



2017 Air Quality Annual Status Report (ASR)

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

July 2017

Guildford Borough Council

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Executive Summary: Air Quality in Our Area

Overview of Air Quality in Guildford Borough

This overview is a summary of the state of air quality in the Guildford Borough Council (GBC) area and progress on actions that the local authority and others are taking to improve air quality. The report covers air quality monitoring and actions in 2016.

Air Quality in Guildford Borough

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 areas¹.

The annual health cost to society of the impacts of particulate matter alone in the UK is estimated to be around £16 billion².

History and Background

The Borough of Guildford, centred on the town of Guildford, has a population around 148,000, approximately half of which live within the urban area. The main source of emissions in Guildford Borough is from motor vehicles. Four major roads pass through the Borough. The M25 enters the Borough briefly at Wisley at its junction with the A3. The A3 runs from north to south through the Borough, linking with the A31, which joins the A331 Blackwater Valley Road. Whilst the land use is predominantly residential, there are a number of light industrial sites; to date there is no record of any significant air quality impact from these locations.

Guildford Borough established Smoke Control Areas in the 1960's covering approximately 12 square kilometres of the urban area. These areas are still operational and subject to statutory control.

The Annual Status Report (ASR) 2016 considered the monitoring data over the calendar years 2014 and 2015 and compared the levels measured with national objectives. One site required further investigation as levels are constantly above the annual nitrogen dioxide (NO₂) annual objective level. The area in question is the B3000, which passes through the village of Compton and specifically the area at the northern end where the properties are in close proximity to the road. This area was subject of air quality modelling in September 2016, which recommended further monitoring. Both additional passive diffusion tubes and automatic continuous monitoring equipment for nitrogen dioxide have been located in close proximity to the site of the original exceedance; the process will be completed in August 2017.

We recognise that in order to deal with air quality, the co-operation of Surrey County Council (SCC), Highways Agency (HA) and the Environment Agency is vital. At officer level, there is a Surrey Air Alliance Group, where all eleven districts work with SCC to address statutory obligations and matters raised in the Surrey Air Quality Strategy 2016. One of the main targets is to map levels of PM_{2.5} throughout the county, investigate hotspots and quantify the links with health indicators this work is in progress and will conclude in 2017.

Finally, a number of transport related actions, which are aimed at tackling air quality issues can be found in the revised Guildford Borough Transport Plan 2017.

Actions to Improve Air Quality

The principal issues and findings of the Annual Status report are:

- In order to implement the recommendations of the Air Quality Overview and Scrutiny Group, the Executive has established an Executive Air Quality Monitoring Group, where councillors are working together with officers to implement actions to include in the air quality strategy. This has led to a higher profile of air quality issues, in

¹ Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006

² Defra. Abatement cost guidance for valuing changes in air quality, May 2013

particular the links with public health, which have been classed as high priority by the Guildford Health and Wellbeing Board.

- Guildford Borough Council (GBC) recognises that the significant source of air pollution in the borough is from road traffic. GBC reviewed the monitoring of Nitrogen Dioxide (NO₂) using passive diffusion tubes during 2016 and the monitoring locations has been altered with a number of new sites in areas where road traffic may have an influence on sensitive receptors. Further investigation is triggered by exceedances of the objective levels that have been calculated at the nearest sensitive property.
- Surrey County Council (SCC) and the Highways Agency (HA) are the highway authorities; in addition, GBC has updated its' Guildford Borough Transport Strategy 2017, which includes a section on air quality.
- The detailed investigation of a specific area of the B3000 road in the village of Compton has continued with;
 - relocation of some of the passive diffusion tubes,
 - a modelling exercise which confirmed the likelihood of and extent of an Air Quality Management Area (AQMA),
 - automatic continuous monitoring commencing in early 2017,
 - consultation with SCC Highways has commenced on potential remedial measures within the potential AQMA.
 - drafting of an AQMA declaration prior to obtaining committee approval.
- GBC commissioned AECOM to carry out an Air Quality Review of Guildford Borough Proposed Submission Local Plan; the final report, which was published in June 2017, considers the potential air quality effects of major sites and recommends further detailed modelling in specific areas of the Borough.
- The consultation by Defra in May 2017 on the Draft UK Air Quality Action Plan has identified GBC as a local authority with one or more roads forecast to persistently exceed NO₂ objective levels based on modelling predictions. The final plan, which was published in July 2017 indicates that GBC will be required to develop and implement a Clean Air Zone. The other authorities involved are Rushmoor BC, Surrey Heath BC and the respective highway authorities.
- GBC recognises the need to co-ordinate work with partners and the public in order to improve air quality. One of the targets for 2017 is to produce an Air Quality Strategy and Action Plan to address the key issues. This document will also include details of any actions.
- GBC have worked with SCC on installing further rapid charge facilities in the town centre and SCC have commenced drafting an Electric Vehicle Charging Strategy.

Local Priorities and Challenges

In line with those set out in 2016, GBC has set out the following priorities:

1. Enhance our approach to air quality

- a. Complete and publish an Air Quality Strategy and Action Plan. This will form the basis of future actions and initiatives.

2. Monitoring and reporting of air pollution levels

- a. Complete a detailed investigation of the potential AQMA in The Street Compton
- b. Maintain and where necessary expand the nitrogen dioxide passive diffusion tube network
- c. Report on the two six month continuous monitoring exercises in Compton and Tongham
- d. Explore the link between PM_{2.5}, NO₂ and public health by carrying out a modelling exercise across Surrey.
- e. Undertake real time monitoring of NO₂ adjoining the A331 in Ash

- f. Respond to Defra consultation " Draft UK Air Quality Plan" and investigate whether a Clean Air Zone is required.

3. Reducing vehicle emissions

- a. Reduce emissions in the GBC transport fleet by increasing the percentage of low emission vehicles.
- b. Produce an Air Quality Action Plan for any potential AQMA in Compton
- c. In conjunction with SCC provide facilities to ensure the efficient electric charging of vehicles is available to a wider part of the community and business.
- d. Explore opportunities to retrofit existing buses with the operators.
- e. Apply for government funding to facilitate improvements where appropriate.
- f. Explore future options for Taxi Vehicle Licensing requirements.

4. Working with other agencies

- a. Reinforce the public health to work by continuing to work with SCC Public Health to ensure that the profile of air quality improvements is elevated.
- b. Work with the two respective authorities Highways England and SCC through the Guildford Transport Strategy.
- c. Work with SCC on local improvements where required in the potential AQMA in Compton.
- d. Work with Surrey Heath Borough Council, Rushmoor Borough Council, SCC and Hampshire County Council on the potential Clean Air Zone on the A331.

5. Planning Framework

- a. Ensure that the Local Plan process takes account of any relevant findings within air quality investigations or modelling.
- b. In conjunction with SCC and other Surrey authorities; provide guidance for developers to ensure that air quality is uniformly addressed at the pre application phase.
- c. Create a sustainable movement corridor.
- d. Facilitate infrastructure improvements including ; new railway stations and relief schemes for areas of localised congestion for example a bridge to replace a level crossing in Ash.

6. Challenges

The following challenges to achieving priorities have been identified:

- a. Provision of an effective process to link air quality with health outcomes in a reportable manner.
- b. Sufficient budget and resource allocation to achieve the priorities and strategy targets.
- c. Influencing behavioural change in the population of the Borough.
- d. Engagement with other organisations and commitment of their resource (human and financial) on actions.
- e. Nature of the road network in the Borough.
- f. Cost of infrastructure improvements and the provision of funding.

