2019 Air Quality Annual Status Report (ASR)

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

June 2019

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Report Reference number	-
Date	June 2019

Executive Summary: Air Quality in Our Area

Air Quality in Winchester

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].

Winchester City Council (WCC)'s administrative area comprises the city of Winchester and wider district area. The main source of air pollution in the borough is road traffic emissions from major roads, including the M3, A34, A31 and A303. Other pollution sources, including commercial, industrial and domestic sources, also make a contribution to background pollution concentrations.

The main pollutant of concern in Winchester is nitrogen dioxide (NO_2), which currently exceeds the annual mean air quality objective close to busy roads within the city centre. In 2003 an Air Quality Management Area (AQMA) was designated for exceedances of the annual mean NO_2 objective and 24-hr PM_{10} objective. The 24-hr PM_{10} AQMA was later revoked in 2013 after a number of years of measured concentrations remaining below objective levels. Details of the current AQMA are available online at https://uk-air.defra.gov.uk/aqma/local-authorities?la_id=314.

WCC currently monitors NO_2 concentrations at various locations throughout Winchester. Results from the monitoring network of diffusion tubes show that there are still areas adjacent to the main roads within the AQMA that fail to meet the UK annual mean objective. These exceedances are centred within the one way system around the city centre and on Romsey Road. In the wider district, pollutant concentrations are all below the national air quality objectives.

[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

Between the years 2013-2018, a decreasing trend in NO_2 concentrations has generally been observed at all monitoring locations, however, the trend now appears to have plateaued in 2018. There are some year-to-year variations in concentrations, which are likely due to meteorological influences.

Prior to 2018, no monitoring of particulates (PM_{10} and $PM_{2.5}$) was carried out within Winchester, but the Council intended to re-instate monitoring within the AQMA on Romsey Road using low cost monitoring devices. In December 2018 the Council installed a continuous monitor (AQMesh) at Romsey Road to monitor for NO_2 and Particulate Matter, annual results of which will be reported fully within the next ASR.

In May 2017 Winchester City Council issued a new Air Quality Action Plan (AQAP)[4], with the aim of tackling the remaining hotspots in the city centre. This action plan replaces the previous action plan which ran from 2006 to 2016.

Actions to Improve Air Quality

The 2017 AQAP outlines nine high impact core actions aimed at improving air quality and working towards meeting the relevant air quality objectives within Winchester district. Due to the main source of pollution within the AQMA being road traffic, some of the key actions in the new AQAP aim to reduce congestion and vehicle emissions in the city centre, with the focus on improving NO_2 concentrations.

The core actions are:

1. Review current car parking charges and increase the cost to park in central car parks;
2. Review and consider introducing restrictions of delivery vehicles by time of day;
3. Introduce a Park and Ride site in the North of Winchester;
4. Introduce new parking charges to limit diesel and high polluting petrol cars parking in central car parks;
5. Reduce emissions from lorries and buses in the city centre by 2020;
6. Reduce emissions from all Council owned, leased or contracted vehicles by 2020;
7. Put in place requirements to integrate air quality fully into the planning process;

[4] Winchester City Council Air Quality Action Plan (2017) Available at: https://www.winchester.gov.uk/environment/air-quality/historical-air-quality-reports-for-government

8. Continue to work with and lobby Hampshire County Council to identify and deliver additional projects; and
9. Monitor the performance of the plan and reassess the need to introduce additional measures to achieve the objective.

Progress has been made with these core actions since the 2017 AQAP. With Action 7 a planning guidance is currently being prepared for the Council and is set to be issued in the next reporting year.

There is also a range of complementary measures that mainly relate to the continued support for ongoing softer measures such as supporting walking, cycling and travel plan initiatives. These can be seen below in Table 2.2. A new electric vehicle charging strategy[5] has been implemented within the city as part of Measure 11 and proposes to install 46 Electric Vehicle Chargers.

3 additional diffusion tubes were added in Martyr Worthy, as part of the 'Enhanced Kingsworthy Study', to investigate the failures in NO_2 concentrations seen at Site 3 - Martyr Worthy. So far only 3-4 months of data is available and the results from this study will be presented in the next reporting year.

New AQMesh monitors were installed in December 2018 on Romsey Road to monitor for NO_2 and Particulate Matter. Full data from this monitoring is set to be presented in the 2020 ASR, though the 2019 1 hour mean NO_2 concentrations monitored to date are discussed in Section 3.2.1, to give an indication of concentrations, all of which were below the objective of 200µg/m^3.

Hampshire County Council is the lead local authority for transport in Winchester District. Policies to improve transport, and encourage sustainable transport have been set out within the Local Transport Plan for Hampshire[6]. WCC is working with the County to deliver measures in their AQAP and conduct a Movement Study to gather the required data to monitor progress. Consultation on the study was completed in January 2019 and it is expected that the strategy will be finalised and completed by the end of 2019.

[5] Electric Vehicle Charging Infrastructure Study for Winchester City Centre and District (2018), Available at: https://www.winchester.gov.uk/environment/air-quality/air-quality-in-winchester
[6] Hampshire County Council LTP Implementation Plan 2014-2017 https://www.hants.gov.uk/transport/strategies/transportstrategies

Conclusions and Priorities

This Annual Status Report confirms that concentrations of NO_2 in the Winchester City Centre AQMA continue to exceed the NO_2 annual mean air quality objective of 40µg/m^3. There is one exceedance outside of the AQMA in Kings Worthy, though this is marginal, rapidly improving and highly localised. The conclusion therefore is not declare an AQMA immediately, however, if the exceedance is repeated in 2019 then the Council will move to AQMA declaration. No significant changes in emissions sources within the Council's area have been identified in the last year.

The priorities for the coming year will be to deliver progress on the core measures outlined within the new AQAP and to progress the development of parallel strategies for delivering an identified number of complementary measures.

Winchester City Council will also undertake continuous monitoring of particulate matter throughout 2019 using newly-installed AQMesh monitor, in order to identify if there are any exceedances of the $PM_{2.5}$ objective.

Local Engagement and How to get Involved

Members of the public can take simple measures to help improve air quality, the main ones being, where possible, making short trips and journeys on foot or by bike instead of by car. Traffic congestion can further be reduced by the general public through car sharing or by using public transport including the park and ride buses to access the city centre. A car share club was launched in 2017 and is currently being actively promoted. In 2017, Winchester hosted its first National Clean Air Day event where members of the public were encouraged to get involved. This was carried on into 2018 and again into the National Clean Air Day which took place on 20th June 2019.

Winchester City Council provides information on air quality on their website http://www.winchester.gov.uk/environment/air-quality/ and air quality monitoring data from Winchester can be viewed on UK Air Quality net http://www.ukairquality.net/.

Further information on air quality can be found on Defra's Local Air Quality Management (LAQM) website[7].

[7] Defra LAQM website: http://laqm.defra.gov.uk/

Table of Contents

List of Tables

List of Figures

1 Local Air Quality Management

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

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

WCC has declared one AQMA, summary details can be found in Table 2.1. 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=314 . Alternatively, see Appendix D: Maps of Monitoring Locations and AQMAs, which provides a map of air quality monitoring locations in relation to the AQMA.

The current designated AQMA is in respect to the annual mean nitrogen dioxide (NO_2) objective. An AQMA with the same extent, designated in respect to the particulate matter 24-hour mean objective, was revoked in 2013. A Detailed Assessment undertaken in 2015 recommended the designation of additional AQMA's at a number of roadside locations within the centre, for exceedances of the NO_2 hourly mean objective. The data collected at Chesil Street shows that this site is not exceeding the hourly mean objective value and therefore there is no requirement to declare an AQMA here. The Council commenced monitoring at Romsey Road in January 2019 to determine whether the hourly objective value for NO_2 is likely to be exceeded at this site. The full results from this monitor, relevant to 2019, will be reviewed in the next reporting year. However, hourly mean results are discussed in Section 3.2.1 for an indication of 1 hour mean concentrations.

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 (inc. date of publication)
						At Declaration	Now	
Winchester Town Centre AQMA	Declared 14/11/2003	NO_2 Annual Mean	Winchester	Area surrounded by the town centre one way system and the town centre end of the major roads feeding into it.	No	>40µg/m^3 at multiple locations	47.6µg/m^3 at Diffusion tube site 23, Romsey Rd	Winchester City Council Air Quality Action Plan , 2006 (superseded), http://www.winchester.gov.uk/environment/air-quality/historical-air-quality-reports-government/ Winchester City Council Air Quality Action Plan, 2017, https://winchester.citizenspace.com/licensing/air-quality/supporting_documents/Winchester%20AQAP_Final%20Draft_16012017.pdf

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

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

Defra's appraisal of last year's ASR stated that the conclusions reached were acceptable for all sources and pollutants. In 2017, WCC purchased new automatic monitoring equipment (AQMesh) to determine whether an AQMA needs to be declared for the hourly mean NO_2 objective in Romsey Road. The monitor was set up in January 2019 and currently only 3 months of data is available (January – March 201) for 2019, which is not relevant to this report. However, hourly mean results are discussed in Section 3.2.1 for an indication of 1 hour mean concentrations.

In 2018, WCC has continued working on a number of direct measures which were set out during the previous reporting year of 2017 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2.

