Worcestershire
Regulatory Services
Supporting and protecting you

2019 Air Quality Annual Status Report (ASR)

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

June 2019

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Report Reference number	WDC/ASR/2019
Date	June 2019

Executive Summary: Air Quality in Our Area

Air Quality in Wychavon District

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 and older people, and those with heart and lung conditions. There is also often a strong correlation with equalities issues, because areas with poor air quality are also often the less affluent areas[1,2].

The annual health cost to society of the impacts of particulate matter alone in the UK is estimated to be around £16 billion[3].

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

Monitoring across the Wychavon District focuses on nitrogen dioxide via a network of diffusion tubes. Tubes are located in the main urban centres of Evesham, Pershore, Droitwich and Wychbold.

A comparison of monitored levels of nitrogen dioxide across the Wychavon District between 2016 and 2018 shows a general decrease across the District. This is discussed further below.

[1] Environmental equity, air quality, socioeconomic status and respiratory health, 2010
[2] Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006
[3] Defra. Abatement cost guidance for valuing changes in air quality, May 2013

Please note that 2017 data is not being included in any trend analysis, this is due to the unusually low 2017 bias-adjustment factor (0.77) published by Defra last year. This unusually low bias-adjustment factor resulted in significantly lower adjusted measurements of nitrogen dioxide for 2017, levels that are well below local long term trends. Despite correspondence with Defra and the National Physics Laboratory WRS was unable to obtain any satisfactory explanation as to why the published 2017 bias-adjustment factor was so low. Therefore WRS believe that the 2017 monitoring results should not be replied upon as indicative of local trends.

There is currently one Air Quality Management Area (AQMA) in the Wychavon District. This AQMA was declared for the Worcester Road, Wychbold area on 1st May 2018 due to exceedances of the annual mean objective for nitrogen dioxide (NO_2). A copy of the formal declaration Order is attached as part of Appendix C.

Details of the AQMA declaration and plans of the AQMA can be found on the following pages of the WRS website: http://www.worcsregservices.gov.uk/pollution/air-quality/air-quality-management-areas.aspx

A full list of declared and revoked AQMAs can be viewed at http://uk-air.defra.gov.uk/aqma/list

Nitrogen Dioxide in the Worcester Road, Wychbold AQMA during 2018

A single marginal exceedence of the annual mean objective for NO_2 has been recorded at relevant exposure in the Worcester Road, Wychbold AQMA in 2018.

A comparison of 2016 and 2018 levels of nitrogen dioxide shows an average decline in levels of 9.2% (4.3µg/m^3) within the Wychbold AQMA. This indicates a significant

improvement in levels of NO_2 between 2016 and 2018. This trend is discussed further in section 3.2.1 of this report.

In 2018 development of an Action Plan for the area has commenced. A Source Apportionment exercise for the A38 Worcester Road has been completed. This exercise has been undertaken following guidance laid out in LAQM Technical Guidance 16. It aims to identify and quantify the emission sources which contribute to the exceedance of the nitrogen dioxide annual mean objective in the area. This will allow the Action Plan to focus on those emission sources which contribute the most in terms of emissions. For further details see Section 2.2 below.

Air Quality in the Port Street, Evesham area in 2018

In 2018 there has been no exceedence of the annual average mean objective for nitrogen dioxide in the Port Street, Evesham area. In addition, in 2018 no concentrations of nitrogen dioxide were within 5% of the annual average mean objective for nitrogen dioxide in the Port Street, Evesham area.

In 2017 a detailed Revocation Screening Assessment of monitoring data gathered over the ten year period 2006 to 2016 was carried out. This Revocation Screening Assessment is available to view online at http://www.worcsregservices.gov.uk/media/3332956/Port-Street-Revocation-Screening-Assessment-FINAL.pdf Please note that this Screen Assessment was also submitted with the 2017 ASR for Wychavon and as such has previously been reviewed by DEFRA.

Based on the conclusions of the Screening Assessment Wychavon District Council took the decision to revoke the Port Street AQMA. This decision was subject to consultation until 2nd March 2018. Formal revocation of the AQMA came into effect on 1st May 2018. A copy of the formal revocation order is attached as part of Appendix C.

Other areas across the District in 2018

No exceedences of the annual mean objective for nitrogen dioxide, or any concentrations within 5% of that objective, have been recorded at relevant exposure at any other location in the District in 2018.

A comparison of 2016 and 2018 levels of nitrogen dioxide shows an average decline in levels of 5.2% (1.5µg/m3) across the Wychavon area (excluding the Wychbold AQMA). This represents a moderate improvement in levels of nitrogen dioxide. This trend is discussed further in section 3.2.1 of this report.

Actions to Improve Air Quality

No direct measures to address air quality in relation to Worcester Road, Wychbold have been undertaken in 2018. During 2017 a Detailed Dispersion Modelling Assessment was undertaken to confirm the requirement for an AQMA and inform the decision as to the geographical extent of the AQMA. The AQMA was formally declared by Wychavon District Council on 1st May 2018. A copy of the formal declaration order is attached in Appendix C. Following this declaration work towards developing an Air Quality Action Plan for the area has commenced, this has included:

- Initial contact with key stakeholders including Highways England, Worcestershire County Council, local district Councillors and the local Parish Council.

- Completion of a Source Apportionment exercise to inform the development of the Action Plan.

Conclusions and Priorities

The main conclusions of the 2018 ASR are:

- The Port Street, Evesham AQMA was revoked on 1st May 2018.
- A new AQMA was declared at Worcester Road, Wychbold on 1st May 2018.
- In general there has been a downward trend in nitrogen dioxide levels between 2016 and 2018 across the district. A comparison of 2016 and 2018 levels of NO_2 shows an average decline in levels of 5.2% (1.5µg/m^3) across the Wychavon area (excluding the Wychbold AQMA).
- Within the Worcester Road, Wychbold AQMA a comparison of 2016 and 2018 levels of NO_2 shows an average decline in levels of 9.2% (4.3µg/m^3).

Priorities for addressing air quality in Wychavon across the coming year are:

- Launch of a formal Steering Group to work towards developing and delivering an Action Plan for the Worcester Road, Wychbold AQMA.
- Development of a draft Action Plan for the new Worcester Road, Wychbold AQMA. It is anticipated that the key challenge in developing the Action Plan will be in relation to securing engagement and involvement of key stakeholders.

Local Engagement and How to get Involved

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.

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.

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

- **Walk or cycle, leave you 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;
- 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 Skype 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 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 charge-points. 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-emission-vehicles#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.energysavingtrust.org.uk/travel/driving-advice

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

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

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)[4,5]. 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/.

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

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

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

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1 Local Air Quality Management

This report provides an overview of air quality in Wychavon District during 2018. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995) and the relevant Policy and Technical Guidance documents.

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

The statutory air quality objectives applicable to LAQM in England can be found in Appendix E.

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 must prepare an Air Quality Action Plan (AQAP) within 12-18 months setting out measures it intends to put in place in pursuit of compliance with the objectives.

A summary of AQMAs declared by Wychavon District Council can be found in Table 2.1. Further information related to declared or revoked AQMAs, including maps of AQMA boundaries are available online at http://www.worcsregservices.gov.uk/pollution/air-quality/air-quality-management-areas.aspx. Alternatively, please refer to Appendix D which provides for a map of air quality monitoring locations in relation to the AQMA(s).

Table 2.1 – Declared Air Quality Management Areas

AQMA Name	Date of Declaration	Pollutants and Air Quality Objectives	City / Town	One Line Description	Is air quality in the AQMA influenced by roads controlled by Highways England?	Level of Exceedance (maximum monitored/modelled concentration at a location of relevant exposure)				Action Plan		
						At Declaration		Now		Name	Date of Publication	Link
Worcester Road, Wychbold	Declared 1st May 2018	NO_2 Annual Mean	Wychbold	An area encompassing a number of properties surrounding strategic road network around J5 M5 and A38	YES	40	µg/m3	40	µg/m3	Currently being developed	N/A	N/A

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

2.2 Progress and Impact of Measures to address Air Quality in Wychavon District

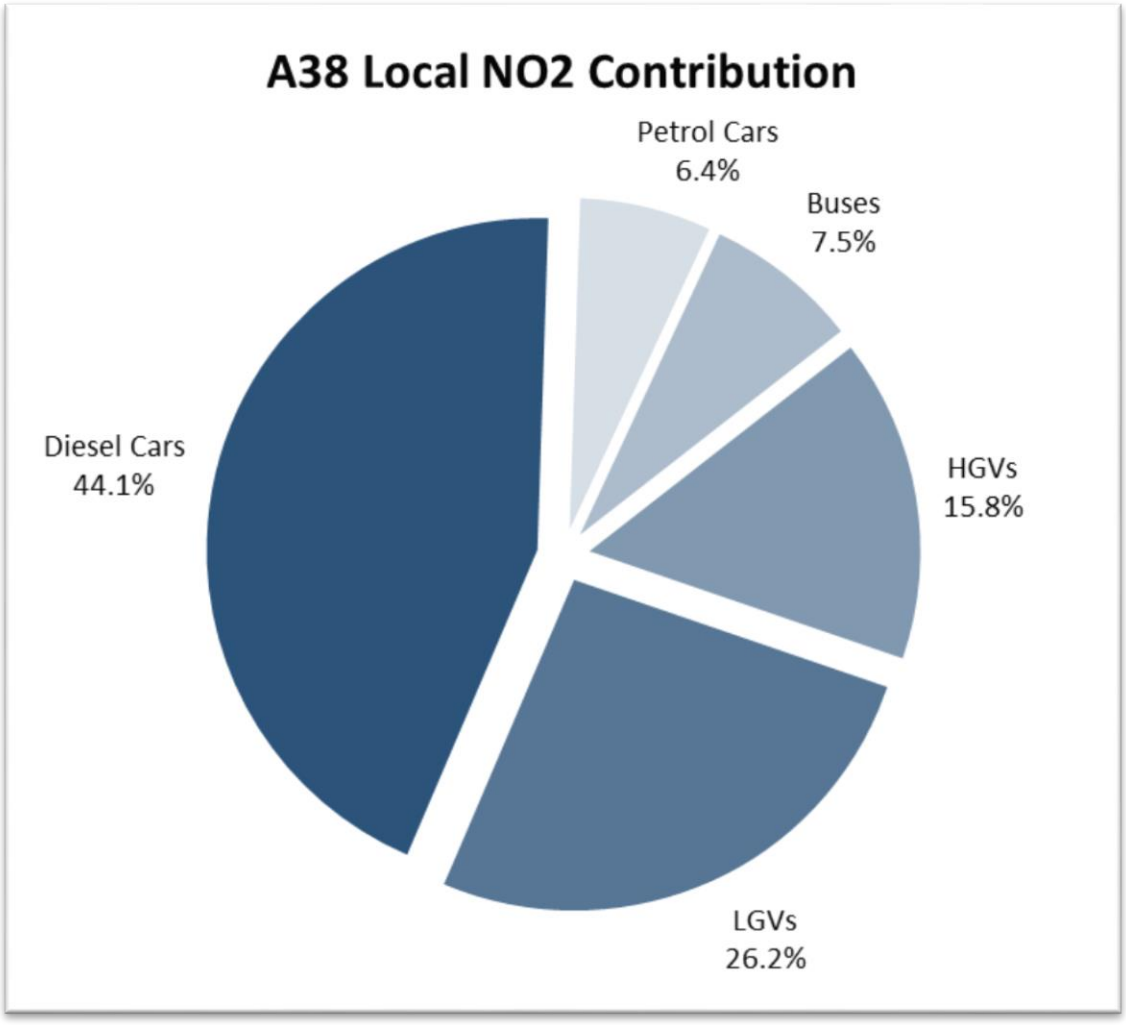
During 2017 a Detailed Dispersion Modelling Assessment was undertaken to confirm the requirement for an AQMA at Worcester Road, Wychbold and inform the decision as to the geographical extent of the AQMA. The AQMA for formally declared by Wychavon District Council on 1st May 2018. A copy of the formal order is attached as part of Appendix C, and can be viewed at http://www.worcsregservices.gov.uk/media/3697283/Worcester-Road-Wychbold-declaration-order.pdf

Following the declaration of an AQMA at Worcester Road, Wychbold work towards developing an Air Quality Action Plan for the area has commenced. Further details are provided below:

In 2018 a Source Apportionment exercise for the A38 Worcester Road has been completed. This exercise has been undertaken following guidance laid out in LAQM Technical Guidance 16. A copy of the Source Apportionment report is attached as part of Appendix C. Source apportionment has been undertaken to inform the development of a draft Action Plan going forward. It aims to identify and quantify the emission sources which contribute to the exceedance of the nitrogen dioxide annual mean objective in the area. This will allow the Action Plan to focus on those emission sources which contribute the most in terms of emissions.

The exercise concludes that the three main contributors to emissions associated with the A38 within the AQMA are diesel cars (contributing 43.9%), diesel LGVs (contributing 26.0%) and HGVs (contributing 15.7%). Figure 2.1 below provides a graphical representation of the contribution of each vehicle category to local NO_2 concentrations.

Figure 2.1 – Contribution to Local NO_2 emissions A38 (Source Apportionment)



In addition background concentration contributes a significant proportion of the overall concentration of NO_2 measured within the AQMA (36.87%).

Cars, which make up the largest proportion of traffic volume (81%), contribute approximately 50% of local traffic emissions within the AQMA with diesel cars in particular responsible for a large proportion (approximately 44%). LGVs contribute approximately 26% of local traffic emission and HGVs approximately 16%.

