2018 Air Quality Annual Status Report (ASR)

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

July 2018

Local Authority Officer	Sarah Clark
Department	Public Protection
Address	Cheltenham Borough Council, Promenade, Cheltenham GL50 9SA
Telephone	07824 560054
E-mail	Sarah.clark@cheltenham.gov.uk
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Executive Summary: Air Quality in Our Area

Air Quality in Cheltenham

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 air quality issues within the borough of Cheltenham are almost exclusively as a result of vehicular emissions in distinct town centre locations.

There are limited sources of emissions from permitted industrial/commercial processes within the borough but these are located outside the town centre and are not a contributory factor regarding those areas coming near to, or failing, the air quality objective limit values. There have been no new major sources of emissions.

The principal pollutant of concern is Nitrogen Dioxide (NO_2), from vehicle emissions. Other pollutants, for example Particulate Matter and Ozone, have historically been measured by roadside monitoring equipment, but protracted measurement over many years has shown that those pollutants come well below the limit values. For that reason measurement of those pollutants has been discontinued.

Nitrogen Dioxide has been measured in Cheltenham since 1996. This is carried out by affixing passive measuring devices (commonly known as “diffusion tubes”) throughout the borough, at various roadside locations. The Council is then able to build up a picture of the worst air pollution areas in Cheltenham as a result of vehicular traffic.

[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

In addition to the passive measuring devices around the town, a real-time roadside monitoring instrument was installed in August 2011 to record Nitrogen Dioxide levels at a location with relevant exposure. Data from this installation is compared with data obtained from co-located diffusion tubes.

Each year the Council is obliged to report its annual air pollution findings to DEFRA, in particular to state how many of its annualised Nitrogen Dioxide readings breached the air quality objective limits.

The annual monitoring of Nitrogen Dioxide over previous years has shown marginal fluctuation in results. This is mainly due to differing temperature and weather conditions from year to year (particularly cold spells increase NO_2 results) whilst vehicular traffic flows have remained fairly constant.

The Council decided at the end of 2015 to reduce the number of diffusion tubes for measurement in 2016 and a further reduction in the number of diffusion tubes occurred in 2017. This is because some locations exhibited year-on-year low results consistently below the national objective limit and were considered unlikely to increase, whilst other locations had several tubes located near to each other in already known areas of poor air quality, so some reduction could occur without compromising the evidence base. It was decided to leave most diffusion tubes in areas of known poor air quality, where there was a change in traffic flow (two-way

traffic as a result of Traffic Regulation Order), or where new housing became located near to the above. In 2017 four new diffusion tube locations were added to the monitoring network due to changes in traffic flow as part of the County Council Highways action to improve access to car parks at point of entry to town. This change of traffic flow forms one of the measures within the Air Quality Action Plan.

Bias adjusted measurements obtained in 2017 indicate that only three sites in Cheltenham breached the air quality limit value for Nitrogen Dioxide and these are the same locations which failed in 2016.

The poor air quality in central Cheltenham resulted in the declaration of the whole Borough, in 2011, as an Air Quality Management Area (AQMA).

The poor air quality is almost solely as a result of vehicular activity within the town centre area, which cannot be easily addressed. Areas outside of the town centre consistently meet the air quality objectives.

To address the failures of air quality objectives at a number of locations, an Air Quality Action Plan was required. This is in the process of being implemented.

Continued monitoring during 2017 showed a slight decrease in Nitrogen Dioxide levels at several monitoring locations compared to 2016 results; however some monitoring locations indicated a slight rebound in levels compared to 2016. The annual mean Nitrogen Dioxide level at three locations was still being exceeded in 2017 which means the existing AQMA declaration remains justified.

Actions to Improve Air Quality

The Cheltenham Air Quality Action Plan was released in April 2014 and proposed 20 separate initiatives. These mainly consisted of promoting alternative modes of travel, various traffic/highway measures, and a change to Planning Policy.

Some of the above initiatives are currently being addressed both separately and jointly at County and District level. Gloucestershire County Council's Sustainable Transport Plan & Fund aims to achieve a modal shift to public transport, cycling & walking. The Cheltenham Transport Plan aims to reduce vehicle use leading to improved air quality. The Gloucestershire initiative *Thinktravel* provides information & resources for sustainable travel in Gloucestershire. The initiative can be found here www.thinktravel.info. More detailed information regarding these initiatives is given within the main body of this report.

Local Priorities and Challenges

The Local Priority is to continue working with the County Council and other partners to look at further ways to bring air quality within national limit values. Various traffic schemes are ongoing and more are scheduled to be implemented in 2018 which may have a measureable effect on the worst air quality areas within the town centre.

There are funding and resource challenges to overcome before some initiatives can be implemented.

How to Get Involved

Members of the public can do their bit by choosing alternative means of transport, particularly in the winter months. Firstly, think…

“Can I get into town without using the car?” Perhaps dig out that old bike?

“It’s a nice day, I think I’ll walk”. In fact at some times of the day your walk can almost take the same time as it does to drive. You’ll get fitter and feel better for it.

How about taking the bus and let somebody else do the driving whilst you relax?

Do you have any work colleagues who live nearby and would like to share the cost of taking the car? You’ll not only reduce your costs at least by half (the more who share, the greater the savings), but save on wear and tear, and mileage increases on your vehicles.

If living outside Cheltenham then perhaps think of our Park and Ride facilities (pay for the bus fare and receive free parking).

How about walking your child to school? Not only will the reduction in vehicles bring improved air quality, but you and your child will have the added benefit from the exercise.

Local schools can continue their work in persuading parents to encourage their children to walk or cycle to school and leave the car at home.

User greener and cleaner vehicles (Electric Vehicles, Hybrid, LPG, etc.)

Lead by example and champion better air quality.

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1 Local Air Quality Management

This report provides an overview of air quality in Cheltenham during 2017. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995) and the relevant Policy and Technical Guidance documents.

The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives 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 Cheltenham Borough Council to improve air quality and any progress that has been made.

The statutory air quality objectives applicable to LAQM in England can be found in **Error! Reference source not found.** in Appendix E.

2 Actions to Improve Air Quality

2.1 Air Quality Management Areas

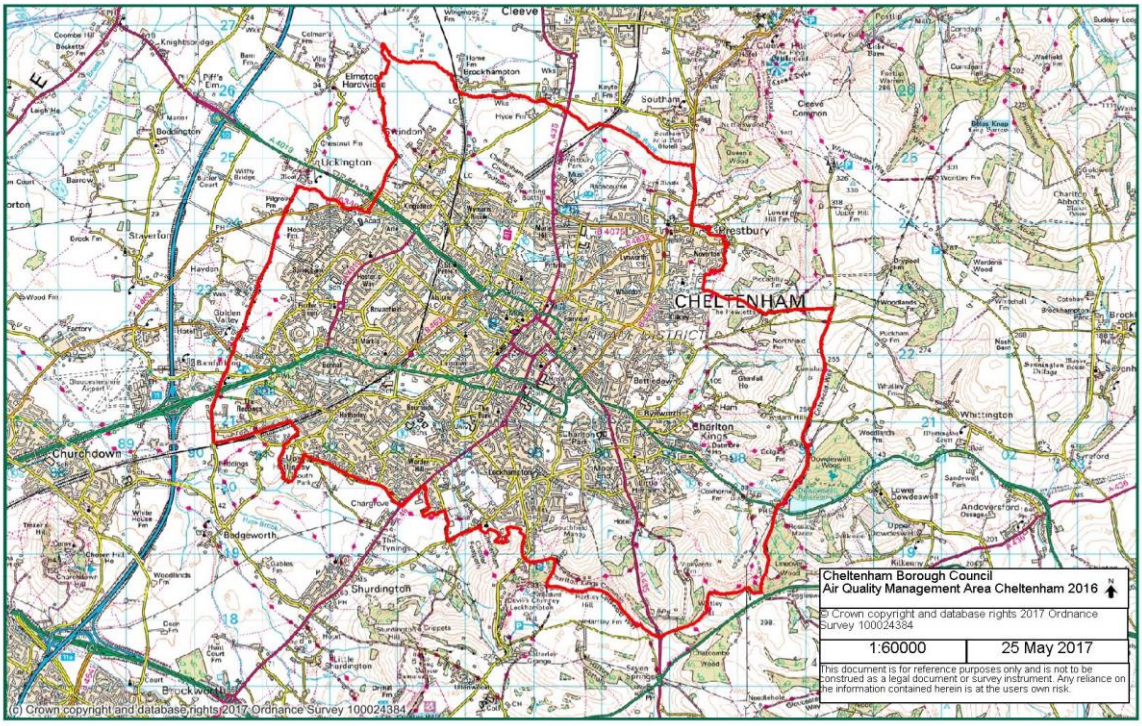
Air Quality Management Areas (AQMAs) are declared when there is an exceedance or likely exceedance of an air quality objective. After declaration, the authority must prepare an Air Quality Action Plan (AQAP) within 12-18 months setting out measures it intends to put in place in pursuit of the objectives.

Subsequent monitoring since 1996 highlighted several distinct areas of exceedance of EU limit values in the town centre due to road traffic. This led to the declaration in 2008 of a section of Bath Road/High Street as an Air Quality Management Area (AQMA).

Figure 2.1 Air Quality Management Area 2008

It was decided in 2011, following failure of air quality objectives at several other town centre locations, that instead of declaring several small AQMAs, the whole of the Borough Council area would be declared as an AQMA.

Figure 2.2 Air Quality Management Area declared in 2011



The declaration of the whole of the Borough does not mean that areas outside the town centre have poor air quality. The air quality is reasonably good in most areas of the town and almost all monitoring of Nitrogen Dioxide levels in the Borough come well within EU limit values.

