Borough Council of King's Lynn & West Norfolk
Annual Status Report 2019

Bureau Veritas

July 2019

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Identification	
Client	Borough Council of King's Lynn & West Norfolk
Document Title	2019 Annual Status Report
Bureau Veritas Ref No.	6486114/UK/V4.0

Contact Details		
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Configuration				
Version	**Date**	**Author**	**Reason for Issue/Summary of Changes**	**Status**
V1.0	19/06/19	B Turner	-	Draft
V2.0	09/07/19	B Turner	Comments Received	Final
V3.0	15/0719	B Turner	Comments Received	Revised Final
V4.0	25/0719	T Campbell	Comments Received	Revised Final
V5.0	31/0719	T Campbell	Comments Received	Revised Final

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Borough Council of
King's Lynn &
West Norfolk

2019 Air Quality Annual Status Report (ASR)

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

July 2019

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Date	July 2019

Executive Summary: Air Quality in Our Area

Air Quality in Borough Council of King's Lynn and West Norfolk

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].

The main source of air pollution in the borough is road traffic emissions from major roads, notably the A148 – Lynn Road, A148 – Wootton Road, A148 – London Road, A47, A10 – Main Road, A148 – Nar Ouse Way, Edward Benefer Way and A149 – Hardwick Road. These roads, among others, form the main arterial highway network within King's Lynn, carrying high volumes of traffic within the Borough, specifically through areas of exposure: such as King's Lynn Town Centre. As a result, the Borough Council of King's Lynn and West Norfolk (BCKLWN, 'the Council') currently have two designated Air Quality Management Areas (AQMAs): Town Centre AQMA and the Gaywood Clock AQMA, both declared for the exceedance of the annual mean NO_2 Air Quality Strategy (AQS) objective limit.

Both AQMAs can be viewed online at https://uk-air.defra.gov.uk/aqma/local-authorities?la_id=138, details of the AQMAs are provided in Table 2.1 and boundary maps are presented in Appendix D: Maps of Monitoring Locations and AQMAs.

An Air Quality Action Plan (AQAP) was adopted by the Council in 2015. This AQAP outlines a series of measures to be completed in order to improve air quality within the AQMAs and therefore the Borough as a whole. An update to the source apportionment study providing a revised understanding of key vehicle contributors in both AQMAs was completed in December 2017. The Council intend to utilise the model outputs from

[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

the source apportionment exercise to update the 2015 AQAP, following completion of the King's Lynn Transport Study.

BCKLWN undertook monitoring of NO_2, PM_{10} and $PM_{2.5}$ throughout 2018 at a series of monitoring locations. These pollutants are discussed in turn.

Nitrogen Dioxide

Concentrations of NO_2 are monitored at 70 sites across the Borough, comprising 71 diffusion tubes and two automatic monitors, including a triplicate co-location study.

During 2018, one site (Site 2) reported an exceedance of the NO_2 annual mean AQS objective limit and four reported concentrations to be within 10%. These monitoring locations were all found to be located within the boundaries of the two declared AQMAs, with Site 2 located within the Town Centre AQMA.

Site 2 has reported the highest annual mean NO_2 concentration within the Borough three times (inclusive) since 2014. Site 2 is located on a façade of a residential house (deemed to represent relevant exposure), along a stretch of Railway Road, an arterial one-way route passing through the Town Centre where congestion is considered to be prevalent.

Looking at the past five years, NO_2 annual mean concentrations appear to have reduced at the majority of sites (48 out of 55 sites with available data), with reductions of 2.0µg/m^3 and over recorded at 40% of the sites. The reduction is evidence of the Councils' continued commitment and work towards improving air quality across the Borough.

The annual mean NO_2 concentration was not greater than 60µg/m^3 at any non-automatic monitoring site. In particular, the diffusion tube located at Site 5 (King's Lynn Bus Station) reported concentrations below 60µg/m^3, which is where short term exposure is most relevant. Therefore in accordance with Defra's TG(16), an exceedance of the 1-hour mean objective during 2018 at any monitoring location within King's Lynn is considered to be unlikely. Furthermore, both continuous NO_2 monitors present within King's Lynn reported no exceedance of the 1-hour objective throughout 2018, or since 2014.

Particulate Matter

The Councils' 2018 PM_{10} network comprises one PM_{10} TEOM monitor and four indicative Osiris dust monitors. In February 2018, the Council took the decision to

relocate the TEOM monitor from North Lynn, King's Lynn (Site CM3) to Lynn Road, Stoke Ferry – labelling this new site CM4. However, Site CM4 only became operational in October 2018 due to a power supply issue. This move was in response to a number of complaints made by the public in regards to dust potentially being emitted from a neighbouring animal feed plant – and to help validate the indicative readings reported by the Osiris (OS2) located at the same site. In response to the relocation of the TEOM, the existing Osiris (OS2) was then relocated to a new site within Stoke Ferry, located at Buckenham Drive in August 2018 (renamed OS5) to help improve air quality reporting within the area.

Full details of the monitoring sites are provided in Table A.1. PM_{10} concentrations reported at these sites have remained below the annual mean and 24-hour mean AQS objective limits since 2015, with a detailed assessment to be completed by the end of the year.

$PM_{2.5}$ is regulated by standards in the UK which presently places no statutory duty on Local Authorities to report against the annual mean objective limit. These standards are scheduled to be legally enforced in 2020. Nonetheless, the Council undertake monitoring of $PM_{2.5}$ within the borough indirectly via four Osiris dust monitors. Concentrations recorded since 2016 (first year of Council $PM_{2.5}$ monitoring) have been below the obligatory annual mean standard of 25µg/m^3. As the monitoring is completed using Osiris instruments that do not hold an accreditation for $PM_{2.5}$ monitoring; the concentrations reported should not be taken as absolutes.

Full details of the $PM_{2.5}$ monitoring completed within the borough are provided in Table A.1.

Actions to Improve Air Quality

The declaration of the two AQMAs (Gaywood Clock and the Town Centre) and the adoption of the AQAP have previously driven the actions being taken to improve air quality across the Borough. The AQAP comprises Policy, Road Traffic and Emissions actions to help reduce pollutant levels. The measures are wide ranging and include considerations of air quality impacts within the planning process by commenting on specific planning applications as well as making sure air quality is embedded within local policies. On-going actions include implementation of urban traffic control systems, promotion of public transport and electric vehicle charging. A full list of measures is detailed in Table 2.2.

An update to the source apportionment study, providing a revised technical understanding of key vehicle contributors in both AQMAs, was completed in December 2017. The study found cars to be the greatest vehicle contributor to NO_x emissions within both AQMAs, but the NO_x contribution from HGVs and buses/coaches was higher in the Town Centre AQMA compared to the Gaywood Clock AQMA. The Council intend to utilise the model outputs from the source apportionment exercise to update the 2015 AQAP, following completion of the King's Lynn Transport Study, in order to deliver effective AQAP measures.

During 2018, the Council, with Norfolk County Council (NCC) progressed the King's Lynn Transport Study which focuses on the possibility of implementing various transport improvement schemes in the Borough to help reduce pollutant contributions from vehicular traffic. Potential schemes focus on exploring promoting active transport, public transport and changes to the existing road layout along arterial routes and junctions within both declared AQMAs. The Transport Study attempts to continue the stability of annual mean NO_2 concentrations within Gaywood Clock AQMA below the AQS objective level, whilst ensuring future year compliance within the Town Centre AQMA. The Council have commissioned Bureau Veritas to undertake the dispersion modelling to support this study.

Local Engagement and How to get Involved

Information on air quality in the borough is available on The Council's website[4], and a wider view of air quality in the Norfolk region can be viewed at Norfolk Air Quality[5], where live data from the Council's continuous monitoring stations is published.

The following are suggested as alternatives to private travel that would contribute to improving the air quality in the borough:

- Use public transport where available – This reduces the number of private vehicles in operation reducing pollutant concentrations through the number of vehicles and reducing congestion;
- Walk or cycle if your journey allows – From choosing to walk or cycle for your journey the number of vehicles is reduced and also there is the added benefit of keeping fit and healthy;
- Car/lift sharing – Where a number of individuals are making similar journeys, such as travelling to work or to school car sharing reduces the number of vehicles on the road and therefore the amount of emissions being released. This can be promoted via personal travel plans which can be obtained from Norfolk Country Council;
- Alternative fuel / more efficient vehicles – Choosing a vehicle that meets the specific needs of the owner, fully electric, hybrid fuel and more fuel efficient cars are available and all have different levels benefits by reducing the amount of emissions being released; and
- Turning engines off where possible – Reduce the amount of idling vehicles, for example when dropping children at school or waiting at level crossings, will help reduce harmful emissions from vehicle exhausts.

[4] https://www.west-norfolk.gov.uk/info/20137/air_quality/170/air_quality_%20management%20_areas/
[5] http://www.norfolkairquality.net/

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1 Local Air Quality Management

This report provides an overview of air quality in Borough Council of King's Lynn & West Norfolk 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 Borough Council of King's Lynn & West Norfolk 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 in Appendix E.

2 Actions to Improve Air Quality

2.1 Air Quality Management Areas

Air Quality Management Areas (AQMAs) are declared when there is an exceedance or likely exceedance of an air quality objective. After declaration, the authority must prepare an Air Quality Action Plan (AQAP) within 12-18 months setting out measures it intends to put in place in pursuit of compliance with the objectives.

A summary of AQMAs declared by Borough Council of King's Lynn & West Norfolk 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=138 see full list at https://uk-air.defra.gov.uk/aqma/list. Alternatively, see Appendix D: Maps of Monitoring Locations and AQMAs, which provides for a map of air quality monitoring locations in King's Lynn.

BCKLWN propose to keep the current two designated AQMAs in Borough Council of King's Lynn & West Norfolk (see monitoring section) and to review the NO_2 monitoring network surrounding these 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
Gaywood Clock	01/04/2009	NO_2 Annual Mean	King's Lynn	An area encompassing a number of properties at the junction of the A148 (Lynn Road/Wootton Road) and the A1076 (Gayton Road)	NO	45.1	µg/m^3	36.7	µg/m^3	Borough Council of King's Lynn and West Norfolk AQAP	2015	https://www.west-norfolk.gov.uk/info/20137/air_quality/170/air_quality_management_areas
Town Centre	Declared: 01/11/2003 Amended: 01/02/2007	NO_2 Annual Mean	King's Lynn	A 'P' shaped area encompassing a number of properties comprising the main road to/from the town centre of King's Lynn (London Road and St James' Road) and the town centre one way system (Railway Road, Austin Street and Blackfriars Road).	NO	55.0	µg/m^3	43.2	µg/m^3	Borough Council of King's Lynn and West Norfolk AQAP	2015	https://www.west-norfolk.gov.uk/info/20137/air_quality/170/air_quality_management_areas

☒ **Borough Council of King's Lynn and West Norfolk confirm the information on UK-Air regarding their AQMAs is up to date**

2.2 Progress and Impact of Measures to address Air Quality in Kings Lynn and West Norfolk Borough Council

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

> *"The report is well structured, detailed, and provides the information specified in the Guidance, using the latest reporting template. The following comments are provided.*

1. *2017 monitoring confirms the continued exceedance of the annual mean NO_2 objective at one site of relevant exposure – Site 2 on Town Centre, inside the Town Centre AQMA. There have been no other exceedances of NO_2, PM_{10} or $PM_{2.5}$ objectives in 2017.*

2. *At present, NO_2 concentrations inside the Gaywood Clock AQMA are compliant with national air quality objectives, and are below 10% of the objective level (36 µg/m^3) at locations of relevant exposure. Concentrations have decreased from 2016 to 2017 in the AQMA.*

3. *The Local Authority are reminded that it is recommended they consider revoking the Gaywood Clock AQMA if annual mean NO_2 concentrations remain stable below 36 µg/m³ for three consecutive years.*

4. *It is also suggested that the Town Centre AQMA boundary could be considered for amendment according to where exceedances are still occurring/ considered still likely to occur, using results from both current monitoring and the recent modelling exercise.*

5. *QA/QC procedures have been applied correctly and in full for bias adjustment, annualisation and distance. The Local Authority has provided details of calculations for corrections which are useful and encouraged.*

6. *The report demonstrates the Council's' efforts to address $PM_{2.5}$ in the Borough, and draws links with $PM_{2.5}$ and the Public Health Outcomes Framework.*

7. *The Local Authority should continue to keep the monitoring program under review, and implement changes to the network to ensure that monitoring is taking place at all sites of potential exceedance at relevant exposure.*

8. *The new AQAP should be developed in line with the Technical Guidance TG(16), and should include measures specifically designed to target the remaining pollution hotspots, and achieve stable, long-term compliance within the borough in the shortest time possible."*

The comments made within the appraisal report, as shown above, have been taken into account for the completion of the 2019 ASR.

The Council 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.

More detail on these measures can be found in the Council's 2015 AQAP. A list of measures completed prior to 2018 can be found in the 2018 ASR.

The Council expects the following measure to be completed over the course of the next reporting year:

- Measure 14: King's Lynn Transport Study

During 2018, the Council with NCC, progressed the King's Lynn Transport Study in which one aim is to possibly implement various transport improvement schemes in the Borough to help reduce pollutant contributions from vehicular traffic. Potential schemes focus on exploring changes to the existing road layout along arterial routes and junctions within both declared AQMAs. The Transport Study attempts to continue the stability of annual mean NO_2 concentrations within Gaywood Clock AQMA below the AQS objective level, whilst ensuring future year compliance within Town Centre AQMA. The Council are currently in the process of identifying potential transport improvement schemes to appraise. Additional air quality monitoring will be completed to assist in the decision making process.