The results of Source Apportionment suggest that targeting individual types of vehicles on the A38 in isolation would not lead to the annual mean objective being achieved, unless the reductions are very large, for example an approximately reduction of 55% in emissions from cars would be required. However a reduction in

total vehicle emissions of approximately 25% to 30% would potentially be effective in achieving the annual mean objective.

The findings of this source apportionment exercise will be used to inform the development of the draft Action Plan for the area.

A copy of the full source apportionment report is attached as Appendix C.

Following completion of the Source Apportionment exercise initial contact with key stakeholders has taken place, including Highways England, Worcestershire County Council, Strategic Planning Teams and the local Parish Council. A formal steering group to include key stakeholders is planned for the near future.

In addition to the above initial internal work has been started to consider potential measures for improving air quality based on the outcome of Source Apportionment. This work is still in early stages.

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 PM2.5 (particulate matter with an aerodynamic diameter of 2.5µm or less). There is clear evidence that PM2.5 has a significant impact on human health, including premature mortality, allergic reactions, and cardiovascular diseases.

There are currently no automatic PM2.5 monitoring stations in Worcestershire. The nearest AURN PM2.5 monitoring station is the Birmingham Acocks Green site approximately 32 miles to the north east of the Wychavon District.

WRS has reviewed the 2017 based DEFRA national background maps to determine projected PM2.5 concentrations with the Wychavon District for the 2018 calendar year. The average total PM2.5 at 657 locations (centre points of 1km x 1km grids) across the Wychavon District is 8.07µg/m^3, with a minimum concentration of 7.39µg/m^3 and a maximum concentration of 9.67µg/m^3.

This indicates that PM2.5 concentrations within the Wychavon District are well below the annual average EU limit value for PM2.5 of 25µg/m^3.

As outlined in Policy Guidance LAQM.PG16 WRS has discussed the role of the DoPH, and the details of PM2.5 levels across the County, with the Director of Public Health at Worcestershire County Council. The DoPH has not confirmed to WRS that they are advocating or supporting any specific actions to reduce PM2.5 concentrations across the County at this time.

In light of the above no additional actions are currently planned by Wychavon District Council in relation to the reduction of PM2.5 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 PM2.5 levels.

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

3.1 Summary of Monitoring Undertaken

This section sets out what monitoring has taken place and how it compares with objectives

3.1.1 Automatic Monitoring Sites

Wychavon District Council has not undertaken any automatic monitoring in 2018.

3.1.2 Non-Automatic Monitoring Sites

Wychavon District Council undertook non- automatic (passive) monitoring of NO_2 at 22 sites during 2018. Table A.1 in Appendix A shows the details of the 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” and distance correction. Further details on adjustments are provided in Appendix C.

3.2.1 Nitrogen Dioxide (NO_2)

Table A.2 in Appendix A compares the ratified and adjusted monitored NO_2 annual mean concentrations for the past 5 years with the air quality objective of 40µg/m^3.

For diffusion tubes, the full 2018 dataset of monthly mean values is provided in Appendix B.

In 2018 there was a single exceedance of the NO_2 annual mean objective in the Wychavon District. This exceedance measured 40.0µg/m^3 at EPS56 (Post Office façade) in the Worcester Road, Wychbold AQMA. It should be noted that the diffusion tube at this location is located at groundfloor level with relevant exposure (residential façade) at first floor level. It is therefore possible that the Objective was not exceeded at relevant exposure, however without an appropriate tool to calculate NO_2 drop-off with height this assumption cannot be fully evidenced.

Due to the low national bias-adjustment factor published for 2017 and the WRS conclusion that the 2017 data cannot be relied upon as being indicitative of of local trends (see Wychavon District Council 2017 ASR for further details), 2016 data has been used for comparison purposes.

When compared to bias-adjusted and annualised 2016 results, the 2018 data show a downward trend at fifteen of the sixteen locations with sufficient data to compare the two years. The average reduction across the Wychavon District (excluding the Worcester Road, Wychbold AQMA) is 5.2% (1.5µg/m^3). Within the Wychbold AQMA all locations with sufficient data to compare the two years show a downward trend between 2016 and 2018. The average reduction within the Worcester Road, Wychbold AQMA is 9.2% (4.3µg/m^3).

There were no recorded annual means above 60µg/m^3 across the Wychavon District in 2018.

3.2.2 Particulate Matter (PM_{10})

PM_{10} is not monitored within the Wychavon District.

3.2.3 Particulate Matter ($PM_{2.5}$)

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

3.2.4 Sulphur Dioxide (SO_2)

Sulphur Dioxide is not monitored within the Wychavon District.

Appendix A: Monitoring Results

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

Site ID	Site Name	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)
EPS8	40 High Street Street Light 8, Pershore	Roadside	395048	245527	NO2	NO	2	0.5	NO	2.27
EPS9	St. Andrews Road Street light 139, Pershore	Suburban	394571	245377	NO2	NO	6	2.98	NO	2.26
EPS14	Port Street Road Sign, Evesham	Kerbside	404128	243630	NO2	NO	1.7	0.73	NO	2.35
EPS14a	Port Street Road Sign, Evesham	Kerbside	404128	243630	NO2	NO	1.7	0.73	NO	2.35
EPS14b	Port Street Road Sign, Evesham	Kerbside	404128	243630	NO2	NO	1.7	0.73	NO	2.35
EPS27	Worcester Rd, Wychbold	Roadside	392031	265624	NO2	YES	15.5	2.31	NO	2.13
EPS33	High Street Street light LP 32, Evesham	Roadside	403753	244068	NO2	NO	2.5	3.5	NO	2.3
EPS43	Long Stay opp cinema,	Roadside	404222	243598	NO2	NO	0	1.85	NO	2.35

	Port St, Evesham									
EPS44	Camera Post opp 33, Port St, Evesham	Roadside	404183	243611	NO2	NO	2.6	1.18	NO	2.45
EPS52	The Bungalow, Whittington	Roadside	387598	252511	NO2	NO	0	12	NO	1.99
EPS53	Hillview Cottage, Whittington	Suburban	387595	252533	NO2	NO	0	22	NO	1.68
EPS56	Post Office, Worcester Rd, Wychbold	Roadside	391983	265688	NO2	YES	0 (first floor)	8.08	NO	2.13
EPS58a	2 Rose Villas (façade), Worcester Road, Wychbold S14	Roadside	392027	265770	NO2	YES	9	3	NO	2.27
EPS60	Corner of Rynal Street & De La Bere Close, Evesham SL2	Roadside	403914	244046	NO2	NO	5.5	1.1	NO	2.13
EPS61	1-6 The Old Dairy, Swan Lane, Evesham	Roadside	403796	244006	NO2	NO	0	1.9	NO	2
EPS62	Bengal Dreams No 53 Façade,	Roadside	403729	243971	NO2	NO	1.32	5.38	NO	2.18

	Evesham									
EPS63	60 Mayflower Road, Droitwich	Roadside	390708	262863	NO2	NO	0	2.46	NO	1.93
WMD1	Walk Mill Drive, Wychbold LP363	Roadside	392050	265790	NO2	YES	4.94	2.3	NO	2.14
WyAQ1	Rose Dene, Worcester Road, Wychbold	Roadside	392019	265736	NO2	YES	9.91	1.93	NO	2.22
WychAD	Lampost between BP Garage and Mill Lane junction	Roadside	392384	266195	NO2	YES	n/a	1.53	NO	2.13
WychCH	Lampost outside 6 Council Houses, Worcester Road, Wychbold	Roadside	392160	265937	NO2	YES	7.5	2.14	NO	2.26
WychSC	Street light on A38 within vicinity of Sheldon Close	Roadside	392022	265702	NO2	YES	19.6	1.2	NO	1.28

Notes:

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

(2) N/A if not applicable.

Table A.2 – Annual Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2018 (%) [2]	NO_2 Annual Mean Concentration ($\mu g/m^3$) [3]				
					2014	2015	2016	2017	2018
EPS8	Roadside	Diffusion Tube	100	100	26.34	26.33	28.62	22.9	26.9
EPS9	Suburban	Diffusion Tube	100	100	15.56	11.86	13.32	10.46	12.0
EPS14	Kerbside	Diffusion Tube	100	100			34.3	35.24	**40.9**
EPS14a	Kerbside	Diffusion Tube	92	92			35.2	37	**42.0**
EPS14b	Kerbside	Diffusion Tube	100	100			35	36.23	**40.9**
Average EPS14/a/b	Kerbside	Diffusion Tube	97	97	**40.38**	35.49	**41.53**	36.2	**41.2**
EPS27	Roadside	Diffusion Tube	75	75	**44.37**	39.01	**44.47**	39.5	**41.5**
EPS33	Roadside	Diffusion Tube	100	100	30.3	30.04	32.58	24.49	29.9
EPS43	Roadside	Diffusion Tube	100	100	31.7	31.2	33.78	27.3	33.3
EPS44	Roadside	Diffusion Tube	92	92	30.59	31.12	35.27	28.44	31.1
EPS52	Roadside	Diffusion Tube	92	92	32.81	31.1	33.78	30.81	31.6
EPS53	Suburban	Diffusion Tube	100	100	30	29.35	29.99	25.75	27.7
EPS56	Roadside	Diffusion Tube	100	100	**45.38**	**45.12**	**45.56**	36.4	**40.0**
EPS58a	Roadside	Diffusion Tube	75	50					35.1
EPS60	Roadside	Diffusion	100	100	17.67	15.97	16.63	15.32	15.8

		Tube							
EPS61	Roadside	Diffusion Tube	100	100	29.9	30.01	29.63	27.2	29.7
EPS62	Roadside	Diffusion Tube	92	92	30.89	33.47	34.37	29.56	32.8
EPS63	Roadside	Diffusion Tube	92	92		24.54	24.87	18.9	24.8
WMD1	Roadside	Diffusion Tube	100	100			**46.28**	**40.2**	**40.2**
WyAQ1	Roadside	Diffusion Tube	83	83			**52**	**44.2**	**49.6**
WychAD	Roadside	Diffusion Tube	83	83					36.8
WychCH	Roadside	Diffusion Tube	100	100					35.8
WychSC	Roadside	Diffusion Tube	92	92					39.4

☒ **Diffusion tube data has been bias corrected**

☒ **Annualisation has been conducted where data capture is <75%**

Notes:

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

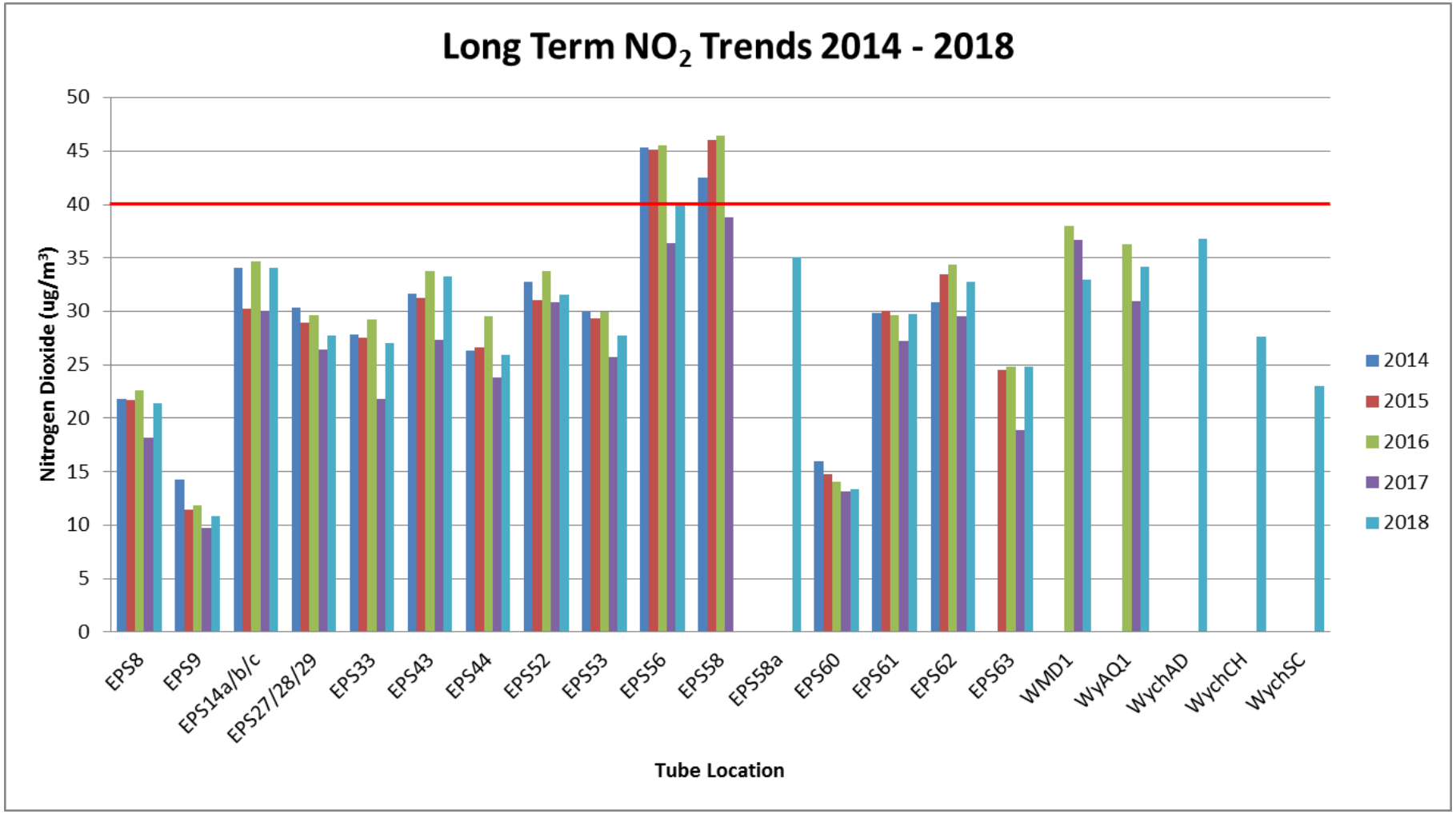
NO_2 annual means exceeding 60µg/m^3, indicating a potential exceedance of the NO_2 1-hour mean objective are shown in **bold and underlined.**

(1) 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%).

