Road North and Chester Road South, Kidderminster Dispersion Modelling Assessment, 2021

public health, air quality, strategic planning, sustainability, highways and transport disciplines, and also representatives from the NHS and Highways England. The group is largely driven by DoPH so, due to COVID-19 taking priority, the business of the partnership has been postponed indefinitely.

WRS is also a member of Central England Environmental Protection Managers Group (CEEPG) which provides a strategic overview and direction for the delivery of Environmental Protection Services across the area of Central England covered by participating authorities. CEEPG responsibilities covers all environmental health matters regarding air quality, noise, contaminated land and LAPPC/IPPC including cooperation and coordination with the Environment Agency and Public Health England.

Following direct contact WRS were invited by Defra LAQM Team to join their Local Authority Air Quality Advisory Group (LAQAG), formed in 2017. The group consists of a network of local authority officials acting as an informal sounding board by Defra to enable development of better-informed strategy and policy proposals across the two areas of work in air quality- local authorities and domestic combustion. It is an advisory body and not a decision-making body.

Conclusions and Priorities

There are currently two AQMAs declared in the Wyre Forest District, Horsefair/Coventry Street, Kidderminster and Welch Gate, Bewdley. Monitoring results for 2021 show that air quality in the Horsefair/Coventry Street AQMA and the Welch Gate AQMA was below the annual mean objective. The highest monitored annual mean NO_2 concentration within Horsefair/Coventry Street AQMA was 35.1 µg/m^3 (at diffusion tube '(F) 69COV') and within the Welch Gate AQMA was 31.9 µg/m^3 (at diffusion tube '(WG(B)').

The monitoring network was increased in January 2020 by two diffusion tubes at locations in Chester Road South (A449) (outside the existing AQMA) to further inform a detailed assessment of the area published in March 2021[11]. The detailed assessment has revealed that the air quality in the vicinity of the junction of Comberton Road, Chester Road North and Chester Road South is not exceeding the 40µg/m^3 annual mean air quality objective;

[11] Worcestershire Regulatory Services, Junction of Comberton Road, Chester Road North and Chester Road South, Kidderminster Dispersion Modelling Assessment, 2021

therefore it does not meet the threshold for an Air Quality Management Area (AQMA) to be declared.

Monitoring results demonstrate a significant increase in NO_2 concentrations at all monitoring locations in 2021 compared to 2020; this is consistent with trends across Worcestershire. This is likely to have been caused by the increase in traffic following the 'lockdowns' in 2020 caused by COVID-19. There were no exceedances of the annual mean objective for NO_2 at any location within the Wyre Forest District area in 2021. The decrease between 2019 and 2020 monitoring data should not be considered as indicative of local trends.

Monitored concentrations overall in 2019 were much higher than that in 2021, as air quality levels is yet to return to the pre-covid levels.

There are two major residential developments proposed on the eastern side of Kidderminster which may have an impact on air quality in the future. The Lea Castle, Cookley development for up to 600 dwellings, employment and retail use has been given planning permission and the second for a mixed use, residential led development with up to 1400 dwellings on land between the A456 Birmingham Road and A448 Comberton Road is pending a decision at the time of the report's writing. A second planning application for an additional 800 dwellings has been received in 2022 for the Lea Castle development. The second development is still pending a decision.

The priorities for Wyre Forest District Council are to continue to monitor nitrogen dioxide at key points across the area. WRS on behalf of Wyre Forest District Council will continue to monitor locations in 2021 to assess any improvements or degradation in NO_2 concentrations. The data gathered will assist in further assessment of areas of poor air quality within the District. Further update on monitoring and action progress will be provided in the 2023 Annual Status Report.

Local Engagement and How to get Involved

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

- **Walk or cycle, leave your car at home:** Leaving your car at home and walking or cycling instead will benefit in three ways - increased exercise, reduced pollution exposure and will reduce individual's pollution emissions;

- **Turn off your engine when stationary or parked,** don't 'idle', particularly outside sensitive receptors such as schools, hospitals, care homes and residential properties;
- Worcestershire County Council have launched a car sharing website, **LiftShare**, to help people find others journeying to the same destinations to share journeys and costs and reduce traffic and emissions. Visit this link for more information https://worcestershire.liftshare.com/
- Contact Worcestershire County Council for help and advice on a **Travel Plan** for your business. General travel planning advice is available on Worcestershire County Council's website (including walking, cycling and bus maps and timetables).
- **Hold meetings by Conference Call** by phone or Video conference via Skype, Facetime, Zoom or other service rather than driving to meetings. This reduces fuel and other travel costs, vehicle maintenance and hire cost, increases productivity through reduction in hours lost through unnecessary travel;
- Facilitate **Flexible Working Arrangements** for non-front-line staff to **work remotely from home** or nearer home facilities for one or more days a week thus removing or reducing any journey to work. This reduces congestion which has beneficial impacts for delivery times, reduced business costs and thus economic benefits. Additionally, provides social benefits through improved work life balance for employees, reduces local air quality and reduced emergency vehicle response times.
- **Switch Fleet to Low Emission Vehicles**: The government is providing £80m funding to encourage installation of Electric Vehicle (EV) charging points. Eligible businesses, charities and public sector organisations with off street parking for staff or vehicles fleets can apply for vouchers to redeem costs of electric vehicle chargepoints. There is a limit of 1 voucher per applicant; however, applicants with a 'franchise' may apply for up to 20 franchisees. There is an approved charge points list and a list of authorised installers:

  https://www.gov.uk/government/collections/government-grants-for-low-emissionvehicles#workplace-charging-scheme

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

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

  http://www.dft.gov.uk/vca/fcb/smarter-driving-tips.asp

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

Air pollution can affect all of us over our lifetime however certain groups will be more sensitive to the effects of air pollution. Vulnerable groups include adults and children with lung or heart conditions such as asthma, chronic bronchitis, emphysema and chronic obstructive lung disease (COPD)[12,13]. Senior citizens are more likely to be affected by respiratory diseases and children are more likely to be affected by air pollution due to relatively higher breathing and metabolic rates as well as a developing lung and immune system.

Vulnerable individuals and groups can keep informed of:

- Current levels and forecasts of air pollution from Defra at:

  https://uk-air.defra.gov.uk/.

- If you are sensitive to the effects of air pollution, it may be appropriate to limit the length of time spent in areas of local poor air quality – see advice from Defra at https://uk-air.defra.gov.uk/air-pollution/daqi

- If you are on social media, sign up to the WRS Twitter feed. WRS tweet when pollution is forecast by Defra to be moderate to very high.

Further information for the general public on reducing your family's exposure to poor air quality in Worcestershire and how individuals, business and schools can assist with

[12] http://www.breathelondon.org/

[13] https://www.londonair.org.uk/LondonAir/guide/MyActionsForMe.aspx

reducing their impact on local air quality can currently be found at http://www.worcsregservices.gov.uk/pollution/air-quality/public-advice.aspx .

Local Responsibilities and Commitment

This ASR was prepared by Ricardo PLC on behalf of Worcestershire Regulatory Services for Wyre Forest District Council with the support and agreement of the following officers and departments:

- Neil Kirby / Stephen Williams – Land and Air Quality Team, Technical Services, Worcestershire Regulatory Services
- Emily Barker - Worcestershire County Council Highways Department
- Wyre Forest District Council

This ASR has been approved by Worcestershire Regulatory Services

This ASR has not been signed off by a Director of Public Health.

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

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1 Local Air Quality Management

This report provides an overview of air quality in Wyre Forest District Council during 2021. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995) and the relevant Policy and Technical Guidance documents.

The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether the air quality objectives are likely to be achieved. Where an exceedance is considered likely the local authority must declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives. This Annual Status Report (ASR) is an annual requirement showing the strategies employed by Wyre Forest District 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 12 months setting out measures it intends to put in place in pursuit of compliance with the objectives.

A summary of the Horsefair/Coventry Street and Welch Gate AQMAs declared by Wyre Forest District Council can be found in Table 2.1. The table presents a description of the two AQMAs that are currently designated within Wyre Forest District Council. Appendix D: Map(s) of Monitoring Locations and AQMAs provides maps of AQMAs and also the air quality monitoring locations in relation to the AQMAs. The air quality objectives pertinent to the current AQMA designations are 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 National Highways?	Level of Exceedance: Declaration	Level of Exceedance: Current Year	Name and Date of AQAP Publication	Web Link to AQAP
The Kidderminster Ring Road (Horsefair/Coventry Street)	Declared 06/01/2003 Amended 30/07/2009	NO_2 Annual Mean	An area of residential & commercial properties in The Horsefair & Blackwell Street. The AQMA was extended to include part of the Kidderminster Ring Road and residential properties in the vicinity of Coventry Street.	No	54 µg/m^3	35.1 µg/m^3	Air Quality Action Plan for Worcestershire September 2013 Updated September 2016	Visit the AQAP for AQMA Kidderminster Ring Road Air Quality Action Plan - Worcestershire Regulatory Services (worcsregservices.gov.uk)
Welch Gate, Bewdley	Declared 06/01/2003	NO_2 Annual Mean	A short section of Welch Gate encompassing a number of residential properties from the junction of Dog Lane running south west to north east to a point level with 84 Welch Gate	No	47 µg/m^3	31.9 µg/m^3	Air Quality Action Plan for Worcestershire September 2013 Updated September 2016	Visit the AQAP for AQMA Welch Gate Air Quality Action Plan - Worcestershire Regulatory Services (worcsregservices.gov.uk)

☒ **Wyre Forest District Council confirm the information on UK-Air regarding their AQMA(s) is up to date**

☒ **Wyre Forest District Council confirm that all current AQAPs have been submitted to Defra.**

2.2 Progress and Impact of Measures to address Air Quality in Wyre Forest District Council

Defra's appraisal of last year's ASR concluded that the report was well structured, detailed, and provides the information specified in the Guidance.

Defra provided the following comments:

1) Trends are presented and discussed and a robust comparison with air quality objectives is provided.
2) The diffusion tube mapping labelling is complicated and messy. A simpler label e.g. DT1,2,3 or DT1W,1K (to highlight AQMA tubes) would make it easier for the reader to locate and compare the diffusion tubes around the borough.
3) It is appreciated that the concentrations may not represent the local trends however if there are exceedances in future years it may be helpful to colour the points on the map e.g. red for exceeded and green for not exceeded.
4) Due to the pandemic, annualisation was needed for all the sites (calculations were shown in the appendix) and distance correction was not needed due to such low concentrations.
5) QA/QC of the data was considered to be thorough, with a national bias adjustment factor used for the non-automatic network.
6) The introduction of new diffusion tube locations for 2020 is welcomed and the network should continue to be reviewed to ensure the most relevant locations are monitored as required. Especially, in the vicinity of the Horsefair, Kidderminster AQMA following the Kidderminster Ring Road development.
7) Although the Action Plan measures have been updated from year to year the AQAP was created in 2013 and updated in 2016, which is now 5 years ago. An updated AQAP will soon be needed so it is recommended that the Council update their AQAP as soon as possible.
8) Although all sections were filled in where possible there were still some blank squares. 'TBC' or 'NA' is better than blank squares as this highlights that every section was considered and filled in.
9) Feedback from last year's appraisal was included and addressed. This is welcomed and is encouraged to continue in future years.

Wyre Forest District Council has taken forward most of the recommendations made by Defra and maps has now been updated to be much clearer. However, an AQAP has not been progressed for the existing Horsefair/Coventry Street AQMA and Welch Gate, Bewdley AQMA as the annual mean NO_2 concentration have remained below the air quality objective in 2021. Exceedances of the annual mean objective in the AQMA were last observed in 2019 and air quality levels is yet to return to the pre-covid levels. Wyre Forest District Council will continue to review future monitoring data to ascertain whether the Horsefair/Coventry Street and Welch Gate AQMAs are still required and whether there is still a need for an AQAP.

Nevertheless, the District Council has taken forward a number of direct measures during the current reporting year of 2021 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2. 14 measures are included within Table 2.2, with the type of measure and the progress Wyre Forest District Council have made during the reporting year of 2021 presented. Where there have been, or continue to be, barriers restricting the implementation of the measure, these are also presented within Table 2.2. These measures are continuations from those presented in the previous ASR with relevant updates made.

More detail on these measures can be found in the 'Air Quality Action Plan Progress Report for Worcestershire April 2015 – April 2016' at: http://www.worcsregservices.gov.uk/pollution/air-quality/air-quality-action-plan.aspx

Key Actions in 2021 were:

- **Kidderminster Ring Road (Horsefair / Coventry Street) AQMA**
  Proposals to develop a scheme to improve traffic flow at key junctions are included in the Infrastructure Delivery Plan for the Wyre Forest Local Plan[14], subject to adoption by Wyre Forest council. This will include active travel interventions and the provision of further car parking at train stations. A strategic outline business case is also being developed for the North West Worcestershire corridor (A456/491/450) to address congestion, improve traffic flow and mitigate the impact of development.
- **Welch Gate AQMA - alternative traffic rerouting**

[14] Wyre Forest Local Plan, 2019

Proposals to develop a scheme to improve traffic flow in Welch Gate are included in the Infrastructure Delivery Plan for the Wyre Forest Local Plan[15], subject to adoption by Wyre Forest District Council.

- **Produce Air Quality Supplementary Planning Document (SPD)**
  Wyre Forest District Council are leading on producing SPD's, with their adoption linking to Local Plan review timetables. Worcestershire County Council and Worcestershire Regulatory Services are developing an air quality SPD with the intention that this is rolled out across the county in time.

Progress on the following measures has been slower than expected due to:

- **HGV or weight restriction on affected roads**:
  The B4190 Cleobury Road/Welch Gate is the main access route for traffic from the B456 Bewdley By-pass to the B4194 Dowles Road which leads to towns in Shropshire. Enforcement of the 7.5 tonne weight limit and access only restriction is proving problematic as alternative routes in the area for HGVs are not considered viable.

The measures stated above and in Table 2.2 will help to contribute towards compliance in Wyre Forest District Council and enable the revocation of all the AQMAs.

[15] Wyre Forest Local Plan, 2019

Table 2.2 – Progress on Measures to Improve Air Quality

Measure No.	Measure	Category	Classification	Year Measure Introduced	Estimated / Actual Completion Year	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
1	Loading and unloading restrictions during peak traffic times	Traffic Management	UTC, Congestion management, traffic reduction	2016	2016	WFDC	N/A	NO	Not funded	N/A	Completed	2 - 5%	Decrease in illegally parked vehicles	WFDC parking enforcement targeting AQMA areas.	Currently in operation
2	HGV or weight restriction on affected roads	Freight and Delivery Management	Route Management Plans/ Strategic routing strategy for HGV's	2016	2016	WFDC	N/A	NO	Not funded	N/A	Completed	2%	Fewer HGV's travelling through Welch Gate AQMA	A 7.5 tonne weight limit and access only restriction is currently in operation on the B4190 Cleobury Road leading into Welch Gate.	HGVs use the B4190 for access to the B4194 (Dowles Road)
3	Promote flexible working arrangements	Promoting Travel Alternatives	Encourage / Facilitate homeworking	2017	N/A	WCC & WFDC	N/A	NO	Not funded	N/A	Implementation	1%	Increase in uptake of personal travel planning services. Change in behaviour towards more sustainable modes of transport	Currently in operation	N/A
4	Freight Quality Partnership - work with satellite navigation companies to route HGVs around AQMAs	Traffic Management	UTC, Congestion management, traffic reduction	2016	N/A	WCC	N/A	NO	Not funded	N/A	Implementation	5 - 10%	Fewer HGVs travelling through AQMAs	Implementation ongoing	It can take some time for the information to filter down to users.
5	Churchfields Urban Highway Improvement Scheme	Traffic Management	UTC, Congestion management, traffic reduction	2018	2020	WCC	Worcestershire LEP, Homes England, Greater Birmingham & Solihull LEP	NO	Funded	£1 million - £10 million	Completed	10 - 40%	Horsefair / Coventry Street AQMA reduction in congestion	Highways Infrastructure in the Churchfields area via a one-way system. Opened in Sep-20	N/A
6	Introduction of traffic signals at roundabouts	Traffic Management	UTC, Congestion management, traffic reduction	2018	N/A	WCC & WFDC	N/A	NO	Not funded	N/A	Pending	N/A	N/A	N/A	Proposals are included in the Infrastructure Delivery Plan
7	Installing electric vehicle charging points	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	2014	N/A	WRS & WFDC	N/A	NO	Not funded	N/A	Implementation	1%	Increase in availability of EV charging points and corresponding increase in use of electric vehicles	Recommendations for installation of EV Charging Points routinely recommended by WRS on relevant planning consents.	WRS technical guidance note for planning (v.5.1), produced on behalf of Worcestershire local authorities
8	Travel Planning	Promoting Travel Alternatives	Personalised Travel Planning	2017	2018	WCC	N/A	NO	Not funded	N/A	Completed	<1 %	Increased uptake of alternative modes of transport	WCC have developed a “one-stop-shop” online travel portal	N/A
9	Measures linked to walking and cycling initiatives	Promoting Travel Alternatives	Promotion of cycling	2015	2016	WFDC	N/A	NO	Not funded	N/A	Completed		Increased uptake of walking and cycling in Wyre Forest	WFDC has a web page dedicated to the promotion of walking and cycling.	N/A
10	Car Sharing	Alternatives to private vehicle use	Car & lift sharing schemes	2015	2016	WCC	N/A	NO	Not funded	N/A	Completed	<1%	Increase in number of people car sharing	LiftShare booking is available on the WCC Website	N/A
11	Produce Air Quality Supplementary Planning	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	2017	2021	WRS & District Councils	N/A	NO	Not funded	N/A	Completed	<1%	Formally adopted and utilised SPD at all six LPAs across County	Formally adopted by North Worcestershire Strategic Planning. Currently being formulated by South Worcestershire Strategic Planning	N/A
12	Encourage developers to provide sustainable transport facilities and links serving new developments	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	2017	2021	WRS & District Councils	N/A	NO	Not funded	N/A	Completed	<1%	Formally adopted and utilised SPD at all six LPAs across County	Formally adopted by North Worcestershire Strategic Planning. Currently being formulated by South Worcestershire Strategic Planning	N/A
13	Air quality networks	Policy Guidance and Development Control	Regional Groups Co-ordinating programmes to develop Area wide	2014	N/A	WFDC & WRS	N/A	NO	Not funded	N/A	Implementation	1%	Improved cross boundary working between Local	WRS are members of the Midlands Joint Advisory Council (MJAC). Provision of	Ongoing

Measure No.	Measure	Category	Classification	Year Measure Introduced	Estimated / Actual Completion Year	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
			Strategies to reduce emissions and improve air quality										Authorities in Worcestershire	AQ services to Tewkesbury Borough Council & Gloucester City Council	
14	Forge closer links with local health agencies	Other	Other	2019	2019	WRS, District Councils & WCC	N/A	NO	Not funded	N/A	Completed	1%	Participation of relevant health agencies in the Worcestershire Air Quality Steering Group	Director of Public Health at Worcestershire County Council set up an air quality group in 2019 to discuss air quality issues in the County	Ongoing

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

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

There are currently no automatic $PM_{2.5}$ monitoring stations in Worcestershire. The nearest AURN $PM_{2.5}$ monitoring station is the Walsall Woodlands site approximately 23 kilometres to the north-east of the Wyre Forest District.

WRS has reviewed the DEFRA national background maps to determine projected $PM_{2.5}$ concentrations in the Wyre Forest District area for the 2021 calendar year. The annual average total $PM_{2.5}$ at 197 locations (centre points of 1km x 1km grids) across the Wyre Forest District is 7.4 µg/m^3, with a minimum concentration of 6.6 µg/m^3 and a maximum concentration of 8.9 µg/m^3.

This indicates that $PM_{2.5}$ concentrations within the Wyre Forest District is below the proposed annual average limit value for $PM_{2.5}$ target of 10µg/m^3 to be met across England by 2040.

WRS has reviewed the fraction of mortality attributable to particulate air pollution (indicator D01) as published by Public Health England as part of the Public Health Outcomes Framework[16]. The fraction of mortality attributable to particulate emissions in Worcestershire in 2020 (the most recent year available) was 5.0%. This falls below the national figure for England (5.6% in 2020) and below the figure for the West Midlands region (5.4% in 2020). Recent trend data is not available for Worcestershire due to a lack of data points with valid values.