How to Get Involved

Guildford Borough has a number of ways that the public can get involved in air quality issues (relevant web links) they include:

- g. Reporting bonfires or air pollution incidents to our Customer Service Centre, to enable investigation under the Environmental Protection Act 1990 or other related legislation. <http://www.guildford.gov.uk/bonfires>
- h. Reporting on residential localities where traffic congestion is significant, in order that monitoring of air pollution can be considered under the Annual Status Report mechanism. <https://www.guildford.gov.uk/article/14060/Report-air-quality>
- i. Use cleaner (ultra-low emission) vehicles. Advice is available from The Office for Low Emission Vehicles <https://www.gov.uk/government/organisations/office-for-low-emission-vehicles>
- j. Reduce vehicle use, by participation in sustainable transport options; public transport, park and ride, walking, cycling, car clubs and car sharing. <http://www.guildford.gov.uk/carclubs>; <https://www.surreycc.gov.uk/roads-and-transport/buses-and-trains/guildford-park-and-ride>
- k. Ensure compliance with Smoke Control Orders, by only using authorised appliances and fuel. <http://www.guildford.gov.uk/article/1734/Smoke-control-area>
- l. Participate in the activities of Guildford Environmental Forum. <http://www.gefweb.org.uk/index.html>

Comment on the potential impact of proposed developments in the Borough via the planning process. <http://www.guildford.gov.uk/commentonaplanningapplication>

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1 Local Air Quality Management

This report provides an overview of air quality in Guildford Borough during 2016. 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 Guildford 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 Table E.1 in Appendix E.

2 Actions to Improve Air Quality

2.1 Air Quality Management Areas

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

Currently the Council does not have an AQMA.

GBC are currently investigating an area centred around four roadside cottages in The Street, Compton, as the annual nitrogen dioxide levels indicate that it may need to be declared an AQMA. The area under investigation was modelled by AECOM, The Street, Compton-Air Quality Assessment September 2016 and will be assessed for nitrogen dioxide levels using automatic continuous monitoring from February to August 2017.

2.2 Progress and Impact of Measures to address Air Quality in Guildford Borough Council

Following an Overview and Scrutiny Committee recommendation, GBC has established an Executive Air Quality Monitoring Group, where councillors are working together with officers to examine our duties and commitments under the Local Air Quality Management (LAQM) regime. The findings have led to a higher profile of air quality priorities and impetus on finding solutions to the challenges set in 2016.

In the ASR 2016 we set out a number of priorities, an outline of the key areas progress is set out below :

Priority 1 – Enhance our approach to air quality

A draft air quality strategy in line with the Surrey Air Quality Strategy 2016 is being prepared by the Executive Air Quality Working Group, it is being drafted in line with the Defra template for Air Quality Action Plans. After a consultation exercise it will be adopted in 2017.

Priority 2 - Actions to improve air quality and monitor progress (See Table 2.1)

We have worked through the Surrey Health and Wellbeing Board, Guildford Health and Wellbeing Board to raise individual and organisational awareness of the need improve air quality by changing to cleaner transport and reducing motor vehicle emissions.

We recognised the need to monitor the progress of actions, Table 2.1 provides details of the relevant actions.

Priority 3 - Monitoring and reporting of air pollution levels:

- During 2016, GBC reviewed the monitoring of nitrogen dioxide (NO₂) using passive diffusion tubes and the network has been altered with a number of new monitoring locations in areas where road traffic may have an influence on sensitive receptors.
- GBC has carried out further diffusion tube monitoring and commissioned modelling of nitrogen dioxide (NO₂) in the village of Compton.

- Two automatic monitoring stations have been set up in Compton and Tongham to run from March to August 2017.
- The air quality page on the GBC website contains the most up to date results and reports.
- All Surrey local authorities and SCC Public Health have jointly commissioned a countywide modelling of Pm₁₀, Pm_{2.5} NO_x, NO₂ and health indicators. The results will help identify hotspots and determine future monitoring and/or action plans.

Priority 4 - Reducing vehicle emissions: (see Table 2.1)

During 2016 and into 2017 GBC and our partner authorities have taken a number of steps to try to reduce vehicle emissions and traffic congestion by linking car use with the promotion of public and alternative means of transport, This remains central to reducing pollution from vehicle exhaust emissions in Guildford. Park and ride schemes, car share schemes, car clubs, green scheme for parking electric vehicles, bus lanes, cycling and walking strategies and integrated transport plans, all form part of the overall approach.

GBC has taken actions to reduce vehicle emissions from its own activities:

- Emissions are a prominent factor in procurement of The Council's vehicle fleet.
- GBC encourage internal lease car users to lease low emission vehicles setting a limit on the carbon dioxide (CO₂) emissions.
- Guildford town centre car clubs have expanded and utilise more vehicles that are electric.
- GBC have carried out a scoping exercise; with the intention to provide additional charging points in town centre public car parks during 2017.
- Use of the two electric pool cars by staff has increased , the installation of the associated rapid charging points is planned for autumn 2017.
- Provide more guidance on Smoke Control Orders, Travel Plans and other legislative requirements via the GBC website.
- Where practicable, we procure ultra-low emission fleet vehicles.
- In 2017 GBC will report on the environmental benefits accrued from reduced car journeys, as we continue to encourage home working by staff.

Priority 5 – Planning controls on development

The requirement for additional housing and associated infrastructure across GBC and the south east of England, represents significant challenge of maintaining and improving air quality. The Local Plan for Guildford Borough is a key document. Local Plan Air Quality

- AECOM consultants were commissioned by GBC to conduct air quality modelling exercises for the major sites identified in the Local Plan and major changes to road systems. The Air Quality Review of Guildford Local Plan was published in June 2017.

- Planning applications - Where a proposed development is likely to impact local air quality, an air quality assessment is required. SCC have set guidance for Planning Development Managers in consultation with Surrey Air Alliance.
- SCC advise on and monitor travel plans as part of their Travel Smart initiative.
- The Guildford Borough Transport Strategy 2017 has an indicative programme which includes measures set out as far as 2034, actions anticipated within the current year are:
 - Guildford Town Centre Transport Package -improvements for buses and active modes have been planned
 - Increase train service frequency on the North Downs line to two fast trains per hour between Reading and Gatwick, via Guildford.

Details of all measures completed, in progress or planned are set out in Table 2.1.

More detail on these measures can be found in the;

- Guildford Borough Transport Strategy 2017
- Surrey Transport Plan: Air Quality Strategy (SCC 2016)
- Guildford Borough Cycling Plan 2015
 - GBC has a green scheme for car parking, which heavily discounts parking of electric vehicles. <http://www.guildford.gov.uk/carparks>
 - The Guildford Borough Transport Strategy 2017 was updated in June 2017.

Table 2.1 – Progress on Measures to Improve Air Quality

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Progress to Date	Estimated Completion Date	Comments
1	GBC Transport policy	Alternatives to private vehicle use	Car & lift sharing schemes	SCC/GBC	1999	Ongoing	Restrain or reduce traffic	GBC have a register of car sharers.	Ongoing	
2	Provision of electric charging points in GBC car parks	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	GBC	2016	2017	Reduce emissions at source	Four charging points to be installed in town centre car parks during 2017. Waitrose store in Guildford has four charging points.	2017	Locations to be finalised.
3	Provision of electric charging points in public areas and residential streets	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	SCC	2017	2017-2020	Reduce emissions at source	Feasibility study for the provision of additional charging points in residential streets in Guildford town centre. 27 publically accessible electric vehicle charging points in the Borough.	2019	GBC are the street parking authority and are working with SCC on the new locations.
	Car Clubs in Guildford Town Centre	Alternatives to private vehicle use	Car Clubs	SCC/GBC	2016	2016	Restrain or reduce traffic	GBC are working in partnership with SCC and Enterprise Car Club to develop the scheme, with funding from the Department for Transport. There are 8 car clubs in Guildford town centre, all vehicles are either low or ultra- low emission with at least 3 electric vehicles.	Ongoing	No increase in numbers 2017.
4	Environmental Protection Act 1990	Environmental Permits	Other	GBC	2015	2016	Control emissions at source	Replacement cremators at Guildford Crematorium	2019	Variation to permit for temporary new cremators May 2017