(3) Means for diffusion tubes have been corrected for bias. All means have been "annualised" as per Boxes 7.9 and 7.10 in LAQM.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Figure A.1 – Trends in Annual Mean NO_2 Concentrations (bias-adjusted, annualised and corrected for distance)



Appendix B: Full Monthly Diffusion Tube Results for 2018

Table B.1 – NO_2 Monthly Diffusion Tube Results - 2018

Site ID	NO_2 Mean Concentrations ($\mu g/m^3$)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean		
													Raw Data	Bias Adjusted (0.89) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
EPS8	35.0	36.4	33.3	30.4	26.5	22.2	30.0	26.5	28.6	33.0	29.1	31.1	30.2	26.9	21.4
EPS9	17.1	18.7	16.9	11.9	10.2	9.1	8.4	10.0	10.7	15.8	16.8	16.6	13.5	12.0	10.8
EPS14	**53.51**	**49.95**	**49.36**	**43.02**	**46.03**	38.47	**48.61**	39.96	**45.17**	**43.8**	**45.91**	**46.94**	**45.9**	**40.9**	33.8
EPS14a	**58.66**	**51.02**	**52.99**	**46.98**	**47.99**	39.93		39.87	**45.17**	**45.46**	**44.94**	**46.08**	**47.2**	**42.0**	34.6
EPS14b	**55.78**	**46.52**	**52.44**	**43.8**	**43.13**	**43.74**	**44.5**	**45.22**	**43.93**	**44.49**	**43.52**	**43.74**	**45.9**	**40.9**	33.8
Average EPS14/a/b	**55.98**	**49.16**	**51.60**	**44.60**	**45.72**	**40.71**	**46.56**	**41.68**	**44.76**	**44.58**	**44.79**	**45.59**	**46.33**	**41.2**	34.1
EPS27	**56.77**	**53.04**	**50.83**	**44.68**	**42.7**	39.86	**47.8**	**43.23**	**47.08**	**48.7**	**40.69**	**43.76**	**46.6**	**41.5**	27.7
EPS33	34.87	37.66	**41.43**	36	37.04	30.56	26.51	27.47	25.29	35.2	37.61	33.56	33.6	29.9	27.0
EPS43	39.9	**40.01**	**42.85**	33.45	**40.65**	30.27	39.8	31.5	32.56	38.93	37.09	**41.44**	37.4	33.3	33.3
EPS44	38.55	38.13	38.54	32.96	35.13	29.86	37.49	31.55	34.18	34.97	32.59		34.9	31.1	25.9
EPS52	36.74	38.7	38.34	35.2	33.16	23.59	38.83		35.76	37.15	34.84	37.82	35.5	31.6	31.6
EPS53	35.58	33.53	33.51	30.53	26.58	19.87	29.56	29.89	33.31	34.24	31.24	35.81	31.1	27.7	27.7
EPS56	**49.42**	**48.37**	**45.14**	**40.92**	**43.01**	38.99	**46.26**	**44.82**	**45.55**	**47.93**	**45.72**	**43.85**	**45.0**	**40.0**	**40.0**
EPS58a				37.03	36.23	31.11	36.2			38.93		35.48	35.8	35.1	35.1
EPS60	23.47	23.83	21.73	16.48	13.38	9.66	11.15	15.95	15.73	18.98	19.74	22.92	17.8	15.8	13.4

EPS61	38.18	33.9	36.14	32.34	28.41	22.48	34.28	35.4	33.8	33.19	35.61	37.14	33.4	29.7	29.7
EPS62	**46.15**	**40.01**	39.09	35.46	32.54	27.81		36.26	39.21	37.95	33.56	37.14	36.8	32.8	32.8
EPS63		35.99	32.76	30.74	33.17	27.94	18.72	17.75	18.61	26.88	36.49	27.03	27.8	24.8	24.8
WMD1	**53.58**	**55.39**	**54.3**	**45.85**	**43.66**	37.69	**44.53**	**40.73**	**42.66**	**43.47**	34.63	**45.75**	**45.2**	**40.2**	33.0
WyAQ1	**64.45**	**64.58**	**58.53**	**54.37**	**49.33**	**48.19**		**47.75**	**56.83**	**58.1**		**55.3**	**55.7**	**49.6**	34.2
WychAD	**43.41**	**42.75**	**42.64**	**41.61**	**48.33**	**46.57**	38.05	39			27.19	**43.53**	**41.3**	36.8	n/a
WychCH	**46.41**	**45.14**	**44.4**	36.68	34.27	30.8	36.57	36.89	**40.61**	**41.39**	**48.26**	**41.12**	**40.2**	35.8	27.6
WychSC	**49.87**	**50.29**	**44.37**	**45.99**	**41.65**	39.12		37.37	**40.42**	**47.21**	**43.48**	**46.68**	**42.5**	39.4	23.6

☒ **Local bias adjustment factor used**

☒ **National bias adjustment factor used**

☒ **Annualisation has been conducted where data capture is <75%**

☒ **Where applicable, data has been distance corrected for relevant exposure**

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) See Appendix C for details on bias adjustment and annualisation.

(2) Distance corrected to nearest relevant public exposure.

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

Diffusion Tube Bias Adjustment Factors

The following UKAS accredited company provides Wychavon 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. Under the AIR NO_2 PT (formerly WASP) Scheme Somerset Scientific Services performed 100% satisfactory for the period January to October 2018. Tube precision was 'Good' throughout 2018.

The bias-adjustment factor applied to 2018 nitrogen dioxide diffusion tube data was 0.89 which has been derived from the national studies and published by DEFRA (Spreadsheet Version No. 03/19).

Annualisation

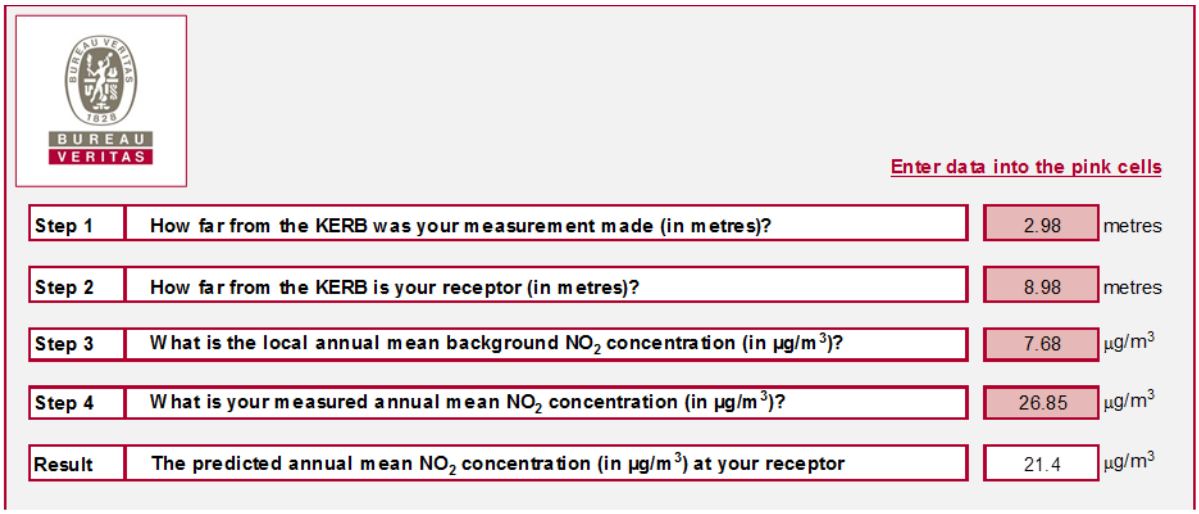
Table C.1 – Annualisation calculations for monitoring location EPS58a, Worcester Road, Wychbold

Site	Site Type	Annual Mean	Period Mean	Ratio
Birmingham Acocks Green	Urban Background	18	16.7	1.1
Coventry Allesley	Urban Background	20	18.1	1.1
Leamington Spa Rugby Road	Urban Background	17	14.4	1.2
			Annualisation Factor	1.1
			EPS58a bias-adjusted result	31.9
			Annualised result	35.1

Estimates of concentrations at the nearest receptor

If an exceedance is measured at a monitoring site (or close to the air quality objective) which is not representative of public exposure, Defra advise the procedure specified in Technical Guidance LAQM.TG(16) should be used to estimate the concentration at the nearest receptor where applicable. For consistency and purposes of demonstrating long term trends this procedure has been adopted for all monitoring locations which are representative of public exposure. The results are presented in Figures C1 to C11 below and summarised in Table B.1

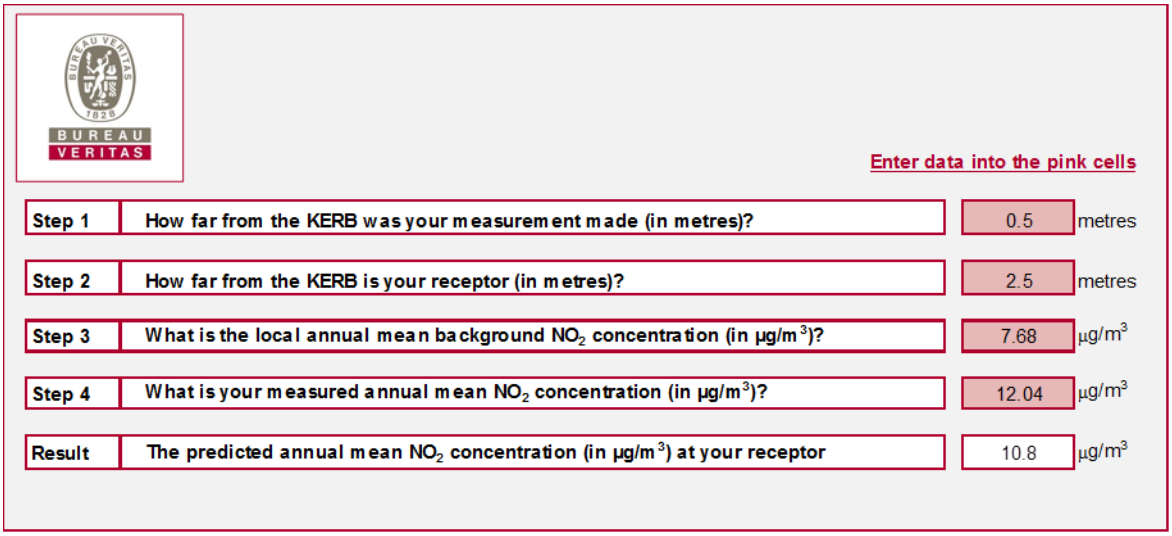
Figure C.1 Distance Correction EPS8



Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	2.98	metres
Step 2	How far from the KERB is your receptor (in metres)?	8.98	metres
Step 3	What is the local annual mean background NO_2 concentration (in $\mu g/m^3$)?	7.68	$\mu g/m^3$
Step 4	What is your measured annual mean NO_2 concentration (in $\mu g/m^3$)?	26.85	$\mu g/m^3$
Result	The predicted annual mean NO_2 concentration (in $\mu g/m^3$) at your receptor	21.4	$\mu g/m^3$

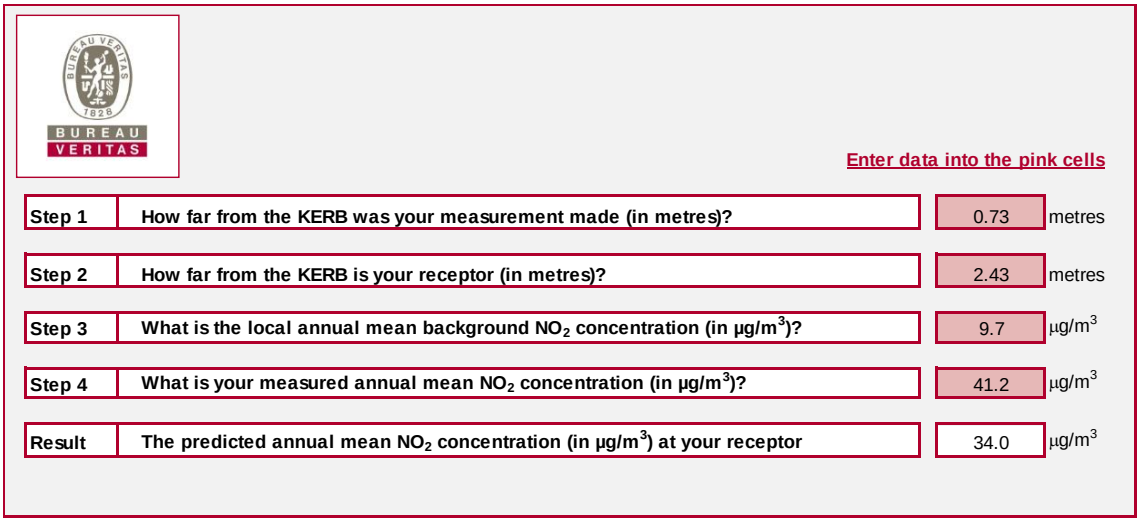
Figure C.2 Distance Correction EPS9



Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	0.5	metres
Step 2	How far from the KERB is your receptor (in metres)?	2.5	metres
Step 3	What is the local annual mean background NO_2 concentration (in $\mu g/m^3$)?	7.68	$\mu g/m^3$
Step 4	What is your measured annual mean NO_2 concentration (in $\mu g/m^3$)?	12.04	$\mu g/m^3$
Result	The predicted annual mean NO_2 concentration (in $\mu g/m^3$) at your receptor	10.8	$\mu g/m^3$