Information on the Air Quality Management Area in Cheltenham can be found here https://www.cheltenham.gov.uk/info/66/environmental_protection_and_pollution/288/air_quality/3

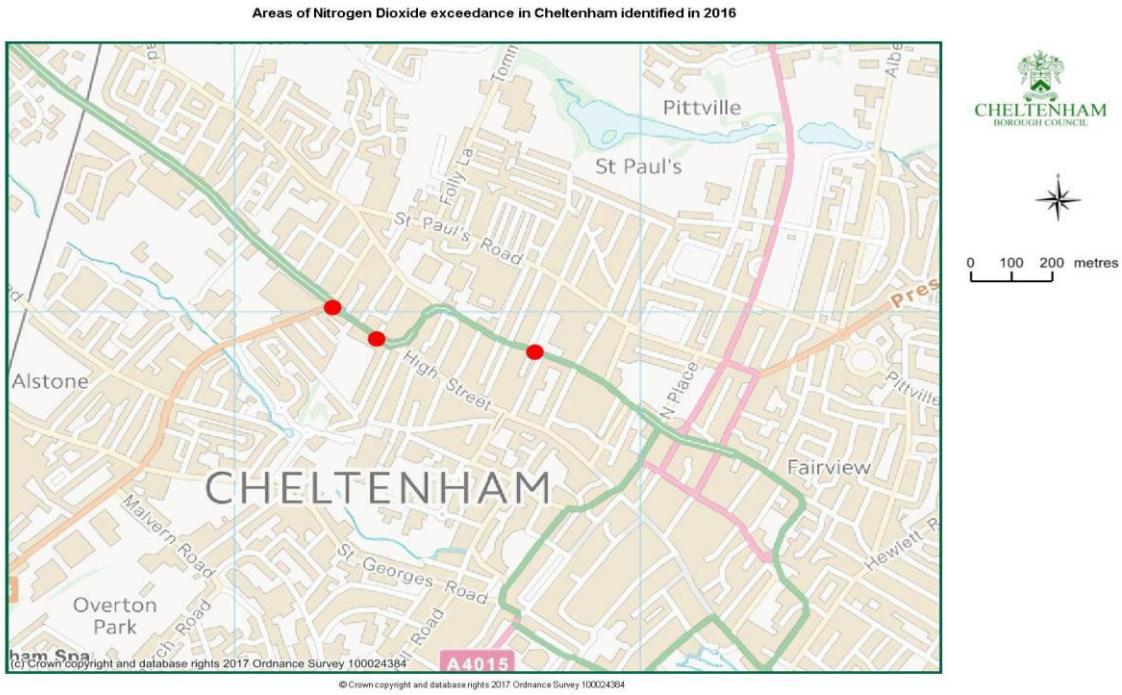
Of the areas monitored, 2017 data indicates three distinct locations that still give cause for concern regarding annual failure of EU limit values for Nitrogen Dioxide. These are; at the lower High Street (No 422), at the High Street junction with Gloucester Road and at one location on Swindon Road. There are two other hotspot locations which also exhibit elevated Nitrogen Dioxide levels but have fallen within the EU limit for annual average levels in 2017. The other monitoring locations are used to monitor representative background levels in areas outside of the town centre, and also where the Council might see some change in traffic load due to development or a change in the road layout.

The four main air quality hotspots in Cheltenham town centre remain as follows;

- the lower High Street, from its junction with Poole Way up to and including the junction at Gloucester Road (failure of annual NO2 limit at 2 locations)
- parts of the A4019 on the north perimeter of the town centre, in particular Swindon Road and Fairview (failure of annual NO2 limit at 1 location)
- where the Upper High Street turns into Bath Road (towards the east of the town centre)
- the busy traffic light junction at the intersection of London Road, College Road, Hewlett Road and High Street

As can be seen, this is the route of traffic from the west or east coming into and arriving at the town centre, either to park within the town centre area or skirting it to the north, and then leaving it at Tewkesbury Road or London Road.

Figure 2.3 Locations of Nitrogen Dioxide exceedences in Cheltenham in 2017



A summary of AQMAs declared by Cheltenham Borough Council can be found in Table 2.1. Further information related to declared or revoked AQMAs, including maps of AQMA boundaries are available online at https://www.cheltenham.gov.uk/info/66/environmental_protection_and_pollution/288/air_quality

In 2017, having looked at year-on-year results (which are consistently below the limit values for almost the whole of the Borough), the Council was due to consider revoking the current borough-wide AQMA in favour of a much smaller linear AQMA across the north of the town centre, which has consistently given poor air quality results. Unfortunately due to resourcing issues and other factors, this planned re-consideration of the AQMA has not taken place. During 2018, it is anticipated that further consideration of the currently designated AQMA will occur to assess whether it would be more appropriate to focus on the failing hotspot areas only rather than the entire Borough.

It is considered that a new, smaller AQMA would: -

- Illustrate to visitors, residents, and prospective purchasers of properties within Cheltenham that the whole of the Borough is NOT an area of poor air quality
- Allow more concerted and targeted action, by the District and County Councils and their partners, to address the known areas of poor air quality.

Should a new AQMA be approved, and declared by Order, then the previous AQMA will be revoked at the same time. This would be followed by a new Air Quality Action Plan to address poor air quality in the new AQMA.

Table 2. 1 Declared Air Quality Management Areas

AQMA Name	Pollutants and Air Quality Objectives	City / Town	One Line Description	Action Plan
Cheltenham Borough Council Air Quality Management Area	NO_2 annual mean	Cheltenham	The whole of the Cheltenham Borough Council area, amalgamating several earlier, separate AQMAs	Air Quality Action Plan 2014 https://www.cheltenham.gov.uk/downloads/file/3780/air_quality_action_plan_2014

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

A range of proposals were highlighted within the Council's Air Quality Action Plan (AQAP) 2014, which included trying to encourage drivers to use alternative modes of travel (walking, cycling, etc.), or to alter traffic flow direction in order to ease to ease congestion and thereby improve air quality.

Cheltenham Borough Council and Gloucestershire County Council have taken forward a number of measures since 2014 and up to the reporting year of 2017 in pursuit of improving local air quality. Some of the measures in the AQAP have since been completed. Details of these can be found in previous air quality reports available from the Council's website. Details of the remaining measures in progress or planned are set out in **Error! Reference source not found.**. More detail on these measures can be found in the Cheltenham Air Quality Action Plan, here: https://www.cheltenham.gov.uk/downloads/file/3780/air_quality_action_plan_2014

Key completed measures are:

Highway improvements. A 2-way traffic scheme at Albion Street was completed in 2016. The Council is currently monitoring with a diffusion tube adjacent to residential premises on this highway, to assess whether the 2-way system will result in a breach of the NO_2 limit values. 2017 monitoring results indicate that the NO_2 limit has not been breached at this location. The 2-way scheme on Imperial Square allowing better access to Regent's Arcade Car Park, was completed in March 2017.

A Cheltenham Borough Council 20mph Cabinet Member Working Group was set up in 2016 to look at the potential for reducing the urban traffic speed limit to 20mph in some areas to reduce congestion and improve traffic flow on busier roads. The member group are still considering the potential benefits pending improved guidance.

Phase 1 of the Wayfinding Initiative was completed 2016. Totems and signage were installed.

Increase Car Sharing. Parish Lift', a new community car sharing scheme was developed in 2016 to help support social inclusivity and rural accessibility across the Cotswolds Area of Outstanding Natural Beauty (AONB). The scheme compliments the current Carshare Gloucestershire initiative and is being funded by Communities Connected, a Community Interest Company (CIC). No new initiatives are planned.

Since 2014, 22 spaces have been added to the Arle Court Park & Ride site in Cheltenham to increase capacity with plans for a further 9 under consideration

Cheltenham Borough Council expects the following measures to be completed over the course of the next reporting year:

Highway Improvements. The Cheltenham Transport Plan is implemented in four phases. Phase 2 was completed in late summer 2017, Phase 3 in Autumn 2017 and Phase 4 is in the process of being implemented including the closure of Boots Corner in summer 2018.

Promotion of greener vehicles will continue. Further electric car charging points are due to be installed within Cheltenham in 2018. Charging points have been installed at the Rail Station, Montpellier Street and in selected car parks to date.

HGV & LGV restrictions. As part of the Cheltenham Transport Plan Phase 4 (Boots Corner closure) it is proposed to have HGV & LGV restrictions to encourage deliveries during the quieter footfall periods of the day to reduce the pedestrian – HGV interface and reduce congestion during peak traffic hours.

In subsequent years the following proposals are tabled for commencement and/or completion:

Further Park and Ride schemes are proposed and include the new Elmbridge scheme on the outskirts of Gloucester. The building of this Park and Ride would however be the subject of a separate funding bid by Gloucestershire County Council. This scheme will assist in reducing car travel to and from Cheltenham.

The Cheltenham High Street Project will commence in the Summer of 2018 and will involve environmental improvements such as planting, drainage work under SUDS, and additional street furniture to encourage walking and cycling, such as the installation of benches and cycle parking.

There is a Bath Road Safety Scheme also tabled which will look to fund tree planting and SUDS, and will incorporate an enhanced cycle infrastructure.

A further Park and Ride scheme at Elms Park, Tewkesbury Road (to the west of Cheltenham) forms part of the Bloor Homes/Persimmon Homes Development. This development is yet to commence.

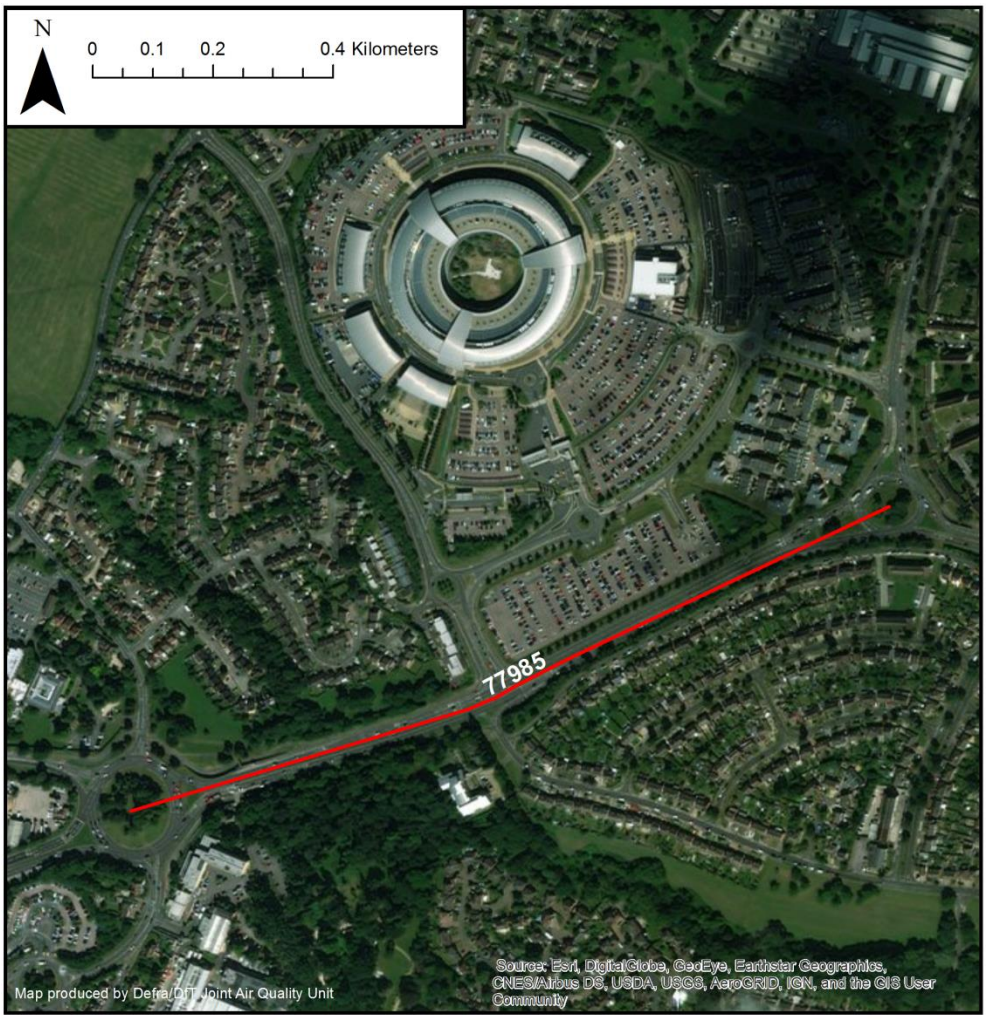
Planning Policy for Air Quality - An Air Quality Policy was to be adopted as part of the new Cheltenham Local Plan, to ensure that air quality impacts of all significant developments are properly assessed and mitigation actions taken where necessary. However it was decided that this was not required because the JCS (Joint Core Strategy for Gloucester, Cheltenham and Tewkesbury) already covers this in policies SD3 and INF1. These policies require applicants to assess any potential impacts on air quality. This will integrate with Cheltenham's Air Quality Action Plan.

