

2020 Air Quality Annual Status Report (ASR)

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

June 2020

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Executive Summary: Air Quality in Our Area

Air Quality in Worcester City

Air pollution is associated with a number of adverse health impacts. It is recognised as a contributing factor in the onset of heart disease and cancer. Additionally, air pollution particularly affects the most vulnerable in society: children 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 billion³.

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.

Three Air Quality Management Areas (AQMA) were declared by Worcester City Council in 2009 for exceedances of the annual average mean objective for nitrogen dioxide (NO₂):

- Dolday/Bridge Street AQMA declared 1st March 2009;
- Lowesmoor/Rainbow Hill AQMA declared 1st March 2009; and
- Newtown Road AQMA declared 1st March 2009.

The Newtown Road AQMA was revoked by the council on 30th July 2014.

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

A further AQMA was declared by the council for the St Johns area of Worcester for exceedance of the annual mean objective for NO₂ on 26th September 2014.

In 2017, a detailed assessment was undertaken of an area within London Road and Sidbury by Air Quality Consultants (AQC) on behalf of Worcester City Council. The AQC report concluded that an area at the western end of London Road should be declared as an AQMA. A copy of AQC (July 2017) 'Detailed Assessment of Air Quality along London Road, Worcester' (ref: J2829A/1/F1) is available to download from WRS website at <http://www.worcsregservices.gov.uk/pollution/air-quality/local-air-quality-progress-reports.aspx>

Additionally, long term trend measurements and automatic analyser results up to 2018 within Foregate Street, The Butts and The Tything, Worcester indicate that requirement for a new AQMA declaration of this combined study area would likely be confirmed by detailed assessment.

On the 11th June 2019 Worcester City Council formally declared the Worcester City AQMA (Political Boundary of Worcester City) which encompasses the whole district area as an AQMA, for likely breach of the nitrogen dioxide annual mean.

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

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

Monitoring results within Worcester City Council area demonstrate there have been significant decreases in NO₂, averaging 19.03%, at all monitored locations across the district between 2018 and 2019, consistent with trends across Worcestershire. This

significant decrease is attributed to the low bias adjustment factor of 0.78 applied to raw 2019 NO_x tube data and should not be considered as indicative of local trends.

Given the above, it is considered more appropriate to compare the bias adjusted 2019 results with 2017 data, which also was subject to a similar low bias adjustment factor. Overall the 2019 measured results indicate an average decrease of 0.60 µg/m³ and a 1.90% reduction from 2017 data.

Poor areas of air quality within Worcester typically coincide with the strategic road network in and around the city centre in proximity with sensitive residential receptors: The Butts-All Saints Road-Bridge Street strategic road one way system, The Tything A38 to The Foregate corridor, Lowesmoor-Rainbow Hill-Astwood Road B4850 corridor, St Johns Bull Ring A44 and London Road A44.

Like many parts of the UK, poor air quality in Worcester City is linked to areas with high volumes of traffic, congestion and 'street canyon' landscapes (where height of buildings is greater than width of road). Worcestershire County Council has responsibility for strategic transport issues in the county and published the fourth Local Transport Plan (LTP4) in 2017. WRS continues to liaise with the County Council in the development of countywide plans to ensure that remediation of the AQMA remain a strategic transport priority.

WRS has good working relationship with the County Council's Strategic Transport Team and has also experienced closer working ties with the Director of Public Health (DoPH) and Sustainability departments within the County Council in the last 2 – 3 years.

A new Air Quality Partnership led by the DoPH, supported by WRS, and comprising members from public health, air quality, strategic planning, sustainability, highways and transport was set up in 2019. The group have discussed potential actions to

improve air quality across the County and work is continuing in 2020 to formalise an action plan for implementation.

Actions to Improve Air Quality

Key actions in 2019 are:

- 1. Task and Finish Group (Air Quality) recommendations adopted 22nd January 2019.** The six recommendations are listed below in Table 2.2. More detail on the task and finish work and recommendations is available [here](#) and in the [Worcester City 2019 ASR](#).
- 2. Decision to implement a Task and Finish Group (Taxis), 28th May 2019.** This group has been set up to develop a Worcester City Taxi Strategy which will include consideration of sustainable issues such as the encouragement of electric vehicles.
- 3. Declaration of Worcester City AQMA (Political Boundary), 11th June 2019.** Worcester City Council is currently preparing a new AQAP setting out measures to improve local air quality. Unfortunately, this work has been delayed due to flooding in the city followed by the COVID-19 outbreak and UK lockdown. It is anticipated traffic surveys and source apportionment work to inform the AQAP will be completed in the latter part of 2020 with a draft AQAP ready for consultation by spring 2021.
- 4. City Centre Masterplan adopted 16th July 2019.** The Masterplan document can be found via the following link: <https://www.worcester.gov.uk/planning/city-centre-masterplan>. Actions within the plan potentially benefitting local air quality include:
 - Development opportunities that include the replacement of numerous surface level car parks with multi storey car parking at strategic points; and
 - Development opportunities and public realm enhancements supporting more active movements around the city e.g. walking and cycling.

Worcestershire County Council Highways & Transport Improvements

- **Worcestershire Parkway Station SWST1** – Works completed in 2019 and the new station opened on 23rd February 2020.
- **Southern Link Road (A4440) Phase 4 (Ketch to Powick Hams) SWST5** – Work began in March 2019 on Phase 4 to complete dualling of carriageway between the Ketch and Powick roundabouts, capacity improvements to those junctions, an additional bridge over River Severn and new foot/cycle bridges. Completion is now anticipated in spring 2022. Further information available [here](#).
- **Worcester Western Link Road SWST12** – to develop a new link road connecting A4440 with B4204 Martley Road. A detailed Options Appraisal Report is currently being prepared for this scheme. Progress is being maintained, but completion of this report will be delayed due to COVID-19, so may not complete until autumn 2020.
- **LTP4 Scheme W1 (Worcester Rainbow Hill/Astwood Road/Bilford Road/Blackpole Road Key Corridor of Improvement)** – An Options Appraisal Report is expected in autumn 2020 to identify a package of investment to improve the efficient and safe operation of this corridor.
- **LTP4 Scheme W4 Worcester East – West Axis Way Key Corridor Improvement** – This corridor improvement scheme is mostly completed, with the exception of the St Johns District Centre. Works will continue in 2020. Further information is available [here](#).

Conclusions and Priorities

Worcester City Council undertook non- automatic (passive) monitoring of NO₂ at 37 sites during 2019. Three monitoring locations recorded exceedances of the long term objective for NO₂ in 2019, with three other locations within 5% of the air quality objective (AQO) for NO₂.

Monitoring results demonstrate decreases in NO₂ at all monitored locations across the district between 2018 and 2019, consistent with trends across Worcestershire. This is attributed to the low bias adjustment factor of 0.78 applied to raw 2019 NOx (nitrogen oxides) tube data. The significant decrease between 2018 and 2019 monitoring data should not be considered as indicative of local trends.

Given the above it is considered more appropriate to compare the bias adjusted 2019 results with 2017 data which demonstrates a downward trend at 21 monitoring locations, averaging 1.56µg/m³ reduction. However 14 monitoring locations demonstrated an increase of on average 0.83µg/m³ increase. Overall the results indicate an average decrease of 0.60µg/m³ and a 1.90% reduction from 2017 data.

Worcester City Council's priorities for 2020 are progressing the following:

- Task and Finish Group (Air Quality) recommendations.
- New 5 year Air Quality Action Plan.
- Worcester City Taxi Strategy.
- Environmental Sustainability Strategy for the City of Worcester 2020-2030
- The Office of Low Emission Vehicles (OLEV) and Virgin Media funded installation of Electric Vehicle Chargepoints.
- The Arches and Worcester Foregate Station pedestrian and cyclist access development.

The principal challenges and barriers to implementation of improving measures that Worcester City anticipates facing are resourcing and funding sources for potential significant improving actions and measures, and delays to programs and work streams due to COVID-19 outbreak and enforced lockdown.

The 2017 'UK plan for tackling roadside nitrogen dioxide' outlines Government's approach and preferred options for mitigation of national areas of poor air quality detailing 29 local authorities required to produce strategies to accelerate compliance with the air quality objectives in their areas. A further 33 local authorities have since been required to produce feasibility studies on accelerating compliance following a High Court order. In autumn budget 2017, the chancellor announced a £220 million Clean Air Fund to support those local authorities and the people and businesses affected by these local plans. Worcester City Council is not one of these named councils and therefore has not been prioritised for access to that funding.

The coronavirus COVID-19 and subsequent mitigation measures put in place by the UK government to combat the impact of the virus occurred during the production of this ASR. The lockdown and required reallocation of resources has led to a temporary cessation of many local council activities and programs which impact on potential improving measures, such as progressing new strategies and policies, strategic highway improvement works and implementation of new infrastructure. As a result timelines for delivery of planned actions and measures are subject to significant delay and change in some circumstances.

Local Engagement and How to get Involved

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 public health, air quality, strategic planning, sustainability, highways and transport disciplines, and also representatives from the NHS and

Highways England. Further discussions and work to formalise an action plan are continuing in 2020.

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;
- **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 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>
- **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)^{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/>.
- 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/daqj>.
- 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> .

⁴ <http://www.breathelondon.org/>

⁵ <https://www.londonair.org.uk/LondonAir/guide/MyActionsForMe.aspx>

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1 Local Air Quality Management

This report provides an overview of air quality in Worcester City during 2019. 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 Worcester City 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 Table E.1 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 Worcester City 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, see Appendix D: Map(s) of Monitoring Locations and AQMAs, 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 City AQMA (Political Boundary)	11.06.2019	NO ₂ Annual Mean	Worcester City	AQMA encompasses whole district within political boundary of Worcester City	NO	55.03	µg/m ³	42.11	µg/m ³	Draft	In Progress	Not yet published

Worcester City confirms 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 Worcester City

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

The report is well structured, detailed, and provides the information specified in the Guidance. The following comments are designed to help inform future reports.

1. Trends are clearly presented and discussed and a robust comparison with air quality objectives is provided.
2. The diffusion tube mapping is comprehensive and clearly demonstrates the monitoring network. AQMA boundaries are also clearly shown on the map.
3. Highlighting the measured exceedances and borderline results in a separate table was especially helpful. Separate discussion of the concentrations and trends within each AQMA was detailed and informative.
4. The decision to declare the city-wide AQMA is greatly encouraged as NO₂ concentrations in the Foregate/The Butts/The Tything study area have been above the AQO for a number of years.
5. Annualisation was carried out for 1 site and distance correction for 14 sites. Calculations were provided; this is helpful and encouraged to continue.
6. The report is a good source for members of the public wanting to know more about air quality in their area and how they can get involved.
7. Many highways improvements have taken place during this reporting year; hopefully this will have a positive effect on air quality in the area. The Council should continue their hard work.

Worcester City Council has taken forward a number of direct measures during the current reporting year of 2020 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2. More detail on these measures can be found in their respective Action Plans and updates <http://www.worcsregservices.gov.uk/pollution/air-quality/air-quality-action-plan.aspx>.

Key actions in 2019 are:

- **Task and Finish Group (Air Quality) recommendations adopted 22nd January 2019.** The six recommendations are listed below in Table 2.2. More detail on the task and finish work and recommendations is available [here](#) and in the [Worcester City 2019 ASR](#). An internal officer working group (chaired by the Corporate Director for Homes & Communities), and supported by WRS officers, commenced in late 2019 to provide an impetus to progressing the T&F recommendations.
- **Decision to implement a Task and Finish Group (Taxis), 28th May 2019.** This group has been set up to develop a Worcester City Taxi Strategy which will include consideration of sustainable issues such as the encouragement of electric vehicles. This is particularly relevant to T&F (AQ) recommendation 5, see Table 2.2 below. Currently it is anticipated a draft taxi strategy will be ready for consultation in spring 2021.
- **Declaration of Worcester City AQMA (Political Boundary), 11th June 2019.** In line with Defra policy guidance (LAQM.PG16), Worcester City Council is currently preparing a new AQAP setting out measures to improve local air quality. Unfortunately, it has not been possible to complete traffic surveys required for source apportionment work due to flooding in the city in February/March 2020 followed by a halt to such works due to the COVID-19 outbreak. At this time, it is anticipated normalised traffic movements will resume in autumn allowing the surveys and subsequent source apportionment to be completed in the latter part of 2020 with a draft AQAP ready for consultation by spring 2021.
- **City Centre Masterplan adopted 16th July 2019.** The Masterplan document can be found via the following link: <https://www.worcester.gov.uk/planning/city-centre-masterplan>. Actions within the plan potentially benefitting local air quality include:

- Development opportunities that include the replacement of numerous surface level car parks with multi storey car parking at strategic points; and
- Development opportunities and public realm enhancements supporting more active movements around the city e.g. walking and cycling.

Currently, the council are redeveloping Victorian railway arches in the heart of the city. [The Arches](#) development includes pedestrian/cyclist access between Worcester Foregate Station and the river front. It is anticipated improved access will encourage additional uptake of active travel within the city centre and is due completion in 2021.

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

- Task and Finish Group (Air Quality) recommendations.
- New 5 year Air Quality Action Plan.
- Worcester City Taxi Strategy.
- Environmental Sustainability Strategy for the City of Worcester 2020-2030
- The Office of Low Emission Vehicles (OLEV) and Virgin Media backed installation of Electric Vehicle Chargepoints.
- The Arches and Worcester Foregate Station pedestrian and cyclist access.

The principal challenges and barriers to implementation of improving measures that Worcester City anticipates facing are resourcing and funding sources for potential significant improving actions and measures, and delays to programs due to COVID-19 outbreak and enforced lockdown.

In July 2017 Defra and DfT Joint Air Quality Unit (JAQU) published their detailed 'UK plan for tackling roadside nitrogen dioxide'. Within this plan, and the previous 2015 plan, 5 authorities were mandated to implement a Clean Air Zone (CAZ) in addition to Greater London, and a further 23 local authorities were required to produce

strategies to accelerate compliance with the air quality objectives in their areas following the governments preferred options for mitigation e.g. CAZ Framework.

A further 33 local authorities have since been required to produce feasibility studies on accelerating compliance following a High Court order. In the autumn budget 2017, the chancellor announced a £220 million Clean Air Fund to support those local authorities and the people and businesses affected by these local plans.

Worcester City Council is not one of these named councils and therefore has not been prioritised for access to that funding. There is no comparable funding for local authorities not named in those UK plans that have similar, sometimes even worse, areas of poor air quality identified under the LAQM regime.

The coronavirus COVID-19 and subsequent mitigation measures put in place by the UK government to combat the impact of the virus occurred during the production of this ASR. The lockdown and required reallocation of resources has led to a temporary cessation of many local council activities and programs which impact on potential improving measures, such as progressing new strategies and policies, strategic highway improvement works and implementation of new infrastructure. As a result timelines for delivery of planned actions and measures are subject to significant delay and change in some circumstances.

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

2.2.1 Worcestershire County Council Highways & Transport Improvements

- **Worcestershire Parkway Station SWST1** – to provide significantly improved direct access to national rail services between Hereford – Oxford – Reading and London Paddington, and Cardiff to Nottingham via Birmingham New Street and Derby. Works completed in 2019 and the new station opened on 23rd February 2020.
- **Southern Link Road (A4440) Phase 4 (Ketch to Powick Hams) SWST5** – dualling of carriageway to remove capacity constraint, support growth, reduce travel times and costs, improve network resilience to extreme weather events. Phase 3 of works comprising improvements to capacity of Norton Roundabout and completion of dualling between Whittington and Ketch junctions was completed in 2019. Work began in March 2019 on Phase 4 to complete dualling of carriageway between the Ketch and Powick roundabouts, capacity improvements to those junctions, an additional bridge over River Severn and new foot/cycle bridges. Completion is now anticipated in spring 2022, following the decision to cease works on the project due to the COVID-19 outbreak. Further information available [here](#).
- **Worcester Western Link Road SWST12** – to develop a new link road connecting A4440 with B4204 Martley Road. A detailed Options Appraisal Report is currently being prepared for this scheme. Progress is being maintained, but completion of this report will be delayed due to COVID-19, so may not complete until autumn 2020.
- **LTP4 Scheme W1 (Worcester Rainbow Hill/Astwood Road/Bilford Road/Blackpole Road Key Corridor of Improvement)** – An Options Appraisal Report is currently underway to identify a package of investment to improve the efficient and safe operation of this corridor. It is expected to report in autumn 2020, which will include a delivery programme for identified investment schemes.

