2019 Air Quality Annual Status Report (ASR)

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

June 2019

Report for	Euan Tapper Neighbourhood Services, Woking Borough Council Civic Office, Gloucester Square, Woking, Surrey GU21 6YL, United Kingdom Euan.Tapper@woking.gov.uk		
Main contributors	Ellénore Calas		
Issued by	Ellénore Calas		
Approved by	Ben Warren		
Wood Environment & Infrastructure Solutions UK Limited	Floor 23, 25 Canada Square, Canary Wharf, London E14 5LB, United Kingdom Tel +44 (0) 203 215 1610		
Third party disclaimer	Any disclosure of this report to a third party is subject to this disclaimer. The report was prepared by Wood at the instruction of, and for use by, our client named on the front of the report. It does not in any way constitute advice to any third party who is able to access it by any means. Wood excludes to the fullest extent lawfully permitted all liability whatsoever for any loss or damage howsoever arising from reliance on the contents of this report. We do not however exclude our liability (if any) for personal injury or death resulting from our negligence, for fraud or any other matter in relation to which we cannot legally exclude liability.		
Management systems	This document has been produced by Wood Environment & Infrastructure Solutions UK Limited in full compliance with the management systems, which have been certified to ISO 9001, ISO 14001 and OHSAS 18001 by LRQA.		
Document revisions	No.	Details	Date
	1	Draft	14/06/2019
	2	Final	24/06/2019

Executive Summary: Air Quality in Our Area

Air Quality in Woking Borough Council

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

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

Woking Borough Council (WBC) has completed all past rounds of Review and Assessment. This Annual Status Report (ASR) considers all new monitoring data and assesses the data against the Air Quality Strategy Objectives (AQOs). It also considers any changes that may have an impact on air quality. Progress on measures to improve air quality are identified, as well as WBC's approach to reducing emissions and/or concentrations of fine particulates ($PM_{2.5}$), which has increased focus in the ASR as a result of emerging evidence of the health impacts.

A Detailed Assessment for Anchor Hill[4] published in 2012 identified predicted exceedances of the annual mean nitrogen dioxide (NO_2) AQO at the façade of properties at the top of Anchor Hill. Contour plots showed that concentrations at the three main housing blocks at the top of Anchor Hill exceeded the objective or were within 10% of the objective. Due to the historical trend of high pollution levels at this location and the modelled exceedances it was recommended that WBC declared an Air Quality Management Area (AQMA) as a result of exceedances of the annual mean NO_2 AQO at Anchor Hill.

[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
[4] Bureau Veritas. Woking Borough Council Anchor Hill LAQM Detailed Assessment, October 2012

Based on the results of the Anchor Hill Further Assessment in January 2015[5] it was recommended that the AQMA should remain in place as both monitoring and modelling results show that although in some places the AQO was being achieved, concentrations in other places were above the AQO.

An Air Quality Action Plan (AQAP) was produced for the Anchor Hill AQMA in July 2015[6]. The plan determined that the upgrade of traffic signals at the Anchor Hill junction is likely to improve traffic flow and reduce NO_2 concentrations so that the annual mean AQO is no longer exceeded in the AQMA. The progress towards compliance is currently being tracked using monitoring data collected by WBC and being reported in the ASRs. It is recommended that the AQMA will be revoked when monitoring results from three consecutive years show no exceedances of the AQO, so that a permanent improvement in air quality can be demonstrated. NO_2 levels complied with the AQO at every Anchor Hill monitoring site in 2016, 2017 and 2018 as shown in this report. However, in 2018 the highest concentration within the AQMA was 39 µg/m^3 which is higher than in 2017, it is recommended that the AQMA is maintained until a clear long-term reduction in concentration can be demonstrated.

Exceedances of the annual mean AQO for NO_2 were recorded between 2012 and 2015 at diffusion tubes located on Guildford Road. Additional monitoring in the area around Guildford Road commenced in 2014 and recorded exceedances of the AQO at five locations in 2015. A Detailed Assessment was carried out in November 2016 for the junction between Guildford Road, Constitution Hill and Mount Hermon Road. This assessment indicated that concentrations at some receptor locations with relevant exposure were exceeding the AQO because of road traffic emissions around Guildford Road. It was recommended that an AQMA should be declared on Guildford Road. Further monitoring was recommended around the junctions where Guildford Road meets York Road and Station Approach to confirm if the NO_2 annual mean AQO is exceeded where there is relevant exposure. Consequently, the Guildford Road AQMA was declared in May 2017.

Local Highways have advised that the particularly high NO_2 concentrations monitored in the Guildford Road area in 2015 were likely to be due to roadworks in the Town

[5] Amec Foster Wheeler Environment & Infrastructure UK Ltd. Air quality further assessment for Woking Borough Council, May 2015
[6] Amec Foster Wheeler Environment & Infrastructure UK Ltd. Woking Borough Council – Anchor Hill AQMA – Air Quality Action Plan, 2015

Centre causing diversions in the area, which resulted in increased traffic along Guildford Road. WBC have confirmed that there is likely to be increased development occurring in the Town Centre over the next few years and therefore concentrations around Guildford Road are likely to vary but remain high during times of traffic diversion. Annual mean NO_2 concentrations in Guildford Road AQMA were exceeding the AQO at 2016, 2017 and 2018. However, when concentrations were calculated at the nearest locations of relevant exposure, all concentrations were considered to be below the annual mean AQO. As there were still exceedances of the annual mean AQO (before distance correction) It is recommended that the Guildford Road AQMA remains until concentrations are comfortably below the AQO.

The 2017 and 2018 ASR[7,8] determined that monitoring and analysis of concentrations at all locations included in the monitoring programme should continue, with specific consideration on Anchor Hill and Guildford Road.

Actions to Improve Air Quality

The Further Assessment of the Anchor Hill AQMA included recommendations to improve air quality at the junction. As a result of the recommendations, Surrey County Council (SCC) have updated the Traffic Signals in operation at the junction of Anchor Hill and High Street, Knaphill. In August 2016, a Microprocessor Optimised Vehicle Actuation (MOVA) scheme was introduced on Anchor Hill. No exceedance of the NO_2 AQO were recorded in Anchor Hill AQMA since 2016.

Following declaration of Guildford Road AQMA in May 2017, an AQAP was prepared. Measures included are focused on managing the increase in traffic that may be diverted down the road, as increased development is anticipated in this area in future years.

Conclusions and Priorities

WBC has declared two AQMAs at Anchor Hill and Guildford Road as a result of exceedance of the annual mean NO_2 AQO. Although 2016, 2017 and 2018 monitoring results indicate that the NO_2 AQO are not exceeded at relevant locations in the AQMAs, these remain the main priority locations for improving air quality.

[7] Amec Foster Wheeler Environment & Infrastructure UK Ltd. 2017 Air Quality Annual Status Report, May 2017
[8] Wood Environment & Infrastructure Solutions UK Limited. 2018 Air Quality Annual Status Report, June 2018

The priorities for WBC following this ASR are as follows:

- Continue monitoring of NO_2 to confirm if concentrations remain below the annual mean AQO at locations of relevant exposure and in the Anchor Hill and Guildford Road AQMAs.