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Progress to Date	Estimated Completion Date	Comments
5	GBC Air Quality Strategy	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	SCC/GBC	2016-17	2017	Targets within strategy	GBC air quality strategy to compliment the Surrey County Council Air Quality Strategy 2016	2017	To be produced in draft as part of action plan July 2017
6	Smoke Control Orders compliance	Promoting Low Emission Plant	Regulations for fuel quality for low emission fuels for stationary and mobile sources	GBC	2016	2017	Compliance with statute	Guildford town centre has Smoke Control areas set up in 1960's. Increase awareness and obligations for residents.	October 2017	Increase awareness of the areas on GBC website to be completed in October 2017
7	GBC procurement of vehicles	Promoting Low Emission Transport	Company Vehicle Procurement - Prioritising uptake of low emission vehicles	GBC	2016	2016	Reduce emissions at source	GBC procurement of fleet vehicles geared toward ultra-low emission vehicles where practicable.	August 2017	Ongoing process subject to renewal of fleet and lease cars
8	GBC procurement of vehicles	Promoting Low Emission Transport	Company Vehicle Procurement - Prioritising uptake of low emission vehicles	GBC	2016	2016	Reduce emissions at source	One Nissan Leaf and one ENV-200 electric pool cars are in use. Two additional electric vehicles to be purchased by Fleet Manager in 2017	Ongoing	No further plans at present
9	Council Transport policy	Promoting Travel Alternatives	Encourage / Facilitate home-working	GBC	1999	Ongoing	Restrain or reduce traffic	Subject to their duties council officers are encouraged to work from home.	Ongoing	
10	Council Transport policy	Promoting Travel Alternatives	Promotion of cycling	GBC	2015	2016	Health and restrain or reduce traffic	Guildford Borough cycling plan 2015	Ongoing	Staff scheme for cycle benefits is promoted by Climate Change Team
11	Council Transport policy	Promoting Travel Alternatives	Promotion of walking	GBC	Ongoing	Ongoing	Health and restrain or reduce traffic	Walking for health included Guildford Walkfest 2016	Ongoing	GBC Climate Change Team are planning a further Walkfest event in September 2017
12	"Council Transport policy	Promoting Travel Alternatives	School Travel Plans	SCC	Ongoing	Ongoing	Restrain or reduce traffic	These are usually voluntary or dealt with as part of planning approvals.	Ongoing	Compliance checks are carried out by SCC Travel Smart Team

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Progress to Date	Estimated Completion Date	Comments
13	Council Transport policy	Promoting Travel Alternatives	Work Travel Plans	SCC	Ongoing	Ongoing	Restrain or reduce traffic	These are usually voluntary or dealt with as part of planning approvals.	Ongoing	Compliance checks are carried out by SCC Travel Smart Team
14	GBC website	Public Information	Via leaflets, Via the Internet	GBC	2016	2016	Public perception of issues	Air quality page on GBC website was revised in July 2016. Updated information on measured levels and how to reduce air pollution at source.	December 2017	In future it is planned to provide information on alternative fuels and other initiatives
15	Green scheme parking fees for electric vehicles	Traffic Management	Emission based parking or permit charges	GBC	2015	2016	Reducing emissions	Owners of electric vehicles can apply for a parking permit to obtain reduced fees.	2017	.
16	Road Investment Strategy schemes to tackle congestion on Strategic Road Network	Traffic Management	Urban Traffic Control, Congestion management, traffic reduction	GBC/SCC	2016	Ongoing	Restrain or reduce traffic	Planning phase as part of the Guildford Borough Transport Strategy; includes a number of actions on the A3 junctions	2034	Long term objectives over the next 20 years
17	Guildford Town Centre Transport Package improvements for buses and active modes	Transport Planning and Infrastructure	Bus route improvements	SCC	2015	2016	Restrain or reduce traffic	Implementation phases are staggered; current bus targeted schemes are the A25/A320 Stoke crossroads improvement scheme including some bus priority	2017-18	
18	Improvements to cycling network	Transport Planning and Infrastructure	Cycle network	GBC/SCC	2015	2016	Alternative means of transport	Travel Smart in Surrey have used funding to improve and extend parts of the National Cycle Network in Guildford Borough	2017	Surrey Cycling Strategy 2016

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Progress to Date	Estimated Completion Date	Comments
19	Great Western Railway increased service frequency on North Downs Line with introduction of a second fast service in each hour via Guildford rail station between Reading and Gatwick Airport	Transport Planning and Infrastructure	Public transport improvements- interchanges stations and services	Great Western Railway	2015	2016	Alternative means of transport	Implementation phase is due to commence during 2016	2018	
20	Electric Vehicle Charging Strategy	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	SCC	2017	2018	Alternative means of transport	Draft strategy produced by Travel Smart Team at SCC,	2018	Supported by Surrey Air Alliance
21	Potential declaration and implementation of Air Quality Management Area	Traffic Management	UTC, Congestion management, traffic reduction	GBC/SCC	2015-2017	2018	Reducing emissions	The Street, Compton is subject to a detailed investigation. SCC have been consulted on the potential control measures.	2019	Subject to further consultation Defra approval during 2017.
22	Air quality review of Local Plan	Transport Planning and Infrastructure	Other	GBC	2016	2017	Sustainable development	The review was published in June 2017	2019	There are recommendations to carry out detailed modelling where notable changes in traffic flows are predicted.

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Progress to Date	Estimated Completion Date	Comments
23	Potential Clean Air Zone	Traffic Management	Strategic highway improvements, Re-prioritising road space away from cars, including Access management, Selective vehicle priority, bus priority, high vehicle occupancy lane	GBC/SCC	2017-19	2018	Reducing emissions	Following Defra consultation Air Quality Strategy 2017; an area of the A331 in Ash will be investigated as a potential Clean Air Zone (Non Charging). The area is also within Surrey Heath and Rushmoor authority areas.	Unknown	Subject to further consultation in 2017.
24	Air quality modelling of Surrey districts	Policy Guidance and Development Control	Regional Groups Coordinating programmes to develop Area wide Strategies to reduce emissions and improve air quality	All Surrey authorities	2016	2017	Information	Agreement to procure in May 2017	Dec 2017	This will include PM _{2.5} , PM ₁₀ , NO ₂ , NO _x , source apportionment in hotspots and health statistics.

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.

GBC is taking measures as shown in Section 2.2 to address air quality, any actions, which reduce emissions and vehicle use will have a significant impact on PM_{2.5}. Whilst there are no plans to monitor PM_{2.5}, GBC along with all Surrey authorities are carrying a county wide modelling exercise commencing in August 2017. The modelling will consist of detailed mapping of the Borough, however it will also include source apportionment in at least 20 specific hotspots per authority.

The findings will be used to gain a clearer indication of where to target future monitoring and mitigation. GBC will report on modelling as part of the AQSAP and it will included in the 2018 ASR.

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

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

GBC had no automatic (continuous) monitoring sites during 2016.

Two roadside sites to continuously monitor NO_x, NO and NO₂ have run from March to August 2017 at the following locations.

1. The Street, Compton – for the purpose of investigating the potential declaration of an AQMA. Grid ref: 495444, 147261
2. Junction of A331 and A31- for the purpose of ascertaining the ambient levels adjacent to a major trunk road and a potential housing development. Grid ref: 487978, 148480

GBC will publish the results and conclusions on the air quality web page in early September 2017.

3.1.2 Non-Automatic Monitoring Sites

GBC operated 30 non automatic monitoring sites for nitrogen dioxide during 2016.

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 (NO₂)

In June 2016, GBC reviewed all of its monitoring tube location

- Appendix A shows the details of the sites.
- Table A.2 and Graph A1 in Appendix A compares the ratified and adjusted monitored NO₂ annual mean concentrations for the past 5 years with the air quality objective of 40µg/m³.
- Appendix B contains the full 2016 dataset of monthly mean values.
- Appendix C contains further details on Quality Assurance/Quality Control (QA/QC) and bias adjustment for the diffusion tubes are included in.
- Appendix D contains the maps showing the location of the monitoring sites.