- **LTP4 Scheme W4 Worcester East – West Axis Way Key Corridor**

Improvement – To deliver improvements to known congestion 'pinch points' and inefficient junctions along the main A44 west-east axis through the City Centre. This includes the sections between St Johns and Sidbury, as well as Croft Road to the north and all the key approaches to these areas.

This will include investment in traffic signals to improve network efficiency, waiting restrictions to regulate and maintain free flowing traffic along these key corridors, measures to tackle poor local air quality and 'town centre' improvements to improve facilities for pedestrians and cyclists and improved highway design.

This corridor improvement scheme is mostly completed, with the exception of the St Johns district centre. Works will continue in 2020. Further information is available [here](#).

Table 2.2 – Progress on Measures to Improve Air Quality

Measure No.	Measure	EU Category	EU Classification	Date Measure Introduced	Organisations involved	Funding Source	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
T&F 1	Consider AQ impacts in every Council Policy	Policy Guidance and Development Control	Other policy	Jan 2019	Worcester City Council	Worcester City Council (officer resource)	Implementation of Policy	0	Policy completed and implemented	2019	
T&F 2	Electric Vehicle Infrastructure in Residential Streets	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	Jan 2019	Worcester City Council, Worcestershire County Council (Virgin Media bid)	Virgin Media fund for one chargepoint. No further funding identified at this time.	Implementation of EV charging points in local residential areas, uptake of ULEV	0-8%	AQ group formed to implement T&F measures in Nov 2019	TBC	22% of residents have no access to off road parking. Significant funding required to provide all with access to EV chargepoints
T&F 3	AQ in Car Parking (Masterplan) Proposals	Transport Planning and Infrastructure	Other	Jan 2019	Worcester City Council	Not identified at this time	Design and location of multi storeys to replace multiple single level car parking and limit AQ impact e.g. promote ULEV	Not quantified at this time	AQ group formed to implement T&F measures in Nov 2019	TBC	Long timeline of 20+ years for implementation of Masterplan strategy
T&F 4	ULEV Pool Cars	Promoting Low Emission Transport	Other	Jan 2019	Worcester City Council	Not identified at this time	Purchase and use of vehicles for staff journeys	<0.2ug/m3	AQ group formed to implement T&F measures in Nov 2019	TBC	
T&F 5	Emissions Standard for Licensed Taxis	Promoting Low Emission Transport	Taxi Licensing conditions	Jan 2019	Worcester City Council, Worcestershire Regulatory Services	WRS (officer resource)	Introduction of emission standard, uptake of ULEV	0 - 9%	Task & Finish Taxi Group formed in 2019	TBC	
T&F 6	Low Emission Strategy	Policy Guidance and Development Control	Low Emissions Strategy	Jan 2019	Worcester City Council, Worcestershire Regulatory Services	WRS (writing strategy)	Completion of LES	0	AQ group formed to implement T&F measures in Nov 2019	Anticipated 2021	Dependent on availability of detail of other Task and Finish group measures
NAWC1	Develop and implement Worcester City Centre Masterplan	Traffic Management	UTC, Congestion management, traffic reduction	Oct 2015	Worcester City Council and others for the various measures	TBC as various measures progress	Masterplan - potentially reduced vehicle movements in some key areas through car parking provision strategy (e.g. uptake of EV), realm enhancements supporting walking and cycling.	Reduced emissions - not quantifiable at this time.	Masterplan adopted 16th July 2019	Masterplan improvements 20+ years.	Long time to implementation. Pre COVID-19 plans subject to delay.
5.2.10	Installing electric vehicle charging points	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to	Sept 2013	Worcester City Council, Worcestershire County Council	OLEV funding secured for 2 (double socket)	Increase in availability of EV charging points and	0 to 37%	EV Charging Point in developments recommendations formalised in WRS	Ongoing	Significant funding required for publicly available chargepoints.

Measure No.	Measure	EU Category	EU Classification	Date Measure Introduced	Organisations involved	Funding Source	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
			promote Low Emission Vehicles, EV recharging, Gas fuel recharging			chargepoints. No further funding identified at this time.	corresponding increase in uptake of electric vehicles		'Technical Guidance Note for Planning' (2018). T&F2 & 3 recommendations (2019). Virgin Media and OLEV funding for 3 chargepoints.		
5.2.1	Bus Quality Partnership	Promoting Low Emission Transport	Public Vehicle Procurement - Prioritising uptake of low emission vehicles	Sept 2013	Worcester City Council / Worcestershire County Council, local Bus Companies.	None identified at this time	Replacement of lower Euro standard buses on key city centre routes.	0 to 23%	Meetings with First Bus group July 2018	Currently unknown	Worcester is non profitable area for bus companies proving barrier to LEV investment locally. Requires LA subsidisation and/or enforcement.
5.2.2	Freight Quality Partnership	Traffic Management	UTC, congestion management, traffic reduction	Sept 2013	Worcestershire County Council	Worcestershire County Council	Fewer HGVs travelling through AQMA	Reduces Emissions - Not quantified at this time	County Council work with satellite navigation companies to route HGVs around AQMAs. Ongoing	On-going	Can take time for Sat Nav information to filter down to users
LRH7 / 5.1.1	Alteration to traffic light phasing - Lowesmoor Improvement scheme. Renewed enforcement of an existing TRO restricting all vehicles, with the exception of buses at certain times of day	Traffic Management	Strategic highway improvements and congestion reduction	Sept 2013	Worcestershire County Council	Worcestershire County Council	Improved flow of traffic through Lowesmoor. Reduced congestion. Reduced volume of traffic.	5 - 10% (Lowesmoor)	Traffic Light phasing implemented January 2015. TRO updated and implemented. MTE cameras purchased & ready for installation.	Summer 2020	Bus Lane Enforcement (MTE) cameras to be installed within next few months
5.3.4	Promote flexible working arrangements	Promoting travel alternatives	Encourage/facilitate home-working	Sept 2013	Worcestershire County Council, Superfast Worcestershire	Worcestershire County Council, EU Regional Development Fund, Dept. of DCMS	Increase in number of people able to work from home	Reduces Emissions - Not quantified at this time	96.3% Superfast Broadband coverage across County by Jan 2020.	97% coverage by Summer 2021	Impact of COVID-19 on proportion of workers continuing to WFH unknown at this time.
5.1.7	Signage to avoid AQMA	Traffic Management	Other	Sept 2013	Worcestershire County Council	DfT	Decrease in number of strategic journeys through AQMA	Reduces Emissions - Not quantified at this time	VMS around City completed 2016.	2016	
5.1.4	Variable Message Systems	Traffic Management	Other	Sept 2013	Worcestershire County Council	DfT	Decrease in traffic movements through AQMA	Reduces Emissions - Not quantified at this time	Completed	2016	
5.1.1	Major signalling infrastructure updates at St Johns, St Clements, Croft Road, Dolday, Sidbury,	Traffic Management	UTC, Congestion management, traffic reduction	Sept 2013	Worcestershire County Council,	National Productivity Investment Fund	Improve network efficiency and accessibility for all modes of transport	Reduces Emissions - Not quantified at this time	Completed with exception of St Johns centre. Funding secured	2021	Delivery of St Johns scheme delayed by COVID-19

Measure No.	Measure	EU Category	EU Classification	Date Measure Introduced	Organisations involved	Funding Source	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
	Commandery Road and London Road										
5.1.5 /LRH5	Loading and unloading restrictions during peak traffic times (Lovesmoor/ Rainbow Hill)	Traffic Management	Workplace Parking Levy, Parking Enforcement on highway	Sept 2013	Worcester City Council	Worcester City Council	Reduced incidence of loading and unloading during peak times	Reduces Emissions - Not quantified at this time	TRO implemented and updated. MTE cameras purchased & ready for installation.	Summer 2020	Bus Lane Enforcement (MTE) cameras to be installed within next few months
5.1.1/ DD3	Alteration to phasing of traffic light systems/ junction review (Dolday)	Traffic Management	Strategic highway improvements, Re-prioritising road space away from cars, including Access management, Selective vehicle priority, bus priority, high vehicle occupancy lane	Sept 2013	Worcestershire County Council	National Productivity Investment Fund	Improved Traffic Flow	1.2 - 6.8% (Dolday)	Completed.	2014	
5.5.1	Produce Air Quality Supplementary Planning Document	Policy Guidance and Development	Air quality planning and policy guidance	Sept 2013	Worcestershire County Council Strategic Planner, WRS and South Worcestershire Councils	Worcestershire County Council Strategic Planner, WRS and South Worcestershire Councils (resource)	Formal adoption and utilised by Worcester City Council planning authority	Reduces emissions from new developments	WRS 'Technical Guidance Note for Planning' published 2018. Initial discussions on AQ SPD for SWDP Jan 2020.	2022	SPD work awaiting outcome of South Worcestershire Development Plan review due 2021. Work currently suspended due to COVID-19 impacts.
5.2.4	Railway Enhancements - new Worcestershire Parkway Station	Transport Planning and Infrastructure	Public transport improvements- interchanges stations and services	Sept 2013	Worcestershire County Council, Worcestershire Local Enterprise Partnership	DfT, Worcestershire Local Enterprise Partnership	Reduce commuter traffic destined for city central stations at Shrub Hill and Foregate Street	Reduces Emissions - Not quantified at this time	Completed	Opened 23rd February 2020	
5.2.5	Greening Council Fleets	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	Sept 2013	Worcester City Council, Worcestershire County Council	Not identified at this time	Increase in number of Council fleet and contractors vehicles of higher Euro Standard or ULEV	Reduces Emissions - Not quantified at this time	T&F4 recommendation ULEV pool cars (2019)	TBC	
5.3.6	Improve cycling and walking routes in local areas	Promoting Travel Alternatives	Promotion of cycling	Sept 2013	Worcestershire County Council	Worcestershire Network Efficiency Programme, National Productivity Investment Fund	Uptake in commuter journeys undertaken by cycle or walking	Reduces emissions - see comments	LTP4 (2017-2030) includes 8 active corridors that could improve AQ in Worcester City at various stages of development. City Masterplan includes 5 Public Realm	TBC	PHE Public Health Outcomes Framework (PHOF) data indicates levels of cycling and walking in Worcester is above regional and national data indicating limited potential for significant uptake and

Measure No.	Measure	EU Category	EU Classification	Date Measure Introduced	Organisations involved	Funding Source	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
									enhancements including active corridors and spaces, 1 (The Arches) due completion 2021.		improvement. However experience of Choose How You Move programs In Worcestershire indicates uptake of cycling and walking may continue following easing of COVID-19 lockdown measures.
5.3.1	Travel Planning	Promoting Travel Alternatives	Personalised travel planning	Sept 2013	Worcestershire County Council	Worcestershire County Council	Increased uptake of alternative modes of transport	Reduces Emissions - Not quantified at this time	Worcestershire County Council is delivering PTP services on behalf of developers.	On-going	PTP encourages modal shift in new developments towards more sustainable and space efficient forms of transport.
5.3.2	Car Sharing	Alternatives to private car use	Car and lift sharing schemes	Sept 2013	Worcestershire County Council	Worcestershire County Council	Increase in number of people car sharing	<1%	Liftshare Scheme operating, 573 members (May 2020)	Launched Autumn 2015	
5.6.3	Air Quality Networks	Policy Guidance and Development Control	Regional Groups Co-ordinating programmes to develop area wide Strategies to reduce emissions and improve air quality	Sept 2013	Worcestershire Regulatory Services, Central England Environmental Protection Group (CEEPG),	WRS (officer resource)	Improved cross boundary working between local authorities in West Midlands	0	WRS are member of regional environmental protection managers group (CEEPG)	On-going.	Differing AQ issues, priorities and resources in regional authorities
5.4.1	Smarter Driving Tips	Public Information	Via the Internet	Sept 2013	Worcestershire Regulatory Services, Worcestershire County Council	WRS (officer resource)	Webpage hits	<0.2ug/m3	Advice page created for all groups affected by and impacting air quality and shared with County Public Health.	Created Mar 2017, Updated March 2019	Effectiveness depends on behavioural change
5.45	Raise the profile and increase awareness of air quality within the region	Other	Other	Sept 2013	Worcestershire Regulatory Services, Midland Joint Advisory Council (MJAC), Central England Environmental Protection Group (CEEPG)	WRS, MJAC, CEEPG (officer resource)	Improved cross boundary knowledge sharing between local authorities in West Midlands	0	WRS held position of Air Quality technical coordinator for MJAC 2014-17, member of CEEPG formed in 2017.	On-going	Reduced AQ officers in regional authorities and resource to attend meetings
5.1.13	Alteration to Parking Provision	Traffic Management	UTC, Congestion management, traffic reduction	Sept 2013	Worcester City Council, Worcestershire County Council	Not identified at this time	Reduced traffic movements and congestion in inner city	Reduces Emissions - Not quantified at this time	City Masterplan (adopted 2019) proposals to consolidate existing multiple single level surface car parking into fewer multi story car parks at strategic points	TBC	Masterplan long lifetime of 20+ years. Congestion may increase in interim period between sale of existing car park land and implementation of replacement multi storey car parks

Measure No.	Measure	EU Category	EU Classification	Date Measure Introduced	Organisations involved	Funding Source	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
5.6.8	Forge closer links with local health agencies	Other	Other	Sept 2013	Worcestershire Regulatory Services, Director of Public Health	WRS, DoPH (officer resource)	Increase participation of Public Health in Worcestershire Air Quality issues	0	County Air Quality Partnership set up May 2019 by DoPH supported by WRS	On-going	
5.4.2	Provide link to real time air quality information	Public Information	Via the Internet	Sept 2013	Worcestershire Regulatory Services, Director of Public Health	WRS (officer resource)	Increase in WRS Twitter subscribers	0	System put in place at WRS to tweet alerts when Air pollution ≥ 4 (Moderate) in any given 5 day forecast on Defra Daily Air Quality Index and shared with County Public Health representative	On-going	Limited to Twitter users
5.4.4	Make air quality information more available and accessible	Public Information	Via the Internet	Sept 2013	Worcestershire Regulatory Services	WRS (officer resource)	Website hits and enquiries for information	0	Existing LAQM reports and details of AQMAs are publicly available on WRS website.	On-going	

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.

WRS has reviewed the Defra national background maps to determine projected PM_{2.5} concentrations with Worcester City for the 2019 calendar year. The average total PM_{2.5} at 32 locations (centre points of 1km x 1km grids) across Worcester City is 8.33µg/m³, with a minimum concentration of 7.74µg/m³ and a maximum concentration of 9.54µg/m³. This indicates that PM_{2.5} concentrations within Worcester City are well below the annual average EU limit value for PM_{2.5} of 25µg/m³ and the average is below World Health Organisation limits also. The whole district area of Worcester City is a Smoke Control Area.

As outlined in Policy Guidance LAQM.PG16, WRS have discussed the role of the DoPH, and the details of PM_{2.5} levels across the County, with the DoPH at Worcestershire County Council.

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. Further discussions and work to formalise an action plan are continuing in 2020.

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In light of the above no additional actions are currently planned by Worcester City Council in relation to the reduction of PM_{2.5} levels. However, it is anticipated that potential actions to improve NO₂ levels within the forthcoming Air Quality Action Plan 2021-25 will likely result in a linked improvement in PM_{2.5} levels.