Local Engagement and How to get Involved

The following sources of information are available on WBC's website for improving air quality in the borough and seeking further information:

- List of AQMAs in the borough: https://www.woking.gov.uk/airquality
- The Air Quality Action Plan for the Anchor Hill AQMA: https://www.woking.gov.uk/sites/default/files/documents/environmentalservices/Woking%20Borough%20Council%20AQAP%20Anchor%20Hill.pdf
- The Air Quality Action Plan for the Guildford Road AQMA: https://www.woking.gov.uk/sites/default/files/documents/environmentalservices/WBC_Guildford%20Rd_AQAP%20final%20report.pdf
- airAlert service warning local residents who have respiratory problems of whenever the air pollution in Woking is going to be high. This is a free subscription service which individuals, who suffer from asthma, COPD, emphysema or other respiratory illnesses, can sign up to, and they will receive either an email, text message or voicemail giving an advanced warning of high pollution levels: http://airalert.info/Surrey/Default.aspx

Table of Contents

List of Tables

List of Figures

1 Local Air Quality Management

This report provides an overview of air quality in WBC during 2017. 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 (AQOs) 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 WBC 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

AQMAs are declared when there is an exceedance or likely exceedance of an AQO. After declaration, the authority must prepare an AQAP within 12-18 months setting out measures it intends to put in place in pursuit of compliance with the AQO.

A summary of AQMAs declared by WBC can be found in Table 2.1. Both have been declared as a result of exceedance of the nitrogen dioxide (NO_2) annual mean AQO. Further information related to declared or revoked AQMAs, including maps of AQMA boundaries are available online at https://uk-air.defra.gov.uk/aqma/local-authorities?la_id=317. Alternatively, see Distance correction

Table C.3 details the parameters used to derive distance corrected concentrations at the nearest relevant receptors. The “NO2 fall-off with distance” spreadsheet version 4.2 developed by Bureau Veritas and available on the LAQM website was used.

Table C.3 – Distance correction at relevant sites

Site ID	Distance (m)		NO2 Annual Mean Concentration (µg/m3)		
	Monitoring Site to Kerb	Receptor to Kerb	Background	Monitored at Site	Predicted at Receptor
BD	2	8	13.7	16.1	15.3
TW	1.5	11	12.7	16.2	14.7
AH4	2	8	13.5	28.6	23.7
BR	1	16	12.3	28.5	19.4
BR1	1.5	22.5	12.3	26.5	18.1
GR	1	7	14.3	26.2	21.5
YR	1	13	16.9	30.0	23.3
YR1	1	19	16.9	31.2	22.7
LTK	1	4	16.9	28.3	25.1
LT1	1	16	16.9	35.0	24.9
CH	1.5	5.5	16.9	41.8	34.7
CH2	1	13	16.9	43.5	29.8
CH3	1.5	15.5	16.9	38.6	27.5
CH4	1	18	14.1	38.5	24.3
RC	1	11	14.1	18.0	16.1
LD	1	13	13.4	22.3	17.7
PR	1	13	15.3	26.5	20.7
TC	4	28	18.8	31.3	24.5
CR	1	7	17.0	22.9	20.6

WL	1	32	12.9	25.0	16.6
MR	2	6	15.3	31.6	27.4
MR2	2	20	15.3	37.0	25.3
OR	3	29	15.3	27.7	20.4

[a] Warning: receptor is more than 20m further from the kerb than monitor – results to be treated with caution.

Appendix D: Maps of Monitoring Locations and AQMAs, which provides for a map of air quality monitoring locations in relation to the AQMAs.

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
AQMA for Anchor Hill	01/02/2014	NO_2 Annual Mean	Knaphill, Woking	A small area covering a 4-way junction at the top of a steep hill.	NO	41.5 µg/m^3	39.0 µg/m^3	Anchor Hill Air Quality Action Plan	2015	https://www.woking.gov.uk/sites/default/files/documents/environmentalservices/Woking%20Borough%20Council%20AQAP%20Anchor%20Hill.pdf
AQMA Order 2 Guildford Road AQMA	15/05/2017	NO_2 Annual Mean	Woking	AQMA incorporates a small section of Guildford Road to the south of Constitution Hill junction and to the north of the Junction with Ashdown Close.	NO	42.2 µg/m^3 (modelled)	43.5 µg/m^3 (29.8 µg/m^3)	Guildford Road AQMA Air Quality Action Plan	2017	https://www.woking.gov.uk/sites/default/files/documents/environmentalservices/WBC_Guildford%20Rd_AQAP%20final%20report.pdf

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

2.2 Progress and Impact of Measures to address Air Quality in WBC

WBC has taken forward a number of direct measures during the current reporting year of 2018 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2.

WBC officers are working with Surrey County Council (SCC) to develop a Local Walking and Cycling Infrastructure Plan (LWCIP) for Woking. This follows publication of the Government's Cycling and Walking Investment Strategy in 2017 that sets out an ambition to make walking and cycling the natural choices for shorter journeys (or as part of a longer journey). The LWCIP aims to develop a network plan for walking and cycling routes into the Town Centre that connect people to places of work, education, retail etc. It is hoped a draft Plan will be available in summer 2019.

More detail on these measures can be found in WBC's Anchor Hill AQAP and Guildford Road AQAP as well as in the Surrey Transport Plan: Air Quality Strategy[9]

WBC works in accordance with the Surrey Transport Plan (LTP3). A twin-track strategy is proposed to address air quality in SCC, which focuses on AQMAs and synergies with other strategies to deliver countywide air quality improvements. Measures to improve air quality are included in a "Strategy Toolkit" within the Air Quality Strategy.

Key completed measures are:

- Installation of a Microprocessor Optimised Vehicle Actuation (MOVA) system in August 2016 at the junction between Anchor Hill and High Street. This measure is expected to have had an impact on NO_2 levels from road traffic in the Anchor Hill AQMA.
- Improvement of cycling and walking infrastructure. These measures will likely reduce road traffic congestion and improve air quality.

Additionally, 11 local authorities across Surrey and the SCC, including public health professionals, have set up the Surrey Air Alliance (SAA), which is working on a Surrey Action Plan. The alliance is also planning dispersion modelling of $PM_{2.5}$ and

[9] Surrey County Council. Surrey Transport Plan Air Quality Strategy. January 2016

NO_2 concentrations across the borough, which will identify the sources of these pollutants. This will help develop target measures to reduce pollution from the relevant sources. The delivery of the modelling is planned for summer 2019.

An air quality awareness school project was delivered to schools within 2km of an AQMA in Surrey between December 2018 and April 2019 on behalf of the SAA. Six WBC schools were part of the project. This included an air quality theatre play, educational workshops including diffusion tubes monitoring, and bikeability training. SAA made an application to the Defra Air Quality Grant Fund for an extension to the schools programme.

WBC anticipates that the measures stated above and in Table 2.2 will help to achieve compliance in the Anchor Hill and Guildford Road AQMAs.