Winchester City Council's priorities for the coming year are to continue to deliver progress on the nine core measures outlined within their current AQAP and to progress the development of parallel strategies for delivering the additional nine complementary measures. Progress has already been made and improvements already seen on a number of these core measures including;

- The new car parking charges implemented in city centre, inner and outer car parks have promoted the use of park and ride sites, resulting in fewer cars parking in the city centre;
- A new 'Electric Vehicle Charging Strategy'[5] has been adopted and there are plans to install 46 electric vehicle chargers within the city;
- A 'Car Club Scheme' has now been introduced in Winchester and is provided by Enterprise Car Club; and
- The Council have requested an Air Quality Supplementary Planning Document (SPD) to be written. The SPD is currently in its draft stage and it is excepted the document will be ready for public consultation in Summer 2019.

To complement the plan, Hampshire County Council, as the Transport Authority is working with the City Council to develop a Transport Movement Strategy for

Winchester. Consultation on the strategy was completed in January 2019 and it is expected that the strategy will be finalised and completed by the end of 2019.

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

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
Core AQAP Measures											
1	Build on existing car park pricing differentiation strategy	Traffic Management	Other	WCC - Engineering & Transport & Parking Services	2017	April-18	1. Annual mean NO_2 2. Car park patronage 3. Preferential responses	2% reduction in NOx emissions	This measure has already been implemented since April 2018 and have since demonstrated strong trend toward an uptake in use of the P&R sites and a consequential freeing up of city centre parking capacity. All P&R sites are now at operating at near capacity during the week.	Charges introduced and will be reviewed after one year	Impact on pollution reduction will require further assessment
2	Review enforcement of goods deliveries by time of day and enforce	Freight and Delivery Management	Quiet & out of hours delivery	WCC - Parking Services	2017	Apr-18	1. Annual mean NO_2 2. PCNs issued 3. Change in delivery hours	2% reduction in NOx emissions	Adopted to encourage a smooth traffic flow through the one way system during peak periods. After an initial targeted data gathering and enforcement programme by the CEOs several parking tickets have been served. Further data collection is expected to better inform on whether targeted enforcement possess a demonstrable improvement on traffic flow	Ongoing	
3	Introduce a Park and Ride site in the north of Winchester	Alternatives to private vehicle use	Bus based Park & Ride	WCC but informed by City of Winchester Movement Strategy	2017	tbc	1. Bus patronage 2. Traffic flow 3. Use and satisfaction of P&R	3% reduction in NOx emissions	The Study is making good progress and is now embarking on a detailed set of options for further modelling.	tbc	Should the study identify the need for additional P&R facilities at the northern approaches or in other locations on the edge of the city, this will inevitably be subject to a

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
											capital investment programme and will not be realistically delivered in accordance with the relatively short time scales set out in the AQAP.
4	Introduce new parking charges/incentives to reduce diesel car parking and high pollution petrol cars (older than Euro 4) from parking in central car parks in favour of low emission vehicles	Traffic Management	Emission based parking or permit charges	WCC - Parking Services Engineering & Transport	2017/2018	Jun-18	1. Traffic flow and speed 2. Increase in petrol /ULEVs using car parks 3. Preferential responses	10% reduction in NOx emissions	The AQAP modelled the impact of diesel cars at contributing 58% of the NOx emissions from all vehicles entering the AQMA, many of which will elect to use the City Centre car parks. Parking Services continues to closely monitor developments and will, present a further new report setting out proposals to introduce an emissions based charging regime as part of the wider parking strategy for the city. The Council have now introduced the 'Electric Vehicle Charging Strategy' as part of Measure 11 below but it also supports Measure 4	tbc	This measure seeks to adopt 'smart' ticket machine technology to implement differential charging tariffs for higher polluting vehicles, primarily diesels. Such technology is still in its developmental phase within the parking industry and currently only one company can claim to deliver a robust solution.
5	'Investigate the feasibility of introducing a CAZ for heavy duty vehicles that enter the AQMA, which do not meet Euro VI Standards	Promoting Low Emission Transport	Low Emission Zone (LEZ)	WCC	Ongoing	tbc	1. Annual mean NO_2 2. Number of Euro VI entering AQMA 3. PCNs issued	10% reduction in NOx emissions	It has now been determined that the WCC cannot 'ban' non Euro VI heavy duty vehicles from entering the city. Thus the measure has been reworded from 'ensure' to investigate the feasibility of introducing a CAZ'. The feasibility of	Ongoing	Costs of delivering a Charging Zone are considerable and the City Council are weighing up the likely benefits in relation to costs. With regards to alternative measures, a 'Movement Study' is currently being undertaken and that the Council will need to wait for the final findings of the

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
	(amended)								alternative measures, such as bus retrofitting, freight consolidation centres, restrictions on last mile HGV deliveries and the use of bus gates, are to be investigated.		Study before making a decision on how best to proceed.
6	Ensure that all Council-owned, leased, contracted or influence vehicles that enter the AQMA meet the OLEV standards for ULEVs and are not diesel fuelled by 2020	Promoting Low Emission Transport	Company Vehicle Procurement - Prioritising uptake of low emission vehicles	WCC	2017-	End of 2019	1. Low emission vehicles in fleet 2. Number of trips entering AQMAS	2% reduction in NOx emissions	WCC is currently reviewing the Council's current procurement policy and a new policy is expected by the end of the year.	End of 2019	
7	Development of air quality supplementary planning document (SPD)	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	WCC	2017-	2020	1. Annual mean NO_2 2. Planning applications showing regard for SPG	N/A	The Council have requested a bespoke Air Quality SPD to be written by AECOM. The SPD is currently in its draft stage and is expected to be ready for public consultation in 2019.	2019/2020	
8	Continue to work with and lobby Hampshire County Council to identify projects to improve air quality	Policy Guidance and Development Control	Regional Groups Co-ordinating programmes to develop Area wide Strategies to reduce emissions and improve air	WCC/HCC	2017-	2019	1. Annual mean NO_2	N/A	WCC is currently working with HCC on the detailed delivery of the Movement Strategy for Winchester which will consider air quality. Consultation on the strategy was completed in January 2019.	The strategy to be completed and finalised by the end of 2019	

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
			quality								
9	Monitor the performance of the action plan and reassess whether additional measures are required to meet the objective	Public Information	Other	WCC	2017	2018	1. Annual mean NO_2 2. Modelling of actual emissions reductions	See Core Actions	To be undertaken as part of annual reporting requirements and data from monitoring at static monitoring sites	Ongoing	
Additional Measures											
10	Work with authorities towards adoption of a regional LES	Policy Guidance and Development Control	Regional Groups Co-ordinating programmes to develop Area wide Strategies to reduce emissions and improve air quality	WCC with SCC, EBC	2017	2020	1. Adoption of strategy	N/A	Winchester City Council currently chairs the Hampshire Air Quality Sub Group a collective of air quality regulators across the County. This body has identified key work areas of adopting agreed standards for supplementary planning documents, low cost monitoring solutions and public engagement towards behavioural change.	Ongoing	
11	Seek to commit to introduce more electric vehicle charging points within car parks	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	WCC	2017	2017 & beyond	1. Number of points installed	N/A	In January 2019, Winchester City Council adopted its own Electric Vehicle Charging Strategy which recommends the installation of 46 Electric Vehicle Chargers serving a total of 57 bays. Of this 23 EV Chargers will be in the	Ongoing	

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
									City Centre serving 25 bays. Currently work is ongoing on an options appraisal on its delivery.		
12	Ensure that air quality is a standard consideration as part of procurement practice and is reflected in the Council's Procurement Policy;	Promoting Low Emission Transport	Company Vehicle Procurement - Prioritising uptake of low emission vehicles	WCC	2017	tbc	1. Adoption of procurement policy 2. Uptake of LEVs (as per core action)	See core action 6	WCC is updating its procedural strategy and will ensure air quality is a material consideration in contracts.	Ongoing	
13	Continue to improve public access to live parking information and signage and better signage to encourage drivers to use the car park best suited to their journey.	Public Information	Via other mechanisms	WCC/HCC	2017	tbc	1. Utilisation of central car parks	N/A	Planning phase delayed until after the outcome of the Hampshire Movement Study - No progress from previous year	Ongoing	
14	To continue to work on the delivery and promotion of car club schemes operating in the city	Alternatives to private vehicle use	Car Clubs	WCC	2017	Apr-18	1. Number of car club members	N/A	WCC now has a Car Club Scheme in city centre provided by Enterprise Car Club.	Completed in 2018	

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
15	Consider the introduction and promotion of additional cycle stands, in consultation with local cycling groups, as part of planned developments in the AQMA	Promoting Travel Alternatives	Promotion of cycling	WCC	2017	tbc	1. Number of cycle parking 2. Number of cyclists as a modal share (through surveys)	N/A	Limited progress from previous year	tbc	
16	Work with stakeholder organisations and maintain a programme of regular communication to encourage behavioural change	Promoting Travel Alternatives	Other	WCC	2017	tbc	tbc	N/A	Planning phase tbc	tbc	
17	Review and refresh the Council Travel Plan to promote more sustainable travel for staff	Promoting Travel Alternatives	Workplace Travel Planning	WCC	2017	2018	1. Number of staff travelling to work by car (surveys)	N/A	WCC has set up a new Winchester Travel Planners Forum initially targeted at the major employers within Winchester, which includes WCC, HCC, Winchester University, Winchester Hospital and the Prison all of whom have members on the forum. In addition we have members from Southampton University and links with the	tbc	

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
									Southampton Travel Planners Network for a cross regional approach. The group has a Terms of Reference and is working towards a consistent collation of staff travel data to inform policies to assist major employers in the development of sustainable travel policies.		
18	Provide web based information and sign posting to resources that will assist and encourage workplaces and schools in the City to adopt Travel Plans	Promoting Travel Alternatives	Workplace Travel Planning	WCC	2017	tbc	1. Number of travel plans adopted	N/A	Little progress on this measure beyond sign posting to existing resources. It is expected that once the Travel Planners Forum gains traction that a shared-on line resource can be hosted on Winchester's Web Pages.	tbc	

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.