The AQAP is due to be updated in-line with the findings from a source apportionment dispersion modelling exercise completed in 2017 - following completion of the King's Lynn Transport Study. The study found cars to be the greatest vehicle contributor to NO_x emissions within both AQMAs, but the NO_x contribution from HGVs and buses/coaches was higher in the Town Centre AQMA compared to the Gaywood Clock AQMA. This updated insight into prominent NO_x contributors relevant within both AQMAs will aid the discussion and implementation of effective AQAP measures.

Whilst the measures stated above and in Table 2.2 will help to contribute towards compliance, the Council anticipates that further additional measures not yet prescribed will be required in subsequent years to achieve compliance and enable the revocation of the Gaywood Clock and Town Centre AQMAs. Potential measures are expected to be discussed in support of the scheduled update of the AQAP.

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	Consideration of Air Quality Impacts when providing comments on planning applications within an AQMA or where an AQMA could be impacted or created.	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	Borough Council (LPA & Env Quality Team)	On going	On going	Number of pre application discussions and planning applications responded to	Up to 1	In 2018 over 58 applications were commented upon which had potential air quality impacts. They were screened according to Environmental Protection UK (EPUK) & Institute of Air Quality Management (IAQM) guidance and air quality assessments required where appropriate. Best practice measures were also recommended.	N/A -on going measure	This will always be an on-going measure as long as relevant planning application are received
2	With regard to National Planning Policy Framework, include air quality considerations in the Local Plans and adopt an air quality Development Management Policy.	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	Borough Council (LPA & Env Quality Team)	Completed	2014	Production of documents	Up to 1	Completed	Completed	The King's Lynn and West Norfolk Local Plan - Site Allocations & Development Management Policies (SADMP) Plan was formally adopted on 29 September 2016. This includes policy DM15 Environment, Design and Amenity, which provides for the assessment of air quality in planning applications. This policy approach is continued in the Local Plan Review (March 2019) as Policy LP18. The July 2011 Adopted Core Strategy's

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
											Transport Policy CS11 aimed to achieve improvements where there were air quality issues in the towns of Downham Market, Hunstanton and King's Lynn. The Local Plan Review (March 2019) Policy LP12 continues this approach, particularly with reference to the emerging King's Lynn Transport Study and Strategy.
3	With regard to National Planning Policy Framework, adopt Norfolk Technical Guidance on Air Quality and provide preapplication advice on planning applications	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	Borough Council (LPA & Env Quality Team)	2014	2015	Production of documents	Up to 1	Completed	Completed	Norfolk Technical Guidance now superseded by IAQM EPUK Guidance.
4	Develop Parking Management Plan	Transport Planning and Infrastructure	Other	County Council/ Borough Council	2014	On going	Publication of and implementation of plan	Up to 2	A King's Lynn Transport Study is now underway, this will consider car parking arrangements in the town centre.	2019/2020	

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
5	New access road from Wisbech Road through Friars to Boal Street.	Traffic Management	UTC, Congestion management, traffic reduction	County Council/ Borough Council	2010	Dec-11	Continued air quality monitoring. Bus flow counts on London Road and new route	2 to 3	The new access road has been completed and is well used by buses	2019/2020	Consideration is being given to the road as part of the King's Lynn Transport Study
6	Incentivise the use of public transport.	Alternatives to private vehicle use	Other	County Council	2014	2015	Continued air quality monitoring. Bus usage figures	Up to 1	The King's Lynn Transport Interchange has been completed making a physically nicer environment for public transport users. New air conditioned and wifi enabled train carriages were introduced on routes between King's Lynn and London in May 2017.	2017	Consideration is being given to public transport, and encouraging it's use, as part of the King's Lynn Transport Study
7	Implementation of Urban Traffic Control system (UTC) at principal junctions within AQMA and adjacent to AQMA	Traffic Management	Strategic highway improvements, Re-prioritising road space away from cars, including Access management, Selective vehicle priority, bus priority, high vehicle occupancy lane	County Council	2010	2011	Continued air quality monitoring. Queue length at junctions at peak times	2 to 5	Completed		Will be reviewed within the Kings Lynn Transport Study currently underway.

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
8	Installation of selective vehicle detection (SVD) system	Traffic Management	Strategic highway improvements, re-prioritising road space away from cars, including access management, selective vehicle priority, bus priority, high vehicle occupancy lane	County Council	2011	2012	Number of vehicles fitted with SVD Annual average daily traffic numbers	Up to 1	Completed	Completed	None
9	Decriminalisation of parking. Review of parking controls and enforcement in AQMAs and King's Lynn Town Centre	Transport Planning and Infrastructure	Other	Borough Council/ County Council	December 2010 option validation Jan-March 2011	On going	Implementation of enforcement in AQMAs and Town Centre. Continued air quality monitoring.	Up to 1	Will be considered within the Kings Lynn Transport Study currently underway.	On going	
10	Variable car parking rates	Transport Planning and Infrastructure	Other	Borough Council	2014	On going	Continued air quality monitoring, car park usage and queue lengths	Up to 1	Parking will be considered within the Kings Lynn Transport Study currently underway	On going	
11	Variable message signs	Traffic Management	Other	Borough Council/ County Council	2014	2014	Peak hour parking usage, car park usage and continued air quality monitoring queue lengths	Up to 1	Signs have been installed on approach to King's Lynn town centre to indicate where spaces are available.	Completed	None

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
12	Investigate potential for residents only parking in or close to AQMAs	Traffic Management	Workplace Parking Levy, Parking Enforcement on highway	Borough Council	2014	2015	Peak hour parking usage Car park usage Continued air quality monitoring	Up to 1	Residents parking permits have been introduced in South Quay area, on Portland Road (the link between the railway station and the King's Lynn Transport Interchange) , Highgate and Archdale Street which are all close to the town centre AQMA. This had made these areas unavailable for commuter parking.	On going	Potential for review after Kings Lynn Transport Study is completed
13	Support the use of West Lynn ferry	Promoting Travel Alternatives	Promote use of rail and inland waterways	Borough Council	2012	On going	Number of passengers using ferry	Up to 1	BCKLWN has provided funding for the West Lynn ferry, and the ferry will be considered as part of the King's Lynn Transport Study.	On going	The ferry service is well used, but this measure may need reviewing in future depending on the outcome of the ongoing sale.
14	Changes to the Road Layout within the King's Lynn Gyratory as proposed by Kings Lynn Transport Study	Traffic Management	UTC, Congestion management, traffic reduction	County Council	2011 (Linked to measure 3)	On going	Continued air quality monitoring. Daily traffic flow data and queue lengths.	2 to 10	A King's Lynn Transport Study is underway, this will identify possible transport schemes and develop a model to test them and develop a preferred strategy.	2019/2020	
15	Traffic Management at London Road and	Traffic Management	UTC, Congestion management, traffic reduction	County Council	2014	2015	Continued air quality monitoring. Queue length	1 to 5	The King's Lynn Transport Study will include London Road and the Southgates area.	2019/2020	

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
	Southgates						at junctions at peak times				
16	Traffic Management at Gaywood clock	Traffic Management	UTC, Congestion management, traffic reduction	County Council	2014	2015	Continued air quality monitoring. Traffic queue lengths.	1 to 5	The King's Lynn Transport Study will include the Gaywood Clock area.	2019/2020	
17	Promotion of travel plans, school travel plans and promotion of car sharing	Promoting Travel Alternatives	Personalised Travel Planning	County Council/ Borough Council	2014	On going	Continued air quality monitoring. Number of travel plans	Up to 1	Travel plans are requested by BCKLWN and County Council in response to relevant planning application	On going	
18	Improved cycling and walking provision	Promoting Travel Alternatives	Promotion of cycling	County Council/ Borough Council	2014	On going	Cycle usage and walking provision. Number of cycle/foot path improvements.	Up to 1	Active transport will be considered in the King's Lynn Transport Study.		
19	Investigate feasibility and if viable, provide Electric Vehicle charging points in car parks and in new developments	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	Borough Council	2014	On going	Number & use of EV charging points installed	Up to 1	Charging points are recommended on new developments as a mitigation measure in line with IAQM guidance Principles of Good Practice.	On going	

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
20	Quality Bus Partnerships and contracts	Promoting Low Emission Transport	Public Vehicle Procurement - Prioritising uptake of low emission vehicles	County Council	2014	On going	Continued air quality monitoring. % buses Euro 3 or better. Installation of SVD	Up to 1	A quality bus partnership is in place but there are still a high number of older vehicles used on King's Lynn Town Centre routes.	On going	

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

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

The Council monitors $PM_{2.5}$ concentrations at four locations within the Borough, two within King's Lynn and two within Stoke Ferry. Monitoring is completed using four Osiris instruments that do not hold a MCERTs accreditation for the indicative monitoring of $PM_{2.5}$, therefore the reported concentrations should not be taken as absolute.

The highest annual mean $PM_{2.5}$ concentration reported in the Borough during 2018 was 7.0µg/m^3 – monitored at OS1, located adjacent to Page Stair Lane. This is well below the $PM_{2.5}$ obligatory standard of 25µg/m^3.

The Public Health Outcomes Framework[6] data tool complied by Public Health England quantifies the mortality burden of $PM_{2.5}$ within England on a county and local authority scale. The 2017 fraction of mortality attributable to $PM_{2.5}$ pollution across England is 5.1% and in contrast, the fraction within The Council is 4.9%. This is lower than the fraction of mortality attributable to $PM_{2.5}$ pollution in England and also the East of England region which was estimated to be 5.5%.

The measures already being undertaken in the Councils AQAP have been reviewed against the Toolbox of Annex II within LAQM.TG(16) to determine which can have an effect on reducing $PM_{2.5}$ emissions. It was determined, that measures 6, 7, 8, 13, 15, 16, 17, 18, and 20 will also have an impact on reducing $PM_{2.5}$ emissions.

In addition to these measures, the Council continues to take the following measures to address $PM_{2.5}$:

- The Single Issue Silica Sand Review was published in December 2017 and details the appropriateness of each site. The Council will continue to provide

[6] Public Health Outcomes Framework, Public Health England. data tool available online at http://www.phoutcomes.info/public-health-outcomes-framework

comments on any planning applications relating to the search areas/sites to ensure that there are no adverse effects on air quality.

- Where there is potential for a construction site to impact on the local amenity by way of dust emissions a Construction Management Statement is requested as a pre-commencement planning condition. The statement has to include methods used and the measures taken to control the emission of dust and therefore minimise potential short term exposure to PM_{10} and $PM_{2.5}$.

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 the objectives.

3.1.1 Automatic Monitoring Sites

The Council's 2018 monitoring network comprises two NO_2 chemiluminescent analysers, one PM_{10} TEOM monitor, and four indicative Osiris dust monitors recording both $PM_{2.5}$ and PM_{10} concentrations. In February 2018, the Council took the decision to relocate the TEOM monitor from North Lynn, King's Lynn (Site CM3) to Lynn Road, Stoke Ferry – labelling this new site CM4. However Site CM4 only became operational in October 2018 due to a power supply issue. This move was in response to a number of complaints made by the public in regards to dust potentially being emitted from a neighbouring animal feed plant – and to help validate the indicative readings reported by the Osiris (OS2) located at the existing site. In response to the relocation of the TEOM, the existing Osiris (OS2), was then relocated to a new site within Stoke Ferry, located at Buckenham Drive in August 2018 (renamed OS5) to help improve air quality reporting within the area and aid the completion of an air quality detailed assessment in Stoke Ferry.

Table A.1 in Appendix A shows the details of the sites. National monitoring results are available at https://uk-air.defra.gov.uk/.

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

BCKLWN undertook non-automatic (passive) monitoring of NO_2 at 69 sites during 2018, including the provision of a triplicate co-location study. During 2018 no diffusion tubes were relocated and/or decommissioned from operation. 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: Maps of Monitoring Locations and AQMAs.

Further details on Quality Assurance/Quality Control (QA/QC) for the diffusion tubes, including bias adjustments and any other adjustments applied (e.g. “annualisation”), 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.

2018 data capture for all monitoring was greater than or equal to 75%. As a result, in accordance with TG16, annualisation was not required at any site.

Results for 2018 have been bias adjusted using a locally derived bias adjustment factor of 0.93. Full details of the bias adjustment and QA/QC procedure are provided in Appendix C.

Table A.3 below provides a summary of measured annual mean concentrations (annualised and bias adjusted) for 2018. During 2018, one site (Site 2) reported an exceedance with the NO_2 annual mean AQS objective limit and four reported concentrations to be within 10% of the AQS objective limit (Table 3.1). These monitoring locations were all found to be located within the boundaries of the two declared AQMAs, with Site 2 located within the Town Centre AQMA. All sites were considered to represent relevant exposure and therefore were directly comparable with the AQS objective limit.

Site 2 has reported the highest annual mean NO_2 concentration within the Borough three times (inclusive) since 2014. Site 2 is located along a stretch of Railway Road – an arterial one-way route passing through the Town Centre where congestion is considered to be prevalent.

Table 3.1 - Summary of Measured Annual Mean NO_2 Exceedances and Near Exceedances

Site ID	Within AQMA Y/N	2018 Annual Mean Concentration (µg/m^3)
2	Y – Town Centre AQMA	**43.2**
3	Y – Town Centre AQMA	37.4
10	Y – Town Centre AQMA	36.2
41	Y – Gaywood Clock AQMA	36.7
44	Y – Gaywood Clock AQMA	36.0
All values presented above have been bias adjusted		

Looking at the past five years, NO_2 annual mean concentrations appear to have reduced at the majority of sites (48 out of 55 sites with available data), with reductions of over 2.0µg/m^3 recorded at 40% of the sites. The reduction is evidence of the Councils' continued commitment and work towards improving air quality across the Borough.

