Crawley Borough Council

2017 Air Quality Annual Status Report (ASR)

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

www.crawley.gov.uk

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Executive Summary: Air Quality in Our Area

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].

Air Quality in Crawley Borough Council

Crawley is located in the north of the County of West Sussex, with Gatwick airport lying along its northern boundary with Surrey, and the borough of Reigate & Banstead and the M23 along its eastern border.

As part of the Local Air Quality Management process (LAQM) required by the Environment Act 1995, the council carries out an annual review and assessment of air quality in the borough, which helps us to identify local air quality hot spots, and relate these to pollution sources. If the council finds areas where air quality objectives are not being achieved, it is required to designate an Air Quality Management Area (AQMA) and produce an action plan (AQAP) detailing measures to improve air quality in that area.

Air Quality in Crawley is mainly good, with national targets being met for all pollutants, (4) with the exception of nitrogen dioxide at sites within the AQMA. Road traffic is the main source of nitrogen dioxide in Crawley, and our network of monitoring sites records levels along busy roads as well as at background locations and areas of specific interest, in order to get a broad picture of pollution levels across the borough.

[1] Environmental equity, air quality, socioeconomic status and respiratory health, 2010
[2] Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006
[3] Defra. Abatement cost guidance for valuing changes in air quality, May 2013
[4] Appendix E (The air quality objectives are set out in the Air Quality (England) Regulations 2015)

Monitoring results for 2016 show that there were exceedances of the air quality objective for nitrogen dioxide at eight monitoring sites close to busy roads during that year. However, after adjustments for fall off with distance from the road, only two locations with revenant public exposure were shown to have exceedances. Both these locations were within the AQMA.

A small increase in nitrogen dioxide levels was seen at all of Crawley's monitoring site during 2016, however, this pattern was also seen regionally in 2016 and can be attributed to climatic influences in this year rather than local conditions across Crawley. More importantly, the long term monitoring data indicates a downward trend at roadside, airport and background sites outside of the AQMA, despite significant housing and commercial development over the same period. These long term improvements are driven by decreases in regional sources and reflect the pattern of pollution reduction seen nationally. The implementation of European and U.K legislation has gradually brought about improvements in vehicle emissions through refined engine technologies and, together with local and regional initiatives introduced by local/highways authorities to reduce private car usage by encouraging sustainable modes of transport, this has led to a material improvement in air quality over the years.

Despite these improvements, emissions from road traffic sources are still exceeding the air quality objectives for nitrogen dioxide along Crawley Avenue (A2011), which is the main route between the M23, the town centre and Manor Royal business district. Even though the NO_2 levels at other monitoring locations in Crawley are showing improving trends, current levels within the AQMA are still high and not yet sufficient to reverse the long term upwards trend. In addition, the full impact from the 2,000 dwellings being developed at the new Forgewood neighbourhood adjacent to the AQMA has yet to be assessed over time. Therefore Crawley Borough Council has no current plans to amend the existing AQMA, although there is currently no monitoring evidence to suggest any new AQMAs are required.

The council intends to build upon the improving air quality picture across the borough by developing its air quality action plan and continuing to work in partnership with colleagues in Planning, Highways and Public Health as well as engaging its staff, the public and local businesses to further improve air quality in the area.

Actions to Improve Air Quality

Crawley Borough Council has taken forward a number of measures during the reporting year designed to improve local air quality and increase sustainability:

- A bid for Grant funding from the Defra Air Quality Grant Scheme was submitted at the start of the year by the council for an Eco-Stars driving programme for commercial fleet operators on Crawley's Manor Royal Business District and a clean air zone feasibility study. After evaluation of all applications by the Grant Board our application has been placed on the reserve list, subject to additional funding coming forward. We are currently awaiting their further decision.

- Crawley, as part of the Sussex Air Quality Partnership (SAQP), runs airAlert which is a service that sends alert messages to vulnerable people in Sussex informing them when poor air quality is predicted in their area. The alerts are be sent via email, mobile or landline phone or accessed via a mobile phone app. SAQP developed coldAlert to run alongside airAlert and in the current reporting year the group, working with Sussex Public Health, undertook a campaign with to promote the service and increase awareness and uptake. The campaign was targeted at Clinical Commissioning Groups and organisations working for COPD/asthma/heart conditions such as British Lung Foundation and Breathe Easy groups.

- Partners from the SAQP undertook a review of the framework/best practice for the Sussex Air Quality and Emissions Mitigation Guidance used for air quality impact and mitigation assessments in planning applications.

- Crawley Borough council, along with West Sussex County Council (WSCC), has been working to promote sustainable transport improvements through the Crawley Growth Programme. This programme is delivering improved sustainable transport infrastructure in the town centre, Manor Royal business district and at three railway stations (Crawley, Three Bridges and Gatwick), including unlocking private funds for a new Crawley railway station interchange.

- The council and WSCC have also been involved in discussions about improving surface access to Gatwick Airport through the Gatwick Transport Forum Steering Group, including talks with an electric point-to-point car sharing service provider with a view to installing bays at Gatwick airport and expanding the service into Manor Royal and Crawley.

Conclusions and Priorities

The main conclusions for the 2017 ASR are that long-term trends for nitrogen dioxide continue to be downwards across Crawley at roadside, airport and background sites, and no exceedances of the objectives were recorded at these sites with the exception of the Hazelwick AQMA, where exceedances* the national air quality objective (40ug/m^3) were identified at two locations in 2016, and the long term trend continues to be upwards.

Despite improvements in the long term picture, emissions from road traffic sources continue to be high along some busy roads in the borough, and the development of nearly 2000 new dwellings at the new Forgewood Neighbourhood is still on-going. It may be another 4 or 5 years before the building works are complete and the full impact of the development can be assessed. It is hoped that improvements in engine technologies will continue to drive down emissions and help offset some of the effects of the increased traffic volumes that will result from this development. However, until we have the local monitoring evidence to support this we will maintain the current level of monitoring in the area and continue with our Air Quality Action Plan to implement local and regional initiatives to encourage sustainable modes of transport and the infrastructure improvements that will support them.

[*These exceedances are discussed in more detail in the results section (3.2.1) in relation to the choice of bias adjustment factor]

Crawley Borough Council's priorities for the coming year are the publication of the final AQAP document and if funding becomes available, it will be a key priority to implement the ECO Stars programme at businesses with commercial HGV/LGV fleets adjacent to the AQMA, and to conduct a feasibility study on the introduction of a clear air/low emissions zone for the Manor Royal business district.

Identifying pollution hotspots within the borough and adjusting the monitoring network accordingly will continue to be a priority in responding to local developments and concerns.

In addition the council will, through the planning process, seek to reduce the impact of development that is likely to cause pollution or be exposed to pollution, by signposting all significant development to the Sussex Air Quality and Emissions Mitigation Guidance to identify funding for air quality mitigation schemes.

The principal challenges the council anticipates are the scale of local growth in housing and the continuing pressure to develop on land close to major roads as other development sites are exhausted. The council also faces challenges finding sources of funding to support our action plan measures such as the ECO stars scheme, educational modal shift programmes, infrastructure projects etc. The council expects that budget barriers to some of these measures may slow progress on the implementation of the action plan.

Local Engagement and How to Get Involved

Crawley is one of the smallest local authorities in Sussex covering an area of 17.36 square miles (44.96 km^2). Despite occupying just two per cent of the land mass, it contributes 25 per cent of the economic output of West Sussex and has the second highest job density in the country outside London. Consequently, Crawley attracts more than 43,000 commuters every day, the highest volume in the south east outside the capital, and more than 80 per cent of these commute in by car.

In order to address traffic congestion which contributes to worsening air quality and constrains economic growth, Crawley borough council has engaged with its partners in the Coast to Capital Local Enterprise Partnership to introduce a £60m package of investment (The Crawley Growth Programme) which will unlock opportunity for economic growth, whilst delivering a programme of sustainable transport infrastructure and highway upgrades that will tackle these key concerns and enable significant modal shift and help improve air quality.

Key partners are:

- Coast to Capital Local Enterprise Partnership
- West Sussex County Council

- Crawley Borough Council
- Metrobus, Gatwick Airport Limited
- Manor Royal BID
- Arora Group
- Gatwick Diamond Initiative and
- Crawley Town Centre Partnership

In order to keep the public informed and engage them in the programme the council has held a series of public information events at community centres, the civic hall, and library. Information is also available digitally via the Regenerating Crawley page on the Council's website and Twitter feed. For those not online information is published in Crawley Live, a free council magazine distributed to every household in Crawley four times a year.

In Crawley the main source of pollution is from vehicle emissions and since many car journeys are under two miles, the public can help improve air quality in their area by using sustainable transport options such as walking, cycling, public transport or car sharing. Crawley Borough Council's Sustainability Team's purpose is to work with residents, communities, businesses, developers and the Council to improve sustainability. Their web pages on the council's websites (www.crawley.gov.uk) provides extensive information on sustainable transport infrastructure and services in Crawley, including maps, journey planners, and alert services. There are also links to other organisations, charities and action groups where the public can find information on how to get involved in activities that can support air quality improvements in their area:
http://www.crawley.gov.uk/pw/Streets__Roads_and_Transport/index.htm

Other sources of information for improving air quality in the borough are available on Crawley Borough Council's website:

- Annual Air quality status Reports and details of air quality monitoring in Crawley:
  http://www.crawley.gov.uk/pw/Environment_and_Health/EnvironmentalHealth/Pollution/index.htm
- Air Quality Management Area (AQMA) in the borough:

http://www.crawley.gov.uk/pw/Environment_and_Health/Environmental_Health/Pollution/PUB266051

- Details of The Crawley Growth Programme that include sustainable transport infrastructure and highway upgrades that will encourage modal shift and help improve air quality can be found at: http://www.regeneratingcrawley.org.uk/
- airAlert is a free subscription service which individuals, who suffer from asthma, COPD, emphysema or other respiratory illnesses, can sign up to. The resident receives an advanced warning of high pollution levels via either voicemail, email, text or mobile phone app allowing them to take appropriate steps regarding their medication or activities: http://www.sussex-air.net/AirAlert/Default.aspx

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1 Local Air Quality Management

This report provides an overview of air quality in Crawley 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 Crawley 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 compliance with the objectives.

A summary of AQMA declared by Crawley Borough Council can be found in Table 2.1. Further information related to the AQMA, including maps of AQMA boundaries are available online at:

http://www.crawley.gov.uk/pw/web/PUB266050

http://www.crawley.gov.uk/pw/web/PUB241229

https://uk-air.defra.gov.uk/aqma/details?aqma_ref=1600

(See full list see at: http://uk-air.defra.gov.uk/aqma/list)

Alternatively, see Appendix D: Map(s) of Monitoring Locations and AQMAs, which provides for a map of air quality monitoring locations in relation to the AQMA.

Table 2.1 – Declared Air Quality Management Areas

AQMA Name	Date of Declaration	Pollutants and Air Quality Objectives	City / Town	One Line Description	Is air quality in the AQMA influenced by roads controlled by Highways England?	Level of Exceedance (maximum monitored/modelled concentration at a location of relevant exposure)		Action Plan (inc. date of publication)
						At Declaration	Now	
Hazelwick AQMA	09.07.15	NO2 Annual Mean	Crawley	Area surrounding the Hazelwick Roundabout, including land and properties bordering the roads coming on and of the roundabout.	NO	42 µg/m3	42 µg/m3	Crawley Borough Council Air Quality Action Plan

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

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

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

The report is well structured, detailed, and provides the information specified in the Guidance. The comments below are designed to assist in the development of future reports.

1. The ASR report presents a detailed approach to addressing the localised air quality issues within Crawley Borough, where there have clearly been improvements in air quality over recent years, to the point that 2015 is a year with no recorded exceedances of air quality objectives at positions of relevant exposure.
2. We agree that the Council should proceed with developing the Action Plan for the Hazelwick AQMA as a means of providing continued measures to develop sustainable low emission transport, contributing to improving air quality across the Borough.
3. The Council have adopted a positive approach to developing Borough wide measures that have clearly contributed to emissions reductions that are being demonstrated by the current pollution levels that are now marginally below the objectives, with no current exceedances at positions of relevant exposure.
4. The distance correction calculation has been applied to one result, but not all results, and it is important where results are being presented for comparison to objectives, that all appropriate corrections are applied, to avoid confusion.