Vehicle Management Signage – The joint bid for installation of electronically operated signage to inform drivers of the nearest available car parking spaces and congestion was unsuccessful. Further progress on this may occur in 2018.

Certain measures are ongoing and need to adapt to changing local conditions. The Borough Council will continue to provide up to date Air Quality Information, will promote Park & Ride schemes, encourage the development of Workplace Travel Plans, promote green planting in urban areas, and continue to provide Cycle Safety Improvements.

A40 Feasibility Study – DEFRA direction

National Pollution Climate Modelling (PCM) carried out by the government has projected that a section of the A40 will exceed the national annual mean objective for the pollutant nitrogen dioxide (NO2). The road link in question forms part of the A40, running from the B4063 at Arle Court Roundabout to the A4013 at Princess Elizabeth Way Roundabout on the western side of Cheltenham, and is shown in Map 1 below. This section of the A40 connects Cheltenham town centre to the M5 at Junction 10 and beyond to Gloucester. The link is approximately 800m long.



Map 1: Satellite map identifying A40 with Census ID 77985 between B4063 and A4013

Pollution Climate Modelling (PCM) Results predict the following NO2 concentrations:

- 2017 43 µg/m3
- 2018 41 µg/m3
- 2019 40 µg/m3
- 2020 38 µg/m3
- 2021 36 µg/m3

These results show that the road link is expected to comply with guideline limits from the end of 2018. In 2018, CBC will be investigating whether the A40 modelled non-compliant zone can be brought into compliance before the end of the year.

Table 2. 2 Progress on Measures to Improve Air Quality

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
1	Highways improvements	Transport Planning and Infrastructure	Strategic highway improvements, Re-prioritising road space away from cars, including Access management, Selective vehicle priority, bus priority, high vehicle occupancy lane	Gloucestershire County Council	2013-14	2016-18	Reduction in through traffic and improved access to car parks. Reduced congestion at key junctions	1-2%	A range of highway amendments have taken place and others are planned, subject to traffic regulation orders. To take place in 4 phases.	2017	Phases 3 completed in Autumn 2017. Phase 4 (closure of Boots Corner to through traffic – allowing buses and taxis). This is to be implemented in Summer 2018 on a trial basis. 2-way junction priority changes at Albion Street and Imperial Square allowing traffic easier access to town centre car parks was completed in 2017.
2	Air Quality Information	Public Information	Via the Internet	Cheltenham Borough Council	2014-2015	2015-16	Hit counter on webpage	< 0.1%	Up to date Air Quality information available on CBC website	Ongoing	Emission reductions directly attributable to this action cannot be measured.
3	Promotion of Park & Ride	Alternatives to private vehicle use	Bus based Park & Ride	Gloucestershire County Council	2014-15	2014-16	Reduced car travel into & out of Cheltenham	0.1-1%	Improved signage installed at Arle Court. 22 new spaces added to Arle Court Park and Ride.	2018	The Elmbridge Park & Ride proposal on the outskirts of Gloucester is the subject of a separate funding bid. The Elmbridge highway improvements were completed on time. A further scheme at Elms Park, Tewkesbury Road (to the west of Cheltenham) forms part of the proposed Bloor/Persimmon Development,

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
4	Promotion of greener vehicles	Promoting low emission transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	Gloucestershire County Council	2012	2013-2015	Charge point usage data	< 0.5%	Electric charging points (fast) are installed at Regent Arcade, Montpellier Street and Arle Court Park and Ride site. Rapid chargers are installed at Cheltenham Chase Hotel (Brockworth) and Compass Holidays (Cheltenham Railway Station). Promenade charging has not been installed to date.	Ongoing	The Borough and County Councils continue to encourage electric vehicle use through the installation of charging points in car parks or on-street. Cheltenham and Gloucestershire County councils will also investigate the potential for differential parking charges for electric and hybrid vehicles on street and in car parks. The Borough currently provide free EV charging at its car park charging points.
5	HGV Restrictions	Freight and delivery management	Route Management Plans/ Strategic routing strategy for HGV's	Gloucestershire County Council	2014	2015	Traffic count data	< 0.5%	See comments	2017	HGV/LGV restrictions in Phase 4 of the Cheltenham Transport Plan Ph4 (Boots Corner closure) are currently being implemented. Deliveries are restricted to certain times only. This junction will however be closed to all vehicles apart from delivery vehicles. Buses and taxis.

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
6	Increased car sharing	Alternatives to private vehicle use	Car & lift sharing schemes	Gloucestershire County Council	2013	2015	Traffic count data	0.1%	A new website has been launched with promotional work taking place at businesses and on street across Cheltenham via flyers and face to face discussions. New road signage is installed. No further progress in 2017	2016	'Parish Lift', a new community car sharing scheme was developed in 2016 to help support social inclusivity and rural accessibility across the Cotswolds Area of Outstanding Natural Beauty (AONB). The scheme compliments the current Carshare Gloucestershire initiative and is being funded by Communities Connected, a Community Interest Company (CIC). Parish Lift is an online platform designed to help match registered users, whether they be drivers or people seeking a 'lift'.

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
7	Business Travel Grants	Promoting low emission transport	Other	Gloucestershire County Council	2013	2014-15	Uptake of grants	< 0.1%	Grants completed in 2015. Further contacts made – see comments.	2018	In 2016/17, 132 businesses, representing 2,205 staff, were contacted in the Cheltenham parking zones areas to raise awareness of parking enforcement and encourage a shift towards more sustainable modes of travel. 13 businesses, representing 14,865 staff, were engaged in a more intensive site assessment and awareness raising events promoting Thinktravel and sustainable modes.
8	Wayfinding Initiative	Promoting travel alternatives	Promotion of walking	Gloucestershire County Council	2013	2014-15	None	< 0.1%	Signage installed	2017	Work is ongoing to improve signage and route access for cyclists and pedestrians Phase 2 was completed in 2017.

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
9	Promote workplace travel plans	Promoting travel alternatives	Personalised travel planning	Cheltenham Borough Council	2014	2015	Whether or not a plan is implemented	< 0.1%	None to date.	unknown	Cheltenham Borough Council will develop its own workplace 'smarter' travel plan where resources allow and encourage larger businesses in Cheltenham to develop and implement similar plans. This will encourage more sustainable transport choices such as bus travel, car-sharing, cycling and walking.
10	Air Quality Planning Policy	Policy guidance and development	Air Quality planning and policy guidance	Cheltenham Borough Council	2013	2015	Air Quality Planning Policy adopted	Unknown but potentially significant - >1%	Planning for Air Quality - A good practice guide for Planners and Developers published in March 2013. The Joint Core Strategy contains policies that require consideration of air quality in planning	2018	Although no specific policy on Air Quality will be adopted as part of the emerging Cheltenham Local Plan (due 2017-2018), Air Quality is still a material consideration with planning and air quality impacts of all significant developments will be properly assessed and mitigation actions taken where necessary.
11	Traffic light appraisal	Traffic Management	Strategic highway improvements, Re-prioritising road space away from cars, including Access management, Selective vehicle priority, bus priority, high vehicle occupancy lane	Gloucestershire County Council	2014	2015-17	Number of traffic lights removed & traffic count/speed data	Potentially significant at current areas of poor air quality	Under the Cheltenham Transport Plan 2 sets of traffic lights have been removed. No further removals planned. Upgrades to traffic lights to MOVA system is ongoing. (see comments)	Ongoing with MOVA signals	MOVA is an intelligent traffic signal system, which over time can optimise traffic signals reducing queues and congestion. These are currently being installed following routine upgrades to signal systems in Cheltenham.

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
12	Bus and Taxi quality partnership	Promoting low emission transport	Other	Gloucestershire County Council	2014	2015-16	Anecdotal	Unknown	The current fleet of Stagecoach buses now have a black box system which monitors driving behaviour and promotes more fuel efficient driving and anti-idling.	2018 and ongoing	The Council's AQAP proposed a Bus and Taxi Quality Partnership, to obtain an agreement with the main taxi and bus operators to encourage fuel efficient driving, no-idling when stationary and training in safe driving practices – with the aim of reducing vehicle emissions. No specific partnership but buses and taxis are not allowed to idle at bus stops and taxi ranks in town.
13	Twenty Is Plenty	Traffic management	Reduction of speed limits, 20mph zones	Cheltenham Borough Council	2014-15	2015-17	Traffic count / Speed data	< 0.5%	The Cabinet working group are awaiting better guidance on the benefits and implementation.	Ongoing	Cheltenham and Gloucestershire County Council will look at the potential for reducing urban traffic speed limit to 20mph in some areas to reduce congestion and improve traffic flow on busier roads, which may improve highway safety for cyclists and pedestrians as well as improve air quality.
14	A lower emission bus fleet	Vehicle fleet efficiency	Promoting low emission public transport	Cheltenham Borough Council	2013	2014-16	Bus fleet data	0.5%	Initial funding bid to Government failed but received positive response.	Ongoing	The main bus fleet company in Cheltenham and Gloucester has the most modern fleet in any area of the UK. Many buses are Euro 6 compliant.

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
15	Green planting	Traffic management	Other	Cheltenham Borough Council	2014	2014-16	Number of urban planning applications with green planting schemes adopted	< 0.1%	Greening of parts of Cheltenham High Street is due as part of improvements to the public realm during 2018/19.	Ongoing	Cheltenham Borough Council will seek to encourage green planting through planning control to help off-set potential pollution impacts where developments occur in areas of poorer air quality. Such measures include planting through planning controls, on CBC parks and property, and on Highways, which is ongoing and planting as part of street enhancement schemes (particularly through the Cheltenham Transport Plan) scheduled between 2016-2019.