Figure C.3 Distance Correction EPS14a/b/c



Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	0.73	metres
Step 2	How far from the KERB is your receptor (in metres)?	2.43	metres
Step 3	What is the local annual mean background NO_2 concentration (in $\mu g/m^3$)?	9.7	$\mu g/m^3$
Step 4	What is your measured annual mean NO_2 concentration (in $\mu g/m^3$)?	41.2	$\mu g/m^3$
Result	The predicted annual mean NO_2 concentration (in $\mu g/m^3$) at your receptor	34.0	$\mu g/m^3$

Figure C.4 Distance Correction EPS27

Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	2.31	metres
Step 2	How far from the KERB is your receptor (in metres)?	17.81	metres
Step 3	What is the local annual mean background NO_2 concentration (in µg/m^3)?	12.95	µg/m^3
Step 4	What is your measured annual mean NO_2 concentration (in µg/m^3)?	41.5	µg/m^3
Result	The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor	27.4	µg/m^3

Figure C.5 Distance Correction EPS33

Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	3.5	metres
Step 2	How far from the KERB is your receptor (in metres)?	6	metres
Step 3	What is the local annual mean background NO_2 concentration (in µg/m^3)?	9.38	µg/m^3
Step 4	What is your measured annual mean NO_2 concentration (in µg/m^3)?	29.91	µg/m^3
Result	The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor	26.9	µg/m^3

Figure C.6 Distance Correction EPS44

Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	1.18	metres
Step 2	How far from the KERB is your receptor (in metres)?	3.78	metres
Step 3	What is the local annual mean background NO_2 concentration (in µg/m^3)?	9.7	µg/m^3
Step 4	What is your measured annual mean NO_2 concentration (in µg/m^3)?	31.07	µg/m^3
Result	The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor	25.9	µg/m^3

Figure C.7 Distance Correction EPS60

Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	1.1	metres
Step 2	How far from the KERB is your receptor (in metres)?	6.6	metres
Step 3	What is the local annual mean background NO_2 concentration (in $\mu g/m^3$)?	9.38	$\mu g/m^3$
Step 4	What is your measured annual mean NO_2 concentration (in $\mu g/m^3$)?	15.8	$\mu g/m^3$
Result	The predicted annual mean NO_2 concentration (in $\mu g/m^3$) at your receptor	13.4	$\mu g/m^3$

Figure C.8 Distance Correction WMD1

Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	2.66	metres
Step 2	How far from the KERB is your receptor (in metres)?	7.6	metres
Step 3	What is the local annual mean background NO_2 concentration (in $\mu g/m^3$)?	12.95	$\mu g/m^3$
Step 4	What is your measured annual mean NO_2 concentration (in $\mu g/m^3$)?	40.2	$\mu g/m^3$
Result	The predicted annual mean NO_2 concentration (in $\mu g/m^3$) at your receptor	33.0	$\mu g/m^3$

Figure C.9 Distance Correction WyAQ1

Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	1.93	metres
Step 2	How far from the KERB is your receptor (in metres)?	11.84	metres
Step 3	What is the local annual mean background NO_2 concentration (in $\mu g/m^3$)?	12.95	$\mu g/m^3$
Step 4	What is your measured annual mean NO_2 concentration (in $\mu g/m^3$)?	49.6	$\mu g/m^3$
Result	The predicted annual mean NO_2 concentration (in $\mu g/m^3$) at your receptor	34.2	$\mu g/m^3$

Figure C.10 Distance Correction WychCH

Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	2.14	metres
Step 2	How far from the KERB is your receptor (in metres)?	9.64	metres
Step 3	What is the local annual mean background NO_2 concentration (in µg/m^3)?	12.95	µg/m^3
Step 4	What is your measured annual mean NO_2 concentration (in µg/m^3)?	35.8	µg/m^3
Result	The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor	27.6	µg/m^3

Figure C.11 Distance Correction WychSC

Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	1.2	metres
Step 2	How far from the KERB is your receptor (in metres)?	20.8	metres
Step 3	What is the local annual mean background NO_2 concentration (in µg/m^3)?	12.95	µg/m^3
Step 4	What is your measured annual mean NO_2 concentration (in µg/m^3)?	39.4	µg/m^3
Result	The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor	23.6	µg/m^3

Port Street, Evesham AQMA Revocation Order

WYCHAVON DISTRICT COUNCIL

WYCHAVON DISTRICT COUNCIL

ENVIRONMENT ACT 1995, PART IV, SECTION 83(2)(b)

THE PORT STREET, EVESHAM AIR QUALITY MANAGEMENT AREA (NITROGEN DIOXIDE) VARIATION ORDER 2018

Wychavon District Council, in exercise of the powers conferred upon it by Section 83(2)(b) of the Environment Act 1995, hereby makes the following Order

Whereas on 1st September 2007 Wychavon District Council ("the Council"), made the Port Street (Evesham) Air Quality Management Area (Nitrogen Dioxide) Order ("the 2007 Order") declaring that the area edged black on the hereto attached map to be an Air Quality Management Area ("AQMA") for the pollutant Nitrogen Dioxide (NO_2)

Due to overall improvements in Nitrogen Dioxide levels measured as an annual average over the period January 2008 to December 2016, the Council has decided that the AQMA relating to Port Street, Evesham as edged in red on the attached map, shall be revoked

This Order may be cited/referred to as the Wychavon District Council Port Street, Evesham AQMA Variation Order 2018, and shall come into effect on 1st May 2018

The Order shall remain in force until it is varied or revoked by a subsequent Order

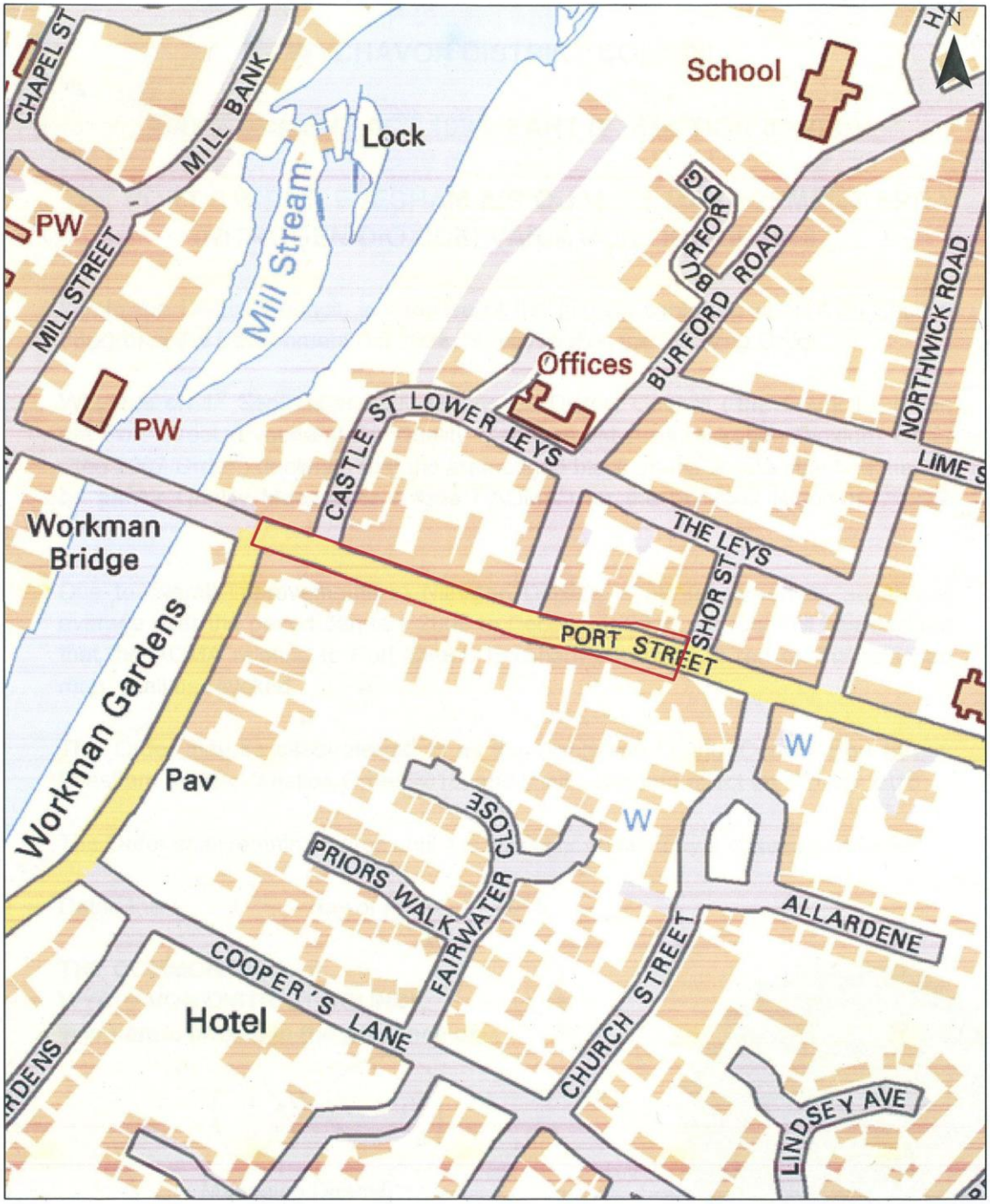
Dated this 9th day of May 2018

THE COMMON SEAL of)
WYCHAVON DISTRICT COUNCIL)
was hereto affixed in the presence of)

Managing Director

Legal Services Manager

12946



Ordnance Survey 100018317
Indicative Scale: 1:1500
Date Printed: 08/05/2018
0 15 30 60 90 120 Meters

Port Street, Evesham
Air Quality Management Area

WYCHAVON DISTRICT COUNCIL
good services, good value

Wychavon District Council
Civic Centre
Queen Elizabeth Drive
Pershore
WR10 1PT

Worcester Road, Wychbold Declaration Order

WYCHAVON DISTRICT COUNCIL

WYCHAVON DISTRICT COUNCIL

ENVIRONMENT ACT 1995, PART IV, SECTION 83(1)

AIR QUALITY MANAGEMENT AREA ORDER

Wychavon District Council, in exercise of the powers conferred upon it by Section 83(1) of the Environment Act 1995, hereby makes the following Order.

This Order my be cited/referred to as the Wychavon District Council Air Quality Management Area (Worcester Road, Wychbold) Declaration Order and shall come into effect on 1st May 2018.

The area shown on the attached map outlined in red is to be designated as an Air Quality Management Area (the designated area). The designated area incorporates the stretch of A38 between M5 Junction 5 and the roundabout for Webbs of Wychbold and a section of the main M5 carriageway at Junction 5.

This Area is designated in relation to a likely breach of the Nitrogen Dioxide (Annual Mean) objective as specified in the Air Quality Regulations 2000.

This Order shall remain in force until it is varied or revoked by a subsequent order.