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

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

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

Worcester City Council did not undertake any automatic (continuous) monitoring during 2019.

3.1.2 Non-Automatic Monitoring Sites

Worcester City Council undertook non- automatic (passive) monitoring of NO₂ at 37 sites during 2019. 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 bias⁶, “annualisation” (where the data capture falls below 75%), and distance correction⁷. Further details on adjustments are provided in Appendix C.

3.2.1 Nitrogen Dioxide (NO₂)

Table A.2 in Appendix A compares the ratified and adjusted monitored NO₂ annual mean concentrations for the past 5 years with the air quality objective of 40µg/m³. Note that the concentration data presented in Table A.2 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).

⁶ <https://laqm.defra.gov.uk/bias-adjustment-factors/bias-adjustment.html>

⁷ Fall-off with distance correction criteria is provided in paragraph 7.77, LAQM.TG(16)

For diffusion tubes, the full 2020 dataset of monthly mean values is provided in Appendix B. Note that the concentration data presented in Table B.1 also includes distance corrected values, where monitoring positions are not representative of locations appropriate to national objectives.

Table 3.1 below provides a summary of measured exceedances or concentrations recorded within 5% of the air quality objective (AQO) for nitrogen dioxide in 2019 following adjustments for annualisation and/or distance to relevant exposure where necessary.

Table 3.1 - Summary of measured exceedances and borderline results in 2019

Site ID	Location	Bias Adjusted Measurement ($\mu\text{g}/\text{m}^3$) ¹
But2	The Butts, City Centre	42.11
BrS2	Bridge Street, former Dolday/Bridge Street AQMA, City Centre	38.62
Tyn2	Upper Tything, City Centre	39.89
Tyn	The Tything, City Centre	41.75
Bkc	Berkeley Court, Foregate Street, City Centre	38.39

¹ Annualised and calculated back to relevant receptor where appropriate. Exceedances shown in bold

3.2.1.1 Trends in NO₂ Monitoring Data

Figure A.1 in Appendix A shows the five year trend for NO₂ concentrations, adjusted for bias and annualised where applicable at all monitoring locations. NB this does not represent concentrations calculated back to relevant exposure. The figure demonstrates there have been decreases in NO₂ at all monitored locations across the district between 2018 and 2019, consistent with trends across Worcestershire. In Worcester City the average of bias adjusted concentrations of NO₂ at all locations has decreased from 38.16 to 30.90 $\mu\text{g}/\text{m}^3$, a decrease of 19.03%.

This significant decrease is attributed to the bias adjustment factor of 0.78 applied to raw 2019 NO_x tube data. This is comparatively lower than annual adjustment factors applied between 2014 and 2018 which in 4 of the 5 previous years has consistently

been 0.89, including 2018, and averaged 0.866. Therefore, in WRS opinion, the significant decrease between 2018 and 2019 monitoring data should not be considered as indicative of local trends.

Given the above it is considered more appropriate to compare the bias adjusted 2019 results with 2017 data, which also was subject to a similar low bias adjustment factor of 0.77. When compared with 2017 bias adjusted and annualised results, the 2019 data shows a downward trend at 21 monitoring locations averaging $1.56\mu\text{g}/\text{m}^3$ reduction. However 14 monitoring locations demonstrated an increase of on average $0.83\mu\text{g}/\text{m}^3$ increase. Overall the results indicate an average decrease of $0.60\mu\text{g}/\text{m}^3$ and a 1.90% reduction from 2017 data.

3.2.1.2 The Butts and the former Dolday/ Bridge Street AQMA area

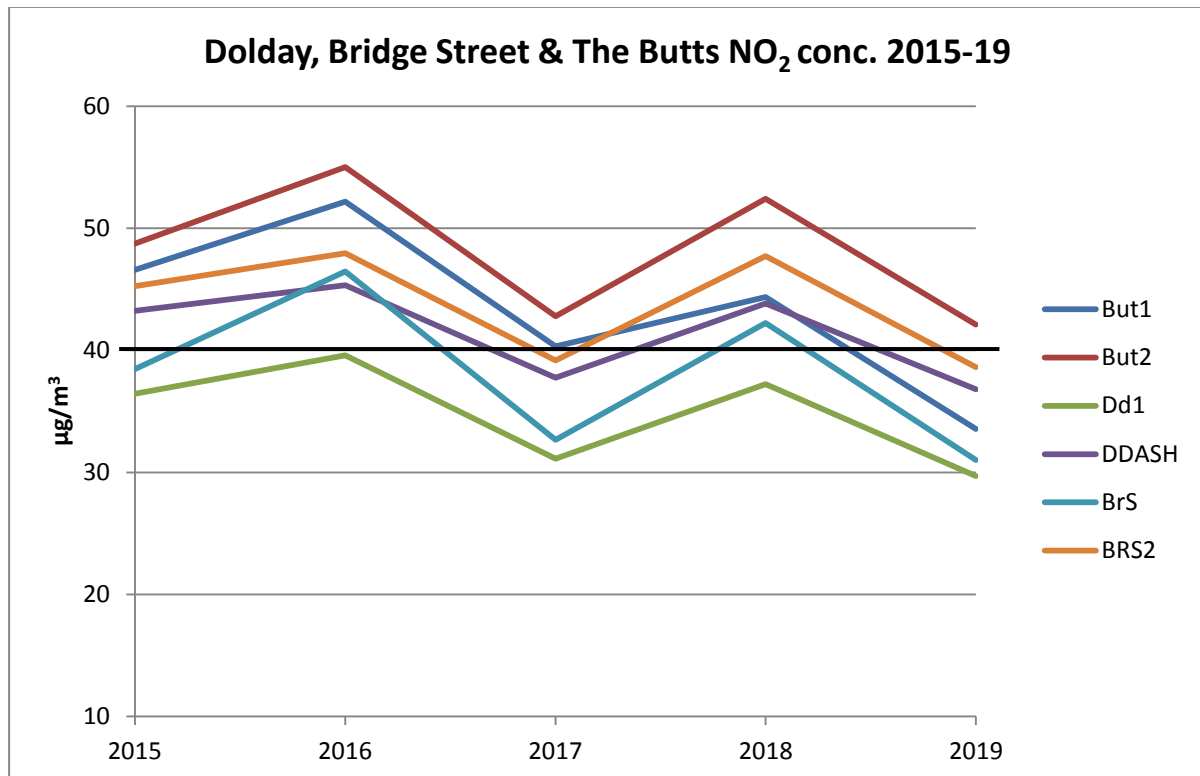
This area comprises the A44 one way system at the heart of the city that connects the strategic road network from north to south and west across the River Severn via the Worcester Bridge crossing. Worcester bus station is adjacent and several car parks are accessible from this area.

Monitoring locations in this area are shown in Figure D.2 in Appendix D. Concentrations exceeding $40\mu\text{g}/\text{m}^3$ have been recorded in one monitoring location, Loc.But2, in this area in 2019. Additionally the NO_2 concentration at Loc.Brs2 is within 5% of the AQO.

Figure 3.1 below demonstrates the five year trend for NO_2 concentrations at monitoring locations within the former Dolday/Bridge Street AQMA and The Butts, following adjustment for bias. Concentrations within this area demonstrate a similar picture to the overall trend across the district, a significant decrease from 2018 measured data due to the low bias adjustment factor for 2019 as outlined above, but broadly similar to 2017 measurements. Loc.But1 demonstrates a downward trend over the 5 year period. There have been no changes to monitoring strategy within the AQMA in 2019.

The Dolday/Bridge Street AQMA was incorporated into the Worcester City Council AQMA (Political Boundary) on 11th June 2019.

Figure 3.1 - Long Term Trend Graph of NO₂ concentrations in Dolday, All Saints Road, Bridge Street and The Butts Area



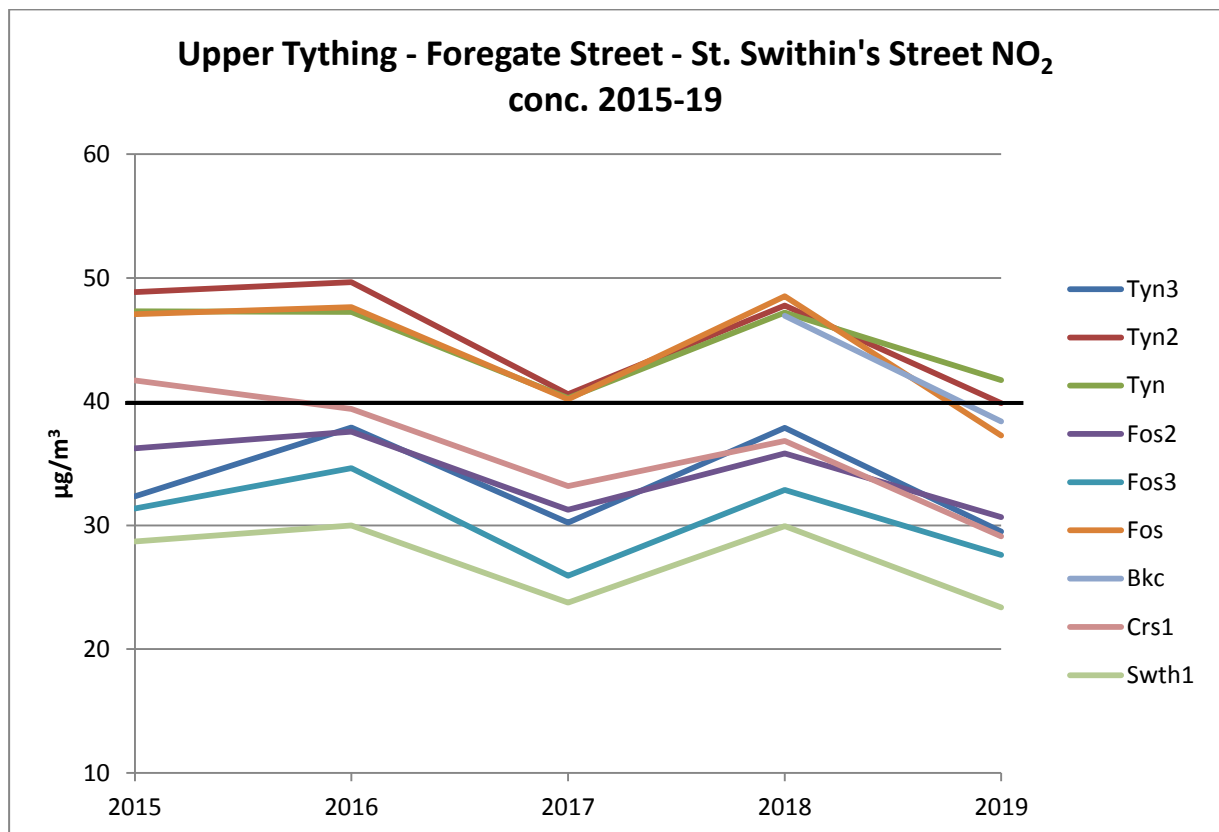
3.2.1.3 The Tything and The Foregate, A38 Corridor

The A38 strategic road corridor leads north of the city and dissects the north western part of the town centre. It includes the major public transport hubs of Worcester Foregate Street railway station, taxi ranks and access to the bus station to the south west via Angel street. Monitoring locations are situated within Barbourne Road, along The Tything, Foregate Street to The Cross and St Swithin’s Street, as shown in Figure D.3 and Figure D.4 in Appendix D.

Concentrations exceeding 40µg/m³ have been recorded at one monitoring location Loc.Tyn, in this area in 2019. Additionally, the NO₂ concentration at Loc.Bkc is within 5% of the AQO and is just below the AQO at Loc.Tyn2, although this is reduced to 92.5% of AQO when calculated back to nearest sensitive receptor.

Figure 3.2 below demonstrates the five year trend for NO₂ concentrations at monitoring locations within the corridor following adjustment for bias. Concentrations within the AQMA demonstrate a similar picture to the overall trend across the district, a significant decrease from 2018 measured data due to the low bias adjustment factor for 2019 as outlined above, but broadly similar or slightly decreased from 2017 measurements. However, Loc.Fos3 demonstrates a slight increase from 2017 measurements whilst Loc.Crs1 demonstrates a downward trend over the 5 year period. There have been no changes to monitoring strategy within the corridor in 2019.

Figure 3.2 - Long Term Trend Graph of NO₂ concentrations in the Tything – Foregate Corridor



3.2.1.4 Lowesmoor, Rainbow Hill and Astwood Road Corridor

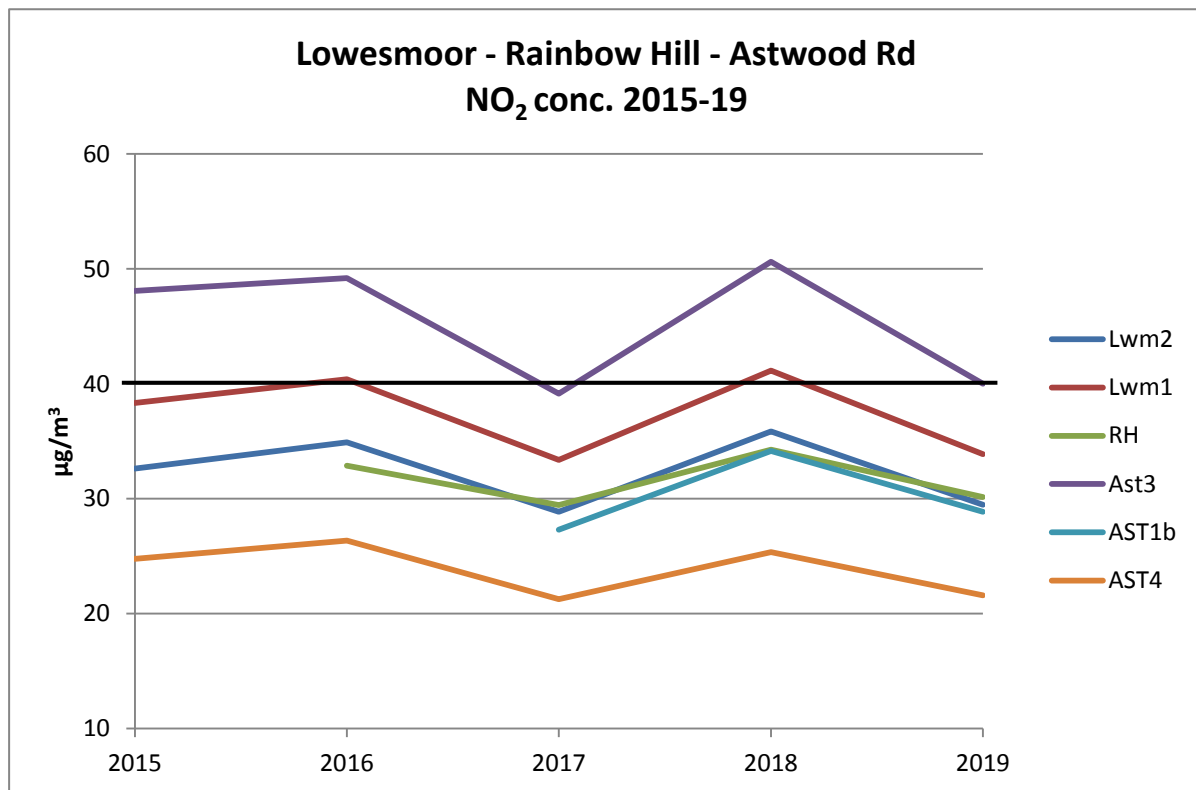
This monitoring corridor begins at the junction of Astwood Cemetery and Brickfields Road to the north east of the city, and ends at the confluence of Lowesmoor with the City Walls Road/ A38 strategic road network. The corridor was formally declared as the Lowesmoor/Rainbow Hill AQMA in 2009.