Table 2.2 – Progress on Measures to Improve Air Quality

Measure No.	Measure	EU Category	EU Classification	Organisations involved and Funding Source	Planning Phase	Implementation Phase	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
1	Urban Traffic Management and Control (UTMC)	Traffic Management	UTC, Congestion Management, Traffic Reduction	SCC / WBC	2015	2015	Restrain or reduce traffic volumes in AQMA	Y	MOVA installed and in operation since August 2016 at the busy junction in the Anchor Hill AQMA.	Completed	
2	New and/or improved cycle lane and track	Transport Planning & Infrastructure	Cycle Network	SCC / WBC		2008 - 2011	Restrain or reduce traffic volumes in AQMA	Y	Officers are working with SCC to develop a Local Walking and Cycling Infrastructure Plan (LWCIP) for Woking. This follows publication of the Government's Cycling and Walking Investment Strategy in 2017 that sets out an ambition to make walking and cycling the natural choices for shorter journeys (or as part of a longer journey). The LWCIP aims to develop a network plan for walking and cycling routes into the Town Centre that connect people to places of work, education, retail etc. and a prioritised programme of infrastructure improvements for future investment. It is hoped a draft Plan will be available in summer 2019. The Business Case for the Woking Strategic Transport Project (WSTP), led by SCC, incorporating walking and cycling schemes linked to the Town Centre was submitted at the end of August 2018. A funding decision from the LEP is expected imminently (late March / April 2019). Surrey County Council's website provides information on cycle and walking improvements in Woking completed by March 2016 www.travelsmartsurrey.info/achievements/cycling-and-walking-improvements-in-Surrey	Summer 2019	Staff resource; funding for infrastructure improvements

3	Cycle parking	Transport Planning & Infrastructure	Cycle Network	SCC / WBC	N/a	2008 - 2011	Restrain or reduce traffic volumes in AQMA	Y	Various improvements made under Cycle Woking 2008 – 2011. In 2015 the Cycle Hub was installed at Woking station providing storage for over 200 cycles and encouraging cycle / rail integration. New cycle storage compound implemented at Brookwood station in 2016. These storage facilities have been funded by Department for Transport funding secured by South West Trains together with WBC S106 funding contributions. Approximately 20 cycle stands are to be reinstated around the Town Centre (which were previously removed due to construction of the Town Twinning sign being installed in Gloucester Square).	01/11/2019	None identified
4	Cycle infrastructure and storage improvement	Transport Planning & Infrastructure	Cycle Network	WBC/SCC	2018	N/a	Restrain or reduce traffic volumes in AQMA	Y	Further cycle infrastructure and storage improvements planned as part of the Woking Integrated Transport Project including improved cycle links to Woking Railway Station. https://www.woking.gov.uk/major-developments/woking-integrated-transport-project Planning permission has now been granted for the new pedestrian / cycle bridge and walkway over the Basingstoke Canal next to the Chobham Road Bridge.	3 years	Funding identified as part of the Woking Integrated Transport Project
5	Infrastructure to support the use of hybrid/ electric vehicles	Traffic Management	Other	SCC / WBC	N/a	2015	Reduce tailpipe emissions in AQMA	Y	The Council currently has 22 EV charging points across Town Centre car parks. Details are available here: www.woking.gov.uk/parking-and-streets/car-parks/electric-vehicle-charging-points The Council has published a position statement taking account of emerging EV policy and market changes in order to inform next steps www.woking.gov.uk/sites/default/files/documents/Nature/WBC%20Electric%20Vehicle%20Position%20Statement.pdf	Completed	Potential barriers identified within the statement
6	Car clubs	Alternatives to private vehicle use	Car Clubs	SCC / WBC	N/a	N/a	Restrain or reduce traffic volumes in AQMA	Y	The Council has a car club arrangement with Enterprise Rent A Car Ltd for staff business use – the Car Club scheme – see more info on 'Ewokplus'. It comprises two low emission vehicles available for hires up to four hours. Enterprise also operates Surrey County Council's car club scheme that is also available for the public. In Woking, there are four cars available in Guildford Road (one car), Goldsworth Road (one car) and at Quadrant Court (two cars). https://www.enterprisecarclub.co.uk/gb/en/home.html	Ongoing	None identified

7	Workplace travel planning	Promoting Travel Alternatives	Personalised Travel Planning	SCC / WBC	N/a	N/a	Restrain or reduce traffic volumes in AQMA	Y	The Council has its own Staff Transport Plan including various initiatives to encourage alternative modes of transport to the car. Criteria has been applied to lease cars in order to lower emissions and air pollution associated with this fleet. In October 2018, it was agreed that diesel vehicles will no longer qualify as part of the Council's lease car scheme recognising research and Government policy that finds that diesel cars are more polluting in terms of NO_X and PM. The CO_2 threshold for lease cars was increased slightly to 135g/km to enable a wider choice of petrol vehicle within the lease car fleet. Environmental standards also apply to cash alternative vehicles. Details are available via Ewokplus. For staff that need to undertake business mileage but do not own a car that fits the Council's environmental criteria, cars can be hired through the car club operated by Enterprise Rent A Car Ltd.	Ongoing	None identified
8	Differential parking charges	Traffic Management	Emission based parking or permit charges	SCC / WBC	N/a	N/a	Reduce tailpipe emissions in AQMA	Y	Differential parking charges - The cost of a season ticket is based on a vehicle's CO_2 emission rating (determined by the Vehicle Certification Agency). A 50% discount is applied for vehicles that produce the lowest emissions (CO_2 band A) and a 25% discount for band B vehicles. Those with a band G rating (the highest band) pay a 25% surcharge. www.woking.gov.uk/parking-and-streets/car-parks/how-we-calculate-season-ticket-charges	Ongoing	None identified
9	Encourage boroughs and districts to consider adopting minimum emissions standards or vehicle age restricti	Promoting Low Emission Transport	Taxi Licensing conditions	SCC / WBC	N/a	2014	Reduce tailpipe emissions in AQMA	Y	With effect from the 4th of January 2014, WBC have required all Private Hire Vehicles and all non-wheelchair compliant Hackney Carriages to meet the Euro Emissions V Criteria. As wheelchair accessible vehicles tend to be larger and more van-like, it is unrealistic for us to expect them to meet the low emissions criteria. However – there are at least 540 private hire vehicles in Woking – all of which are at least Euro Emissions V . Some even are Euro Emissions VI. Euro Emission Standard VI has been applied to manufactures of new vehicles from September 2014 and they are given 12 months to comply. This means that from September 2015 no new vehicle (passenger car) should be being produced that is not Euro VI. Our policy is stating that as Euro Emissions VI is to be applied to manufacturers from September 2014, it will therefore apply to new and renewal vehicles presented to Woking Borough Council from 20th of January 2022. With effect from the 20th of January 2022 there will be no Euro Emissions V vehicles licenced by WBC.	Ongoing	None identified

	ons into taxi licensing procedures										

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.

WBC is working to address $PM_{2.5}$ through implementation of the measures to improve air quality detailed in Table 2.2.

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

3.1 Summary of Monitoring Undertaken

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

3.1.1 Automatic Monitoring Sites

WBC does not undertake any automatic (continuous) monitoring.

3.1.2 Non-Automatic Monitoring Sites

WBC undertook non-automatic (passive) monitoring of NO_2 at 34 sites during 2018. Details of Non-Automatic Monitoring Sites 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, “annualisation” and distance correction, are included in Appendix C.

3.2 Individual Pollutants

The air quality monitoring results presented in this section are, where relevant, adjusted for bias, “annualisation” and distance correction. Further details on adjustments are provided in Appendix C.

3.2.1 Nitrogen Dioxide (NO_2)

Table A.2 – Annual Mean NO2 Monitoring Results in Appendix A compares the ratified and adjusted monitored NO_2 annual mean concentrations for the past 5 years with the air quality objective of 40µg/m^3.

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

Two diffusion tubes in Guildford Road AQMA (CH and CH2), recorded exceedances of the AQO in 2018. Using distance correction to predict concentrations at locations

of nearest relevant exposure, all locations of relevant exposure on Guildford Road are considered to have NO_2 concentrations below the AQO.