The annual mean NO_2 concentration was not greater than 60µg/m^3 at any non-automatic monitoring site. In particular, the diffusion tube located at Site 5 (King's Lynn Bus Station) reported concentrations below 60µg/m^3, which is where short term exposure is most relevant. Therefore exceedance of the 1-hour mean objective during 2018 at any monitoring location within King's Lynn is considered to be unlikely. Furthermore, both continuous NO_2 monitors installed within King's Lynn reported no exceedance of the short term NO_2 1-hour objective throughout 2018, or since 2014.

Town Centre AQMA

The annual mean concentration results for the NO_2 diffusion tubes located within Town Centre AQMA are presented in Figure A.1. NO_2 monitoring within the Town Centre AQMA was undertaken at 25 sites during 2018, comprising 27 diffusion tubes and one continuous monitor (CM1) – including the provision of a triplicate co-location site. One site reported (Site 2) an exceedance with the NO_2 annual mean AQS objective limit, whereas two reported concentrations to be within 10% (Site 3 and 10). All three sites are deemed to represent relevant exposure and therefore no distance correction calculations were performed. All three sites are located along differing stretches of the A148 – Railway Road – an arterial route through the Town Centre. Site 2 reported the highest concentration in 2018 (43.2µg/m^3).

CM1 has reported NO_2 annual mean concentrations below or equal to 25.0µg/m^3 since 2014 – 37.5% below the AQS objective limit. Similarly, CM1 has reported no exceedance of the short term 1-hour AQS objective limit, or concentrations to exceed 200µg/m^3 on any occasion since 2014.

Based on historical and 2018 monitoring data, it is recommended that the AQMA remain in force. However, it is recommended that the Council review the effectiveness of the current monitoring network within the AQMA, with the view to relocate monitoring locations reporting concentrations to be well below the AQS annual mean objective to further improve confidence in air quality reporting.

Gaywood Clock AQMA

The annual mean concentration results for the NO_2 diffusion tubes located within Gaywood Clock AQMA are presented in Figure A.2. NO_2 monitoring within Gaywood Clock AQMA was undertaken at seven sites during 2018, comprising 6 diffusion tubes and one continuous monitor (CM2). No sites reported an exceedance of the NO_2 annual mean AQS objective limit, however, two sites (Site 41 and 44) reported concentrations to be within 10% of the AQS objective limit. Site 41 reported the highest recorded concentration in the AQMA during 2018 (36.7µg/m^3). Both sites are deemed to represent relevant exposure and therefore no distance correction calculations were performed. Both sites are located adjacent to locations where queuing traffic from neighbouring junctions may be prevalent.

All sites reported NO_2 annual mean concentrations to be between 30.0µg/m^3 and 36.7µg/m^3 for 2018. CM2 reported concentrations to be below 36µg/m^3 (10% of the AQS objective limit) for the first time since 2014 – where exceedances had been reported in 2015 and 2016. CM2 reported no exceedance of the short term 1-hour AQS objective limit, or concentrations to exceed 200µg/m^3 on any one occasion since 2014.

Based on historical and 2018 monitoring data, it is recommended that the AQMA remain in force, with the view of revocation if NO_2 annual mean concentrations continue to stabilise below the AQS objective limit.

Outside of Declared AQMAs

The annual mean concentration results for the NO_2 diffusion tubes located outside of a declared AQMA boundary are presented in Figure A.3. NO_2 monitoring was undertaken at 38 sites outside of an AQMA boundary during 2018.

Sites 90, 91, 92 and 93 were commissioned to monitor potential emissions from the new road; Lynnsport Way. The road is now open with results showing minimal impact.

Site 76 was commissioned in 2013 to monitor emissions from the addition of Sainsbury's and Tesco superstores to the Hardwick retail park. Concentrations recorded at Site 76 continue to remain well below the AQS NO_2 annual mean objective limit.

Eight new sites (Sites 61, 62, 63, 64, 72, 73, 74, and 83) were commissioned in 2016, funded by Palm Paper Ltd, to monitor NO_2 concentrations surrounding the Palm Paper facility, located off Saddlebow Industrial Estate. Annual mean NO_2 concentrations recorded at the eight sites have remained well below the annual AQS objective limit since commission, with Site 73 reporting the highest concentration of 24.3µg/m^3 in 2018.

In 2018, outside of the existing AQMAs, Site 5 reported the highest annual mean NO2 concentration (28.8µg/m). Site 5 is located by Bay D within the King's Lynn Bus Station. Adjacent to this, Site 86 recorded an annual mean NO2 concentration of 27.1µg/m3 (32.3% under the AQS objective limit). Site 86 was commissioned due to public concerns relating to emissions around the taxi rank located within Vancouver (Sainsbury's) car park. No exceedance of the annual mean NO2 AQS objective limit has been reported at site 86 within the past five years, with Site 5 last exceeding in 2014 (prior to tube relocation due to the renovation of the bus station).

Based on historical and 2018 monitoring data, the AQMA boundaries are considered to be of relevance due to the absence of any reported exceedances at monitoring sites located outside of a declared AQMA boundary since 2014.

3.2.2 Particulate Matter (PM_{10})

Table A.5 – in Appendix A compares the ratified and adjusted monitored PM_{10} annual mean concentrations for the past 5 years with the air quality objective of 40µg/m^3.

Table A.6 in Appendix A compares the ratified continuous monitored PM_{10} daily mean concentrations for the past 5 years with the air quality objective of 50µg/m^3, not to be exceeded more than 35 times per year.

No exceedances of either the annual mean or short term (24-hour mean) AQS objective was reported at any site throughout King's Lynn during 2018, a trend prevalent since 2014.

Figure A.4 presents trends in annual mean PM10 concentrations measured at the five automatic monitoring sites over the past 5 years. It can be seen that overall the annual mean PM10 concentration has remained steady between 2014 and 2018, with an overall decrease largely observed. The highest recorded concentration over the past five years was reported at Site OS1 and OS2 (21µg/m3) for 2016. OS1 is located along Page Stair Lane, King's Lynn, whilst OS2 was located along Furlong Road, Stoke Ferry.

Table A.6 – 24-Hour Mean PM10 Monitoring Results in Appendix A shows the number of exceedances of the PM_{10} daily mean air quality objective of 50µg/m^3 at the five automatic monitoring sites. It can be seen that the number of exceedances have been well below the limit of 35 exceedances a year for the past five years.

Within Stoke Ferry, due to previous recorded levels of PM_{10} and local concerns, particulate monitoring is being undertaken at three locations within the village (CM4, OS4, and OS5) using two OSIRIS units and a TEOM. The results show that no exceedances of the PM_{10} annual mean concentration or 24-hour mean have been recorded since these three sites were commissioned. The results will be explored in more detail later in 2019 through completion of a detailed assessment.

3.2.3 Particulate Matter ($PM_{2.5}$)

$PM_{2.5}$ is regulated by standards in the UK which presently places no statutory duty on Local Authorities to report against the annual mean objective limit. These standards are scheduled to be legally enforced in 2020. Nonetheless, the Council undertake monitoring of $PM_{2.5}$ within the borough indirectly via four Osiris dust monitors. The MCERTs accreditation for the Osiris instrument is only for the indicative measurement of PM_{10} and not $PM_{2.5}$, therefore the $PM_{2.5}$ concentrations should not be taken as absolute.

Table A.7 – in Appendix A presents the ratified and adjusted monitored $PM_{2.5}$ annual mean concentrations for the past 5 years.

There were no exceedances of the obligatory annual mean standard of 25µg/m^3 at any of the monitoring sites.

Figure A.5 presents trends in annual mean $PM_{2.5}$ concentrations measured at the five automatic monitoring sites for the past 3 years, since monitoring began. It can be seen that annual mean $PM_{2.5}$ concentrations have been below the obligatory annual mean standard of 25µg/m^3 for the previous three years (2016-2018). $PM_{2.5}$ concentrations have remained largely constant across all four sites, however OS4 has experienced the largest shift, a 3.8µg/m^3 reduction since 2016.

4 Conclusions and Priorities

During the 2018 reporting year, BCKLWM demonstrated proactive steps to stabilising and improving air quality across the Borough. These measures include the development of the King's Lynn Transport Study, the relocation of monitoring in response to complaints and the consideration to update the existing AQAP in-line with the completed source apportionment dispersion modelling exercise.

During 2018 there was only one reported exceedance of the annual mean NO_2 AQS objective limit in-line with relevant exposure (Site 2), located within the Town Centre AQMA. Four additional sites reported NO_2 annaul mean concentrations to be within 10% of the AQS objective. All four sites were situated within the declared AQMAs.

The main priorities for the Council in 2019 are to:

- Continue to monitor both NO_2 and PM_{10} concentrations throughout the Borough, notably within both AQMAs;
- Undertake a detailed assessment in Stoke Ferry;
- Regularly review the locations within the monitoring network to ensure that any hotspots are identified;
- Complete the King's Lynn Transport Study and the supporting dispersion modelling exercise; and
- Update the existing AQAP with dispersion modelling outputs and outcomes from the King's Lynn Transport Study.

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)
CM1	Southgates Park, King's Lynn	Roadside	562225	319191	NO_2	YES	Chemiluminescent	N/A	5	1.7
CM2	Gaywood, King's Lynn	Roadside	563437	320472	NO_2	YES	Chemiluminescent	5	1	1.7
CM3	North Lynn, King's Lynn	Roadside	562086	321325	PM_{10}	NO	TEOM	35	17	3
CM4	Lynn Road, Stoke Ferry	Roadside	570339	300083	PM_{10}	NO	TEOM	5	1	3
OS1 (3)	Page Stair Lane, King's Lynn	Roadside	561527	320437	PM_{10} / $PM_{2.5}$	NO	Osiris	5	3.3	3.5
OS2 (3)	Lynn Road, Stoke Ferry	Roadside	570339	300083	PM_{10} / $PM_{2.5}$	NO	Osiris	5	1	3.5
OS3 (3)	Estuary Road, King's Lynn	Roadside	561593	321466	PM_{10} / $PM_{2.5}$	NO	Osiris	2	1	3.5
OS4 (3)	Wretton Road, Stoke Ferry	Roadside	570438	299905	PM_{10} / $PM_{2.5}$	NO	Osiris	24	19	3.5
OS5 (3)	Buckenham Drive, King's Lynn	Roadside	570264	299943	PM_{10} / $PM_{2.5}$	NO	Osiris	12	1	3.2

Notes:

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

(2) N/A if not applicable.

(3) The Osiris monitors are not an equivalence method of monitoring for either PM_{10} or $PM_{2.5}$. The monitoring is accredited by the Environmental Agency's MCERTs scheme (Monitoring Certification Scheme) for indicative PM_{10} monitoring, but no accreditation is held by the Osiris for monitoring of $PM_{2.5}$.

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)
1	Town Centre 1	Roadside	562073	320304	NO_2	TC	2	2	NO	2.5
2	Town Centre 4	Roadside	562100	320222	NO_2	TC	0	2	NO	2.4
3	Town Centre 5	Roadside	562117	320095	NO_2	TC	0	1.5	NO	2.4
5	Bus Station - Shelters, Bay D	Roadside	562003	320099	NO_2	N	N/A	N/A	NO	2.2
6,7,8	Southgates Monitoring Station	Roadside	562226	319191	NO_2	TC	No but property façade 4m from kerb further north	5	YES	3.2
9	Mill Fleet	Roadside	561912	319711	NO_2	N	0	4	NO	2.5
10	London Road 1	Roadside	562101	319679	NO_2	TC	0	3	NO	1.4
11	London Road 2	Roadside	562165	319575	NO_2	TC	0	3	NO	2.2
12	London Road 3	Roadside	562243	319452	NO_2	TC	1	3	NO	2.1
13	London Road 4	Roadside	562264	319375	NO_2	TC	0	4.5	NO	2.2
14	London Road 5	Roadside	562227	319266	NO_2	TC	0.5	4	NO	2.2
15	Southgates	Roadside	562190	319102	NO_2	N	1	0.5	NO	2.4
18	Hardwick Rd	Roadside	562266	319043	NO_2	N	0	7	NO	1.6
19	Vancover Avenue	Roadside	562277	319098	NO_2	N	0	6	NO	1.5
20	London Road 10	Roadside	562244	319261	NO_2	TC	0	3.5	NO	2.2
22	London Road 6	Roadside	562285	319386	NO_2	TC	0	5	NO	1.3

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)
23	London Road 7	Roadside	562162	319614	NO_2	TC	0	4.5	NO	2.1
24	London Road 8	Roadside	562136	319651	NO_2	TC	0	5.5	NO	2.2
25	The Walks	Roadside	562191	319695	NO_2	N	0	75	NO	1.7
26	Town Centre 7	Roadside	562131	319996	NO_2	TC	0	2	NO	2.3
27	St John's Terrace	Roadside	562178	319999	NO_2	TC	3	2	NO	2.1
28	St John's Terrace/Blackfriar's	Roadside	562253	320015	NO_2	TC	0	1.5	NO	2.6
29	Waterloo Street	Kerbside	562175	320055	NO_2	N	2.5	1	NO	1.6
30	Portland Street	Kerbside	562204	320108	NO_2	N	2.5	1	NO	2.4
31	Town Centre 2	Roadside	562129	320132	NO_2	TC	0	2	NO	2.3
32	Town Centre 3	Roadside	562119	320216	NO_2	TC	0	2	NO	2.4
33	Wellesley Street	Roadside	562203	320159	NO_2	N	2.5	0.5	NO	2.4
34	Blackfriars 2	Roadside	562244	320129	NO_2	TC	0	2.5	NO	2.4
35	Blackfriars 1	Roadside	562245	320238	NO_2	TC	3	1.5	NO	2.3
36	Norfolk Street	Roadside	562219	320319	NO_2	N	0	2	NO	2.2
37	Blackfriars 3	Roadside	562254	320259	NO_2	TC	N/A	2	NO	2.5
38	Littleport Street	Roadside	562257	320323	NO_2	TC	0	2.5	NO	2.4
39	Gaywood Road 2	Roadside	562822	320427	NO_2	N	0	7	NO	5
40	The Swan (1) Gayton Road	Roadside	563490	320469	NO_2	GC	0	2	NO	2.5
41	Wootton Road 2	Roadside	563478	320515	NO_2	GC	0	2	NO	3.4
42	Wootton Road 1	Roadside	563480	320582	NO_2	GC	0	3	NO	1.7