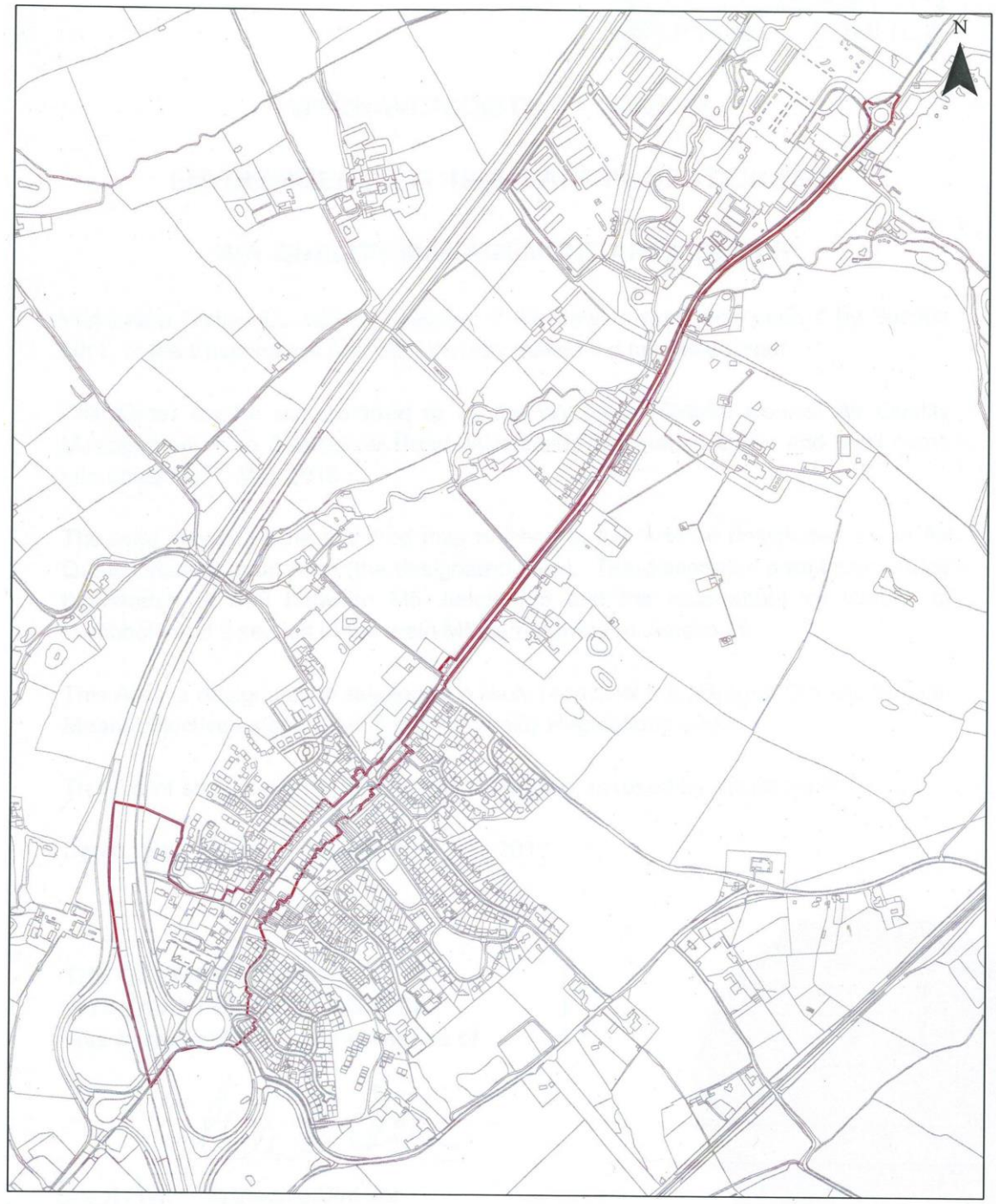
Dated this 17th day of May 2018

THE COMMON SEAL of)
WYCHAVON DISTRICT COUNCIL)
was hereto affixed in the presence of)

Deputy Managing Director

Legal Services Manager

12951



Ordnance Survey 100018317
Indicative Scale: 1:1500
Date Printed: 15/05/2018
0 45 90 180 270 360
Meters

Worcester Road, Wychbold
Air Quality Management Area

WYCHAVON DISTRICT COUNCIL
good services, good value

Wychavon District Council
Civic Centre
Queen Elizabeth Drive
Pershore
WR10 1PT

Worcester Road, Wychbold
Source Apportionment Assessment 2018

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

October 2018

Local Authority Officer	Laura Carradine
Department	Land & Air Quality Team
Address	Wyre Forest House Finepoint Way Kidderminster Worcestershire DY11 7WF
Telephone	01905 822799
E-mail	wrsenquiries@worcsregservices.gov.uk
Report Reference number	WDC/WORCSRD/SA/2018
Date	October 2018

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Appendices

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1.0 Introduction

This report fulfils the requirements of the Local Air Quality Management (LAQM) process as set out in Part IV of the Environment Act 1995, the Air Quality Strategy for England, Wales and Northern Ireland 2007 and the relevant Policy and Technical Guidance.

Policy Guidance (LAQM.PG16) requires a Local Authority to produce an Air Quality Action Plan (AQAP) following declaration of an Air Quality Management Area (AQMA). In order to develop an appropriate plan it is necessary to identify the emission sources contributing to the exceedance of the Objective.

2.0 Air Quality Objectives

The air quality objectives set out in the Air Quality (England) Regulations 2000, as amended by the Air Quality (England) (Amendment) Regulations 2002, provide the statutory basis for the air quality objectives under LAQM in England. The relevant objectives for the propose of this assessment are set out in Table 1 below.

Table 1 Nitrogen Dioxide AQOs

Pollutant	Objective	Averaging Period	Obligation
Nitrogen Dioxide	200µg/m^3	1-hour mean	All local authorities
	not to be exceeded more than 18 times a year		
	40µg/m^3	Annual mean	All local authorities

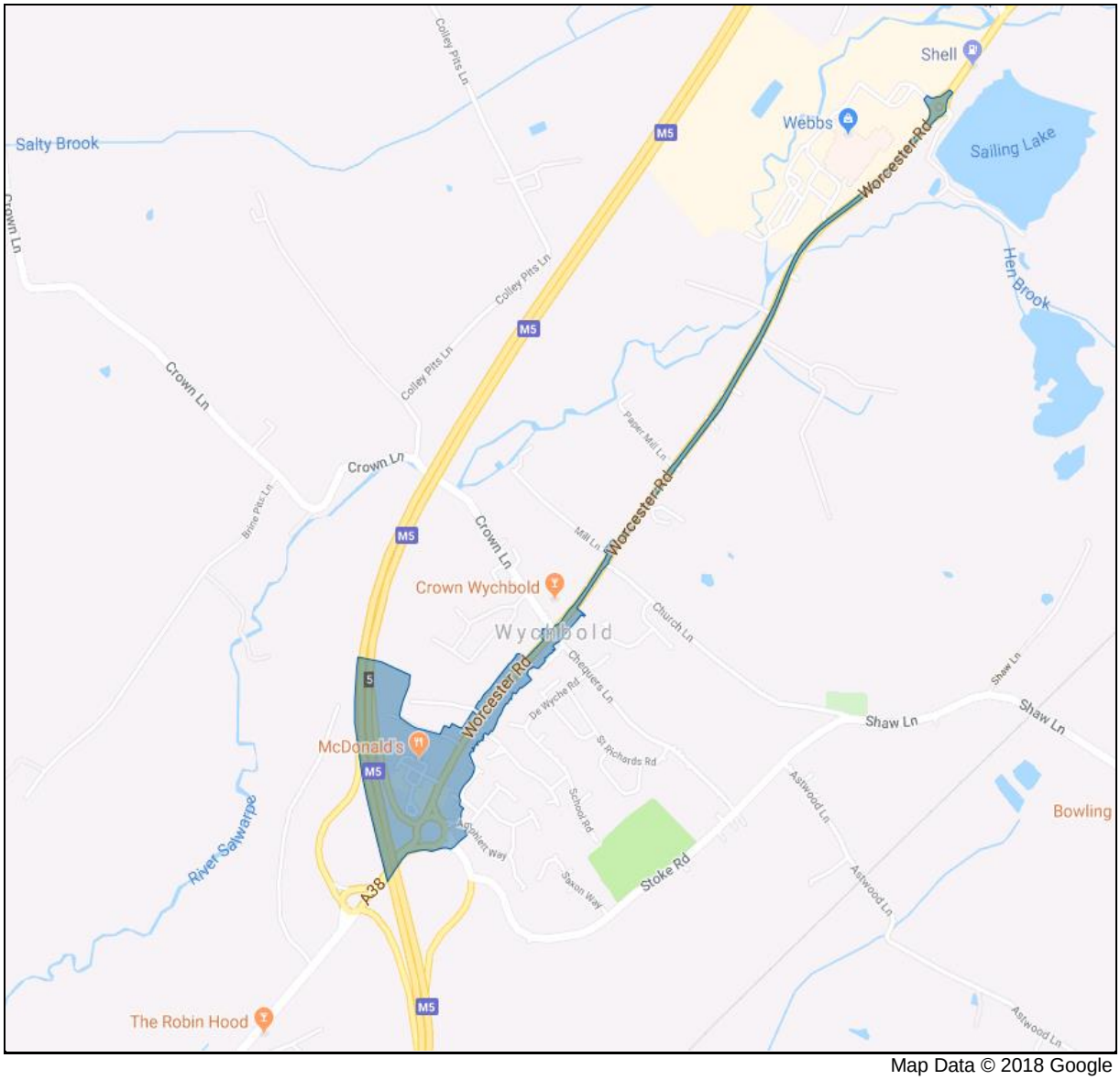
3.0 Declaration

Previous rounds of Local Authority Review and Assessment between 2012 and 2016 have highlighted exceedances of the nitrogen dioxide annual mean objective at Worcester Road, Wychbold. In 2017 a detailed review, including a detailed dispersion modelling exercise, was completed and confirmed that an Air Quality Management Area (AQMA) is required and determined the necessary minimum geographical extent of the AQMA. Further details can be found in the WRS Worcester Road, Wychbold Dispersion Modelling Assessment 2016 (October 2017, WDC/WORCSRD/DA/2017) available to view online at http://www.worcsregservices.gov.uk/media/3332953/Worcester-Rd-Wychbold-Dispersion-Modelling-Assessment-October-2017-FINAL.pdf

On 1st May 2018 Wychavon District Council declared an AQMA at Worcester Road, Wychbold. A plan of the proposed AQMA is provided below. The geographical area is based on predicted exceedances of the nitrogen dioxide annual mean objective and areas considered to be relevant in terms of the management of an AQMA i.e. the surrounding strategic road network.

The report details the first step in the process of developing an Action Plan for improving nitrogen dioxide levels within the AQMA. It identifies and aims to quantify the emission sources which contribute to the exceedance of the nitrogen dioxide annual mean objective in the area.

Figure 1 Worcester Road, Wychbold AQMA



Map Data © 2018 Google

4.0 Methodology and Input Data

This source apportionment assessment has been undertaken generally following the process outlined in Technical Guidance (LAQM.TG16). LAQM.TG16 (paragraph 7.100) advised that "source apportionment may be undertaken using a simple spreadsheet approach. For example, where road traffic emissions are the principal concern, the percentage contribution to NOX emissions may be calculated using the appropriate emissions factors".

Source apportionment has not been carried out using detailed dispersion modelling undertaken in 2017 in relation to the declaration of the AQMA. During the 2016 dispersion modelling assessment all reasonable steps were taken to minimise model uncertainty however an average error of approximately 6µg/m^3 persisted in the results. At the time advice in relation to this error was sought from Ricardo who advised that, given the magnitude of the concentrations modelled at receptors the error was not sufficient to materially change the conclusions of that work; that is that an AQMA was warranted and should be declared based on the modelling. However, Ricardo advised that the model should be revisited during any action planning process in order to narrow down the compliance gap as much as possible. In light of this it was decided to carry out source apportionment following the simple spreadsheet approach outlined in LAQM.TG16 in the interests of working towards the submission of an Air Quality Action Plan within 12 months of the declaration of the AQMA.

4.1 Emission Factor Toolkit

Source apportionment was undertaken using the most recent version of DEFRA's Emission Factor Toolkit (EfT v.8.0.1).

4.2 Traffic Data

Traffic Count Data

A 12 hour road traffic count was undertaken by Worcestershire County Council within the AQMA on the A38 Worcester Road on 15th February 2018. The traffic count data were scaled to 24hours using DfT Table TRA037. The traffic data and scaling calculations are provided in Appendix B.

Speed Data

Speed data for the A38 Worcester Road were derived from a basic speed survey carried out by Worcestershire Regulatory Services on Wednesday 25th January 2017. The survey was carried out using Android App "Speedometer GPS" which uses the inbuilt GPS of the smart phone to monitor and record journey statistics, including speed. These data are then displayed on a Google base map. The data are stored and can be reviewed at a later date. There is no function to export the data from the app and as such it is not possible to reproduce it in full as part of this report. However a summary of the information gathered is provided in Appendix B.

The surveys were undertaken during peak times between 0730 and 0930 and then again between 1630 and 1800. North bound and south bound speeds for specific points were extracted from the dataset. These were then averaged across the morning and evening peak time runs to give a single averaged speed for the area.

Bus Fleet Data

Worcestershire County Council provided WRS with local bus fleet composition for First Group and AT Group who, between them, operate the public bus services running along the A38 through Wychbold. The generalised Euro code compositions assumed in the EfT were amended to reflect the local fleet composition in order to provide a more accurate EfT output. A copy of the current bus fleet composition information is provided in Appendix B.

4.3 Diffusion Tube Data

Wychavon District Council monitors annual mean nitrogen dioxide concentrations using passive diffusion tubes located across the District. In 2016 there were six diffusion tube monitoring locations within the AQMA area. A plan showing the locations of diffusion tube monitoring locations is included in Appendix A.

LAQM.TG16 advises that as diffusion tubes are no the reference method for monitoring nitrogen dioxide, and passive diffusion typically results in a low accuracy, it is necessary to bias-adjust the results based upon local or national co-location studies with chemiluminescent analysers.

A bias-adjustment factor of 0.89 was applied to diffusion tubes for 2016. This was derived from a local co-location study undertaken in Wychbold between March and September 2016. The local bias-adjustment factor correlates with the National Diffusion Tube Bias Adjustment Factor Spreadsheet 09/16 which report 0.90.

It should be noted that 2016 diffusion tube data has been used in this source apportionment assessment. This decision was taken following the publication of very low national bias-adjustment factors for 2017. A 2017 national bias-adjustment factor of 0.77 was published for Somerset Scientific Services. It was noted that lower than usual bias-adjustment factors were published across the board in 2017. When this low bias-adjustment factor was applied to 2017 diffusion tube results the results dropped significantly in comparison with previous years. WRS made enquiries with the LAQM Helpdesk and directly with the National Physics Laboratory to further understand the drop in national bias-adjustment factors but were unable to obtain any satisfactory explanation. As a result WRS consider that the 2017 bias-adjusted diffusion tube results are not representative of the situation in Wychbold and as such this source apportionment assessment is based on the 2016 bias-adjusted diffusion tube results to ensure that the outcome of the assessment is as robust and relevant as possible. The 2016 results are reproduced in Table 2 below.