An exceedance of the AQO was recorded at monitoring site M25, located on a bridge over the motorway. The site has recorded high concentrations of NO_2 as would be expected close to a motorway. Previous rounds of Review and Assessment have determined this site is not representative of relevant exposure[10].

Analysis of UK continuous NO_2 monitoring data has shown that it is unlikely that the hourly mean NO_2 objective, of 18 hourly means over 200 µg/m^3, would be exceeded where the annual mean objective is below 60 µg/m^3. There was one exceedance of 60 µg/m^3 in 2015 at the diffusion tube located near the M25, which is not representative of relevant exposure. In 2018 no exceedances of 60 µg/m^3 were recorded.

The Anchor Hill monitoring sites are located on a steep hill leading to a traffic light controlled junction. A Detailed Assessment was carried out for this area in 2012 and a Further Assessment carried out in 2015. The results in the 2015 Further Assessment highlighted the need to consider options to reduce exposure of nearby residential receptors[11]. Due to exceedances of the AQO at diffusion tubes AH and AH6 along Anchor Hill, it was recommended that the AQMA remain in place until further monitoring consistently records concentrations below the AQO. In 2017 and 2018 there were no exceedance of the AQO at any of the sites within the Anchor Hill AQMA.

3.2.2 Particulate Matter (PM_{10})

WBC does not undertake any PM_{10} monitoring.

3.2.3 Particulate Matter ($PM_{2.5}$)

WBC does not undertake any $PM_{2.5}$ monitoring.

3.2.4 Sulphur Dioxide (SO_2)

WBC does not undertake any SO_2 monitoring.

[10] Woking Council (2014). Air quality progress report for Woking Council.

[11] Amec Foster Wheeler Environment & Infrastructure UK Ltd (2015). Air quality further assessment for Woking Borough Council.

Appendix A: Monitoring Results

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

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
BD	Bitterne Drive	Roadside	498025	158949	NO_2	NO	6.0*	2.0*	NO	-
TW	Tresta Walk	Roadside	498435	159451	NO_2	NO	9.5*	1.5*	NO	-
AH	Anchor Hill 1	Kerbside	496618	158699	NO_2	YES	69	1	NO	-
AH2	Anchor Hill 2	Roadside	496615	158696	NO_2	YES	0	5	NO	-
AH3	Anchor Hill 3	Roadside	496646	158750	NO_2	NO	0	5	NO	-
AH4	Anchor Hill 4	Roadside	496679	158767	NO_2	NO	6	2	NO	-
AH5	Anchor Hill 5	Roadside	496594	158698	NO_2	YES	0	5	NO	-
AH6	Anchor Hill 6	Roadside	496586	158686	NO_2	NO	0	2	NO	-
LGR	Lower Guildford Rd	Roadside	496601	158668	NO_2	YES	0	3	NO	-
BR	Bagshot Road	Kerbside	495821	157793	NO_2	NO	15	1	NO	-
BR1	Bagshot Road	Roadside	495852	157188	NO_2	NO	21	1.5	NO	-
GR	Goldsworth Road	Kerbside	499952	158545	NO_2	NO	6	1	NO	-
YR	York Road	Kerbside	500450	158278	NO_2	NO	12*	1*	NO	-
YR1	York Road	Kerbside	500447	158256	NO_2	NO	18*	1*	NO	-
LTK	Constitution Hill 1	Kerbside	500437	158120	NO_2	NO	3	1	NO	-

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
LT1	Constitution Hill 1	Kerbside	500453	158100	NO_2	NO	15	1	NO	-
CH	Constitution Hill 4	Roadside	500417	158102	NO_2	YES	4	1.5	NO	-
CH2	Constitution Hill 5	Kerbside	500367	158073	NO_2	YES	12	1	NO	-
CH3	Constitution Hill 6	Roadside	500330	158012	NO_2	YES	14	1.5	NO	-
CH_4	Constitution Hill 7	Kerbside	500332	157983	NO_2	NO	17	1	NO	-
RC	Rosebery Crescent	Kerbside	500946	157110	NO_2	NO	10	1	NO	-
LD	Lincoln Drive	Kerbside	503244	159659	NO_2	NO	12	1	NO	-
PR	Dartnell Avenue (previously Parvis Road)	Kerbside	504926	161063	NO_2	NO	12	1	NO	-
M25	M25	Other	505611	161180	NO_2	NO	N/a	0	NO	-
TC	The Cedars	Roadside	506731	161229	NO_2	NO	24.0*	4	NO	-
CR	Church Road	Kerbside	506401	160504	NO_2	NO	6.0*	1.0*	NO	-
WL	Woodham Lane	Kerbside	502854	161062	NO_2	NO	31	1	NO	-
MR	Monument Road	Roadside	501611	159645	NO_2	NO	4	2	NO	-
MR2	Monument Road	Roadside	501613	159646	NO_2	NO	18	2	NO	-
OR	Oriental Road	Roadside	501679	159148	NO_2	NO	26.0*	3	NO	-
VW	Victoria Way	Kerbside	500510	159030	NO_2	NO	N/a	1	NO	-

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
VW2	Victoria Way 2	Roadside	500281	158827	NO_2	NO	N/a	8	NO	-
VW3	Victoria Way 3	Roadside	500270	158731	NO_2	NO	N/a	3	NO	-
VW4	Victoria Way 4	Roadside	500425	158584	NO_2	NO	N/a	5.5	NO	-

Notes:

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

(2) N/A if not applicable.

* Distances estimated from online mapping sources.

Table A.2 – Annual Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2017 (%) [2]	NO_2 Annual Mean Concentration (µg/m^3) [3]				
					2014	2015	2016	2017	2018
BD	Roadside	Diffusion Tube	100	100	13.9	17.0	18.0	15.6	16.1
TW	Roadside	Diffusion Tube	100	100	-	-	-	13.3	16.2
AH	Kerbside	Diffusion Tube	92	92	37.1	**44.1**	36.0	34.6	39.0
AH2	Roadside	Diffusion Tube	100	100	29.1	36.7	34.9	31.6	31.2
AH3	Roadside	Diffusion Tube	100	100	20.7	27.1	23.3	22.5	23.9
AH4	Roadside	Diffusion Tube	100	100	24.6	34.5	31.6	27.3	28.6
AH5	Roadside	Diffusion Tube	100	100	26.3	34.0	29.4	26.3	31.1
AH6	Roadside	Diffusion Tube	100	100	33.5	**40.9**	34.7	29.2	34.0
LGR	Roadside	Diffusion Tube	100	100	25.2	32.0	26.2	23.7	27.0
BR	Kerbside	Diffusion Tube	92	92	24.5	31.6	28.4	24.5	28.5
BR1	Roadside	Diffusion Tube	92	92	23.1*	26.2	24.4	22.8	26.5
GR	Kerbside	Diffusion Tube	100	100	23.6	26.8	27.3	26.0	26.2
YR	Kerbside	Diffusion Tube	100	100	-	-	-	23.9	30.0
YR1	Kerbside	Diffusion Tube	100	100	-	-	-	25.0	31.2
LTK	Kerbside	Diffusion Tube	92	92	31.0	**40.7**	23.6	24.3	28.3
LT1	Kerbside	Diffusion Tube	100	100	17.8	24.9	33.9	33.9	35.0
CH	Roadside	Diffusion Tube	83	83	34.2	**48.8**	**43.3**	36.5	**41.8**
CH2	Kerbside	Diffusion Tube	92	92	**40.6***	**51.6**	**47.6**	**41.3**	**43.5**
CH3	Roadside	Diffusion Tube	100	100	37.9*	**51.5**	**45.4**	**41.0**	38.6
CH4	Kerbside	Diffusion Tube	92	92	34.5*	**42.4**	**40.0**	37.6	38.5
RC	Kerbside	Diffusion Tube	83	83	17.7*	16.5	16.6	18.0	18.0