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)
43	Lynn Road 1	Roadside	563412	320477	NO_2	GC	0	5	NO	3.4
44	Lynn Road 2	Roadside	563377	320484	NO_2	GC	0	2	NO	3.4
45	Gaywood Road 3	Roadside	563202	320488	NO_2	N	0	4.5	NO	2.2
46	Gaywood Road 1	Roadside	562565	320509	NO_2	N	0	6.5	NO	2.09
47	Austin Street 1	Roadside	562186	320376	NO_2	TC	0.5	1	NO	1.7
48	Austin Street 2	Roadside	562180	320365	NO_2	TC	0	2	NO	2.6
51	Wootton Road 3	Roadside	563521	320628	NO_2	N	6	1.5	NO	1.8
52	Lynn Road 3	Roadside	563289	320504	NO_2	N	5.5	1	NO	1.6
58	NORR	Roadside	562171	319019	NO_2	N	18	2	NO	2.5
61	Sydney Terrace	Roadside	561854	318272	NO_2	N	0	3.5	NO	1.55
62	Burney Road	Roadside	561604	318601	NO_2	N	0	7	NO	1.55
63	High Road, Saddlebrow 1	Roadside	560593	315712	NO_2	N	0	15	NO	1.7
64	High Road, Saddlebrow 2	Roadside	560917	316766	NO_2	N	0	22	NO	1.7
66	Gaywood Road	Urban Background	562595	320527	NO_2	N	0	N/A	NO	2.4
67	Greyfriars , London Road	Urban Background	562236	319579	NO_2	N	0	N/A	NO	2.3
68	Nursery, London Road	Urban Background	562143	319838	NO_2	N	0	N/A	NO	1.6
69	Whitefriars 1, Whitefriars Road	Urban Background	561994	319395	NO_2	N	0	N/A	NO	2.2
70	Whitefriars 2, Whitefriars Road	Urban Background	561930	319355	NO_2	N	0	N/A	NO	2.4

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)
72	Ferry Square, West Lynn	Roadside	561223	320295	NO_2	N	0.5	1.5	NO	2.2
73	Main Road, West Winch	Roadside	563161	315848	NO_2	N	10	11	NO	1.7
74	Saddlebow Caravan Park	Roadside	561754	317910	NO_2	N	0	1	NO	2.2
75	The Swan (2) Gayton Road	Roadside	563469	320469	NO_2	GC	0	2	NO	2.8
76	Hardwick Road	Roadside	562597	318740	NO_2	N	1	8	NO	1.58
79	Tennyson Ave	Roadside	562804	320423	NO_2	N	0	2	NO	3.8
83	The Elms	Suburban	560779	318509	NO_2	N	0	115	NO	1.7
86	Bus Station - Taxi Rank	Other	562019	320139	NO_2	N	0	N/A	NO	2.2
87	Albion Street	Roadside	562103	320164	NO_2	TC	0	2.6	NO	2.1
88	Tennyson Avenue (2)	Roadside	562795	320290	NO_2	N	0	7.4	NO	2
89	Whitefriars Terrace	Roadside	561888	319467	NO_2	N	0	1	NO	2.4
90	Spenser Road	Roadside	563366	322065	NO_2	N	0	8	NO	1.8
91	Reid Way	Roadside	563255	321613	NO_2	N	0	8	NO	2.5
92	Garden Court	Roadside	563256	321589	NO_2	N	0	16	NO	2
93	Front Way	Roadside	563213	321283	NO_2	N	0	9.7	NO	2

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.

TC = Town Centre AQMA

GC = Gaywood Clock AQMA

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 (µg/m³) [3]				
					2014	2015	2016	2017	2018
CM1	Roadside	Automatic	97.9	97.9	21.0	21.0	25.0	25.0	23.9
CM2	Roadside	Automatic	96.3	96.3	36.0	**42.0**	**45.0**	38.0	34.5
1	Roadside	Diffusion Tube	100.0	91.7	38.2	36.6	35.5	35.9	33.8
2	Roadside	Diffusion Tube	100.0	91.7	**47.0**	**46.6**	**44.6**	**45.5**	**43.2**
3	Roadside	Diffusion Tube	100.0	100.0	39.7	36.9	38.6	38.5	37.4
5	Roadside	Diffusion Tube	100.0	100.0	-	-	32.4	30.4	28.8
6,7,8	Roadside	Diffusion Tube	100.0	94.4	26.7	25.2	24.6	24.6	23.9
9	Roadside	Diffusion Tube	100.0	100.0	21.2	20.3	20.8	19.5	19.9
10	Roadside	Diffusion Tube	100.0	100.0	36.7	37.8	36.3	37.2	36.2
11	Roadside	Diffusion Tube	100.0	100.0	30.4	28.5	27.9	27.7	28.1
12	Roadside	Diffusion Tube	100.0	100.0	34.7	33.1	32.0	33.5	29.8
13	Roadside	Diffusion Tube	100.0	100.0	31.5	30.3	31.0	29.9	28.8
14	Roadside	Diffusion Tube	100.0	100.0	35.0	33.1	33.1	33.6	33.6
15	Roadside	Diffusion Tube	100.0	100.0	38.4	37.2	35.4	34.9	35.3
18	Roadside	Diffusion Tube	100.0	91.7	26.5	25.8	24.5	25.9	24.1

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
19	Roadside	Diffusion Tube	100.0	100.0	23.6	23.7	23.0	24.0	21.9
20	Roadside	Diffusion Tube	100.0	100.0	33.1	30.8	30.6	28.2	30.0
22	Roadside	Diffusion Tube	100.0	100.0	34.2	31.4	32.6	30.1	34.0
23	Roadside	Diffusion Tube	100.0	100.0	35.3	31.6	32.5	29.6	32.6
24	Roadside	Diffusion Tube	100.0	100.0	32.0	28.7	28.9	26.4	30.5
25	Roadside	Diffusion Tube	100.0	100.0	16.3	15.0	14.4	15.3	15.9
26	Roadside	Diffusion Tube	100.0	100.0	36.0	33.8	31.5	31.4	32.9
27	Roadside	Diffusion Tube	100.0	100.0	30.0	27.5	28.5	27.8	28.5
28	Roadside	Diffusion Tube	100.0	100.0	30.0	30.2	30.0	30.5	28.9
29	Kerbside	Diffusion Tube	100.0	100.0	19.1	18.6	18.3	18.7	19.0
30	Kerbside	Diffusion Tube	100.0	100.0	21.3	21.4	20.4	19.7	19.4
31	Roadside	Diffusion Tube	100.0	100.0	30.9	30.4	28.2	28.3	30.2
32	Roadside	Diffusion Tube	100.0	100.0	30.9	27.7	29.0	28.3	28.8
33	Roadside	Diffusion Tube	100.0	100.0	29.7	27.4	26.1	27.8	27.4
34	Roadside	Diffusion Tube	100.0	100.0	32.1	30.1	28.7	28.9	31.1

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
35	Roadside	Diffusion Tube	100.0	100.0	29.0	28.5	27.2	28.2	27.7
36	Roadside	Diffusion Tube	100.0	100.0	29.2	27.9	27.3	27.6	27.4
37	Roadside	Diffusion Tube	100.0	100.0	33.1	27.3	26.5	26.5	30.6
38	Roadside	Diffusion Tube	100.0	100.0	35.1	32.5	31.5	33.2	34.0
39	Roadside	Diffusion Tube	100.0	100.0	26.8	24.3	24.1	24.3	24.5
40	Roadside	Diffusion Tube	100.0	100.0	32.8	31.2	30.2	31.2	31.3
41	Roadside	Diffusion Tube	100.0	100.0	35.2	31.2	32.2	32.1	36.7
42	Roadside	Diffusion Tube	100.0	100.0	29.7	29.8	29.3	30.5	30.0
43	Roadside	Diffusion Tube	100.0	100.0	30.9	28.7	30.0	29.2	30.9
44	Roadside	Diffusion Tube	100.0	100.0	36.6	31.8	32.8	32.4	36.0
45	Roadside	Diffusion Tube	100.0	100.0	26.8	26.0	27.0	25.2	28.8
46	Roadside	Diffusion Tube	100.0	100.0	26.2	23.8	24.0	22.5	24.6
47	Roadside	Diffusion Tube	100.0	100.0	34.9	29.6	30.3	29.3	30.6
48	Roadside	Diffusion Tube	100.0	100.0	32.1	28.4	26.8	27.8	27.7
51	Roadside	Diffusion Tube	100.0	100.0	19.0	17.3	18.3	19.0	18.8

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
52	Roadside	Diffusion Tube	100.0	100.0	28.7	27.2	27.3	28.7	30.1
58	Roadside	Diffusion Tube	100.0	100.0	28.9	26.7	28.2	24.7	28.2
61	Roadside	Diffusion Tube	100.0	100.0	-	-	-	16.9	16.7
62	Roadside	Diffusion Tube	100.0	100.0	-	-	-	14.9	13.9
63	Roadside	Diffusion Tube	100.0	100.0	-	-	-	9.7	10.2
64	Roadside	Diffusion Tube	100.0	100.0	-	-	-	10.4	10.5
66	Urban Background	Diffusion Tube	100.0	83.3	22.6	20.9	20.4	18.5	20.6
67	Urban Background	Diffusion Tube	100.0	100.0	16.8	16.4	15.7	17.2	16.4
68	Urban Background	Diffusion Tube	100.0	83.3	19.4	18.8	19.0	19.5	20.5
69	Urban Background	Diffusion Tube	100.0	100.0	14.1	12.8	12.7	12.5	13.7
70	Urban Background	Diffusion Tube	100.0	100.0	13.9	12.4	12.3	12.7	12.7
72	Roadside	Diffusion Tube	100.0	100.0	-	-	-	12.3	12.3
73	Roadside	Diffusion Tube	100.0	91.7	-	-	-	19.6	24.3
74	Roadside	Diffusion Tube	100.0	100.0	-	-	-	14.2	14.2
75	Roadside	Diffusion Tube	100.0	100.0	35.1	33.0	32.2	31.6	34.1

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
76	Roadside	Diffusion Tube	100.0	100.0	20.8	18.8	18.2	19.6	18.8
79	Roadside	Diffusion Tube	100.0	91.7	34.7	34.0	34.6	32.8	32.7
83	Suburban	Diffusion Tube	100.0	100.0	-	-	-	11.8	12.9
86	Other	Diffusion Tube	100.0	75.0	-	27.6	27.7	27.6	27.1
87	Roadside	Diffusion Tube	100.0	83.3	-	28.7	30.5	29.3	32.0
88	Roadside	Diffusion Tube	100.0	100.0	-	18.9	18.3	17.8	18.2
89	Roadside	Diffusion Tube	100.0	100.0	-	13.3	13.0	13.2	13.2
90	Roadside	Diffusion Tube	100.0	100.0	-	-	14.0	15.0	15.9
91	Roadside	Diffusion Tube	100.0	100.0	-	-	13.6	13.7	14.4
92	Roadside	Diffusion Tube	100.0	100.0	-	-	12.9	12.6	12.9
93	Roadside	Diffusion Tube	100.0	100.0	-	-	13.1	11.9	13.3

☒ **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 $40\mu g/m^3$ are shown in **bold**.