Monitoring locations in this corridor are shown in Figure D.5 in Appendix D. Concentrations exceeding $40\mu\text{g}/\text{m}^3$ have been recorded at one monitoring location, Loc.Ast3, in this corridor in 2019 although this is reduced to 76.5% of AQO when calculated back to nearest sensitive receptor.

Figure 3.3 below demonstrates the five year trend for NO_2 concentrations at monitoring locations within the corridor, following adjustment for bias. Concentrations demonstrate a similar picture to the overall trend across the district, a significant decrease from 2018 measured data due to the low bias adjustment factor for 2019 as outlined above, but broadly similar to 2017 measurements. However, Loc.Ast3 shows a slight increase between 2017 and 2019 measurements. There have been no changes to monitoring strategy within the corridor in 2019. However an additional monitoring location was installed in George Street just south of Lowesmoor, which recorded a bias adjusted concentration of $35.8\mu\text{g}/\text{m}^3$ in 2019.

The Lowesmoor/Rainbow Hill AQMA was incorporated into the Worcester City Council AQMA (Political Boundary) on 11th June 2019.

Figure 3.3 - Long Term Trend Graph of NO₂ concentrations in the Lowesmoor – Rainbow Hill – Astwood Road Corridor



3.2.1.5 St. Johns Area

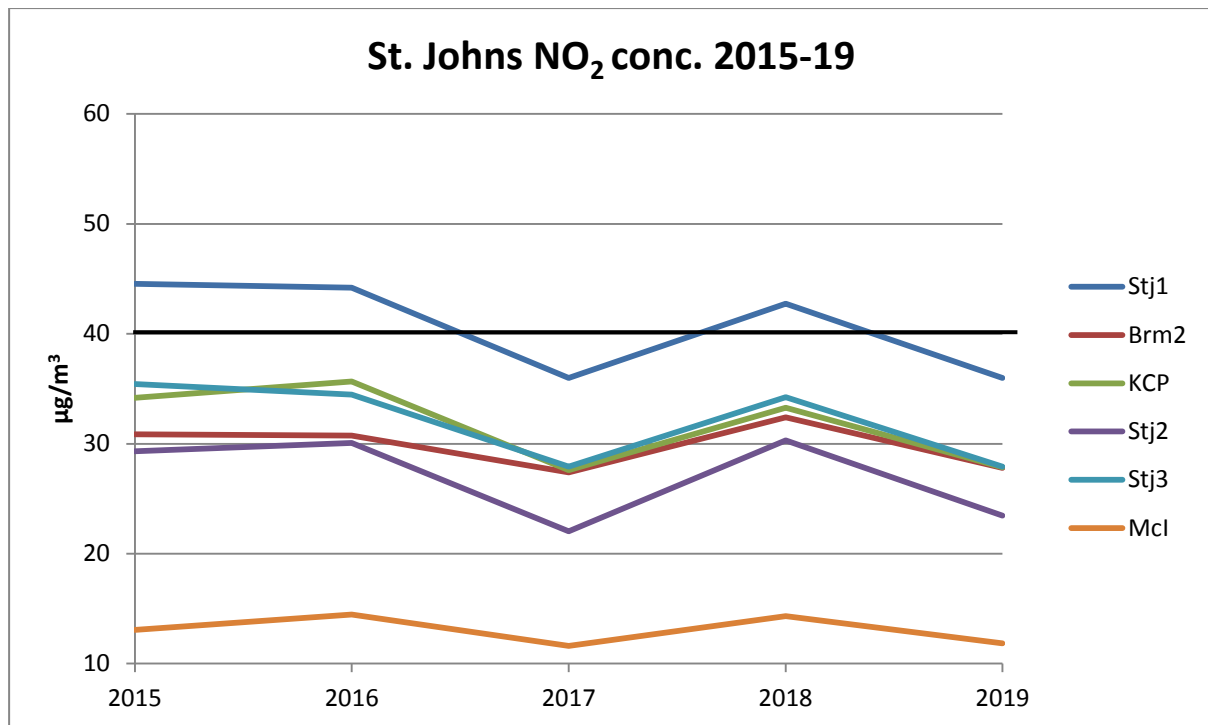
This area comprises all monitoring locations west of the city and River Severn and includes the former St. Johns AQMA.

Figure D.6 in Appendix D demonstrates the monitoring locations in this area. No concentrations exceeding 40µg/m³ or within 5% of the AQO have been recorded in this area in 2019.

Figure 3.4 below demonstrates the five year trend for NO₂ concentrations at monitoring locations within the St Johns area, following adjustment for bias. Concentrations demonstrate a similar picture to the overall trend across the district, a significant decrease from 2018 measured data due to the low bias adjustment factor for 2019 as outlined above, but broadly similar to 2017 measurements. There have been no changes to monitoring strategy within the area in 2019.

The St Johns AQMA was incorporated into the Worcester City Council AQMA (Political Boundary) on 11th June 2019.

Figure 3.4 - Long Term Trend Graph of NO₂ concentrations in the St Johns area



3.2.1.6 London Road and Sidbury Area

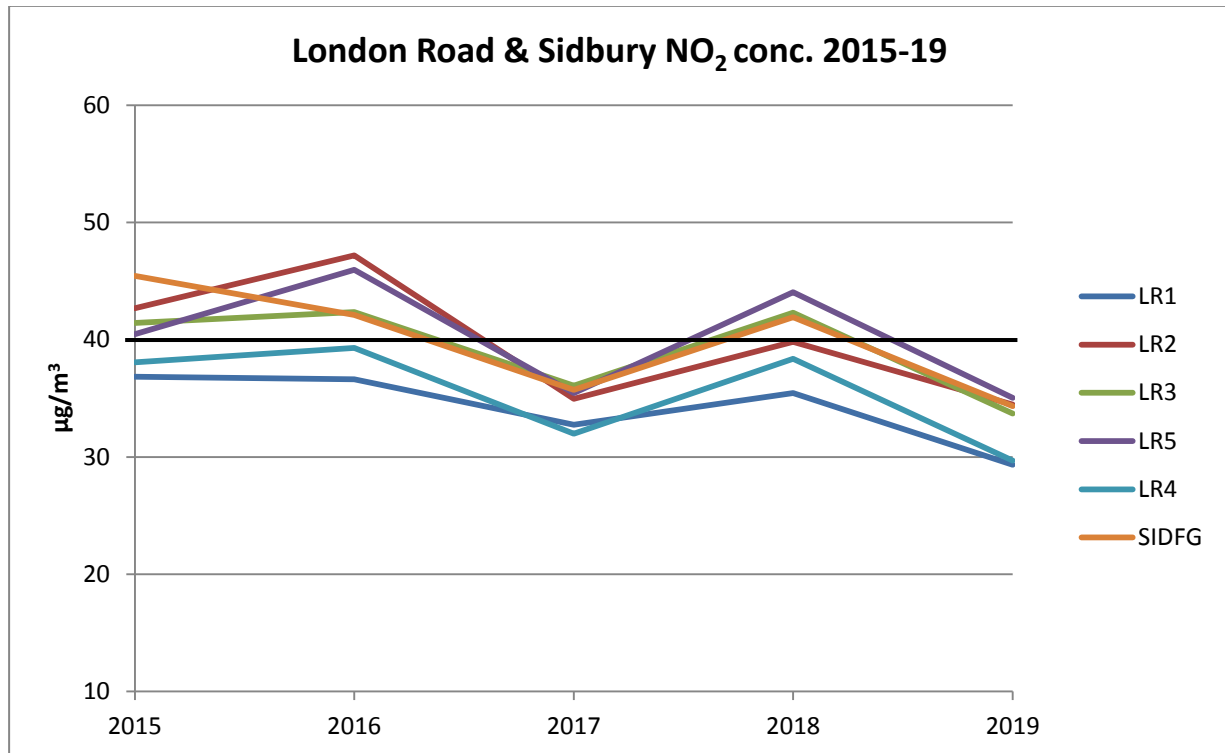
This area comprises part of the A44 strategic corridor at the western end of London Road, adjacent to Fort Royal Park, and the junction of the A38 City Walls Road with the A44 at The Commandery.

Figure D.7 in Appendix D demonstrates the monitoring locations in this area. No concentrations exceeding 40µg/m³ or within 5% of the AQO have been recorded in this area in 2019.

Figure 3.5 below demonstrates the five year trend for NO₂ concentrations at monitoring locations within this area, following adjustment for bias. Concentrations demonstrate a similar picture to the overall trend across the district, a significant decrease from 2018 measured data due to the low bias adjustment factor for 2019 as

outlined above, but broadly similar to 2017 measurements. Loc.LR1 and LR4 demonstrate a slight decrease from 2017 measurements. There have been no changes to monitoring strategy within the area in 2019.

Figure 3.5 - Long Term Trend Graph of NO₂ concentrations in the London Road and Sidbury area



3.2.1.7 Other Areas

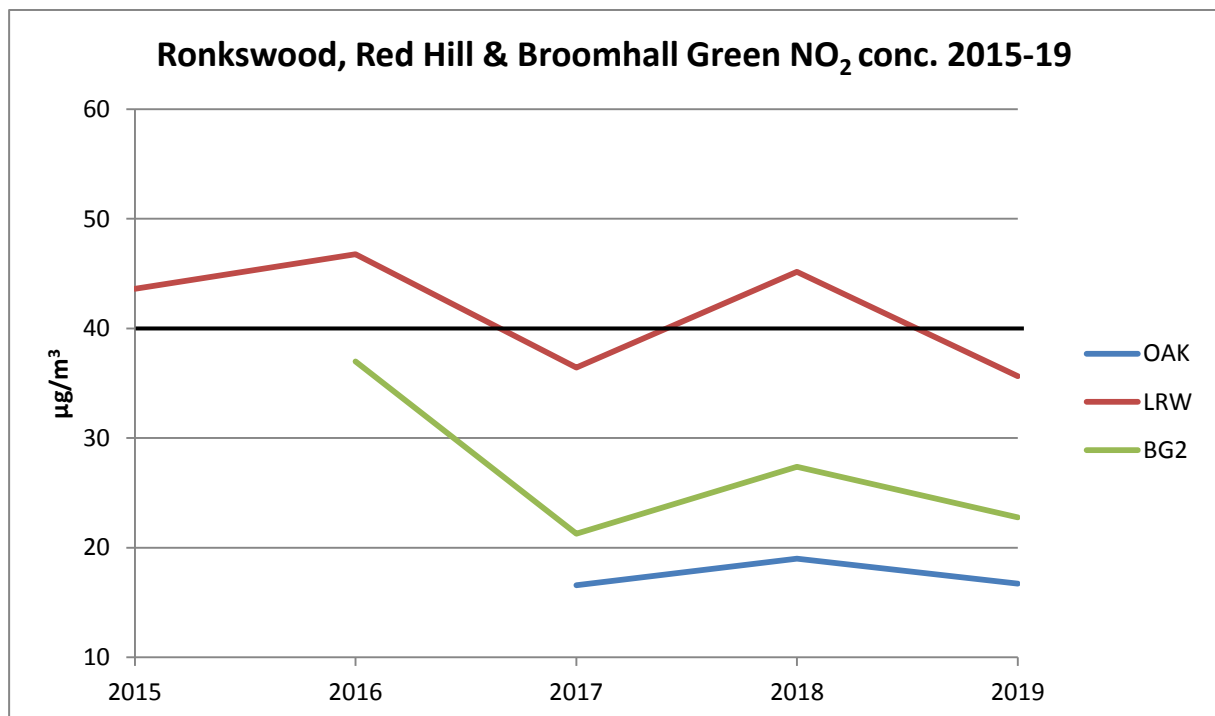
Three areas distant from the city centre are currently monitored: Loc.OAK in the Ronkswood area near Worcestershire Royal Hospital, Loc.LRW in the Red Hill area of London Road and Loc.BG in Broomhall Green, St.Peters along the A4440 southern link road.

The monitoring locations are shown in Figure D.8 and Figure D.9 in Appendix D. No concentrations exceeding 40µg/m³ or within 5% of the AQO have been recorded in these locations in 2019.

Figure 3.6 below demonstrates the five year trend for NO₂ concentrations at these monitoring locations, following adjustment for bias. Concentrations demonstrate a

similar picture to the overall trend across the district, a significant decrease from 2018 measured data due to the low bias adjustment factor for 2019 as outlined above, but broadly similar to 2017 measurements. There have been no changes to monitoring strategy within these areas in 2019. However, an additional monitoring location Loc.BG has been included in previous reports. An evaluation of political maps confirm Loc.BG is within the Wychavon District Council side of confluence of three local authority district boundaries and therefore will be reported within Wychavon DC ASR's from 2020 onwards.

Figure 3.6 - Long Term Trend Graph of NO₂ concentrations in Ronkswood, Red Hill and Broomhall Green, St Peters area



Appendix A: Monitoring Results

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

Site ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) ^(1,2,3)	Distance to kerb of nearest road (m)	Tube collocated with a Continuous Analyser?	Height (m)
But1	Magdala Court, The Butts	Roadside	384776	255107	NO ₂	Yes	0	1.15	No	2.5
But2	Magdala Court, The Butts	Roadside	384724	255086	NO ₂	Yes	0	1.67	No	2.38
Dd1	Ambirak, Dolday 1 (opp Bus Station)	Roadside	384652	254986	NO ₂	Yes	N/A	2.18	No	2.17
DDASH	All Saints House	Roadside	384682	254924	NO ₂	Yes	2	2.33	No	2.13
BrS	Bridge Street, John Gwen House	Kerbside	384666	254818	NO ₂	Yes	2	0.66	No	2.21
BRS2	Bridge Street	Roadside	384695	254840	NO ₂	Yes	1	1.96	No	2.06
Tyn3	No. 26 Upper Tything	Roadside	384679	255998	NO ₂	Yes	0.1	2	No	2.22
Tyn2	Lamp & Flag PH Upper Tything (LP) 934	Roadside	384767	255606	NO ₂	Yes	FF 1.29	2.28	No	2.21
Tyn	925 - HAMMERCHILDS, Upper Tything	Roadside	384833	255461	NO ₂	Yes	FF 1.29	1.63	No	2.21
Fos2	Hewitt Recruitment, 35 Foregate Street	Roadside	384866	255367	NO ₂	Yes	FF 1.36	3.2	No	2.14
Fos3	Café Mela, 22 Foregate Street	Roadside	384899	255329	NO ₂	Yes	FF 1.03	2.21	No	2.47

Worcester City Council

Site ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) ^(1,2,3)	Distance to kerb of nearest road (m)	Tube collocated with a Continuous Analyser?	Height (m)
Fos	Foregate Street/ Shaw Street jcnctn	Kerbside	384941	255140	NO ₂	Yes	FF 1.19	1	No	2.47
Crs1	29 The Cross	Roadside	384967	255012	NO ₂	Yes	FF 1.33	3.35	No	2.17
Swth1	St. Swithin's Street	Roadside	385013	254987	NO ₂	Yes	FF 1.33	2.06	No	2.17
Lwm2	Lowesmoor 2 City Walls Rd end	Roadside	385164	255134	NO ₂	Yes	FF 1	1.86	No	2.5
Lwm1	Lowesmoor 1 Rainbow Hill End	Roadside	385268	255191	NO ₂	Yes	FF 1	1.43	No	2.56
Stj1	1A St. Johns	Roadside	384137	254510	NO ₂	Yes	FF 1.48	2.7	No	2.02
Brm2	10 Bromyard Road	Roadside	383967	254481	NO ₂	Yes	0	8.8	No	1.9
KCP	King Charles Place	Roadside	384016	254399	NO ₂	Yes	FF 1.41	2.2	No	2.09
Stj2	Fortune House, 65 St. Johns	Roadside	384013	254356	NO ₂	Yes	FF 1.53	2.22	No	1.97
Stj3	The Bell, 35 St. Johns	Roadside	384046	254424	NO ₂	Yes	FF 1.53	2.05	No	1.97
Mcl	McIntyre Road	Suburban	383454	254606	NO ₂	Yes	4.5	1.24	No	2.28
AST4	246 Astwood Road	Roadside	386097	256565	NO ₂	Yes	0	9.85	No	2
AST1b	LP5129 170/172 Astwood Road	Roadside	386022	256401	NO ₂	Yes	5.5	3.5	No	2.05
Ast3	Astwood Road 3 Rainbow Hill	Roadside	385764	255968	NO ₂	Yes	6.62	1.68	No	2.26
OAK	22 Oaklands	Roadside	387810	254993	NO ₂	Yes	0	7	No	1.85
LRW	London Road	Kerbside	386654	253761	NO ₂	Yes	4	0.5	No	1.85