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2017 (%) (2)	NO_2 Annual Mean Concentration ($\mu g/m^3$) (3)				
					2014	2015	2016	2017	2018
LD	Kerbside	Diffusion Tube	92	92	16.3	20.7	18.7	16.7	22.3
PR	Kerbside	Diffusion Tube	92	92	23.3	28.4	25.9	22.2	26.5
M25	Other	Diffusion Tube	92	92	**50.3**	**61.0**	**51.4**	**42.2**	**53.9**
TC	Roadside	Diffusion Tube	100	100	-	-	29.9	26.3	31.3
CR	Kerbside	Diffusion Tube	75	75	-	-	-	20.7	22.9
WL	Kerbside	Diffusion Tube	42	42	26.4	29.0	30.5	23.5*	25.0*
MR	Roadside	Diffusion Tube	100	100	27.1*	35.0	37.8	31.3	31.6
MR2	Roadside	Diffusion Tube	83	83	29.3	35.7	32.5	28.0	37.0
OR	Roadside	Diffusion Tube	83	83	-	-	27.6	25.2	27.7
VW	Kerbside	Diffusion Tube	92	92	27.4	**43.2**	35.7	31.2	35.9
VW2	Roadside	Diffusion Tube	83	83	-	-	-	18.0	27.9
VW3	Roadside	Diffusion Tube	100	100	-	-	-	19.8	26.8
VW4	Roadside	Diffusion Tube	92	92	-	-	-	23.4	32.8

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

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

Notes:

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

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

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

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

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

*Means have been "annualised" as per Boxes 7.9 and 7.10 in LAQM.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Figure A.1 – Trends in Annual Mean NO_2 Concentrations within Anchor Hill AQMA (before distance correction)

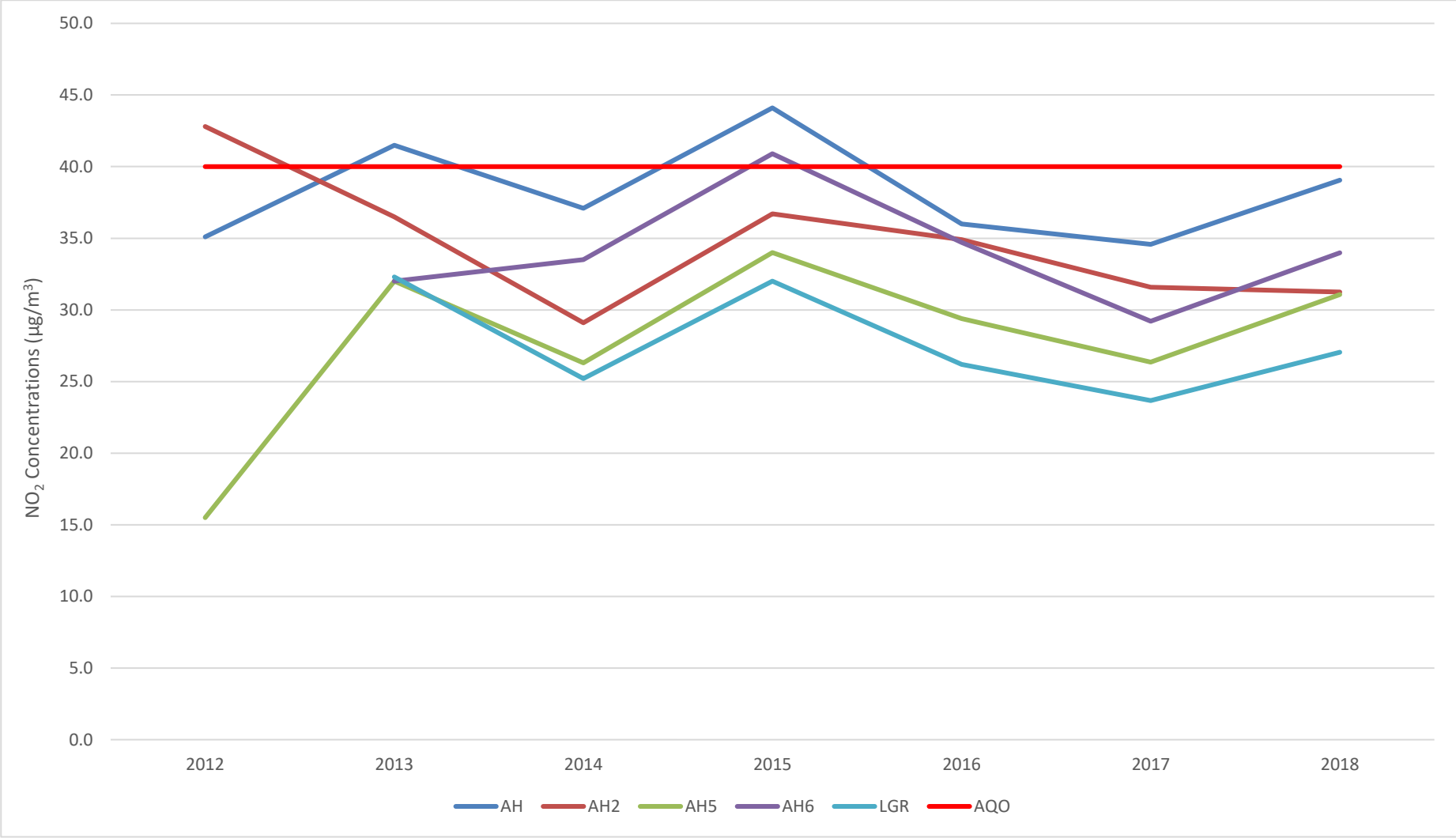
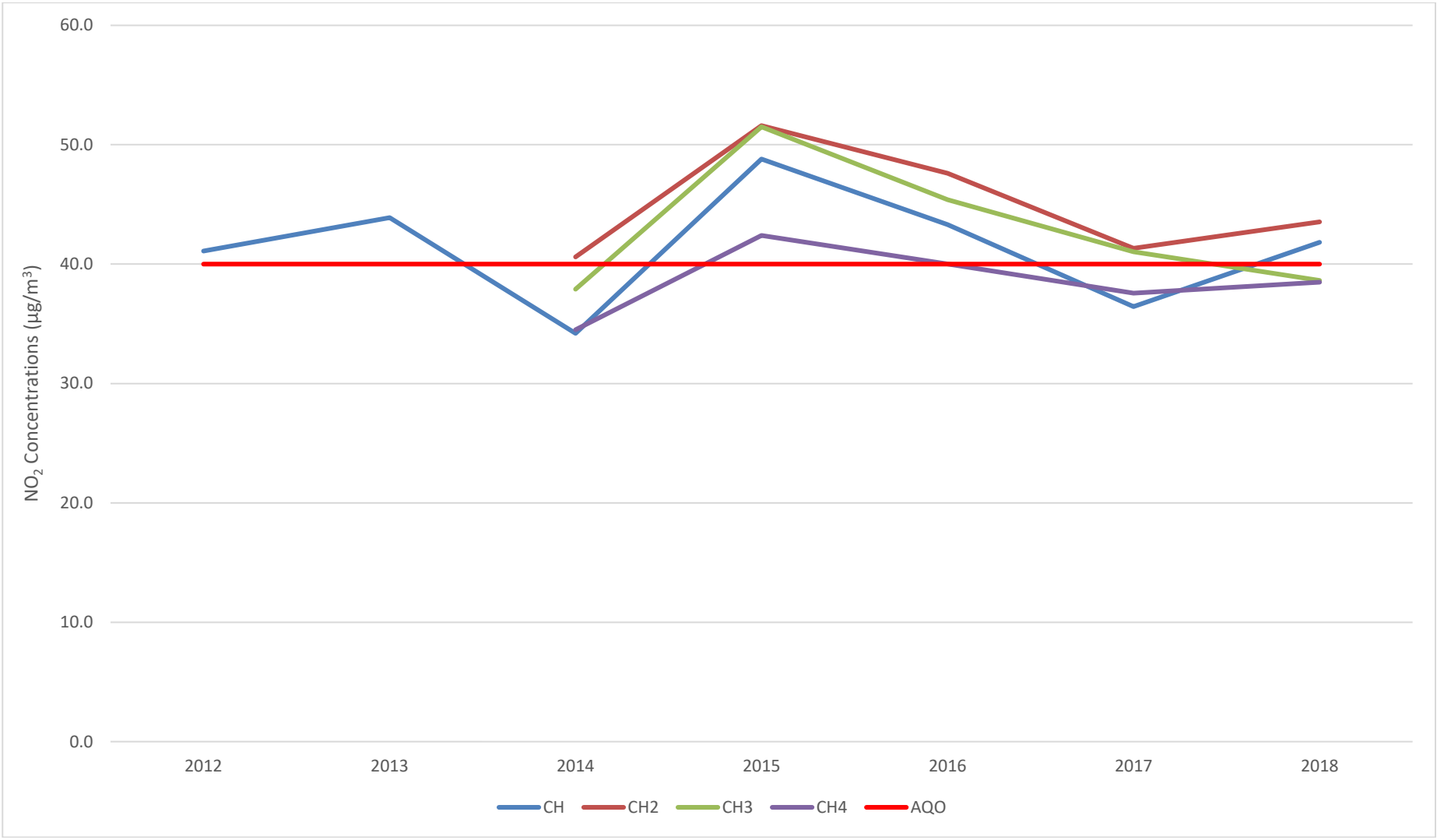