Between 2011-16, Winchester has below the national average for the Public Health Framework Indicator, 'Fraction of mortality attributable to particulate air pollution'. However in 2017, the fraction value increased marginally from 5% to 5.1% and is now the same as the national average[8]. This trend is not dissimilar to neighbouring councils, East Hampshire and Test Valley. Despite the fractional increase bringing Winchester in line with the national average, values are still below neighbouring councils, Basingstoke and Deane and Southampton, which both have values above the national average.

Winchester City Council is taking a number of measures to address $PM_{2.5}$. Measures include working with Public Heath colleagues, adopting transport initiatives included in The Local Transport Plan for Hampshire and local planning policies supporting the implementation of the Winchester Air Quality Action Plan.

New measures to help WCC address $PM_{2.5}$ have been introduced this year with the installation of an AQMesh on Romsey Road in December 2018 to monitor concentrations of $PM_{2.5.}$ Currently only data from January – March 2019 is available and a full year of monitoring results, relevant to the annual mean, will be presented in the 2020 ASR. The installation of a MCERTs $PM_{2.5}$ analyser at an existing air quality station is also currently under consideration by the council to further improve understanding of this pollutant.

Defra mapped background $PM_{2.5}$ concentrations in Winchester district in 2018 were between 8.3µg/m^3 and 11.3µg/m^3, higher than previously seen in 2017 (7.3µg/m^3 and

[8] Public Health Outcome Framework (2019), 'Health Protection'. Available at: https://fingertips.phe.org.uk/profile/public-health-outcomes-framework/data#page/0/gid/1000043/pat/6/par/E12000008/ati/101/are/E07000094

10.7µg/m^3). However, $PM_{2.5}$ concentrations are still below the limit proposed by the EU Ambient Air Quality Directive[9].

All measures outlined in Table 2.2 that aim to reduce NO_x and PM_{10} will also have a beneficial impact on $PM_{2.5}$.

[9] Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe

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

Winchester City Council undertook automatic (continuous) monitoring at two sites during 2018. The roadside sites were installed in March 2017 to monitor NO_2 only. The locations for these sites are on St George's Street and on Chesil Street by Station Approach. Both sites have room for a particulate matter monitor, should future resources and demand dictate.

In December 2018 an AQMesh monitor was installed on Romsey Road to monitor NO_2, PM_{10} and $PM_{2.5}$. Annual data will be made available in the 2020 ASR, though 1-hour mean results are discussed in Section 3.2.1 to give an indication of hourly concentrations.

The previous roadside site at the Echo Office in St George's Street was decommissioned in May 2017, as the area was marked for improvement as part of a refurbishment scheme. Until 2015, Winchester City Council operated an additional automatic monitoring site at Godson House. 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 how the monitors are calibrated and how the data has been adjusted are included in Appendix C.

3.1.2 Non-Automatic Monitoring Sites

Winchester City Council undertook non-automatic (passive) monitoring of NO_2 at 35 sites during 2018, 23 of these were within the city and 12 monitoring sites were within the wider district area. Table A.2 in Appendix A shows the details of the sites.

Maps showing the location of the monitoring sites are provided in Appendix D. There have been two site location changes. In 2015, site 19 was relocated from Andover Road to Burma Road following concerns expressed regarding traffic congestion

between the hospital and university. However, in 2018 this site was removed entirely due to the low NO_2 concentrations measured at the site. More recently, in 2017, site 3 within the District Wide Study was relocated from Church Street Close to Martyr Worthy Road on 24th March 2017, as the old location was not deemed representative of exposure and was monitoring low concentrations. 3 additional sites have been added to the wider district area as part of the 'Enhanced Kingsworthy study', however these only cover up to 4 months of monitoring. The 'Enhanced Kingsworthy study', was implemented to investigate the exceedances seen at Site 3 – Martyr Worthy by placing additional diffusion tubes in the surrounding area to identify the potential extent of any exceedance areas, and the causes of possible exceedances.

Further details on Quality Assurance/Quality Control (QA/QC) for the diffusion tubes, including bias adjustments and any other adjustments applied 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.3 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. Site 19 – Burma Road was removed in 2017 and is therefore no longer included in this ASR. As a consequence, City diffusion tube sites have been renumbered in 2018.

In 2018, Winchester had two active roadside automatic monitoring sites; St. George's Street and Chesil Street. The automatic monitor at St. George's Street exceeds the annual mean NO_2 objective in 2018, reaching a concentration of 41µg/m^3, though Chesil Street is compliant.

The diffusion tube results show that a general improvement from 2017, with one site, site 8, which has historically exceeded coming into compliance, showing the new AQAP is taking effect. A large improvement was also seen at City site 22, though this

site was missing January and December data. In January 2018, the location of City site 22 was changed (hence the missing data), however the site was only moved 2 metres away from its original location and still maintains its original height and distance from the road. It is noted that this move is unlikely to have caused the large improvement seen and this trend will continue to be monitored.

Three sites recorded exceedances of the annual mean NO_2 objective in 2018 at sites 3 (district), 9 (city) and 23 (city). Only sites 9 and 23 are located within the current AQMA, within the one way system around the city centre and Romsey Road. Site 3 (district) is located north of the city centre in Kings Worthy. Diffusion tubes on sites 3 and 9 are located on building facades and are therefore representative of relevant exposure. Site 23, whilst on a lamp post, is located approximately adjacent to a nearby residential façade.

Site 9 is located on St George's Street and site 23 located on Romsey Road within the AQMA. At both these locations, exceedances have occurred over the last 5 years, however a trend in decreasing concentrations is evident and measured concentrations in 2018 are lower than those measured in 2017.

The district wide diffusion tube sites remain in compliance with the annual mean NO_2 objective with the exception of site 3, which was relocated in 2017. Most measured concentrations in 2018 are similar to those in 2017, again with the exception of site 3, though still exceeding, has lowered considerably since 2017 (see Figure A1.2 in Appendix A). Further data will be needed to confirm any long term trend changes. Whilst this site is exceeding and is not currently covered by an AQMA, the exceedance is marginal and the drastic improvement from 2017 concentrations (albeit 2017 was an annualised result) is encouraging. The 'Enhanced Kingsworthy study' implemented to investigate the extent of any possible exceedance in this area returned very low concentrations, which highlights that site 3 is an extremely isolated incidence of high concentrations. As such, it is not considered that an AQMA declaration is required at this time. However, the extent of the monitoring in this area will remain and if concentrations are again elevated at site 3 in 2019, the Council will move to declare an AQMA in order to address this issue.

All diffusion tube measured concentrations for 2018 are below 60µg/m^3; the criteria above which exceedances of the 1-hour mean objective are likely to occur.

Table A.4 in Appendix A compares the ratified continuous monitored NO_2 hourly mean concentrations for the past 2 years with the air quality objective of 200µg/m^3, not to be exceeded more than 18 times per year. This objective has been met in each of these years.

The three months worth of data available at time of writing from the AQmesh monitoring implemented at the end of this reporting year highlights that 1 hour mean NO_2 concentrations are below the objective of 200µg/m^3, with no exceedances. This will be reported further in 2020 ASR.

3.2.2 Particulate Matter (PM_{10})

Monitored PM_{10} concentrations are no longer available due to the decomissioning of the Echo Office automatic monitoring site in May 2017.

3.2.3 Particulate Matter ($PM_{2.5}$)

A new continous monitor (AQMesh) was installed on Romsey Road in December 2018 that measures $PM_{2.5.}$ A full year of data will be published in the 2020 ASR. The Council is also currently exploring the possibility of installing an MCERTs $PM_{2.5}$ monitor within an existing monitoring station.

Appendix A: Monitoring Results

Table A.1 – Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Monitoring Technique	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Inlet Height (m)
Echo Office	Echo Office	Roadside	448212	129510	NO_2; PM_{10} (until May 2017)	YES	Chemiluminescent; BAM	N/A	2.75	2.7
Godson House	Godson House	Urban Background	448509	129539	NO_2 (until March 2015); PM_{10} (until 2014)	YES	Chemiluminescent	N/A	18	2.8
St George's Street	St George's Street	Roadside	448062	129537	NO_2 (from March 2017)	YES	Chemiluminescent	0	2.25	2.2
Station Approach (Chesil Street)	Station Approach (Chesil Street)	Roadside	448664	129257	NO_2 (from March 2017)	YES	Chemiluminescent	0	4.6	2.2

Notes:

(1) 0 m 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 or available.