Details of monitoring sites

For all the following locations please refer to Table A1 in Appendix A for the site location and distance to relevant exposure.

Please refer to the DEFRA calculator for calculation of NO₂ levels near receptor which has been used for distance correction. The calculator is available at the following link:

<https://laqm.defra.gov.uk/tools-monitoring-data/no2-falloff.html>

Guildford town centre locations (GD1 and GD13)

GD1 is a roadside location at Bridge Street. The location is of interest for short term exposure due to high pedestrian usage trying to gain access to the Guildford Station or the Town Centre. The annual mean NO₂ at this location was measured 36µg/m³ in 2016.

Near GD13, the YMCA with first floor residential accomodation is identified as potential site of public exposure with regard to long term objective value. GD13 is approximately 2.5m from the kerb and receptor approximately 6.0m and annual mean measured at this location is 35µg/m³. The NO₂ level at the receptor after distance correction is 32.6 µg/m³.

Junction of Stoke Road/York Road, Guildford (GD2, GD14)

GD2 and GD14 are located at York Road/Stoke Road junction, they are 12 and 5 metres respectively to the nearest receptors. The NO₂ levels at both the locations remained slightly below the air quality objectives. Considering the distance to the nearest receptors, the national objective is unlikely to be exceeded at these locations.

Stoke Road (Lido, GD15), and Josephs Road (GD3) Guildford

GD3 is an urban background site. There are no objective level exceedances, but we intend to continue monitoring to provide background levels near the town centre and major roads.

GD15 was introduced in August 2016. The tube is located on the façade of two cottages adjacent to the Stoke Cross roads, which is heavily trafficked throughout the day. As only five months data has been gathered, no conclusion can be made on any potential exceedances of the national objective levels.

Junction A3/M25, Wisley (GD5) changed to Elm Corner (WS1) in July 2016

The original location (GD5) was selected to give an indication of background levels in an area of high traffic flow. This site location was revised in July 2016 as sufficient background data has been gathered. The new location is nearer to residential properties. It is representative of semi-rural background and there are currently no exceedances of the objective levels.

Compton Village B3000: (C1-10)

As was outlined in 2016, objective levels were being exceeded at C4 which was on the façade of a residential property. The area identified was in the upper part of the Street, Compton centred around 5 cottages that are all very close to the highway. Further assessment was required with respect to declaring an AQMA at this location. An air quality modelling exercise using Advanced Dispersion Modelling Software (ADMS) was commissioned in June 2016.

A review of the tube locations was also carried out and three new tubes locations were added close to C4 (C7, C9 and C10) from July 2016. During the latter part of 2016, it was noted that the levels at the new tubes and the existing C4 exceeded the objective level. This and the conclusion of the modelling exercise led to the installation of an automatic continuous monitor in March 2017 near one of the tube locations in the potentially affected area.

The rest of the monitoring locations (C1,2, 3, 5 & 6) were discontinued as there were no exceedances of the objective level.

High Street, Ripley (RP1 and RP2)

The two locations were added in July 2016. RP1 is located on street furniture in Ripley High Street and RP2 is in Newark Lane. None of the locations have exceeded the objective level, however only 6 months of monitoring data is currently available.

Following our observations at other locations, we decided to investigate the "canyon effect" on properties in Newark Lane and it is planned to place an additional tube on one of the houses in that area.

Send Road, Send (Send1 and Send2)

Two tube locations Send1 and Send 2 were installed in August 2016. Send 1 is at the A247/B368 junction on the façade of a property. Send 2 is on street furniture in A247, approximately 16 metres to the nearest sensitive property. There were no exceedances of the objective level.

A281, Horsham Road, Shalford (SH1)

This location commenced in June 2016. Initial findings do not show any exceedance in the NO₂ objective levels. However, it is intended to continue monitoring for the full year and to examine the locality with respect to any potential hot spots near residential properties.

The Garth (GD10), A331 Ash (GD9) and Brittens Close (ASH1)

GD10 is an urban background site with no objective level exceedances. It will be used for precision monitoring using triplicate tubes from June 2017.

GD9 was a monitoring location, which was discontinued in May 2016 as there were no exceedances of the objective levels. However, following the publishing of the DEFRA's draft Air Quality Action Plan in May 2017, the location was reinstated in April 2017.

Pitch Place, Worplesdon (WP1)

This site was introduced in July 2016. It is on a road sign post in proximity to residential properties. Although six months of monitoring has been carried out, there are no exceedances of the objective levels.

3.2.2 Future monitoring site proposals

We aim to carry out further nitrogen dioxide diffusion tube monitoring at the following sites during 2017:

Proposed new sites:

1. Guildford Park Road, Guildford
2. A331 Roadside
3. Newark Lane, Ripley, at a residential façade
4. The Street, Tongham
5. Farnham Road, Guildford

Validation

We aim to put triplicate tubes at GD13 and GD10. In future years, if practical, we will locate a diffusion tube near to the continuous monitoring station operated to test correlation of the annual mean measurement with that from a continuous automatic monitoring device.

Appendix A: Monitoring Results

Table A.1 – Details of Non-Automatic Monitoring Sites 2016

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)	Notes
GD1	Bridge Street	Roadside	499269	149522	NO ₂	N	NA	<5m	N	2 -3	
GD2	York Road	Roadside	499799	149934	NO ₂	N	12m	<5m	N	2 -3	
GD3	Josephs Road	Urban background	499659	150739	NO ₂	N	0m	>5m	N	2 -3	
GD5	Wisley	Kerbside	507947	159099	NO ₂	N	NA	<1m	N	2 -3	Discontinued July 2016
GD6	The Chantry	Rural background	500385	148342	NO ₂	N	0m	120	N	2 -3	
GD8	Down Lane	Roadside	496302	148429	NO ₂	N	NA	<5m	N	2 -3	Discontinued July 2016
GD9	A331, Ash	Roadside	488275	149859	NO ₂	N	NA	<5m	N	2 -3	Discontinued July 2016
GD10	The Garth	Urban background	488629	150032	NO ₂	N	0m	>5m	N	2 -3	
GD11	Beckingham Road	Near Road	498133	150648	NO ₂	N	0m	8m	N	2 -3	

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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)	Notes
GD13	YMCA	Kerbside	499305	149512	NO ₂	N	6m	<1	N	2 -3	
GD14	Sandfields	Roadside	499800	149913	NO ₂	N	5m	<5	N	2 -3	
GD15	Stoke Road (Lido)	Near Road	499807	150792	NO ₂	N	0m	8	N	2-3	Monitoring started from August 2016
STN1	Stoughton Road	Kerbside	498831	151472	NO ₂	N	5m	<1m	N	2-3	Monitoring started from March 2017
C1	New Pond Road E	Kerbside	497005	146328	NO ₂	N	NA	<1	N	2 -3	Discontinued July 2016
C2	New Pond Road W	Kerbside	495411	147412	NO ₂	N	NA	<1	N	2 -3	Discontinued July 2016
C3	Compton 3	Near road	495509	147024	NO ₂	N	0m	6	N	2 -3	Discontinued July 2016
C4	Compton 4	Roadside	495437	147288	NO ₂	N	0m	1.5	N	2 -3	Monitoring started from July 2016
C5	Compton 5	Roadside/near road	495498	147097	NO ₂	N	0m	8	N	2 -3	Discontinued July 2016