More information on the Public Health Outcomes Frameworks that examines indicators that help us understand trends in public health can be found at:

Public Health Outcomes Framework - PHE

[16] Public Health Outcomes Framework - OHID (phe.org.uk)

A new Air Quality Partnership led by the DoPH, and supported by WRS Land and Air Quality Team, was set up in 2019 to discuss potential actions to improve air quality across the County and determine an action plan for implementation. The group comprises officers from the County and District authorities from public health, air quality, strategic planning, sustainability, highways and transport disciplines, and also representatives from the NHS and Highways England. The group met initially in May 2019 to discuss terms and references and in September to discuss potential actions. The group is largely driven by DoPH so, due to Covid-19 taking priority, the business of the partnership has been postponed indefinitely.

In light of the above no additional actions are currently planned by Wyre Forest District Council in relation to the reduction of $PM_{2.5}$ levels. However, it is anticipated that any actions taken to improve NO_2 levels across the District will likely result in a linked improvement in $PM_{2.5}$ levels.

There are currently four declared smoke control areas operating within the Wyre Forest District Council area:

- Habberley
- Offmore
- Hoobrook
- Spennells.

More information, maps and guides on the type of fuels that can be used can be found at:

Smokeless Zones - Worcestershire Regulatory Services (worcsregservices.gov.uk)

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

This section sets out the monitoring undertaken within 2021 by Wyre Forest District Council; and how it compares with the relevant air quality objectives. In addition, monitoring results are presented for a five-year period between 2017 and 2021 to allow monitoring trends to be identified and discussed.

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

Wyre Forest District Council undertook automatic (continuous) monitoring at one site during 2021. Table A.1 in Appendix A shows the details of the automatic monitoring sites.

The Air Quality in the United Kingdom (ukairquality.net) page presents automatic monitoring results for Wyre Forest District Council.

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

3.1.2 Non-Automatic Monitoring Sites

Wyre Forest District Council undertook non- automatic (i.e. passive) monitoring of NO_2 at 51 sites during 2021. 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.

3.1.3 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 40 µg/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 2021 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

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.

Monitoring data from 2020 does not represent a standard year with the emergence of the COVID-19 pandemic, the first lockdown in March 2020 and subsequent lockdowns that followed which resulted in the lowest concentrations of nitrogen dioxide at all locations in Wyre Forest District area between 2017-2020[17]. As such, monitoring data shows an overall increase in average recorded annual mean NO_2 concentrations of 1.7 µg/m^3 (8.1%) between 2020 (21.4 µg/m^3) to 2021 (23.1 µg/m^3) across the Wyre Forest District area. 92% of monitoring stations in the Wyre Forest District area saw an increase in annual mean NO_2 concentrations between 2020 and 2021. This is likely to have been caused by the increase in traffic following the easing of 'lockdowns' in 2020 caused by the COVID-19 pandemic.

In 2021, the highest concentration of NO_2 recorded across the Wyre Forest District area was 35.1 µg/m^3 at (F) 69COV (located in the Horsefair/Coventry Street AQMA). This location was also the highest measured concentration in the area in 2020 (34.5 µg/m^3). No exceedances of the annual mean objective were recorded within Wyre Forest District Council during 2021, and all monitoring stations measured annual mean NO_2

[17] Worcestershire Regulatory Services, 2021 Air Quality Annual Status Report (ASR)

concentrations under 10% below the exceedance threshold (36 µg/m^3). No annual means greater than 60 ug/m^3 have been recorded indicating that it is very unlikely that there have been any exceedances of the 1-hour mean objective for NO_2 at any monitoring sites.

Monitored concentrations overall in 2019 were much higher than that in 2021, as air quality levels is yet to return to the pre-covid levels.

3.1.4 Particulate Matter (PM_{10})

PM_{10} is not monitored within the Wyre Forest District.

3.1.5 Particulate Matter ($PM_{2.5}$)

$PM_{2.5}$ is not monitored within the Wyre Forest District.

3.1.6 Sulphur Dioxide (SO_2)

SO_2 is not monitored within the Wyre Forest District.

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)
WFH	Kidderminster Stourport Road	Roadside	381768	273551	NO_2	No	Chemiluminescent Detection	2.98	11.01	1.50m

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)
HLR1	139 Stourport Road, Kidderminster	Roadside	382136	274589	NO_2	No	0.0	18.6	No	1.7
SR113	Signpost O/S 113. Stourport Rd, Kidderminster	Roadside	382342	275054	NO_2	No	2.6	1.0	No	2.3
(F) 69COV	69 Coventry Street, Kidderminster	Roadside	383552	276870	NO_2	Yes - Horsefair/Coventry Street	0.0	5.5	No	1.8
(F)SGC	6/7 St George's Court, Kidderminster	Roadside	383475	276760	NO_2	Yes - Horsefair/Coventry Street	0.0	10.0	No	1.8
K1	50 Radford Avenue, Kidderminster	Roadside	383391	277086	NO_2	Yes - Horsefair/Coventry Street	0.0	2.1	No	2.5
21HF	21 Horsefair, Kidderminster	Roadside	383338	277215	NO_2	Yes - Horsefair/Coventry Street	0.0	4.7	No	3.0
HF(K)	Lamppost @ Peacock PH, Blackwell Street, Kidderminster	Roadside	383311	277087	NO_2	Yes - Horsefair/Coventry Street	0.0	2.5	No	2.5
HF(K) (F)	Hudson Florists, Blackwell Street, Kidderminster	Roadside	383304	277071	NO_2	Yes - Horsefair/Coventry Street	0.0	2.5	No	2.5
K4	1 Silver Street, Kidderminster	Roadside	383337	276998	NO_2	Yes - Horsefair/Coventry Street	0.0	18.2	No	2.4
SBR121	121 Stourbridge Road, Kidderminster	Roadside	383905	277857	NO_2	No	0.0	2.4	No	2.7

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)
334CRN	334 Chester Road North, Kidderminster	Roadside	383965	277823	NO_2	No	0.0	3.1	No	2.2
294CRN	Cambrian House, 294 Chester Road North, Kidderminster	Roadside	384054	277444	NO_2	No	0.0	11.0	No	1.6
383CRN	383 Chester Road North, Kidderminster	Roadside	384175	277275	NO_2	No	0.0	11.0	No	2.4
239CRN	239 Chester Road North, Kidderminster	Roadside	384221	276911	NO_2	No	0.0	6.1	No	1.6
CSLOC	Flats at top of Coventry Street - Land Oak Court, Kidderminster	Roadside	384205	277121	NO_2	No	0.0	7.9	No	1.9
K3	53 Coventry Street, Kidderminster	Roadside	383726	276909	NO_2	Yes - Horsefair/Coventry Street	0.0	2.7	No	1.3
K2	34 Leswell Lane, Kidderminster	Roadside	383657	276890	NO_2	Yes - Horsefair/Coventry Street	0.0	3.1	No	1.8
CAS1	Casper's Polish Shop, 99 Comberton Hill, Kidderminster	Roadside	383636	276377	NO_2	No	4.2	2.7	No	2.5
CR1	Cuts4Scruffs, 29 Comberton Hill, Kidderminster	Roadside	383696	276388	NO_2	No	0.0	4.6	No	3.0
CR2	Severn Valley Lock & Safe, 9/10 Comberton Road, Kidderminster	Roadside	383890	276333	NO_2	No	0.0	3.4	No	2.0

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)
(F)COMR(K)	Holmwood, Comberton Road, Kidderminster	Roadside	384214	276242	NO_2	No	13.5	3.5	No	2.2
CRS1	Signpost o/s King Charles 1 School. Junc. A449 & A448, Kidderminster	Roadside	384129	276263	NO_2	No	32.6	3.3	No	2.3
TCH	Lamppost, (On corner with the Firs) Top Comberton Hill, Kidderminster	Roadside	384086	276228	NO_2	No	1.0	2.0	No	2.0
PL2	2 Pelham Lodge, Kidderminster	Roadside	384065	276196	NO_2	No	5.5	10.4	No	1.8
CR3	20 Comberton Road, Kidderminster	Roadside	384069	276304	NO_2	No	0.0	13.1	No	1.9
470CRN	470 Chester Road North, Kidderminster	Roadside	384154	276340	NO_2	No	0.0	4.9	No	1.9
SP(K)	Lamppost, Spennells, Kidderminster (located at Jay Park Crescent)	Urban Background	384486	274596	NO_2	No	11.0	1.7	No	2.3
50CRS	50 Chester Road South, Kidderminster	Roadside	383699	275251	NO_2	No	0.0	14.6	No	1.6
100CRS	100 Chester Road South, Kidderminster	Roadside	383766	275723	NO_2	No	0.0	12.5	No	1.6

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)
(F)447S	447 Stourport Road, Kidderminster	Roadside	382447	275506	NO_2	No	0.0	10.6	No	1.8
SR(K)	Pole O/S 431 Stourport, Road, Kidderminster	Roadside	382429	275315	NO_2	No	9.0	3.0	No	2.3
SPR2	Flat 2, Park House, Sutton Park Road, Kidderminster	Roadside	382496	275417	NO_2	No	0.0	7.0	No	1.7
SRLEC	Flat s at crossroads - Lucy Edwards Court, Sutton Road, Kidderminster	Roadside	382183	276388	NO_2	No	0.0	9.5	No	2.0
BH166	Lamppost, 166 Bewdley Hl, Kidderminster	Roadside	382135	276409	NO_2	No	5.0	2.0	No	2.2
(F)BR(K)	52 Bewdley Road, Kidderminster	Roadside	382437	276542	NO_2	No	0.0	6.5	No	1.7
HAB203	203 Habberley Lane, Kidderminster	Roadside	381713	278069	NO_2	No	0.0	3.1	No	1.5
(F)GIL	10 The Gilgal, Stourport-on-Severn	Roadside	381482	271534	NO_2	No	0.0	2.0	No	2.3
(F)LSNS(S)	Lumsdons Solicitors, New Street, Stourport-on-Severn	Roadside	380957	271284	NO_2	No	0.0	1.5	No	2.3
(F)FBS(S)	Flamingo's, 21 Bridge Street,	Roadside	380933	271247	NO_2	No	0.0	1.9	No	2.4

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)
	Stourport-on-Severn									
HS(S)	Lamppost, High Street, Corner of York Street, Stourport-on-Severn	Roadside	380974	271268	NO_2	No	0.0	2.3	No	2.8
(F)25YS(S)	22 York Street, Stourport-on-Severn	Roadside	380990	271268	NO_2	No	0.0	1.5	No	2.5
(F)19YS(S)	19 York Street, Stourport-on-Severn	Roadside	381086	271268	NO_2	No	0.0	1.7	No	2.3
KSW(S)	Kodak Spectacles Warehouse, High Street, Stourport-on-Severn	Roadside	381072	271347	NO_2	No	0.0	2.2	No	2.3
HS15(S)	15 High Street, Stourport-on-Severn	Roadside	381114	271380	NO_2	No	0.0	2.2	No	2.3
HS4(S)	4 High Street, Stourport-on-Severn	Roadside	381169	271420	NO_2	No	0.0	3.5	No	2.4
A1	35 High Street, Stourport-on-Severn	Roadside	380989	271298	NO_2	No	0.0	3.2	No	2.4
KID22(B)	22 Kidderminster Road, Bewdley	Roadside	373996	275464	NO_2	No	0.0	2.0	No	2.4
(F)WG42	42 Welch Gate, Bewdley	Roadside	378383	275328	NO_2	No	0.0	1.7	No	2.5
WG(B)	88 Welch Gate, Bewdley	Roadside	378465	275292	NO_2	Yes - Welch Gate	0.0	1.0	No	2.5

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? 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)
LS(B)	Lamppost, The Melting Pot, Load Street, Bewdley	Roadside	378590	275302	NO_2	No	0.0	3.0	No	2.5
B1	Lamppost, Adam & Eves, Load Street, Bewdley	Roadside	378513	275317	NO_2	No	0.0	1.1	No	2.3
WFH1, WFH2, WFH3	Co-Location Study Wyre Forest House, Finepoint Way, Kidderminster, DY11 7WF	Roadside	381768	273551	NO_2	No	3.0	11.0	Yes	1.5

Notes:

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

(2) N/A if not applicable.

Table A.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 2021 (%) (2)	2017	2018	2019	2020	2021
WFH	381768	273551	Roadside	79.2	79.2	-	-	-	-	13.9

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

Notes:

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

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

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

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

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

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

Table 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 2021 (%) [2]	2017	2018	2019	2020	2021
HLR1	382136	274589	Roadside	100.0	100.0	16.4	20.9	17.7	14.3	16.9
SR113	382342	275054	Roadside	82.7	82.7	30.7	33.6	27.7	24.5	27.9
(F) 69COV	383552	276870	Roadside	100.0	100.0	**43.4**	**50.6**	**42.2**	34.5	35.1
(F)SGC	383475	276760	Roadside	51.9	51.9	31.0	31.6	26.9	22.1	24.8
K1	383391	277086	Roadside	100.0	100.0	22.4	23.0	19.9	16.9	16.9
21HF	383338	277215	Roadside	100.0	100.0	-	-	22.5	21.2	23.5
HF(K)	383311	277087	Roadside	100.0	100.0	**55.2**	**60.9**	**50.5**	28.4	24.4
HF(K) (F)	383304	277071	Roadside	100.0	100.0	**59.6**	**68.5**	**54.0**	29.6	25.9
K4	383337	276998	Roadside	100.0	100.0	24.1	26.6	22.6	19.6	18.2
SBR121	383905	277857	Roadside	100.0	100.0	29.0	32.2	27.0	22.6	25.8
334CRN	383965	277823	Roadside	100.0	100.0	-	-	29.0	26.4	29.3
294CRN	384054	277444	Roadside	100.0	100.0	-	-	20.0	16.3	18.0
383CRN	384175	277275	Roadside	100.0	100.0	-	-	18.3	15.7	16.4
239CRN	384221	276911	Roadside	100.0	100.0	-	-	19.2	16.2	17.0
CSLOC	384205	277121	Roadside	100.0	100.0	32.1	32.5	27.6	23.4	24.2
K3	383726	276909	Roadside	100.0	100.0	29.0	38.0	30.1	25.3	27.3
K2	383657	276890	Roadside	100.0	100.0	20.4	23.2	20.0	16.2	17.0
CAS1	383636	276377	Roadside	100.0	100.0	32.0	**40.7**	34.4	26.4	29.7
CR1	383696	276388	Roadside	100.0	100.0	-	32.6	28.8	22.9	26.2
CR2	383890	276333	Roadside	100.0	100.0	-	35.8	29.5	22.8	26.4
(F)COMR(K)	384214	276242	Roadside	100.0	100.0	29.7	32.2	29.0	22.9	27.3
CRS1	384129	276263	Roadside	100.0	100.0	-	-	-	18.3	21.8
TCH	384086	276228	Roadside	100.0	100.0	**44.0**	**48.8**	38.7	28.8	31.9
PL2	384065	276196	Roadside	100.0	100.0	-	-	-	12.6	13.7
CR3	384069	276304	Roadside	100.0	100.0	-	23.7	20.7	16.0	19.4
470CRN	384154	276340	Roadside	100.0	100.0	-	34.0	29.1	22.3	24.5
SP(K)	384486	274596	Urban Background	100.0	100.0	10.9	12.5	11.1	9.4	9.7
50CRS	383699	275251	Roadside	100.0	100.0	-	-	16.6	13.0	13.5
100CRS	383766	275723	Roadside	92.3	92.3	-	-	14.8	11.2	12.6
(F)447S	382447	275506	Roadside	100.0	100.0	21.3	24.8	21.0	18.0	19.6
SR(K)	382429	275315	Roadside	92.3	92.3	33.5	**41.7**	35.0	28.3	32.9
SPR2	382496	275417	Roadside	100.0	100.0	29.6	34.0	29.5	23.1	24.5
SRLEC	382183	276388	Roadside	100.0	100.0	31.3	35.7	27.9	22.9	25.0
BH166	382135	276409	Roadside	100.0	100.0	25.3	30.5	25.6	19.6	21.6
(F)BR(K)	382437	276542	Roadside	100.0	100.0	27.1	31.5	25.3	19.8	22.3

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 2021 (%) [2]	2017	2018	2019	2020	2021
HAB203	381713	278069	Roadside	100.0	100.0	27.2	32.9	25.4	18.9	21.9
(F)GIL	381482	271534	Roadside	84.6	84.6	22.6	28.6	24.1	20.6	22.4
(F)LSNS(S)	380957	271284	Roadside	100.0	100.0	23.6	30.1	22.5	18.5	21.0
(F)FBS(S)	380933	271247	Roadside	100.0	100.0	34.5	**42.9**	34.0	28.3	31.9
HS(S)	380974	271268	Roadside	100.0	100.0	31.1	38.7	31.7	24.7	27.6
(F)25YS(S)	380990	271268	Roadside	100.0	100.0	33.4	36.7	28.4	23.1	24.8
(F)19YS(S)	381086	271268	Roadside	100.0	100.0	24.4	28.8	23.5	19.0	21.4
KSW(S)	381072	271347	Roadside	100.0	100.0	26.2	31.8	27.2	21.5	23.7
HS15(S)	381114	271380	Roadside	100.0	100.0	26.3	31.4	26.5	21.7	23.8
HS4(S)	381169	271420	Roadside	100.0	100.0	26.9	33.4	27.8	21.6	23.6
A1	380989	271298	Roadside	92.3	92.3	34.9	**42.2**	34.7	27.0	29.1
KID22(B)	373996	275464	Roadside	100.0	100.0	29.7	36.3	28.3	22.6	25.4
(F)WG42	378383	275328	Roadside	100.0	100.0	25.3	30.0	25.0	19.4	21.7
WG(B)	378465	275292	Roadside	100.0	100.0	37.8	**45.6**	37.4	29.4	31.9
LS(B)	378590	275302	Roadside	100.0	100.0	27.8	34.0	27.6	20.9	24.0
B1	378513	275317	Roadside	100.0	100.0	30.6	38.1	29.9	23.0	27.0
WFH1, WFH2, WFH3	381768	273551	Roadside	100.0	100.0	-	-	-	-	10.6

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

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

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

Notes:

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

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

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

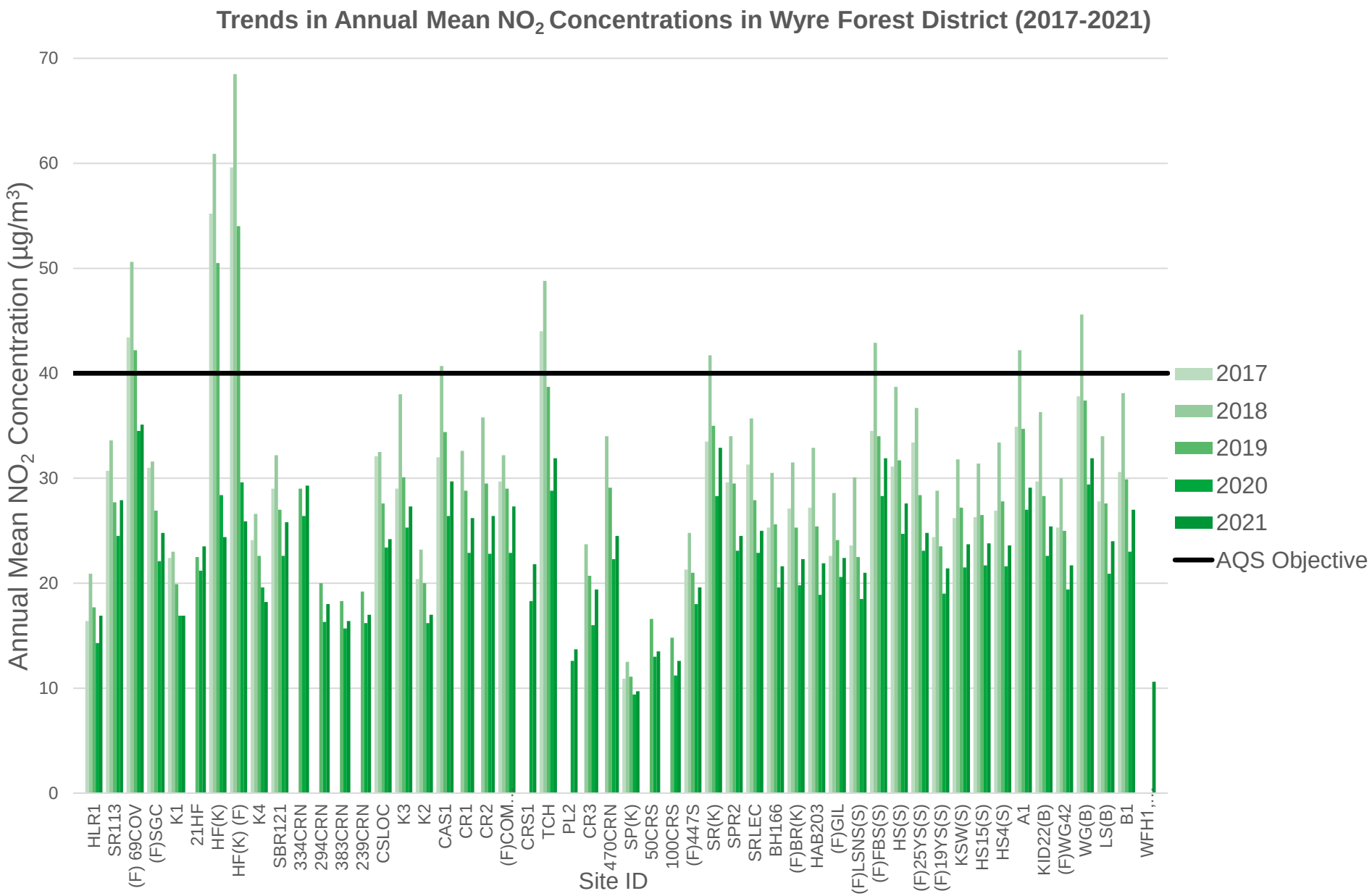
Means for diffusion tubes have been corrected for bias. All means have been "annualised" as per LAQM.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