Table A.2 – 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)
City Study										
Site 1 (City Study)	10 Eastgate St	Roadside	448563	129391	NO_2	YES	0	5.55	NO	1.7
Site 2 (City Study)	Greyfriars	Roadside	448566	129560	NO_2	YES	0	9.7	NO	1.75
Site 3 (City Study)	Friarsgate	Roadside	448426	129523	NO_2	YES	4.6	4.25	NO	2.4
Site 4 (City Study)	Upper Brook St (Echo)	Roadside	448227	129504	NO_2	YES	9.2	8	NO	2.45
Site 5 (City Study)	Roadside Monitor	Roadside	448213	129504	NO_2	YES	0	3.1	YES	1.7
Site 6 (City Study)	Roadside Monitor	Roadside	448213	129504	NO_2	YES	0	3.1	YES	1.7
Site 7 (City Study)	Roadside Monitor	Roadside	448213	129504	NO_2	YES	0	3.1	YES	1.7
Site 8 (City Study)	St Georges St Bed	Roadside	448106	129541	NO_2	YES	0	4.05	NO	2.45
Site 9 (City Study)	St Georges St Lad	Roadside	448163	129512	NO_2	YES	0	3.6	NO	2.4
Site 10 (City Study)	Jewry St	Roadside	448046	129692	NO_2	YES	0	4.05	NO	2.4
Site 11 (City Study)	Southgate St DV	Roadside	447918	129413	NO_2	YES	0	3.65	NO	2.6
Site 12 (City Study)	Sussex St	Roadside	447804	129741	NO_2	YES	2.4	3.6	NO	2.6
Site 13 (City Study)	City Road	Roadside	447963	129875	NO_2	YES	0	6.55	NO	3
Site 14 (City Study)	74 Northwalls	Roadside	448297	129789	NO_2	YES	10.2	3.7	NO	2.3

Site 15 (City Study)	Wales St	Roadside	448842	129820	NO_2	YES	0	1.7	NO	2.45
Site 16 (City Study)	Alresford Rd (M3)	Other	449563	129439	NO_2	NO	24	N/A (M3)	NO	1.5
Site 17 (City Study)	Chesil St	Roadside	448679	129068	NO_2	YES	0	1.3	NO	2.6
Site 18 (City Study)	Stockbridge Rd	Roadside	447534	130006	NO_2	YES	10	5.4	NO	2
Site 19 (City Study) (previously 20)	Worthy Rd 1	Roadside	448092	130411	NO_2	YES	3.7	2.2	NO	2.5
Site 20 (City Study) (previously 21)	Worthy Rd 2	Roadside	448092	130411	NO_2	YES	3.7	2.2	NO	2.5
Site 21 (City Study) (previously 22)	Worthy Rd 3	Roadside	448092	130411	NO_2	YES	3.7	2.2	NO	2.5
Site 22 (City Study) (previously 23)	St Cross Rd	Roadside	447842	129050	NO_2	YES	6	2.4	NO	2.2
Site 23 (City Study) (previously 24)	Romsey Road	Roadside	447495	129511	NO_2	YES	0	1.1	NO	2.5
Site 24 (City Study) (previously 25)	Andover Rd	Roadside	447898	130065	NO_2	YES	0	4.2	NO	2.15
Site 25 (City Study) (previously 26)	Bus Station	Other	448427	129401	NO_2	YES	N/A**	N/A	NO	2.4
District Study										
Site 1 (District Study)	High St, Twyford	Roadside	448046	124296	NO_2	NO	0	1.4	NO	N/A
Site 2 (District Study)	Southdown Road, Otterbourne	Other	446680	124644	NO_2	NO	N/A***	N/A	NO	N/A
Site 3	Martyr	Other	449647	132669	NO_2	NO	0	0.5	NO	N/A

(District Study)	Worthy Rd, Kings Worthy									
Site 4 (District Study)	West St/Broad St, New Alresford	Roadside	458826	132719	NO_2	NO	N/A***	N/A	NO	N/A
Site 5 (District Study)	Hambledon Rd, Denmead	Roadside	465917	112050	NO_2	NO	N/A***	N/A	NO	N/A
Site 6 (District Study)	Winchester Rd, Wickham	Roadside	457199	111391	NO_2	NO	N/A***	N/A	NO	N/A
Site 7 (District Study)	Winchester Rd, Bishops Waltham	Roadside	455330	117406	NO_2	NO	N/A***	1	NO	N/A
Site 8 (District Study)	Whiteley Lane, Whiteley	Other	453680	108312	NO_2	NO	N/A***	1.3	NO	N/A
Site 9 (District Study)	Stepherds Lane, Compton	Other	444573	124865	NO_2	NO	N/A***	N/A	NO	1.4
Enhanced Kingsworthy Study										
Old School House	(B3047) Abbots Worthy	Roadside	449623	132675	NO_2	NO	0	8	NO	1.7
Kings Worthy Cottage	(B3047) Abbots Worthy	Roadside	449650	132673	NO_2	NO	0	4.5	NO	1.7
Mill Lane	(B3047) Abbots Worthy	Roadside	449752	132674	NO_2	NO	0	6	NO	1.7

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 or available. * Burma Rd was installed at a location where there is no close long term exposure location for annual mean. It is being used as an indicator of hourly mean exposure for students. ** Site 26 is for an indication of hourly mean exposure at the bus station. ***A number of the district wide sites are measuring roadside locations as a worst case scenario for comparison of trends.

Table A.3 – Annual Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2018 (%) [2]	NO_2 Annual Mean Concentration ($\mu g/m^3$) [3]				
					2014	2015	2016	2017	2018
Echo Office	Roadside	Automatic	0	0	**41.0**	38.0	38.0	-	-
Godson House	Urban Background	Automatic	0	0	24	20	-	-	-
St George's Street	Roadside	Automatic	99.9	99.9	-	-	-	38.5	**41**
Station Approach (Chesil Street)	Roadside	Automatic	100	100	-	-	-	29.7	30
City Study									
Site 1 (City Study)	Roadside	Diffusion Tube	72.7	69.3	**44.6**	37.6	36.8	30.9	28.9
Site 2 (City Study)	Roadside	Diffusion Tube	100	95.3	34.1	31.5	30	27.5	26.2
Site 3 (City Study)	Roadside	Diffusion Tube	100	95.3	28.4	25.9	26.9	23.9	23.8
Site 4 (City Study)	Roadside	Diffusion Tube	100	95.3	39	37.6	37.1	33	30.6
Site 5 (City Study)	Roadside	Diffusion Tube	100	95.3	**40.3**	38.2	37.2	32.1	29.8
Site 6 (City Study)	Roadside	Diffusion Tube	100	95.3	**40.3**	38.2	38.6	31.7	30.8
Site 7 (City Study)	Roadside	Diffusion Tube	100	95.3	**40.3**	38.2	37.7	31.9	30.6
Site 8 (City Study)	Roadside	Diffusion Tube	100	95.3	**54.7**	**50.2**	**49.8**	**46.8**	39.5
Site 9 (City Study)	Roadside	Diffusion Tube	100	95.3	**57.1**	**52.6**	**48.9**	**46.5**	**41.4**
Site 10 (City Study)	Roadside	Diffusion Tube	81.8	78.0	**47.1**	**40.6**	**41.7**	38.7	35.9

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2018 (%) [2]	NO_2 Annual Mean Concentration ($\mu g/m^3$) [3]				
					2014	2015	2016	2017	2018
Site 11 (City Study)	Roadside	Diffusion Tube	100	95.3	38	37.7	37	31.6	28.8
Site 12 (City Study)	Roadside	Diffusion Tube	100	95.3	36.1	33.9	37.3	28	29
Site 13 (City Study)	Roadside	Diffusion Tube	100	95.3	38.1	36.7	33.8	31.6	28.8
Site 14 (City Study)	Roadside	Diffusion Tube	100	95.3	31.1	30	29.7	28.2	25.7
Site 15 (City Study)	Roadside	Diffusion Tube	81.8	78.0	31.2	30.5	31.5	29.8	26.1
Site 16 (City Study)	Other	Diffusion Tube	90.9	86.7	**41.3**	37	38.4	33	34.6
Site 17 (City Study)	Roadside	Diffusion Tube	81.8	78.0	**42.8**	36.4	39.9	37.6	34.7
Site 18 (City Study)	Roadside	Diffusion Tube	100	95.3	25	21.2	24.8	23.7	20
Site 19 (City Study)	Roadside	Diffusion Tube	90.9	86.7	29.3	24.2	22.8	20	23.3
Site 20 (City Study)	Roadside	Diffusion Tube	90.9	86.7	29.3	24.2	23.8	22.2	23.8
Site 21 (City Study)	Roadside	Diffusion Tube	90.9	86.7	29.3	24.2	22.9	20.4	23.7
Site 22 (City Study)	Roadside	Diffusion Tube	81.8	78.0	33.4	35.3	33.4	32.5	19.3
Site 23 (City Study)	Roadside	Diffusion Tube	100	95.3	**57.2**	**48.8**	**56.6**	**50.8**	**47.6**
Site 24 (City Study)	Roadside	Diffusion Tube	100	95.3	36.4	33.5	32.9	32.4	30.6
Site 25 (City Study)	Roadside	Diffusion Tube	100	95.3	35.9	33.7	30.4	28	22.7
District Study									