Response: *Fall off with distance corrections have been carried out for all locations where exceedances of the objective are shown and there is relevant public exposure.*

5. Now that it is possible to see improvements in local air quality at most monitoring locations, the Council may wish to consider a review of the monitoring programme, in order to check there are no other locations with exceedances, including the new Forgewood

neighbourhood as discussed within the report. This is with a view to proceeding towards revoking the Hazelwick AQMA when results are consistently below the objectives.

Response: *The council reviews its monitoring programme every year and makes adjustments accordingly. For example, new monitoring locations (CR72 and 73) were set up to the south of Gatwick airport in 2014 when the wide spaced second runway was proposed in order to gather baseline data. In 2015/16 sites CR 74 and 75 were set up to monitor levels at phase1 of the Forgewood development and extra sites (CR 76 and 77) were set up within the AQMA. In 2016 new sites were set up at residential locations alongside the M23 motorway and busy roads at CR 78, 79, 80, 81. Sites 82, 83 and 84 were also set up in 2016 in response to concerns about HGV movements along a residential road.*

6. The map of monitoring sites should be labelled to enable the identification of results on maps showing the AQMA boundary.

Response: *New maps have been provided for the 2017 ASR (see Appendix D) which are labelled for identification as requested and should provide a clear picture of where monitoring is located around the borough and in relation to the AQMA.*

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

Key completed measures are:

Crawley Borough Council has taken forward a number of measures during the reporting year designed to improve local air quality and increase sustainability:

- Draft Air quality Action Plan (AQAP) for Hazelwick AQMA
- A bid for Grant funding from the Defra Air Quality Grant Scheme submitted for Eco-Stars driving programme for commercial fleet operators on Crawley's Manor Royal Business District and a clean air zone feasibility study.
- Review by SAQP of the Sussex Air Quality and Emissions Mitigation Guidance used for planning applications.
- SAQP campaign to increase awareness and uptake of the airAlert service.

- Two Nissan e-NV200 (zero emissions) vans ordered for CBC Parking services.
- 5 new subscribers to the Council's staff bike to work scheme were taken up in 2016, an increase on the previous reporting year.
- Crawley Growth Programme delivered improved sustainable transport infrastructure upgrades for Manor Royal business district: Selective road space re-prioritising for bus routes and subsequent increased frequency of bus service to Gatwick via Manor Royal.
- Initial discussions started with private electric point-to-point car sharing service provider to identify road space for docking bays within Crawley.
- Living Streets campaign event January 2017 for CBC staff (approximately 100 pledges from staff for modal shift)
- Solar Panel installation at CBC property: Metcalf Way Vehicle Workshop Depot, Bewbush Centre, Maidenbower Community Centre and Maidenbower Pavilion.

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

- Consultation and publication of the Hazelwick AQAP. Expected impact: sets out a broad raft of measures to promote sustainable transport, modal shift and reduced emissions (although there has been delay in publishing this document, many of the measures outlined in draft are currently being implemented)
- Joint Sussex funding bid with SAQP for anti-idling campaign including an educational and awareness project working with volunteers and schools (reduce emissions)
- New cycle schemes across the borough through Sec.106 funds as well as improving existing schemes including:
    1. Town Centre – County mall
    2. Manor Royal Road
    3. Flemming Way

  Expected impact: Encourage modal shift
- Draft Workplace Travel Plans for CBC staff. Expected impact: Encourage modal shift.

- Crawley Growth Programme to deliver upgrades to new super-hub bus shelters Expected impact: Encourage modal shift.
- Crawley Growth Programme to deliver train and bus station upgrades. Expected impact: Encourage modal shift
- Procurement of electric vehicles for Community wardens as current leasing agreement up for renewal this year. Expected impact: Reduce emissions.
- Solar Panel installation at CBC Tilgate Nature Centre, Ifield Drive Community Centre, The Hawth Theatre, and Waterlea and Millpond play centres. Expected impact: Reduce emissions

Crawley Borough Council's priorities for the coming year are the publication of the final AQAP document and if funding becomes available, it will be a key priority to implement the ECO Stars programme and feasibility study on the introduction of a clear air/low emissions zone for the Manor Royal business district.

The principal challenge the council anticipates is the scale of local growth in housing adjacent to the AQMA which may offset the improvement in vehicle emissions which have brought nitrogen dioxide levels down over recent years. Other barriers to implementation are mainly financial; with strong competition for funding streams and grants to support action plan measures.
Progress on the AQAP has been slower than expected due to reduced officer time available to take the plan forward. However, many of the measures outlined in draft are currently being implemented.

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

Table 2.2 – Progress on Measures to Improve Air Quality

Measure No.	Measure	EU Category	EU Classification	Organisations involved and Funding Source	Planning Phase	Implementation Phase	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
1	Crawley Growth Programme Three Bridges and Gatwick railways stations Interchange improvement schemes	Transport Planning and Infrastructure	Public transport improvements-interchanges stations and services	Coast to Capital Local Enterprise Partnership	2014	2016-2022 Ongoing	Modal Shift/ Improved traffic flow	Medium/High	Road space re-prioritising for bus routes to Gatwick via Manor Royal delivered	Phased delivery, to be completed in stages. Final completion estimated 2022	working with LEP and partners to deliver major interchange improvements at Crawley, Three Bridges and Gatwick railways stations for both buses and cyclists
2	Air Quality and Emissions Mitigation Guidance for Sussex	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	CBC with Sussex-air	2011/12	ongoing	Conditions on planning applications to require emissions mitigation/ S.106 funding	Medium/Low	Air Quality and Mitigation Guidance incorporated in Crawley Local Plan referenced to developers in local list	ongoing	Under review - completion due 2017/18
3	Crawley Cycle Network	Transport Planning and Infrastructure	Cycle Network	CBC - S106 funding	Completed	ongoing	Modal shift	No Target set - Medium/low	New cycle schemes and improvements to existing schemes including: Town Centre – County mall, Manor Royal Road, Fleming Way	Phased delivery, to be completed in stages. Final completion estimated 2018/19	
4	Manor Royal Business Park Travel Plans	Promoting Travel Alternatives	Workplace Travel Planning	Crawley Borough Council (CBC)	complete	ongoing	Modal shift/ staff travelling by sustainable means	No Target set Medium/low	Guidance pack drafted/ Planning requirement for Travel plans to be integrated into new development on Business District	2018/19	Time priorities and access to businesses to promote

5	School Travel plans	Promoting Travel Alternatives	School Travel Plans	West Sussex County Council (WSCC)	complete	ongoing	Modal Shift %children travelling to school by sustainable means	No Target set Medium/low	Increase % Uptake	Ongoing	Helps reduce emissions during morning rush hour
6	CBC Travel Plans	Promoting Travel Alternatives	Workplace Travel Planning	CBC	complete	2018	% staff travelling by sustainable means	No Target set Medium/low	Draft Travel plan produced	2018/19	Time priorities
7	easit discount(15%) on staff commuting on rail and bus - available to CBC and business across Crawley.	Promoting Travel Alternatives	Promote use of rail and bus	easit/CBC	Completed	ongoing	% staff travelling by sustainable means	No Target set Medium/low	Currently 5708 registered users across Crawley	Ongoing	Council originally involved in funding the setting up of the scheme
8	Crawley car club scheme with private sector partner	Promoting Travel Alternatives	Personalised Travel Planning	CBC	2015	2018	Reduction in private vehicle ownership	No Target set Medium/low	Procurement due 2018/ Launch 2019	2019	Procurement delayed launch now due 2019
9	Cycle Crawley campaign	Promoting Travel Alternatives	Promotion of Cycling	CBC	2011	ongoing	Modal shift	No Target set Medium/low	Events, activities and materials that support uptake and promotion of cycling in Crawley.	Ongoing	Undertaken in partnership with the Crawley Cycle Forum
10	Living Streets campaign	Promoting Travel Alternatives	Promotion of Walking	CBC	2014	ongoing	Modal shift	No Target set Medium/low	campaign event January 2017 for CBC staff (approximately 100 pledges from staff for modal shift)	Ongoing	Information, events, and activities to promote walking amongst council staff and local businesses
11	Residential travel plans	Promoting Travel Alternatives	Residential travel plans	CBC	2015	ongoing	% residents using sustainable transport modes	No Target set	Developments of certain size required to implement Travel Plan	Ongoing	Implemented through Planning process - each application has its own target plan

12	Fastway Route Crawley to Gatwick via Manor Royal	Traffic Management	Strategic highway improvements, Re-prioritising road space away from cars, including Access management, Selective vehicle priority, bus priority, high vehicle occupancy lane	WSCC/CBC	completed	completed	Improved journey times and timetable accuracy / Modal shift	Medium Air Quality Improvement: Variable depending on scheme/busses	Increased Fastway service through Manor Royal: Service 10 every 8mins Service 100 every 15min	completed	
13	Crawley Growth Programme Upgrade to Super-Hub bus shelters	Transport Planning and Infrastructure	Bus route improvements	Coast to Capital Local Enterprise Partnership (WSCC/CBC)	2017	2018/19	Modal shift	low	Still in design	2019	
14	New Manor Royal bus Route	Promoting Travel Alternatives	Bus route improvements	MetroBus	2017	2018/19	Improved journey times and timetable accuracy / Modal shift	No Target set Medium/low	Still in design	201819	
15	Council Vehicle procurement code requires information on vehicle emissions and consideration of LEVs	Promoting Low Emissions Transport	Company/public Vehicle Procurement - Prioritising uptake of low emission vehicles	CBC	Completed	ongoing	Minimum CO2 level of < 150 g/kg.	No Target set Medium/low	100% uptake for vehicle procurement and staff car loan applications	Ongoing	
16	Council Vehicle Fleet LEVs	Promoting Low Emissions Transport	Prioritising uptake of low emission vehicles	CBC	2016	ongoing	Modal shift to LEV (zero emissions)	medium	Two Nissan e-NV200 (zero emissions) vans ordered for CBC Parking services 2016/17	ongoing	Community Wardens vehicle leasing agreement up for renewal 2017/18 LEV procurement planned for 2018

17	CBC Staff Bicycle Loan Scheme	Promoting Low Emissions Transport	Prioritising uptake of low emission vehicles	CBC	2015	ongoing	Modal shift from private vehicle to bicycle	low	5 loans awarded 2016	ongoing	
18	Town Hall Rapid Charging Point (50 kWh) for electric vehicles	Promoting Low Emissions Transport	Procuring alternative refuelling infrastructure to promote Low Emission Vehicles, EV recharging, gas fuel recharging	CBC	2014	2015	kWh of electricity supplied indicating EV usage.	High depending on uptake of LEV (zero emissions)	Continuing increase (180%) in demand since installed	Ongoing	
19	Council has home-working Policy	Promoting Travel Alternatives	Encourage / Facilitate home-working	CBC	Completed	completed	% annual working from home	No Target set low	Positive staff uptake (numbers variable)	ongoing	
20	Taxi License Fee Discount Scheme for LEVs	Promoting Low Emissions Transport	Taxi emission incentives	CBC	Completed	ongoing	% uptake	No Target set	Gatwick Cars currently using 5 Tesla Electric vehicle taxis and planning on 100% hybrid/electric vehicle fleet by 2020	ongoing	
21	Manor Royal Business District Eco-driver training	Vehicle Fleet Efficiency	Driver training and ECO driving aids	CBC	2015/16	2017	Fuel economy/ reduction in vehicle emission	No Target set Medium/low	Awaiting decision on grant funding	2018	Awaiting funding
22	Solar Panel Installation Program	Promoting Low Emission Plant	Shift to installations using low emission fuels	CBC	2010	2011-18	20% Reduction in CO2 Emissions by 2020 100% Reduction in CO2 Emissions by 2050	25% reduction in last 5 years	Solar panels installed at CBC property: Metcalf Way Depot, Bewbush Centre, Maidenbower Community Centre, Maidenbower Pavilion	2018/19	2018/19 aim to install at Tilgate Nature Centre, Ifield drive Community Centre, The Hawth Theatre, Waterlea and Millpond Play Centres
23	airAlert Pollution Warning Service for vulnerable groups	Public Information	Via other mechanisms SMS/ Mobile phone App/ Email	CBC with Sussex Air Quality Partnership SAQP /CBC	2008	ongoing	Uptake: Number of people receiving forecasting alert	No Target set	Over 800 registered subscribers	ongoing	

24	Energise Network	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	SAQP/CBC	2011	2013/14	Uptake: Number of charges	No Target set	Refuelling infrastructure Network throughout East and West Sussex	completed	
25	Sussex Air Website	Public Information	Via the Internet	SAQP	-	ongoing	-	-	-	-	
26	Air Quality Strategic Plan 2010	Policy Guidance and Development Control	Regional Groups Coordinating programmes to develop Area wide Strategies to reduce emissions and improve air quality	SAQP	-	2010 - 2015	-	No Target set	-	ongoing	

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.