NO_2 annual means exceeding $60\mu g/m^3$, 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 Measured at Monitoring Sites: Town Centre AQMA

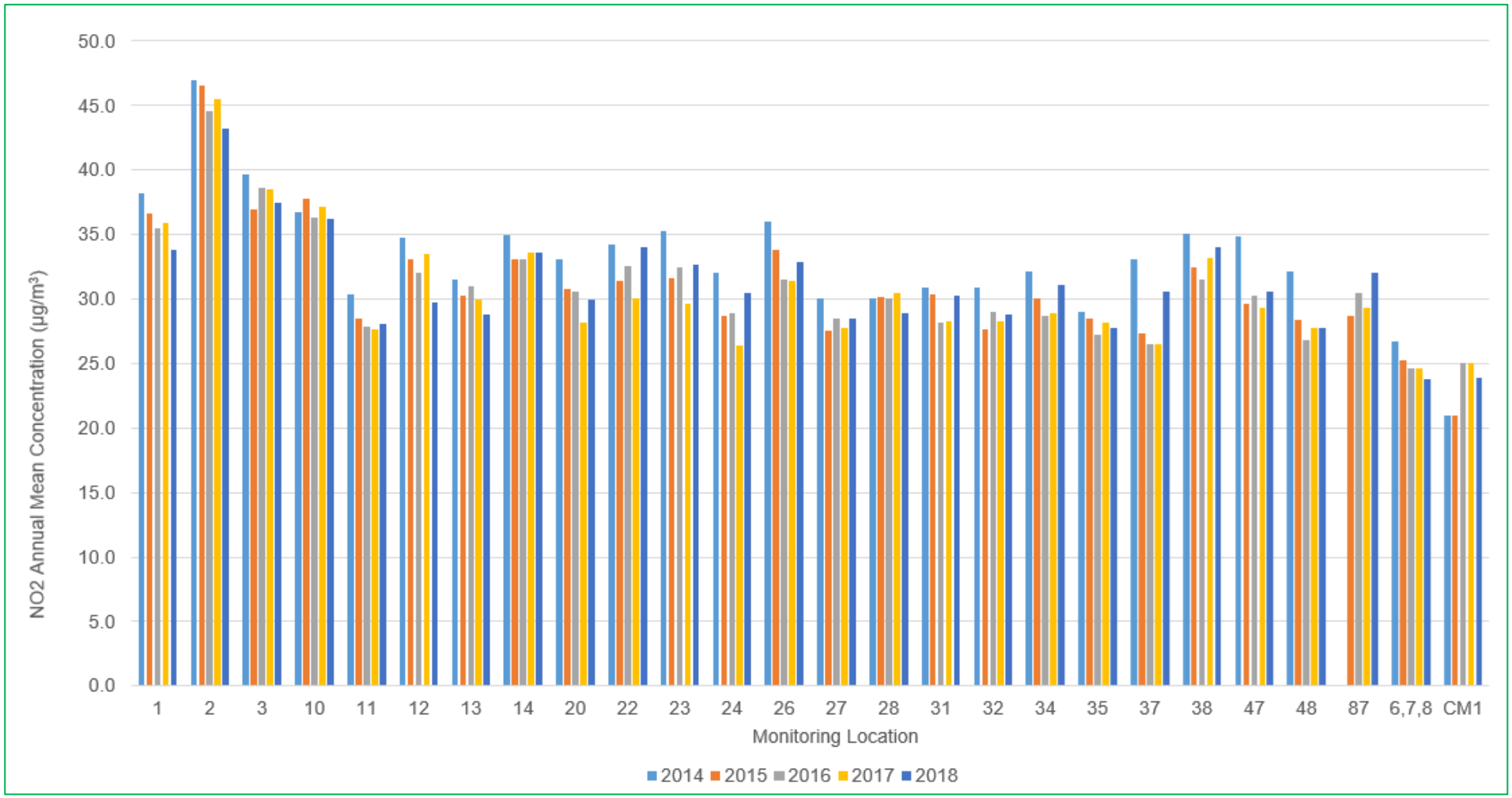


Figure A.2 – Trends in Annual Mean NO_2 Concentrations Measured at Monitoring Sites: Gaywood AQMA

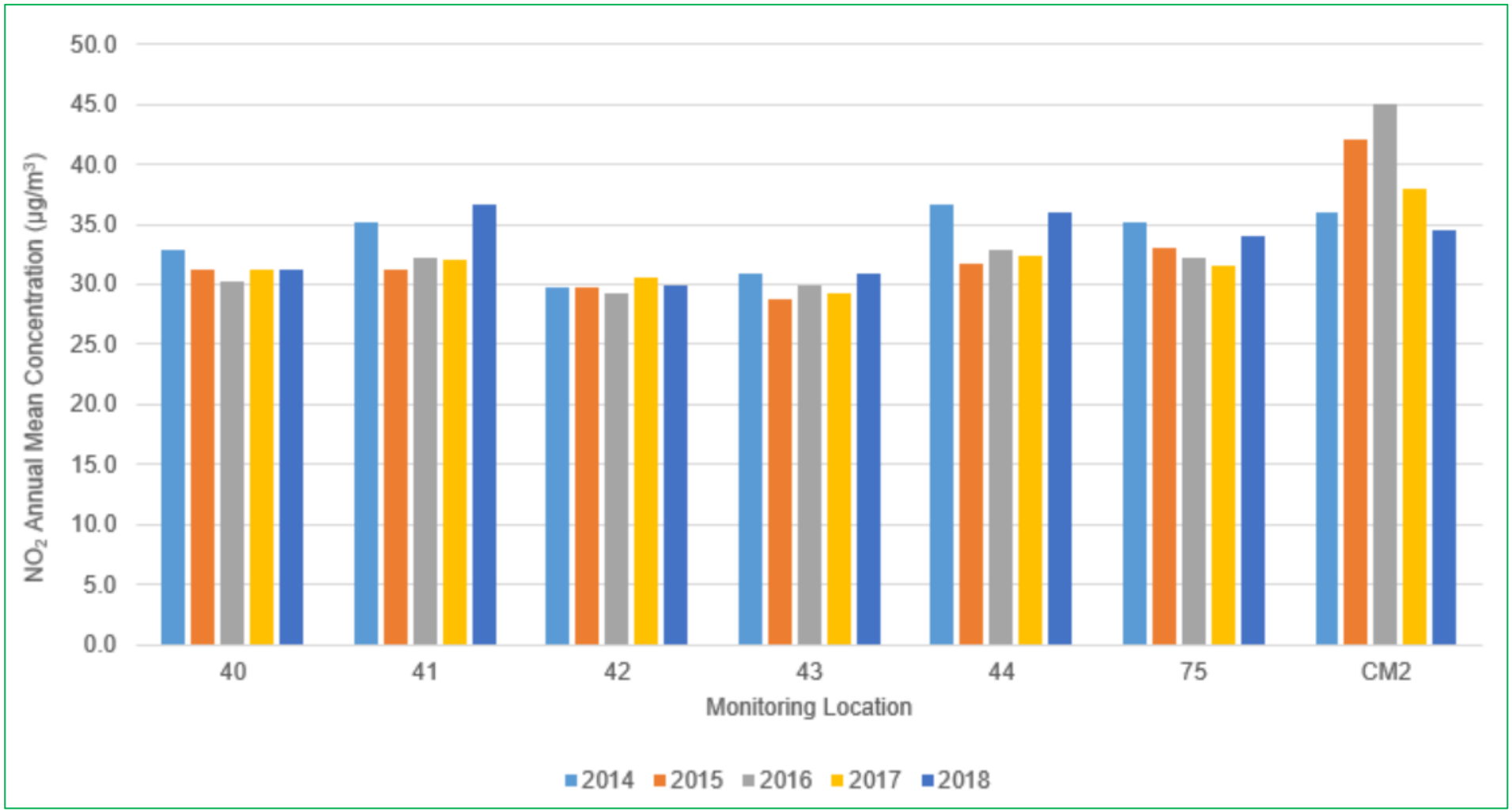


Figure A.3 – Trends in Annual Mean NO_2 Concentrations Measured at Monitoring Sites: Outside of AQMAs

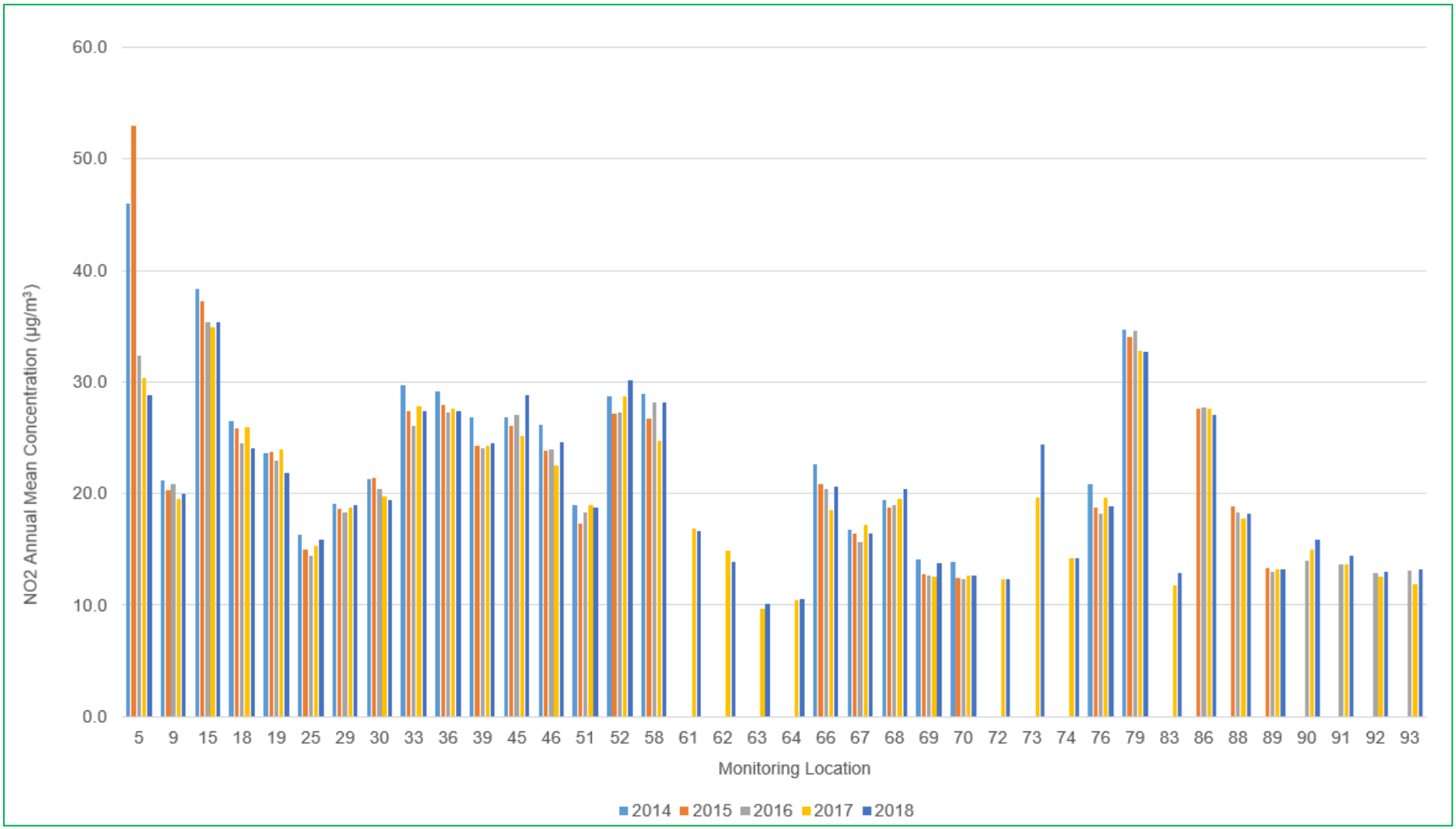


Table A.4 – 1-Hour Mean NO_2 Monitoring Results

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
CM1	Roadside	Automatic	97.9%	97.9%	0	0	0	0	0
CM2	Roadside	Automatic	96.3%	96.3%	0	0	0	0	0

Notes:

Exceedances of the NO_2 1-hour mean objective (200 µg/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.

Table A.5 – Annual Mean PM_{10} Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2018 (%) (2)	PM_{10} Annual Mean Concentration ($\mu g/m^3$) (3)				
				2014	2015	2016	2017	2018
CM3**	Roadside	98.5%	13.9%	18.0	18.0	18.0	19.0	-
CM4**	Roadside	99.8%	18.9%	-	-	-	-	18.4*
OS1	Roadside	89.3%	89.3%	19.0	19.0	21.0	18.0	16.4
OS2**	Roadside	99.8%	65.4%	18.0	16.0	21.0	17.0	10.3
OS3	Roadside	82.2%	82.2%	16.0	20.0	15.0	13.0	14.6
OS4	Roadside	99.2%	88.7%	-	-	16.0	12.0	13.2
OS5**	Roadside	54.1%	18.6%	-	-	-	-	12.7*

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

Notes:

Exceedances of the PM_{10} annual mean objective of 40 $\mu g/m^3$ 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) All means have been "annualised" as per Boxes 7.9 and 7.10 in LAQM.TG16, valid data capture for the full calendar year is less than 75%. See Appendix C for details.

* Due to low data capture (>25% for 2018) for sites CM4 and OS5 2018 monitoring results for these monitors refer to the period and should not be taken as absolute.