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
16	Vehicle management signage	Traffic management	Other	Cheltenham Borough Council	2014	2014-18	Traffic count data	< 0.1%	Air Quality Grant Scheme bid submitted in 2016 but was unsuccessful. Further bids will be looked at.	unknown	Through the Cheltenham Transport Plan and the CBC Car Parking Strategy the Borough Council will work with the County Council on the implementation of Vehicle Management Signage. This proposal is for the installation of electronically operated signs to inform drivers of the nearest available car parking spaces and alert drivers of possible congestion. This may encourage more sustainable transport choices and reduce traffic queues which will improve air quality.
17	Cycle safety improvements	Transport planning and infrastructure	Cycle network	Cheltenham Borough Council	2014	2014-16	Number of cyclists and accident & injury statistics	< 0.1%	None	Ongoing	'Barriers to Cycling' project completed Autumn 2017 with installation of contraflow cycle lane on Sandford Mill Road Cycle Improvements on Up Hatherley Way with a new Shared Use Footway Cycleway, completed in June 2018. Kingsditch Lane Cycle Improvements, conversion of existing footway to shared use completed Oct 2017. Pitville to the Park Cycle Route – signing of the cycle route completed.

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.

No $PM_{2.5}$ monitoring was carried out by Cheltenham Borough Council during the period covered by this report. Historical Urban Background monitoring up to 2009 did not identify any exceedance of PM_{10} levels, which correlate closely with $PM_{2.5}$ levels, but it is possible that roadside locations near busy roads and junctions could exhibit elevated levels of $PM_{2.5}$.

Unfortunately there is no currently practical or affordable method for measuring $PM_{2.5}$ levels at roadside locations where there is potential exposure in Cheltenham.

This Local Authority will look at measures to include consideration of $PM_{2.5}$ within Annual Status Reports subsequent to this one.

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

3.1 Summary of Monitoring Undertaken

In recent years Cheltenham Borough Council has submitted the following reports:

2011: Detailed Assessment for Cheltenham for Nitrogen Dioxide

2012: Updating and Screening Assessment

2013: Progress Report

2014: Progress Report

2015: Updating and Screening Assessment

2016: Annual Status Report

2017: Annual Status Report

A Detailed Assessment was completed for Bath Road and High Street in 2007 where an exceedance of the annual mean objective for NO_2 occurred with relevant exposure. In December 2008 an Air Quality Management Area (AQMA) was declared along a section of Bath Road and High Street in Cheltenham. The area was designated in relation to a likely breach of the Nitrogen Dioxide (annual mean) objective as specified in the Air Quality Regulations (England) 2000.

The 2010 Progress Report identified a number of new locations in Cheltenham which had exceeded the annual mean objective for NO_2. Following submission of a detailed assessment report in 2011, the existing AQMA was revoked and a new AQMA covering the whole of Cheltenham Borough was declared in relation to a likely breach of the Nitrogen Dioxide (annual mean) objective at a total of seven locations, including the old AQMA area (see Figure 1.2).

During 2017 the number of locations in Cheltenham that breached the annual mean objective for NO_2 has remained at three (see figure 1.3). These are the same locations that breached limits in 2016 but significantly less than the eleven locations that exceeded limits in 2015. The AQMA designation nevertheless remains justified as a result of the continued breaches at these locations.

No other air pollutants are monitored in Cheltenham since previous rounds of review and assessment demonstrated that no breaches were likely.

3.1.1 Automatic Monitoring Sites

This section sets out what monitoring has taken place and how it compares with the air quality objectives (see Appendix E below).

A roadside monitoring unit is installed at the junction of Swindon Road and St Georges Street, Cheltenham where exceedance of Nitrogen Dioxide (annual mean) had been recorded nearby from previous diffusion tube monitoring data. The unit measures NOx, NO_2 and NO and commenced operation in August 2011. Data is sent via telemetry to Enviro Technology limited and forwarded to AQDM for data validation and ratification purposes. Monthly routine calibration and maintenance is carried out by the equipment supplier, Enviro Technology Limited.

Cheltenham Borough Council undertook automatic (continuous) monitoring at one site during 2017. Table A.1 in Appendix A shows the details of the site. National monitoring results are available at https://uk-air.defra.gov.uk/networks/find-sites

Further details on how the monitors are calibrated and how the data has been adjusted are included in Appendix C. Maps showing the location of the monitoring sites are provided in Appendix D.

3.1.2 Non-Automatic Monitoring Sites

In 2017 Cheltenham Borough Council undertook non-automatic (passive) monitoring of NO_2 at twenty locations throughout the Borough, on a month-by-month basis. Maps showing the location of the monitoring sites are provided in Appendix D. **Error! Reference source not found.** in Appendix A shows the details of the sites. Further details on Quality Assurance/Quality Control (QA/QC) and bias adjustment for the diffusion tubes are included in Appendix C.

The previous year (2016) thirty locations were chosen for monitoring purposes as they represented a mix of areas where

- higher levels of Nitrogen Dioxide were expected (almost exclusively as a result of vehicular traffic),
- normal levels of air quality are to be expected (to be able to make a comparison with the worst areas).

Following evaluation of the 2016 annual monitoring data, it was again apparent that some of the measurement locations were producing results consistently below the limit value for Nitrogen Dioxide, and there was no expectation that this situation would change in forthcoming years. For that reason it was decided to discontinue monitoring in these areas. In addition, some tubes were also removed in known areas of poor air quality that were not contributing their results to the overall picture. A total of 14 locations were discontinued and a further 4 new locations were added to check for potential changes in air pollution following planned highways improvements across Cheltenham.

Looking at the results of monthly measurements of Nitrogen Dioxide, it is clear that the worst areas for Nitrogen Dioxide are located in a relatively short vehicular route skirting the town centre to the north.

The highest monitoring tube measurements tend to occur in the winter months, generally between November and February. The results obtained from winter monitoring can have the effect of pushing the rest of the year average results over the annual limit values. Monitoring in the summer months shows that Nitrogen Dioxide levels can be almost half of what they are in the winter months.

Details of Bias Adjustment

The 20 diffusion tubes monitored during 2017 across the Borough of Cheltenham have a monthly exposure period. Three of those tubes are located adjacent to the Council's St Georges Street roadside monitoring unit, in order to assess the difference in accuracy between the tubes and the monitoring device, which is calibrated monthly. This is termed a 'co-location' study.

For 2017 the Bias Adjustment factor applied to the diffusion tube data was a Local Bias Adjustment Factor obtained from the co-location diffusion tube study. The bias adjustment value for 2017 was 1.00.

3.2 Individual Pollutants

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

3.2.1 Nitrogen Dioxide (NO_2)

Cheltenham Borough Council currently only monitors for exceedance of the Nitrogen Dioxide limit values.

Error! Reference source not found. 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.

The most recent trend, as indicated in Figure 3.1 below, saw a slight decrease in Nitrogen Dioxide levels compared to the previous year, which is encouraging. N.B. The locations used for the trend data are those expected to remain monitored for the foreseeable future, whilst some trend data in previous air quality reports used locations which have now been discontinued.

For diffusion tubes, the full 2017 dataset of bias-adjusted monthly mean values is provided in Appendix B. All diffusion tube measurements were within the AQMA of Cheltenham Borough Council and all were at locations of relevant exposure.

Whilst the trend data for 2017 indicates a slight overall downward trend in levels of Nitrogen Dioxide levels at most monitoring locations, this may be due to temperature fluctuations during the winter months. However it is also considered likely that some

of the reduction can be directly attributed to actions taken in line with the Council's Air Quality Action Plan, for example encouraging alternative forms of travel (e.g. cycling) and highways improvements. However there were some locations which indicated a slight increase in Nitrogen Dioxide levels such as the lower High Street and Gloucester Road. This is of concern as these locations are associated with an area that has consistently breached the annual mean objective limit over recent years and is showing little evidence of air quality improvement.**Error! Reference source not found.** in Appendix A compares the ratified continuous monitored NO_2 hourly mean concentrations for the past 5 years with the air quality objective of 200µg/m^3, not to be exceeded more than 18 times per year. No annual means were greater than 60µg/m^3, which indicates that an exceedance of the 1-hour mean objective is also unlikely at these sites.

Figure 3.1 Trends in Annual Mean Nitrogen Dioxide Concentrations measured at Diffusion Tube Monitoring Sites

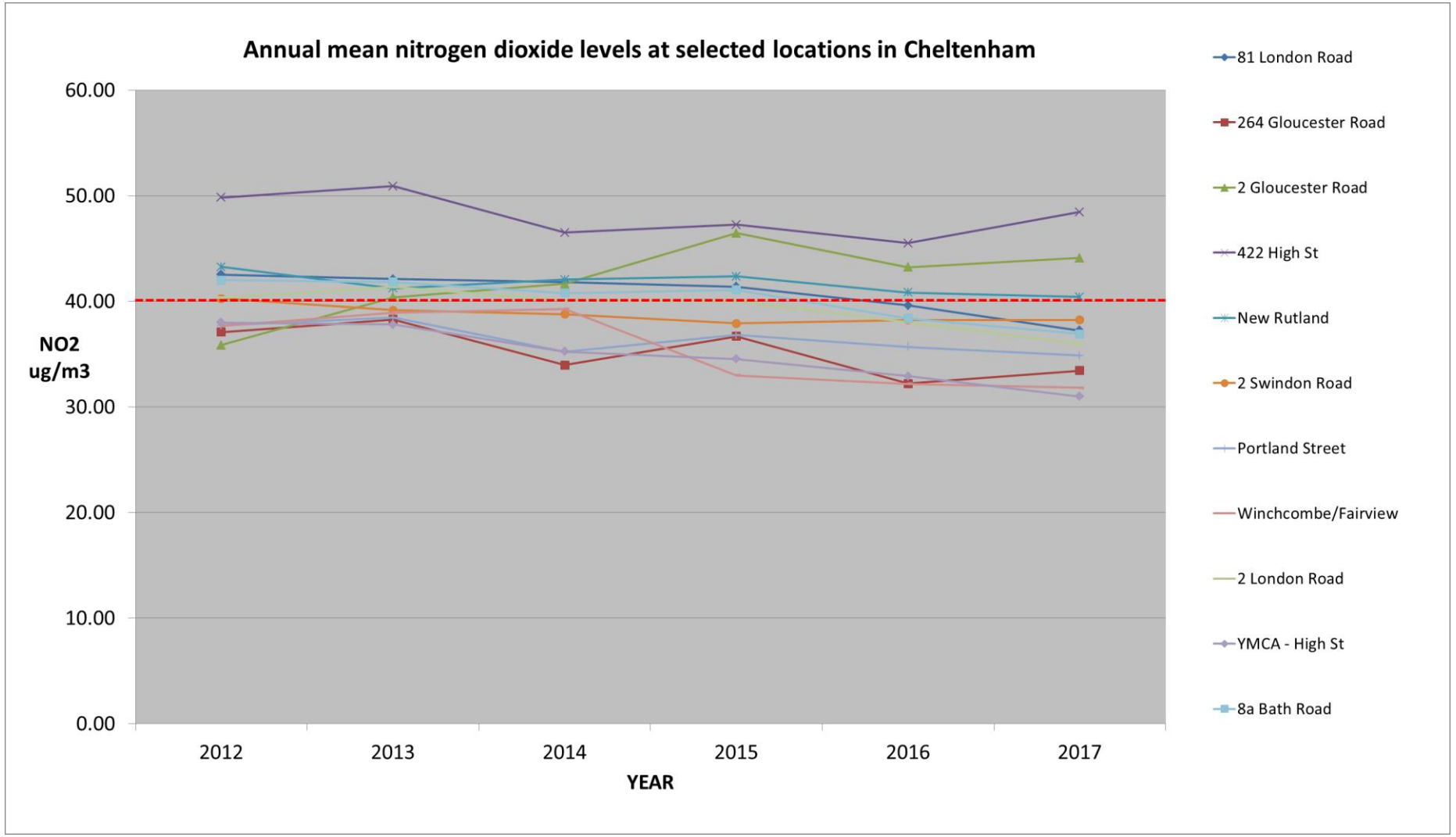


Figure 3.2 Time series of hourly averaged concentrations of NO2 (ug/m3) at Swindon Road automatic monitoring site 2017