Site ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) ^(1,2,3)	Distance to kerb of nearest road (m)	Tube collocated with a Continuous Analyser?	Height (m)
	Waitrose									
LR1	London Road LP 6569	Roadside	385636	254158	NO ₂	Yes	2.9	1.63	No	2.12
LR2	London Road Royal Court LP 6561	Roadside	385428	254238	NO ₂	Yes	3	1.45	No	2.2
LR3	London Road Commandery Road Junction	Roadside	385357	254272	NO ₂	Yes	0.5	1.77	No	2.31
LR5	London Road Bus stop SL6554	Roadside	385325	254329	NO ₂	Yes	0.25	1.45	No	2.22
LR4	London Road SL6565 adj No 61	Roadside	385525	254219	NO ₂	Yes	3.1	1.86	No	2.06
SIDFG	Sidbury Street o/s Fisher German Estate Agents	Roadside	385146	254474	NO ₂	Yes	FF 3.94	2.3	No	2.16
BG2	Near 17 Broomhall Green, Broomhall	Roadside	386165	252146	NO ₂	Yes	5.3	5.1	No	2.3
RH	Nursery Rainbow Hill LP5196	Roadside	385420	255413	NO ₂	Yes	7.8	1.45	No	2.43
Bkc	Berkeley Court, Foregate Street	Roadside	384948	255111	NO ₂	Yes	0.16	4.12	No	2.46
GS	54 George Street	Roadside	385358	254969	NO ₂	Yes	0	2	No	2.3

Notes:

- (1) 0m if the monitoring site is at a location of exposure (e.g. installed on the façade of a residential property).
- (2) N/A if not applicable.
- (3) FF if nearest sensitive receptor is at first floor level.

Table A.2 – Annual Mean NO₂ Monitoring Results

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2019 (%) ⁽²⁾	NO ₂ Annual Mean Concentration (µg/m ³) ^{(3) (4)}				
							2015	2016	2017	2018	2019
But1	384776	255107	Roadside	Diffusion Tube	100	100	46.59	52.18	40.32	44.36	33.55
But2	384724	255086	Roadside	Diffusion Tube	75	75	48.75	55.03	42.80	52.43	42.11
Dd1	384652	254986	Roadside	Diffusion Tube	100	100	36.44	39.60	31.12	37.24	29.70
DDASH	384682	254924	Roadside	Diffusion Tube	83	83	43.25	45.34	37.75	43.84	36.82
BrS	384666	254818	Kerbside	Diffusion Tube	83	83	38.47	46.46	32.68	42.25	31.00
BRS2	384695	254840	Roadside	Diffusion Tube	83	83	45.26	47.97	39.18	47.73	38.62
Tyn3	384679	255998	Roadside	Diffusion Tube	92	92	32.35	37.90	30.23	37.90	29.51
Tyn2	384767	255606	Roadside	Diffusion Tube	100	100	48.86	49.67	40.61	47.78	39.89
Tyn	384833	255461	Roadside	Diffusion Tube	92	92	47.31	47.26	40.28	47.21	41.75
Fos2	384866	255367	Roadside	Diffusion Tube	100	100	36.24	37.58	31.26	35.81	30.67
Fos3	384899	255329	Roadside	Diffusion Tube	92	92	31.38	34.63	25.94	32.87	27.62
Fos	384941	255140	Kerbside	Diffusion Tube	92	92	47.08	47.63	40.19	48.51	37.26
Crs1	384967	255012	Roadside	Diffusion Tube	100	100	41.72	39.41	33.18	36.83	29.11
Swth1	385013	254987	Roadside	Diffusion Tube	100	100	28.69	30.00	23.75	29.96	23.38

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2019 (%) ⁽²⁾	NO ₂ Annual Mean Concentration (µg/m ³) ^{(3) (4)}				
							2015	2016	2017	2018	2019
Lwm2	385164	255134	Roadside	Diffusion Tube	100	100	32.63	34.92	28.88	35.87	29.49
Lwm1	385268	255191	Roadside	Diffusion Tube	92	92	38.34	40.41	33.39	41.17	33.89
Stj1	384137	254510	Roadside	Diffusion Tube	100	100	44.55	44.21	35.99	42.73	35.98
Brm2	383967	254481	Roadside	Diffusion Tube	100	100	30.85	30.76	27.40	32.41	27.81
KCP	384016	254399	Roadside	Diffusion Tube	100	100	34.17	35.67	27.60	33.29	27.85
Stj2	384013	254356	Roadside	Diffusion Tube	92	92	29.31	30.06	22.05	30.32	23.48
Stj3	384046	254424	Roadside	Diffusion Tube	100	100	35.42	34.48	27.93	34.25	27.92
Mcl	383454	254606	Suburban	Diffusion Tube	100	100	13.08	14.46	11.63	14.32	11.86
AST4	386097	256565	Roadside	Diffusion Tube	100	100	24.78	26.36	21.26	25.35	21.60
AST1b	386022	256401	Roadside	Diffusion Tube	100	100	-	-	27.32	34.17	28.87
Ast3	385764	255968	Roadside	Diffusion Tube	75	75	48.10	49.20	39.14	50.62	40.01
OAK	387810	254993	Roadside	Diffusion Tube	100	100	-	-	16.58	19.00	16.72
LRW	386654	253761	Kerbside	Diffusion Tube	100	100	43.61	46.78	36.44	45.18	35.65
LR1	385636	254158	Roadside	Diffusion Tube	100	100	36.85	36.63	32.75	35.45	29.35
LR2	385428	254238	Roadside	Diffusion Tube	75	75	42.68	47.20	34.96	39.82	34.47

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2019 (%) ⁽²⁾	NO ₂ Annual Mean Concentration (µg/m ³) ^{(3) (4)}				
							2015	2016	2017	2018	2019
LR3	385357	254272	Roadside	Diffusion Tube	92	92	41.44	42.37	36.09	42.30	33.71
LR5	385325	254329	Roadside	Diffusion Tube	100	100	40.46	45.97	35.45	44.06	35.03
LR4	385525	254219	Roadside	Diffusion Tube	100	100	38.08	39.31	31.98	38.38	29.68
SIDFG	385146	254474	Roadside	Diffusion Tube	100	100	45.44	42.12	35.73	41.93	34.33
BG2	386165	252146	Roadside	Diffusion Tube	100	100	-	37.00	21.27	27.39	22.76
RH	385420	255413	Roadside	Diffusion Tube	75	75	-	32.87	29.45	34.26	30.14
Bkc	384948	255111	Roadside	Diffusion Tube	92	92	-	-	-	46.94	38.39
GS	385358	254969	Roadside	Diffusion Tube	92	92	-	-	-	-	36.32

Diffusion tube data has been bias corrected

Annualisation has been conducted where data capture is <75%

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 adjustment

Notes:

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

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

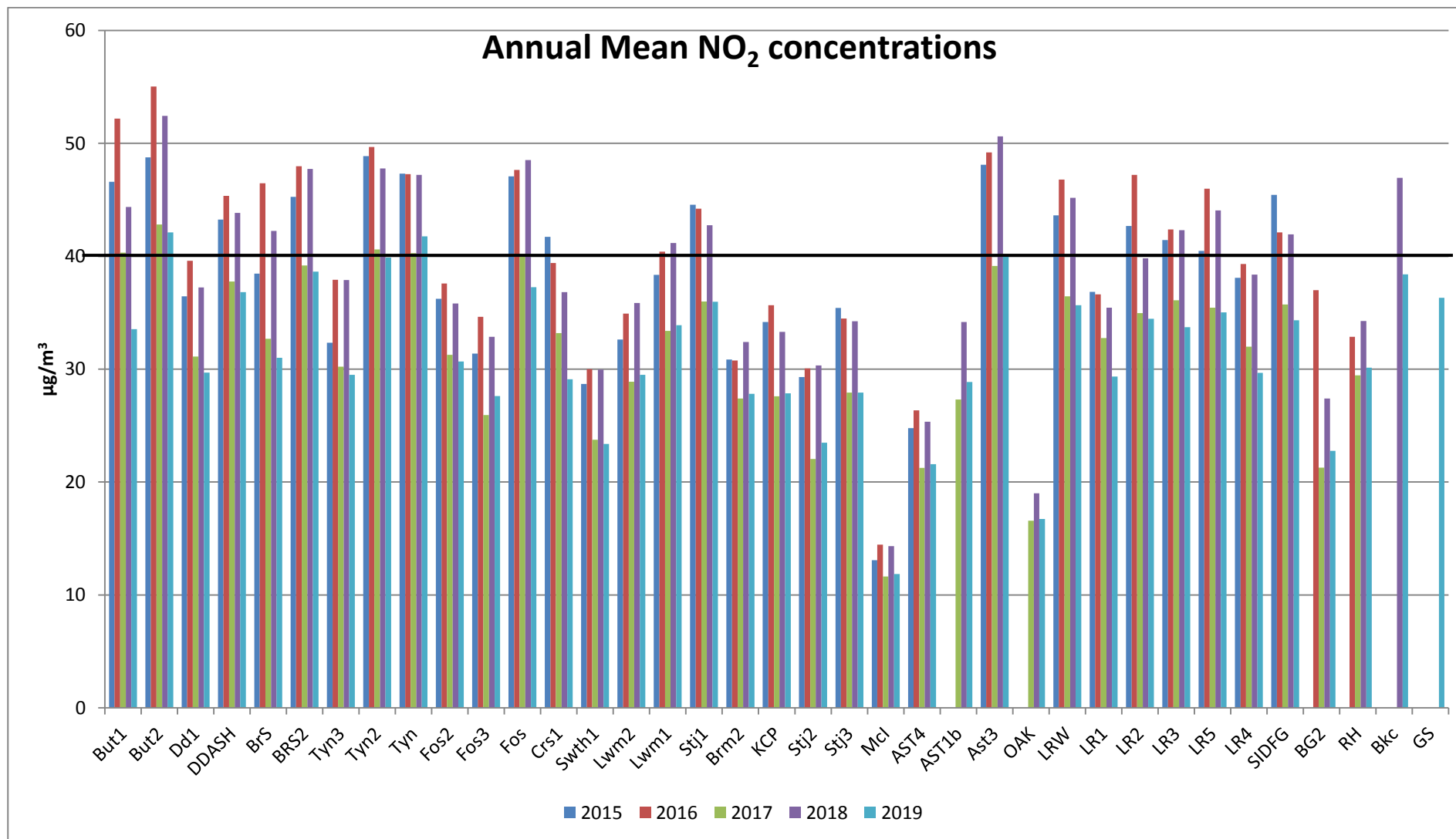
(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(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.

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

Figure A.1 – Trends in Annual Mean NO₂ Concentrations



Appendix B: Full Monthly Diffusion Tube Results for 2019

Table B.1 - NO₂ Monthly Diffusion Tube Results - 2019

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	NO ₂ Mean Concentrations (µg/m ³)															Annual Mean		
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Raw Data	Bias Adjusted (0.78) and Annualised ⁽¹⁾	Distance Corrected to Nearest Exposure ⁽²⁾			
But1	384776	255107	51.5	36.4	43.4	48.5	37.2	42.1	39.8	37.7	39.8	41.5	53.7	44.60	43.01	33.55				
But2	384724	255086	66.3	53.0	59.5	51.0	-	52.1	43.8	51.5	53.4	55.2	-	-	53.99	42.11				
Dd1	384652	254986	47.8	38.1	35.4	51.5	37.7	29.7	31.7	28.6	33.6	37.0	45.3	40.56	38.08	29.70				
DDASH	384682	254924	55.4	-	47.1	43.4	40.6	-	44.2	47.6	42.3	47.2	48.5	55.94	47.21	36.82	33.1			
BrS	384666	254818	48.1	37.5	42.1	-	33.7	41.1	35.8	27.5	39.2	40.9	54.0	37.25	39.75	31.00	29.2			
BRS2	384695	254840	55.1	48.4	48.2	59.6	-	46.4	44.7	40.8	45.5	-	55.3	51.17	49.52	38.62				
Tyn3	384679	255998	46.4	39.1	-	47.2	30.7	35.1	25.3	24.8	34.2	34.8	55.0	43.54	37.83	29.51				
Tyn2	384767	255606	67.6	51.4	49.9	40.8	42.0	46.0	46.2	46.4	47.1	54.6	63.7	58.15	51.14	39.89	37.0			
Tyn	384833	255461	61.1	56.6	58.5	-	43.6	45.0	49.5	48.1	49.0	50.7	70.1	56.64	53.53	41.75				
Fos2	384866	255367	48.8	47.6	38.8	36.6	30.9	32.1	32.4	34.8	35.1	42.9	47.9	44.10	39.32	30.67				
Fos3	384899	255329	40.1	37.6	29.1	42.7	29.9	32.5	25.8	26.1	34.6	40.5	50.6	-	35.41	27.62				
Fos	384941	255140	58.9	-	45.7	53.9	44.2	46.4	41.4	34.4	45.8	48.4	60.2	46.08	47.77	37.26	33.4			
Crs1	384967	255012	47.8	38.7	40.0	34.7	33.7	31.6	29.9	29.8	34.9	38.3	43.8	44.61	37.32	29.11				
Swth1	385013	254987	37.5	27.7	29.2	40.0	28.4	22.9	21.9	19.8	28.6	30.9	42.0	30.78	29.97	23.38				
Lwm2	385164	255134	43.2	36.2	36.4	48.2	32.1	34.4	27.7	28.2	34.7	37.9	49.7	45.06	37.81	29.49				