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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)	Notes
C6	Compton 6	Near road	495453	147206	NO ₂	N	0m	10	N	2-3	Discontinued July 2016
C7	Compton 7	Roadside	495437	147281	NO ₂	N	0m	2.7	N	2-3	Monitoring started from July 2016
C9	Compton 9	Kerbside	495442	147270	NO ₂	N	4m	<1m	N	2-3	Monitoring started from July 2016
C10	Compton 10	Kerbside	495444	147292	NO ₂	N	12m	<1m	N	2-3	Monitoring started from July 2016
SH1	A281	Kerbside	500046	147604	NO ₂	N	4m	<1m	N	2-3	Monitoring started from June 2016
RP1	Ripley High St	Road Side	505243	156819	NO ₂	N	5.47	<5m	N	2-3	Monitoring started from July 2016
RP2	Newark Lane	Kerbside	505090	156777	NO ₂	N	6m	1m	N	2-3	Monitoring started from July 2016
WS1	Elm Corner	Semi rural	507346	158005	NO ₂	N	7m	NA	N	2-3	A3 Approx 250m to the Northwest, Monitoring started from July 2016

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)	Notes
WP1	Worplesdon Rd	Kerbside	497972	152575	NO ₂	N	5m	<1m	N	2-3	Monitoring started from July 2016
ASH1	Britten Cl	Near road	489883	150771	NO ₂	N	4.58	10m	N	2-3	Monitoring started from July 2016
Send1	Box and Holly Court	Near road	502861	155421	NO ₂	N	0	5m	N	2-3	Monitoring started from August 2016
Send 2	Lancaster Hall	Kerbside	502172	155843	NO ₂	N	16	1m	N	2-3	Monitoring started from August 2016
WCL	West Clandon	Roadside	504477	151404	NO ₂	N	19	1m	N	2-3	Monitoring started from August 2016

(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.

Table A.2 – Annual Mean NO₂ Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2016 (%) ⁽²⁾	NO ₂ Annual Mean Concentration (µg/m ³) ⁽³⁾				
					2012	2013	2014	2015	2016
GD1	Roadside	Diffusion Tube		100	37	35	31	33	36
GD2	Roadside	Diffusion Tube		100	37	39	25	33 ⁽³⁾	35
GD3	Urban background	Diffusion Tube		100	22	22	16	20 ⁽³⁾	24
GD5	Kerbside	Diffusion Tube	100	50	44	45	40	46	43 ⁽³⁾
GD6	Rural background	Diffusion Tube		100	13	14	14	13	14
GD8	Roadside	Diffusion Tube	100	50	26	23	19	25	27 ⁽³⁾
GD9	Roadside	Diffusion Tube	83.3	42	26	27	31	30	21 ⁽³⁾
GD10	Urban background	Diffusion Tube		100	19	18	16	17	20
GD11	Near Road	Diffusion Tube		100	27	29	29	28	29
GD13	Kerbside	Diffusion Tube		100	40	35	31	38	35
GD14	Roadside	Diffusion Tube		100	35	37	30	42	36
GD15	Near road	Diffusion Tube	100	42					32
C1	Kerbside	Diffusion Tube	100	50			22	28	29 ⁽³⁾
C2	Kerbside	Diffusion Tube	100	50			32	28	28 ⁽³⁾
C3	Near road	Diffusion Tube	83.3	42				21 ⁽³⁾	22 ⁽³⁾
C4	Roadside	Diffusion Tube		100			67 ⁽³⁾	53	50
C5	Roadside/near road	Diffusion Tube	100	50				27 ⁽³⁾	28 ⁽³⁾
C6	Near road	Diffusion Tube	100	50				17 ⁽³⁾	19 ⁽³⁾
C7	Roadside/near road	Diffusion Tube	100	50					40 ⁽³⁾
C9	Kerbside	Diffusion Tube	100	50					50 ⁽³⁾
C10	Kerbside	Diffusion Tube	100	50					39 ⁽³⁾
SH1	Kerbside	Diffusion Tube	100	58					37 ⁽³⁾
RP1	Road Side	Diffusion Tube	100	50					34 ⁽³⁾
RP2	Kerbside	Diffusion Tube	100	50					29 ⁽³⁾
WS1	Semirural	Diffusion Tube	100	50					14 ⁽³⁾
WP1	Kerbside	Diffusion Tube	100	50					31 ⁽³⁾
ASH1	Near-road	Diffusion Tube	100	50					19 ⁽³⁾
Send1	Near-road	Diffusion Tube	100	42					28 ⁽³⁾
Send2	Kerbside	Diffusion Tube	100	42					26 ⁽³⁾
WCL	Roadside	Diffusion Tube	100	42					27 ⁽³⁾

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

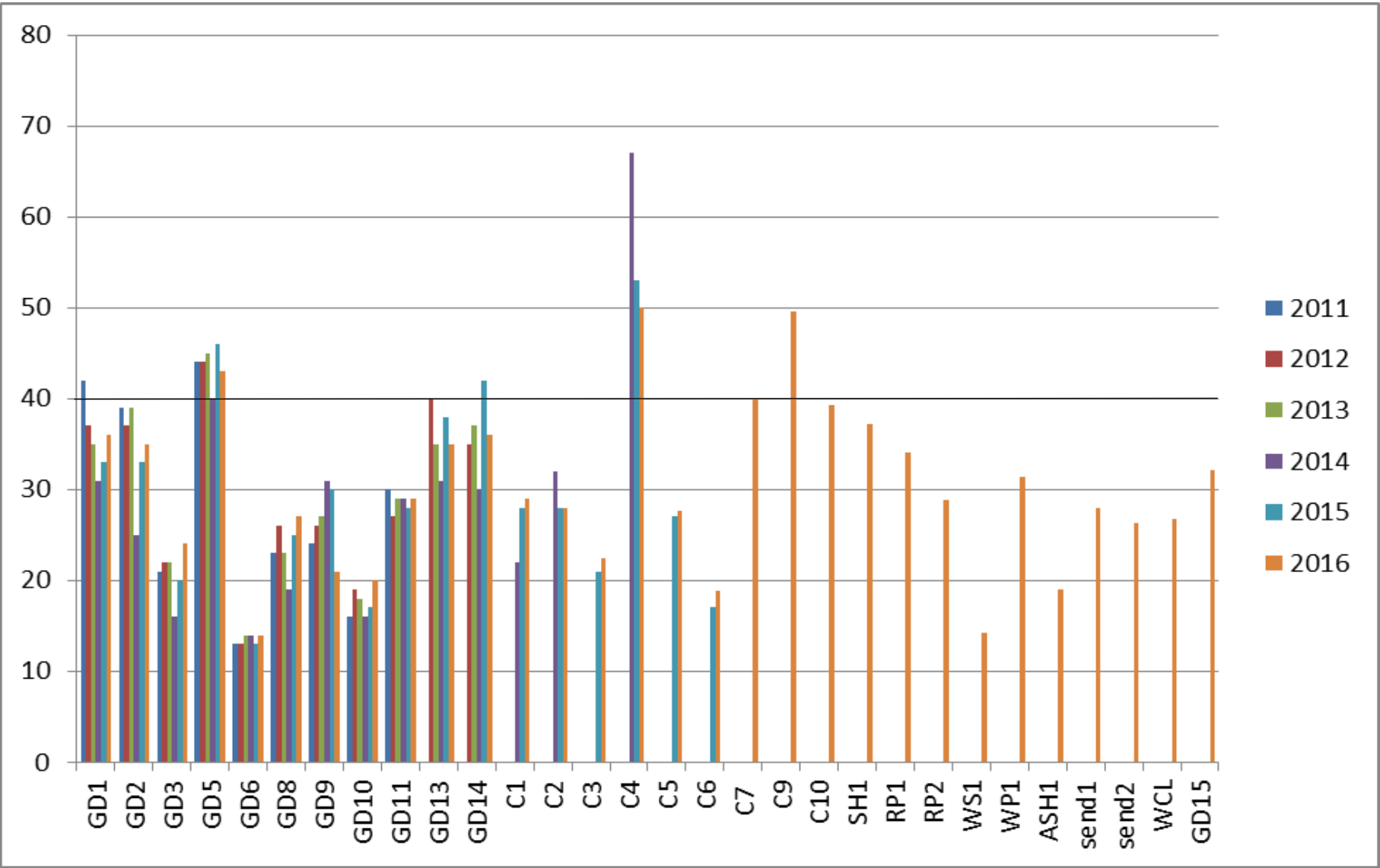
NO₂ annual means exceeding 60µg/m³, indicating a potential exceedance of the NO₂ 1-hour mean objective are shown in **bold and underlined**.