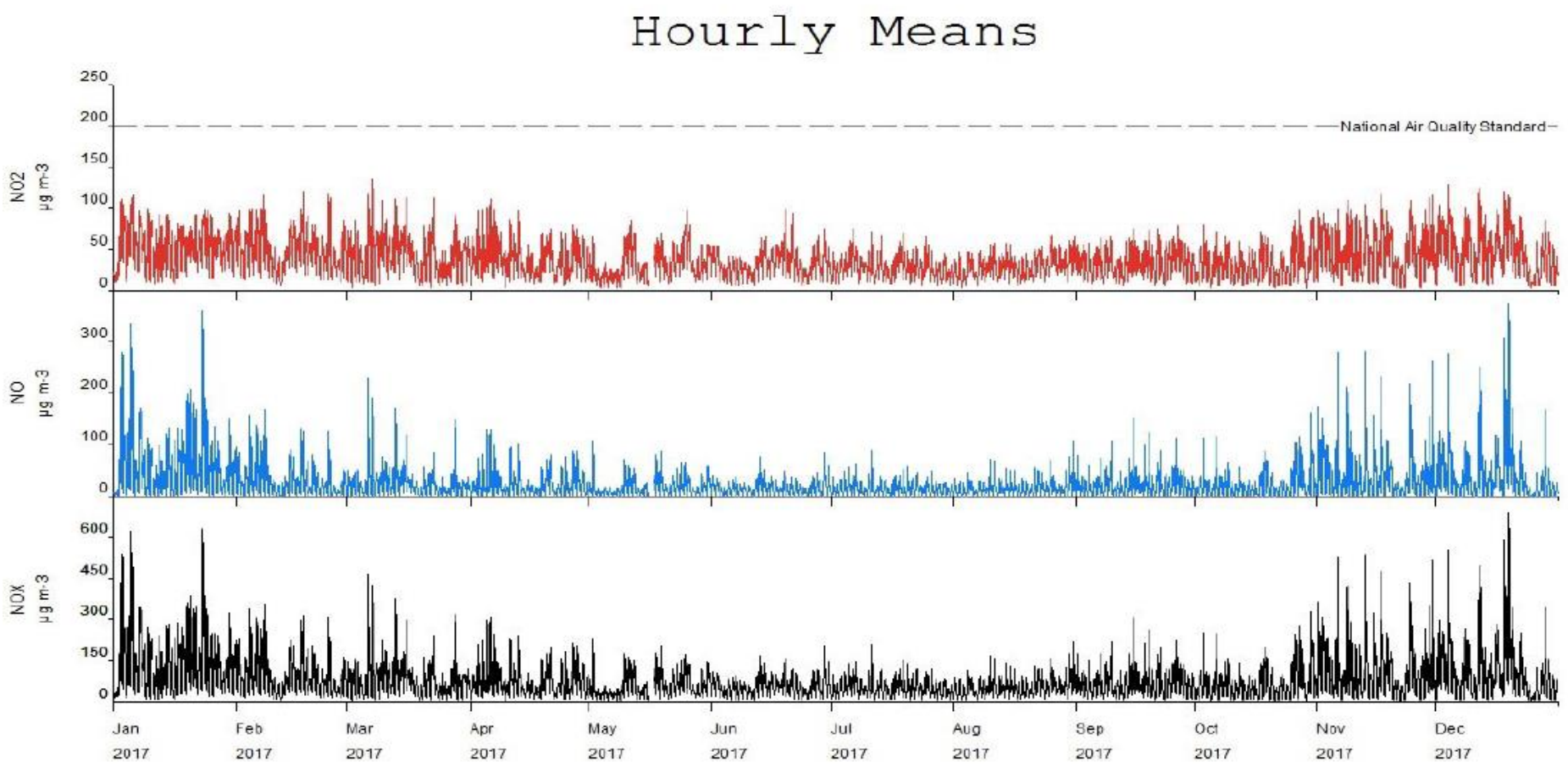


Figure 3.3 Time series plots (hourly, daily and monthly) of NO2 (ug/m3) at Swindon Road automatic monitoring site 2017

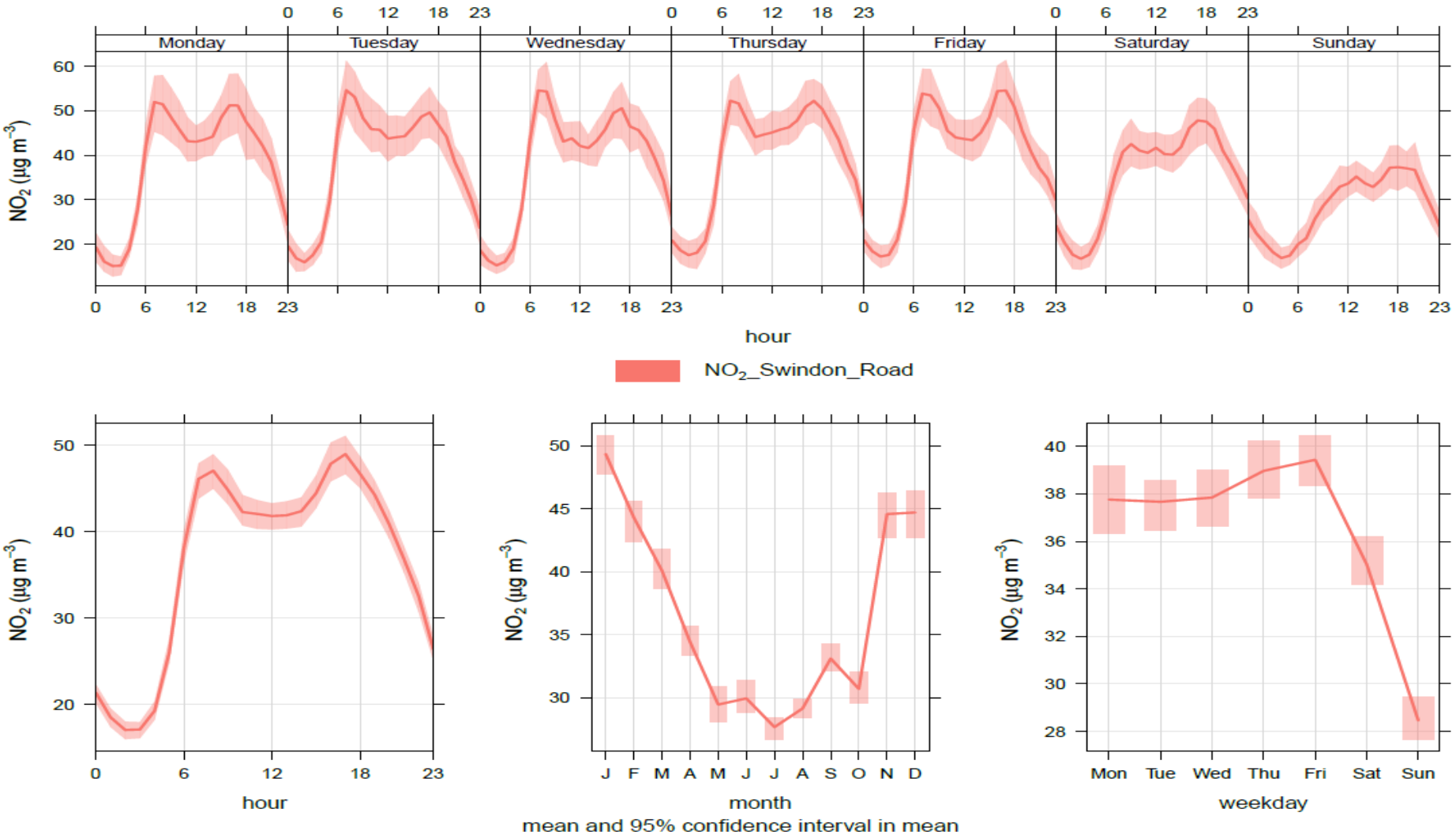
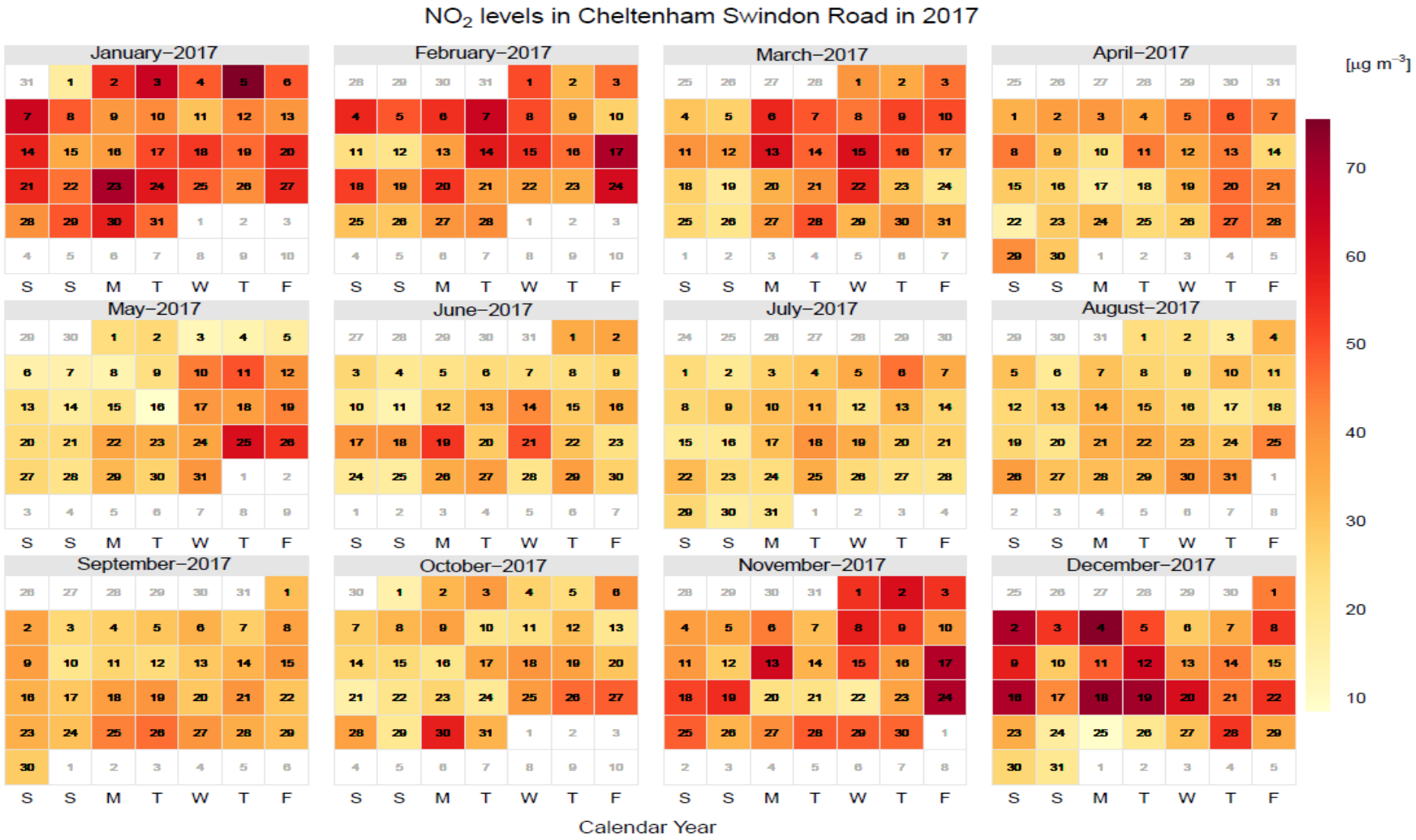