Figure A.2 – Trends in Annual Mean NO_2 Concentrations within Guildford Road AQMA (before distance correction)



Appendix B: Full Monthly Diffusion Tube Results for 2018

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

Site ID	NO_2 Mean Concentrations (µg/m^3)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean		
													Raw Data	Bias Adjusted (1.03) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
BD	21	20	14	14	15	10	13	5	14	18	23	20	15.6	16.1	15.3
TW	18	23	17	13	17	13	9	12	12	18	20	17	15.8	16.2	14.7
AH	44	35	43	33	35	33		19	34	52	52	37	37.9	39.0	-
AH2	35	33	29	27	28	25	23	22	30	40	37	35	30.3	31.2	-
AH3	24	31	24	20	26	16	20	17	17	24	29	31	23.3	23.9	-
AH4	24	24	27	17	28	16	25	37	25	36	40	34	27.8	28.6	23.7
AH5	35	43	33	14	28	21	27	25	20	35	41	40	30.2	31.1	-
AH6	31	52	40	17	37	24	32	30	24	30	48	31	33.0	34.0	-
LGR	25	39	27	23	28	24	25	20	24	24	37	19	26.3	27.0	-
BR	33	35	30	16		23	26	26	27	28	30	30	27.6	28.5	19.4
BR1	24	28	23	20	26		30	22	22	26	38	24	25.7	26.5	18.1
GR	31	38	29	25	16	18	19	23	26	19	32	29	25.4	26.2	21.5
YR	31	33	37	23	33	28	27	14	30	22	39	33	29.2	30.0	23.3
YR1	35	39	35	27	27	15	21	29	30	36	47	22	30.3	31.2	22.7
LTK		26	26	21	22	22	14	20	22	29	30	70	27.5	28.3	25.1
LT1	40	39	29	30	34	22	26	30	34	45	35	44	34.0	35.0	24.9

CH	34	51	48	39	52			32	31	46	26	47	**40.6**	**41.8**	34.7
CH2	46	54	40	33	42	29	39	40		49	54	39	**42.3**	**43.5**	29.8
CH3	31	55	50	29	37	38	29	28	45	45	44	19	37.5	38.6	27.5
CH_4	43	52	34	29	43	21	31	36	31	44	47		37.4	38.5	24.3
RC	18	28		14		13	13	13	14	20	20	22	17.5	18.0	16.1
LD	21	24	25	1	27	17	11	15	16	22		59	21.6	22.3	17.7
PR	28	33	32	18	20	17	22	25	23	30	35		25.7	26.5	20.7
M25	52	65	71	46	65	39	38		46	62	63	29	**52.4**	**53.9**	-
TC	27	45	26	33	37	23	27	25	27	26	34	35	30.4	31.3	24.5
CR	21		21	13	24	20	21	21	23	36			22.2	22.9	20.6
WL	28	35	23	23	34								28.6	29.5	16.6
MR	33	36	34	25	25	23	24	26	32	35	41	34	30.7	31.6	27.4
MR2		42	44	23		35	24	31	22	46	47	45	35.9	37.0	25.3
OR	28	35	29	18	21	22		23	27	22	44		26.9	27.7	20.4
VW		47	40	31	33	20	31	33	27	46	47	28	34.8	35.9	-
VW2		32	31	25		23	18	22	22	32	36	30	27.1	27.9	-
VW3	28	39	3	33	20	33	19	13	23	31	34	36	26.0	26.8	-
VW4	37	44	36	20	21	20		25	26	36	37	48	31.8	32.8	-

☒ **National bias adjustment factor used**

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

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

Notes:

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

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

(2) Distance corrected to nearest relevant public exposure.

Appendix C: Supporting Technical Information

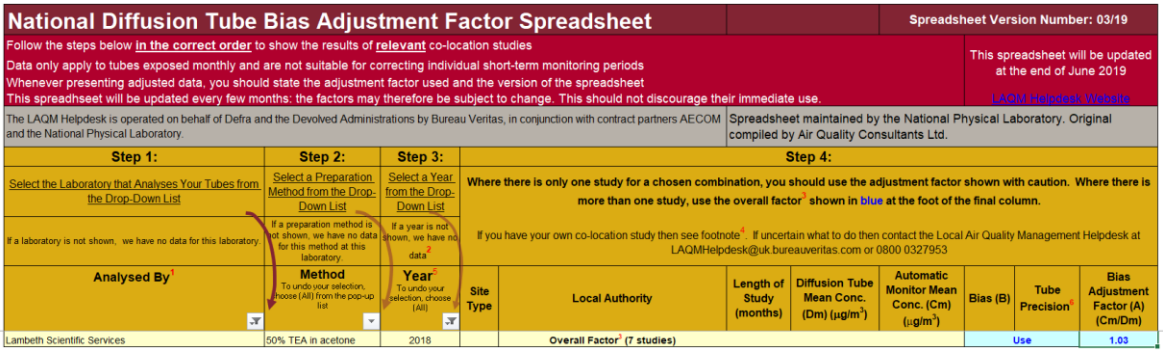
Diffusion tube bias adjustment factors

The diffusion tubes for 2018 were supplied by Lambeth Scientific Services and prepared using a 50% triethanolamine (TEA)/Acetone method.