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

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

(3) Means for diffusion tubes have been corrected for bias. All means have been “annualised” as per Technical Guidance LAQM.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Graph A1 – Trend in NO₂ Annual Mean for past five years (2011 – 2015)



Short-term to Long-term Data adjustment

In June 2016, the diffusion tube sites were reviewed. The tube locations discontinued following the review were GD5, GD8, GD9, C1, C2, C3, C5 and C6. A number of new sites were added (C7, C9, C10, SH1, RP1, RP2, WS1, WP1, Ash1, Send1, Send 2, WCL and GD15). All of these sites have data capture of less than 75% and thus were annualised as per the procedure described in chapter 7 of the LAQM Technical Guidance (LAQM.TG(16), <https://laqm.defra.gov.uk/technical-guidance/index.html?d=Chapter72>). The details are covered in Appendix C of the report.

Appendix B: Full Monthly Diffusion Tube Results for 2016

Table B.1 – NO₂ Monthly Diffusion Tube Results - 2016

Site ID	NO ₂ Mean Concentrations (µg/m ³) (Bias adjustment factor – 1.02)													Annual Mean	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Raw Data	Bias Adjusted ⁽¹⁾	
	GD1	37	37	40	31	32	31	29	23	33	39	36	49	34.75	35.5
GD2	42	33	39	31	34	32	26	25	30	36	33	49	34.16	34.9	
GD3	26	23	30	22	22	19	15	16	18	28	25	37	23.42	23.9	
GD5	44	37	57	31	51	34							42.3	43.2	
GD6	14	13	18	14	9	12	10	10	9	19	17	20	13.8	14.0	
GD8	23	27	36	26	23	23							26.3	26.9	
GD9	29	11	33	22	12								21.4	21.8	
GD10	20	23	23	21	14	14	13	15	13	20	25	30	19.3	19.6	
GD11	28	22	34	21	22	26	27	24	27	33	32	39	27.92	28.5	
GD13	37	31	40	32	38	32	29	27	28	33	37	46	34.2	34.9	
GD14	36	25	48	38	40	28	26	26	32	43	40	42	35.3	36.0	
GD15								13	28	40	29	56	33.2	34	
C1	29	27	30	31	26	28							28.5	29.1	
C2	30	17	34	34	25	25							27.5	28.1	
C3	22	24	31	19	19	0							23	23.5	
C4	47	45	57	45	52	50	45	40	57	Not valid	50	50	48.9	49.9	
C5	34	26	30	27	23	23							27.2	27.7	
C6	21	18	26	17	15	14							18.5	18.9	
C7							33	31	40	48	43	45	40	40.8	
C9							48	39	48	52	55	55	49.5	50.5	
C10							37	31	40	39	45	43	39.2	40	

Site ID	NO ₂ Mean Concentrations (µg/m ³) (Bias adjustment factor – 1.02)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean	
													Raw Data	Bias Adjusted ⁽¹⁾
SH1						36	29	33	32	42	38	35	35	35.7
RP1							27	25	29	39	36	48	34	34.7
RP2							21	22	24	33	35	38	28.8	29.4
WS1							10	12	11	19	11	22	14.2	14.5
WP1							28	18	28	34	37	43	31.3	32
ASH1							11	16	10	20	25	32	19	19.4
Send1								20	11	32	27	54	28.8	29.4
Send2								18	20	33	27	38	27.2	27.7
WCL								22	23	30	28	35	27.6	28.2

(1) See Appendix C for details on bias adjustment

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

C.1 Diffusion Tubes

Lambeth Scientific Services supplied all the diffusion tubes for 2016 period, these were prepared using a 50% triethanolamine (TEA) method

C.2 Table of bias adjustment factors:

Year	National bias adjustment factor, Gradko (20% TEA in water)	National bias adjustment factor, Lambeth (50% TEA in acetone)	Reigate-Banstead BC bias adjustment factor based on triplicate tubes at three real time sites
2011	0.89	1.06	
2012	0.97	0.91	
2013	0.95	0.87	
2014	0.91	0.80	
2015	0.88	1.07	
2016		0.94	1.02

C.3 Annualisation of data:

A period adjustment (annualisation) calculation was carried out for the diffusion tube sites with valid data capture less than 75% (75% is the threshold for satisfactory data capture according to Box 3.2 in LAQM.TG(09)). Two of the local background diffusion tube data (GD6 and GD10) and realtime monitoring data for London Eltham, which is part of national network (https://uk-air.defra.gov.uk/data/flat_files?site_id=LON6) were used to obtain the annualisation factor. The calculations are shown below.

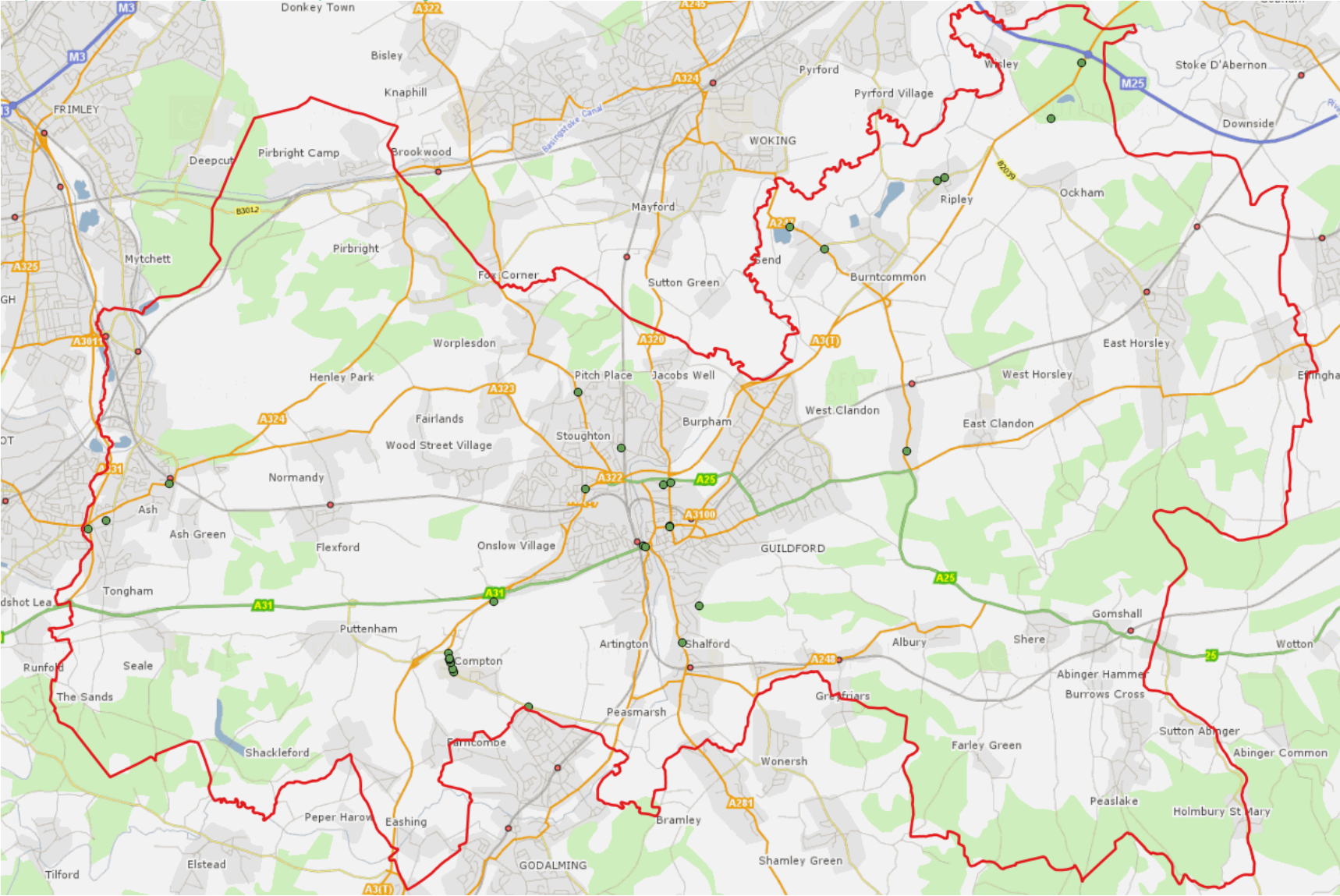
The Chantry (GD6)				London Eltham (suburban background)			The Garth (GD10)	
				data capture				
				98.40%				
		Period		Approximately 51Km from Guildford				
January	37.74			24.7			20.4	
February	37.74			26.1			23.46	
March	40.8			24.3			23.46	
April	31.62			19.3			21.42	
May	32.64			20.5			14.28	