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	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 (0.78) and Annualised ⁽¹⁾	Distance Corrected to Nearest Exposure ⁽²⁾
Lwm1	385268	255191	46.4	38.8	45.8	44.4	37.4	40.3	38.5	35.1	39.5	-	53.5	58.24	43.45	33.89	
Stj1	384137	254510	46.9	49.8	47.7	47.7	39.5	42.9	37.4	44.6	47.3	54.8	48.8	-	46.12	35.98	
Brm2	383967	254481	43.6	43.4	30.9	35.3	26.7	26.2	23.7	32.7	30.1	43.5	42.3	49.56	35.66	27.81	
KCP	384016	254399	42.8	42.4	34.2	35.8	27.9	29.8	28.9	28.2	33.9	36.3	44.0	44.10	35.71	27.85	
Stj2	384013	254356	35.6	35.9	23.8	38.2	24.0	26.3	22.1	20.2	28.8	-	40.0	36.15	30.10	23.48	
Stj3	384046	254424	37.6	40.0	29.6	45.7	30.8	31.6	28.3	26.8	35.0	36.4	44.6	43.18	35.79	27.92	
Mcl	383454	254606	19.9	19.7	10.7	16.1	9.6	10.9	8.7	7.8	13.3	19.7	24.1	22.11	15.21	11.86	
AST4	386097	256565	33.6	32.9	23.5	30.6	23.0	24.4	19.6	22.2	25.5	31.5	30.9	34.44	27.69	21.60	
AST1b	386022	256401	43.0	45.3	34.1	41.1	30.6	30.1	25.5	30.2	32.9	40.8	43.2	47.39	37.02	28.87	25.2
Ast3	385764	255968	66.8	59.0	-	55.2	45.5	47.0	40.3	-	53.2	54.4	61.2	-	51.30	40.01	30.6
OAK	387810	254993	27.5	28.2	18.1	20.7	16.2	16.5	14.9	16.0	19.2	23.6	29.1	27.25	21.44	16.72	
LRW	386654	253761	52.5	46.8	44.0	51.0	44.6	40.8	35.6	35.5	46.6	49.3	54.9	46.98	45.71	35.65	25.7
LR1	385636	254158	44.8	41.0	37.8	42.1	28.6	32.5	29.3	33.3	31.5	37.1	49.5	43.76	37.62	29.35	25.7
LR2	385428	254238	54.3	48.7	-	49.2	35.7	41.0	37.1	45.3	41.4	45.1	-	-	44.19	34.47	29.3
LR3	385357	254272	53.9	45.0	45.8	43.8	37.2	39.2	39.7	45.3	39.4	43.6	-	42.44	43.22	33.71	32.6
LR5	385325	254329	51.7	38.8	40.4	57.5	38.9	44.3	37.3	28.7	41.2	46.4	62.8	50.93	44.91	35.03	
LR4	385525	254219	51.9	35.8	40.1	43.6	36.6	34.5	31.3	26.7	33.8	38.0	48.1	36.13	38.06	29.68	26.0
SIDFG	385146	254474	54.0	45.3	47.4	45.2	39.2	42.1	37.9	35.7	40.3	44.1	52.6	44.43	44.01	34.33	29.3
BG2	386165	252146	32.9	36.8	22.4	35.1	24.6	26.4	20.5	24.9	28.4	31.3	32.7	34.08	29.18	22.76	20.1

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	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 (0.78) and Annualised ⁽¹⁾	Distance Corrected to Nearest Exposure ⁽²⁾
RH	385420	255413	39.9	44.9	35.1	39.4	-	-	31.5	-	31.3	35.5	44.8	45.34	38.64	30.14	23.6
Bkc	384948	255111	53.2	50.2	47.4	50.2	42.0	44.2	-	43.5	46.0	52.0	55.0	57.56	49.22	38.39	
GS	385358	254969	50.1	-	47.4	53.3	41.4	44.6	34.5	38.8	43.9	47.5	57.2	53.49	46.56	36.32	

- Local bias adjustment factor used
- National bias adjustment factor used
- Annualisation has been conducted where data capture is <75% (N/A)
- Where applicable, data has been distance corrected for relevant exposure in the final column

Notes:

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

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

(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

Sources of pollution

Worcester City Council has not identified any new or significant changes to sources of pollution as described in Chapter 7, section 1 of Technical Guidance

LAQM.TG(16)

QA/QC of Diffusion Tube Monitoring

The following UKAS accredited company provides Worcester City 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 NO₂ Proficiency Testing Scheme Somerset Scientific Services performed 100% satisfactory for the period January to November 2019. Tube precision was 'Good' throughout 2019.

Bias adjustment

The bias adjustment factor applied to the results in 2019 was 0.78 (Spreadsheet Version No. 03/20) which were derived from the national studies.

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 not representative of public exposure. The results are presented in Figures C.1 to C.14 below and summarised in Table B.1 - NO₂ Monthly Diffusion Tube Results - 2019.

Figure C.1 - Loc. DDASH - Distance from road to relevant exposure calculation

BUREAU VERITAS

Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	2.33	metres
Step 2	How far from the KERB is your receptor (in metres)?	4.33	metres
Step 3	What is the local annual mean background NO ₂ concentration (in µg/m ³)?	12.42218	µg/m ³
Step 4	What is your measured annual mean NO ₂ concentration (in µg/m ³)?	36.82	µg/m ³
Result	The predicted annual mean NO ₂ concentration (in µg/m ³) at your receptor	33.1	µg/m ³


Figure C.2 - Loc. BrS - Distance from road to relevant exposure calculation

BUREAU VERITAS

Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	1.96	metres
Step 2	How far from the KERB is your receptor (in metres)?	2.96	metres
Step 3	What is the local annual mean background NO ₂ concentration (in µg/m ³)?	12.42218	µg/m ³
Step 4	What is your measured annual mean NO ₂ concentration (in µg/m ³)?	31	µg/m ³
Result	The predicted annual mean NO ₂ concentration (in µg/m ³) at your receptor	29.2	µg/m ³


Figure C.3 - Loc. Tyn2 - Distance from road to relevant exposure calculation



Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	2.28	metres
Step 2	How far from the KERB is your receptor (in metres)?	3.57	metres
Step 3	What is the local annual mean background NO ₂ concentration (in µg/m ³)?	12.77523	µg/m ³
Step 4	What is your measured annual mean NO ₂ concentration (in µg/m ³)?	39.89	µg/m ³
Result	The predicted annual mean NO ₂ concentration (in µg/m ³) at your receptor	37.0	µg/m ³


Figure C.4 - Loc.Fos - Distance from road to relevant exposure calculation



Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	1	metres
Step 2	How far from the KERB is your receptor (in metres)?	2.19	metres
Step 3	What is the local annual mean background NO ₂ concentration (in µg/m ³)?	12.77523	µg/m ³
Step 4	What is your measured annual mean NO ₂ concentration (in µg/m ³)?	37.26	µg/m ³
Result	The predicted annual mean NO ₂ concentration (in µg/m ³) at your receptor	33.4	µg/m ³


Figure C.5 - Loc. Ast1b - Distance from road to relevant exposure calculation



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)?	8	metres
Step 3	What is the local annual mean background NO ₂ concentration (in µg/m ³)?	12.22556	µg/m ³
Step 4	What is your measured annual mean NO ₂ concentration (in µg/m ³)?	28.87	µg/m ³
Result	The predicted annual mean NO ₂ concentration (in µg/m ³) at your receptor	25.2	µg/m ³


Figure C.6- Loc. Ast3 - Distance from road to relevant exposure calculation



Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	1.68	metres
Step 2	How far from the KERB is your receptor (in metres)?	8.3	metres
Step 3	What is the local annual mean background NO ₂ concentration (in µg/m ³)?	13.97388	µg/m ³
Step 4	What is your measured annual mean NO ₂ concentration (in µg/m ³)?	40.01	µg/m ³
Result	The predicted annual mean NO ₂ concentration (in µg/m ³) at your receptor	30.6	µg/m ³


Figure C.7 - Loc. LRW - Distance from road to relevant exposure calculation



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)?	4.5	metres
Step 3	What is the local annual mean background NO ₂ concentration (in µg/m ³)?	10.11769	µg/m ³
Step 4	What is your measured annual mean NO ₂ concentration (in µg/m ³)?	35.65	µg/m ³
Result	The predicted annual mean NO ₂ concentration (in µg/m ³) at your receptor	25.7	µg/m ³


Figure C.8- Loc. LR1 - Distance from road to relevant exposure calculation



Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	1.63	metres
Step 2	How far from the KERB is your receptor (in metres)?	4.53	metres
Step 3	What is the local annual mean background NO ₂ concentration (in µg/m ³)?	13.41561	µg/m ³
Step 4	What is your measured annual mean NO ₂ concentration (in µg/m ³)?	29.35	µg/m ³
Result	The predicted annual mean NO ₂ concentration (in µg/m ³) at your receptor	25.7	µg/m ³


Figure C.9 - Loc. LR2 - Distance from road to relevant exposure calculation



Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	1.45	metres
Step 2	How far from the KERB is your receptor (in metres)?	4.45	metres
Step 3	What is the local annual mean background NO ₂ concentration (in µg/m ³)?	13.41561	µg/m ³
Step 4	What is your measured annual mean NO ₂ concentration (in µg/m ³)?	34.47	µg/m ³
Result	The predicted annual mean NO ₂ concentration (in µg/m ³) at your receptor	29.3	µg/m ³


Figure C.10 - Loc. LR3 - Distance from road to relevant exposure calculation



Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	1.77	metres
Step 2	How far from the KERB is your receptor (in metres)?	2.27	metres
Step 3	What is the local annual mean background NO ₂ concentration (in µg/m ³)?	13.41561	µg/m ³
Step 4	What is your measured annual mean NO ₂ concentration (in µg/m ³)?	33.71	µg/m ³
Result	The predicted annual mean NO ₂ concentration (in µg/m ³) at your receptor	32.6	µg/m ³


Figure C.11 - Loc. LR4 - Distance from road to relevant exposure calculation



Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	1.86	metres
Step 2	How far from the KERB is your receptor (in metres)?	4.96	metres
Step 3	What is the local annual mean background NO ₂ concentration (in µg/m ³)?	13.41561	µg/m ³
Step 4	What is your measured annual mean NO ₂ concentration (in µg/m ³)?	29.68	µg/m ³
Result	The predicted annual mean NO ₂ concentration (in µg/m ³) at your receptor	26.0	µg/m ³


Figure C.12 - Loc.SidFG - Distance from road to relevant exposure calculation



Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	2.3	metres
Step 2	How far from the KERB is your receptor (in metres)?	6.24	metres
Step 3	What is the local annual mean background NO ₂ concentration (in µg/m ³)?	13.41561	µg/m ³
Step 4	What is your measured annual mean NO ₂ concentration (in µg/m ³)?	34.33	µg/m ³
Result	The predicted annual mean NO ₂ concentration (in µg/m ³) at your receptor	29.3	µg/m ³


Figure C.13 - Loc. BG2 - Distance from road to relevant exposure calculation



Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	5.1	metres
Step 2	How far from the KERB is your receptor (in metres)?	10.4	metres
Step 3	What is the local annual mean background NO ₂ concentration (in µg/m ³)?	10.13409	µg/m ³
Step 4	What is your measured annual mean NO ₂ concentration (in µg/m ³)?	22.76	µg/m ³
Result	The predicted annual mean NO ₂ concentration (in µg/m ³) at your receptor	20.1	µg/m ³

Figure C.14 - Loc. RH - Distance from road to relevant exposure calculation





Enter data into the pink cells

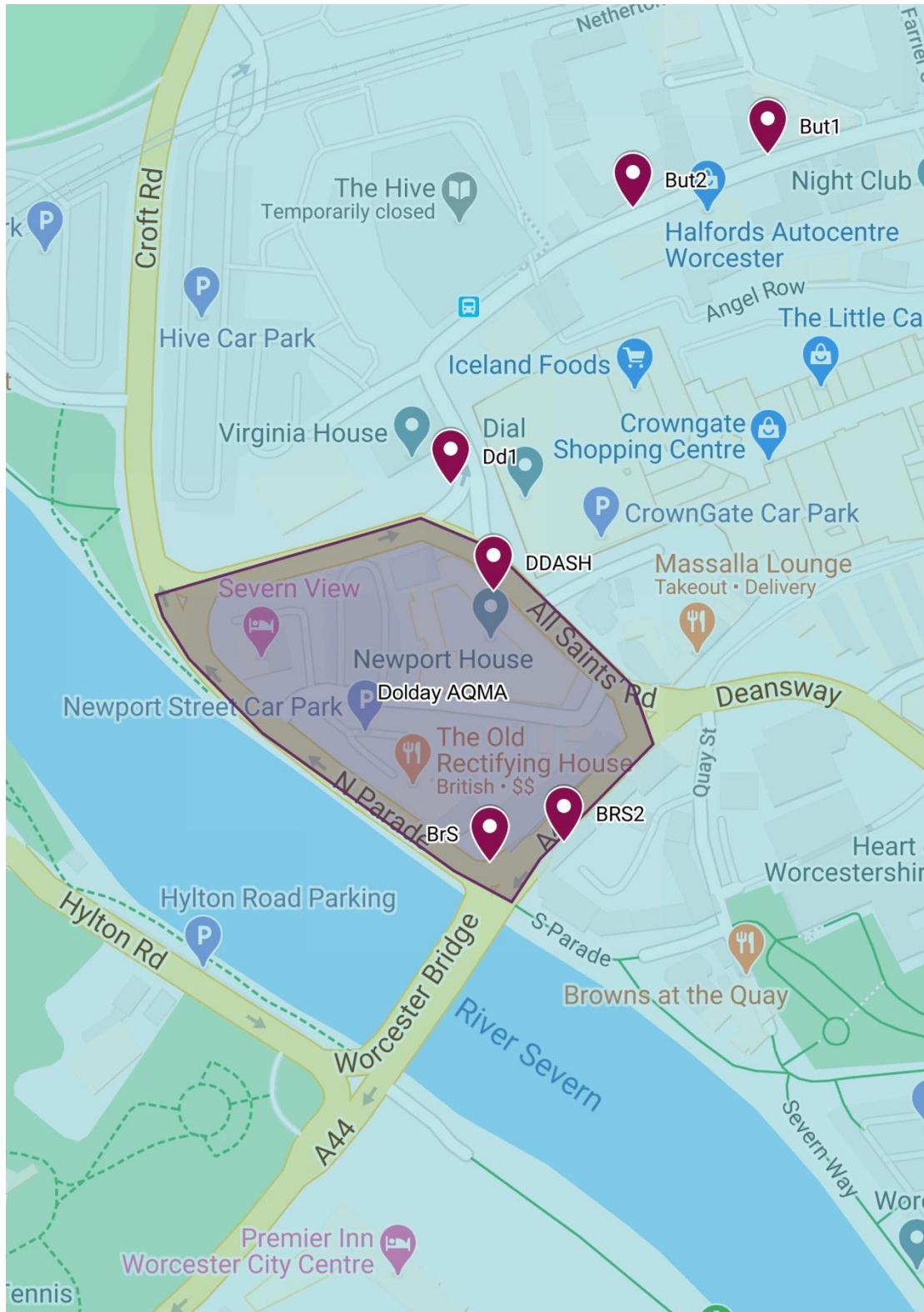
Step 1	How far from the KERB was your measurement made (in metres)?	1.45	metres
Step 2	How far from the KERB is your receptor (in metres)?	9.25	metres
Step 3	What is the local annual mean background NO ₂ concentration (in µg/m ³)?	13.97388	µg/m ³
Step 4	What is your measured annual mean NO ₂ concentration (in µg/m ³)?	30.14	µg/m ³
Result	The predicted annual mean NO ₂ concentration (in µg/m ³) at your receptor	23.6	µg/m ³