It should be noted that the diffusion tube monitoring network within the Wychbold AQMA has been expanded in 2017 and 2018.

Table 2 Annual mean nitrogen dioxide concentrations measured at diffusion tube locations along Worcester Road, Wychbold (µg/m^3)

Site	Description	2016[abc]
EPS27/28/29	Lamppost on roundabout, Worcester Road	30.1
EPS56	Façade of post office, Worcester Road	**45.57**
EPS58	Road sign outside 2 Rose Villas, Worcester Road	**46.4**
EPS59	Lamppost outside Weathervale, Worcester Road, Wychbold	37.1
WMD1	Lamppost at Walkmill Drive/Worcester Road junction	38
WyAQ1/2/3	Triplicate with automatic monitor lamppost outside Rose Dene, Worcester Road	36.3
Objective	40	

[a] *bias-adjusted using 2016 local factor 0.89*
[b] *annualised in accordance with DEFRA TG16*
[c] *calculated back to relevant exposure in accordance with DEFRA TG16*

5.0 Background and Local Contributions

Technical guidance (LAQM.TG16) advises that determining "…the apportionment for NO_2 is not straightforward due to the non-linear relationship between emissions of NO_2 and nitrous oxides (NO_X). This is additionally complicated by the different proportions of NO_2 in the NO_X emission for different sources, for example, petrol cars or diesel cars. The following advise therefore applies to NO_2 source apportionment:

- Background contributions: the national maps will give the total background NO_2 concentration. This should be apportioned to regional and local background using the ration of the background NO_X concentrations attributable to these two sources, which are also available in the national maps; and

- Local contributions: the local contribution to NO_2 is the difference between the total (measured or modelled) NO_2 and the total background NO_2. This is then apportioned to the local sources, for example, buses, HGVs, taxis, cars, using the relative contributions of these sources to the local NO_X concentration"

Regional and total background concentrations of NO_X and NO_2 for 2016, available from the DEFRA website, have been used to calculate the contribution of local NO_2 for the monitoring location with the highest measured level of NO_2 in 2016 (EPS58) following the procedure laid out in LAQM.TG16 Box 7.5. The local contribution has then been apportioned to each vehicle class according to the results of the EfT. Calculations are presented in Appendix C. The results are summarised in Tables 3 and 4 below.

Table 3 Measured NO_2 concentrations & contribution of each main source type

Annual Mean Concentration (µg/m^3)								
Site ID	Regional Background	Local Background	Cars	LGVs	HGVs	Buses	Motorcycles	Total
EPS58	17.12	2.06	13.77	7.11	4.28	2.04	0.03	46.41
% Contribution to Total								
Site ID	Regional Background	Local Background	Cars	LGVs	HGVs	Buses	Motorcycles	Total
EPS58	36.87	4.44	29.70	15.32	9.21	4.40	0.06	100.00

Background split determined following technical guidance in Defra (Oct 2016) 'Background Concentration Maps User Guide':

(1) Regional background includes emissions from sources not in LA control e.g. Motorways outside of study area, Industrial sources, Domestic properties, Railways, Rural sources, Others

(2) Local background includes emissions from sources LA have some influence over e.g. Primary A roads, Minor Roads and Point sources in and outside of study area

Table 3 above demonstrates that the main contributors to emissions within the Wychbold AQMA are regional background at 36.87% and diesel car emissions at 25.88%, followed by LGVs at 15.32% and HGVs at 9.21%.

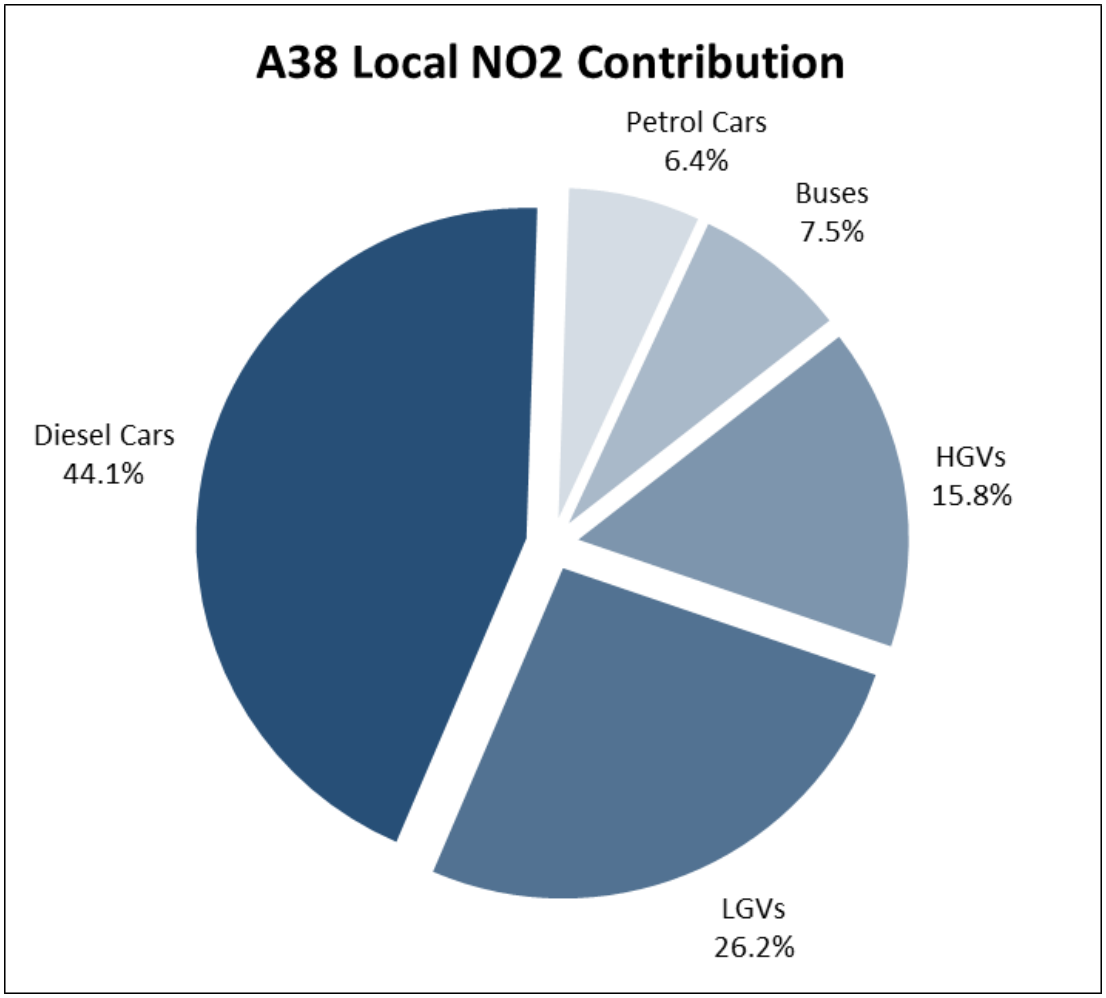
As the local authority is largely unable to influence regional background levels it is more useful to consider the source apportionment of the local traffic sources in isolation when developing actions for improving air quality. Table 4 below illustrates the local traffic contribution, excluding background concentrations, broken down into vehicle type.

Table 4 Concentrations & percentage contribution of emissions to local traffic sources

Annual Mean Concentration (µg/m^3)								
Site ID	Cars			LGVs		HGVs	Buses	Motorcycles	Total
	Petrol	Diesel	Other	Petrol	Diesel				
EPS58	1.74	11.95	0.08	0.03	7.08	4.28	2.04	0.03	27.23
% Contribution to Total									
Site ID	Cars			LGVs		HGVs	Buses	Motorcycles	Total
	Petrol	Diesel	Other	Petrol	Diesel				
EPS58	6.40	43.90	0.30	0.10	26.00	15.70	7.50	0.10	100.00

Table 4 illustrates that three main contributors to emissions within the AQMA are diesel cars (contributing 43.9%), diesel LGVs (contributing 26.0%) and HGVs (contributing 15.7%). Figure 2 below provides a graphical representation of the contribution of each vehicle category to local NO2 concentrations.

Figure 2 Contribution to Local NO2 emissions A38



6.0 Required Improvements

The improvement required to in order to achieve the annual mean objective for NO2 is represented by the difference between the highest measured or predicted concentration and the objective level (40µg/m^3).

Technical Guidance (LAQM.TG16) advises that it is most useful to consider required reductions in terms of nitrogen oxides (NOX). Therefore the road NOX reduction required for the objective to be achieved has been calculated in accordance with LAQM.TG16 Box 7.6 using DEFRAs NOX to NO2 Conversion Spreadsheet v6.1. The calculations are included as Appendix C.

It is generally accepted that the revocation of an AQMA is not appropriate unless measured concentrations are consistently below the objective to avoid 'bouncing' between revocation and re-declaration of borderline AQMAs. Therefore, the reduction in NOX required to achieve targets at 5% and 10% below the objective have also been calculated. Achieving these levels would provide greater confidence to the local authority that emissions of NO2 are unlikely to exceed the objective again. A summary of the required reductions in NOX and NO2 to achieve concentrations of 36µg/m^3, 38µg/m^3 and 40µg/m^3 at the worst-case receptor location (EPS58) is presented in Table 5 below.

Table 5 Required reduction in annual mean concentration at worst-case receptor EPS58

Required reduction in NO_X/NO_2 concentrations at worst-case receptor EPS58			
	Required NO_X reduction (µg/m^3)	Required NO_X reduction (% of local sources)	Equivalent NO2 reduction (µg/m^3)
Required reduction to Objective 40µg/m^3	15.21	25.98	7.08
Required reduction to 5% below Objective 38µg/m^3	19.76	33.75	9.19
Required reduction to 10% below Objective 36µg/m^3	24.22	41.37	11.27

Table 5 indicates that a reduction of 25.98% in emissions, or 7.08µg/m^3 is required to reduced levels of NO2 to the Objective level.

This report does not focus on how required reductions might be achieved. However, in order to inform the focus of potential measures for consideration as part of Action Plan development Table 6 below demonstrates the reduction in emissions that could

be expected to be achieved assuming stepped nominal emission reductions for each main vehicle category.

Table 6 Nominal Emissions Reduction per Vehicle Type

Reduction in Emissions (µg/m3)							
Vehicle Type	25% reduction	30% reduction	35% reduction	40% reduction	45% reduction	50% reduction	55% reduction
Cars	3.44	4.13	4.82	5.51	6.2	6.89	**7.58**
LGVs	1.78	2.13	2.49	2.84	3.2	3.55	3.91
HGVs	1.07	1.28	1.5	1.71	1.92	2.14	2.35
Buses	0.51	0.61	0.71	82	0.92	1.02	1.12
Total Vehicles	6.81	**8.17**	**9.53**	**10.89**	**12.25**	**13.62**	**14.98**

NB: Figures in **bold** indicate reductions that would achieve Objective

When compared with the equivalent NO2 reduction required demonstrated in Table 5, the results highlight that targeting individual types of vehicle using the A38 in isolation would not lead to the annual mean objective being achieve unless the reductions are very large. In reality actions to improve emissions are likely to target more than one type of vehicle. Table 6 illustrates that:

- Reducing total emissions from all vehicle types by between 25% and 30%, or targeting a combination of 35% cars and LGVs, would be potentially effective measures for achieving the Objective.
- Reducing total emissions from all vehicle types by around 35%, or targeting a combination of around 45% cars and LGVs, would be potentially effective for achieving concentrations 5% below the Objective.
- Reducing total emissions from all vehicles by between 40% and 45%, or targeting a combination of around 55% cars and LGVs, would be potentially effective measures for achieving concentrations 10% below the Objective.

7.0 Summary and Conclusions

Wychavon District Council declared the Worcester Road, Wychbold AQMA on 1st May 2018 following measured and modelling exceedances of the nitrogen dioxide annual mean objective.