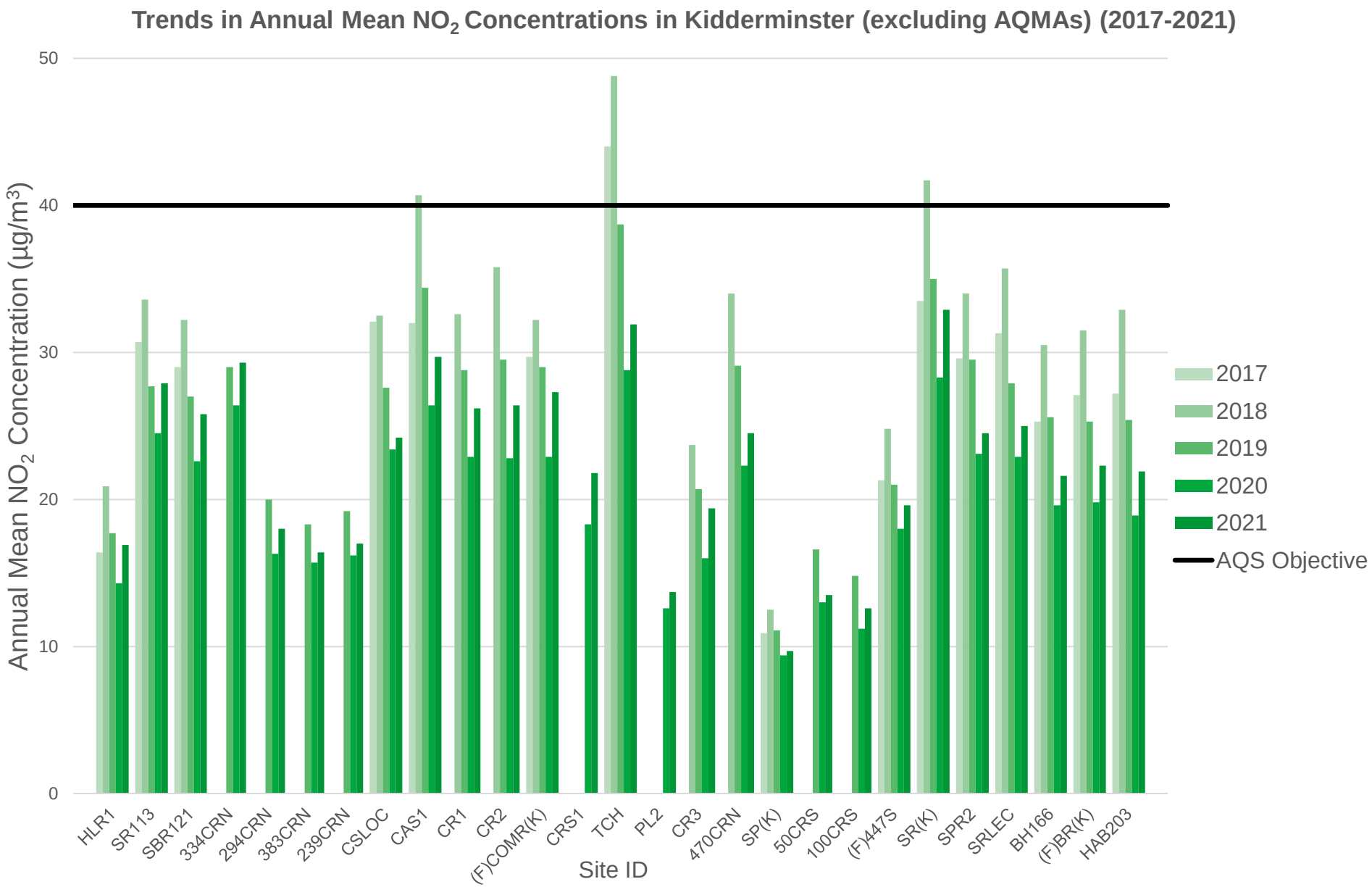
Concentrations are those at the location of monitoring and not those following any fall-off with distance adjustment.

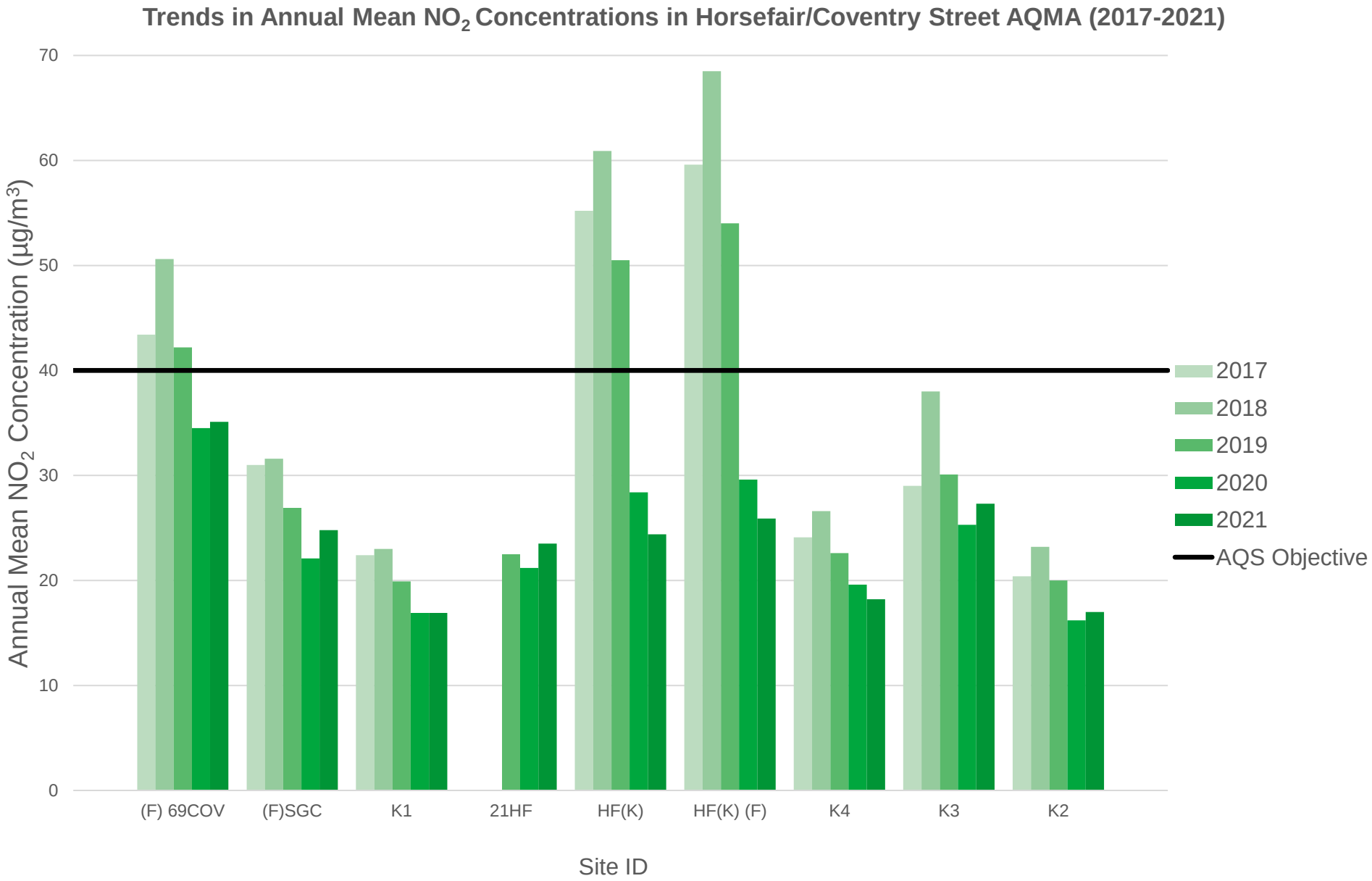
(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

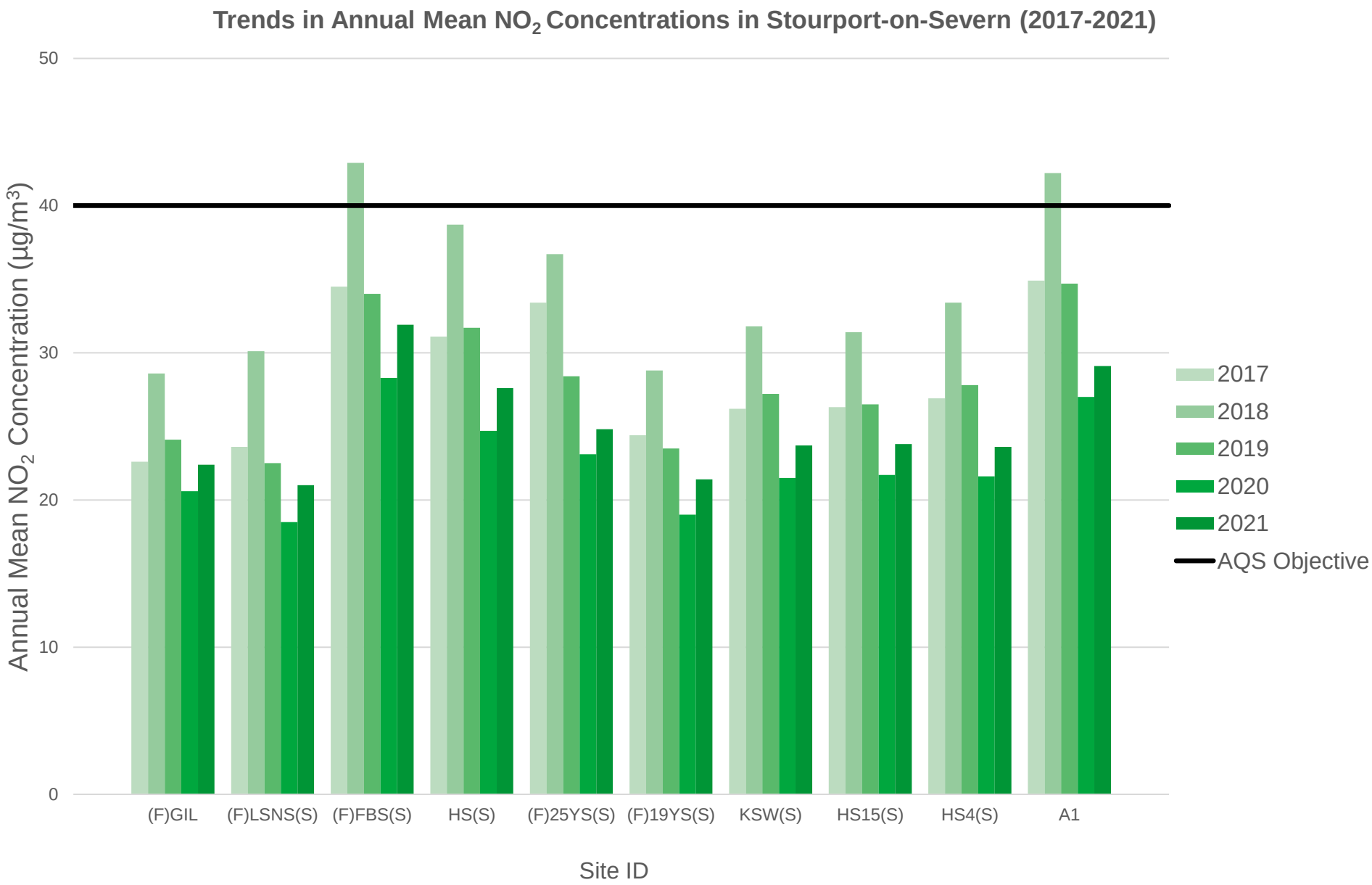
(2) Data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

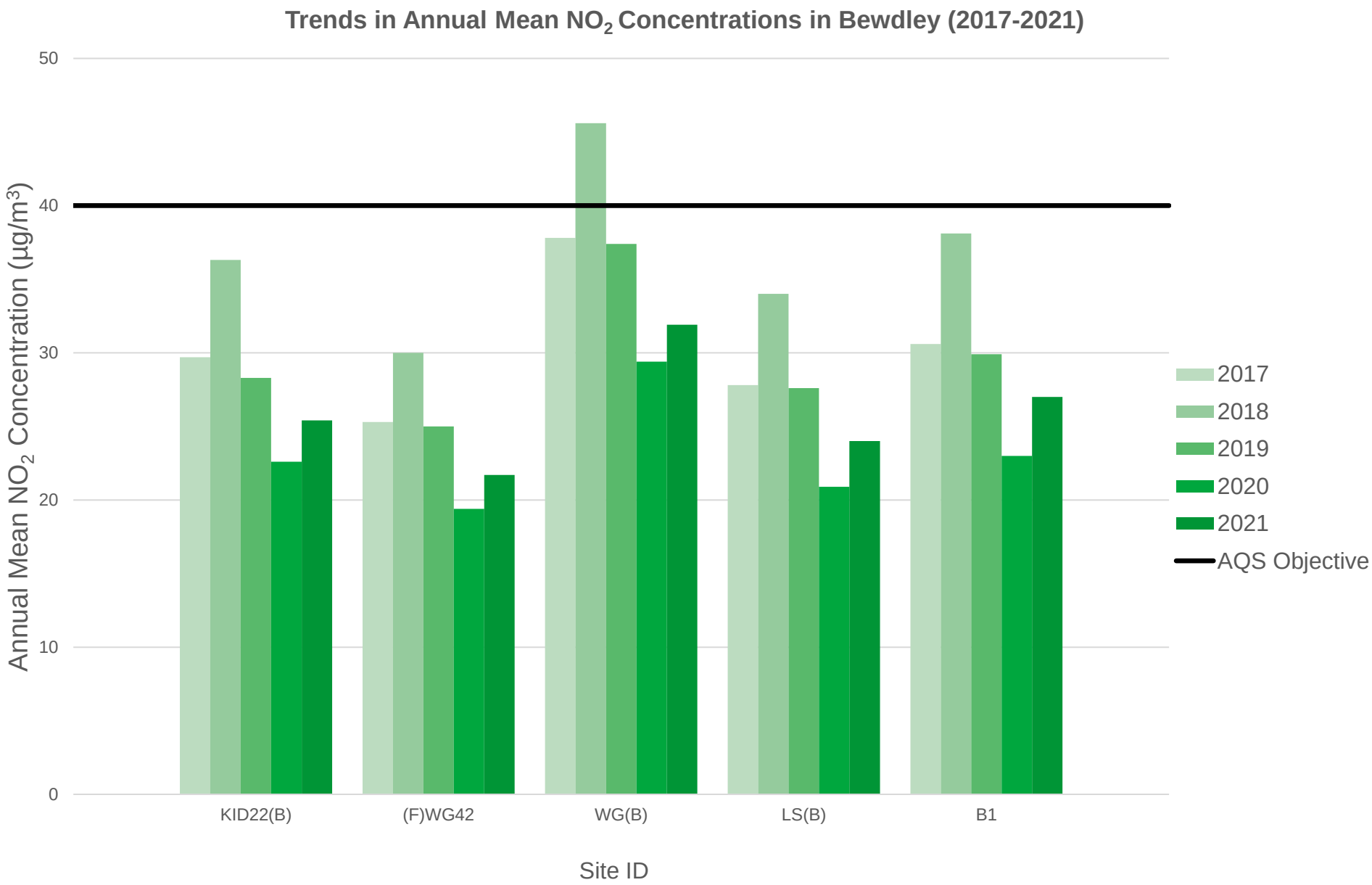
Figure A.1 – Trends in Annual Mean NO_2 Concentrations


Trends in Annual Mean NO2 Concentrations in Wyre Forest District (2017-2021)
Annual Mean NO2 Concentration (µg/m3)
70
60
50
40
30
20
10
0
HLR1
SR113
(F) 69COV
(F)SGC
K1
21HF
HF(K)
HF(K) (F)
K4
SBR121
334CRN
294CRN
383CRN
239CRN
CSLOC
K3
K2
CAS1
CR1
CR2
(F)COM…
CRS1
TCH
PL2
CR3
470CRN
SP(K)
50CRS
100CRS
(F)447S
SR(K)
SPR2
SRLEC
BH166
(F)BR(K)
HAB203
(F)GIL
(F)LSNS(S)
(F)FBS(S)
HS(S)
(F)25YS(S)
(F)19YS(S)
KSW(S)
HS15(S)
HS4(S)
A1
KID22(B)
(F)WG42
WG(B)
LS(B)
B1
WFH1,…
Site ID
2017
2018
2019
2020
2021
AQS Objective


Trends in Annual Mean NO2 Concentrations in Kidderminster (excluding AQMAs) (2017-2021)
Annual Mean NO2 Concentration (µg/m3)
50
40
30
20
10
0
HLR1
SR113
SBR121
334CRN
294CRN
383CRN
239CRN
CSLOC
CAS1
CR1
CR2
(F)COMR(K)
CRS1
TCH
PL2
CR3
470CRN
SP(K)
50CRS
100CRS
(F)447S
SR(K)
SPR2
SRLEC
BH166
(F)BR(K)
HAB203
Site ID
2017
2018
2019
2020
2021
AQS Objective


Trends in Annual Mean NO2 Concentrations in Horsefair/Coventry Street AQMA (2017-2021)
Annual Mean NO2 Concentration (µg/m3)
70
60
50
40
30
20
10
0
(F) 69COV
(F)SGC
K1
21HF
HF(K)
HF(K) (F)
K4
K3
K2
Site ID
2017
2018
2019
2020
2021
AQS Objective


Trends in Annual Mean NO2 Concentrations in Stourport-on-Severn (2017-2021)
Annual Mean NO2 Concentration (µg/m3)
50
40
30
20
10
0
(F)GIL
(F)LSNS(S)
(F)FBS(S)
HS(S)
(F)25YS(S)
(F)19YS(S)
KSW(S)
HS15(S)
HS4(S)
A1
Site ID
2017
2018
2019
2020
2021
AQS Objective


Trends in Annual Mean NO2 Concentrations in Bewdley (2017-2021)
Annual Mean NO2 Concentration (µg/m3)
50
40
30
20
10
0
KID22(B)
(F)WG42
WG(B)
LS(B)
B1
Site ID
2017
2018
2019
2020
2021
AQS Objective

Appendix B: Full Monthly Diffusion Tube Results for 2021

Table B.1 – NO_2 2021 Diffusion Tube Results ($\mu g/m^3$)