There is no direct monitoring of $PM_{2.5}$ in Crawley. However, using the correction factor in TG (16) it is possible to estimate concentrations from our local monitoring of PM_{10}. This method suggests that 2016 $PM_{2.5}$ levels in Crawley are estimated at 12.6µg/m^3. The annual average EU limit for $PM_{2.5}$ is 25µg/m^3 so the risk of exceedance is negligible. However, the council is still committed to reducing emissions and exposure to this pollutant and is taking the following measures to address $PM_{2.5}$:

1. Regulation of Industrial Process through the environmental permitting regime to control emissions of $PM_{2.5}$ from mineral processes such as concrete batching, concrete rushing and road-stone coating.
2. Working in partnership with other authorities in Sussex through the Sussex Air Quality working group to set up the Energise Network of electric vehicle charging points throughout the county.
3. Policy measures to which will help reduce $PM_{2.5}$, including planning policy, local transport planning and the development of the Air Quality Action Plan.

- Local Plan Policy: Requirement to adhere to the Sussex Air Quality and Emissions Mitigation Guidance document
- Local Transport Plan: Traffic management measures to reduce congestion and improve traffic flow, which should also bring about a reduction in road traffic pollutant emissions (including $PM_{2.5}$ emissions).
- Air Quality Action Plan: the emerging action plan will include the promotion of low emission travel alternatives (e.g. cycling, walking, electric vehicles, lift sharing etc).

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

3.1 Summary of Monitoring Undertaken

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

NB. Local authorities do not have to report annually on the following pollutants: 1,3 butadiene, benzene, carbon monoxide and lead, unless local circumstances indicate there is a problem.

3.1.1 Automatic Monitoring Sites

Crawley Borough Council undertook automatic (continuous) monitoring at one site on the eastern border of Gatwick airport (CA2) during 2016. Table A.1 in Appendix A shows the details of the site. National monitoring results are available at https://uk-air.defra.gov.uk/. Monitoring results for Sussex authorities are also available at www.sussex-air.net/.

3.1.2 Non-Automatic Monitoring Sites

Crawley Borough Council undertook non- automatic (passive) monitoring of NO_2 at 30 sites during 2016. Table A.2 in Appendix A shows the details of the sites.

Maps showing the location of the monitoring sites are provided in Appendix D (Figs D.1 – D.4). Further details on Quality Assurance/Quality Control (QA/QC) for the diffusion tubes, including bias adjustments and any other adjustments applied (e.g. “annualisation” and/or distance correction), are included in Appendix C.

3.2 Individual Pollutants

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

3.2.1 Nitrogen Dioxide (NO_2)

Table A.3 in Appendix A compares the ratified and adjusted monitored NO_2 annual mean concentrations for the past 5 years with the air quality objective of 40µg/m^3. This is for both diffusion tube and continuous monitored data.

For diffusion tubes, the full 2016 dataset of monthly mean values is provided in Appendix B.

Table A.4 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.

The data in Table B.1 shows that air quality in Crawley is mainly good, with national targets being met at all monitoring sites with the exception of some sites close to busy roads. Exceedances of the nitrogen dioxide 40 µg/m^3 annual mean objective were found at eight roadside sites in 2016 (CR1, 55, 62, 63, 64, 69, 76 and 77) . Seven of these sites were within the Hazelwick AQMA and one (CR1), was located on the high street where there was no relevant public exposure in relation to the annual mean objective.

Five sites (CR 55, 63, 64, 76 and 77) were closer to the road than the houses and therefore were not truly representative of residential exposure because pollution concentrations decrease with distance from the source. In order to account for this falling off in pollution concentration, an adjustment was made. After calculating the effect of fall off with distance from the road, to provide a more representative estimation of exposure, it was found that there were no exceedances at the point of relevant exposure at these five locations.

The remaining two locations (CR 62 and 69) were measured at the façade of the house and therefore the measurement was representative of relevant public exposure. These measured values indicate that nitrogen dioxide levels within the AQMA remain high and still have the potential to exceed.

At this point it is appropriate to consider how the choice of the local bias adjustment factor affects these results. The rationale for choosing the local factor is discussed fully in Appendix A, however, its effect on the reported results is discussed in more detail here.

Following Guidance from LAQM Guidance (TG.16) and the laqm helpdesk, the local adjustment factor (1.06) was chosen to take into account the effect of the airport and provide a conservative approach to the monitoring data. However, at busy road locations such as in the AQMA, the influence of road traffic sources is more dominant and the use of the national bias adjustment factor (0.92) may have been more appropriate. If the national factor had been applied to the data, this would have resulted in no exceedances of the objective within the AQMA. However, it is not appropriate to apply two different adjustments within the same report.

Ultimately which ever factor had been chosen, the results at these locations would have been within +/- 10% of the air quality objective of 40ug/m^3 and therefore, with the potential to exceed, would have resulted in the same conclusions being drawn, that is: That the AQMA should remain in place and we should continue to implement the actions drawn up for the AQAP.

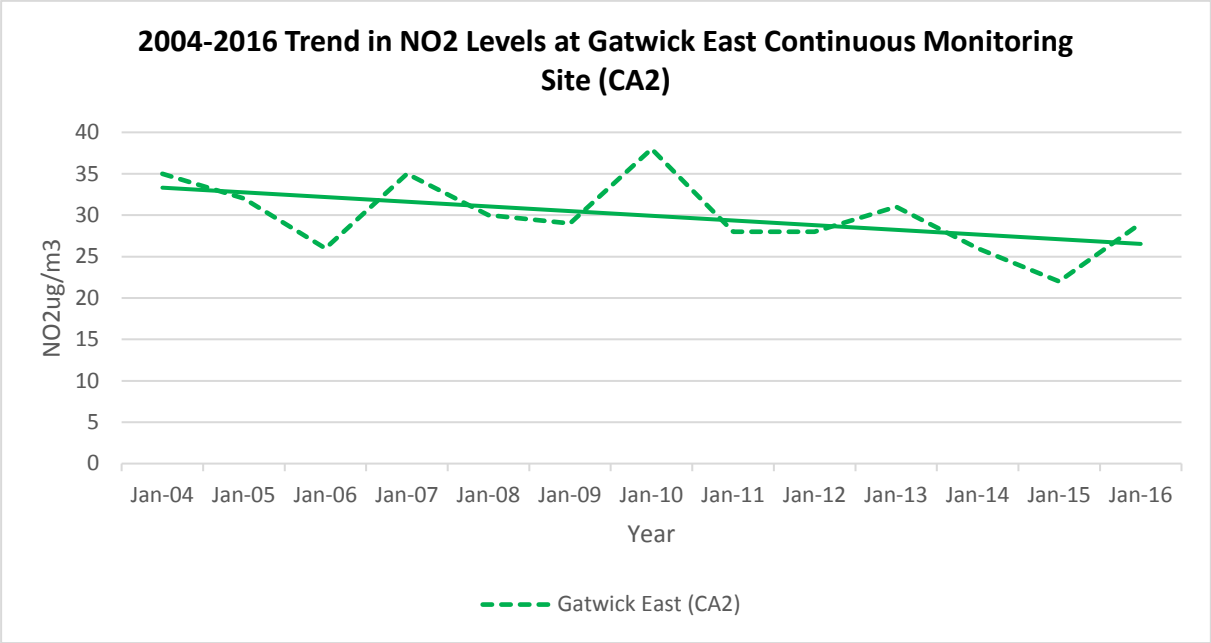
Diffusion tubes cannot provide hourly measurements of NO_2; however, Defra Technical Guidance (TG (16)) states that where annual mean NO_2 concentrations measured by diffusion tubes exceed 60 µg/m3 there is a likelihood that the 1-hour objective may be exceeded. No exceedances of 60 µg/m3 were measured at any of the diffusion sites in Crawley in 2016.

Trends in Annual Mean NO_2

Despite the slight upturn in levels in 2016, the long term trends for NO_2 at roadside, background and airport sites in Crawley are downwards indicating that levels of nitrogen dioxide have generally fallen over time. The only exception for this is within the AQMA when the long term trend continues to be upwards.

Although there was an increase in annual mean NO_2 levels at the Gatwick East continuous monitoring site in 2016 (CA2 30µg/m^3), there were no exceedances of the annual or hourly mean objectives and the long term trend continues to be downwards indicating noticeable reductions in NO_2 over the last few years (Fig 3.1). The co-located diffusion tube data at this site mirrors this pattern with a slight increase in 2016 but an overall downward trend for the long term data.

Fig 3.1



Determining relevant exposure at residential properties within 1000m of the airport is one of the assessment criteria required for authorities with a major airport within their boundary. In 2016 there were no exceedances of annual mean NO_2 at any of these residential receptors (CR 48, 49, 50, 51, 74, 75).

In Fig 3.2 the levels of nitrogen dioxide from the airport's LGW3 site located at the eastern end of the runway (and therefore considered to be worst case) are compared to residential receptors in Crawley within 1000m of the airport. The long term trend at these sites is also shown to be downwards.

Fig 3.2

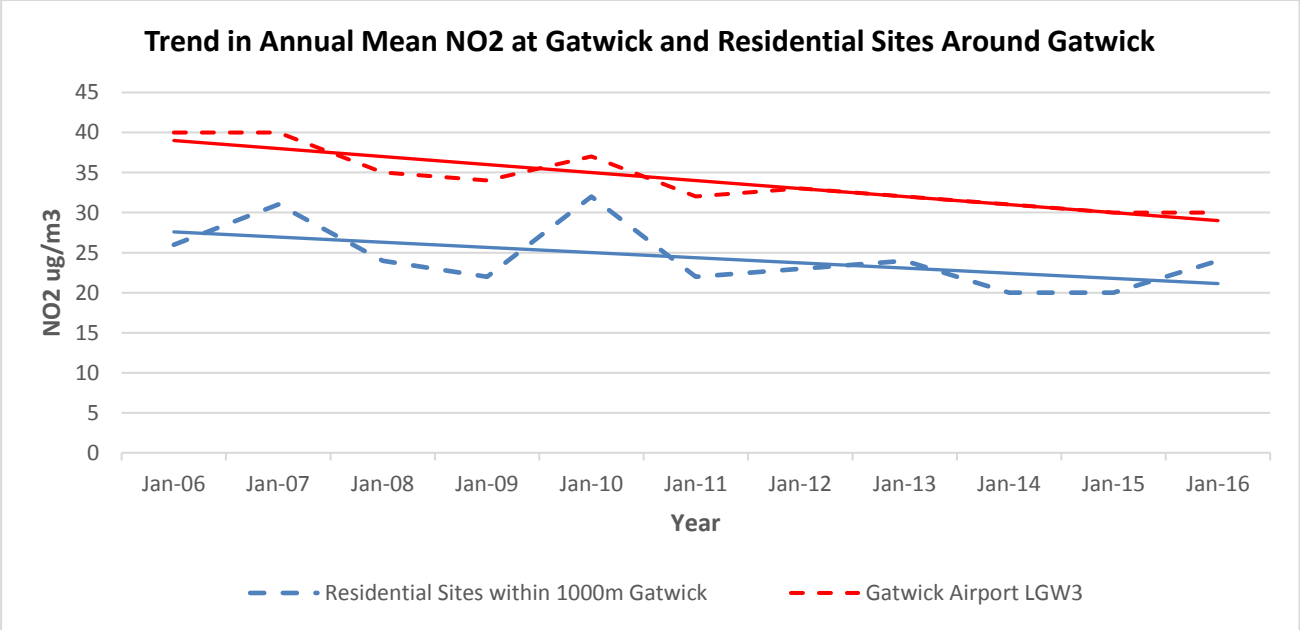


Fig 3.3 shows the long term trend in roadside NO_2 in Crawley continues to be downwards indicating that overall levels have fallen despite increases in traffic volumes over the same period (Fig 3.4). A range of measures at European, national and local level, such as improvements in engine technologies, and gradual shift to more sustainable forms of transport have helped reduce vehicle emissions, which, over time have resulted in reductions in NO_2 both regionally and locally.