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

Figure D.2 – Former Dolday/ Bridge Street AQMA and The Butts , Worcester

Legend

-  Monitoring Locations (ID)
-  AQMA





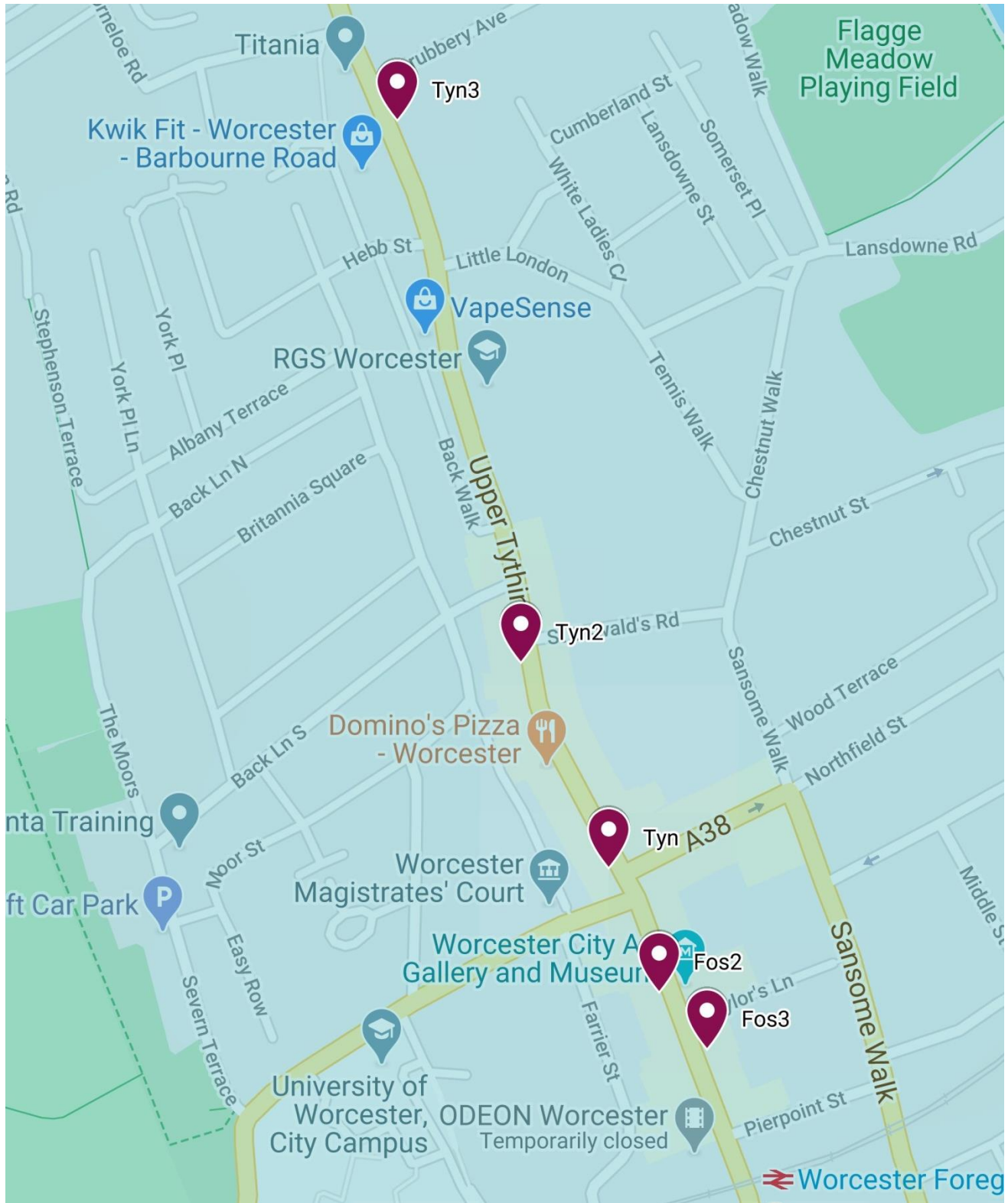
Date: 21.05.2020

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Figure D.3 –The Tything and Foregate Street, Worcester

Legend

-  Monitoring Locations (ID)
-  AQMA





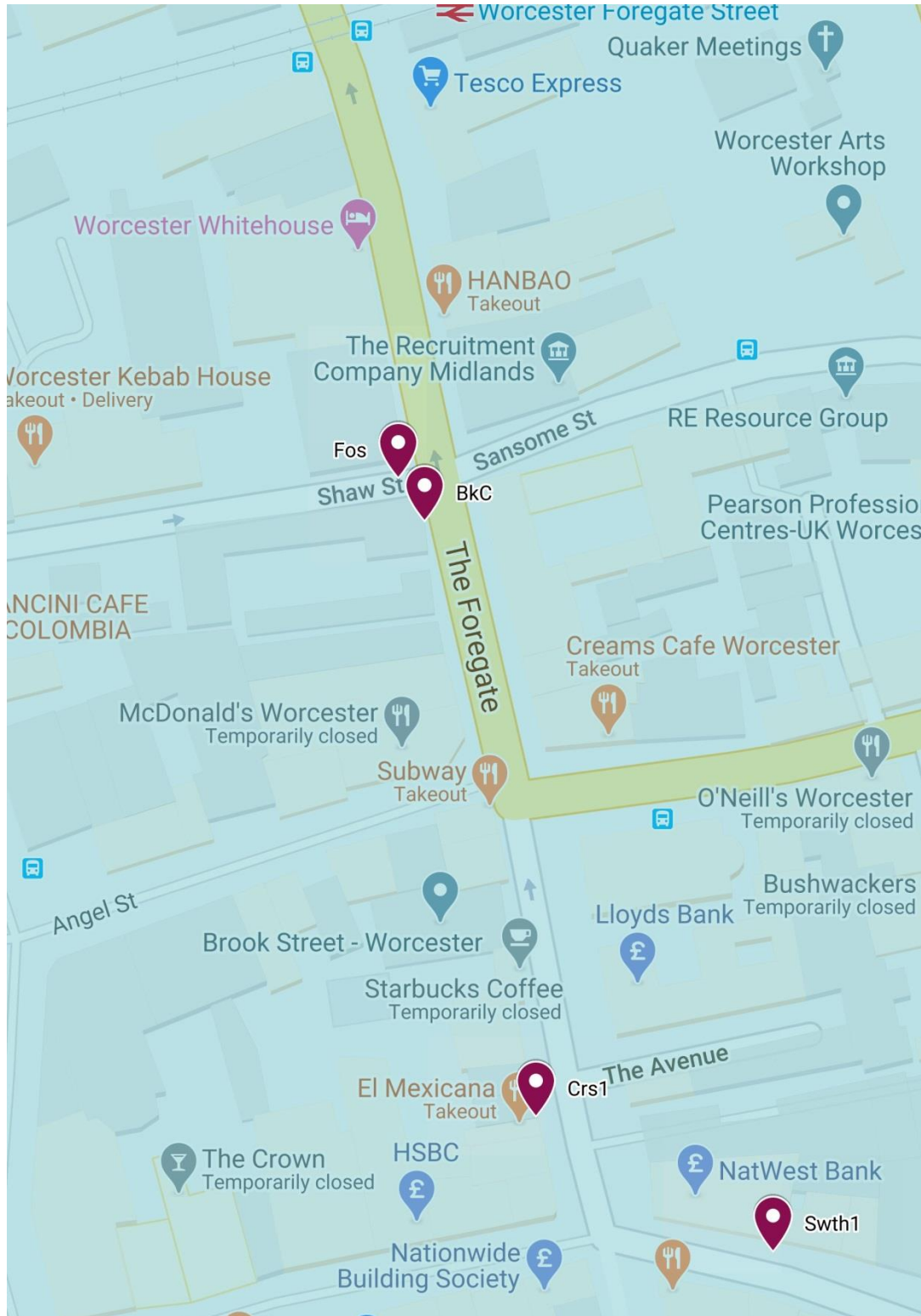
Date: 21.05.2020

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Figure D.4 – The Foregate, The Cross and St. Swithin’s Street , Worcester

Legend

-  Monitoring Locations (ID)
-  AQMA





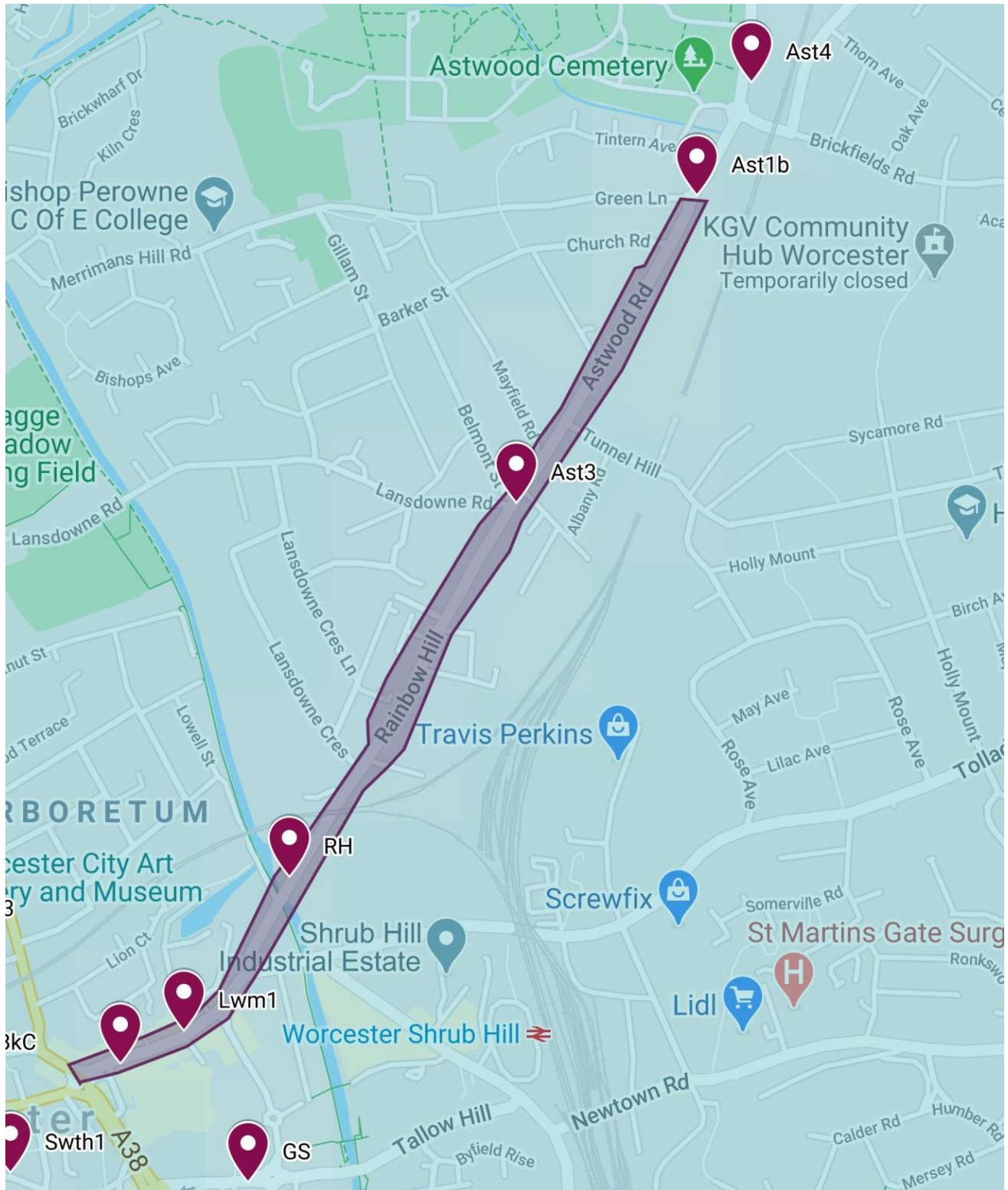
Date: 21.05.2020

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Figure D.5 – Former Lowesmoor/Rainbow Hill AQMA, Astwood Road and George Street, Shrub Hill, Worcester

Legend

-  Monitoring Locations (ID)
-  AQMA





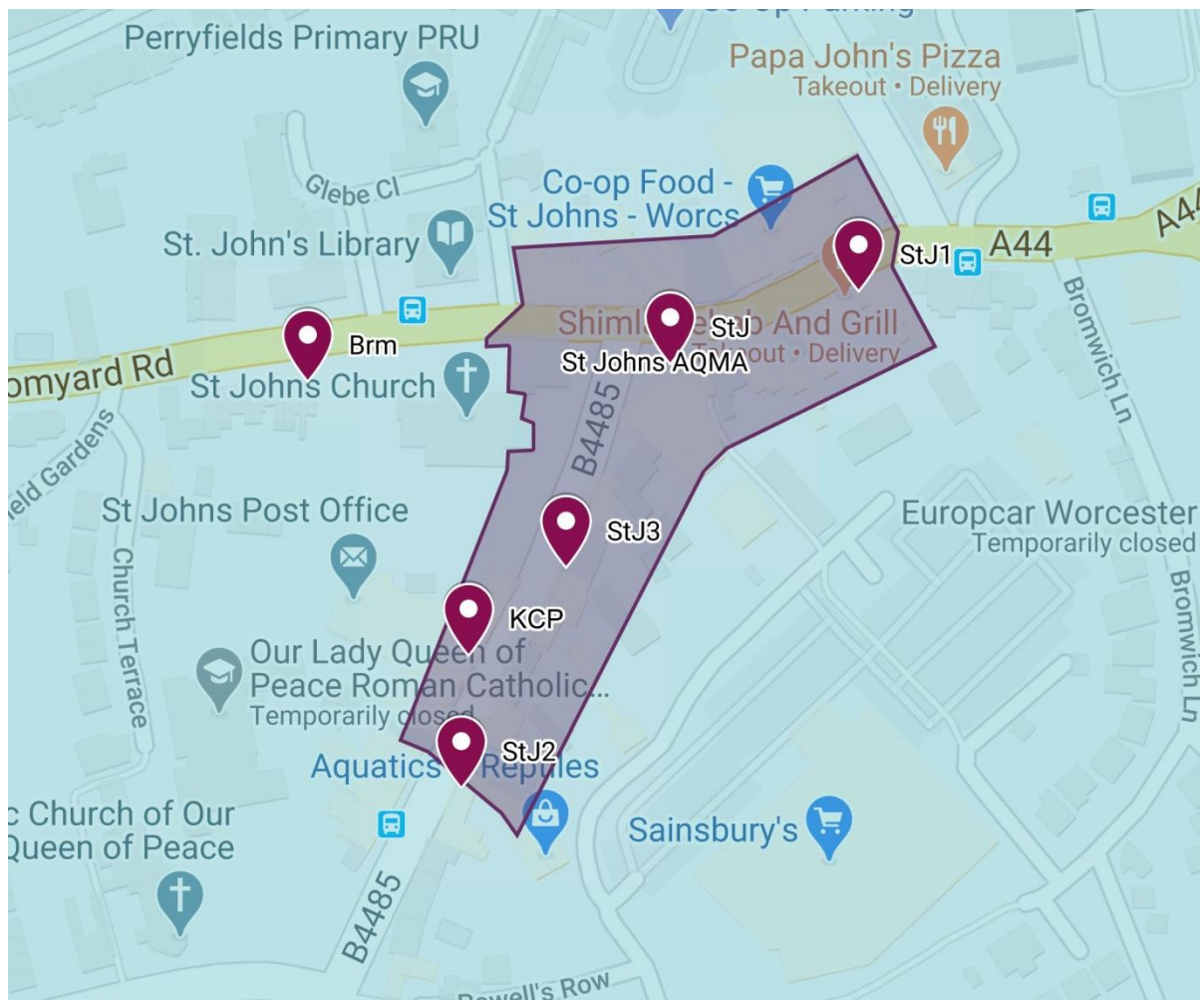
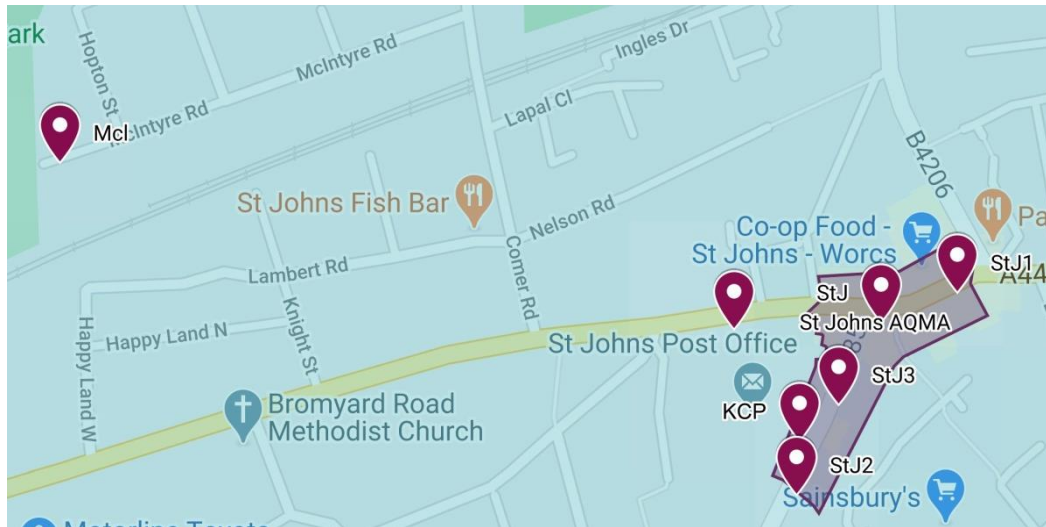
Date: 21.05.2020