Figure 3.4 Colour representation of daily NO2 concentrations (ug/m3) at Swindon Road automatic monitoring site 2017



3.2.2 Particulate Matter (PM_{10})

No PM_{10} monitoring was carried out by Cheltenham Borough Council during the period covered by this report. Although historical Urban Background monitoring up to 2009 did not identify any exceedance of PM_{10} levels, it is possible that roadside locations near to busy roads and junctions could exhibit elevated levels of PM_{10}.

Unfortunately there is no currently practical or affordable method for measuring PM_{10} levels at roadside locations where there is potential exposure in Cheltenham.

3.2.3 Particulate Matter ($PM_{2.5}$)

No Particulate Matter ($PM_{2.5}$) monitoring was undertaken in 2017 as no threshold limit values were stipulated. Cheltenham Borough Council will be considering the extent of monitoring required to satisfy subsequent Annual Status Reports.

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	St Georges Street	Kerbside	394760	228878	NO_2	Y	Chemiluminescence	0	2.4	1.3

(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.

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	Municipal Offices(front)	Roadside	394757	222320	NO2	Y	0	7	N	4
2	Municipal Offices (rear)	Roadside	394724	222320	NO2	Y	10	4.5	N	3.5
3	Ladies College	Roadside	394621	222215	NO2	Y	0	3	N	2.8
4	2 Gloucester Rd	Roadside	394235	223055	NO2	Y	2	2	N	3
5	422 High Street	Roadside	394350	222923	NO2	Y	0	2	N	3
6	New Rutland	Roadside	394738	222888	NO2	Y	0	2	N	3
7	Co-location – St Georges Street	Roadside	394760	222878	NO2	Y	1	2	Y	1.4
8	Co-location – St Georges Street	Roadside	394760	222878	NO2	Y	1	2	Y	1.4
9	Co-location – St Georges Street	Roadside	394760	222878	NO2	Y	1	2	Y	1.4
10	2 Swindon Road	Kerbside	394830	222845	NO2	Y	1	1	N	3
11	Portland Street	Roadside	395110	222670	NO2	Y	2	2	N	2.9
12	Winchcombe Street	Roadside	395210	222618	NO2	Y	1	2	N	3.1
13	Albion Street (outside No: 54)	Kerbside	395207	222465	NO2	Y	5	0.5	N	3.5
14	2 London Road	Roadside	395362	222000	NO2	Y	0	2	N	2.9
15	YMCA Shop	Roadside	395182	222183	NO2	Y	0	2	N	3.2
16	8a Bath Road	Roadside	395146	222149	NO2	Y	0	2	N	3.1
17	Clarence Parade (opposite No: 6)	Roadside	394801	222454	NO2	Y	0	3	N	3
18	81 London Road	Roadside	395660	221670	NO2	Y	0	5	N	2.7
19	264 Gloucester Rd	Roadside	393296	222170	NO2	Y	5	2	N	3
20	340 Gloucester Rd	Roadside	392912	221862	NO2	Y	0	2	N	2.9

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

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 2017 (%) (2)	NO_2 Annual Mean Concentration ($\mu g/m^3$) (3)				
					2013	2014	2015	2016	2017
St Georges St	Roadside	Automatic	99.3	99.3	36	35	35	34	36
1	Roadside	Diffusion Tube	100.0	100.0	nm	nm	nm	nm	26.4
2	Roadside	Diffusion Tube	100.0	100.0	nm	nm	nm	nm	32.9
3	Roadside	Diffusion Tube	100.0	100.0	nm	33.9	36.6	33.8	32.8
4	Roadside	Diffusion Tube	100.0	100.0	**40.4**	**41.7**	**46.5**	**43.2**	**45.4**
5	Roadside	Diffusion Tube	100.0	100.0	**50.9**	**46.5**	**47.3**	**45.5**	**49.9**
6	Roadside	Diffusion Tube	100.0	100.0	**41.2**	**42.1**	**42.4**	**40.8**	**41.6**
7	Roadside	Diffusion Tube	91.7	91.7	37.1	35.1	34.6	32.9	36.0
8	Roadside	Diffusion Tube	100.0	100.0	36.5	34.0	35.2	34.2	36.9
9	Roadside	Diffusion Tube	91.7	91.7	35.3	34.1	34.0	32.8	36.2
10	Kerbside	Diffusion Tube	91.7	91.7	39.2	38.8	37.9	38.2	39.4
11	Roadside	Diffusion Tube	100.0	100.0	38.5	35.2	36.8	35.7	35.9
12	Roadside	Diffusion Tube	100.0	100.0	38.9	39.3	33.0	32.2	32.8
13	Kerbside	Diffusion Tube	91.7	91.7	nm	nm	nm	nm	34.8
14	Roadside	Diffusion Tube	100.0	100.0	**41.4**	**40.1**	**40.0**	38.0	37.1
15	Roadside	Diffusion Tube	91.7	91.7	37.8	35.2	34.5	32.9	31.9
16	Roadside	Diffusion Tube	91.7	91.7	**41.8**	**40.8**	**41.1**	38.4	38.0
17	Roadside	Diffusion Tube	91.7	91.7	nm	nm	nm	Nm	33.8
18	Roadside	Diffusion Tube	91.7	91.7	**42.1**	**41.8**	**41.4**	39.6	38.4
19	Roadside	Diffusion Tube	100.0	100.0	38.3	34.0	36.7	32.2	34.4
20	Roadside	Diffusion Tube	91.7	91.7	37.6	36.3	38.7	35.9	38.6

Notes: Exceedances of the NO_2 annual mean objective of $40\mu g/m^3$ are shown in **bold**. nm = not monitored during this period.

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 Technical Guidance LAQM.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

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 2017 (%) (2)	NO_2 1-Hour Means > 200µg/m^3 (3)				
					2013	2014	2015	2016	2017
St Georges Street	Roadside	Automatic	99.3	99.3	0	0	0	0	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 2016

Table B. 1 NO_2 Monthly Diffusion Tube Results - 2016

Site ID		NO_2 Mean Concentrations (µg/m^3) – before bias adjustment												Annual Mean		
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Raw Data	Bias Adjusted and annualised	Distance corrected to nearest exposure
1	Municipal Offices (Front)	39.3	26.5	27.1	21.7	18.8	21.1	22.6	22.0	22.6	25.9	31.4	29.2	25.7	26.4	26.4
2	Municipal Offices (Back)	47.0	33.3	31.9	28.5	29.9	27.4	24.8	27.9	26.6	31.8	39.2	34.8	31.9	32.9	27.2
3	Ladies College	41.9	31.9	33.3	27.2	27.6	32.6	27.4	29.2	29.1	33.1	37.2	31.7	31.8	32.8	32.8
4	2 Gloucester Road	64.0	44.6	44.5	37.5	39.0	44.3	37.1	38.6	42.5	45.6	48.6	43.0	44.1	**45.4**	**40.1**
5	422 High St	61.6	44.0	44.7	43.7	41.1	48.9	37.8	40.4	45.6	48.3	67.5	58.1	48.5	**49.9**	**49.9**
6	New Rutland	60.9	42.1	43.0	33.7	32.6	39.7	32.2	36.9	34.9	42.5	45.3	41.1	40.4	**41.6**	**41.6**
7	Co-location - 1	57.5	33.0	38.9	33.2	29.4	32.5	27.2	29.0	27.9	missing	43.3	33.3	35.0	36.0	34.1
8	Co-location - 2	53.8	40.4	37.2	31.8	31.1	32.2	29.6	26.6	35.1	35.5	41.3	35.1	35.8	36.9	34.9
9	Co-location - 3	48.6	missing	32.9	33.7	31.6	34.3	28.4	27.6	36.6	34.0	39.9	39.1	35.1	36.2	34.3
10	2 Swindon Road	58.8	40.1	39.3	33.7	33.1	33.8	31.0	30.8	34.1	38.9	46.8	missing	38.2	39.4	39.4
11	Portland Street	45.1	37.7	37.7	32.6	31.0	32.0	28.8	29.0	30.9	34.2	41.4	38.1	34.9	35.9	32.5
12	Winchcombe/Fairview	46.3	32.5	33.7	27.8	27.9	27.5	24.7	25.7	30.6	31.4	39.0	34.6	31.8	32.8	31.1
13	Albion Street (#54)	51.0	32.6	missing	36.8	27.8	29.4	24.5	28.0	34.2	30.1	41.1	36.3	33.8	34.8	26.4
14	2 London Road	53.3	37.9	37.0	37.1	31.5	31.0	28.2	29.2	28.7	36.2	44.7	37.3	36.0	37.1	37.1
15	YMCA - High St	46.9	33.9	30.2	25.1	10.5	27.4	missing	24.9	38.4	30.1	40.4	33.3	31.0	31.9	31.9
16	8a Bath Road	53.5	41.7	37.2	missing	34.4	33.0	29.3	28.6	33.0	36.9	41.8	36.6	36.9	38.0	38.0
17	Clarence Parade (opp. #6)	48.0	34.2	missing	31.3	25.5	28.6	25.0	24.1	32.7	37.7	39.5	34.7	32.8	33.8	33.8
18	81 London Road	48.3	missing	42.7	34.2	36.4	37.0	30.5	29.5	30.5	39.7	41.9	38.9	37.2	38.4	38.4
19	264 Gloucester Road	49.6	35.1	37.9	28.7	25.6	29.4	27.0	24.7	32.8	33.8	41.7	34.9	33.4	34.4	28.6
20	340 Gloucester Road	49.8	40.1	39.0	29.6	31.2	35.7	33.3	28.6	missing	36.8	46.3	41.3	37.4	38.6	38.6