The bias adjustment factor has been taken from Defra's UK national bias adjustment spreadsheet (Spreadsheet Version Number: 03/19) and is based on the results of seven study in the UK. The bias adjustment factor for 2018 monitored data is 1.03. Table C.1 below details the bias adjustment factors for the period 2013 through 2018 used to adjust WBC monitoring data.

Table C.1 – Bias adjustment factors

Year	National Bias Adjustment Factor
2013	0.87
2014	0.80
2015	1.07
2016	0.94
2017	0.90
2018	1.03



National Diffusion Tube Bias Adjustment Factor Spreadsheet — Spreadsheet Version Number: 03/19

Follow the steps below in the correct order to show the results of relevant co-location studies
Data only apply to tubes exposed monthly and are not suitable for correcting individual short-term monitoring periods
Whenever presenting adjusted data, you should state the adjustment factor used and the version of the spreadsheet
This spreadhseet will be updated every few months: the factors may therefore be subject to change. This should not discourage their immediate use.

This spreadsheet will be updated at the end of June 2019
LAQM Helpdesk Website

The LAQM Helpdesk is operated on behalf of Defra and the Devolved Administrations by Bureau Veritas, in conjunction with contract partners AECOM and the National Physical Laboratory.

Spreadsheet maintained by the National Physical Laboratory. Original compiled by Air Quality Consultants Ltd.

Step 1: Select the Laboratory that Analyses Your Tubes from the Drop-Down List. If a laboratory is not shown, we have no data for this laboratory

Step 2: Select a Preparation Method from the Drop-Down List. If a preparation method is not shown, we have no data for this method at this laboratory

Step 3: Select a Year from the Drop-Down List. If a year is not shown, we have no data[2]

Step 4: Where there is only one study for a chosen combination, you should use the adjustment factor shown with caution. Where there is more than one study, use the overall factor[3] shown in blue at the foot of the final column.

If you have your own co-location study then see footnote[4]. If uncertain what to do then contact the Local Air Quality Management Helpdesk at LAQMHelpdesk@uk.bureauveritas.com or 0800 0327953

Analysed By[1]	Method (To undo your selection, choose (All) from the pop-up list)	Year[2] (To undo your selection, choose (All))	Site Type	Local Authority	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) (µg/m³)	Automatic Monitor Mean Conc. (Cm) (µg/m³)	Bias (B)	Tube Precision[5]	Bias Adjustment Factor (A) (Cm/Dm)
Lambeth Scientific Services	50% TEA in acetone	2018		Overall Factor[3] (7 studies)				Use		1.03

QA/ QC of diffusion tube monitoring

Lambeth Scientific Services are a UKAS accredited laboratory, complying with the requirements of ISO/IEC 17025.

Annualisation

Results were annualised in line with guidance included in Box 7.9 and 7.10 of the LAQM.TG(16) for monitoring site WL as data capture was below 75%.

Data from Spelthorne Sunbury Cross and Chilbolton Observatory automatic monitoring stations were used to derive the adjustment factors. Both monitors are in background locations and had a data capture above 85% in 2018. They are both managed by the Automatic Urban and Rural Network (AURN), and ratified data was downloaded from the Air Quality England website[12]. Table C.2 details the calculations used to derive the annualisation factors for WL.

Table C.2 – Annualisation for WL

Date	Chibolton Observatory	Spelthorne Sunbury Cross	WL	Chibolton Observatory when WL available	Spelthorne Sudbury Cross when WL available
January	10.9	36.5	28	10.9	36.5
February	15.3	39.3	35	15.3	39.3
March	10.6	41.4	23	10.6	41.4
April	11.7	35.9	23	11.7	35.9
May	11.4	28.9	34	11.4	28.9
June	7.3	22.6	-	-	-
July	6.4	29.7	-	-	-
August	5.7	25.5	-	-	-
September	6.7	24.8	-	-	-
October	8.6	34.7	-	-	-
November	11.8	37.9	-	-	-
December	8.9	36.0	-	-	-
Average	9.6	32.8	28.6	12.0	36.4
Ratios	0.8	0.9			
Average Ratio	0.9				

[12] https://www.airqualityengland.co.uk/

Distance correction

Table C.3 details the parameters used to derive distance corrected concentrations at the nearest relevant receptors. The "NO_2 fall-off with distance" spreadsheet version 4.2 developed by Bureau Veritas and available on the LAQM website[13] was used.

Table C.3 – Distance correction at relevant sites

Site ID	Distance (m)		NO_2 Annual Mean Concentration (µg/m^3)		
	Monitoring Site to Kerb	Receptor to Kerb	Background	Monitored at Site	Predicted at Receptor
BD	2	8	13.7	16.1	15.3
TW	1.5	11	12.7	16.2	14.7
AH4	2	8	13.5	28.6	23.7
BR	1	16	12.3	28.5	19.4
BR1	1.5	22.5	12.3	26.5	18.1
GR	1	7	14.3	26.2	21.5
YR	1	13	16.9	30.0	23.3
YR1	1	19	16.9	31.2	22.7
LTK	1	4	16.9	28.3	25.1
LT1	1	16	16.9	35.0	24.9
CH	1.5	5.5	16.9	41.8	34.7
CH2	1	13	16.9	43.5	29.8
CH3	1.5	15.5	16.9	38.6	27.5
CH4	1	18	14.1	38.5	24.3
RC	1	11	14.1	18.0	16.1
LD	1	13	13.4	22.3	17.7
PR	1	13	15.3	26.5	20.7
TC	4	28	18.8	31.3	24.5
CR	1	7	17.0	22.9	20.6
WL	1	32	12.9	25.0	16.6
MR	2	6	15.3	31.6	27.4
MR2	2	20	15.3	37.0	25.3
OR	3	29	15.3	27.7	20.4

[a] Warning: receptor is more than 20m further from the kerb than monitor – results to be treated with caution.