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June	31.62			15			14.28
July	29.58			13.4			13.26
August	23.46			12.6			15.3
September	33.66			19			13.26
October	39.78			20.5			20.4
November	36.72			28.1			25.5
December	49.98			31.4			30.6
A _m	35.445			21.24			19.635
P _m (jan - Jun)	35.4			21.7			19.55
P _m (Jul-Dec)	37.9			20.8			19.72
P _m (Aug-Dec)	36.72			22.32			21.012
P _m (Jan-May)	36.1		P _m (Jan-May)	23		P _m (Jan-May)	20.6
P _m (Jun-Dec)	35		P _m (Jun-Dec)	20		P _m (Jun-Dec)	18.9
R1 (jan-jun)	1.002		R2(Jan-Jun)	0.981		R3(jan-Jun)	1.004
R1 (Jul-Dec)	0.934		R2(Jul-Dec)	1.020		R3(Jul-Dec)	0.995
R1(Aug-Dec)	0.965		R2(Aug-Dec)	0.952		R3(Aug-Dec)	0.934
R1(Jan-May)	0.982		R2(Jan-May)	0.924		R3(Jan-May)	0.953
R1(Jun-dec)	1.014		R2(Jun-Dec)	1.062		R3(Jun-Dec)	1.037
Ra (Jan-Jun)	0.9959 6367						
Ra(Jul-Dec)	0.9831 43147						
Ra(Aug-Dec)	0.9504 77124						
Ra(Jan-May)	0.953						
Ra(Jun-Dec)	1.037						

Appendix D: Map(s) of Nitrogen Dioxide Monitoring Locations

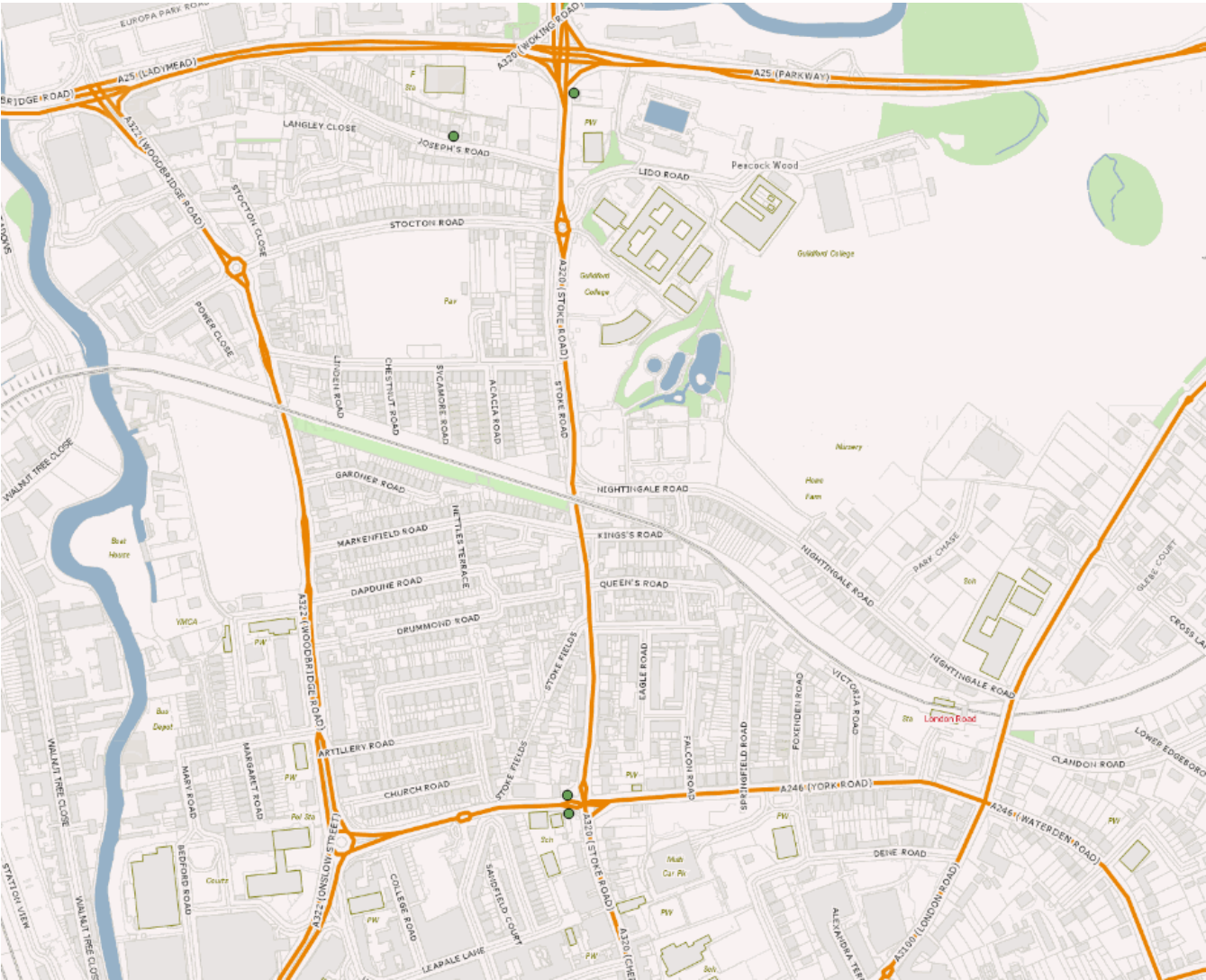
Map D1: Guildford Borough; location of passive nitrogen dioxide diffusion tubes 2016