(1) See Appendix D for details on bias adjustment – Breaches of EU limit values (after bias adjustment) shown in **BOLD**

Appendix C: Annual Mean Diffusion Tube Results for 2013 - 2017

Table C. 1 NO_2 Annual Mean Diffusion Tube Results – 5 years

Site ID		NO_2 Annual Mean Concentrations (µg/m^3) – after bias adjustment				
		2013	2014	2015	2016	2017
1	Municipal Offices (Front)	nm	nm	nm	nm	26.4
2	Municipal Offices (Back)	nm	nm	nm	nm	32.9
3	Ladies College	nm	33.9	36.6	33.8	32.8
4	2 Gloucester Road	40.4	41.7	46.5	43.2	45.4
5	422 High St	50.9	46.5	47.3	45.5	49.9
6	New Rutland	41.2	42.1	42.4	40.8	41.6
7	Co-location - 1	37.1	35.1	34.6	32.9	36.0
8	Co-location - 2	36.5	34.0	35.2	34.2	36.9
9	Co-location - 3	35.3	34.1	34.0	32.8	36.2
10	2 Swindon Road	39.2	38.8	37.9	38.2	39.4
11	Portland Street	38.5	35.2	36.8	35.7	35.9
12	Winchcombe/Fairview	38.9	39.3	33.0	32.2	32.8
13	Albion Street (outside #54)	nm	nm	nm	nm	34.8
14	2 London Road	41.4	40.1	40.0	38.0	37.1
15	YMCA - High St	37.8	35.2	34.5	32.9	31.9
16	8a Bath Road	41.8	40.8	41.1	38.4	38.0
17	Clarence Parade (opp. #6)	nm	nm	nm	nm	33.8
18	81 London Road	42.1	41.8	41.4	39.6	38.4
19	264 Gloucester Road	38.3	34.0	36.7	32.2	34.4
20	340 Gloucester Road	37.6	36.3	38.7	35.9	38.6

nm = Not measured at this time

pm = Only Partially Monitored (4 months) therefore not representative

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

Assessment of Monitoring Data:

There are continued exceedances of the Nitrogen Dioxide annual mean objective within the AQMA.

There are no other pollutants of concern within Cheltenham Borough Council.

The whole of the Borough was declared as an AQMA in 2011, as it was felt undesirable to have a multitude of smaller and probably linear (single road) AQMAs, which would require their own AQAPs, consultations, and other processes.

Assessment of Sources:

Following the screening criteria in LAQM.TG (16), there are no other transport sources of concern; therefore, a Screening Assessment will not be required.

Following the screening criteria in LAQM.TG (16), there are no industrial sources of concern; therefore, a Screening Assessment will not be required.

Following the screening criteria in LAQM.TG (16), there are no commercial/domestic sources of concern; therefore, a Screening Assessment will not be required.

Following the screening criteria in LAQM.TG (16), there are no fugitive sources of concern; therefore, a Screening Assessment will not be required.

QA:QC Data

Diffusion Tube Bias Adjustment Factors

During the period covered by this report, the diffusion tubes (20% TEA in Acetone) were supplied and analysed by Gradko International Limited. The tubes at all locations throughout the area have a monthly exposure period.

The bias adjustment factors utilised were:

• 2013 bias adjustment factor: 1.04

• 2014 bias adjustment factor: 0.97

• 2015 bias adjustment factor: 1.06

• 2016 bias adjustment factor: 1.01

• 2017 bias adjustment factor: 1.03

From 2012 local Bias Adjustment Factors were used from a triplicate co-location study that commenced at the Council's roadside Air Quality Monitoring Station in April 2012. Triplicate co-location measurements continue to be used.

Factor from Local Co-location Studies

The Bias Adjustment Factor used for 2017 was from a local co-location study located at the roadside Automatic NO2 analyser instrument at the junction of St George's Street and Swindon Road. The Bias Adjustment Calculation resulted in a Bias Adjustment Factor of 1.03 for 2017. This was calculated using the AEA_DifTPAB_v04.xls spreadsheet. A copy of the spreadsheet is included below.

Discussion of Choice of Factor to Use

The Local Bias Adjustment Factor was used since the triplicate study demonstrated good precision and we obtained high quality chemiluminescence analyser results.

QA/QC of automatic monitoring

Cheltenham Borough Council's nitrogen dioxide Air Quality Monitoring Station (AQMS) on St Georges Street/Swindon Road junction is operated and managed by Enviro Technology Services plc. The unit was installed in August 2011 and Enviro Technology Services undertake routine monthly calibration visits and data download services. Data received is ratified by Geoff Broughton from Air Quality Data Management (AQDM). Ratified data is provided to us every quarter in a .pdf format (see below).

The M200E NOx analyser is MCERTS approved and measures nitric oxide and oxides of nitrogen in total. The analyser uses a technique called chemiluminescence to detect the gases. The analytical technique used can be broadly explained by stating that a beam of light is directed onto the molecules of gases as they enter the analyser. As a result, the gas molecules themselves either emit or absorb light, and it is the intensity of the emitted or absorbed light that is measured by the analysers, and the concentrations of the pollutants are then calculated. The concentrations of the gases are then expressed in parts per billion (parts of gas per billion parts of air).

QA/QC of diffusion tube monitoring

Nitrogen dioxide diffusion tubes used by Cheltenham Borough Council in 2017 were 20% TEA in water supplied and analysed by Gradko International Limited. It can be confirmed that the laboratory follows the procedures set out in the Harmonisation Practical Guidance Procedures under the DEFRA practical guidance. It also participates in the Ambient, Indoor, Workplace Air and Stack Emissions Proficiency Testing (AIR PT) scheme. This is an independent analytical proficiency-testing (PT) scheme, operated by the Health and Safety Laboratory (HSL) and accredited by LGC Limited. The results from the AIR PT scheme for this laboratory during 2017 indicate that 100% of the results submitted were deemed to be satisfactory.

Figure D. 1 Copy of Diffusion Tube Co-location study calculation of Precision and Bias Adjustment 2017

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	29/12/2016	30/01/2017	57.52	53.76	48.57	53	4.5	8	11.2	49.9	98.6	Good	Good
2	30/01/2017	06/03/2017	32.95	40.41		37	5.3	14	47.4	43.5	99.6	Good	Good
3	06/03/2017	05/04/2017	38.89	37.21	32.88	36	3.1	9	7.7	40.4	99.6	Good	Good
4	05/04/2017	05/05/2017	33.21	31.83	33.73	33	1.0	3	2.4	31.4	99.6	Good	Good
5	05/05/2017	07/06/2017	29.35	31.12	31.58	31	1.2	4	2.9	30.5	96.1	Good	Good
6	07/06/2017	05/07/2017	32.45	32.19	34.28	33	1.1	3	2.8	29.9	99.4	Good	Good
7	05/07/2017	07/08/2017	27.19	29.64	28.35	28	1.2	4	3.0	27.2	99.7	Good	Good
8	07/08/2017	04/09/2017	28.96	26.55	27.59	28	1.2	4	3.0	30.5	99.6	Good	Good
9	04/09/2017	04/10/2017	27.89	35.13	36.55	33	4.6	14	11.5	32.8	99.7	Good	Good
10	04/10/2017	02/11/2017		35.53	34.04	35	1.1	3	9.5	32.0	99.1	Good	Good
11	02/11/2017	06/12/2017	43.26	41.31	39.86	41	1.7	4	4.2	46.0	99.8	Good	Good
12	06/12/2017	01/01/2018	33.31	35.06	39.11	36	3.0	8	7.4	41.9	99.7	Good	Good
13													
										Overall survey -->		Good precision	Good Overall DC

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

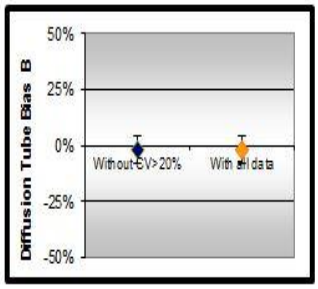
(Check average CV & DC from Accuracy calculations)

Site Name/ ID:	Cheltenham Borough Council

Precision: 12 out of 12 periods have a CV smaller than 20%

Accuracy (with 95% confidence interval) without periods with CV larger than 20%	
Bias calculated using 12 periods of data	
Bias factor A	1.03 (0.97 - 1.1)
Bias B	-3% (-9% - 3%)
Diffusion Tubes Mean:	35 μgm^{-3}
Mean CV (Precision):	7
Automatic Mean:	36 μgm^{-3}
Data Capture for periods used:	99%
Adjusted Tubes Mean:	36 (34 - 39) μgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 12 periods of data	
Bias factor A	1.03 (0.97 - 1.1)
Bias B	-3% (-9% - 3%)
Diffusion Tubes Mean:	35 μgm^{-3}
Mean CV (Precision):	7
Automatic Mean:	36 μgm^{-3}
Data Capture for periods used:	99%
Adjusted Tubes Mean:	36 (34 - 39) μgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

Ratified data from NO2 analyser on St Georges Road - Swindon Road junction

Produced by AQDM on behalf of Cheltenham B.C.

CHELTENHAM SWINDON ROAD 1 January to 31 December 2017

This data has been fully ratified by AQDM to LAQM TG(09) standards

Site Description

ROADSIDE: Junction of Swindon Road and St George St

Statistical Summary Report

This 2017 report contains all the statistics required for the LAQM reporting.

Figure D. 2 Air Quality Statistics 2017

Pollutant	NO	NO_2	NO_X
Number Very High #	-	0	-
Number High #	-	0	-
Number Moderate #	-	0	-
Number Low #	-	8700	-
Maximum 15-minute mean	405 µg m^{-3}	151 µg m^{-3}	742 µg m^{-3}
Maximum hourly mean	375 µg m^{-3}	134 µg m^{-3}	690 µg m^{-3}
Maximum running 8-hour mean	236 µg m^{-3}	101 µg m^{-3}	461 µg m^{-3}
Maximum running 24-hour mean	137 µg m^{-3}	79 µg m^{-3}	288 µg m^{-3}
Maximum daily mean	126 µg m^{-3}	76 µg m^{-3}	268 µg m^{-3}
Average	24 µg m^{-3}	36 µg m^{-3}	73 µg m^{-3}
Data capture	99.3 %	99.3 %	99.3 %

Daily Air Quality Index (DAQI) as defined by COMEAP January 2012 and revised April 2013
Mass units for the gases are at 20'C and 1013mb
NO_X mass units are NO_X as NO_2 µg m^{-3}

Figure D. 3 Air Quality Exceedences 2017

Pollutant	Air Quality (England) Regulations 2000 & (Amendment) Regulations 2002	Max Conc	Number	Days	Allowed	Exceeded
Nitrogen Dioxide	Annual mean > 40 µg m^{-3}	36 µg m^{-3}	0	-	-	No
Nitrogen Dioxide	Hourly mean > 200 µg m^{-3}	134 µg m^{-3}	0	0	18 hours	No

The annual mean for Nitrogen Dioxide was 36 µg m^{-3} which did not exceed the 40 µg m^{-3} Objective.