Fig 3.3

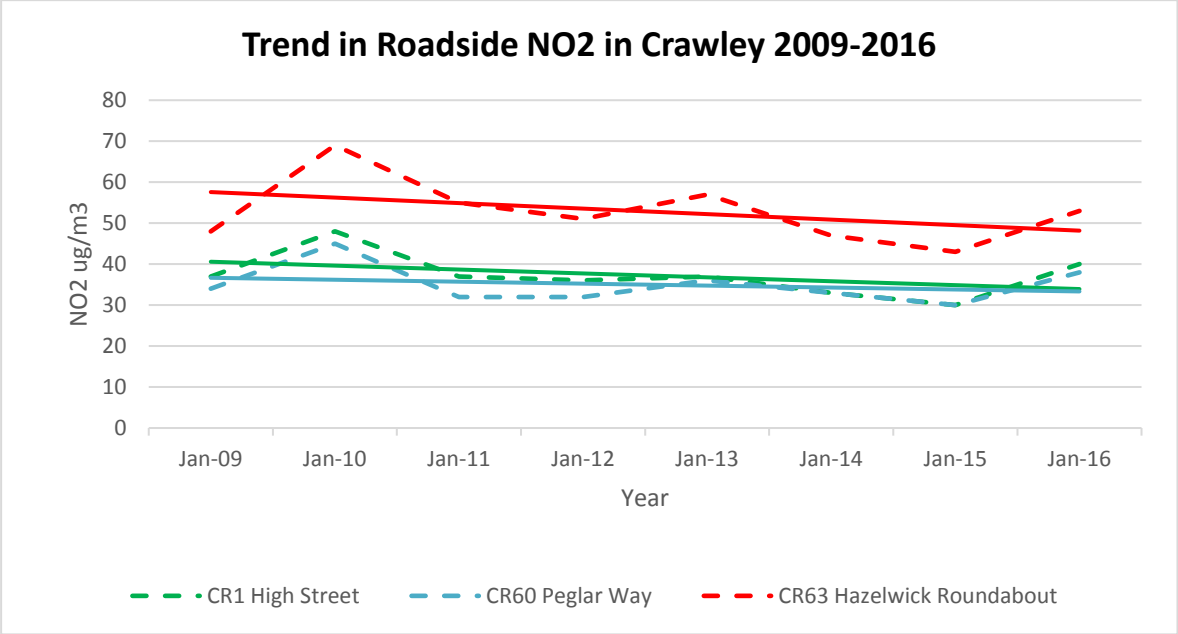
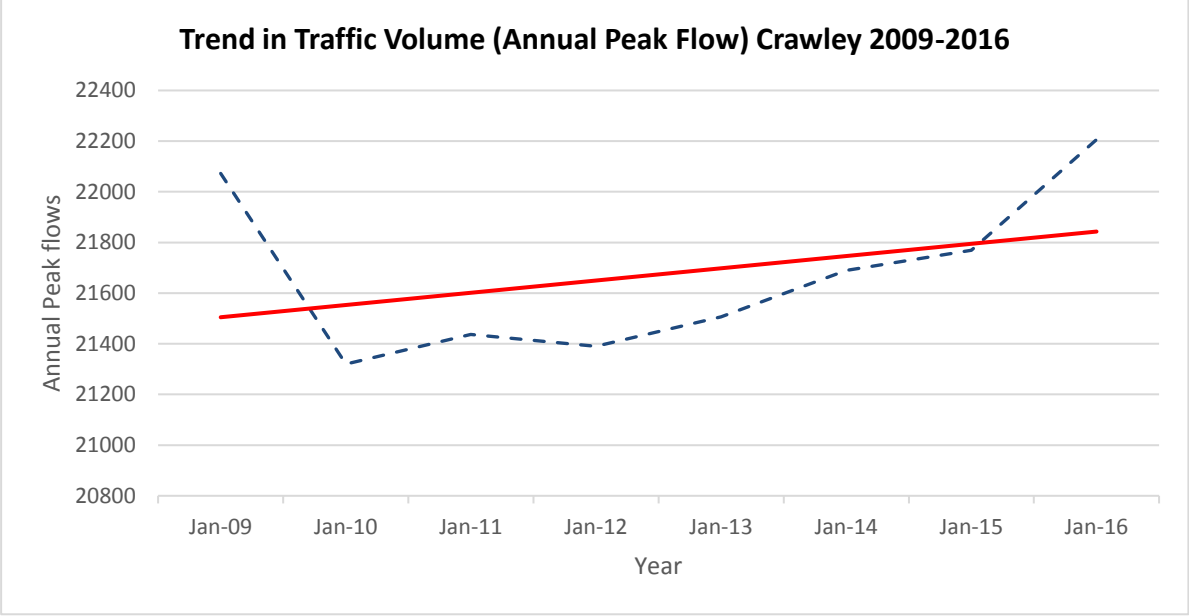
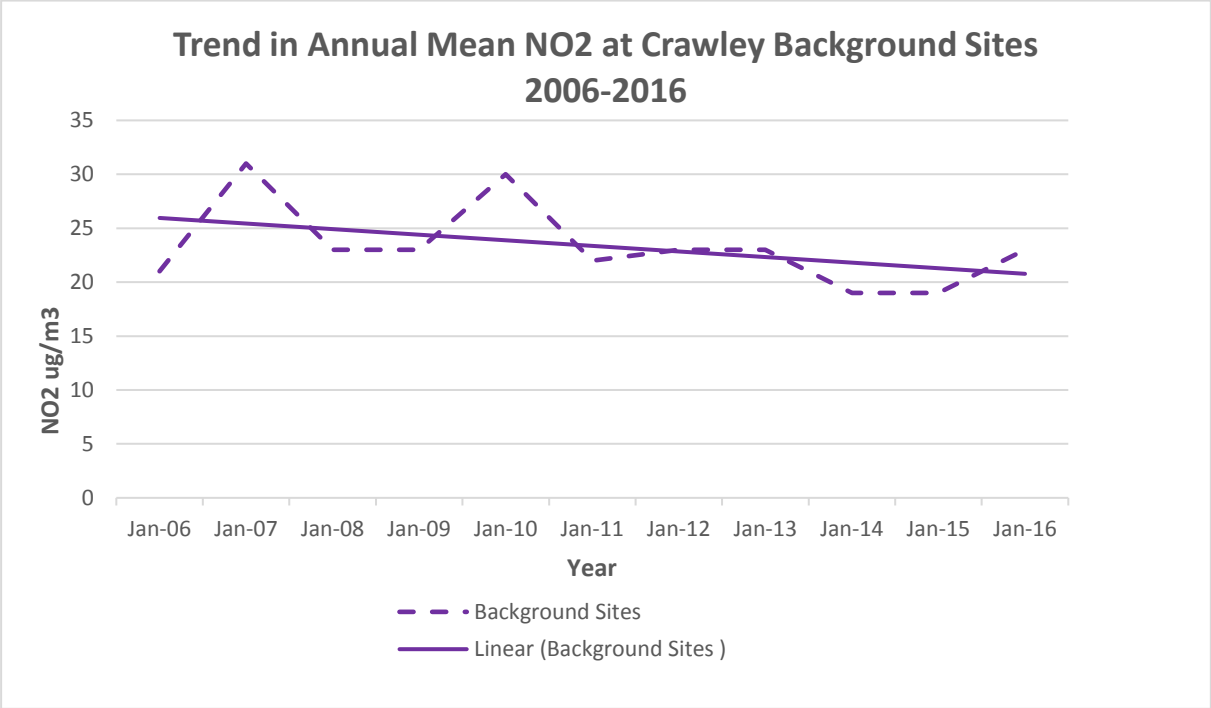


Fig 3.4



The following graph (Fig 3.5) shows the trend in NO_2 at long term background sites in Crawley presents a similar picture to that at roadside and airport sites, with the long term trend downwards confirming that background levels of NO_2 have also been falling over the last decade. The steeper downward slope indicates that background levels have shown greater improvement in air quality over the last decade than at sites close to busy roads and helps to demonstrate the contribution vehicle emissions make to poor air quality at these roadside location. These comparison help evidence the argument for restricting residential development close to busy roads.

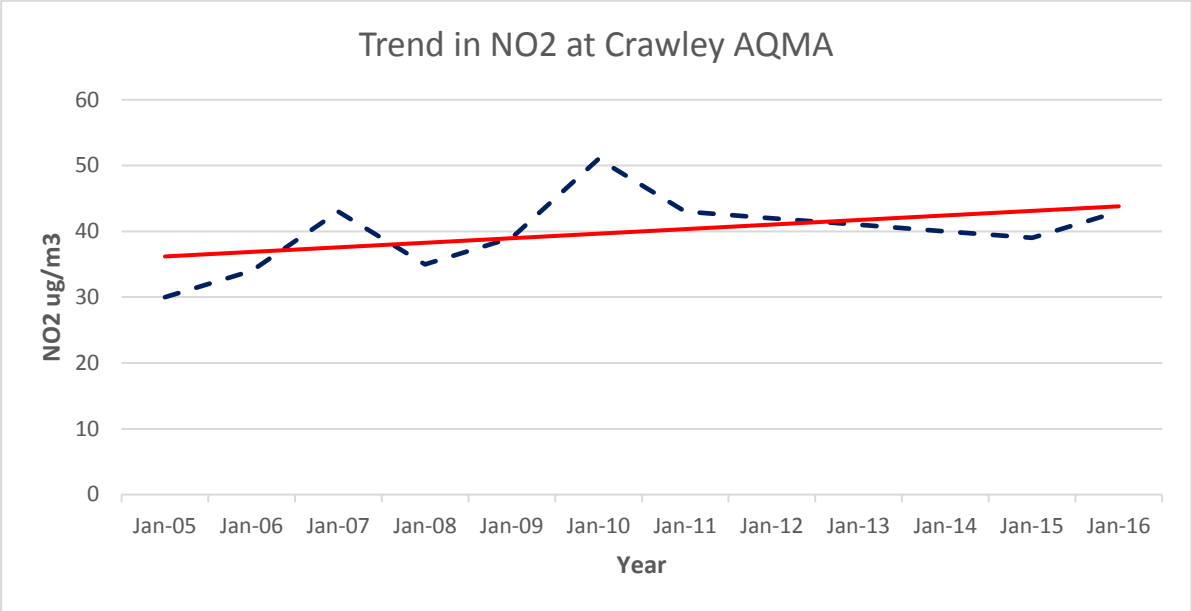
Fig 3.5



Although the general trend for both background and roadside sites in Crawley is down, this is not seen at receptor sites within the AQMA where the long term data is still showing an upwards trend (Fig 3.6). As a result, the council has no current plans to amend the AQMA.

Outside of the AQMA, no exceedances of the air quality objectives were found and therefore no further new AQMAs or expansions to the existing AQMA are recommended.

Fig 3.6


Trend in NO2 at Crawley AQMA
60
50
40
30
20
10
0
NO2 ug/m3
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Year

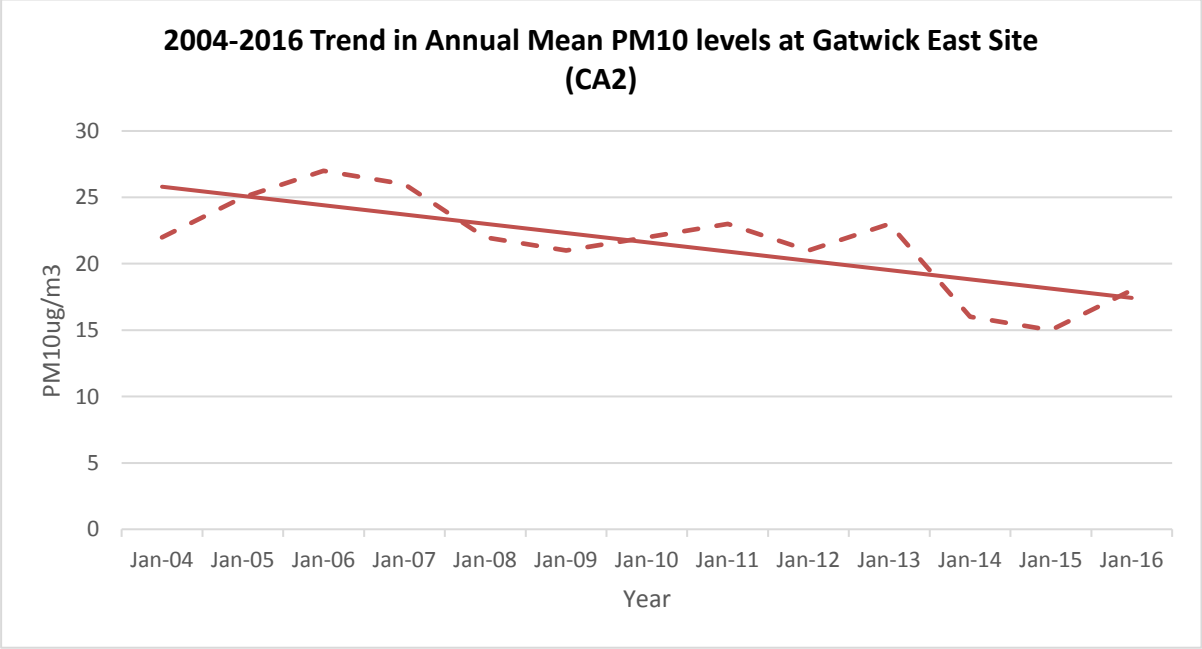
3.2.2 Particulate Matter (PM_{10})

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

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

The 2016 results show that annual mean PM_{10} concentrations increased in 2016 from the previous year (from 15µg/m^3 to 18µg/m^3), but this was in keeping with increases seen regionally and is thought to be due to climatic influences across the region rather than local factors. There were no exceedances of the annual mean or daily mean objectives measured at the Crawley automatic monitoring site and the long-term trend for PM_{10} continues to decline (Fig 3.7). No recommendation for an AQMA is required for this pollutant.