DT ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Easting)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Annualised and Bias Adjusted (0.84)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
HLR1	382136	274589	26.5	23.6	15.6	21.5	16.9	15.5	28.2	16.1	21.8	17.2	19.4	19.3	20.1	16.9		
SR113	382342	275054	41.0	-	31.6	34.5	28.9	28.5	-	29.9	36.2	34.0	37.9	29.7	33.2	27.9		
(F) 69COV	383552	276870	42.4	42.1	38.0	45.4	45.1	40.3	42.3	36.8	46.3	46.4	43.0	33.8	41.8	35.1		
(F)SGC	383475	276760	-	30.9	-	30.4	26.7	24.8	26.9	-	-	-	-	27.6	27.9	24.8		
K1	383391	277086	28.9	23.8	21.1	17.7	16.1	13.7	15.3	15.2	20.7	22.9	26.8	19.1	20.1	16.9		
21HF	383338	277215	35.6	29.6	28.0	28.8	24.5	23.8	25.2	22.8	27.2	29.4	33.5	27.1	28.0	23.5		
HF(K)	383311	277087	37.5	30.1	28.7	28.4	25.8	24.7	26.0	25.8	28.1	32.0	35.3	26.4	29.1	24.4		
HF(K) (F)	383304	277071	39.9	29.8	29.0	31.3	29.7	27.1	27.2	27.7	31.9	34.9	34.8	26.4	30.8	25.9		
K4	383337	276998	31.4	23.1	20.0	17.7	18.0	15.6	16.9	17.3	23.8	23.8	29.8	22.9	21.7	18.2		
SBR121	383905	277857	38.3	31.3	28.2	33.1	28.8	25.5	27.7	27.6	32.8	30.6	36.0	28.9	30.7	25.8		
334CRN	383965	277823	39.2	38.5	32.3	39.2	33.9	32.3	33.2	31.6	37.4	34.7	36.5	30.2	34.9	29.3		
294CRN	384054	277444	30.6	25.7	22.8	20.0	16.8	15.8	15.6	16.9	21.4	23.3	26.4	21.5	21.4	18.0		
383CRN	384175	277275	27.7	24.7	18.1	20.0	16.2	14.4	14.8	14.0	20.6	21.1	22.2	20.5	19.5	16.4		
239CRN	384221	276911	28.8	23.2	19.3	19.4	16.5	14.8	15.6	15.2	20.9	23.8	25.5	20.4	20.3	17.0		
CSLOC	384205	277121	36.2	28.9	30.3	26.5	25.5	25.0	22.8	24.8	28.4	33.9	35.8	27.5	28.8	24.2		
K3	383726	276909	37.5	34.1	28.8	37.2	33.4	22.4	31.1	29.8	36.2	32.8	37.3	29.9	32.5	27.3		
K2	383657	276890	28.3	26.3	20.6	22.4	16.6	15.0	16.3	17.1	14.3	-	25.1	21.1	20.3	17.0		
CAS1	383636	276377	45.7	38.9	32.9	32.3	38.6	30.5	29.6	32.9	-	33.0	39.4	-	35.4	29.7		
CR1	383696	276388	36.4	31.6	28.8	40.3	29.0	27.6	30.4	28.2	33.7	23.7	33.0	-	31.2	26.2		
CR2	383890	276333	35.6	31.7	31.4	41.3	29.4	28.1	27.7	30.8	33.2	26.8	34.0	26.7	31.4	26.4		
(F)COMR(K)	384214	276242	37.3	34.6	30.0	38.0	33.4	25.1	28.8	27.4	39.8	26.4	37.7	31.6	32.5	27.3		
CRS1	384129	276263	31.8	27.0	28.0	32.2	25.9	21.7	23.1	23.1	27.6	18.6	29.2	23.6	26.0	21.8		
TCH	384086	276228	40.5	36.1	39.7	43.8	30.5	35.4	36.7	35.4	40.7	38.2	46.4	31.7	37.9	31.9		
PL2	384065	276196	23.4	19.3	16.2	18.4	13.2	12.3	12.4	14.4	16.1	16.1	19.5	14.9	16.3	13.7		
CR3	384069	276304	27.4	24.7	22.8	25.9	20.5	17.1	18.8	17.8	24.3	-	34.6	20.4	23.1	19.4		
470CRN	384154	276340	36.2	33.3	26.9	30.3	32.1	20.4	23.2	26.1	33.5	31.0	26.5	31.0	29.2	24.5		
SP(K)	384486	274596	18.4	15.5	11.9	11.8	8.3	7.5	7.7	7.8	11.2	10.5	15.1	12.4	11.5	9.7		
50CRS	383699	275251	22.3	19.6	16.1	16.0	13.2	12.1	11.8	12.6	16.5	16.2	19.8	16.6	16.1	13.5		

DT ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Easting)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Annualised and Bias Adjusted (0.84)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
100CRS	383766	275723	22.2	17.3	14.9	15.2	12.0	10.4	11.0	11.2	-	14.6	20.6	15.8	15.0	12.6		
(F)447S	382447	275506	29.4	25.2	23.1	25.3	21.3	20.0	20.9	19.6	23.2	22.2	26.7	23.0	23.3	19.6		
SR(K)	382429	275315	47.6	47.9	-	46.8	36.1	33.2	35.0	31.8	38.9	36.9	44.2	32.4	39.1	32.9		
SPR2	382496	275417	34.2	35.3	28.5	28.3	26.1	21.9	26.0	26.0	34.3	30.1	32.0	27.6	29.2	24.5		
SRLEC	382183	276388	38.5	16.7	33.7	32.2	26.8	26.0	25.9	28.5	34.9	32.7	32.9	28.7	29.8	25.0		
BH166	382135	276409	30.9	30.9	22.6	27.4	23.5	22.9	21.1	22.6	29.2	26.2	25.1	25.5	25.7	21.6		
(F)BR(K)	382437	276542	32.6	29.0	24.3	27.1	24.5	21.8	23.9	22.1	30.4	30.3	25.6	26.8	26.5	22.3		
HAB203	381713	278069	28.1	27.3	23.7	26.1	26.1	22.1	22.9	20.3	29.7	26.6	33.3	26.7	26.1	21.9		
(F)GIL	381482	271534	35.4	28.4	20.6	26.1	23.2	-	21.0	23.5	-	25.8	36.3	26.9	26.7	22.4		
(F)LSNS(S)	380957	271284	30.4	28.3	22.7	27.6	24.7	23.5	21.6	25.6	24.2	21.9	25.3	23.5	25.0	21.0		
(F)FBS(S)	380933	271247	43.5	34.7	41.0	41.7	36.9	33.8	38.9	41.0	30.3	34.4	44.1	35.5	38.0	31.9		
HS(S)	380974	271268	35.5	36.5	31.8	-	35.6	29.8	29.5	27.8	36.1	31.0	34.3	33.4	32.8	27.6		
(F)25YS(S)	380990	271268	33.6	31.5	28.6	31.0	29.2	25.6	27.3	24.8	28.0	27.9	35.0	32.1	29.5	24.8		
(F)19YS(S)	381086	271268	31.6	27.2	27.4	27.6	23.3	22.5	22.3	23.1	26.8	21.6	28.6	24.3	25.5	21.4		
KSW(S)	381072	271347	33.3	33.3	27.7	30.2	26.6	22.8	25.0	27.1	27.8	27.5	28.0	30.0	28.3	23.7		
HS15(S)	381114	271380	36.0	30.7	29.1	31.2	24.2	21.8	26.0	25.5	33.1	26.2	28.6	27.9	28.3	23.8		
HS4(S)	381169	271420	34.6	31.9	28.2	27.6	-	21.8	24.9	23.9	27.5	28.6	30.5	29.3	28.1	23.6		
A1	380989	271298	39.4	31.5	-	39.5	31.6	28.8	35.4	36.0	33.4	31.1	42.4	31.8	34.6	29.1		
KID22(B)	373996	275464	34.3	33.2	30.6	32.0	28.3	24.7	29.5	30.2	27.1	30.1	33.4	30.0	30.3	25.4		
(F)WG42	378383	275328	34.1	27.8	26.8	21.5	23.4	19.6	23.9	23.9	25.2	25.1	30.2	28.7	25.8	21.7		
WG(B)	378465	275292	42.5	41.7	38.6	40.8	34.4	27.7	36.0	39.1	39.5	38.8	41.8	34.4	37.9	31.9		
LS(B)	378590	275302	30.5	27.7	26.5	30.0	26.2	26.9	27.1	25.8	29.3	28.0	33.8	30.5	28.5	24.0		
B1	378513	275317	36.3	32.9	30.8	33.5	30.2	25.2	30.3	29.7	34.6	31.4	36.8	33.7	32.1	27.0		
WFH1	381768	273551	19.0	18.6	13.1	16.2	11.2	10.9	10.5	11.1	7.7	5.1	15.4	14.5	-	-		Triplicate Site with WFH1, WFH2 and WFH3 - Annual data provided for WFH3 only
WFH2	381768	273551	18.5	18.0	13.0	16.3	10.1	10.4	10.6	10.6	7.6	4.9	15.0	13.6	-	-		Triplicate Site with WFH1, WFH2 and WFH3 - Annual data provided for WFH3 only
WFH3	381768	273551	20.1	17.7	13.3	15.9	9.9	10.9	10.6	10.8	7.7	4.8	15.6	13.9	12.6	10.6		Triplicate Site with WFH1, WFH2 and WFH3 - Annual data provided for WFH3 only

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

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

☒ **National bias adjustment factor.**

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

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

Notes:

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

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

See Appendix C for details on bias adjustment and annualisation.

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

New or Changed Sources Identified Within Wyre Forest District Council During 2021

There are two major residential developments proposed on the eastern side of Kidderminster which may have an impact on air quality in the future. The Lea Castle, Cookley development for up to 600 dwellings, employment and retail use has been given planning permission and the second for a mixed use, residential led development with up to 1400 dwellings on land between the A456 Birmingham Road and A448 Comberton Road is pending a decision. A second planning application for an additional 800 dwellings has been received in 2022 for the Lea Castle development. The second development is still pending a decision.

Additional Air Quality Works Undertaken by Wyre Forest District Council During 2021

Wyre Forest District Council carried out a detailed review[18] (see Appendix F for full document) of Nitrogen Dioxide concentrations at the junction of Comberton Road (A448), Chester Road North (A449) and Chester Road South (A449), Kidderminster. This detailed review was undertaken to determine whether the declaration of an Air Quality Management Area (AQMA) is required and to determine the geographical extent of any predicted exceedances at relevant receptors. Long term monitoring results showed that measured annual mean nitrogen dioxide concentrations were exceeding the 40µg/m^3 annual mean air quality objective at diffusion tube location TCH (Top of Comberton Road near the corner with Chester Road South) in 2018, when measured levels are calculated back to relevant exposure (facade of nearest residential property). Conservative assumptions within the Model of vehicle speed and emissions have not been able to

[18] Worcestershire Regulatory Services, Junction of Comberton Road, Chester Road North and Chester Road South, Kidderminster Dispersion Modelling Assessment, 2021

account for the measured NO_2 values at location TCH. There was uncertainty surrounding why NO_2 concentrations are so high at this location, the location of the tube and surrounding microclimate may be having an impact upon the measured results.

The modelled results, including location TCH, showed that there are no NO_2 concentrations within 10% (36µg/m^3) of the annual objective at any of the modelled receptor facades. Monitoring and modelling nitrogen dioxide results at relevant exposure did not exceed 60µg/m^3 as an annual mean concentration. Therefore exceedances of the nitrogen dioxide 1-hour objective were determined to be unlikely.

The modelled results showed that the air quality in the vicinity of the junction of Comberton Road, Chester Road North and Chester Road South is not exceeding the 40µg/m^3 annual mean air quality objective; **therefore it does not meet the threshold for an Air Quality Management Area (AQMA) to be declared.**

There are a number of large residential/commercial developments either approved or proposed for the eastern side of Kidderminster which may impact air quality in the vicinity of the junction in future years. The diffusion tube network was expanded in Chester Road North and Chester Road South in 2019 and 2020 to take this into account.

It is recommended that Wyre Forest District Council continue to keep a watching brief on the area and to carry out a further assessment of the area should the air quality deteriorate once the approved and proposed developments are operational.

QA/QC of Diffusion Tube Monitoring

The following UKAS accredited company provided Wyre Forest District Council with nitrogen dioxide diffusion tubes and analysis in 2021:

Gradko International Limited
St. Martins House
77 Wales Street
Winchester
SO23 0RH
diffusion@gradko.com

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

Gradko International Limited participate in the AIR NO_2 Proficiency Testing Scheme (AIR-PT).

All monitoring undertaken has been completed in accordance with the 2021 Diffusion Tube Monitoring Calendar, i.e. on or within ± 2 days of the specified date.

Diffusion Tube Annualisation

Annualisation was required for one station in the Wyre Forest District Council area ((F)SGC) as recorded data capture was <75% during 2021. Data from three AURN monitoring sites; Leamington Spa, Leominster and Birmingham Ladywood, was used to provide location specific diffusion tube average annualisation factors to apply to the raw data annual mean, giving an annualised annual mean for each location. Details on annualisation methodology is presented in Table C.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.TG16 provides guidance with regard to the application of a bias adjustment factor to correct diffusion tube monitoring. Triplicate co-location studies can be used to determine a local bias factor based on the comparison of diffusion tube results with data taken from NO_x/NO_2 continuous analysers. Alternatively, the national database of diffusion tube co-location surveys provides bias factors for the relevant laboratory and preparation method.

Wyre Forest District Council have applied a national bias adjustment factor of 0.84 to the 2021 monitoring data. A summary of bias adjustment factors used by Wyre Forest District Council over the past five years is presented in Table C.1. WRS has determined the appropriate national bias adjustment factor using Version 03/22 of the Defra published National Diffusion Tube Bias Adjustment Spreadsheet using 32 Gradko studies for the relevant diffusion tubes (20% TEA in water) for 2021.

Table C.1 – Bias Adjustment Factor

Monitoring Year	Local or National	If National, Version of National Spreadsheet	Adjustment Factor
2021	National	03/21	0.84
2020	National	03/21	0.81
2019	National	03/20	0.78
2018	National	03/19	0.89
2017	National	09/18	0.77

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.

No diffusion tube NO_2 monitoring locations within Wyre Forest District Council required distance correction during 2021.

QA/QC of Automatic Monitoring

Data management of the automatic monitor at Kidderminster Stourport Road (WFH) is undertaken by Air Quality Data Management (AQDM) on behalf of Worcestershire Regulatory Services. Local Site Operator (LSO) duties are carried out by Richard Williams, Principle Officer at Worcestershire Regulatory Services. Calibration is carried out monthly, audit/servicing is carried out bi-annually.

The automatic Monitoring Station at Kidderminster Stourport Road (WFH) failed between 14th March 2021 – 14th May 2021, as such no data is available for March 2021 and April 2021. Due to data capture of <90%, the bias adjustment factor determined from automatic monitoring data at location WFH was not used (the method chosen is described in Diffusion Tube Bias Adjustment Factors). However, as data capture was >75%, annualisation was not required for automatic monitoring data. The 2021 data has been fully ratified and is available on Air Quality in the United Kingdom (ukairquality.net).

Automatic Monitoring Annualisation

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

NO_2 Fall-off with Distance from the Road

No automatic NO_2 monitoring locations within Wyre Forest District Council required distance correction during 2021.

Table C.2 – Annualisation Summary (concentrations presented in µg/m^3)

Site ID	Annualisation Factor Leamington Spa	Annualisation Factor Leominster	Annualisation Factor Birmingham Ladywood	Average Annualisation Factor	Raw Data Annual Mean	Annualised Annual Mean	Comments
(F)SGC	1.1269	1.0516	0.9963	1.0583	27.9	29.5	

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

Figure D.1 – Map of Horsefair/Coventry Street AQMA and Monitoring Locations

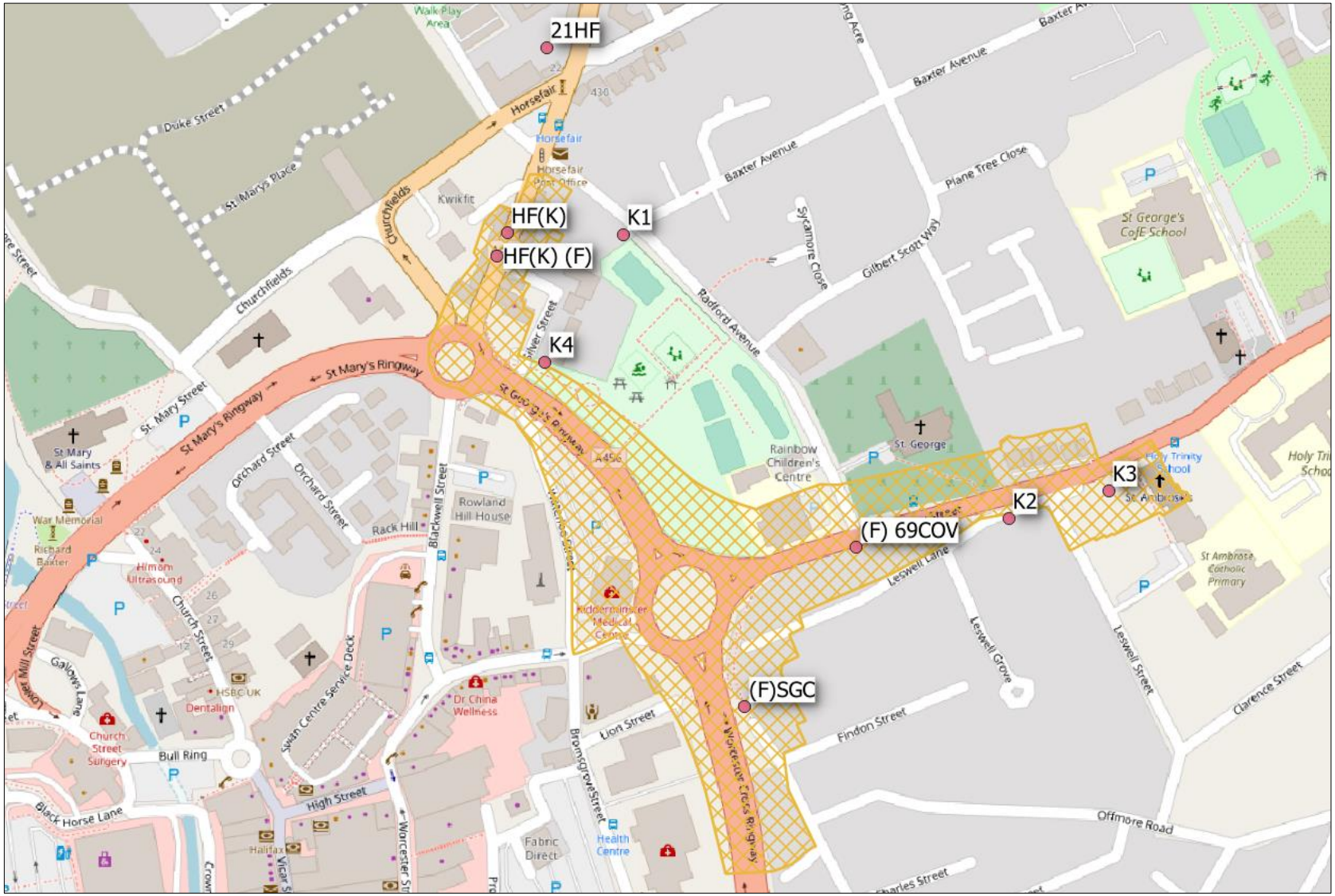


Figure D.2 Map of Welch Gate AQMA and Monitoring Locations

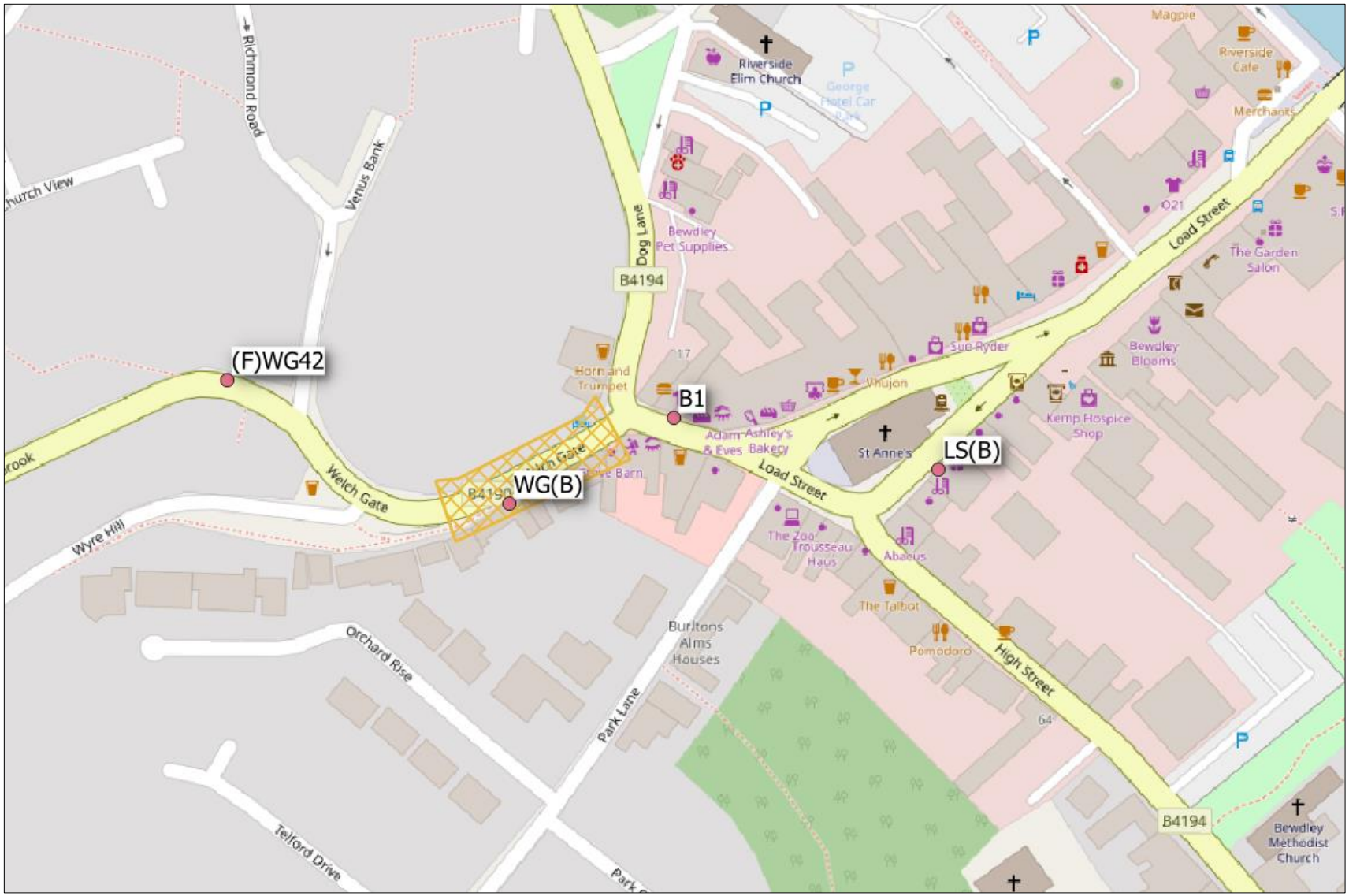


Figure D.3 – Map of Chester Road North (A449). East of Kidderminster Town Centre Monitoring Locations