** Monitoring was either commissioned or decommissioned in 2018 – resulting in a low data capture

Figure A.4 – Trends in Annual Mean PM_{10} Concentrations

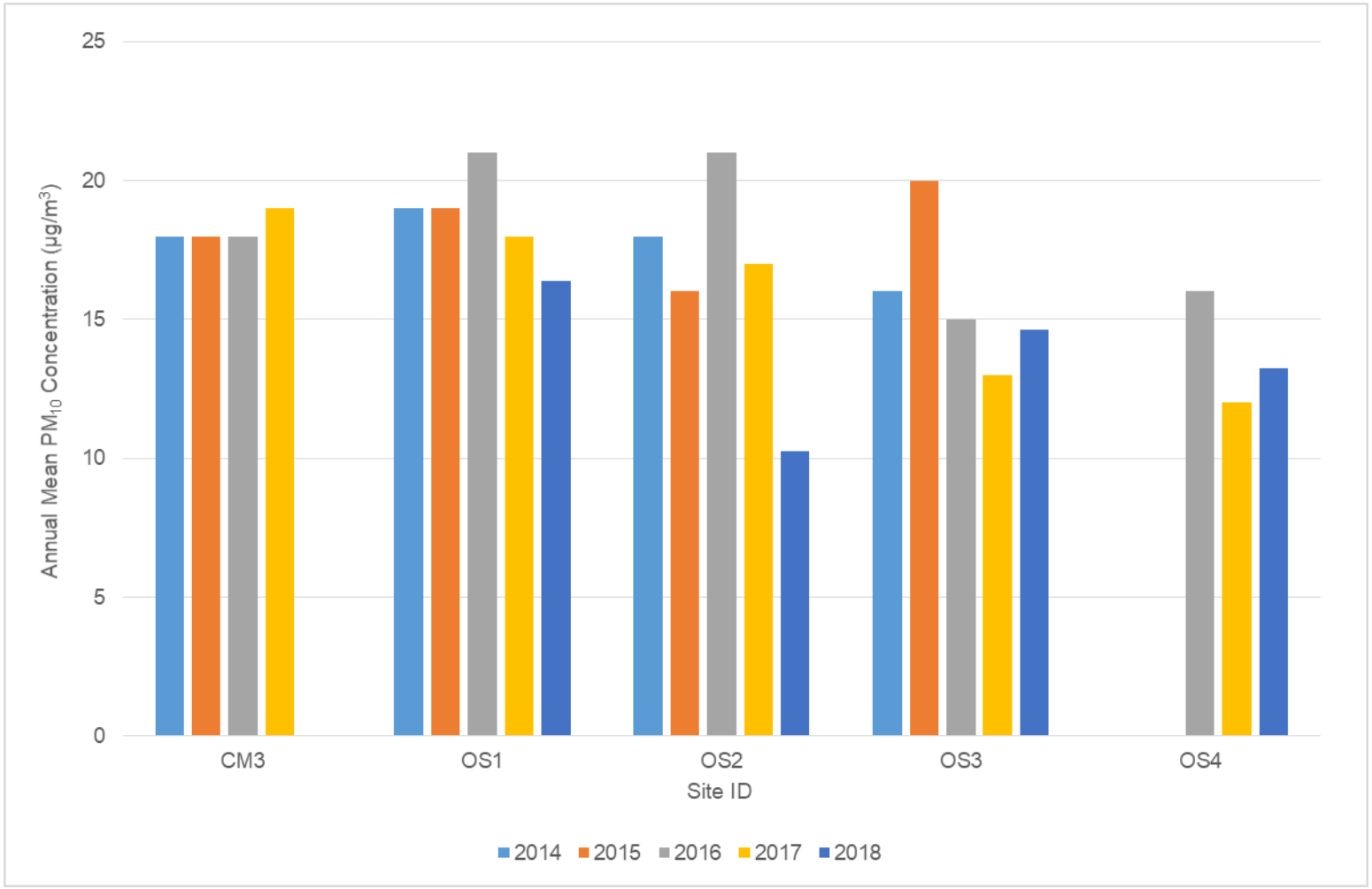


Table A.6 – 24-Hour Mean PM_{10} Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2018 (%) (2)	PM_{10} 24-Hour Means > 50µg/m^3 (3)				
				2014	2015	2016	2017	2018
CM3*	Roadside	98.5%	13.9%	4	3	5	3	0 (23.6)
CM4*	Roadside	99.8%	18.9%					0 (29.8)
OS1	Roadside	89.3%	89.3%	7	4	9	3	4
OS2*	Roadside	99.8%	65.4%	3	9	3	2	0 (16.3)
OS3	Roadside	82.2%	82.2%	2	8	2	0 (21)	0 (23.4)
OS4	Roadside	99.2%	88.7%	-	-	0	0	0
OS5*	Roadside	54.1%	18.6%	-	-	-	-	0 (20.9)

Notes:

Exceedances of the PM_{10} 24-hour mean objective (50µg/m^3 not to be exceeded more than 35 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 90.4th percentile of 24-hour means is provided in brackets.

* Monitoring was either commissioned or decommissioned in 2018 – resulting in a low data capture

Table A.7 – $PM_{2.5}$ Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2018 (%) (2)	$PM_{2.5}$ Annual Mean Concentration ($\mu g/m^3$) (3)				
				2014	2015	2016	2017	2018
OS1	Roadside	89.3%	89.3%	-	-	6.0	6.0	7.0
OS2**	Roadside	99.8%	65.4%	-	-	6.0	7.0	4.9
OS3	Roadside	82.2%	82.2%	-	-	4.0	6.0	6.9
OS4	Roadside	99.2%	88.7%	-	-	10.0	5.0	6.2
OS5**	Roadside	54.1%	18.6%	-	-	-	-	5.9*

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

Notes:

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

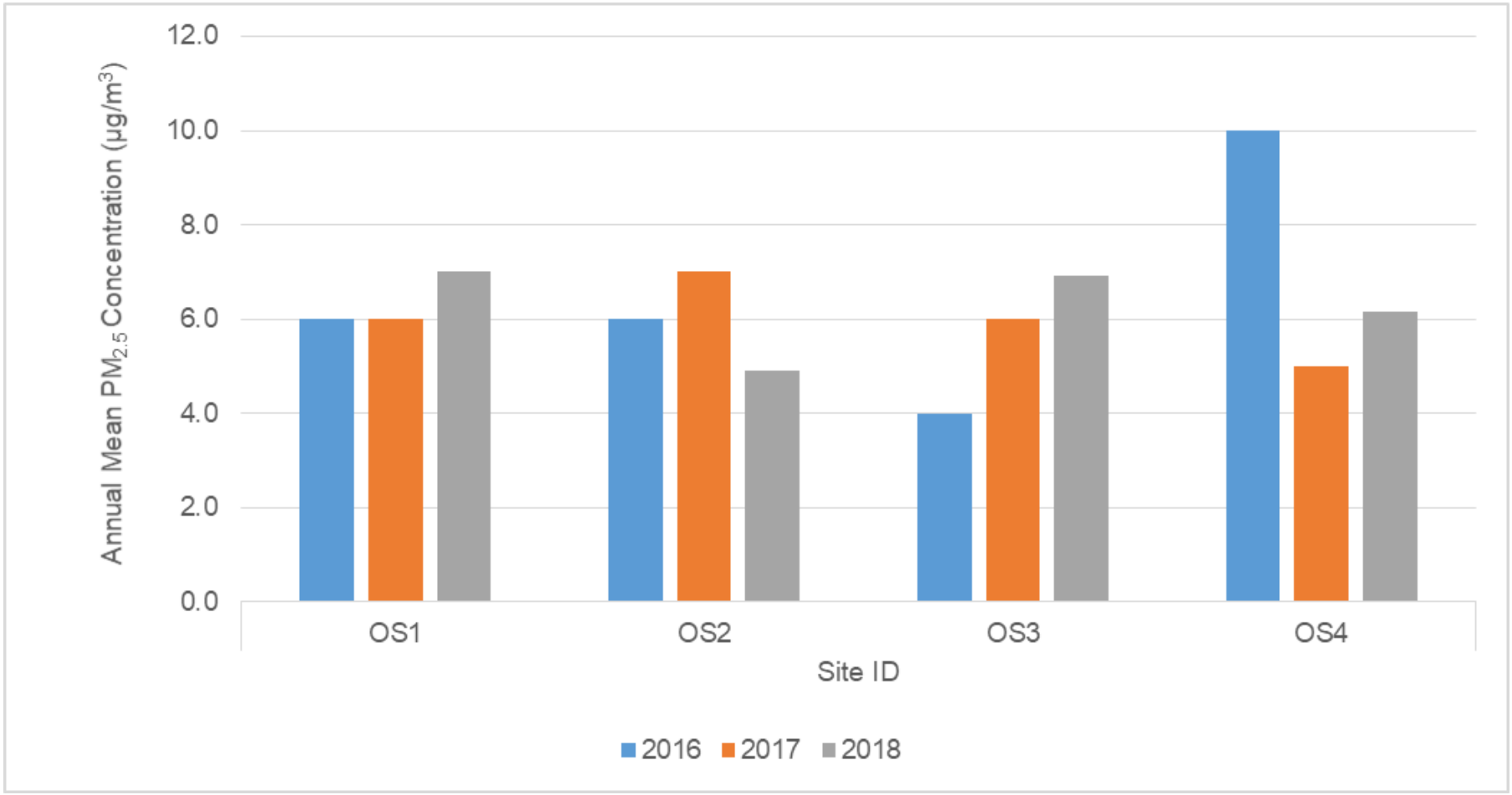
(2) Data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

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

* Due to low data capture (>25% for 2018) for Site OS5 2018 monitoring results for this monitor refers to the period and should not be taken as absolute.

** Monitoring was either commissioned or decommissioned in 2018 – resulting in a low data capture

Figure A.5 – Trends in Annual Mean $PM_{2.5}$ Concentrations



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 (0.93) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
1	37	41	39	36	26	28	41	32	32	Missing	44	44	36.4	33.8	-
2	42	43	42	43	44	37	56	49	54	49	52	Missing	46.5	43.2	-
3	40	44	40	37	47	31	37	37	37	44	40	49	40.3	37.4	-
5	27	32	33	34	34	25	31	25	27	32	40	32	31.0	28.8	-
6	27	26	26	24	24	21	24	22	24	23	33	32	25.5	23.7	-
7	26	Missing	26	26	23	21	24	23	22	29	27	31	25.3	23.5	-
8	30	Missing	29	25	22	21	25	23	24	27	29	31	26.0	24.2	-
9	25	24	26	20	19	16	18	17	15	24	28	25	21.4	19.9	-
10	37	46	39	41	39	31	41	37	33	44	43	36	38.9	36.2	-
11	32	29	32	29	28	24	34	29	30	33	36	26	30.2	28.1	-
12	33	34	36	32	24	23	35	31	31	33	33	39	32.0	29.8	-
13	40	29	30	31	27	24	31	29	30	32	31	38	31.0	28.8	-
14	36	35	36	35	33	28	39	33	38	37	35	48	36.1	33.6	-
15	33	33	39	40	51	38	44	34	27	41	35	41	38.0	35.3	-
18	26	28	31	Void	19	21	26	24	26	27	31	26	25.9	24.1	-
19	19	25	27	25	20	18	26	23	23	24	26	26	23.5	21.9	-

Site ID	NO_2 Mean Concentrations (µg/m^3)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean		
													Raw Data	Bias Adjusted (0.93) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
20	34	31	36	34	34	27	34	29	25	33	38	32	32.3	30.0	-
22	31	35	62	37	34	31	39	30	28	38	38	36	36.6	34.0	-
23	28	39	39	37	44	37	39	29	25	36	38	30	35.1	32.6	-
24	30	34	37	36	40	35	35	25	22	32	35	32	32.8	30.5	-
25	22	20	21	17	11	9	13	14	16	19	21	22	17.1	15.9	-
26	32	34	34	37	40	35	40	33	31	40	32	36	35.3	32.9	-
27	29	30	32	31	33	28	31	26	31	33	30	34	30.7	28.5	-
28	33	28	34	31	30	24	32	32	31	35	31	32	31.1	28.9	-
29	25	26	24	19	15	13	16	18	18	22	24	25	20.4	19.0	-
30	22	26	22	19	21	17	20	18	19	23	25	18	20.8	19.4	-
31	32	34	34	31	33	30	36	30	27	37	37	29	32.5	30.2	-
32	31	35	35	30	28	26	33	28	26	32	37	31	31.0	28.8	-
33	36	33	31	28	24	19	30	28	25	30	36	34	29.5	27.4	-
34	37	33	33	34	28	21	33	31	34	34	37	46	33.4	31.1	-
35	31	31	30	28	28	23	32	28	30	33	30	34	29.8	27.7	-
36	31	32	32	27	25	23	32	27	24	29	36	35	29.4	27.4	-
37	34	34	37	31	37	34	35	27	28	34	33	31	32.9	30.6	-
38	37	38	41	38	34	24	39	34	27	39	45	43	36.6	34.0	-
39	29	31	31	26	24	18	24	25	24	28	28	28	26.3	24.5	-
40	38	35	35	36	26	25	35	34	35	36	34	35	33.7	31.3	-

Site ID	NO_2 Mean Concentrations (µg/m^3)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean		
													Raw Data	Bias Adjusted (0.93) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
41	38	41	46	40	38	39	43	36	32	40	44	37	39.5	36.7	-
42	34	32	35	29	28	27	38	31	29	35	33	36	32.3	30.0	-
43	32	36	34	31	39	31	34	31	30	37	30	34	33.3	30.9	-
44	39	43	41	37	41	39	44	33	28	40	41	39	38.8	36.0	-
45	30	34	33	32	40	30	30	24	24	34	31	30	31.0	28.8	-
46	25	30	31	25	29	26	25	21	21	27	29	28	26.4	24.6	-
47	34	37	36	33	32	25	35	31	29	35	35	33	32.9	30.6	-
48	31	35	35	31	20	18	31	30	29	27	37	34	29.8	27.7	-
51	27	25	25	21	14	13	16	18	16	20	24	23	20.2	18.8	-
52	34	35	31	31	38	30	36	29	26	34	32	33	32.4	30.1	-
58	31	35	34	29	32	24	30	24	23	31	41	30	30.3	28.2	-
61	26	21	22	17	12	9	11	16	16	19	23	23	17.9	16.7	-
62	18	18	18	15	9	9	11	13	13	16	20	19	14.9	13.9	-
63	17	15	13	10	7	6	6	8	8	11	15	15	10.9	10.2	-
64	15	16	14	11	9	7	8	8	8	12	15	13	11.3	10.5	-
66	27	27	24	23	18	17	20	19	22	Missing	Missing	25	22.2	20.6	-
67	23	20	22	17	11	9	14	16	17	18	24	21	17.7	16.4	-
68	27	26	26	21	17	14	Missing	Missing	17	23	25	24	22.0	20.5	-
69	20	22	20	14	11	7	11	11	11	15	19	16	14.8	13.7	-
70	20	18	18	11	9	6	10	10	10	15	22	15	13.7	12.7	-

Site ID	NO_2 Mean Concentrations (µg/m^3)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean		
													Raw Data	Bias Adjusted (0.93) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
72	19	17	18	12	8	7	9	10	11	15	18	15	13.3	12.3	-
73	28	36	42	24	30	25	25	20	17	17	Missing	24	26.2	24.3	-
74	21	21	19	12	11	11	11	12	13	17	18	17	15.3	14.2	-
75	37	46	36	40	33	28	41	31	31	32	47	38	36.7	34.1	-
76	23	24	24	22	12	10	18	21	20	22	24	23	20.3	18.8	-
79	36	34	31	34	35	31	37	35	Missing	39	39	36	35.2	32.7	-
83	16	19	18	8	12	11	12	12	11	15	17	15	13.8	12.9	-
86	28	32	Missing	29	Missing	22	29	Missing	29	31	33	29	29.1	27.1	-
87	29	Missing	Missing	35	42	36	38	28	32	36	39	29	34.4	32.0	-
88	24	21	23	18	14	13	17	17	18	22	26	22	19.6	18.2	-
89	17	17	18	15	10	8	11	11	10	16	20	17	14.2	13.2	-
90	21	20	21	16	11	10	14	15	16	18	23	20	17.1	15.9	-
91	20	19	18	15	10	9	12	13	15	17	20	18	15.5	14.4	-
92	20	17	16	12	9	7	11	12	12	15	19	17	13.9	12.9	-
93	20	18	18	13	9	6	10	11	13	17	19	17	14.3	13.3	-

☒ Local bias adjustment factor used

☐ National bias adjustment factor used

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

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

Notes:

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

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

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

(2) Distance corrected to nearest relevant public exposure if annual mean concentration exceeds or is within 10% of the AQS objective limit.