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2018 (%) (2)	NO_2 Annual Mean Concentration ($\mu g/m^3$) (3)				
					2014	2015	2016	2017	2018
Site 1 (District Study)	Roadside	Diffusion Tube	90.9	86.2	29.4	27.7	28.4	24.0	24.1
Site 2 (District Study)	Other	Diffusion Tube	100	94.8	28.8	28.5	29.4	27.1	25.2
Site 3 NEW (District Study)	Roadside	Diffusion Tube	100	94.8	-	-	-	**56.0**	**40.5**
Site 4 (District Study)	Roadside	Diffusion Tube	100	94.8	30.1	30.1	33.8	28.9	26.6
Site 5 (District Study)	Roadside	Diffusion Tube	100	94.8	20.6	18.4	19.9	17.9	18.1
Site 6 (District Study)	Roadside	Diffusion Tube	90.9	86.2	29.3	28.8	30.6	27.5	29.8
Site 7 (District Study)	Roadside	Diffusion Tube	100	94.8	29.6	29.6	32.5	29.8	29.6
Site 8 (District Study)	Other	Diffusion Tube	90.9	86.2	23.7	21.8	22.6	22.8	20.3
Site 9 (District Study)	Other	Diffusion Tube	90.9	86.2	-	-	-	-	12.3
Enhanced Kingsworthy Study									
Old School House	Roadside	Diffusion Tube	100	35.3	-	-	-	-	20.7
Kings Worthy Cottage	Roadside	Diffusion Tube	100	35.3	-	-	-	-	22.9
Mill Lane	Roadside	Diffusion Tube	50	17.6	-	-	-	-	20.0

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

☒ **Annualisation has been conducted where data capture is <75% (note data capture was above this value for all sites)**

Notes:

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

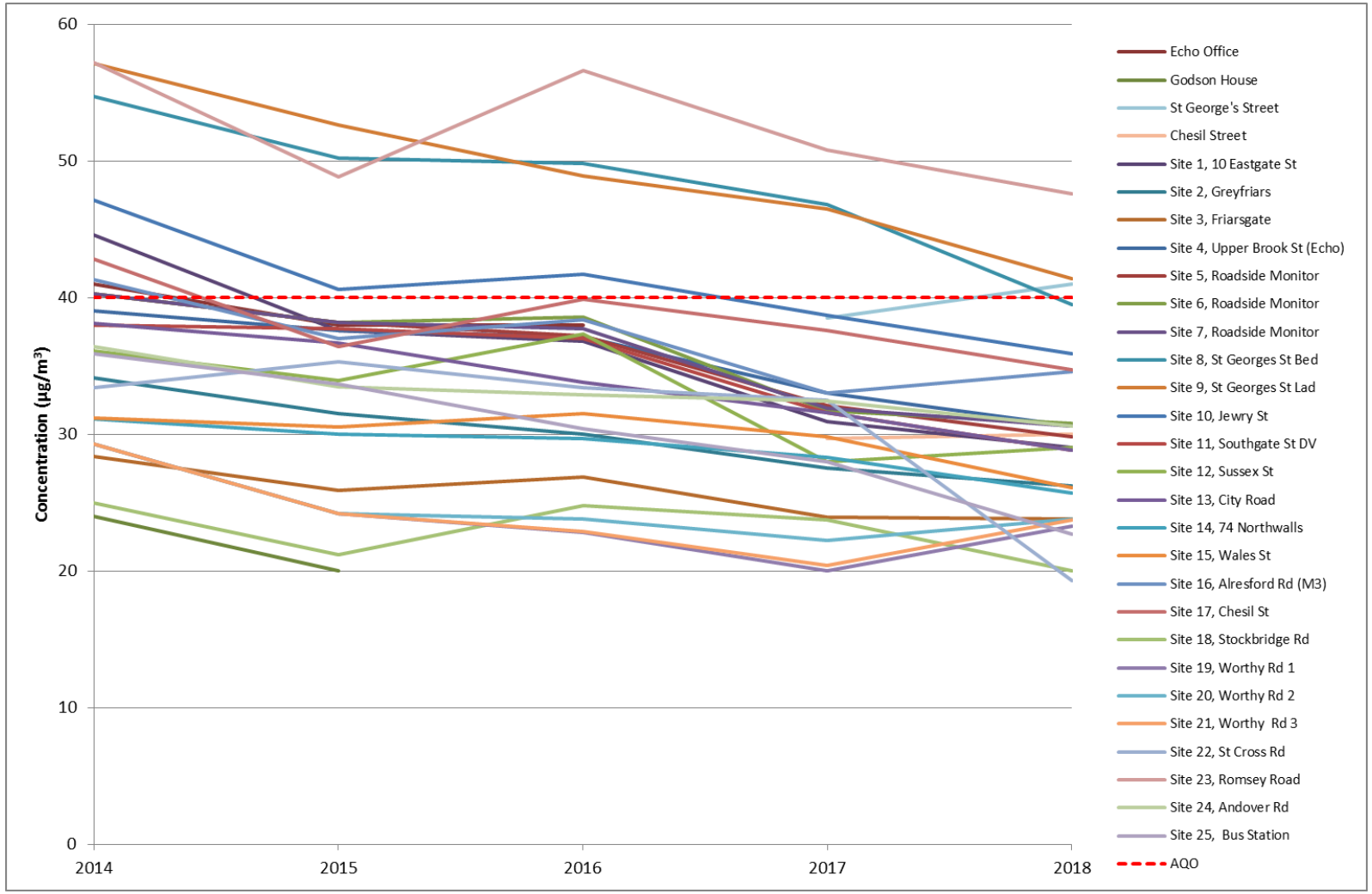
NO_2 annual means exceeding 60µg/m^3, indicating a potential exceedance of the NO_2 1-hour mean objective are shown in **bold and underlined.**

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

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

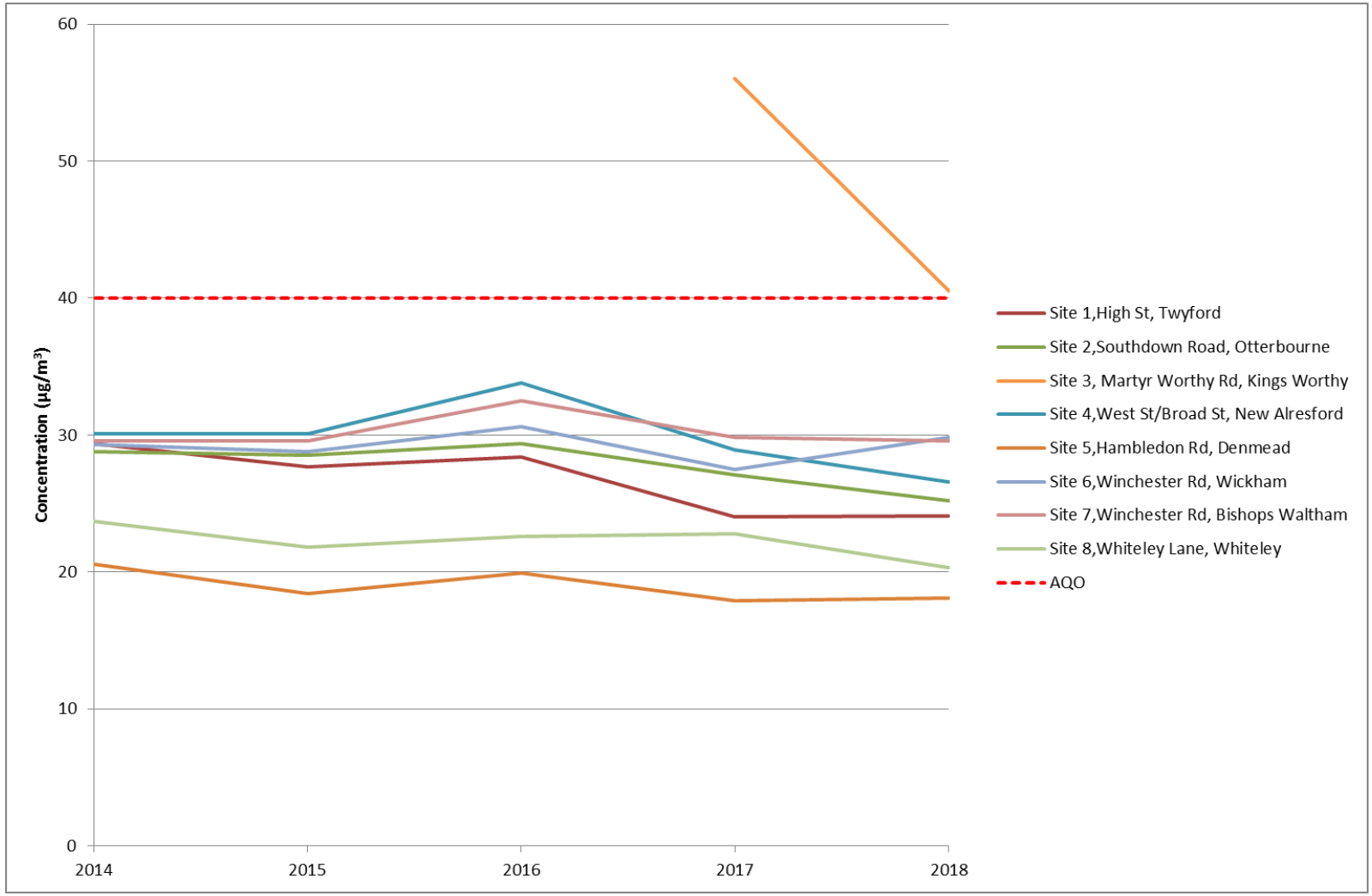
(3) Means for diffusion tubes have been corrected for bias. All means have been "annualised" as per Boxes 7.9 and 7.10 in LAQM.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Figure A.1 – Trends in Annual Mean NO_2 Concentrations – City wide DT study and automatic monitoring sites



AQO = Air Quality Objective. Note data for Site St. George's Street and Chesil Street are only available from 2017.

Figure A.2 – Trends in Annual Mean NO_2 Concentrations – District wide DT study



AQO = Air Quality Objective.