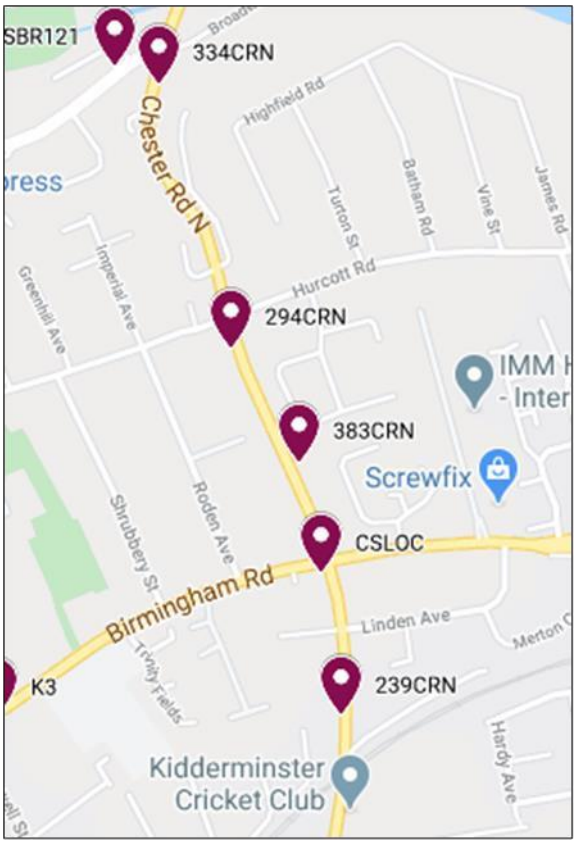


Figure D.4 – Map of Comberton Road, Comberton Hill and Chester Road North and South (A449). East of Kidderminster Town Centre Monitoring Locations

Figure D.5 - Map of Chester Road North South (A449) and Urban Background Monitoring Locations

Figure D.6 – Map of West of Kidderminster Town Centre Monitoring Locations

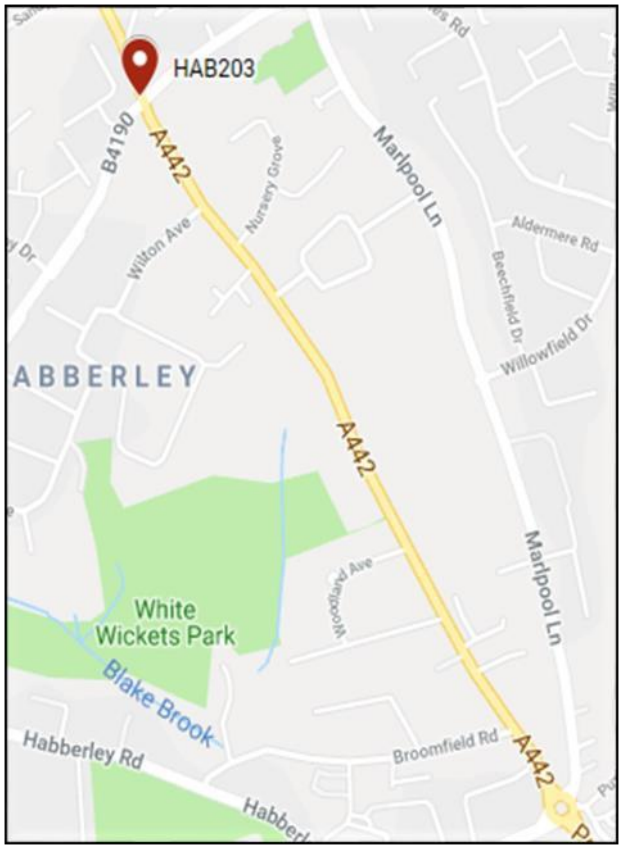


Figure D.7 Map of South of Kidderminster Town Centre Monitoring Locations

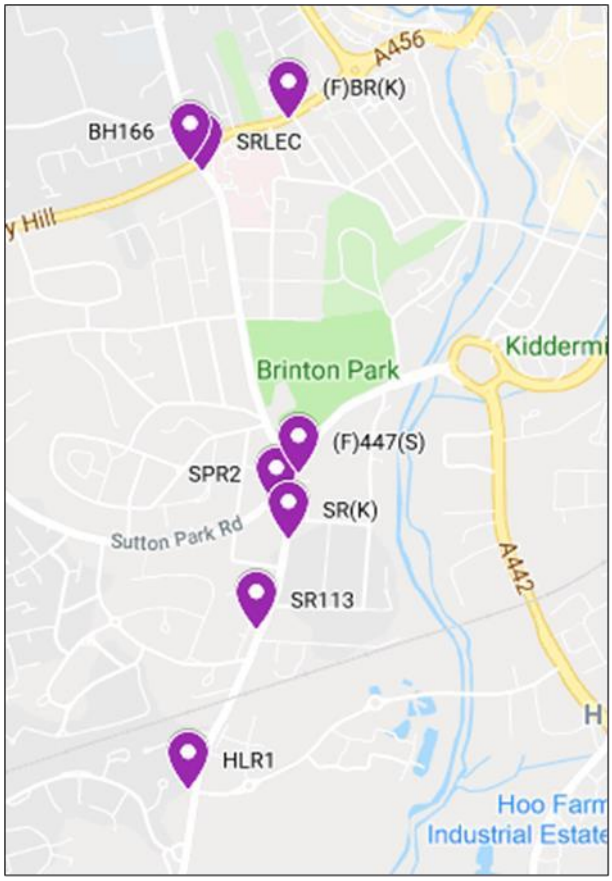
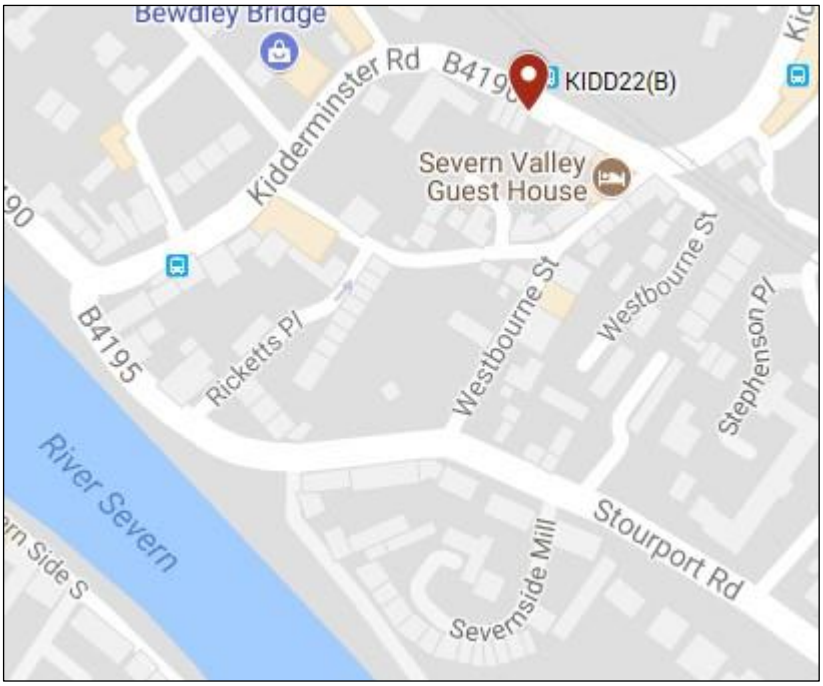


Figure D.8 – Map of Stourport-on-Severn Monitoring Locations

Figure D.9 Map of East of Bewdley Town Centre Monitoring Location



Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England[19]

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

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

Appendix F: Dispersion Modelling Assessment of Junction of Comberton Road, Chester Road North and Chester Road South, Kidderminster, 2021

Junction of Comberton Road, Chester Road North and Chester Road South, Kidderminster Dispersion Modelling Assessment 2021

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

March 2021

Local Authority Officer	Neil Kirby
Department	Land & Air Quality Team
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Report Reference number	WFDC/JUNCTIONDA/2021
Date	March 2021

Executive Summary

Previous rounds of the Wyre Forest District Council's Annual Status Reports (ASR) highlighted the need for a detailed review of Nitrogen Dioxide concentrations at the junction of Comberton Road (A448), Chester Road North (A449) and Chester Road South (A449), Kidderminster. This detailed review was undertaken to determine whether the declaration of an Air Quality Management Area (AQMA) is required and to determine the geographical extent of any predicted exceedances at relevant receptors.

This detailed review was undertaken using both measured and modelled concentrations. Levels of nitrogen dioxide in the area are measured via a network of five diffusion tubes. Modelling was undertaken using the ADMS-Roads dispersion model and verified against four of the five diffusion tube locations.

Long term monitoring results show that measured annual mean nitrogen dioxide concentrations are exceeding the 40µg/m^3 annual mean air quality objective at diffusion tube location TCH (Top of Comberton Road near the corner with Chester Road South) when measured levels are calculated back to relevant exposure (facade of nearest residential property). Conservative assumptions within the Model of vehicle speed and emissions have not been able to account for the measured NO_2 values at location TCH. There is uncertainty surrounding why NO_2 concentrations are so high at this location, the location of the tube and surrounding microclimate may be having an impact upon the measured results.

The modelled results, including location TCH, show that there are no NO_2 concentrations within 10% (36µg/m^3) of the annual objective at any of the modelled receptor facades. There was one exceedance of the annual objective at receptor 22, kerbside in front of 469 Chester Road North. At receptor 23, on the façade of 469 Chester Road North, it is below the annual objective.

Monitoring and modelling nitrogen dioxide results at relevant exposure do not exceed 60µg/m^3 as an annual mean concentration. Therefore, exceedances of the nitrogen dioxide 1-hour objective are unlikely.

The modelled results show that the air quality in the vicinity of the junction of Comberton Road, Chester Road North and Chester Road South is not exceeding the 40µg/m^3 annual mean air quality objective; therefore it does not meet the threshold for an Air Quality Management Area (AQMA) to be declared.

There are a number of large residential/commercial developments either approved or proposed for the eastern side of Kidderminster which may impact air quality in the vicinity of the junction in future years. The diffusion tube network was expanded in Chester Road North and Chester Road South in 2019 and 2020 to take this into account.

It is recommended that Wyre Forest District Council continue to keep a watching brief on the area and to carry out a further assessment of the area should the air quality deteriorate once the approved and proposed developments are operational.

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4 Introduction

The policy framework for air quality management in the UK is set out in The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Defra, 2007). The Strategy provides air quality standards and objectives for key pollutants designed to protect human health and the environment. The Strategy also sets out how local government can contribute to achieving the air quality objectives. The Local Air Quality Management (LAQM) regime is set out in the Strategy and requires every local authority to carry out regular reviews and assessments of air quality in its area to identify whether the air quality objectives have been, or will be, achieved at relevant locations by the appropriate dates. Where air quality objectives are not being met the local authority must declare an Air Quality Management Area (AQMA) and produce an action plan to identify appropriate measures that can be taken in pursuit of the objectives.

The Air Quality Strategy (Defra, 2007) sets out air quality standards and objectives for key pollutants. The standards are set as concentrations below which health effects are unlikely, or below which risks to public health would be very small (even in sensitive population groups). The air quality objectives only apply where “relevant exposure” exists, i.e. where members of the public are likely to be regularly present for the duration of the averaging time of the objective. For annual mean objectives relevant exposure is limited to residential proprieties, school and hospitals. The 1-hour objective applies to residential properties, schools and hospitals as well as any outdoor location where members of the public might reasonably be expected to stay for 1 hour or more, such as outdoor seating areas at eating establishments, parks, busy shopping streets etc. The statutory air quality objectives applicable to LAQM in England can be found in Table A.1 in Appendix A.

Technical Guidance for LAQM (LAQM.TG.16) sets out the approach for LAQM. When an exceedance of an air quality objective has been identified the local authority can take one of two approaches to declaring an AQMA; the decision can follow the “fast track option” and an AQMA can be declared immediately or the local authority can obtain further information and/or data before deciding on the declaration of an AQMA. In the case of the junction at Comberton Road, Chester Road North and Chester Road South,

Kidderminster it was decided that further assessment in the form of dispersion modelling was required in order to determine the necessary geographical extent of any AQMA.

This report provides a detailed review, following the findings of Wyre Forest District Council's ASR reports, which concluded that there was an exceedance of the annual mean nitrogen dioxide objective at a location of relevant exposure at the junction at Comberton Road, Chester Road North and Chester Road South, Kidderminster.

Background

Non-automatic monitoring (passive) of nitrogen dioxide has been undertaken at five locations in the area of the junction. Two diffusion tubes, (F)COMR(K) (Holmwood, Comberton Road) and TCH (corner of Comberton Road and Chester Road South) have been installed since 2002 and 2009 respectively. CR2 (9/10 Comberton Road), CR3 (20 Comberton Road) and 470CRN (470 Chester Road North) were installed at locations of relevant exposure in the area of the junction in 2018 to further inform the detailed review. Exceedences of the nitrogen dioxide annual mean objective have been measured at TCH between 2009 and 2018. As a result, the 2020 Annual Status Report produced for the Wyre Forest area concluded that a detailed review is required at the junction of Comberton Road, Chester Road North and Chester Road South, Kidderminster.

The model was verified against the 2018 diffusion tube results due to the 2019 diffusion tube results having a low bias adjustment factor giving results which are not indicative of the long-term trend in the area. Passive monitoring results and long-term trend data are reproduced in Appendix B.

Section 1.25 of LAQM.TG(16) provides local authorities with the option of fast-tracking declaration of an AQMA where annual monitoring and local intelligence shows a persistent exceedance. In the case of the junction at Comberton Road, Chester Road North and Chester Road South, Kidderminster it was decided that further assessment in the form of dispersion modelling was required in order to determine the necessary geographical extent of any AQMA.

This report provides a detailed review of nitrogen dioxide levels at the junction of Comberton Road, Chester Road North and Chester Road South, Kidderminster. The review has been undertaken for the twelve month period January 2018 to December 2018.

The aim of this review is to confirm if the annual mean objective for nitrogen dioxide is being exceeded at locations with relevant exposure and determine the geographical extent of any required AQMA. The study area is shown in Figure 1 and extends along Comberton Road (A448) and Chester Road North (A449) and Chester Road South (A449). The study area has been defined in this way because it encompasses both the junction of the A448 and A449 where monitoring indicates exceedences of the annual mean objective for nitrogen dioxide exist and because the area represents relevant exposure, i.e. residential properties adjacent to the A448 and A449.

Figure 1: Indicative Study Area Location Plan

5 Assessment Methodology

2.1 Monitoring

The detailed review has been undertaken using passive diffusion tubes and detailed dispersion modelling for the 12 month period January 2018 – December 2018.

Wyre Forest District Council undertook non- automatic (passive) monitoring of NO_2 using diffusion tubes at five locations within the study area in 2018. The location of these monitoring sites is shown in Figure 2.

Diffusion tubes are prepared and analysed by Somerset Scientific Services using the 20% Triethanolamine (TEA)/deionised water preparation method. It is necessary to adjust diffusion tube data to account for laboratory bias; the bias-adjustment factor for 2018 has been calculated using data from national bias adjustment factors published bi-annually by Defra.

Results, supporting technical information and QA/QC details relating to non-automatic monitoring sites and results can be found in Appendix B.

Figure 2: Diffusion Tube Location Plan

2.2 Modelling

Annual nitrogen dioxide (NO_2) concentrations in 2018 have been predicted within the study area using ADMS-Roads 'Extra' v4.1.1.0. NO_2 concentrations have been predicted for a selection of receptors where relevant exposure exists. The location of the modelled receptor sensitive locations is shown in Figure 3.

Figure 3: Modelled Sensitive Receptor Locations

Full details of model input parameters, model verification, model outputs and modelled receptor points can be found in Appendix C.

2.3 Uncertainty

There is an element of uncertainty in all measured and modelled data. All values presented in this report are the best possible estimates implementing approved methods of investigation; however, uncertainties in the results may cause over-predictions or under-predictions. Full details of monitoring and model uncertainty and error can be found in Appendix C.

3 Results

3.1 Monitoring

Diffusion tube monitoring of nitrogen dioxide was carried out at five locations within the study area in 2018. The results of diffusion tube monitoring are presented in Table 1

Results confirm that measured annual mean nitrogen dioxide concentrations are exceeding the objective at TCH - Top of Comberton Road near the corner with Chester Road South when measured levels are calculated back to relevant exposure (facade of nearest residential property).

Long-term trend data for diffusion tube monitoring in the area between 2013 and 2018 is presented in Appendix B.

Table 1: Annual mean NO_2 concentrations measured at diffusion tube locations

Site	Description	2018[a]	2018[ab]
CR2	9/10 Comberton Road (façade)	35.79	
(F)COMR(K)	Holmwood, Comberton Road (lamppost)	32.21	23.6
TCH	Top of Comberton Road near corner with Chester Road South (lamppost)	**48.77**	**45.3**
CR3	20 Comberton Road (façade)	23.56	
470CRN	470 Chester Road North ((façade)	33.96	
Objective		**40**	

[a] bias-adjusted using 2018 factor 0.89
[b] calculated back to relevant exposure in accordance with DEFRA TG16

3.2 Modelling

Modelled annual mean nitrogen dioxide concentrations in 2018 have been calculated at relevant exposure level each of the receptors shown in Figure 3. The results are set out in Table 2.

Table 2: Modelled Annual Mean NO_2 Concentrations at Receptors

Receptor ID	X(m)	Y(m)	Height (m)	Modelled NO_2 $\mu g/m^3$
CR2	383890	276333	2	32.37
(F)COMR(K)	384214	276242	2.2	34.79
TCH	384086	276228	2	29.16
CR3	384069	276304	1.9	26.75
470CRN	384154	276340	1.9	32.19
1	384090	276250	1.5	28.89
2	384094	276251	1.5	32.33
3	384096	276255	1.5	34.26
4	384094	276258	1.5	32.80
5	384089	276258	1.5	29.46
6	384085	276263	1.5	28.39
7	384079	276264	1.5	26.49
8	384071	276263	1.5	23.66
9	384050	276269	1.5	20.81
10	384029	276288	1.5	25.35
11	384034	276315	1.5	21.97
12	384054	276310	1.5	23.61
13	384068	276307	1.5	25.52
14	384090	276300	1.5	31.41
15	384101	276296	1.5	35.71
16	384106	276299	1.5	35.72
17	384107	276308	1.5	30.86
18	384113	276318	1.5	28.63
19	384115	276330	1.5	25.10
20	384121	276338	1.5	25.22
21	384127	276349	1.5	24.22
22	384150	276343	1.5	**41.92**
23	384154	276342	1.5	32.57
24	384151	276333	1.5	34.81

Receptor ID	X(m)	Y(m)	Height (m)	Modelled NO_2 $\mu g/m^3$
25	384148	276322	1.5	35.40
26	384151	276308	1.5	29.05
27	384146	276296	1.5	31.21
28	384149	276284	1.5	30.50
29	384159	276280	1.5	27.39
30	384171	276274	1.5	25.97
31	384207	276259	1.5	23.14
32	384167	276232	1.5	21.39
33	384156	276239	1.5	23.28
34	384147	276235	1.5	21.66
35	384138	276220	1.5	19.09
36	384114	276212	1.5	20.60
37	384183	276211	1.5	17.24
38	384170	276203	1.5	16.25
39	384235	276247	1.5	22.30
40	384086	276247	1.5	26.70
41	384089	276239	1.5	29.07
42	384085	276236	1.5	26.96
43	384077	276228	1.5	22.81
44	384073	276220	1.5	21.16

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

In addition to specified receptors, the model has been used to predict concentrations on a regular grid across the modelled area. The modelled area extends over a 620m x 360m area centred upon the junction of A448 and A449 to allow concentration contours (isopleths) to be plotted on OS base mapping. The isopleth is shown as Figure 4. The modelled grid height is set at 1.5m, equivalent to the average receptor height exposure. No street canyon effects have been considered within the model.