[13] https://laqm.defra.gov.uk/tools-monitoring-data/no2-falloff.html

Appendix D: Maps of Monitoring Locations and AQMAs

Figure D.1 – WBC 2018 monitoring locations

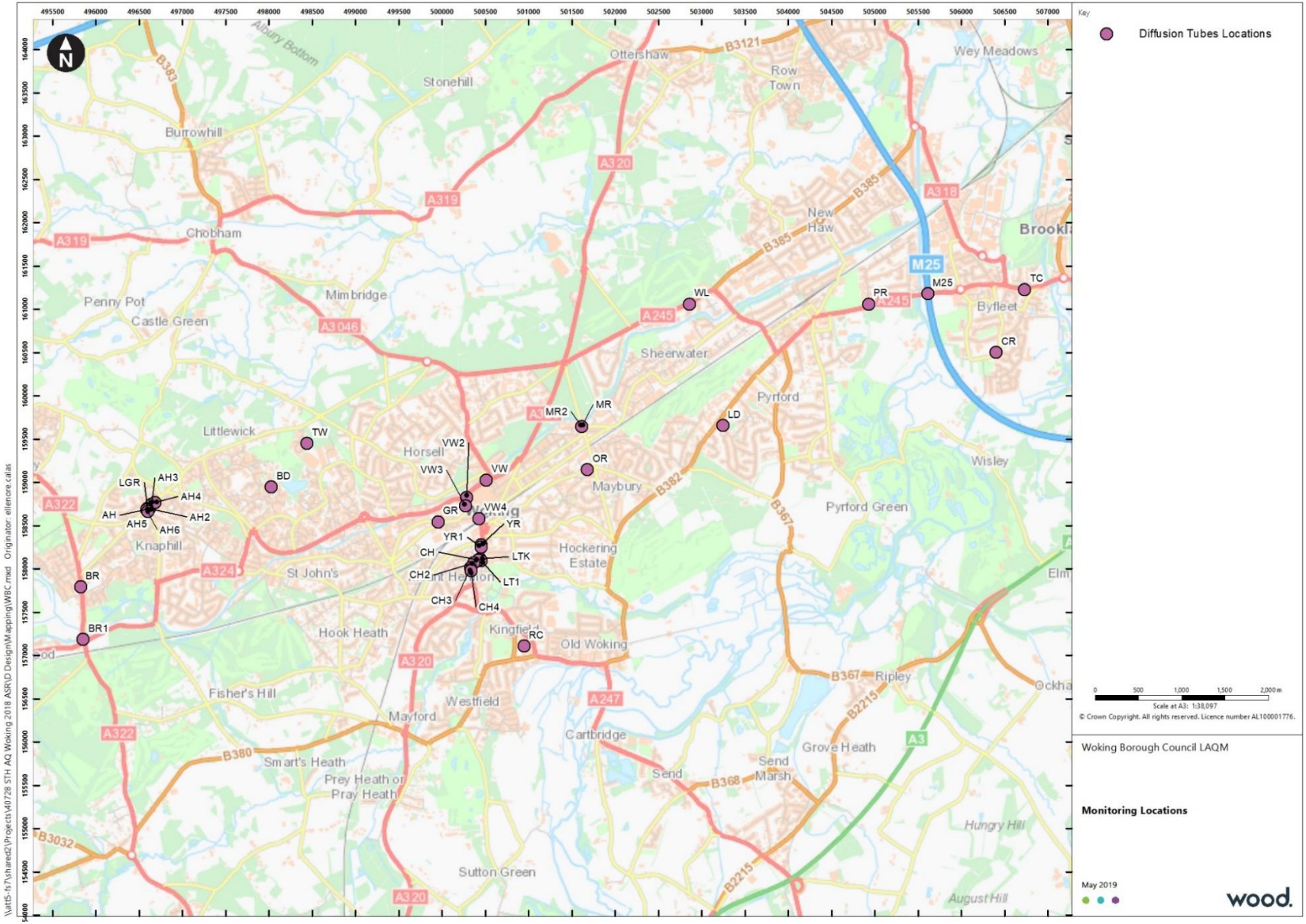


Figure D.2 – Anchor Hill AQMA and monitoring locations

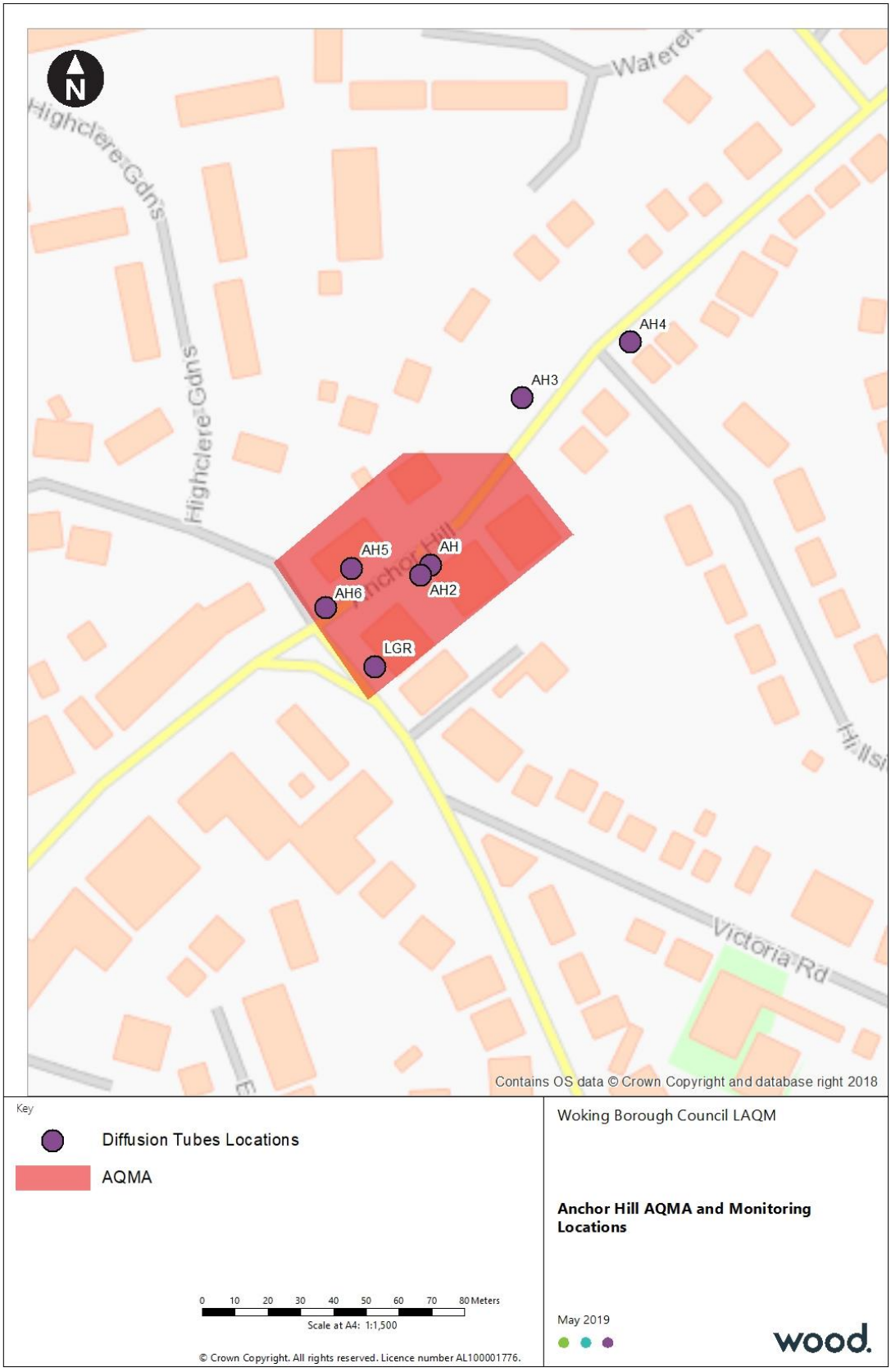


Figure D.3 – Guildford Road AQMA and monitoring locations

Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England

Pollutant	Air Quality Objective[14]	
	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

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

Glossary of Terms

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

References

Environmental equity, air quality, socioeconomic status and respiratory health (2010).

Wood Environment and Infrastructure Solutions UK Limited (2018). Annual Status Report (ASR) for Woking Borough Council.

Amec Foster Wheeler Environment & Infrastructure UK Ltd (2017). Annual Status Report (ASR) for Woking Borough Council.

Amec Foster Wheeler Environment & Infrastructure UK Ltd (2015). Air quality further assessment for Woking Borough Council.

Amec Foster Wheeler Environment & Infrastructure UK Ltd (2015). Woking Borough Council – Anchor Hill AQMA – Air Quality Action Plan.

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

Defra (2013). Abatement cost guidance for valuing changes in air quality.

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

Woking Council (2014). Air quality progress report for Woking Council.

Surrey County Council (2011). Surrey transport plan: Air quality strategy.