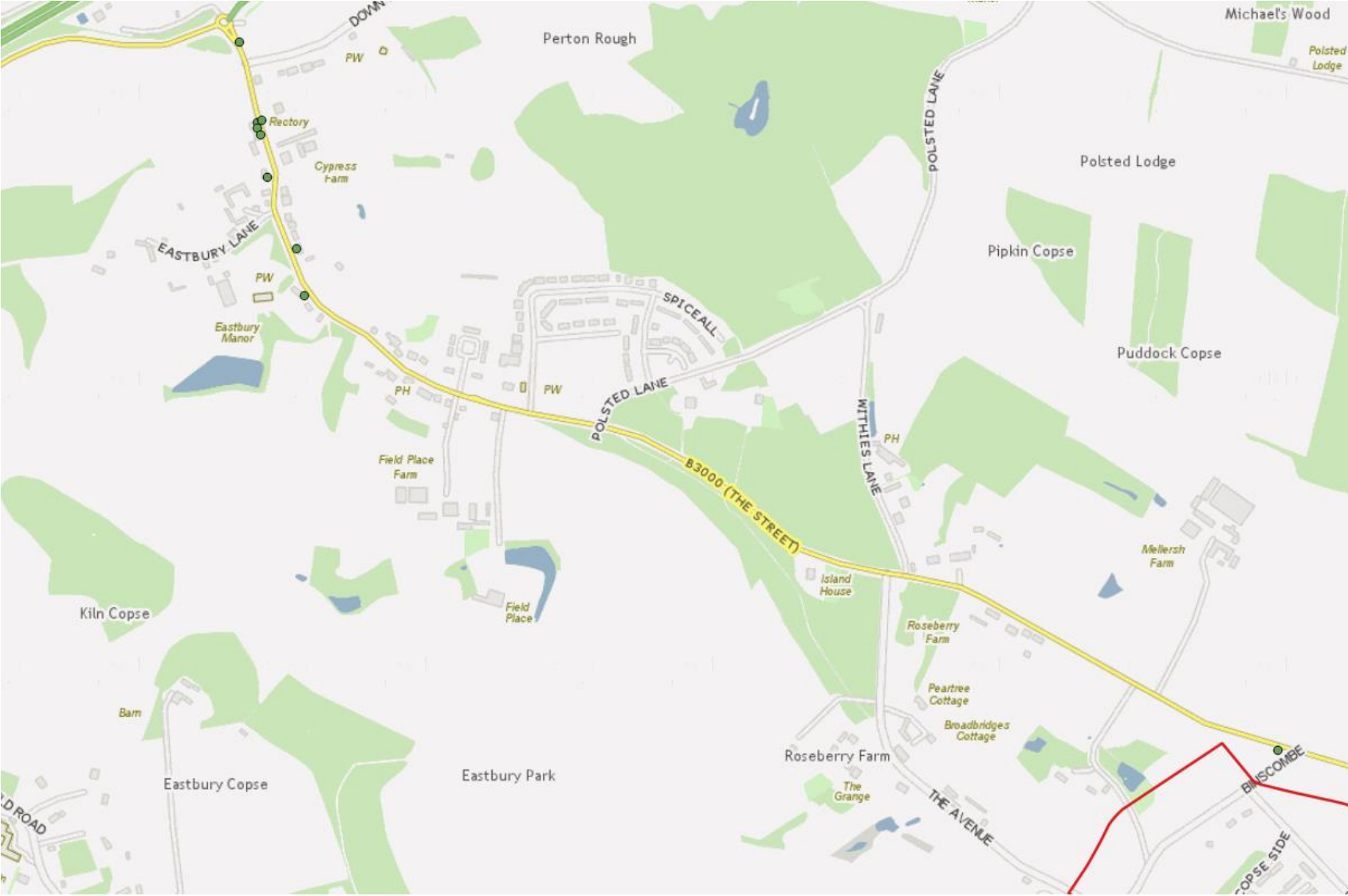
Map D2: Guildford town centre; location of passive nitrogen dioxide diffusion tubes 2016



Map D3 York Road/Stoke Road; location of passive nitrogen dioxide diffusion tubes 2016



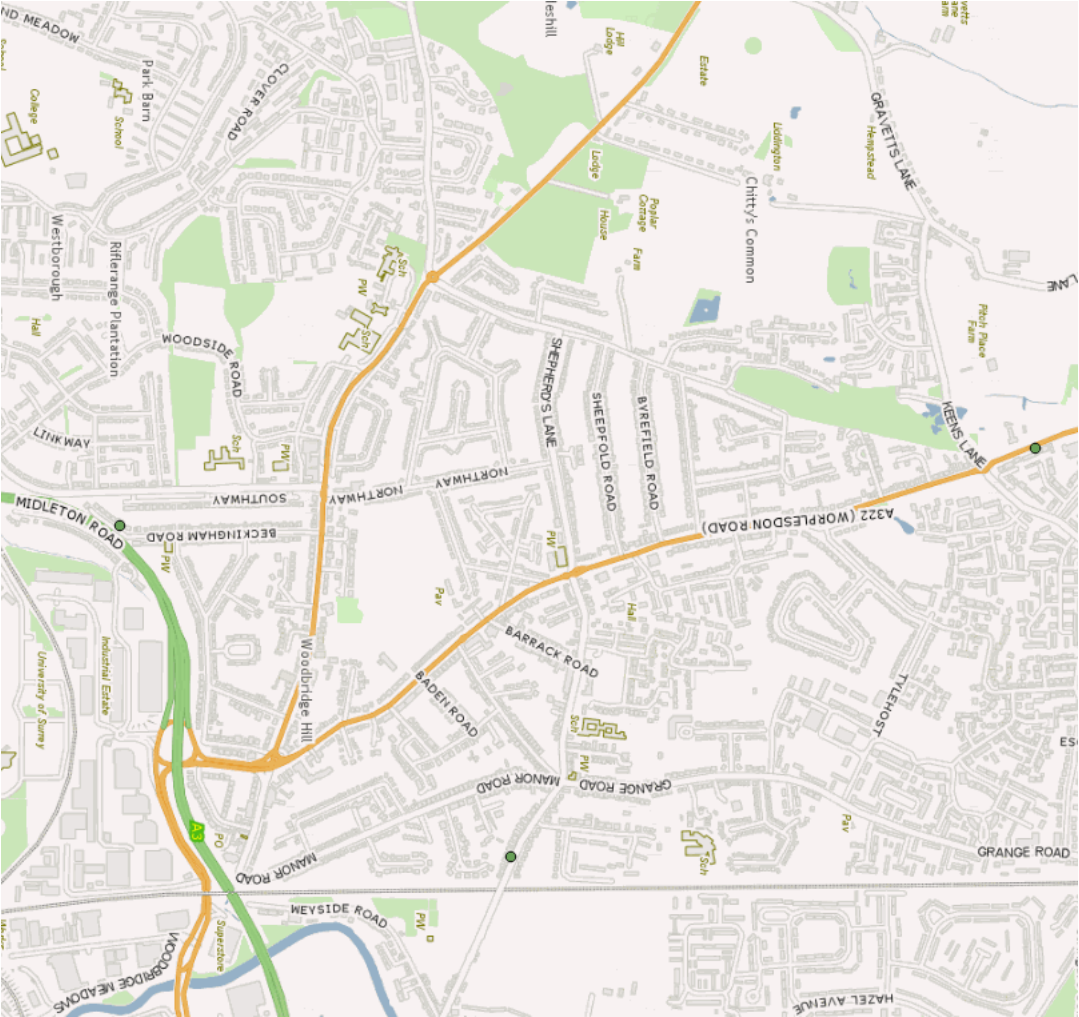
Map D4 Compton; location of passive nitrogen dioxide diffusion tubes 2016



Map D5 Ripley, Send, Wisley and West Clandon; location of passive nitrogen dioxide diffusion tubes 2016



Map D6 Worplesdon Road, Stoughton Road; location of passive nitrogen dioxide diffusion tubes 2016



Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England

Pollutant	Air Quality Objective ³	
	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

³ The units are in microgrammes of pollutant per cubic metre of air (µg/m³).

Glossary of Terms

Abbreviation	Description
AQSAP	Air Quality Strategy 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

References

1. Local Air Quality Management (TG16) Defra April 2016
2. Guildford Air Quality Reviews and Assessments 2006-2016
3. LAQM Tools
4. Guildford Transport Strategy 2017: <http://www.guildford.gov.uk/newlocalplan/CHttpHandler.ashx?id=21339&p=0>
5. Surrey County Council (2011) Surrey Transport Plan: Air Quality Strategy
6. Guildford Borough Cycling Plan <https://www.travelsmartsurrey.info/cycling/guildford-consult>
7. Nitrogen dioxide fall off with distance (Calculator to estimate annual average nitrogen dioxide at one distance from the road using measurements made at a different distance from the same road) <https://laqm.defra.gov.uk/tools-monitoring-data/no2-falloff.html>
8. DEFRA's draft air quality action plan (https://consult.defra.gov.uk/airquality/air-quality-plan-for-tackling-nitrogen-dioxide/supporting_documents/Draft%20Revised%20AQ%20Plan.pdf)