Modelling results calculated one exceedance of the 40µg/m^3 annual mean objective at receptor 22, kerbside in front of 469 Chester Road North. At receptor 23, at the façade of 469 Chester Road North, it is below the annual objective. There are no concentrations within 10% (36µg/m^3) of the air quality objective at any of the modelled receptor facades. Figure 4 below shows an Isopleth of the 36µg/m^3 and 40µg/m^3 contours for the whole of the modelled area. No exceedances of 60µg/m^3 have been calculated at any locations with relevant exposure; therefore, exceedances of the 1-hour objective are unlikely.

Figure 4: Isopleth Contours at 1.5m (whole model area)

4 Conclusions and Recommendations

A detailed review has been carried out for the junction of Comberton Road, Chester Road North and Chester Road South, Kidderminster. The area was identified as exceeding the annual mean objective in Wyre Forest District Council's ASRs. The review was carried out to confirm whether an AQMA declaration is required and to inform the decision making process in regard to the necessary geographical extent of any AQMA.

Long term monitoring results show that measured annual mean nitrogen dioxide concentrations are exceeding the 40µg/m^3 annual mean air quality objective at diffusion tube location TCH (Top of Comberton Road near the corner with Chester Road South) when measured levels are calculated back to relevant exposure (facade of nearest residential property).

There was concern about the validity of data provided by tube location TCH as NO_2 values at this site are particularly high when compared to other NOx tubes located around the road junction. There is uncertainty surrounding why NO_2 values are so high at this location, the location of the tube and surrounding microclimate may be having an impact upon the measured results.

Sensitivity analysis has been carried out changing road link lengths and average vehicle speeds to account for the observed values at TCH. Ultimately the best scenario that validates with 4 out of the 5 diffusion tubes has been presented within this report. The error in the model is too great when measured values from TCH are included within the model adjustment process. As such measured values from TCH have been disregarded to provide a best fit model that validates with 4 out of the 5 tubes in operation.

The long term trend graphs show that when the two years of low bias adjustment factors are included with the annual results (2017 & 2019) there is a decline in NO_2 concentrations at (F)COMR(K) and TCH between 2013 and 2019. When these are excluded there is a decline in concentrations at (F)COMR(K) and no change at TCH.

The modelled results, including location TCH, show that there are no NO_2 concentrations within 10% (36µg/m^3) of the annual objective at any of the modelled receptor facades.

There was one exceedance of the annual objective at receptor 22, kerbside in front of 469 Chester Road North. At receptor 23, at the façade of 469 Chester Road North, it is below the annual objective.

Monitoring and modelling nitrogen dioxide results at relevant exposure do not exceed 60µg/m^3 as an annual mean concentration. Therefore, exceedances of the nitrogen dioxide 1-hour objective are unlikely.

The modelled results show that the air quality in the vicinity of the junction of Comberton Road, Chester Road North and Chester Road South is not exceeding the 40µg/m^3 annual mean air quality objective; therefore it does not meet the threshold for an Air Quality Management Area (AQMA) to be declared.

There are a number of large residential/commercial developments either approved or proposed for the eastern side of Kidderminster which may impact air quality in the vicinity of the junction in future years. The diffusion tube network was expanded in Chester Road North and Chester Road South in 2019 and 2020 to take this into account.

It is recommended that Wyre Forest District Council continue to keep a watching brief on the area and to carry out a further assessment should the air quality deteriorate once the approved and proposed developments are operational.

1. References

1. DEFRA (2016) NO_2 Fall-Off with Distance Calculator v4.1
2. DEFRA (2020) Emissions Factor Toolkit v10.0
3. DEFRA (2018) Background Mapping for Local Authorities
4. DEFRA (2016) 'Local Air Quality Management Policy Guidance LAQM PG.(16)'
5. DEFRA (2016) 'Local Air Quality Management Technical Guidance LAQM TG.(16)'
6. DEFRA (2019) 'National Diffusion Tube Bias Adjustment Factor Spreadsheet v.03/19 '
7. DEFRA (2020) NOx to NO2 Conversion Spreadsheet v8.1
8. Worcestershire Regulatory Services (2013) 'Air Quality Action Plan for Worcestershire'
9. Worcestershire Regulatory Services (2015) 'Air Quality Action Plan Progress Report for Worcestershire April 2013-April 2015'
10. Worcestershire Regulatory Services (2016) 'Air Quality Action Plan Progress Report for Worcestershire April 2015 – March 2016'
11. Worcestershire Regulatory Services (2019) 'Air Quality Annual Status Report (ASR)'

Technical Appendices

Appendix A: Summary of Statutory Air Quality Objectives in England

A.1 – Air Quality Objectives in England

Pollutant	Air Quality Objective[20]	
	Concentration	Measured as
Nitrogen Dioxide (NO_2)	200µg/m^3 not to be exceeded more than 18 times a year	1-hour mean
	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
	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
	125µg/m^3, not to be exceeded more than 3 times a year	24-hour mean
	266µg/m^3, not to be exceeded more than 35 times a year	15-minute mean

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

Appendix B: Diffusion Tube Monitoring

B.1 – Details of Non-Automatic Monitoring Sites

Site ID	Site Description	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA ?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
CR2	9/10 Comberton Road (façade)	Roadside	383890	276333	NO_2	NO	0m	3.4m	NO	2m
(F)COMR (K)	Holmwood, Comberton Road (lamppost)	Roadside	384214	276242	NO_2	NO	13.5m	3.5m	NO	2.18m
TCH	Top of Comberton Rd near corner with Chester Rd South (lamppost)	Roadside	384086	276228	NO_2	NO	1m	2m	NO	2m
CR3	20 Comberton Road (façade)	Roadside	384069	276304	NO_2	NO	0m	13.1m	NO	1.9m
470CRN	470 Chester Road North ((façade)	Roadside	384154	276340	NO_2	NO	0m	4.9m	NO	1.9m

B.2 – Annual Mean NO_2 Non-Automatic Monitoring Results 2013 – 2019

Site ID	Site Type	Monitoring Type	NO_2 Annual Mean Concentration ($\mu g/m^3$)[(a)]						
			2013 (0.98)	2014 (0.89)	2015 (0.87)	2016 (0.89)	2017 (0.77)	2018 (0.89)	2019 (0.78)
(F)COMR(K)	Roadside	Diffusion Tube	**43**	38	36	36.5	31.6	32.2	29
TCH	Roadside	Diffusion Tube	**52**	**46**	**44**	**51.3**	**44**	**48.8**	38.7

Notes: Exceedances of the NO_2 annual mean objective of 40µg/m^3 are shown in **bold**.
(a) Means for diffusion tubes have been corrected for bias.

Figure B.1 shows the seven year trend (including years 2017 & 2019 with low bias adjustment factors).

Figure B.1: Annual Mean NO_2 Non-Automatic Monitoring Results 2013 – 2019

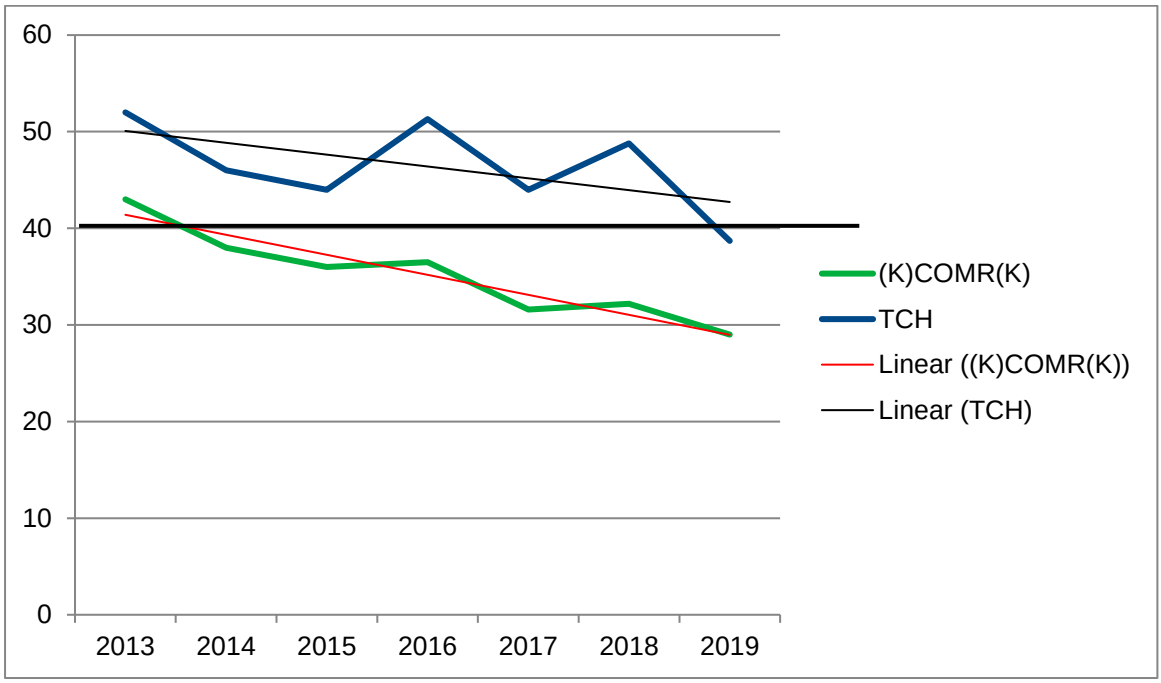
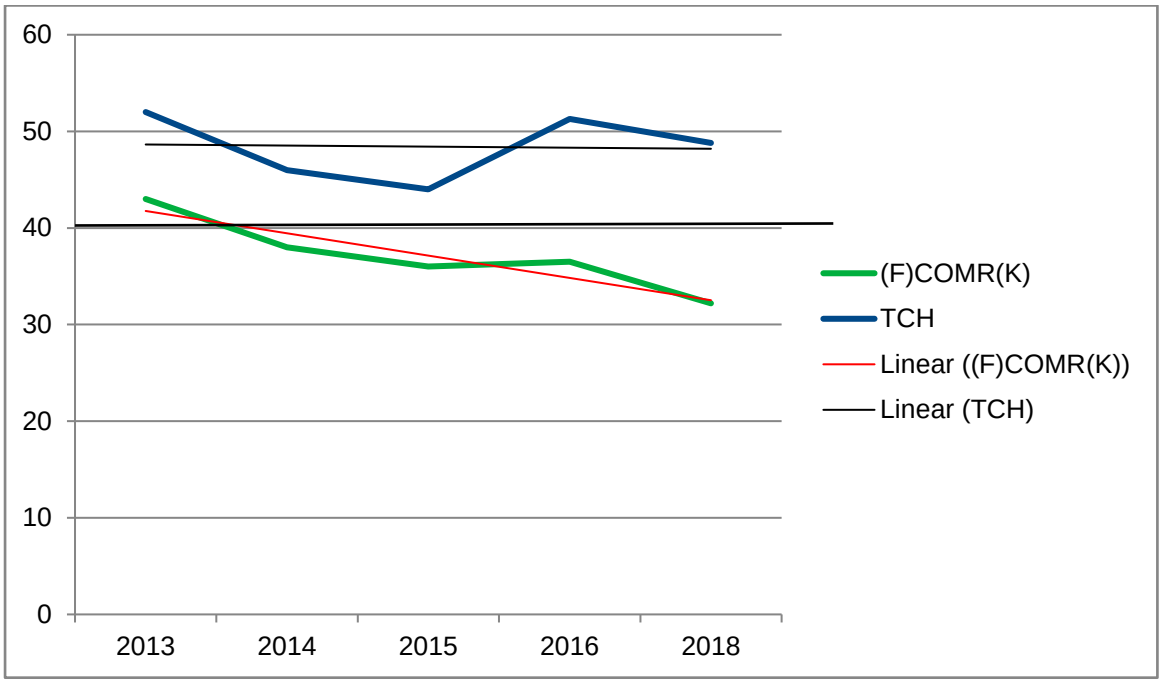


Figure B.2 shows the five year trend (excluding years 2017 & 2019 with low bias adjustment factors).

Figure B2: Annual Mean NO_2 Non-Automatic Monitoring Results 2013 – 2018



B.3 – Full NO_2 Monthly Diffusion Tube Results for 2018

Site ID	NO_2 Mean Concentrations (µg/m^3)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean		
													Raw Data	Bias Adjusted (0.89) (1)	Distance Corrected to Nearest Exposure (2)
CR2		37.07	**49.97**	39.68	**52.55**	**45.23**	38.72	33.35	36.44	**43.29**	38.20	27.89	**40.22**	35.79	
(F)COMR(K)		39.24	**45.69**	36.93	**40.40**	32.58	31.74	33.06	35.33	35.20	37.12	30.80	36.19	32.21	23.6
TCH		**62.46**	**79.22**	**53.38**	**62.82**	**48.30**	**48.62**	**43.13**	**51.63**	**58.33**	**55.34**	39.59	**54.80**	**48.77**	**45.3**
CR3		35.20	34.75	27.11	27.43	23.05	21.29	21.25	23.17	27.24	28.65	23.22	26.58	23.65	
470CRN		**44.57**	**47.68**	**42.95**	**40.30**	29.76	31.12	29.50	35.21	38.53	**44.37**	35.80	38.16	33.96	

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.**

(1) Means for diffusion tubes have been corrected for bias.

(2) Concentrations have been calculated back to relevant exposure as per Technical Guidance LAQM.TG16.

B.4 – Passive Air Quality Monitoring Data QA/QC

Diffusion Tube Bias Adjustment Factors

The following UKAS accredited company provides Wyre Forest District Council with nitrogen dioxide diffusion tubes and analysis:

Somerset Scientific Services,
Unit 2A,
Westpark 26
Chelston
Wellington
Somerset
TA21 9AD

01823 355906

sssmailbox@somerset.gov.uk

The 20% Triethanolamine (TEA) / De-ionised Water preparation method is used. The bias adjustment factor applied to the results in 2018 was 0.89 (Spreadsheet Version No. 03/19) which were derived from the national studies.

QA/QC of Automatic Monitoring

No Automatic Monitoring Data is available for 2018.

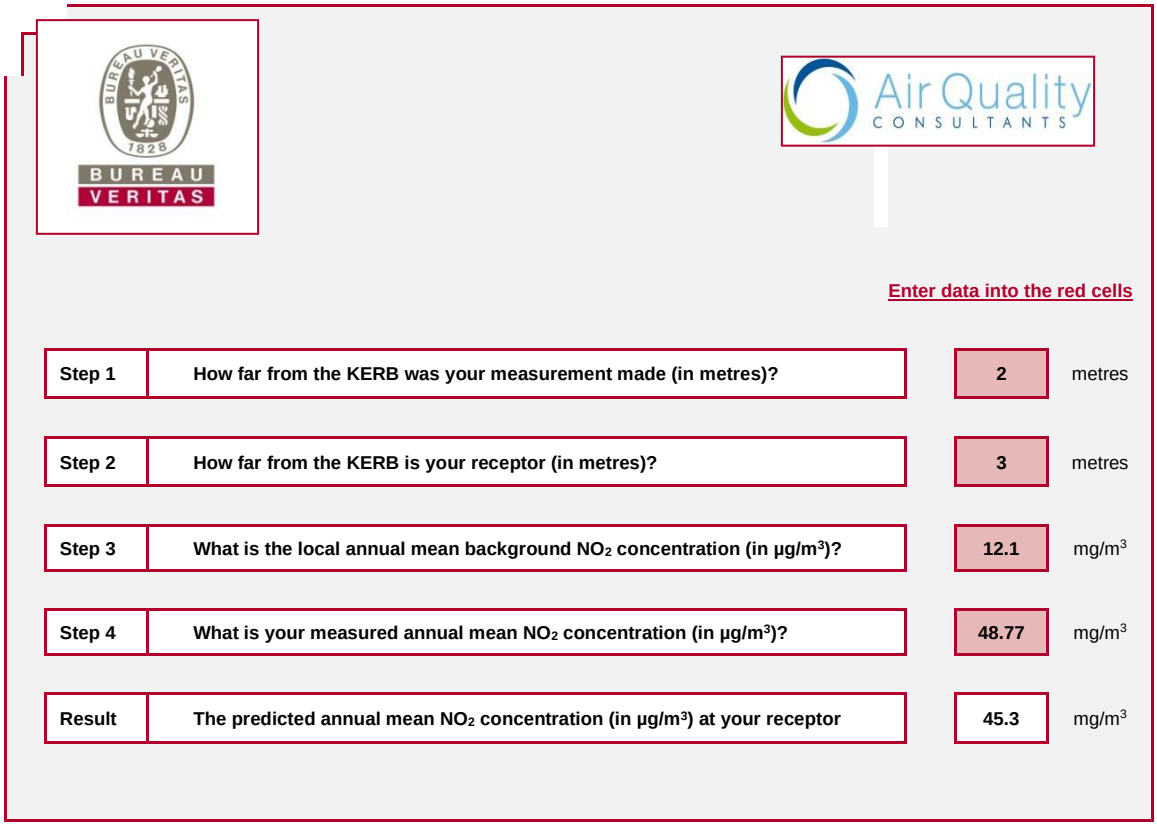
QA/QC of Diffusion Tube Monitoring

Under the AIR NO2 PT (formerly WASP) Scheme Somerset Scientific Services performed 100% satisfactory for the period January to October 2018. Tube precision was ‘Good’ throughout 2018.

B.5 - Estimates of concentrations at nearest receptor

If an exceedence (or result close to an exceedence) is measured at a monitoring site which is not representative of public exposure, the procedure specified in Technical Guidance LAQM.TG.(16) has been used to estimate the concentration at the nearest receptor where applicable.

Figure B.1 TCH – Top of Comberton Rd near corner with Chester Rd South



Appendix C: Dispersion Modelling

C.1 Model Input Parameters

The modelling exercise has been undertaken using ADMS-Roads 'Extra' v4.1.1.0. The model requires the user to provide various input data, including emissions from each section of road, and road characteristics. Vehicle emissions have been calculated based on vehicle flow, composition and speed data using Defra's Emissions Factors Toolkit (EFT) (Version 10.0) published by Defra (2020).