Fig 3.7



Appendices

Appendix A: Monitoring Results

Appendix B: Full Monthly Diffusion Tube Results for 2016

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

Appendix D: Map of Monitoring Locations/ AQMA

Appendix E: Summary of Air Quality Objectives in England

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)
CA2	Gatwick East	Other/Suburban Industrial(AQD2008)	529394	141446	NO_2; PM_{10}	NO	Chemiluminescent; TEOM	63m	27m	1.8

Notes:

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

(2) N/A if not applicable.

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)
CR1	High Street	Roadside	528153	137912	NO_2	N	19.42m	1.5m	N	2.5
CR3	Birch Lea	Urban background	526743	136349	NO_2	N	15.30m	1.5m	N	2.5
CR4	Headley Close	Urban background	526599	136638	NO_2	N	14.80m	0.5m	N	2.5
CR48	Lynhurst Cottage	Urban background	526752	136420	NO_2	N	3.80m	14m	N	2.5
CR49	Charlwood Nursery	Urban background	525530	138472	NO_2	N	0m	36m	N	2.5
CR50	Rowley Cottage	Urban background	526285	138495	NO_2	N	0m	75m	N	2.5
CR51	Balcombe Road	Urban background	529335	139589	NO_2	N	0.50m	24m	N	2.5
CR52 - CR54	Gatwick East, Tri-location)	Other/Suburban Industrial	529394	141446	NO_2	N	63m	27m	Y	1.8

		(AQD2008)								
CR 55	Tinsley Close Fence (11)	Roadside	528446,	138085	NO_2	Y	13.6m	5.7m	N	2.5
CR 60	Peglar Way	Roadside	526740	136934	NO_2	N	6.5m	0m	N	2.5
CR62	Tinsley Close (10)	Urban background	528438	138088	NO_2	Y	0m	13.6m	N	2.5
CR63	Woodfield Lodge (R'bout)	Roadside	528153	137912	NO_2	Y	33m	2.8m	N	2.5
CR64	Woodfield Lodge (N'gteAve)	Roadside	528153	137871	NO_2	Y	10m	3.8m	N	2.5
CR66	Brighton Rd (Rail crossing)	Roadside	526743	136346	NO_2	N	Planned residential 2m	0.5m	N	2.5
CR69	Tinsley Close Facade(11)	Urban background	528443	138082	NO_2	Y	0m	9.3m	N	2.0
CR71	Tinsley Close (6)	Urban background	528380	138062	NO_2	Y	12m	7.2m	N	2.5

CR72	Burlands	Urban background	529335	139589	NO_2	N	5.4m	7.3m	N	2.5
CR73	Cherry Lane	Urban background	528978	139599	NO_2	N	8.4m	18m	N	2.5
CR74	Tinsley Green	Urban Background	528362	137713	NO_2	N	19.2	8.8m	N	2.5
CR75	Steers Lane	Urban Background	528276	137828	NO_2	N	Planned residential10m	2m	N	2.5
CR76	Hazelwick Court	Urban background	528292	137828	NO_2	Y	4.3m	3.4m	N	2.5
CR77	Hazelwick Ave (Bays)	Urban background	528355	137719	NO_2	Y	7.5m	1.3m	N	2.5
CR78	Ferndown	Urban background	530037	138553	NO_2	N	0m	40m	N	2.5
CR79	St Hildas Close	Urban background	529312	138534	NO_2	N	0m	12m	N	2.5
CR80	Saxon Road	Urban background	530424	136521	NO_2	N	0m	8.7m	N	2.5

CR81	Bolton Road	Urban background	529047	134474	NO_2	N	0m	12.8	N	2.5
CR82	Resholm Peeks Brook Lane (RWP)	Urban background	530261	140629	NO_2	N	0m	10.2m	N	2.5
CR83	Resholm Peeks Brook Lane(tel pole)	Urban background	530254	140625	NO_2	N	8.36m	0m	N	2.5
CR84	Fernhill Road	Urban background	529960	141182	NO_2	N	13.6	0m	N	2.5
CR 99	Furnace Farm Road	Urban background	528153	137871	NO_2	N	14.80m	0.5m	N	2.5

Notes:

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

(2) N/A if not applicable.

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 2016 (%) (2)	NO_2 Annual Mean Concentration ($\mu g/m^3$) (3)				
					2012	2013	2014	2015	2016
CR1	Roadside	Diffusion Tube	n/a	100	36	37	33	30	**40**
CR3	Urban background	Diffusion Tube	n/a	100	25	23	20	20	24
CR4	Urban background	Diffusion Tube	n/a	92	23	26	21	21	25
CR48	Urban background	Diffusion Tube	n/a	100	26	27	23	24	28
CR49	Urban background	Diffusion Tube	n/a	100	19	21	17	16	19
CR50	Urban background	Diffusion Tube	n/a	100	21	24	18	19	25
CR51	Urban background	Diffusion Tube	n/a	100	26	24	21	21	25

CR52	Urban background	Diffusion Tube	n/a	100	28	29	25	25	30
CR53	Urban background	Diffusion Tube	n/a	100	27	29	26	24	29
CR54	Urban background	Diffusion Tube	n/a	100	27	29	26	25	29
CR52 – CR54 Mean Trilocated	Other/Suburban Industrial (AQD2008)	Diffusion Tube	n/a	100	27	29	26	25	29
CR 55	Roadside	Diffusion Tube	n/a	100	**42**	**41**	**40**	39	**42**
CR 60	Roadside	Diffusion Tube	n/a	100	32	36	33	31	38
CR62	Urban background	Diffusion Tube	n/a	100	38	39	36	31	**40**
CR63	Roadside	Diffusion Tube	n/a	100	**51**	**57**	**47**	**44**	**53**
CR64	Roadside	Diffusion Tube	n/a	100	39	**40**	37	37	**41**
CR66	Roadside	Diffusion Tube	n/a	100	37	35	31	27	35
CR69	Urban background	Diffusion Tube	n/a	100	**42**	**41**	37	36	**43**
CR71	Urban background	Diffusion Tube	n/a	100	33	33	31	30	32.
CR72	Urban background	Diffusion Tube	n/a	100	-	-	14[(1)]	13	16

CR73	Urban background	Diffusion Tube	n/a	100	-	-	17(1)	16	21
CR74	Urban background	Diffusion Tube	n/a	100	-	-	30 (1)	26	37
CR75	Urban background	Diffusion Tube	n/a	92	-	-	20 (1)	20	25
CR76	Urban background	Diffusion Tube	n/a	92	-	-	**40**(1)	36	**43**
CR77	Urban background	Diffusion Tube	n/a	100	-	-	35(1)	36	**42**
CR78	Urban background	Diffusion Tube	n/a	100	-	-	-	-	29
CR79	Urban background	Diffusion Tube	n/a	100	-	-	-	-	30
CR80	Urban background	Diffusion Tube	n/a	100	-	-	-	-	32

CR81	Urban background	Diffusion Tube	n/a	100	-	-	-	-	28
CR82	Urban background	Diffusion Tube	42	100	-	-	-	-	25[1]
CR83	Urban background	Diffusion Tube	42	100	-	-	-	-	23[1]
CR84	Urban background	Diffusion Tube	33	100	-	-	-	-	28[1]
CR 99	Urban background	Diffusion Tube	n/a	100	21	20	20	16	20
CA2	Other/Suburban Industrial (AQD2008)	Automatic	n/a	96	28*	31	31	25*	29

☒ **Diffusion tube data has been bias corrected local Bias correction factor 1.06**

☒ **Annualisation[1] has been conducted where data capture is <75%**

Notes:

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

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

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

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

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

* Values taken from tri-located diffusion tube as no valid data available from automatic monitor due to equipment failure

Table A.3.1 Automatic Monitoring for Nitrogen Dioxide at Gatwick Sites: CA2 (Crawley Gatwick East) and LGW3 (Adjacent to Runway Gatwick airport) Objective

Site ID	Location	% Data Capture for monitoring period 2016	Annual mean concentrations (μg/m³)												
			2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
CA2	Gatwick East	96	35	32	26	35	30	29	38*	(28)*	28	31	(26)*	22	29
LGW3	Gatwick Airport	99	36	34	**40**	**40**	35	34	37	32	33	32	31	30	30

* Analyser failure – adjusted value in brackets taken from tri-located tubes

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 2016 (%) (2)	NO_2 1-Hour Means > 200µg/m³ (3)				
					2012	2013	2014	2015	2016
CA2	Other/Suburban Industrial	Automatic	N/A	96	0	0	0	0	0

Notes:

Exceedances of the NO_2 1-hour mean objective (200µg/m³ not to be exceeded more than 18 times/year) are shown in **bold.**

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

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

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

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

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	PM_{10} Annual Mean Concentration ($\mu g/m^3$) (3)				
				2012	2013	2014	2015	2016
CA2	Other/Suburban Industrial	N/A	94	21	23	16[3]	15	18

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

Notes:

Exceedances of the PM_{10} annual mean objective of 40$\mu g/m^3$ are shown in **bold.**

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

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

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

(4) All means have been VCM corrected. See Appendix C for details.

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

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	PM_{10} 24-Hour Means > 50µg/m^3 (3)				
				2012	2013	2014	2015	2016
CA2	Other/Suburban Industrial	N/A	94	**3**	5	0	1	1

Notes:

Exceedances of the PM_{10} 24-hour mean objective (50µg/m^3 not to be exceeded more than 35 times/year) are shown in **bold.**

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

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

(3) If the period of valid data is less than 85%, the 90.4th percentile of 24-hour means is provided in brackets.