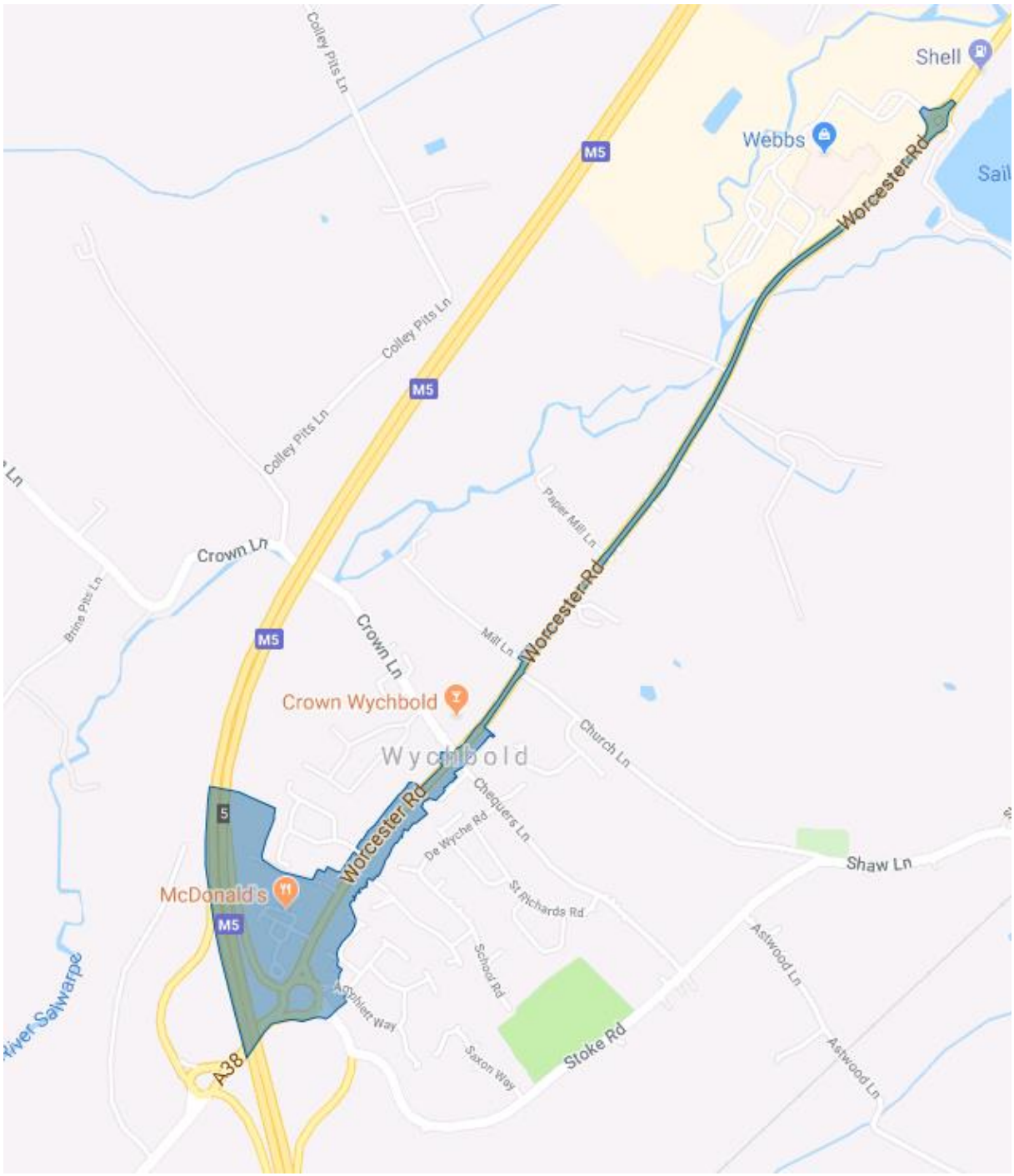
Source apportionment of background and local sources has been undertaken to inform the development on an Air Quality Action Plan. The source apportionment exercise has been undertaken following guidance laid out in LAQM Technical Guidance 16.

The outcome of the source apportionment exercise shows that background concentration contributes a significant proportion of the overall concentration of NO2 measured within the AQMA (36.87%). Cars, which make up the largest proportion of traffic volume (81%) contribute approximately 50% of local traffic emissions iwthin the AQMA with diesel cars in particular responsible for a large proportion (approximately 44%). LGVs contribute approximately 26% of local traffic emission and HGVs approximately 16%.

Targeting individual types of vehicles on the A38 in isolation would not lead to the annual mean objective being achieved unless the reductions are very large, for example an approximately reduction of 55% in emissions from cars would be required. However a reduction in total vehicle emissions of approximately 25% to 30% would potentially be effective in achieving the annual mean objective.

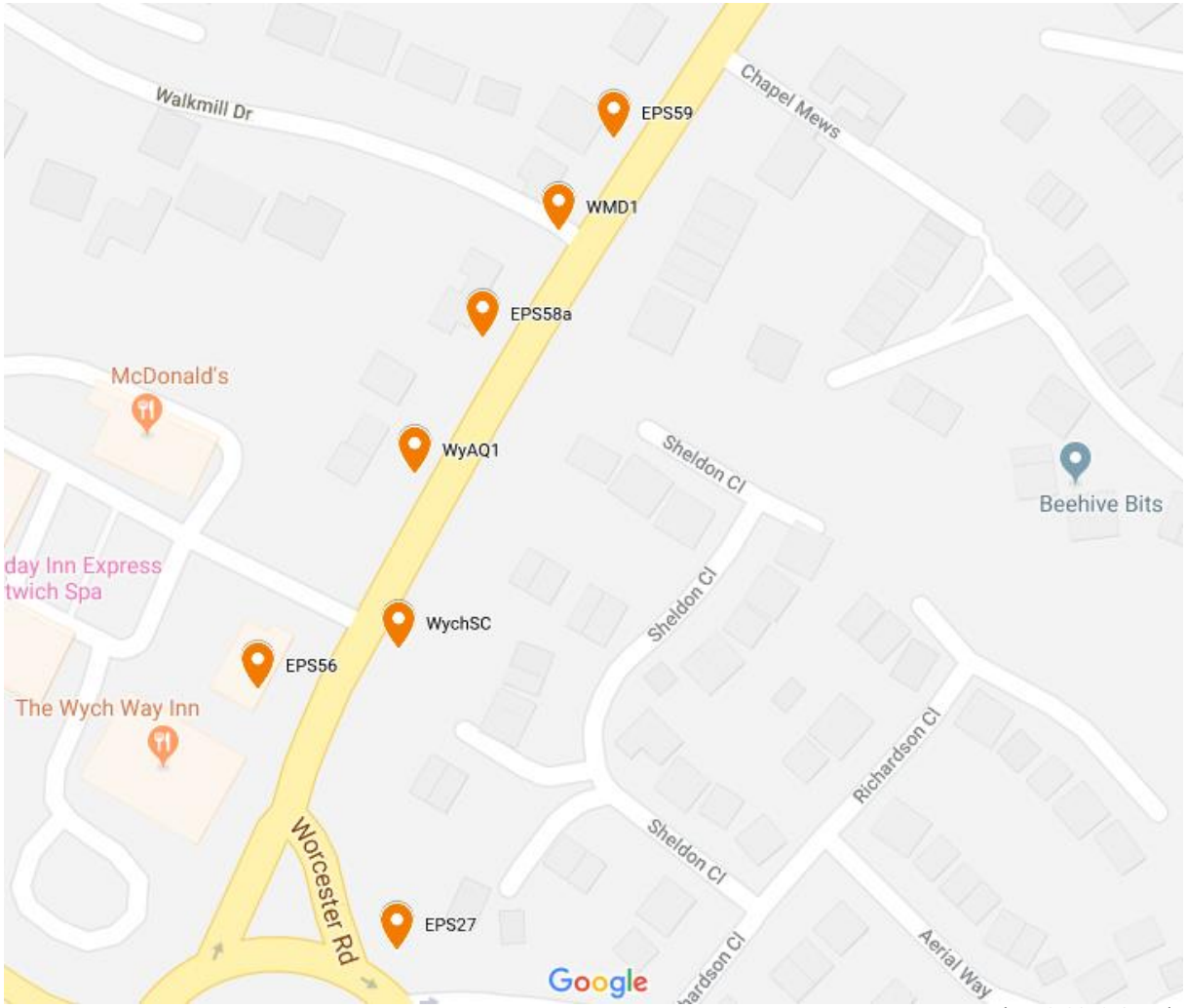
Appendix D: Map(s) of Monitoring Locations and AQMAs

Worcester Road, Wychbold AQMA (declared 1st May 2018)