Road Traffic

Figure C.1 shows the road network included within the model and defines the study area. Road widths were estimated using the measuring tool in ArcGIS v10.2

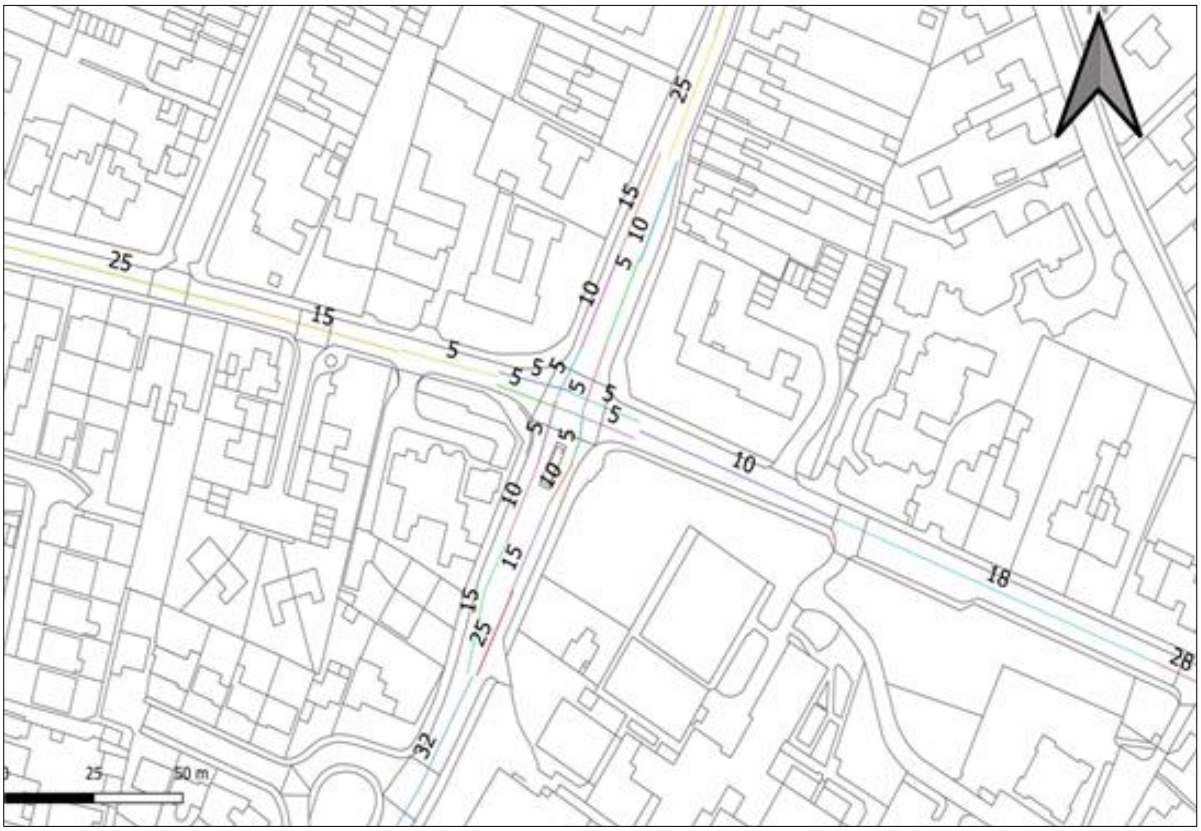
Figure C.1 - Modelled Road Links

Due to the COVID-19 Pandemic, speed surveys were unable to be conducted due to reduced traffic flows and non-representative conditions. Traffic data from Google Maps has been used to investigate average vehicle speeds with road links plotted according to average traffic speeds. A conservative value of 5km/hr has been used to account for the 4 way light change and queuing traffic at the entrance to the junction. Average speeds increase incrementally with distance from the junction (see Table C.1 and Figure C.2 below). Sensitivity testing was carried out to determine the impact of varying road link length and average speeds. The scenario below provided the best fit when validating the model. Diurnal/Peak flows have not been considered within this assessment.

Table C.1: Assumed Average Vehicle Speeds (km/hr)

Source Name	Speed	Width	Pollutant Name	All Vehicles (g/km/s)
A448_EB_JNC_1	5	4.5	NOx	0.07325
A448_EB_JNC_2	5	4.5	NOx	0.06221
A448_WB_JNC_1	5	4.5	NOx	0.08572
A448_WB_JNC_2	5	4.5	NOx	0.0982
A448_1	5	7	NOx	0.15839
A448_2	15	6.6	NOx	0.10467
A448_3	25	6.6	NOx	0.08421
A448_4	32	7.3	NOx	0.07536
A448_2.1	10	7.8	NOx	0.11784
A448_2.2	18	7.4	NOx	0.10927
A448_2.3	28	7.6	NOx	0.07362
A449_SB_JNC_1	5	7.4	NOx	0.09476
A449_SB_JNC_2	5	7.4	NOx	0.09476
A449_SB_JNC_3	10	7.4	NOx	0.07073
A449_NB_JNC_1	5	4.5	NOx	0.11213
A449_NB_JNC_2	10	4.5	NOx	0.07692
A449_NB_JNC_3	15	4.5	NOx	0.07075
A449_NB_1	25	7	NOx	0.10679
A449_NB_2	32	7	NOx	0.07998
A449_NB_JNC_2.1	5	6.4	NOx	0.09142
A449_NB_JNC_2.2	10	6.4	NOx	0.06271
A449_NB_JNC_2.3	15	6.4	NOx	0.05165
A449_SB_JNC_2.1	5	4.5	NOx	0.07434
A449_SB_JNC_2.2	10	4.5	NOx	0.05085
A449_SB_JNC_2.4	15	4.5	NOx	0.04186
A449_SB_JNC_2.5	25	4.5	NOx	0.0325
A449_SB3	32	7.3	NOx	0.0711
A449_SB4	32	7.4	NOx	0.0711

Figure C.2 – Modelled Road Links - Assumed Vehicle Speeds (km/hr)



Fleet composition and traffic flow data was obtained from a 12hr Traffic Count undertaken by Worcestershire County Council on 17th September 2019. Traffic data was provided for each of the four arms of the junction.

Tables C.2 to C.5 (below) details 12 hour and 24 hour scaled data for the four- way junction count carried out by Worcestershire County Council.

Table C.2: A448 To/From Bromsgrove Traffic Count Data – 12 hour and scaled 24 hour

Hour Commencing		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Vehicles	Scaling factor	Scaled to 24hr
Pedal Cycles	To Bromsgrove	0	4	11	1	1	0	1	0	1	0	3	3	1	0	0	0	**26**	**1.38**	**36**
	From Bromsgrove	0	4	3	1	1	1	3	0	0	1	1	1	0	0	0	0	**16**	**1.38**	**22**
	Both	0	8	14	2	2	1	4	0	1	1	4	4	1	0	0	0	**42**	**1.38**	**58**
Motor Cycles	To	0	3	0	0	1	0	2	3	5	5	4	4	5	0	0	0	**32**	**1.38**	**44**
	From	0	5	3	5	4	2	1	5	3	3	2	1	0	0	0	0	**34**	**1.38**	**47**
	Both	0	8	3	5	5	2	3	8	8	8	6	5	5	0	0	0	**66**	**1.38**	**91**
Cars	To	0	298	389	253	232	324	337	316	382	365	362	406	371	0	0	0	**4035**	**1.38**	**5568**
	From	0	318	532	377	302	370	333	336	396	441	439	508	388	0	0	0	**4740**	**1.38**	**6541**
	Both	0	616	921	630	534	694	670	652	778	806	801	914	759	0	0	0	**8775**	**1.38**	**12110**
Buses	To	0	5	3	2	5	3	4	2	3	6	3	4	3	0	0	0	**43**	**1.38**	**59**
	From	0	2	5	5	1	1	1	1	3	4	3	2	2	0	0	0	**30**	**1.38**	**41**
	Both	0	7	8	7	6	4	5	3	6	10	6	6	5	0	0	0	**73**	**1.38**	**101**
Light Goods Vehicles	To	0	26	47	26	27	30	40	45	37	36	53	30	26	0	0	0	**423**	**1.38**	**584**
	From	0	45	58	49	36	68	51	64	65	64	67	58	36	0	0	0	**661**	**1.38**	**912**
	Both	0	71	105	75	63	98	91	109	102	100	120	88	62	0	0	0	**1084**	**1.38**	**1496**
Smaller 2-Axle Lorries	To	0	7	6	9	4	3	5	4	3	3	5	2	3	0	0	0	**54**	**1.38**	**75**
	From	0	4	5	4	3	5	3	4	3	4	3	2	1	0	0	0	**41**	**1.38**	**57**
	Both	0	11	11	13	7	8	8	8	6	7	8	4	4	0	0	0	**95**	**1.38**	**131**
Bigger 2-Axle Lorries	To	0	2	4	7	3	1	4	1	1	2	2	1	0	0	0	0	**28**	**1.38**	**39**
	From	0	4	2	4	1	4	3	1	1	3	0	0	0	0	0	0	**23**	**1.38**	**32**
	Both	0	6	6	11	4	5	7	2	2	5	2	1	0	0	0	0	**51**	**1.38**	**70**
3-Axle Rigid/Artic	To	0	2	4	0	0	1	0	0	1	0	1	0	0	0	0	0	**9**	**1.38**	**12**
	From	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	**3**	**1.38**	**4**
	Both	0	3	5	0	1	1	0	0	1	0	1	0	0	0	0	0	**12**	**1.38**	**17**
4 Axles or more Rigid/Artic	To	0	0	1	2	1	0	2	3	4	0	0	0	0	0	0	0	**13**	**1.38**	**18**
	From	0	1	3	4	4	2	1	0	2	2	1	2	0	0	0	0	**22**	**1.38**	**30**
	Both	0	1	4	6	5	2	3	3	6	2	1	2	0	0	0	0	**35**	**1.38**	**48**
Totals	To Bromsgrove	0	347	465	300	274	362	395	374	437	417	433	450	409	0	0	0	**4663**	**1.38**	**6435**
	From Bromsgrove	0	384	612	449	353	453	396	411	473	522	516	574	427	0	0	0	**5570**	**1.38**	**7687**
	Both	0	731	1077	749	627	815	791	785	910	939	949	1024	836	0	0	0	**10233**	**1.38**	**14122**

Table C.3: A448 To/From Kidderminster Town Centre Traffic Count Data – 12 hour and scaled 24 hour

Hour Commencing		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Vehicles	Scaling factor	Scaled to 24hr
Pedal	To Town Centre	0	6	3	1	1	2	3	1	0	1	2	1	1	0	0	0	**22**	**1.38**	**30**
Cycles	From Town Centre	0	4	3	2	0	0	3	0	2	1	3	3	2	0	0	0	**23**	**1.38**	**32**
	Both	0	10	6	3	1	2	6	1	2	2	5	4	3	0	0	0	**45**	**1.38**	**62**
Motor	To	0	4	1	3	2	2	1	6	2	3	3	2	2	0	0	0	**31**	**1.38**	**43**
Cycles	From	0	3	1	0	1	1	3	3	6	6	4	5	10	0	0	0	**43**	**1.38**	**59**
	Both	0	7	2	3	3	3	4	9	8	9	7	7	12	0	0	0	**74**	**1.38**	**102**
Cars	To	0	379	617	482	424	415	369	379	459	488	480	527	424	0	0	0	**5443**	**1.38**	**7511**
	From	0	327	387	291	286	381	412	386	460	444	440	472	433	0	0	0	**4719**	**1.38**	**6512**
	Both	0	706	1004	773	710	796	781	765	919	932	920	999	857	0	0	0	**10162**	**1.38**	**14024**
Buses	To	0	6	10	13	8	8	7	7	6	8	10	8	9	0	0	0	**100**	**1.38**	**138**
	From	0	10	6	5	8	7	8	8	8	11	6	7	5	0	0	0	**89**	**1.38**	**123**
	Both	0	16	16	18	16	15	15	15	14	19	16	15	14	0	0	0	**189**	**1.38**	**261**
Light	To	0	45	56	58	48	63	62	76	65	64	62	57	36	0	0	0	**692**	**1.38**	**955**
Goods	From	0	27	44	38	42	33	40	54	42	39	62	32	29	0	0	0	**482**	**1.38**	**665**

Vehicles	Both	0	72	100	96	90	96	102	130	107	103	124	89	65	0	0	0	**1174**	**1.38**	**1620**
Smaller	To	0	5	5	7	4	7	3	6	5	3	3	2	1	0	0	0	**51**	**1.38**	**70**
2-Axle	From	0	8	9	10	6	6	7	6	5	3	6	3	2	0	0	0	**71**	**1.38**	**98**
Lorries	Both	0	13	14	17	10	13	10	12	10	6	9	5	3	0	0	0	**122**	**1.38**	**168**
Bigger	To	0	3	4	4	2	3	1	1	2	2	0	0	0	0	0	0	**22**	**1.38**	**30**
2-Axle	From	0	2	3	7	4	4	5	3	1	2	2	1	0	0	0	0	**34**	**1.38**	**47**
Lorries	Both	0	5	7	11	6	7	6	4	3	4	2	1	0	0	0	0	**56**	**1.38**	**77**
3-Axle	To	0	1	1	0	0	1	0	1	0	0	0	0	1	0	0	0	**5**	**1.38**	**7**
Rigid/Artic	From	0	2	4	1	2	2	1	1	0	1	1	0	0	0	0	0	**15**	**1.38**	**21**
	Both	0	3	5	1	2	3	1	2	0	1	1	0	1	0	0	0	**20**	**1.38**	**28**
4 Axles or	To	0	1	3	2	0	0	0	0	3	4	1	1	0	0	0	0	**15**	**1.38**	**21**
more	From	0	0	1	2	3	1	1	3	3	0	0	0	0	0	0	0	**14**	**1.38**	**19**
Rigid/Artic	Both	0	1	4	4	3	1	1	3	6	4	1	1	0	0	0	0	**29**	**1.38**	**40**
Totals	To Town Centre	0	450	700	570	489	501	446	477	542	573	561	598	474	0	0	0	**6381**	**1.38**	**8806**
	From Town Centre	0	383	458	356	352	435	480	464	527	507	524	523	481	0	0	0	**5490**	**1.38**	**7576**
	Both	0	833	1158	926	841	936	926	941	1069	1080	1085	1121	955	0	0	0	**11871**	**1.38**	**16382**

Table C.4: A449 To/From Wolverhampton Traffic Count Data – 12 hour and scaled 24 hour

Hour Commencing		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Vehicles	Scaling factor	Scaled to 24hr
Pedal	To Wolverhampton	0	1	2	1	1	1	2	1	0	1	3	4	3	0	0	0	**20**	**1.38**	**28**
Cycles	From Wolverhampton	0	2	10	1	1	3	1	0	0	0	0	0	1	0	0	0	**19**	**1.38**	**26**
	Both	0	3	12	2	2	4	3	1	0	1	3	4	4	0	0	0	**39**	**1.38**	**54**
Motor	To	0	2	3	3	3	2	1	4	5	3	2	1	6	0	0	0	**35**	**1.38**	**48**
Cycles	From	0	6	1	2	5	2	3	4	1	2	2	1	3	0	0	0	**32**	**1.38**	**44**
	Both	0	8	4	5	8	4	4	8	6	5	4	2	9	0	0	0	**67**	**1.38**	**92**
Cars	To	0	329	362	285	236	308	321	351	419	474	475	496	455	0	0	0	**4511**	**1.38**	**6225**
	From	0	407	475	411	334	318	272	274	300	278	266	336	205	0	0	0	**3876**	**1.38**	**5349**
	Both	0	736	837	696	570	626	593	625	719	752	741	832	660	0	0	0	**8387**	**1.38**	**11574**
Buses	To	0	3	3	3	2	3	3	6	6	5	3	3	2	0	0	0	**42**	**1.38**	**58**
	From	0	1	4	6	5	3	3	3	3	5	2	3	4	0	0	0	**42**	**1.38**	**58**
	Both	0	4	7	9	7	6	6	9	9	10	5	6	6	0	0	0	**84**	**1.38**	**116**

Light	To	0	63	78	81	61	65	58	65	92	81	90	60	45	0	0	0	**839**	**1.38**	**1158**
Goods	From	0	85	71	53	52	56	61	52	58	52	51	30	13	0	0	0	**634**	**1.38**	**875**
Vehicles	Both	0	148	149	134	113	121	119	117	150	133	141	90	58	0	0	0	**1473**	**1.38**	**2033**
Smaller	To	0	8	9	12	9	7	10	10	10	6	6	2	2	0	0	0	**91**	**1.38**	**126**
2-Axle	From	0	12	10	13	7	10	5	6	7	6	3	1	1	0	0	0	**81**	**1.38**	**112**
Lorries	Both	0	20	19	25	16	17	15	16	17	12	9	3	3	0	0	0	**172**	**1.38**	**237**
Bigger	To	0	3	6	11	9	11	6	8	6	5	2	1	0	0	0	0	**68**	**1.38**	**94**
2-Axle	From	0	9	8	8	8	3	3	3	2	2	1	1	1	0	0	0	**49**	**1.38**	**68**
Lorries	Both	0	12	14	19	17	14	9	11	8	7	3	2	1	0	0	0	**117**	**1.38**	**161**
3-Axle	To	0	2	2	2	8	5	2	6	1	2	2	1	0	0	0	0	**33**	**1.38**	**46**
Rigid/Artic	From	0	1	1	3	4	3	2	2	3	1	0	0	1	0	0	0	**21**	**1.38**	**29**
	Both	0	3	3	5	12	8	4	8	4	3	2	1	1	0	0	0	**54**	**1.38**	**75**
4 Axles or	To	0	7	10	13	15	13	7	12	7	8	4	6	4	0	0	0	**106**	**1.38**	**146**
more	From	0	9	13	8	12	13	9	5	10	6	5	3	1	0	0	0	**94**	**1.38**	**130**
Rigid/Artic	Both	0	16	23	21	27	26	16	17	17	14	9	9	5	0	0	0	**200**	**1.38**	**276**
	To Wolverhampton	**0**	**418**	**475**	**411**	**344**	**415**	**410**	**463**	**546**	**585**	**587**	**574**	**517**	**0**	**0**	**0**	**5745**	**1.38**	**7928**

Totals	**From Wolverhampton**	**0**	**532**	**593**	**505**	**428**	**411**	**359**	**349**	**384**	**352**	**330**	**375**	**230**	**0**	**0**	**0**	**4848**	**1.38**	**6690**
	Both	**0**	**950**	**1068**	**916**	**772**	**826**	**769**	**812**	**930**	**937**	**917**	**949**	**747**	**0**	**0**	**0**	**10593**	**1.38**	**14618**

Table C.5: A449 To/From Worcester Traffic Count Data – 12 hour and scaled 24 hour

Hour Commencing		**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**Vehicles**	**Scaling factor**	**Scaled to 24hr**
Pedal	To Worcester	0	0	4	1	1	2	1	0	1	1	0	0	1	0	0	0	**12**	**1.38**	**17**
Cycles	From Worcester	0	1	4	0	2	1	0	2	0	1	4	4	3	0	0	0	**22**	**1.38**	**30**
	Both	0	1	8	1	3	3	1	2	1	2	4	4	4	0	0	0	**34**	**1.38**	**47**
Motor	To	0	6	3	2	5	2	3	3	1	3	1	0	2	0	0	0	**31**	**1.38**	**43**
Cycles	From	0	1	2	1	1	1	0	4	3	3	2	0	2	0	0	0	**20**	**1.38**	**28**
	Both	0	7	5	3	6	3	3	7	4	6	3	0	4	0	0	0	**51**	**1.38**	**70**
Cars	To	0	329	362	320	241	255	236	225	235	213	209	261	142	0	0	0	**3028**	**1.38**	**4179**
	From	0	283	336	261	211	233	246	275	339	377	381	374	366	0	0	0	**3682**	**1.38**	**5081**
	Both	0	612	698	581	452	488	482	500	574	590	590	635	508	0	0	0	**6710**	**1.38**	**9260**
	To	0	2	2	2	2	1	1	1	2	4	1	1	0	0	0	0	**19**	**1.38**	**26**

Buses	From	0	3	3	4	3	4	3	4	3	3	6	4	3	0	0	0	**43**	**1.38**	**59**
	Both	0	5	5	6	5	5	4	5	5	7	7	5	3	0	0	0	**62**	**1.38**	**86**
Light	To	0	71	55	46	44	47	41	41	45	38	43	24	11	0	0	0	**506**	**1.38**	**698**
Goods	From	0	48	63	71	50	48	49	57	74	64	68	51	40	0	0	0	**683**	**1.38**	**943**
Vehicles	Both	0	119	118	117	94	95	90	98	119	102	111	75	51	0	0	0	**1189**	**1.38**	**1641**
Smaller	To	0	9	11	8	6	8	4	4	6	4	1	1	1	0	0	0	**63**	**1.38**	**87**
2-Axle	From	0	5	7	9	7	4	7	8	9	3	3	1	3	0	0	0	**66**	**1.38**	**91**
Lorries	Both	0	14	18	17	13	12	11	12	15	7	4	2	4	0	0	0	**129**	**1.38**	**178**
Bigger	To	0	9	4	4	6	4	2	3	1	2	1	1	1	0	0	0	**38**	**1.38**	**52**
2-Axle	From	0	2	5	7	7	8	2	6	6	4	2	1	0	0	0	0	**50**	**1.38**	**69**
Lorries	Both	0	11	9	11	13	12	4	9	7	6	3	2	1	0	0	0	**88**	**1.38**	**121**
3-Axle	To	0	1	1	4	4	2	2	1	2	1	0	0	0	0	0	0	**18**	**1.38**	**25**
Rigid/Artic	From	0	2	2	2	5	4	1	5	1	1	2	1	0	0	0	0	**26**	**1.38**	**36**
	Both	0	3	3	6	9	6	3	6	3	2	2	1	0	0	0	0	**44**	**1.38**	**61**
4 Axles or	To	0	9	13	8	12	13	8	5	7	4	5	3	1	0	0	0	**88**	**1.38**	**121**
more	From	0	7	10	11	9	10	6	12	6	8	4	5	4	0	0	0	**92**	**1.38**	**127**

Rigid/Artic	Both	0	16	23	19	21	23	14	17	13	12	9	8	5	0	0	0	**180**	**1.38**	**248**
Totals	**To Worcester**	**0**	**436**	**455**	**395**	**321**	**334**	**298**	**283**	**300**	**270**	**261**	**291**	**159**	**0**	**0**	**0**	**3803**	**1.38**	**5248**
	From Worcester	**0**	**352**	**432**	**366**	**295**	**313**	**314**	**373**	**441**	**464**	**472**	**441**	**421**	**0**	**0**	**0**	**4684**	**1.38**	**6464**
	Both	**0**	**788**	**887**	**761**	**616**	**647**	**612**	**656**	**741**	**734**	**733**	**732**	**580**	**0**	**0**	**0**	**8487**	**1.38**	**11712**

Background Concentrations

The background pollutant concentrations across the study area have been defined using the national pollution maps published by Defra (2018). These cover the whole country on a 1x1 km grid and are published for each year from 2013 until 2030.