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)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean		
													Raw Data	Bias Adjusted (1.06) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
CR1	32.35	33.96	43.95	36.77	38.64	32.33	26.71	28.73	**41.25**	**41.78**	**48.52**	**43.11**	37.34	**40**	N/A No relevant exposure
CR3	18.28	23.40	23.65	21.96	19.93	18.90	15.41	16.74	22.01	29.51	32.97	30.16	22.74	24	N/A No exceedance
CR4	16.20	24.58	31.04	19.62	21.41	18.42	13.75	15.62	25.93	29.71	33.43	30.80	23.38	25	N/A No exceedance
CR48	21.79	26.86	32.13	22.37	24.54	23.73	22.14	21.97	27.73	33.46	33.01	30.94	26.72	28	N/A No exceedance
CR49	12.93	15.09	24.12	20.63	17.89	17.92	10.60	12.36	17.77	21.87	25.91	17.88	17.91	19	N/A No exceedance
CR50	15.49	20.03	32.57	21.76	21.78	21.41	12.04	14.73	24.13	31.38	34.21	30.18	23.31	25	N/A No exceedance
CR51	19.48	24.08	29.87	21.01	22.88	18.45	20.48	21.03	22.65	27.26	29.40	25.16	23.48	25	N/A No exceedance
CR52	24.29	29.81	34.57	24.51	27.98	23.84	23.68	24.34	27.92	30.84	35.56	27.72	27.92	30	N/A No exceedance
CR53	17.87	24.72	29.05	24.56	26.99	22.61	24.16	23.70	27.84	31.48	35.70	33.78	26.87	29	N/A No exceedance
CR54	21.78	26.89	33.59	24.24	27.58	21.02	22.68	24.37	27.29	32.37	33.84	34.30	27.50	29	N/A No exceedance

CR 55	36.05	35.56	37.37	35.39	**40.43**	35.79	37.23	37.20	**45.25**	**44.43**	**47.22**	38.50	39.20	**42**	39
CR 60	34.20	36.18	**40.59**	31.01	35.77	29.35	29.39	31.15	34.33	38.88	**44.03**	**40.34**	35.44	38	N/A No exceedance
CR62	**41.49**	37.88	37.63	33.86	38.37	31.07	37.27	31.39	**40.15**	38.13	**43.29**	**43.64**	37.85	**40**	**40** (Façade)
CR63	**45.71**	**43.89**	**53.46**	**45.58**	**50.62**	**45.76**	**44.06**	**44.08**	**54.70**	**53.14**	**55.14**	**64.92**	**50.09**	**53**	36
CR64	26.08	35.99	37.52	34.12	**40.07**	33.15	32.40	35.72	**42.65**	**50.43**	**46.32**	**47.08**	38.46	**41**	36
CR66	26.46	29.40	35.30	25.79	32.32	30.48	33.20	29.98	33.11	38.85	**41.64**	**41.19**	33.14	35	N/A No exceedance
CR69	39.38	38.92	34.47	35.48	**41.80**	34.92	**41.49**	39.01	**44.55**	**43.25**	**47.35**	**46.33**	**40.58**	**43**	**43** (Façade)
CR71	27.14	29.44	31.42	25.62	32.25	27.64	30.74	28.79	**40.54**	11.32	39.12	40.25	30.36	32	N/A No exceedance
CR72	13.81	15.85	18.30	14.25	13.00	12.56	6.64	10.04	15.73	18.69	22.24	19.54	15.05	16	N/A No exceedance
CR73	18.29	17.47	23.55	18.47	17.52	16.26	10.75	13.28	19.67	24.86	27.30	27.93	19.61	21	N/A No exceedance
CR74	20.38	30.26	**41.05**	27.94	33.31	35.34	29.80	29.53	35.16	**43.72**	**46.34**	**41.69**	34.54	37	N/A No exceedance
CR75	16.18	21.70	31.03	21.96	23.38	20.38	17.68	17.84	24.75	29.79		30.83	23.23	25	N/A No exceedance
CR76	32.60	33.89	39.67	**40.16**	39.81	**41.09**	37.32	34.94		**46.66**	**51.26**	**47.73**	**40.47**	**43**	39
CR77	33.88	36.04	**44.31**	33.03	33.94	34.24	33.94	32.16	**46.68**	**42.62**	**50.81**	**48.59**	39.19	**42**	36
CR78		23.60	31.17	26.20	29.35	26.05	14.31	20.66	29.21	34.05	34.19	31.84	27.33	29	N/A No exceedance
CR79		23.11	29.41	26.75	26.80	28.97	20.69	21.81	29.85	36.49	35.00	31.89	28.25	30	N/A No exceedance

CR80		22.30	30.57	29.86	33.45	29.47	17.78	22.39	33.43	36.80	37.04	33.70	29.71	32	N/A No exceedance
CR81		18.88	27.81	24.72	24.43	21.88	21.92	22.43	28.58	31.59	33.30	31.71	26.11	28	N/A No exceedance
CR82								18.34	22.64	27.79	25.17	26.59	24.11	25[1]	N/A No exceedance
CR83								22.01	27.42	31.76	33.25	29.94	28.88	23[1]	N/A No exceedance
CR84									22.94	28.16	30.37	31.24	28.18	28[1]	N/A No exceedance
CR 99	15.51	20.02	22.23	18.31	15.96	15.86	11.30	12.92	19.38	25.56	30.75	23.59	19.28	20	N/A No exceedance

☒ **Local bias adjustment factor used**

☒ **Annualisation[1] has been conducted where data capture is <75%**

Notes:

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

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

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

(2) Distance corrected to nearest relevant public exposure.

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

C.1: QA/QC Diffusion Tube Monitoring Data (NO_2)

All diffusion tube monitoring data has been ratified following the methods described in LAQM.TG(09) A quality assurance/quality control (QA/QC) programme including field duplicates and blanks and instrument calibration with standard gases has been followed (AEAT, 2000).

The NO_2 diffusion tube analysis was carried out and analysed by Gradko Environmental (part of Gradko International Ltd) .The QA/QC methodology for Gradko Environmental Ltd is given below:

Tube Preparation: The preparation of the tubes is done using 20% Triethanolamine / 80% Deionised Water. The preparation procedures adhere to the guidance detailed in the document 'Diffusion Tubes for Ambient NO2 Monitoring: Practical Guidance for Laboratories and Users', Issue 1a Feb.2008 (issued by AEA Energy and Environment).

Analysis Methods: Analysis of the NO_2 diffusion tubes is carried out using colorimetric techniques in accordance with Gradko International Ltd UKAS accredited (ISO/IEC 17025) internal laboratory procedures. The details in these procedures adhere to the DEFRA 'Diffusion Tubes for Ambient NO2 Monitoring: Practical Guidance for Laboratories and Users, Issue 1a Feb 2008', issued by AEA Energy and Environment.

Quality Control Procedures: All tube components are maintained in a high state of cleanliness. New absorbents are prepared by the Laboratory and checked for levels of contamination.

The diffusion tubes are prepared in a dedicated clean laboratory and stored under refrigerated conditions to maintain stability. A sample of each batch of tubes prepared is checked by the analyst for blank levels. If the tubes are stored for more than one week, a further sample is taken and checked for any increases in blank levels. If the levels reach a pre-determined value, the batch of tubes is discarded.

Method Calibration: A full five to seven (dependant on range of concentrations being measured) point calibration is carried out monthly using NIST certified nitrite standards. The linear graph acceptance is $r^2 = 0.999$. At the start of every batch of tubes analysed, two nitrite standards are run to check the accuracy of the calibration graph, this is repeated at the end of the analysis run. Statistical graphs are maintained using the plots of the daily standard results and the acceptance criteria achieved before an analysis run is made. An instrument calibration is run every two months using certified optical filters plus an annual preventative maintenance programme carried out by an external engineer is in operation.

Quality Assurance: The laboratory has a fully documented Quality Management System which has been assessed and accredited by UKAS (Accreditation No. 2187). A copy of the Quality Manual Contents Index is available on request.

Quality Control Procedures are supplemented by the use of external proficiency schemes such as W.A.S.P administered by Health and Safety Laboratories at Buxton and the NETCEN U.K. NO2 Field Inter-comparison project administered by National Physical Laboratories (NPL), Teddington.

C.2: NO_2 Diffusion Tube Precision, Accuracy and Bias Correction

Diffusion tube monitoring has inherent errors. In order to minimise these, a bias-adjustment factor is applied to the measurements to improve the accuracy of the results. This factor is obtained by co-locating three diffusion tubes at a continuous monitoring site.

The co-location study in Crawley is at the Gatwick East Site (CA2), where triplicate tubes (prepared and analysed by Gradko) are located next to the inlet of the chemiluminescence analyser. Using the results of this study, the average values from the monthly exposed tubes for a given year can be compared directly to the corresponding continuously monitored values; allowing the local authority to calculate the precision of their tubes as well as the bias.

Precision of the Crawley Co-location Site Diffusion Tubes: Precision is the ability of a measurement to be consistently reproduced; and the diffusion tube precision is therefore calculated by determining the coefficient of variation CV. Where the CV is <20% for 8 or more periods in a year, then the Tube Precision is considered to be “Good”. Tube precision was calculated using the calculator tool (version 04) on the laqm review and assessment support website (www.airquality.co.uk/archive/laqm/tools.php). The results for the Crawley co-location study are shown in Table C.1 and C.2 below. Overall Precision was “Good”

Table C 2.1 2016 Precision Assessment of Triplicate Tubes (from calculator tool (version 04) on the LAQM Review and Assessment Support Website)

Site Name/ ID:	GATWICK EAST SITE (CA2)								
2016 Co-Location Diffusion Tubes Measurements									
Period	Start Date	End Date	Tube 1 μgm^{-3}	Tube 2 μgm^{-3}	Tube 3 μgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean
1	01/01/2016	31/01/2016	24.3	17.9	21.8	21	3.2	15	8.0
2	01/02/2016	29/02/2016	29.8	24.7	26.9	27	2.6	9	6.3
3	01/03/2016	31/03/2016	34.6	29.1	33.6	32	2.9	9	7.3
4	01/04/2016	30/04/2016	24.5	24.6	24.2	24	0.2	1	0.4
5	01/05/2016	30/05/2016	28.0	27.0	27.6	28	0.5	2	1.2
6	01/06/2016	31/06/2016	23.8	22.6	21.0	22	1.4	6	3.5
7	01/07/2016	31/07/2016	23.7	24.2	22.7	24	0.8	3	1.9
8	01/08/2016	31/08/2016	24.3	23.7	24.4	24	0.4	2	0.9
9	01/09/2016	30/09/2016	27.9	27.8	27.3	28	0.3	1	0.9
10	01/10/2016	31/10/2016	30.8	31.5	32.4	32	0.8	2	1.9
11	01/11/2016	30/11/2016	35.6	35.7	33.8	35	1.0	3	2.6
12	01/12/2016	31/12/2016	27.7	33.8	34.3	32	3.7	11	9.1
13	01/01/2017	31/01/2017	27.7	33.8	34.3	32	3.7	11	9.1
Precision	13 out of 13 periods have a CV smaller than 20%								

Table C 2.2 2016 Co-location Overall Tube Precision and data Capture (from calculator tool (version 04) on the LAQM Review and Assessment Support Website)

2016 Automatic Monitoring Data (Gatwick East CA2)		Data Quality Check	
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data Capture Check
27.66	100	Good	Good
30.8	100	Good	Good
30.13	100	Good	Good
25.42	100	Good	Good
22	84	Good	Good
25	100	Good	Good
18	71	Good	Poor
26	100	Good	Good
26	65	Good	Poor
36	100	Good	Good
35.53	100	Good	Good
41.66	100	Good	Good
28.7	81	Good	Good
Overall survey		Good precision	Overall Good Data Capture

Diffusion Tube Bias Adjustment Factors: Bias represents the overall tendency of the diffusion tubes to depart from the true value, ie to under or over-read relative to the reference method (chemiluminescence analyser). The bias can be corrected, using the appropriate bias correction factor, to improve the accuracy of the diffusion tube results. Local bias adjustment factors are obtained by co-locating three diffusion tubes at a continuous monitoring site in the local authority and national factors are derived from the mean value of a number of different local authority studies. The derivation of the National and Local bias adjustment factors are shown below. (Tables C.3 – C.6).

Local Bias Adjustment factor for Crawley: Crawley has a co-location study located at the Gatwick East Site (CA2). A local bias adjustment factor was calculated using data from triplicate tubes (prepared and analysed by Gradko) mounted next to the inlet of the analyser during 4-week periods throughout the year. The 2016 local bias correction for Crawley was calculated using the method described in LAQM.TG(09) Section 3 and the spread sheet tool provided in www.airquality.co.uk/archive/laqm/tools.php . The bias value (B) derived from the tube data *without* CV > 20% was used to calculate the locally derived bias adjustment factor for Crawley (following the method in foot note 4 on this web-page).

Table C 2.3: Bias and Accuracy - Calculated without periods with CV > 20% (with 95% confidence interval)	
Bias calculated using 11 periods of data Bias factor A Bias B	 1.06 (0.96 – 1.19) -6% (-16% - 4%)
Diffusion Tube Means Mean CV (Precision)	28 µg/m^3 7
Automatic Mean Data capture for periods used	30 µg/m^3 97%
Adjusted Tubes Mean	30(27-34) µg/m^3

Table C 2.4: Bias and Accuracy - Calculated with all data including periods with CV > 20% (with 95% confidence interval)	
Bias calculated using 11 periods of data Bias factor A Bias B	 1.06 (0.96 – 1.19) -6% (-16% - 4%)
Diffusion Tube Means Mean CV (Precision)	28 µg/m^3 7
Automatic Mean Data capture for periods used	30 µg/m^3 97%
Adjusted Tubes Mean	30(27-34) µg/m^3

Table C 2.5 Local Bias Correction Factor for NO_2 diffusion Tube from 2016 Co-location Data Following foot note [4] of the Precision and Accuracy calculator tool LAQM Helpdesk Website (version 03/16)	
Bias (B) value	**= -6%**
Bias value expressed as a factor	**= -0.06**
Bias value, expressed as a factor + 1	**= - 0.06 + 1 = 0.94**
The inverse of 0.94 = The Bias Adjustment Factor	**= 1/0.94**
2016 Local Bias Correction Factor for Crawley	**= 1.06**

National Bias Adjustment Factor: Data from co-location studies are used to calculate the Bias Adjustment Factor. Not all local authorities carry out their own co-location studies, therefore Defra collates the UK co-location study results, and from these calculated the mean value for each laboratory, to provide a national bias adjustment value for the users of each laboratory. The National Bias Adjustment Factor (Gradko) is shown below.