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

Diffusion Tube Local Bias Adjustment Factors

King's Lynn Council operate one continuous NO_2 analyser (Southgates) that has a triplicate site of diffusion tubes co-located at the monitoring site. A local bias adjustment factor has been calculated for the location using the Precision and Bias adjustment spreadsheet (v04), the output is presented below in Figure C.1. The calculated local bias adjustment factor was 0.93.

Figure C.1 - Local Bias Correction Output: Southgates (Tubes 6/7/8)

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements										Automatic Method		Data Quality Check	
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 µgm^{-3}	Tube 2 µgm^{-3}	Tube 3 µgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
1	03/01/2018	31/01/2018	27.0	26.0	30.0	28	2.1	8	5.2	26.6	98.8	Good	Good
2	31/01/2018	28/02/2018	26.0							29.1	99.9		Good
3	28/02/2018	28/03/2018	26.0	26.0	29.0	27	1.7	6	4.3	25.3	100.0	Good	Good
4	28/03/2018	02/05/2018	24.0	26.0	25.0	25	1.0	4	2.5	24.5	99.9	Good	Good
5	02/05/2018	06/06/2018	24.0	23.0	22.0	23	1.0	4	2.5	21.4	99.5	Good	Good
6	06/06/2018	04/07/2018	21.0	21.0	21.0	21	0.0	0	0.0	16.0	98.4	Good	Good
7	04/07/2018	01/08/2018	24.0	24.0	25.0	24	0.6	2	1.4	21.5	99.7	Good	Good
8	01/08/2018	05/09/2018	22.0	23.0	23.0	23	0.6	3	1.4	18.9	99.8	Good	Good
9	05/09/2018	03/10/2018	24.0	22.0	24.0	23	1.2	5	2.9	24.8	100.0	Good	Good
10	03/10/2018	31/10/2018	23.0	29.0	27.0	26	3.1	12	7.6	26.6	100.0	Good	Good
11	31/10/2018	05/12/2018	33.0	27.0	29.0	30	3.1	10	7.6	27.4	99.8	Good	Good
12	05/12/2018	09/01/2019	32.0	31.0	31.0	31	0.6	2	1.4	27.9	60.8	Good	r Data Captur
13													
												Good precision	Good Overall

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

Overall survey -->

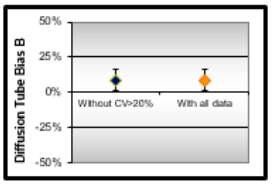
(Check average CV & DC from Accuracy calculations)

Site Name/ ID:

Precision: 11 out of 11 periods have a CV smaller than 20%

Accuracy (with 95% confidence interval) without periods with CV larger than 20%	
Bias calculated using 10 periods of data	
Bias factor A	0.93 (0.87 - 1)
Bias B	7% (0% - 15%)
Diffusion Tubes Mean:	25 µgm^{-3}
Mean CV (Precision):	5
Automatic Mean:	23 µgm^{-3}
Data Capture for periods used:	100%
Adjusted Tubes Mean:	23 (22 - 25) µgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 10 periods of data	
Bias factor A	0.93 (0.87 - 1)
Bias B	7% (0% - 15%)
Diffusion Tubes Mean:	25 µgm^{-3}
Mean CV (Precision):	5
Automatic Mean:	23 µgm^{-3}
Data Capture for periods used:	100%
Adjusted Tubes Mean:	23 (22 - 25) µgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

Diffusion Tube National Bias Adjustment Factor

The diffusion tubes used by King's Lynn Council are supplied and analysed by Gradko International, the tubes were prepared using the 20% TEA in acetone preparation method. The 2018 national bias adjustment factor for Gradko 20% TEA in water is 0.93, based on 30 studies, as derived from the national bias adjustment factor spreadsheet (Round 1 of 3)[7].

[7] National Diffusion Tube Bias Adjustment Factor Spreadsheet version 03/19 available at https://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html

Discussion of Choice of Bias Adjustment Factor to Use

The diffusion tube data has been corrected using a bias adjustment factor, which is an estimate of the difference between diffusion tube concentration and continuous monitoring, the latter assumed to be a more accurate method of monitoring. The Defra LAQM.TG(16) provides guidance with regard to the application of a bias adjustment factor to correct diffusion tube monitoring.

Triplicate co-location studies can be used to determine a local bias factor based on the comparison of diffusion tube results with data taken from NO_x/NO_2 continuous analysers. Alternatively, the national database of diffusion tube co-location surveys provides bias factors for the relevant laboratory and preparation method.

The local bias adjustment factor (0.93) has been used to adjust the 2018 diffusion tube data. The automatic monitor and co-located diffusion tubes all had good overall data capture for the period, whilst the diffusion tubes had good precision throughout. In addition, it is worth noting that the calculated local bias adjustment factor equalled the corresponding national bias adjustment factor reported in the 2019 (Round 1 of 3) publication – a factor based on 30 studies.

QA/QC of Automatic Monitoring

Data from the automatic monitoring stations is collected by Air Quality Data Management (AQDM) on behalf of the Council. The TEOM data has the Volatile Correction Model (VCM) for Indicative Gravimetric Equivalence applied, and the Osiris data has a gravimetric factor of 1.3 for Indicative Gravimetric Equivalence applied. Both the TEOM and NO_x analysers are serviced biannually by Air Monitors, and calibration data is collected fortnightly from the NO_x analysers by council officers and passed to AQDM who carry out any adjustment of the data. The Osiris instruments are serviced and calibrated annually by Turnkey Instruments.

QA/QC of Diffusion Tube Monitoring

Gradko International Ltd (Gradko) is a UKAS accredited laboratory and participates in the AIR-PT Scheme (a continuation of the Workplace Analysis Scheme for Proficiency (WASP) for NO_2 tube analysis and the Annual Field Inter-Comparison Exercise. These provide strict performance criteria for participating laboratories to meet, thereby ensuring NO_2 concentrations are reported to a high level of accuracy. The lab follows the procedures set out in the Harmonisation Practical Guidance.

In the 2018 AIR-PT results, AIR-PT AR024 (January to February 2018), AIR PT AR025 (April to May 2018), AIR PT AR027 (July to August 2018) and AIR PT AR028 (September to October 2018), Gradko scored 100%. The percentage score reflects the results deemed to be satisfactory based upon the z-score of < ±2.

Short-term to Long-term Data Adjustment

Monitoring data capture for 2018 was greater than 75% at all the monitoring locations apart from CM3, CM4 and OS2 for $PM_{2.5}$ and PM_{10}. However, as data capture for CM3 and CM4 was less than 25% for 2018, annualisation was subsequently only performed for OS2 for $PM_{2.5}$ and PM_{10}. This is in accordance with Defra's LAQM TG(16).

Details of the annualisation have been provided in Table C.1 to Table C.3. Due to the limited availability of PM_{10} monitoring within proximity to OS2, annualisation has been undertaken using only two monitoring locations.

Table C.1 - Annualisation of PM_{10} Data Recorded at Site OS2 from Nearby Continuous Monitoring Sites

OS2					
Site	Site Type	Annual Mean (µg/m^3)	Period Mean (µg/m^3)	2018 Data Capture (%)	Ratio Annual Mean / Period Mean
Nottingham Centre	Urban Background	16.3	16.3	94.9	1.004
Norwich Lakenfield	Urban Background	15.7	16.9	86.2	0.932
Average Ratio					**0.968**

Table C.2 - Annualisation of $PM_{2.5}$ Data Recorded at Site OS2 from Nearby Continuous Monitoring Sites

OS2					
Site	Site Type	Annual Mean (µg/m^3)	Period Mean (µg/m^3)	2018 Data Capture (%)	Ratio Annual Mean / Period Mean
Nottingham Centre	Urban Background	10.0	10.7	94.9	0.930
Norwich Lakenfield	Urban Background	10.2	10.8	89.2	0.946
Leicester University	Urban Background	10.5	10.6	100.0	0.992
Average Ratio					**0.956**

Table C.3 Annualisation for OS2

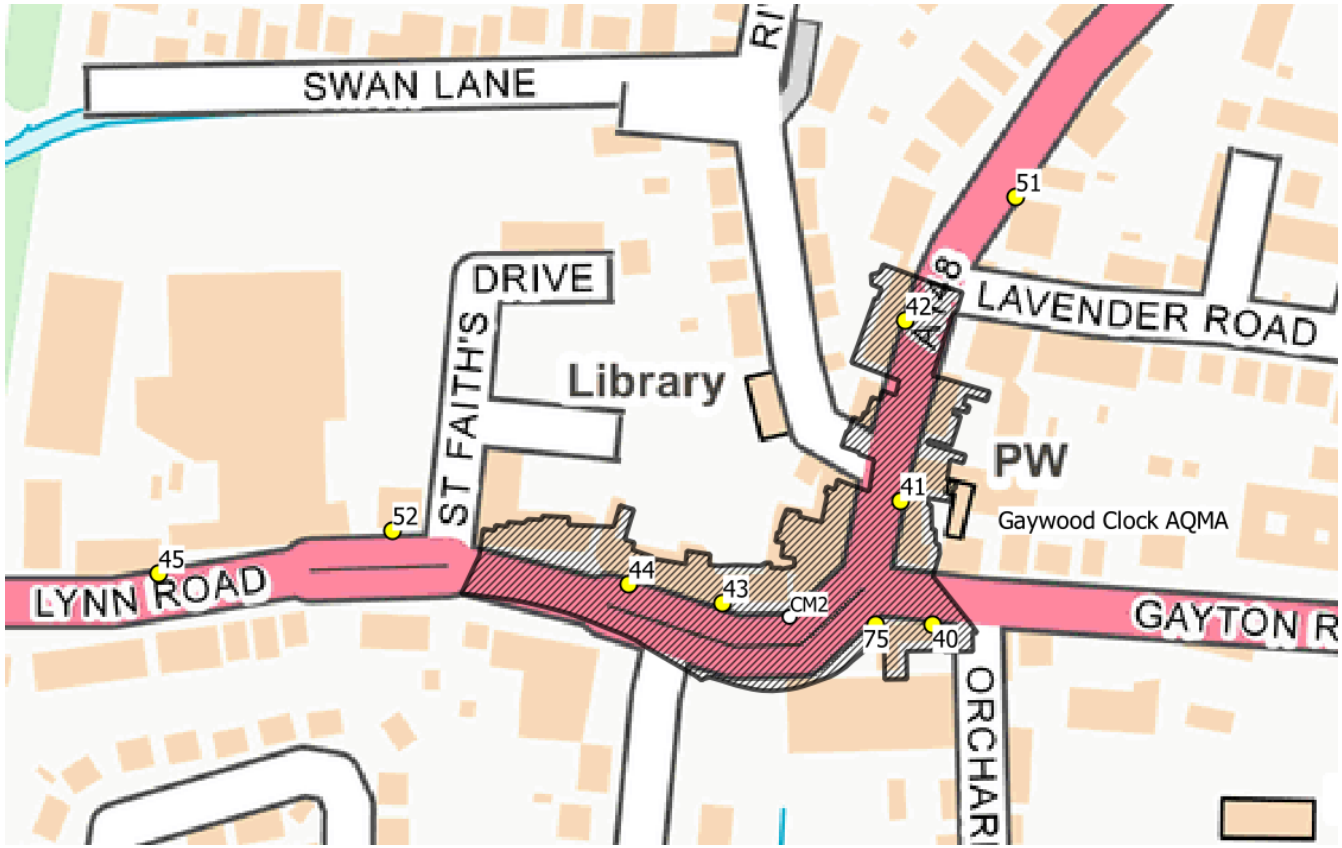
OS2						
Site	Unadjusted Continuous Mean (µg/m^3)	Nottingham Centre AF	Norwich Lakenfield AF	Leicester University AF	Average AF	Annualised Data Average (µg/m^3)
PM_{10}	10.6	1.004	0.932	-	0.968	10.3
$PM_{2.5}$	5.1	0.930	0.946	0.992	0.956	4.9

Fall-off With Distance Correction

In accordance with the conditions stated in Section 7.78 of Defra's TG(16), distance correction calculations, using the NO_2 fall-off with distance calculator, was not required to be undertaken at any site in operation in 2018.