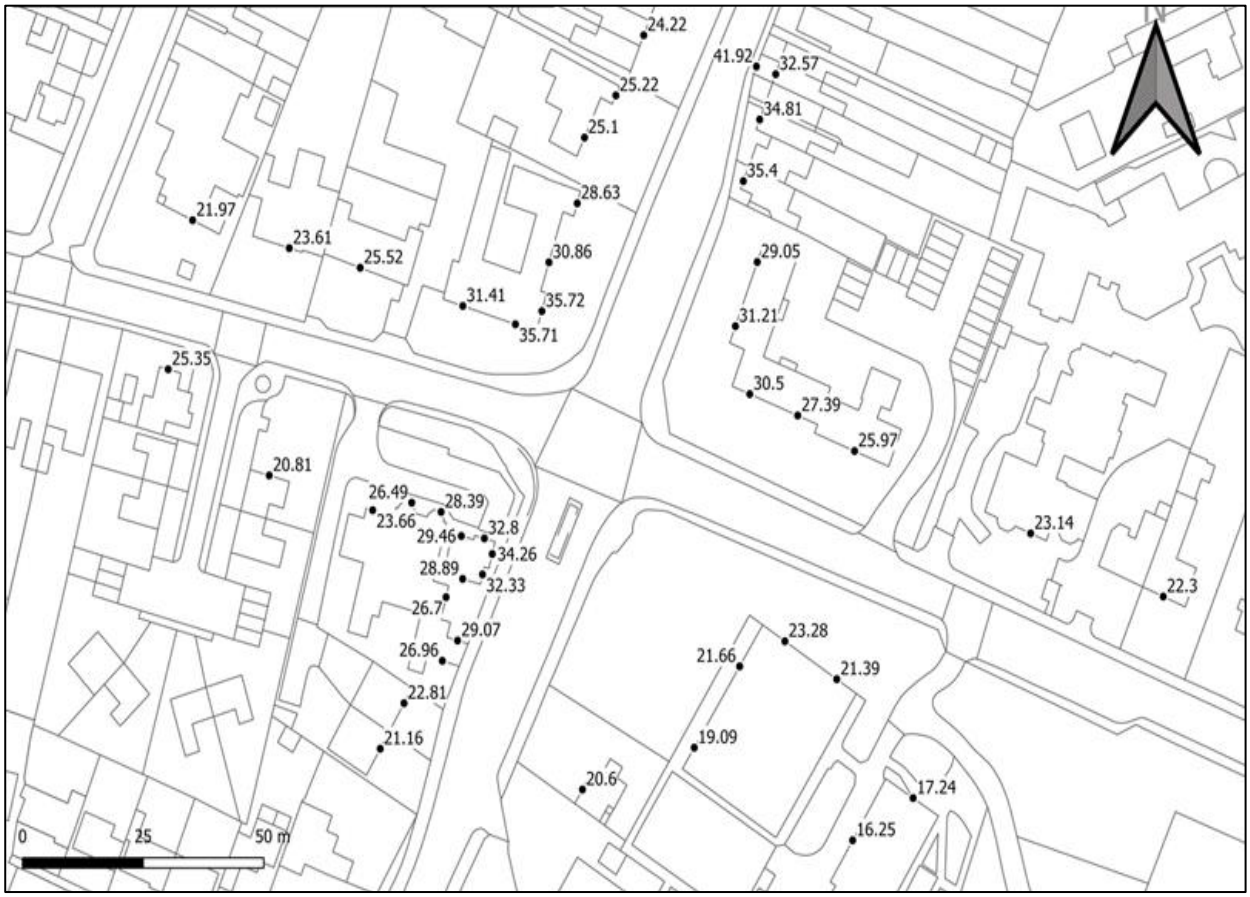
Modelled Receptors

A total of 44 receptor points have been plotted, receptor locations were chosen to represent relevant exposure and to give even coverage across the model domain. Modelled receptor heights have been entered at 1.5m (to represent ground floor level).

Maps of plotted receptor locations and concentrations can be found below.

Figure C.2: Modelled Sensitive Receptor Locations

Figure C.3: Modelled Sensitive Receptor Concentrations



Meteorological Inputs

ADMS Roads 4.1.1.0 uses hourly sequential meteorological data to model emissions from road sources in varying weather conditions. One year of hourly sequential Met Data (2018) from Pershore Meteorological Station (located at SO972500 (easting 397278, northing 250018)) has been used to simulate weather conditions for the purposes of modelling.

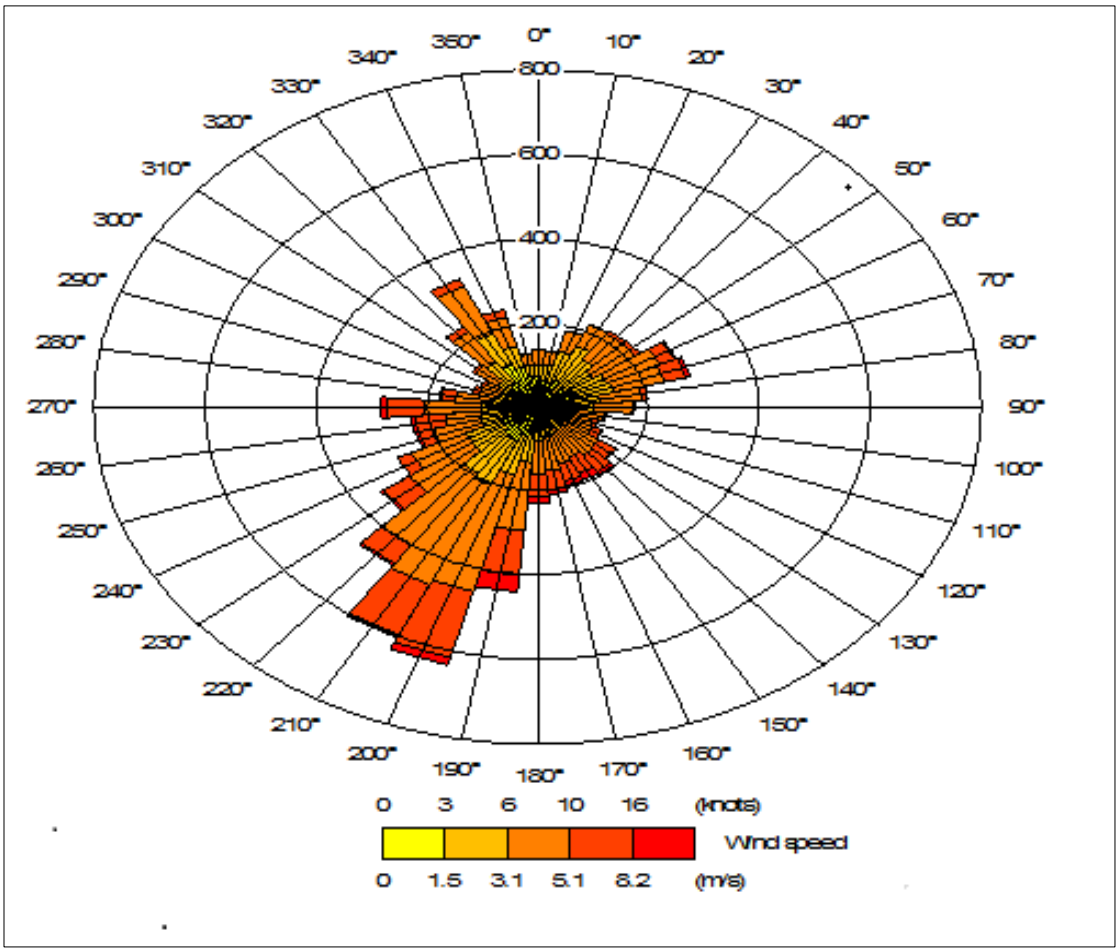
A wind rose for the year has been provided which shows the prevailing wind direction for 2018 (Figure C.4 below). There were 8735 of 8760 usable lines of meteorological data (Met lines) giving 99.71% data capture.

The surface roughness for the model area is set at 1.5m which best describes the situation at the junction. The surface roughness for the meteorological station site is set at 0.02m (open grassland).

The Monin-Obukhov Length is set at 30m as this best describes the model area.

Slope gradients within the modelling envelope are not considered to be greater than 10%, therefore terrain has not been considered as part of the model as its effect upon dispersion is deemed to be insignificant.

Figure C.4 Pershore Meteorological Station Wind Rose (2018)



C.2 Model Verification

In order to ensure that ADMS-Roads predicts local concentrations as accurately as possible it is necessary to verify the model against local monitoring data.

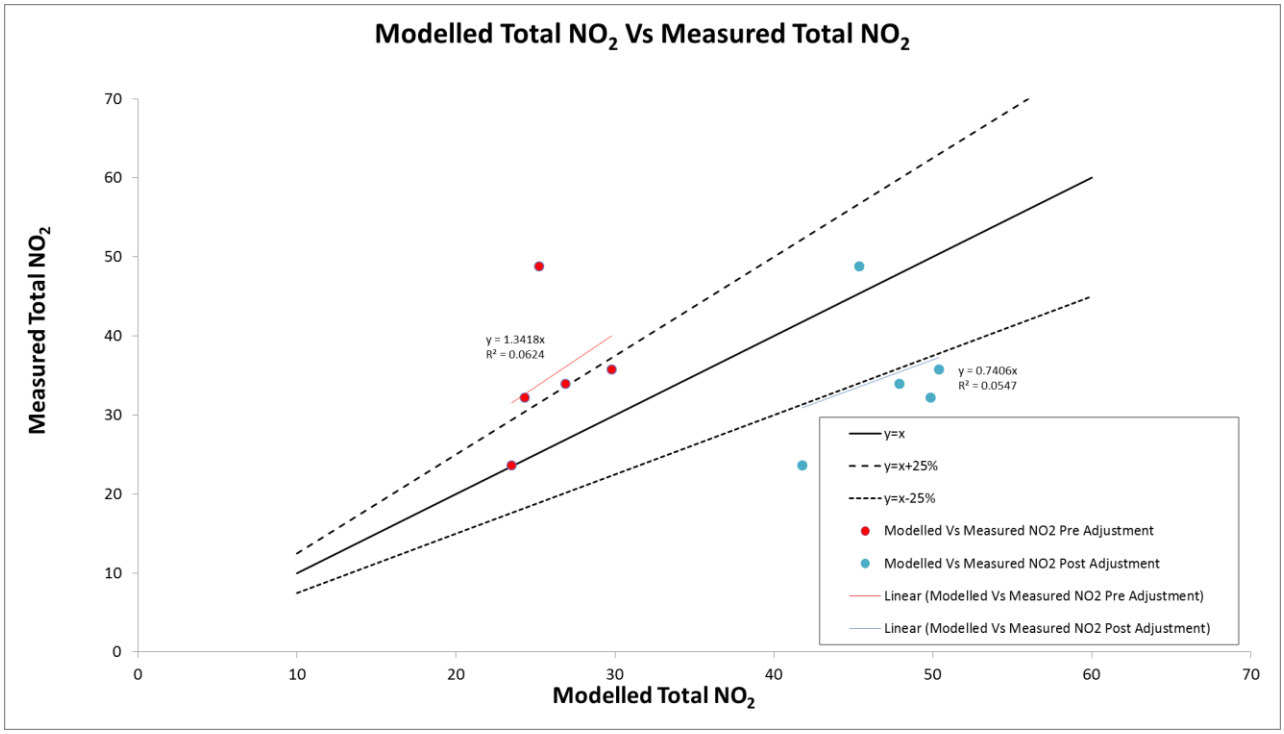
Most nitrogen dioxide is produced in the atmosphere by a reaction between nitric oxide and ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions of nitrogen oxides (NO_X). The model has been run to predict the annual mean NO_X concentrations during 2018 at the CR2, (F)COMR(K), CR3 and 470CRN diffusion tube locations. Concentrations were modelled at heights of the respective monitoring location. Note that measured values for NO_2 at tube location TCH have been disregarded from the model adjustment process in order to achieve validation in line with TG16 parameters.

A primary adjustment factor of 1.89 has been used to correct modelled Road NOx contributions.

When comparing modelled to measured values an RMSE of 2.79 has been achieved and all modelled values are within acceptable tolerance of % difference.

Conservative assumptions within the Model of vehicle speed and emissions have not been able to account for measured NO_2 values at location TCH. Sensitivity analysis has been carried out changing road link lengths and average vehicle speeds to account for the observed values at TCH. Ultimately the best scenario that validates with 4 out of the 5 tubes has been presented within this report. The error in the model is too great when measured values from TCH are included within the model adjustment process. As such measured values from TCH have been disregarded to provide a best fit model that validates with 4 out of the 5 tubes in operation (see Figures C.5 & C.6 below).

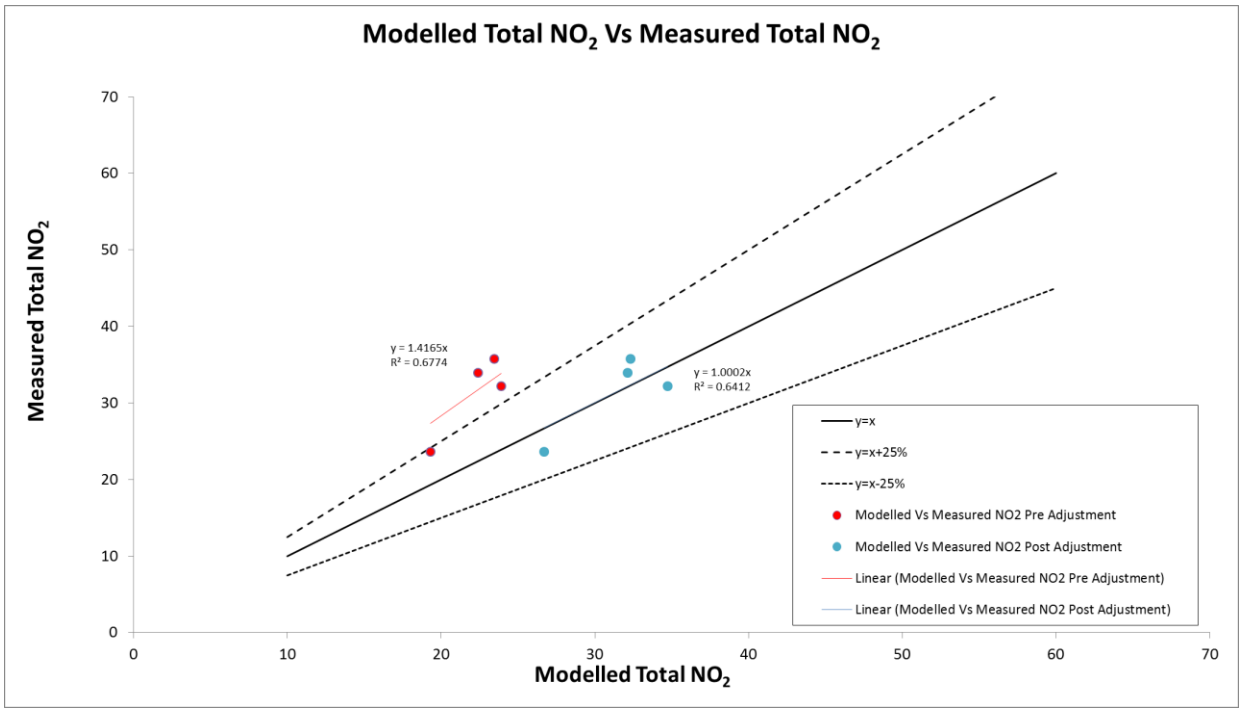
Figure C.5: Verification Results including values from TCH Tube



Modelled Vs Measured NO2 Pre Adjustment			
Point	Measured NO2	Modelled NO2	error squared
CR2	35.79	29.8	35.8801
FCOMRK	32.21	24.33	62.0944
TCH	48.77	25.21	555.0736
CR3	23.65	23.49	0.0256
470CRN	33.96	26.87	50.2681
		RMSE	11.8603693

Modelled Vs Measured NO2 Post Adjustment		
Measured NO2	Modelled NO2	error squared
35.79	50.4	212.984836
32.21	49.9	311.571922
48.77	45.4	11.54368576
23.65	41.8	328.2546768
33.96	47.9	193.7162912
	RMSE	14.54696815

Figure C.6: Verification Results excluding values from TCH tube



Modelled Vs Measured NO2 Pre Adjustment			
Point	Measured NO2	Modelled NO2	error squared
CR2	35.79	23.44	152.5225
FCOMRK	32.21	23.91	68.89
CR3	23.65	19.29	19.0096
470CRN	33.96	22.4	133.6336
		RMSE	9.670259821

Modelled Vs Measured NO2 Post Adjustment		
Measured NO2	Modelled NO2	error squared
35.79	32.3	11.9716
32.21	34.7	6.4009
23.65	26.7	9.3636
33.96	32.1	3.3124
	RMSE	2.786059045

There was concern about the validity of data provided by tube location TCH as NO_2 values at this site are particularly high when compared to other NOx tubes located around the road junction. A 48% difference between modelled and measured NO_2 values before adjustment was observed for this location. To put this in context all other tube modelled tube values were within 25% of the measured NO_2 value.

There is uncertainty surrounding why NO_2 values are so high at location TCH, NO_2 values measured at this location have consistently exceeded the 40µgm^3 air quality objective. The location of the tube and surrounding microclimate may be having an impact upon the measured results.

Glossary of Terms

Abbreviation	Description
AADT	Annual Average Daily Traffic
ADMS-Roads	Atmospheric Dispersion Modelling System model for Roads
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the local authority intends to achieve air quality limit values'
AQMA	Air Quality Management Area – An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives
ASR	Air quality Annual Status Report
Defra	Department for Environment, Food and Rural Affairs
EFT	Emission Factor Toolkit
EU	European Union
LAQM	Local Air Quality Management
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
PM_{10}	Airborne particulate matter with an aerodynamic diameter of 10µm (micrometres or microns) or less
$PM_{2.5}$	Airborne particulate matter with an aerodynamic diameter of 2.5µm or less
QA/QC	Quality Assurance and Quality Control
TEA	Triethanolamine – absorption of nitrogen dioxide in diffusion tubes

Glossary of Terms

Abbreviation	Description
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the local authority intends to achieve air quality limit values'
AQMA	Air Quality Management Area – An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives
ASR	Annual Status Report
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by National Highways
EU	European Union
FDMS	Filter Dynamics Measurement System
LAQM	Local Air Quality Management
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
PM_{10}	Airborne particulate matter with an aerodynamic diameter of 10µm or less
$PM_{2.5}$	Airborne particulate matter with an aerodynamic diameter of 2.5µm or less
QA/QC	Quality Assurance and Quality Control
SO_2	Sulphur Dioxide

References

- Local Air Quality Management Technical Guidance LAQM.TG16. April 2021. 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.PG16. May 2016. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.
- DEFRA (2021) COVID-19: Supplementary Guidance. Local Air Quality Management Reporting in 2021 v.1
- DEFRA (2021) National Diffusion Tube Bias Adjustment Factor Spreadsheet v.03/21
- DEFRA (2013) Background Mapping for Local Authorities
- Worcestershire Regulatory Services (2013) 'Air Quality Action Plan for Worcestershire'
- Worcestershire Regulatory Services (2015) 'Air Quality Action Plan Progress Report for Worcestershire April 2013-April 2015'
- Worcestershire Regulatory Services (2016) 'Air Quality Action Plan Progress Report for Worcestershire April 2015 – April 2016'
- Worcestershire Regulatory Services (2020) Air Quality Annual Status Report for Wyre Forest District Council
- Worcestershire Regulatory Services (2021), Junction of Comberton Road, Chester Road North and Chester Road South, Kidderminster Dispersion Modelling Assessment 2021