Table C 2.6 National Bias Correction Factor for 2016 NO_2 diffusion Tube data from Gradko Co-location Studies. The full spread sheet data for all 32 studies can be view at the LAQM Review and Assessment Support Website http://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html)	
2016 National Bias Adjustment Factor (Gradko 32 Studies)	**0.92**

Choice of Factor for Bias Adjustment: The annual mean NO_2 for the triplicate co-located tubes was very close in value to the automatic monitoring data at the CA2 Gatwick site in 2016. This was reflected in the locally derived bias adjustment figure of 1.06, indicating that although there was a slight under- read in the tube data relative to the reference method (chemiluminescence analyser), there was good correlation over the data capture period. The national bias adjustment value for 2016 was 0.92, which also showed good correlation and was based on a large number of studies (32).

In deciding which Bias adjustment value to use, the following factors were taken into account in accordance to the guidance in TG (16):

Box 7.11 advises that: **"**If the co-location site is unusual in some way: for example, affected by specific large NOX sources other than road traffic, such as local industrial installations. (This is a strong indication in favour of using a locally-derived factor)"

The co-location site is situated on the eastern boundary of the Gatwick Airport and therefore affected by NOX sources from the Airport. The site is only 60m from the nearest residential property, and there are many other properties within 1000m of the airport. Determining relevant exposure within 1km of the airport boundary is one of the assessment criteria required for authorities with a major airport within their boundary. This would therefore favour using the locally derived factor.

However, in paragraph 7.197 the guidance says that: "care should be taken to avoid applying a bias adjustment factor derived from a local co-location study carried out for concentrations that are very different to those being measured in the wider survey"

Although the effect of the airport as an area source should be considered it may be less of an influence at roadside locations where traffic sources will be the major consideration. At these locations the nationally derived factor may be more relevant.

It was considered that using two factors within the report was not appropriate. After consulting the laqm helpdesk and given that the precision and accuracy of the local co-location study was good (AEA precision and accuracy spreadsheet v04), it was decided to use the more conservative locally derived bias factor of 1.06. Consequently all conclusions and recommendations made in this report were based on monitoring results adjusted with the 2016 bias adjustment figure of 1.06.

C.3: Annualising NO_2 Diffusion Tube Monitoring Data (where data capture is < 9 months)

Where data capture is below 75%, it is necessary to annualise the data as described in Box 7.9 of the LAQM Technical Guidance TG (16). The reason for annualisation is that the concentration varies throughout the year, and the instrument may have been operational for a period of above or below average concentrations.

For those sites with fewer than 9 months' worth of data, it is necessary to perform annualisation. This was undertaken for three sites (CR82, 83 and 84) using the technique discussed in Box 7.9.

Methodology:

- Data was available for 5 full calendar months from August – December 2016.
- The measured mean concentration **M** for this period was calculated.
- Two nearby, long-term, continuous monitoring sites: Gatwick East (CA2) and Poles Lane (RG3), with ≥ 85% data capture were identified.
- Annual means, $\mathbf{A_m}$, for 2016 were calculated for these sites (CA2 and RG3)
- Period means, $\mathbf{P_m}$, were calculated for the period of interest, (August- Dec)
- The ratio, **R**, of the annual mean to the period mean ($\mathbf{A_m/P_m}$) for each of the sites was calculated
- The average of these ratios, $\mathbf{R_a}$ was calculated. This is then the annualisation factor.
- The measured period mean concentration **M** multiplied by this annualisation factor $\mathbf{R_a}$ to give the estimate of the annual mean for 2016.
-

Table C 3.1 Annualising Diffusion Tube Monitoring data where data capture <9 months

Background Site	Annual Mean 2016 (A_m)	Period Mean 2016 (P_m)	Ratio (A_m/P_m)
Gatwick East, Crawley (CA2))	29	33	29/33=0.879
Poles Lane, Crawley (RG3)	17	19	17/19 =0.895
		Average (R_a)	0.887

The estimated annualised mean for the three sites with less than 9 months of data was calculated using the annualized factor R_a. The results are given in Table C.8 below

Table C 3.2 Estimated Annualised Mean NO_2 Diffusion Tube Data 2016

Site	Measured Period Mean M	Annualisation Factor (Ra)	Estimated Annual Mean
CR82	28	0.887	**24.84**
CR83	26	0.887	**23.06**
CR84	31	0.887	**27.50**

C.4: Fall off with Distance Calculator for NO_2 Annual Mean

This calculation allows the prediction of annual mean NO_2 concentration for a location "receptor" that is close to a monitoring site, but further from the road than the monitor. Often, for practical reasons, the monitoring site is not located at the façade of the receptor property. Where concentrations are measured closer to the source than the receptor, a fall off with distance calculation is used to check if measured concentrations are representative of exposure.

In this report, fall off with distance calculations have only been done at locations where there are measured exceedances of the air quality objective (40ugm^3 for NO_2), with the purpose of determining if concentrations are still exceeding at the receptor or if they have dropped below the limit value due to their greater distance from the pollution source. Likewise where exceedances have been measured at the receptor/façade no calculation has been done because there will be no fall off and therefore the measurement is already representative of relevant public exposure. For instance site CR 69 - 11Tinsley Close (Façade measurement 43ugm^3), and CR 62 – 10 Tinsley Close (Façade measurement 40ugm^3):

The following sites showed measured exceedances of the air quality objective for NO_2 (40ugm^3):

CR 55 - 11Tinsley Close (Fence) (42ugm^3)

CR 63 – Woodfield Lodge, Hazelwick Roundabout (53ugm^3)

CR 64 - Woodfield Lodge, Northgate Avenue (41ugm^3)

CR 76 – Hazelwick Court, Hazelwick Ave slip road (43ugm^3)

CR 77 Hazelwick Ave, The Bays (42ugm^3)

Table C 4.1: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedence	**CR 55 - 11Tinsley Close (Fence) (528446 138085)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2016	5.7	9.3	20	**42**	**39**

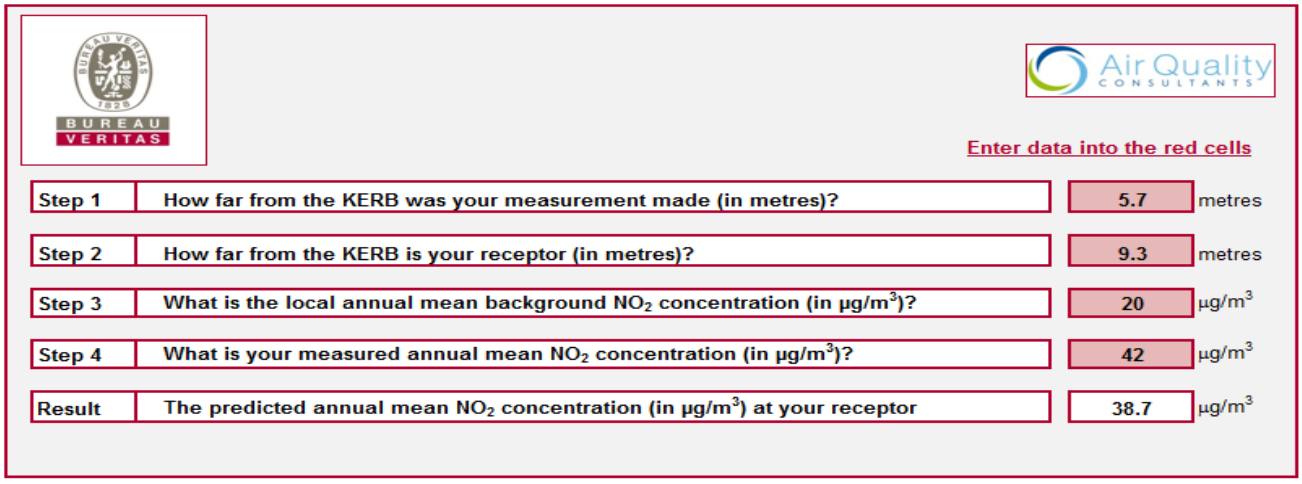


Table C 4.2: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedence	**CR 63 – Woodfield Lodge, Hazelwick Roundabout, (528153 137912)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2016	2.8	35.80	26	**53**	**36**

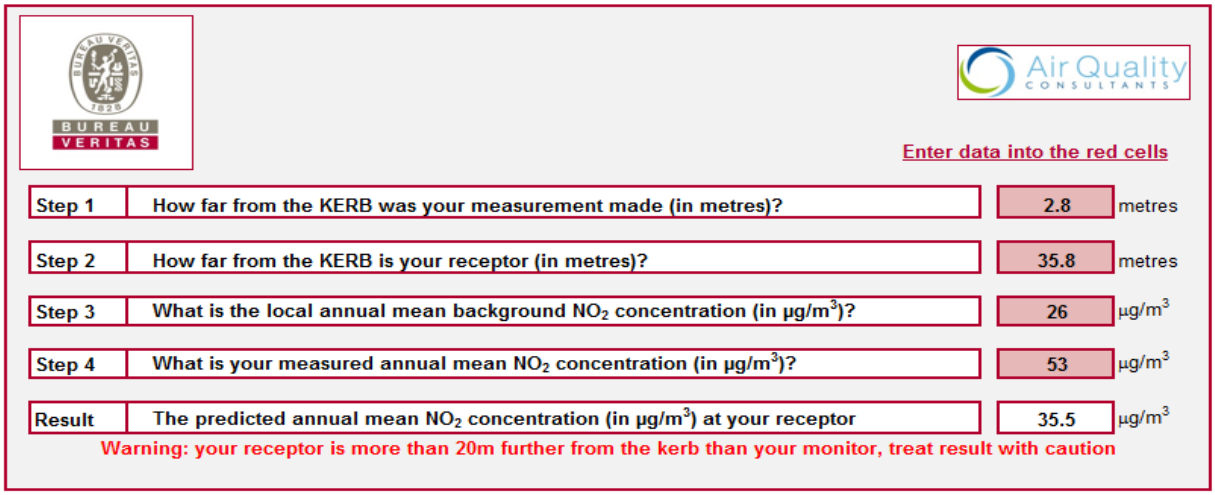


Table C 4.3: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedence	**CR 64 - Woodfield Lodge, Northgate Avenue, (528153 1379871)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2016	3.8	13.8	26	**41**	**36**

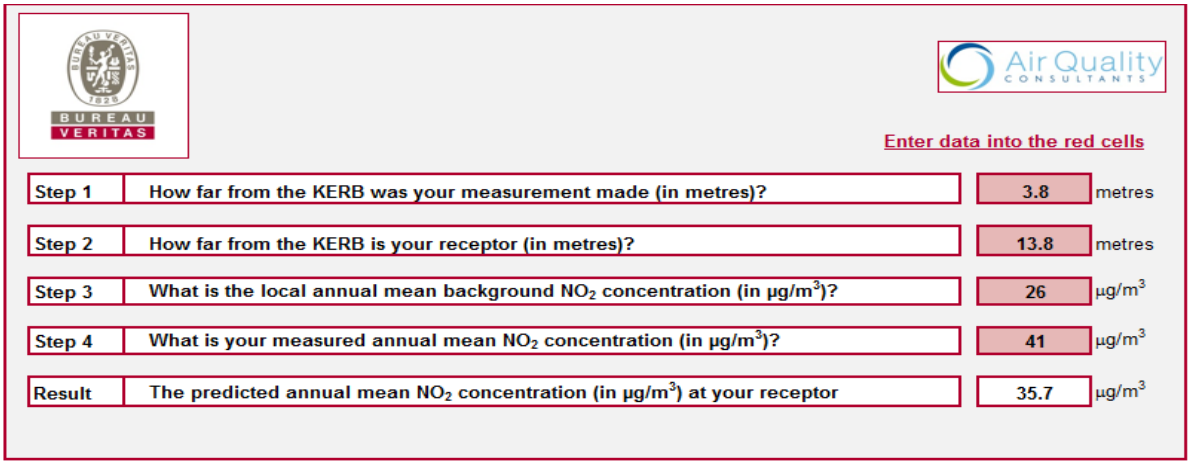


Table C 4.4: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedence	**CR 76 – Hazelwick Court, Hazelwick** Ave slip road **(528292 137828)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2016	3.4	7.7	26	**43**	**39**