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Figure D.6 – Former St. Johns AQMA and McIntyre Road, Worcester

Legend

-  Monitoring Locations (ID)
-  AQMA



Date: 21.05.2020

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Figure D.7 – London Road and Sidbury, Worcester

Legend Monitoring Locations (ID) AQMA	Date: 21.05.2020
	Copyright: Map data ©2020 Google United Kingdom

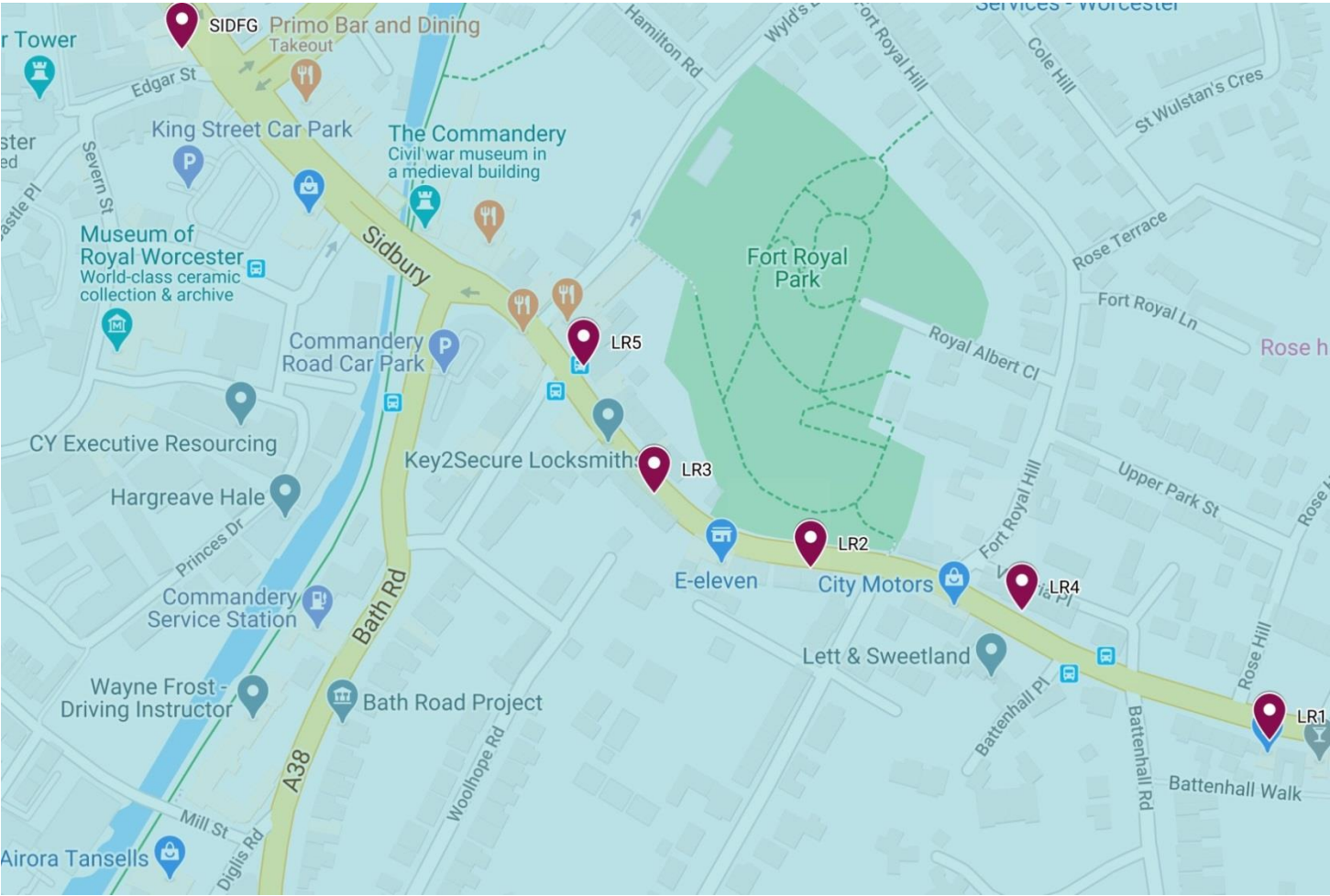


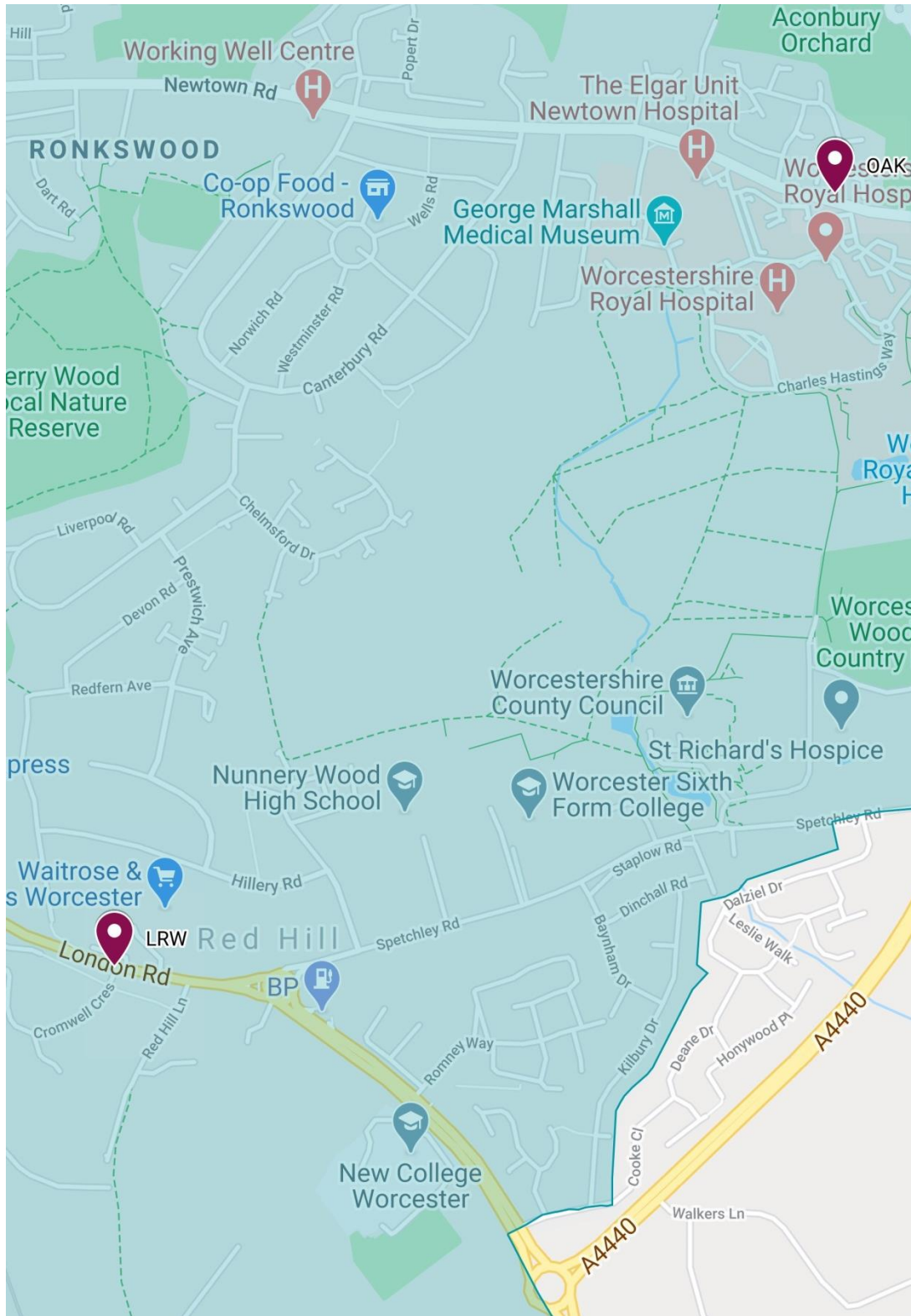


Figure D.8 – London Road Waitrose, Red Hill and Oaklands, Ronkswood, Worcester

Legend

-  Monitoring Locations (ID)
-  AQMA





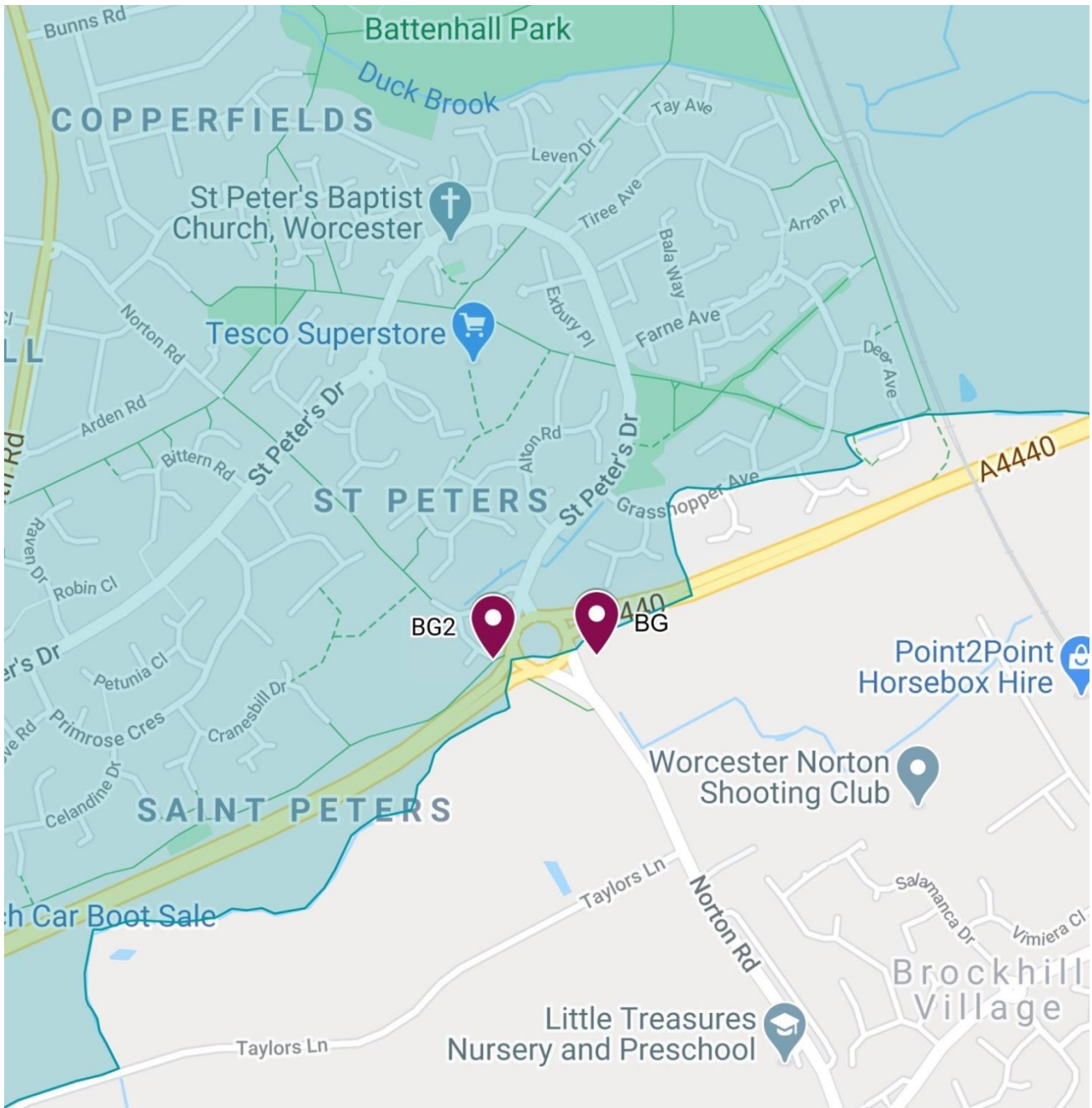
Date: 21.05.2020

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Figure D.9 – Broomhall Green, St. Peters, Worcester

Legend

-  Monitoring Locations (ID)
-  AQMA



Date: 21.05.2020

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NB Monitoring location BG shown is within Wychavon District Council authority boundary

Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England

Pollutant	Air Quality Objective ⁸	
	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

⁸ The units are in microgrammes of pollutant per cubic metre of air (µg/m³).

Glossary of Terms

Abbreviation	Description
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the local authority intends to achieve air quality limit values'
AQMA	Air Quality Management Area – An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives
AQC	Air Quality Consultants
AQO	Air Quality Objective
ASR	Air quality Annual Status Report
CAZ	Clean Air Zone
CBTF	Clean Bus Technology Fund
CEEPG	Central England Environmental Protection Managers Group
CNG	Compressed Natural Gas
COPD	Chronic Obstructive Lung Disease
COVID-19	Coronavirus disease 2019 is an infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).
DCMS	Department of Digital Culture Media and Sport
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DoPH	Director of Public Health, Worcestershire County Council
EU	European Union
EV	Electric Vehicle
HGV	Heavy Goods Vehicle
IPPC	Integrated Pollution Prevention and Control
JAQU	Defra and DfT Joint Air Quality Unit

LA	Local Authority
LAPPC	Local Authority Pollution prevention and Control
LAQAG	Local Authority Air Quality Advisory Group to Defra
LAQM	Local Air Quality Management
LAQM.PG(16)	Defra 2016 Local Air Quality Management Policy Guidance
LAQM.TG(16)	Defra 2016 Local Air Quality Management Technical Guidance
LES	Low Emissions Strategy
LEV	Low Emission Vehicle
LTP4	Worcestershire County Council's fourth edition of the Local Transport Plan for the county
µg/m ³	Micrograms per metre cubed
MJAC	Midland Joint Advisory Council
MTE	Moving Traffic Enforcement
NHS	National Health Service
NO ₂	Nitrogen Dioxide
NO _x	Nitrogen Oxides
OLEV	Office of Low Emission Vehicles
PHE	Public Health England
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
PTP	Personalised Travel Planning
QA/QC	Quality Assurance and Quality Control
SPD	Supplementary Planning Document
TBC	To Be Confirmed
T&F	Task and Finish (Air Quality) Group
TRO	Traffic Regulation Order

UKAS	UK Accreditation Service
ULEV	Ultra Low Emission Vehicle
UTC	Urban Traffic Control
VMS	Variable Messaging System
WFH	Working from home
WRS	Worcestershire Regulatory Services

References

1. AQC (July 2017) 'Detailed Assessment of Air Quality along London Road, Worcester' ref: J2829A/1/F1
2. Defra (2016) 'Local Air Quality Management Policy Guidance LAQM PG.(16)'
3. Defra (2016) 'Local Air Quality Management Technical Guidance LAQM TG.(16)'
4. Defra and DfT (2017) 'UK plan for tackling roadside nitrogen dioxide'
5. Worcester City Council (Jan 2019) 'Licensing and Environmental Health Committee Tuesday, 22nd January 7pm – Agent Reports Pack'
6. Worcester City Council (Jul 2019) 'A Vision for Worcester – City Centre Masterplan'
7. Worcestershire County Council (2017) 'Worcestershire's Local Transport Plan (LTP) 2018 – 2030'
8. WRS (Sept 2013) 'Air Quality Action Plan for Worcestershire' ref: AQAP Doc v2.2
9. WRS (2016) 'Air Quality Action Plan Progress Report for Worcestershire April 2015 – March 2016'
10. WRS (2019) 'Technical Guidance Note for Planning v5.1'
11. WRS (2019) 'Air Quality Annual Status Report'