Table A.4 – 1-Hour Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2018 (%) (2)	NO_2 1-Hour Means > 200µg/m^3 (3)				
					2014	2015	2016	2017	2018
Echo Office	Roadside	Automatic	N/A	N/A	0	1	1	-	-
Godson House	Urban Background	Automatic	N/A	N/A	0	0 (50)	-	-	-
St George's Street	Roadside	Automatic	99.9	99.9	-	-	-	0 (125)	0
Station Approach (Chesil Street)	Roadside	Automatic	100	100	-	-	-	0 (100)	0

Notes:

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

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

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)														
	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6	Period 7	Period 8	Period 9	Period 10	Period 11	Period 12*	Annual Mean		
													Raw Data	Bias Adjusted (0.94) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
Site 1 (City Study)	-	26	34	31	31	32	-	28	28	-	37		30.9	28.9	N/A
Site 2 (City Study)	26	25	29	28	27	26	28	26	26	31	34		27.9	26.2	N/A
Site 3 (City Study)	25	24	28	25	24	23	26	21	21	30	32		25.3	23.8	N/A
Site 4 (City Study)	33	27	36	34	34	36	31	28	28	36	36		32.5	30.6	N/A
Site 5 (City Study)	30	27	35	31	30	33	34	27	27	35	40		31.7	29.8	N/A
Site 6 (City Study)	28	29	37	32	31	33	35	29	29	38	39		32.8	30.8	N/A
Site 7 (City Study)	29	31	35	33	30	33	34	27	27	39	40		32.5	30.6	N/A
Site 8 (City Study)	41	29	45	44	50	47	44	33	33	49	46		**42.0**	39.5	N/A
Site 9 (City Study)	45	34	49	49	35	43	52	43	43	39	52		**44.0**	**41.4**	N/A
Site 10 (City Study)	35	34	42	37	36	36	41	-	-	37	46		38.2	35.9	N/A
Site 11 (City	35	26	34	27	33	32	28	27	27	30	37		30.6	28.8	N/A

Site ID	NO_2 Mean Concentrations ($\mu g/m^3$)														
	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6	Period 7	Period 8	Period 9	Period 10	Period 11	Period 12*	Annual Mean		
													Raw Data	Bias Adjusted (0.94) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
Study)															
Site 12 (City Study)	34	25	32	33	35	30	31	27	27	30	35		30.9	29.0	N/A
Site 13 (City Study)	32	21	37	34	23	26	37	28	28	31	38		30.6	28.8	N/A
Site 14 (City Study)	31	26	33	29	19	23	29	26	25	25	34		27.3	25.7	N/A
Site 15 (City Study)	-	-	30	26	29	29	28	22	22	30	33		27.8	26.1	N/A
Site 16 (City Study)	33	31	38	34	40	40	-	36	36	42	38		36.8	34.6	N/A
Site 17 (City Study)	40	38	40	44	-	35	-	33	33	41	28		36.9	34.7	N/A
Site 18 (City Study)	24	23	23	20	25	19	17	16	16	25	27		21.3	20.0	N/A
Site 19 (City Study)	29	23	28	23	-	19	25	21	21	28	31		24.8	23.3	N/A
Site 20 (City Study)	31	23	29	26	-	19	24	22	22	26	30		25.3	23.8	N/A
Site 21 (City Study)	30	24	28	24	-	19	24	21	21	30	31		25.2	23.7	N/A
Site 22 (City Study)		23	25	21	20	18	18	17	17	26	-		20.5	19.3	N/A
Site 23 (City Study)	49	42	49	48	55	56	54	48	48	53	54		**50.6**	**47.6**	N/A
Site 24 (City Study)	37	34	34	31	27	29	33	29	29	38	38		32.5	30.6	N/A

Site ID	NO_2 Mean Concentrations ($\mu g/m^3$)														
	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6	Period 7	Period 8	Period 9	Period 10	Period 11	Period 12*	Annual Mean		
													Raw Data	Bias Adjusted (0.94) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
Site 25 (City Study)	27	28	24	26	25	22	22	18	18	28	27		24.1	22.7	N/A
Site 1 (District Study)	30.9	22.7	23.3	25.7	24.7	23.7	26.1	23.2	28.3	27.8	ns		25.6	24.1	N/A
Site 2 (District Study)	36.5	28.6	23.8	25.1	26.7	25.5	23.9	24.8	31.3	23.8	25.2		26.8	25.2	N/A
Site 3 (District Study)	48.7	40.0	38.7	42.7	42.2	45.8	44.1	39.8	47.8	38.9	45.6		**43.1**	**40.5**	N/A
Site 4 (District Study)	33.6	28.4	27.2	30.8	23.3	25.0	26.1	23.6	32.5	31.7	29.5		28.3	26.6	N/A
Site 5 (District Study)	23.6	20.7	20.4	22.0	14.8	13.9	18.8	15.3	19.5	20.6	23.0		19.3	18.1	N/A
Site 6 (District Study)	36	30	32	34		30	29	27	33	34	33		31.7	29.8	N/A
Site 7 (District Study)	34	32	33	33	28	26	31	29	34	30	37		31.5	29.6	N/A
Site 8 (District Study)	-	21	23	25	17	18	21	19	23	23	24		21.6	20.3	N/A
Site 9	-	15	12	13	10	9	10	10	11	16	24		13.1	12.3	N/A

Site ID	NO_2 Mean Concentrations (µg/m^3)														
	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6	Period 7	Period 8	Period 9	Period 10	Period 11	Period 12*	Annual Mean		
													Raw Data	Bias Adjusted (0.94) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
(District Study)															
Old School House	-	-	-	-	-	-	-	18.6	23.5	20.1	22.5		21.2	20.7	N/A
Kings Worthy Cottage	-	-	-	-	-	-	-	20.5	24.6	23.3	25.1		23.4	22.9	N/A
Mill Lane	-	-	-	-	-	-	-	13.7	19.5	-	-		16.6	20.0	N/A

☒ **Local bias adjustment factor used**

☐ **National bias adjustment factor used**

☒ **Annualisation has been conducted where data capture is <75% (note data capture was above this value for all sites)**

Notes:

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

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

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

(2) Distance corrected to nearest relevant public exposure. Distance corrections may be not applicable (marked N/A) as explained in Table A.2.

*Exposure periods are slightly different from the suggested LAQM calendar, though cover almost the full calendar year, so can be considered representative of an annual mean where data capture allows. Periods for City study are as follows:

Period 1 08/01/18 - 08/02/18, Period 2 08/02/18 - 09/03/18 , Period 3 09/03/18 - 06/04/2018, Period 4 06/04/2018 - 14/05/2018, Period 5 14/05/2018 - 13/06/2018, Period 6 13/06/2018 -12/07/2018, Period 7 12/07/2018 - 17/08/2018, Period 8 17/08/2018 - 21/09/2018, Period 9 21/09/2018 - 26/10/2018, Period 10 26/10/2018 - 23/11/2018, Period 11 23/11/2018 - 20/12/2018.

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

Automatic Monitoring Data

The data collection efficiency for the roadside NO_2 automatic monitoring stations in 2018 was greater than the required 75% (99.9% for St. George's Street and 100% for Chesil Street). Therefore no annualisation of data was required.

The PM_{10} automatic monitoring site was decommissioned in May 2017. However, in January 2019 an AQMesh monitor was installed on Romsey Road which measured NO_2, PM_{10} and $PM_{2.5}$ concentrations. A full year of results will be published in the 2020 ASR.

All results have been zero and span corrected with readings taken approximately every 2 weeks in accordance with Defra guidance. All gases used for calibration have been independently certified. All instruments were fully serviced every six months by external contractors (Air Monitors). All real data was polled and ratified by Air Quality Data Management (AQDM).

Diffusion Tube Data

All diffusion tubes were from Gradko and used a mixture of 20% TEA in water preparation method. Gradko International Ltd is a UKAS accredited laboratory. Gradko participates in the AIR Proficiency Testing (PT) scheme for diffusion tubes, operated by LGC Standards and supported by the Health and Safety Laboratory (HSL), which provides a Quality Assurance / Quality Control (QA/QC) framework for local authorities carrying out diffusion tube monitoring as a part of their local air quality management process. The percentage of results submitted by Gradko International Ltd that were subsequently determined to be satisfactory was 100% for all tests in AIR-PT Rounds 24, 25, 27 and 28 (January – October 2018)[10], and the lab is therefore deemed to have a satisfactory performance.

The results have been adjusted by using a local bias adjustment factor using the procedure detailed in DEFRA guidance document Technical Guidance LAQM

[10]https://laqm.defra.gov.uk/assets/laqmno2performancedatauptofebruary2019v1.pdfhttps://laqm.defra.gov.uk/assets/airptrounds12to22jan2016oct20171.pdf

TG(16)[11]. This was calculated by locating three diffusion tubes adjacent to the roadside real time analyser and comparing results. The local bias adjustment factor calculated and used was 0.94.

The national bias adjustment factor was also calculated in accordance with LAQM TG(16)[11]. The factor for 2018 was found to be 0.93 and would therefore provide lower adjusted results if applied. As the co-location site was found to have 'good' precision for the diffusion tubes, the local bias adjustment factor was deemed suitable for all tubes in Winchester as for previous years.