Appendix D: Maps of Monitoring Locations and AQMAs

Figure D.1 – Monitoring Sites Within and Adjacent to Gaywood Clock AQMA



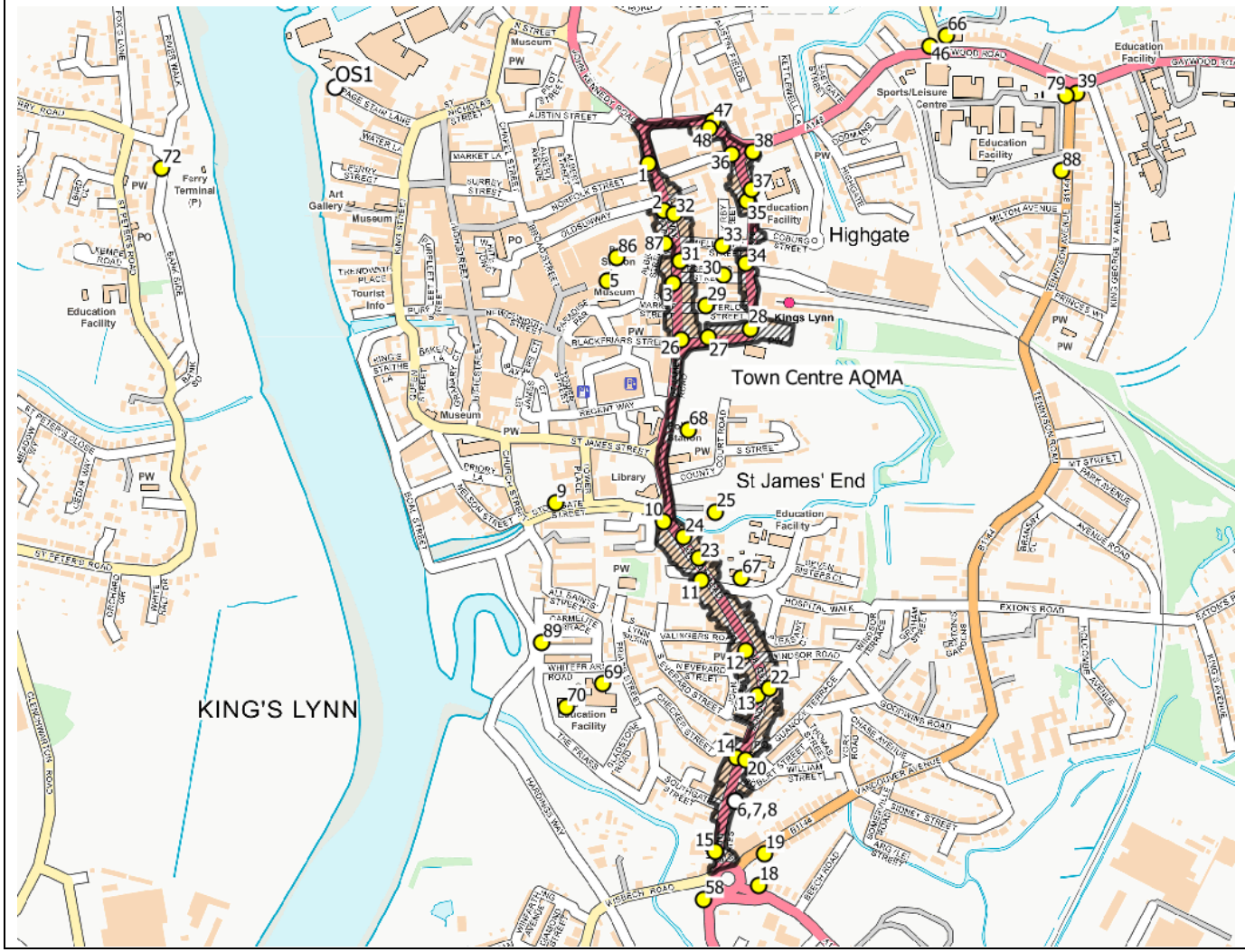
Legend

- Diffusion Tube
- Automatic Monitor
- AQMA

Air Quality
Bureau Veritas
5th Floor
66 Prescot Street
London, E1 8HG

Location	King's Lynn and West Norfolk Council
Title	Monitoring Sites Within and Adjacent to Gaywood Clock AQMA
By BT	**Approved** HS
Scale Not to Scale	**Job Ref** 6486114
Date June 2019	**Figure No.** D.1

Figure D.2 – Monitoring Sites Within and Adjacent to Town Centre AQMA



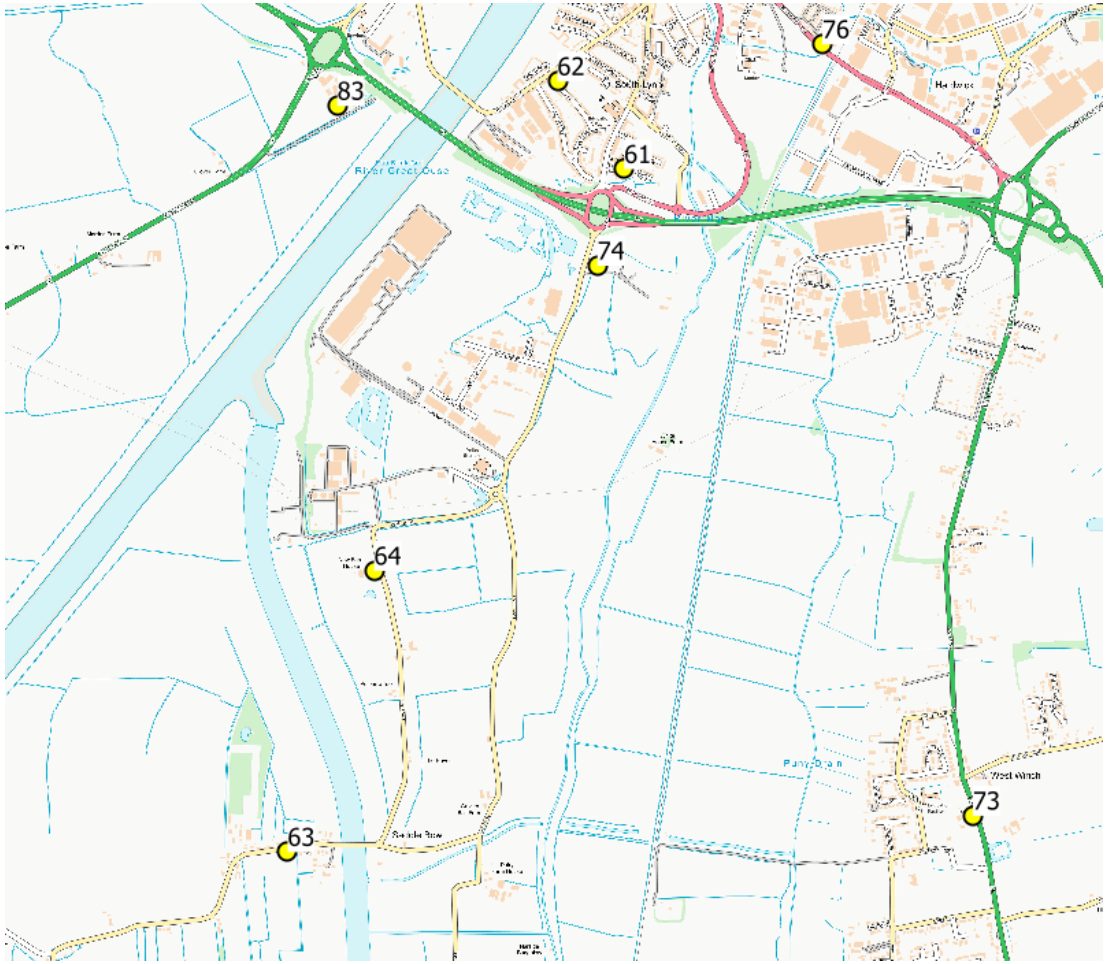
Legend

- Diffusion Tube
- Automatic Monitor
- AQMA

Air Quality
Bureau Veritas
5th Floor
66 Prescot Street
London, E1 8HG

Location	
King's Lynn and West Norfolk Council	
Title	
Monitoring Sites Within and Adjacent to Town Centre AQMA	
By	**Approved**
BT	HS
Scale	**Job Ref**
Not to Scale	6486114
Date	**Figure No.**
June 2019	D.2

Figure D.3 – Monitoring Sites: South of King's Lynn



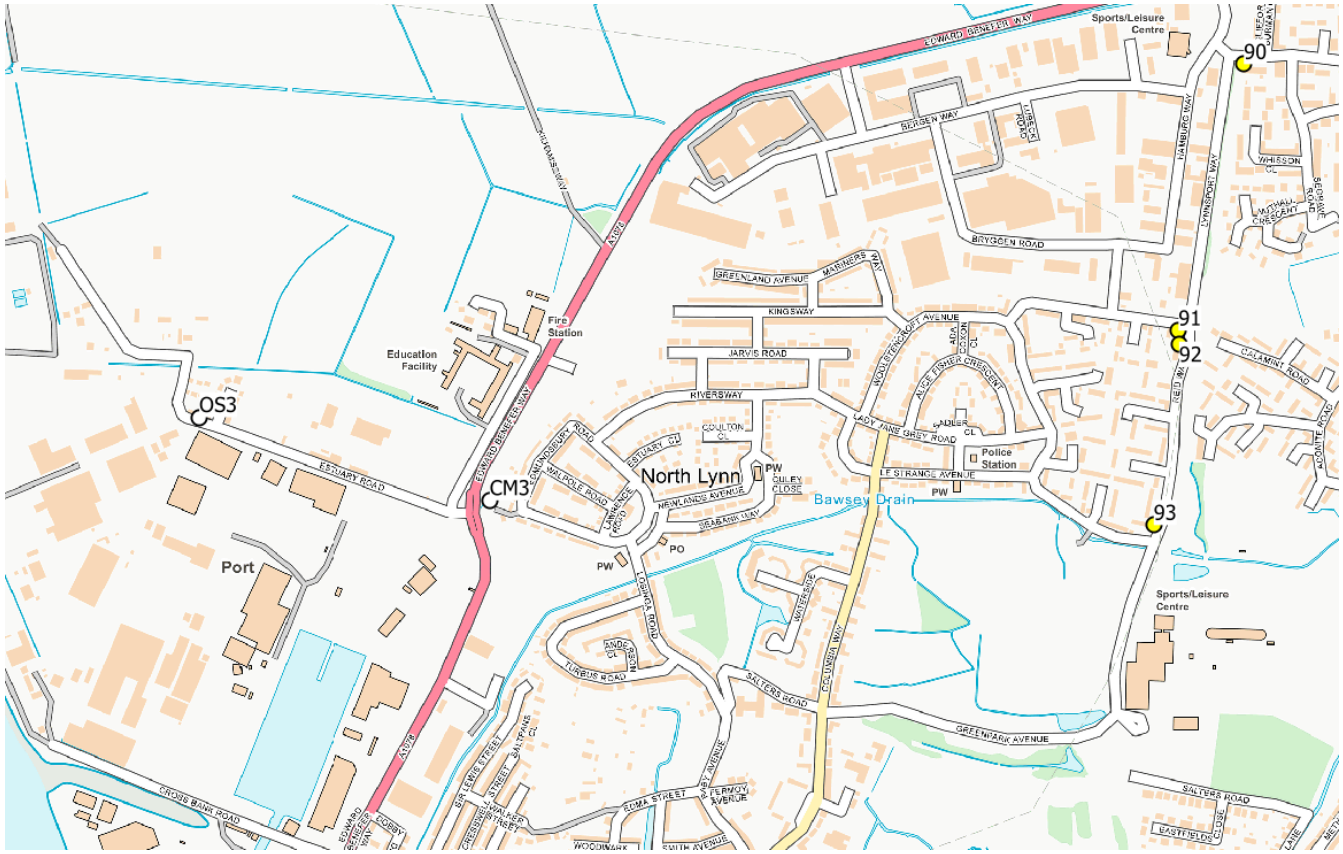
Legend

Diffusion Tube

Air Quality
Bureau Veritas
5th Floor
66 Prescot Street
London, E1 8HG

Location	
King's Lynn and West Norfolk Council	
Title	
Monitoring Sites: South of King's Lynn	
By	**Approved**
BT	HS
Scale	**Job Ref**
Not to Scale	6486114
Date	**Figure No.**
June 2019	D.3

Figure D.4 – Monitoring Sites: North Lynn



Legend

- Diffusion Tube
- Automatic Monitor

Air Quality
Bureau Veritas
5th Floor
66 Prescot Street
London, E1 8HG

Location	
King's Lynn and West Norfolk Council	
Title	
Monitoring Sites: North Lynn	
By	**Approved**
BT	HS
Scale	**Job Ref**
Not to Scale	6486114
Date	**Figure No.**
June 2019	D.4

Figure D.5 – Monitoring Sites: Stoke Ferry

Legend

- Diffusion Tube
- Automatic Monitor
- AQMA

Air Quality
Bureau Veritas
5th Floor
66 Prescot Street
London, E1 8HG

Location	
King's Lynn and West Norfolk Council	
Title	
Monitoring Sites: Stoke Ferry	
By	**Approved**
BT	HS
Scale	**Job Ref**
Not to Scale	6486114
Date	**Figure No.**
July 2019	D.5

Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England

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

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
BCKLWN	Borough Council of King's Lynn and West Norfolk
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
NCC	Norfolk County Council

References

- Local Air Quality Management Technical Guidance LAQM.TG(16). February 2018. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.
- Local Air Quality Management Policy Guidance LAQM.PG(16). May 2016. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.
- National Diffusion Tube Bias Adjustment Factor Spreadsheet, version 03/19 published in March 2019.
- Borough Council of King's Lynn and West Norfolk Annual Status Report 2018.
- Borough Council of King's Lynn and West Norfolk, Local Plan - Site Allocations and Development Management Policies Plan
- Norfolk County Council, Norfolk Minerals and Waste Local Plan, Minerals Site Specific Allocations Development Plan Document: Single Issue Silica Sand Review, December 2017