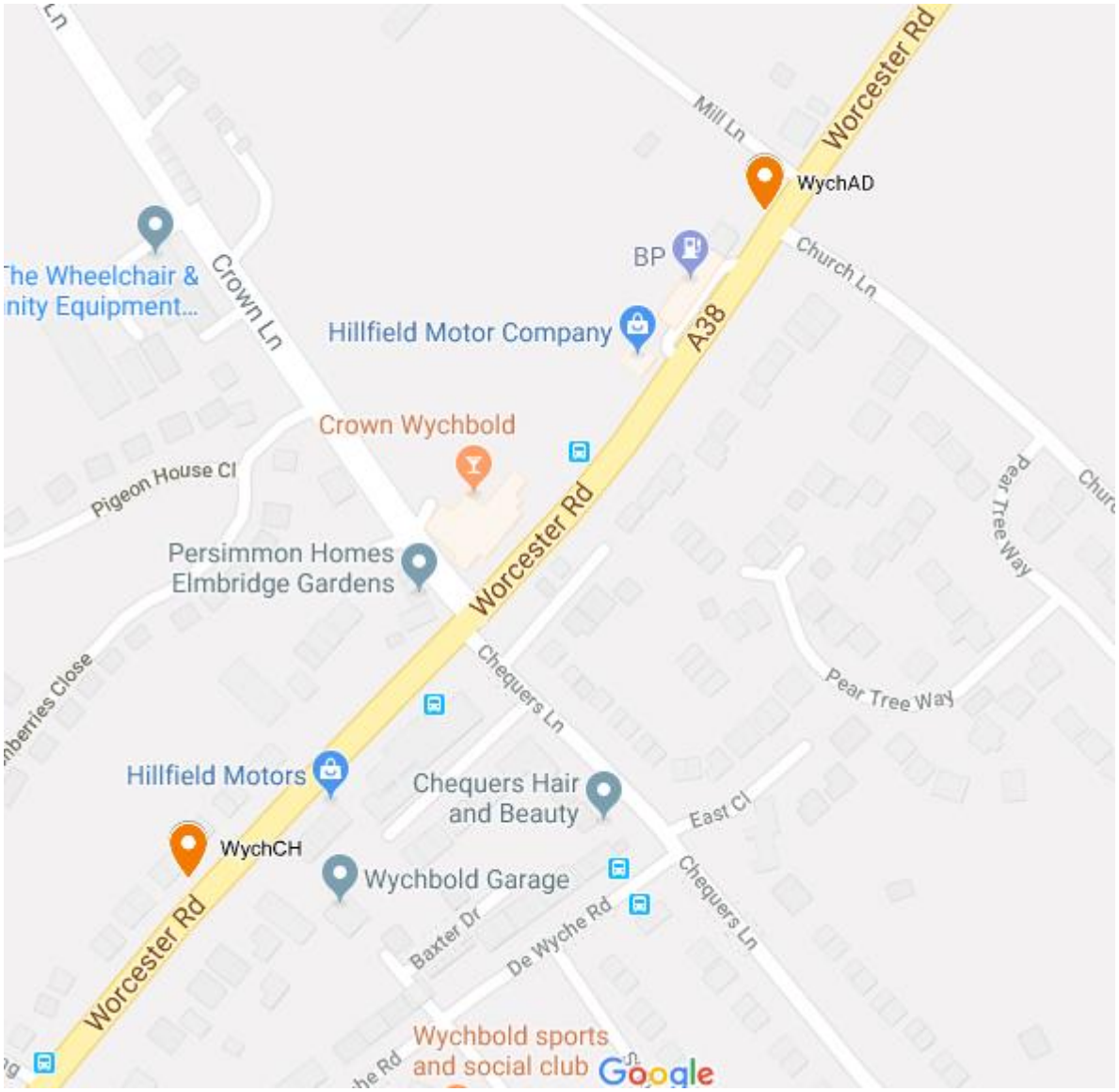


Map data © 2019 Google

Worcester Road, Wychbold AQMA Monitoring Locations

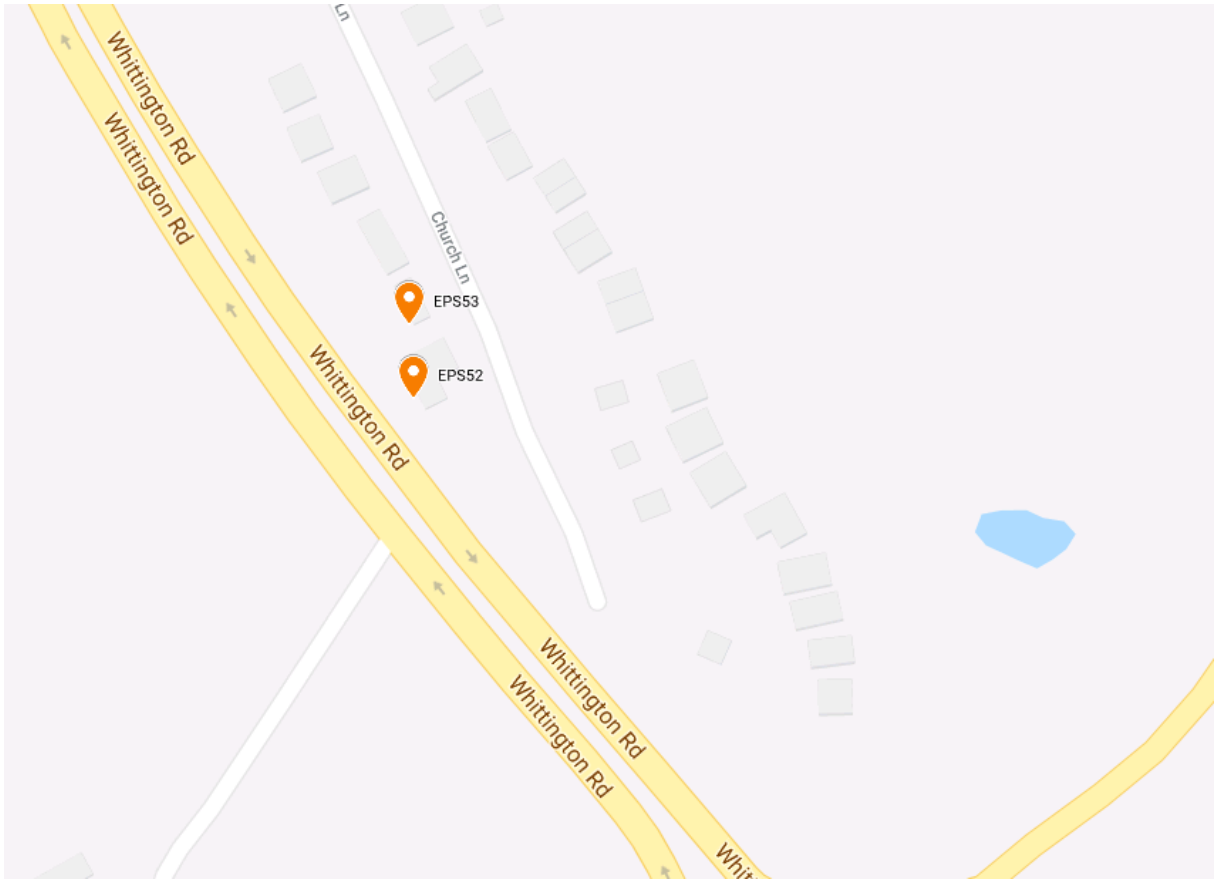


Map data © 2019 Google



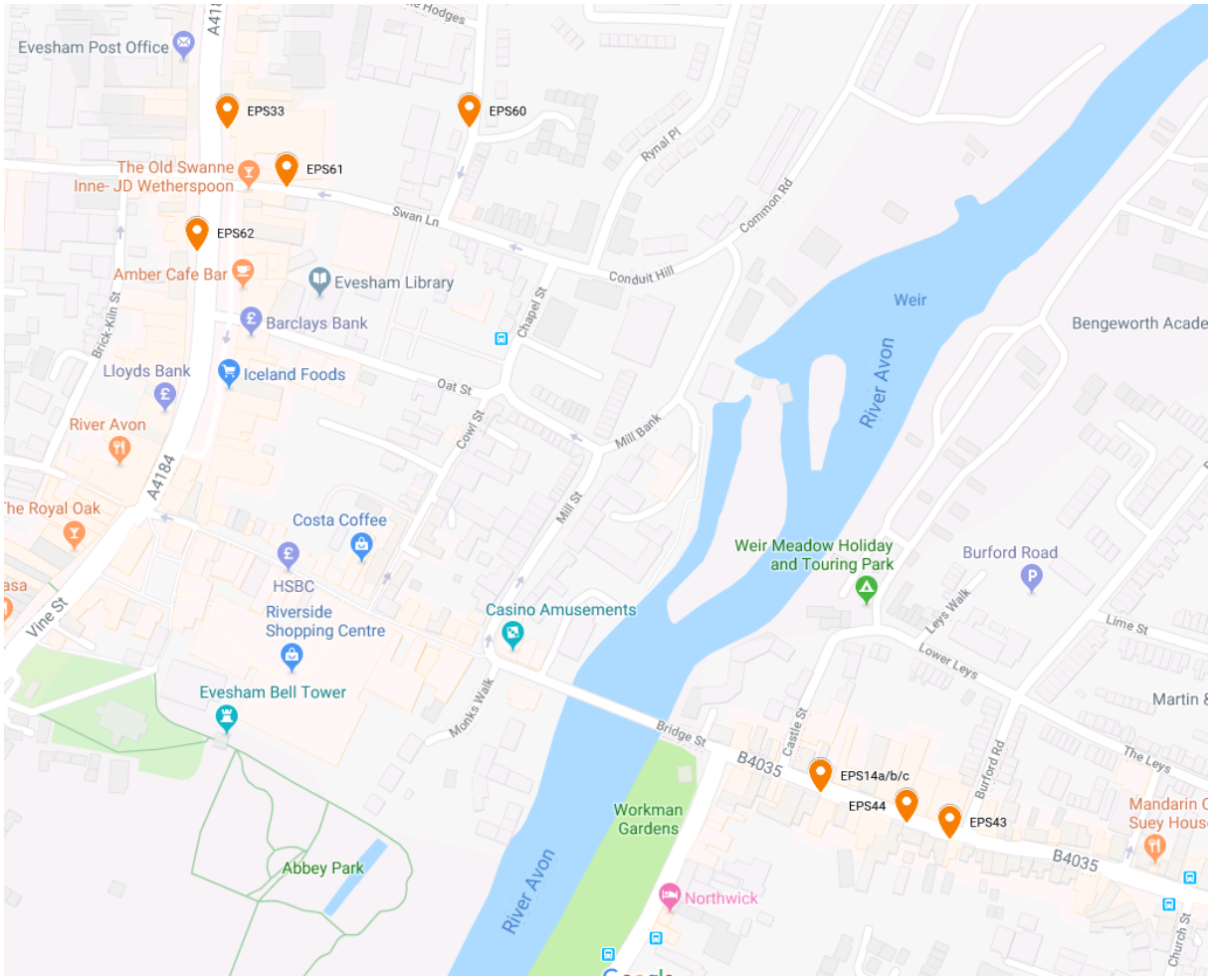
Map data © 2019 Google

Whittington Monitoring Locations



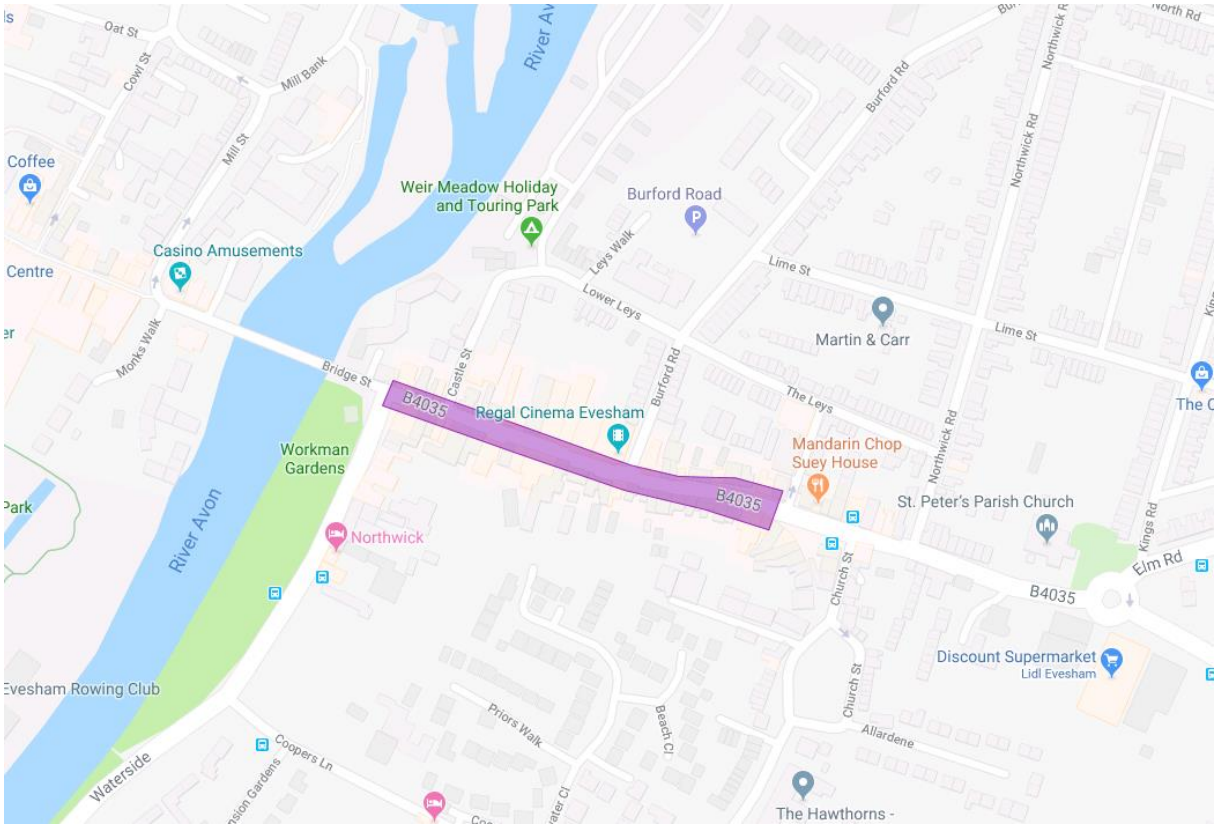
Map data © 2019 Google

Evesham Monitoring Locations



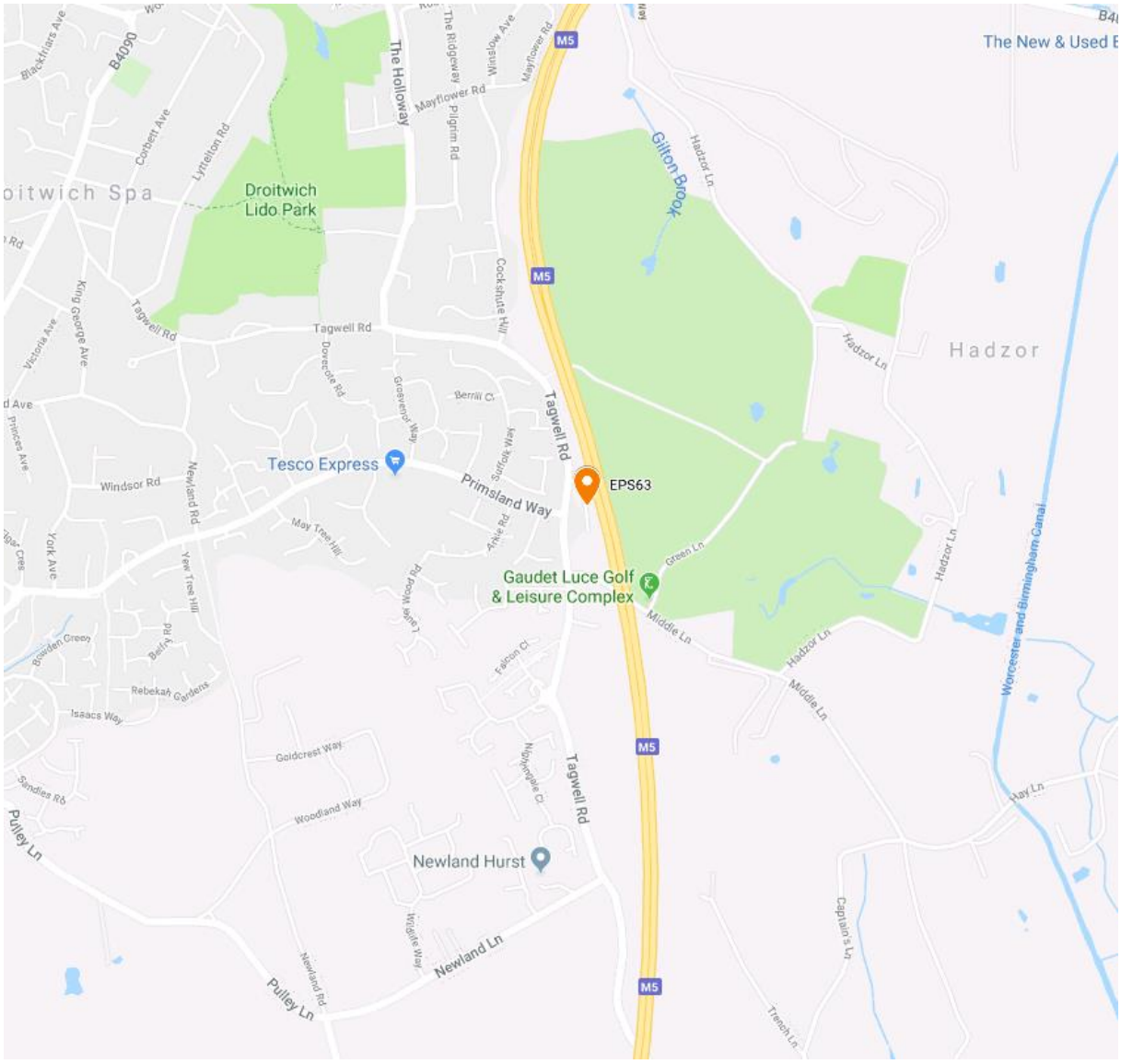
Map data © 2019 Google

Former Port Street, Evesham AQMA (revoked 1st May 2018)



Map data © 2019 Google

Droitwich Monitoring Locations



Map data © 2019 Google

Pershore Monitoring Locations

Map data © 2019 Google

Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England

Pollutant	Air Quality Objective[6]	
	Concentration	Measured as
Nitrogen Dioxide (NO_2)	200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean
	40 µg/m^3	Annual mean
Particulate Matter (PM_{10})	50 µg/m^3, not to be exceeded more than 35 times a year	24-hour mean
	40 µg/m^3	Annual mean
Sulphur Dioxide (SO_2)	350 µg/m^3, not to be exceeded more than 24 times a year	1-hour mean
	125 µg/m^3, not to be exceeded more than 3 times a year	24-hour mean
	266 µg/m^3, not to be exceeded more than 35 times a year	15-minute mean

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

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	Air quality Annual Status Report
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by Highways England
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 (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
SO_2	Sulphur Dioxide

References

DEFRA (2016) 'Local Air Quality Management Policy Guidance LAQM PG.(16)'

DEFRA (2016) 'Local Air Quality Management Technical Guidance LAQM TG.(16)'

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 – March 2016'

Worcestershire Regulatory Services (2018) '2017 Annual Air Quality Status Report' WDC/ASR/2017