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:	Step 2:	Step 3:	Step 4:
Select the Laboratory that Analyses Your Tubes from the Drop-Down List	Select a Preparation Method from the Drop-Down List	Select a Year from the Drop-Down List	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 a laboratory is not shown, we have no data for this laboratory.	If a preparation method is not shown, we have no data for this method at this laboratory.	If a year is not shown, we have no data[2]	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)
Gradko	20% TEA in water	2018	R	Fareham Borough Council	12	28	34	-17.5%	G	**1.21**
Gradko	20% TEA in water	2018	R	Fareham Borough Council	12	37	34	8.9%	G	**0.92**
Gradko	20% TEA in water	2018	R	Fareham Borough Council	12	32	28	12.6%	G	**0.89**
Gradko	20% TEA in water	2018	R	NOTTINGHAM CITY COUNCIL	12	35	34	0.3%	G	**1.00**
Gradko	20% TEA in water	2018	R	Bracknell Forest Borough Council	12	44	37	19.4%	G	**0.84**
Gradko	20% TEA in water	2018	R	Brighton & Hove City Council	9	48	50	-3.7%	G	**1.04**
Gradko	20% TEA in water	2018	R	Eastleigh Borough Council	11	28	32	-12.0%	G	**1.14**
Gradko	20% TEA in water	2018	R	Eastleigh Borough Council	12	42	38	10.2%	G	**0.91**
Gradko	20% TEA in water	2018	UB	Eastleigh Borough Council	12	27	28	-4.4%	G	**1.05**
Gradko	20% TEA in water	2018	R	Gateshead Council	12	29	25	13.9%	G	**0.88**
Gradko	20% TEA in water	2018	R	Gateshead Council	12	32	29	10.8%	G	**0.90**
Gradko	20% TEA in water	2018	R	Gateshead Council	9	40	41	-1.8%	G	**1.02**
Gradko	20% TEA in water	2018	R	Wokingham Borough Council	12	38	33	13.2%	G	**0.88**
Gradko	20% TEA in water	2018	R	Bath & North East Somerset	12	40	39	4.0%	G	**0.96**
Gradko	20% TEA in water	2018	R	Bedford Borough Council	10	30	27	8.8%	G	**0.92**
Gradko	20% TEA in water	2018	KS	Marylebone Road Intercomparison	11	93	85	9.3%	G	**0.91**
Gradko	20% TEA in water	2018	R	South Gloucestershire Council	12	21	20	6.3%	G	**0.94**
Gradko	20% TEA in water	2018	R	Thurrock Borough Council	12	53	52	2.3%	S	**0.98**
Gradko	20% TEA in water	2018	R	Thurrock Borough Council	12	34	30	15.1%	G	**0.87**
Gradko	20% TEA in water	2018	R	Thurrock Borough Council	12	31	24	28.8%	G	**0.78**
Gradko	20% TEA in water	2018	UB	Thurrock Borough Council	12	27	25	9.2%	S	**0.92**
Gradko	20% TEA in water	2018		**Overall Factor[3] (30 studies)**				**Use**		**0.93**

Data capture for a majority of relevant diffusion tube sites was greater than 75%, with the exception of City site 1. Further to this, the 'Enhanced Kingsworthy Study' had annual data capture rates of below 40%. The data for these sites were therefore subsequently annualised, as per Table C.1Table C.1[12].

The Kingsworthy study is an exploratory study and the data provided in this ASR is considered preliminary due to the low data capture but is included for discussion of exceedances in the area. As the monitoring periods for each tube were different, three annualisation calculations were carried out as shown below.

[11] Defra LAQMTG(16). Available at https://laqm.defra.gov.uk/documents/LAQM-TG16-April-16-v1.pdf
[12] Whilst the Mill Lane site had less than the 3 months generally required as the minimum data capture for annualisation, this was still annualised for indicative purposes

Table C.1 – Annualisation Calculations

Four Month (Kings Worthy Cottage & Old School House)

BG CM site	Annual Mean NO_2	Period Mean NO_2	Adjustment Factor
Chilbolton Observatory	9.547	8.538	1.118
Lullington Heath	7.561	6.551	1.154
Charlton Mackrell	5.927	6.956	0.852
		Average Factor	1.041

Two Month (Mill Lane)

BG CM site	Annual Mean NO_2	Period Mean NO_2	Adjustment Factor
Chilbolton Observatory	9.547	7.199	1.326
Lullington Heath	7.561	5.328	1.419
Charlton Mackrell	5.927	5.441	1.089
		Average Factor	1.278

City 1

BG CM site	Annual Mean NO_2	Period Mean NO_2	Adjustment Factor
Chilbolton Observatory	9.547	9.840	0.970
Lullington Heath	7.561	7.678	0.985
Charlton Mackrell	5.927	5.745	1.032
		Average Factor	0.996

Distance correction was not required at any sites, since those exceeding were all at locations of relevant exposure.

Appendix D: Maps of Monitoring Locations and AQMAs

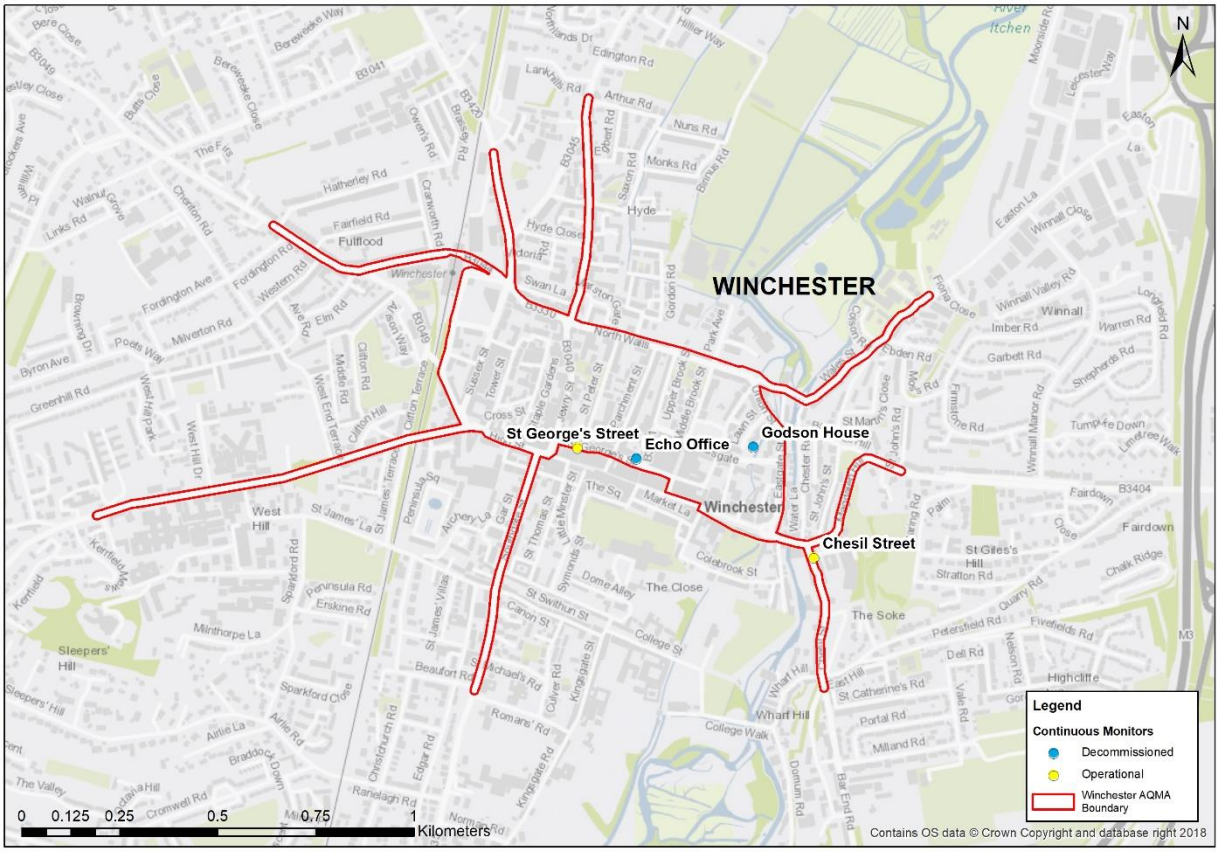


Figure D.1 - Map of Automatic Monitoring Sites & AQMA Boundary

Contains Ordnance Survey data @Crown copyright and database right 2018. Contains public sector information licensed under the Open Government Licence v3.0.