The maximum hourly mean was 134 µg m^{-3} so there were no exceedences on the NO2 hourly limit of 200 µg m^{-3}. There is an annual allowance of 18 hours so this Objective was not exceeded.

Appendix E: Map(s) of Monitoring Locations

Figure E. 1 Location of NO2 roadside monitoring station

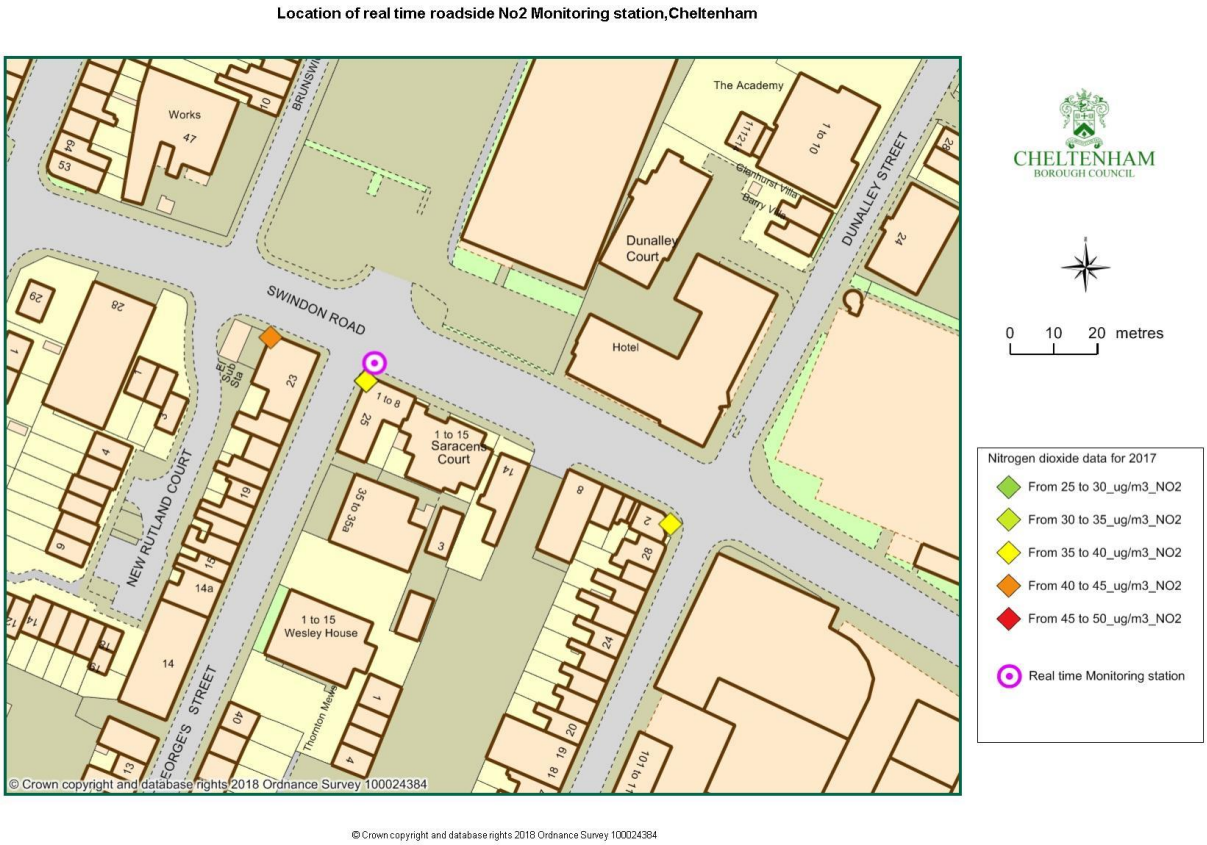


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Figure E. 2 Roadside monitoring station at St Georges Street/Swindon Road

Figure E. 3 Map of Non-Automatic Monitoring Sites 2017

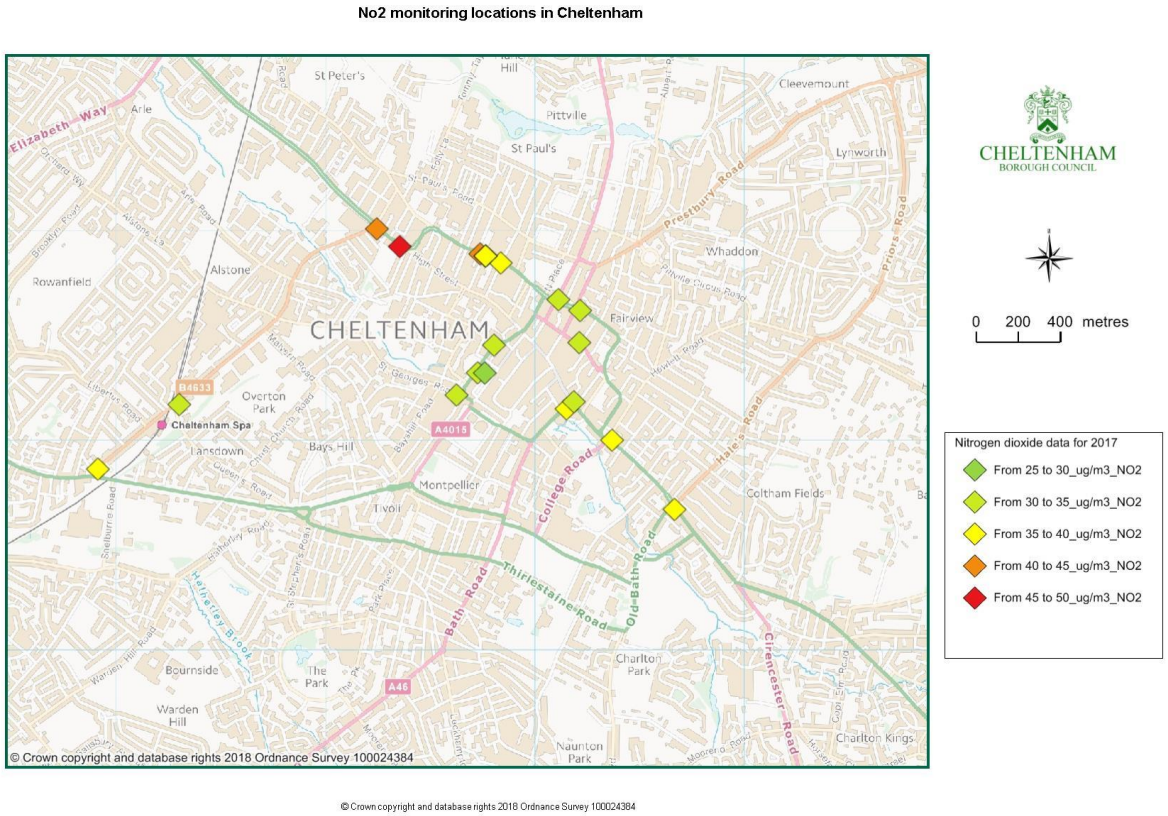
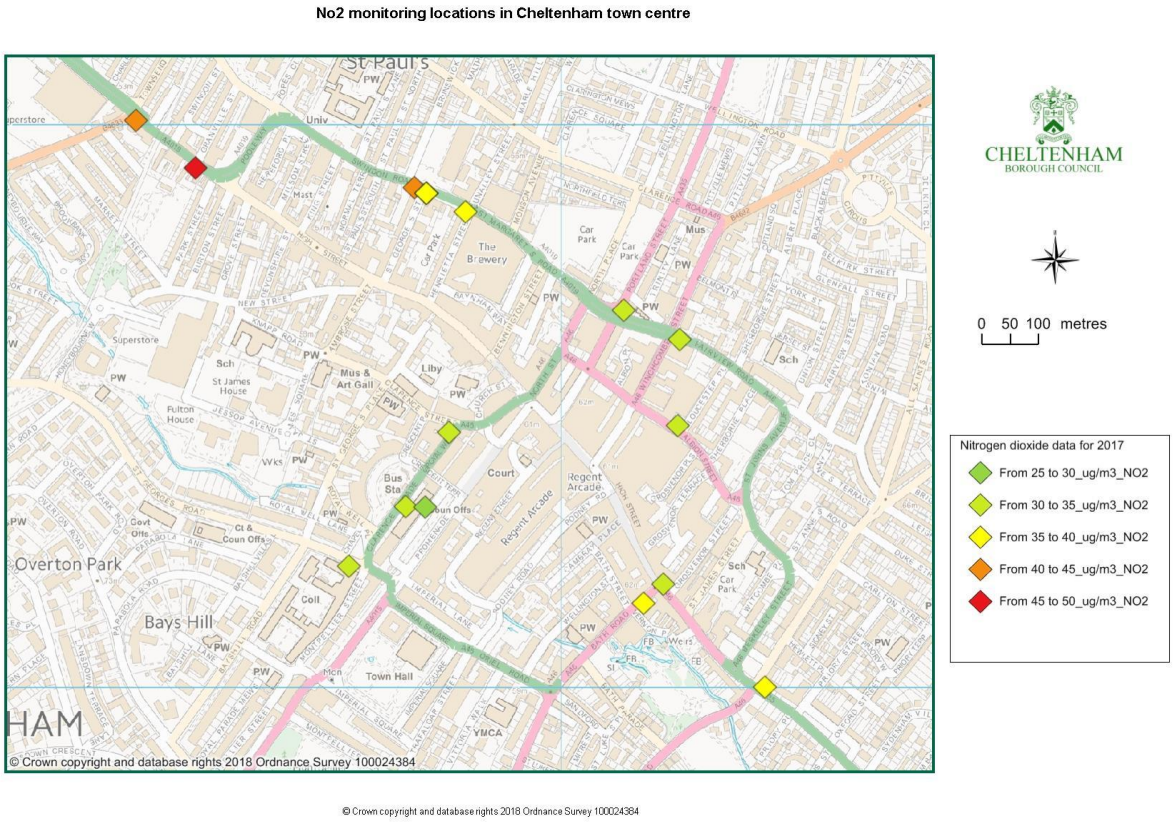


Figure E. 4 Map of Town Centre non-automatic monitoring sites 2017



Appendix F: Summary of Air Quality Objectives in England

Table E. 1 Air Quality Objectives in England

Pollutant	Air Quality Objective[4]	
	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

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

Glossary of Terms

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

References

1. https://laqm.defra.gov.uk/documents/LAQM-PG16-April-16-v1.pdf
2. https://laqm.defra.gov.uk/documents/LAQM-TG16-February-18-v1.pdf
3. Local Air Quality Management – Technical Guidance LAQM.TG(09) – DEFRA (2009)
4. 2018 Air Quality Annual Status Report (ASR) – Cheltenham Borough Council