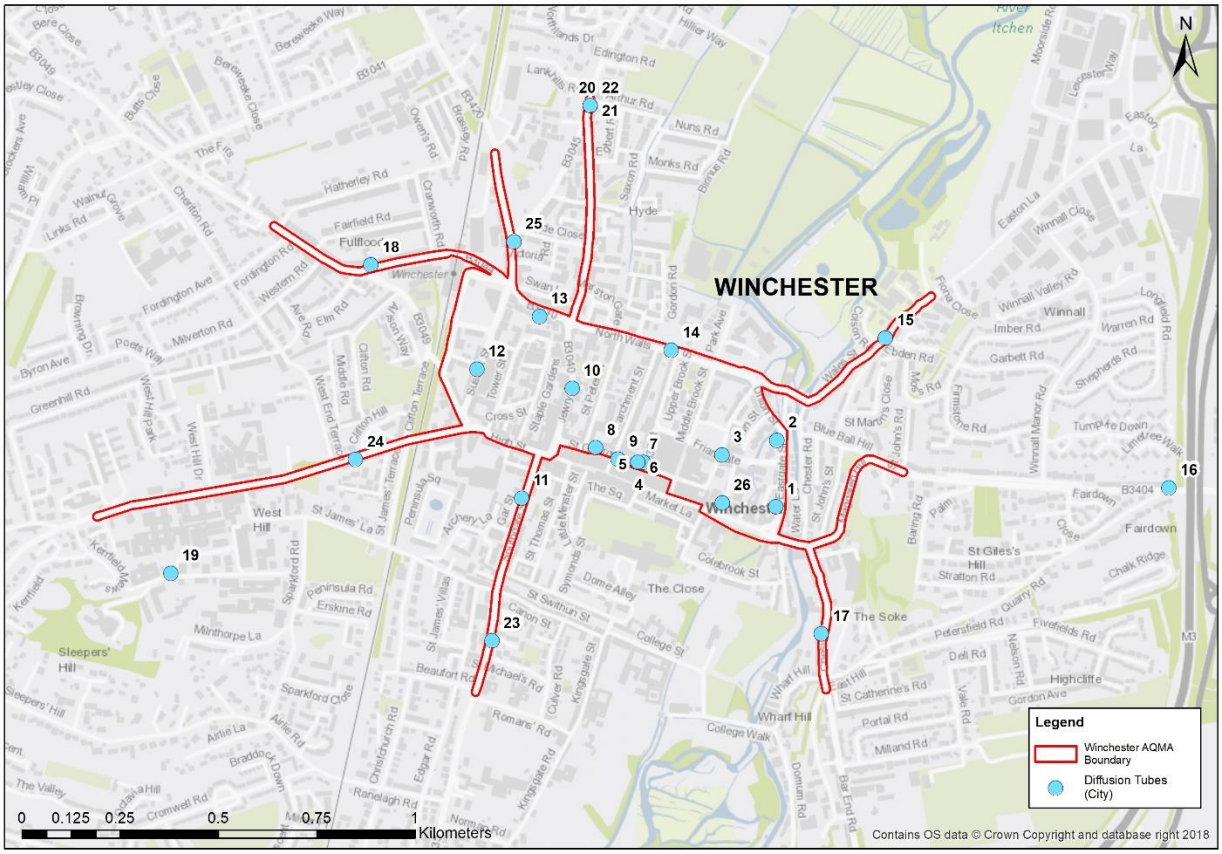


Figure D.2 - Map of City-wide Diffusion Tube Sites & AQMA Boundary

Contains Ordnance Survey data @Crown copyright and database right 2018. Contains public sector information licensed under the Open Government Licence v3.0.

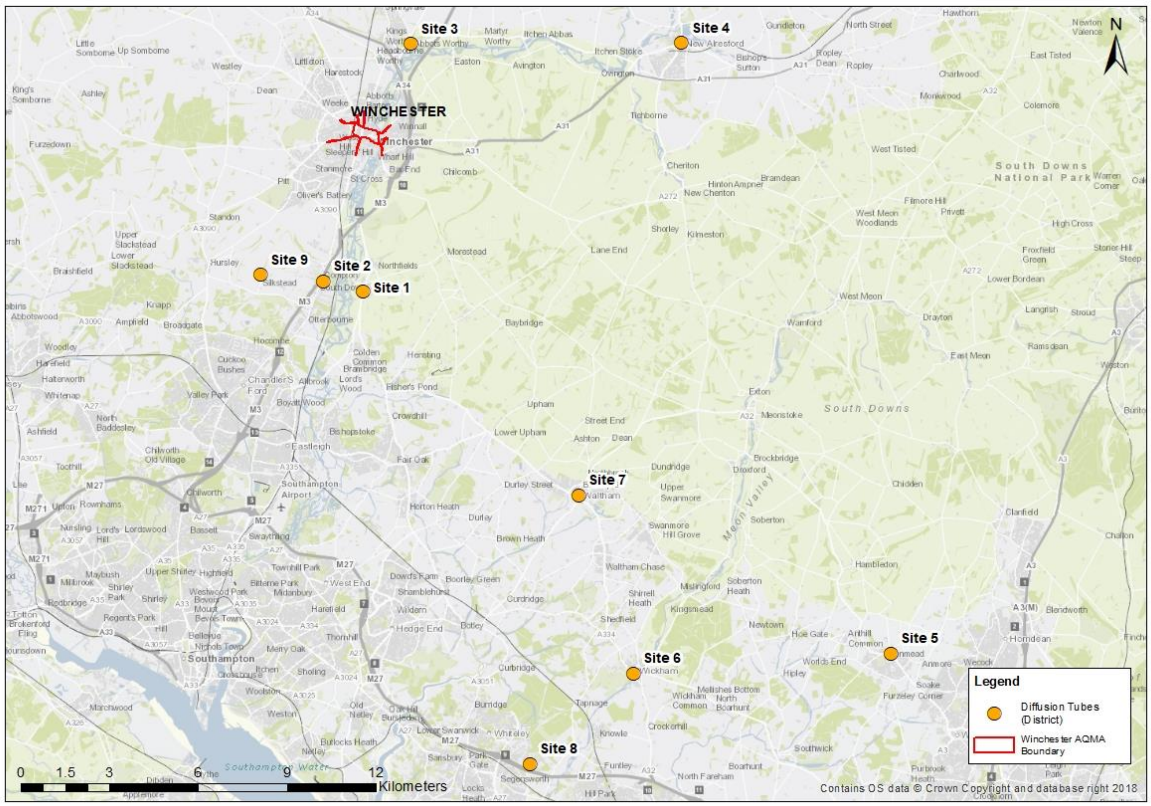


Figure D.3 - Map of District wide Diffusion Tube Sites

Contains Ordnance Survey data @Crown copyright and database right 2018.

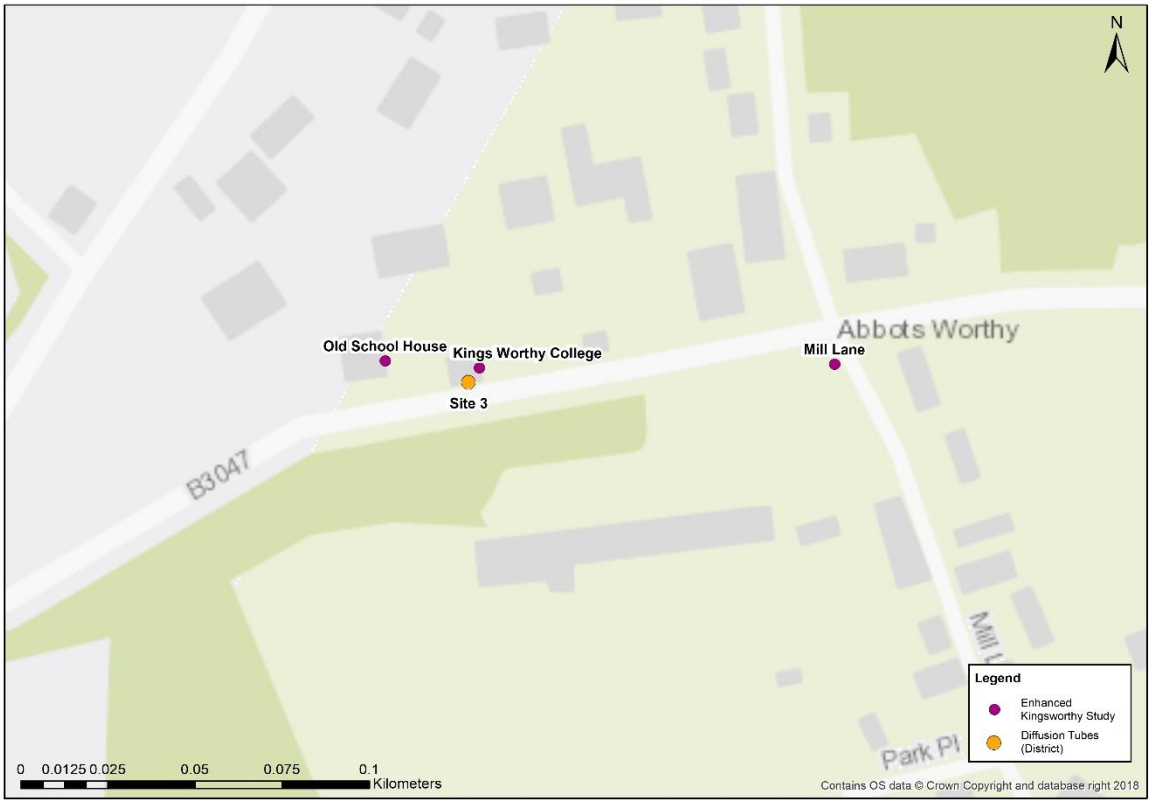


Figure D.4 - Map of Enhanced Kingsworthy Study (and District Wide) Diffusion Tube Sites

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Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England

Pollutant	Air Quality Objective[13]	
	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

[13] The units are in micrograms 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'
AQDM	Air Quality Data Management – external air quality company that ratifies data
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
BAM	Beta attenuation monitoring - a widely used air monitoring technique
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by Highways England
EU	European Union
FDMS	Filter Dynamics Measurement System
HCC	Hampshire County Council
HSL	Health and Safety Laboratory
LAQM	Local Air Quality Management
LAQM.PG(16)	Local Air Quality Management Policy Guidance 2016
LAQM.TG(16)	Local Air Quality Management Technical Guidance 2016
MCERTs	Environment Agency of England & Wales (EA) Monitoring CERTification Scheme
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
SPD	Supplementary Planning Document
WCC	Winchester City Council

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