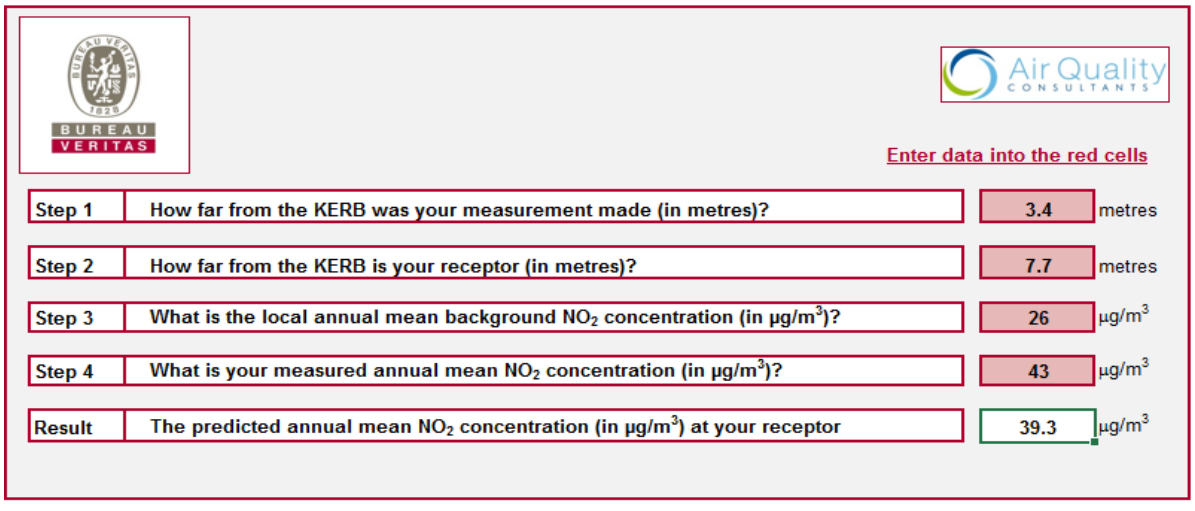
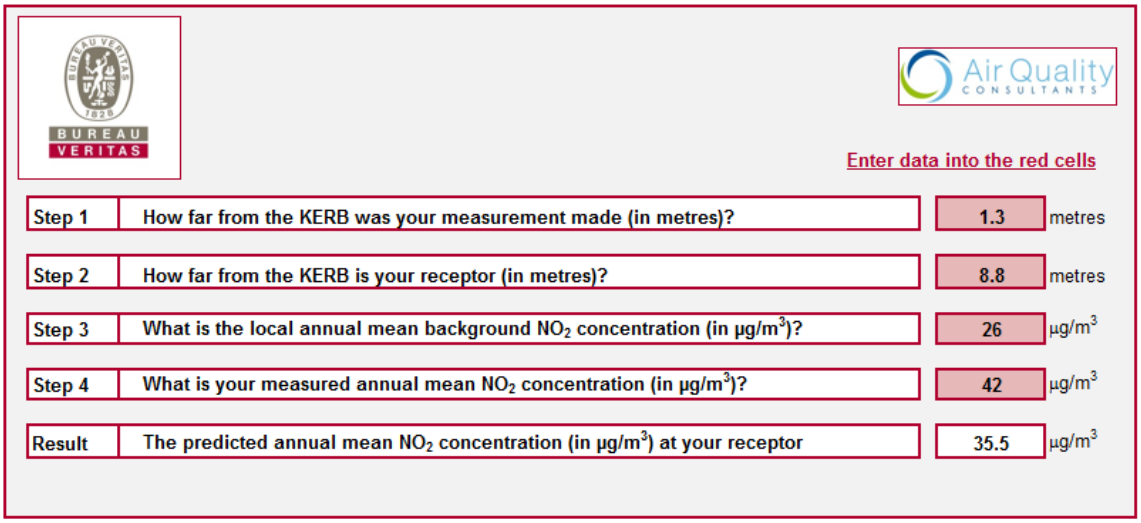


Table C 4.5: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedence	**CR 77 Hazelwick Ave (The Bays) (528355 137719)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2016	1.3	8.8	26	**42**	**36**



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Enter data into the red cells

Step 1	How far from the KERB was your measurement made (in metres)?	1.3	metres
Step 2	How far from the KERB is your receptor (in metres)?	8.8	metres
Step 3	What is the local annual mean background NO_2 concentration (in $\mu g/m^3$)?	26	$\mu g/m^3$
Step 4	What is your measured annual mean NO_2 concentration (in $\mu g/m^3$)?	42	$\mu g/m^3$
Result	The predicted annual mean NO_2 concentration (in $\mu g/m^3$) at your receptor	35.5	$\mu g/m^3$

C.5: Adjustment of PM_{10} Monitoring Data Using Volatile Correction Model (VCM)

For the TEOM data the Volatile Correction Model (VCM) was used to adjust the data for the gravimetric equivalent concentration. VCM corrected data for the Gatwick East data is shown in Table C.10 below.

Table C 5.1: Gatwick East PM_{10} Monitoring Adjustment using Volatile Correction Model (VCM) (from Kings College London ERG vcm web portal)			
Local Measurement Data for VCM correction		**2016 Measured Data**	
Site	Gatwick East, Crawley	TEOM Annual Mean PM_{10} (uncorrected) $\mu g/m^3$	15.00
Year	2016 (1/01/16-31/12/16)		
Timescale	Daily Mean		
Monitor	TEOM		
EPA Constant A	3		
EPA Constant B	1.03		
Instrument Temp ^oC	25		
Instrument Pressure mbar	1013		
Reports to local ambient readings	No	No of exceedences of the 50$\mu g/m^3$ in Daily Mean in 2016 >35	1
Pressure Site	Reigate and Banstead – Horley (RG1)	VCM Corrected Annual Mean PM_{10} $\mu g/m^3$	18.09
Temperature Site	Horley		
FDMS Sites	1. Reigate and Banstead (RG5) 2. Greenwich - Blackheath (GR7) 3. Average of remaining sites*. * Correction includes unratified data		

C.6: Estimating $PM_{2.5}$ Concentrations from Nationally Derived Correction Ratio - TG (16) Method

Where no appropriate local sites measuring both PM10 and PM2.5 are available, then it may not be possible to use a locally derived ratio. In this situation, a nationally derived correction ratio of 0.7 can be used.

This factor was calculated as the average of all ratios of PM2.5/PM10 found for years 2010 to 2014 for forty sites within the AURN where both PM10 and PM2.5 are measured on an hourly basis.

Crawley 2016 Annual Average PM_{10} (CA2 site Gatwick East) = 18 µg/m^3 (VCM)

$PM_{2.5}$ = 18 x 0.7µg/m^3

$PM_{2.5}$ = 12.6µg/m^3

C.7: New Pollution Sources and New Developments

There are a number of significant ongoing new developments within the borough which may cumulatively contribute to pollution sources in the area. These include:

- Manor Royal Business District: major redevelopment works, including expansion of the County Oak retail park site to include two new super markets and Development of Tales site. Manor Royal is adjacent to the Hazelwick AQMA.

- Forgewood Residential neighbourhood: Ongoing development of new neighbourhood, including 2000 new residential units, local shops, amenities, community centre, school and realignment of surrounding roads. The Forge wood development is adjacent to the Hazelwick AQMA.

All new developments are examined through the planning system and where necessary air quality assessments and mitigation are required in order to offset the impacts of existing and new sources of pollution on future residents.

The Forgewood neighbourhood development was decided on planning appeal before the AQMA was designated and conditions were set by the planning inspectorate. The

development is still in the building phase and the full impact from the development will not be known until fully operational. However, monitoring at existing diffusion tube locations at the AQMA and surrounding areas will measure the effect of the developments as it progresses and allow the council to assess long term trends. These results are reported annually through the LAQM process

Appendix D: Map(s) of Monitoring Locations and AQMAs

Fig D.1 Hazelwick AQMA

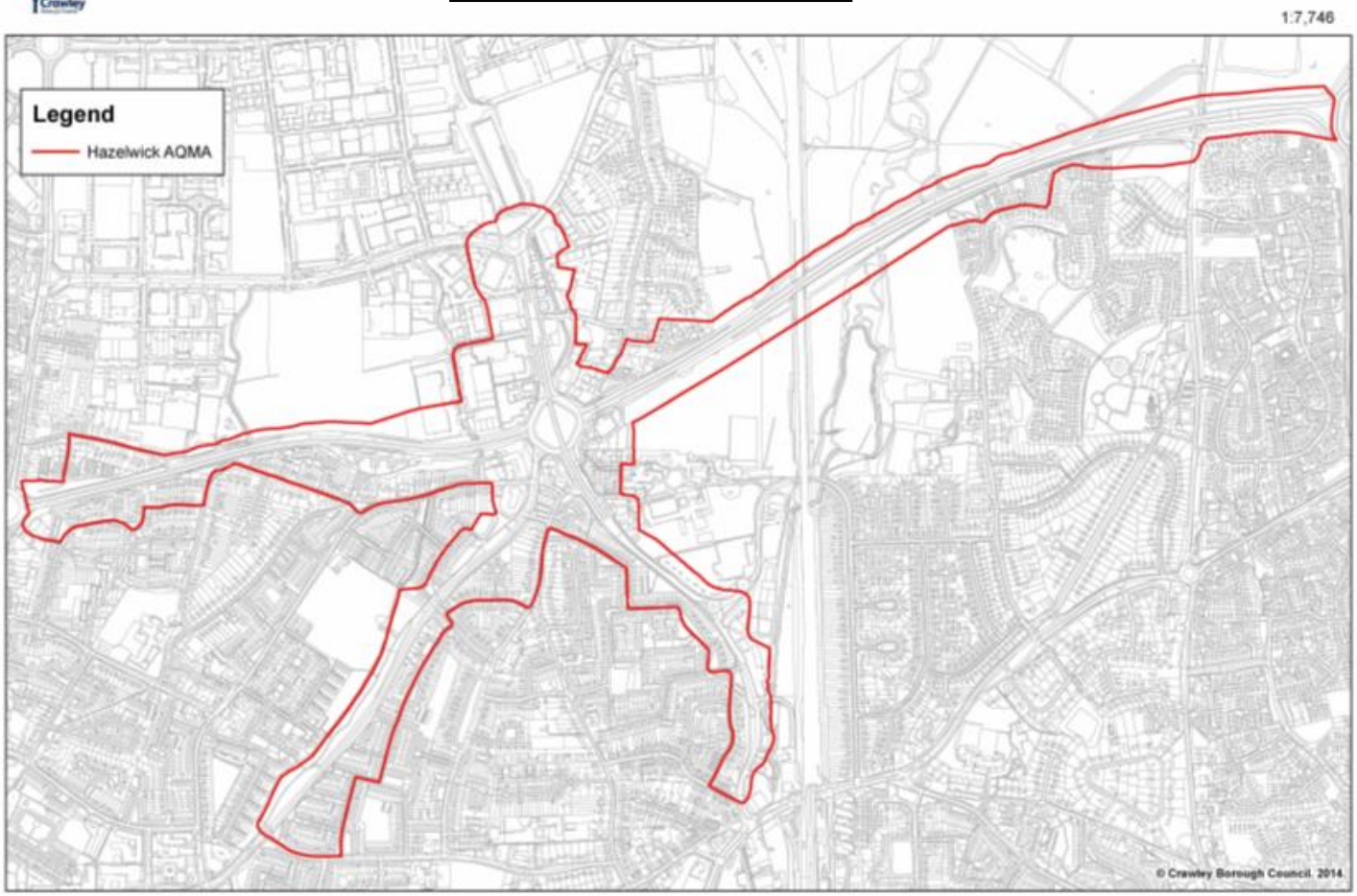


Fig D.2 2016 Diffusion Tube Monitoring Site Crawley Borough Council

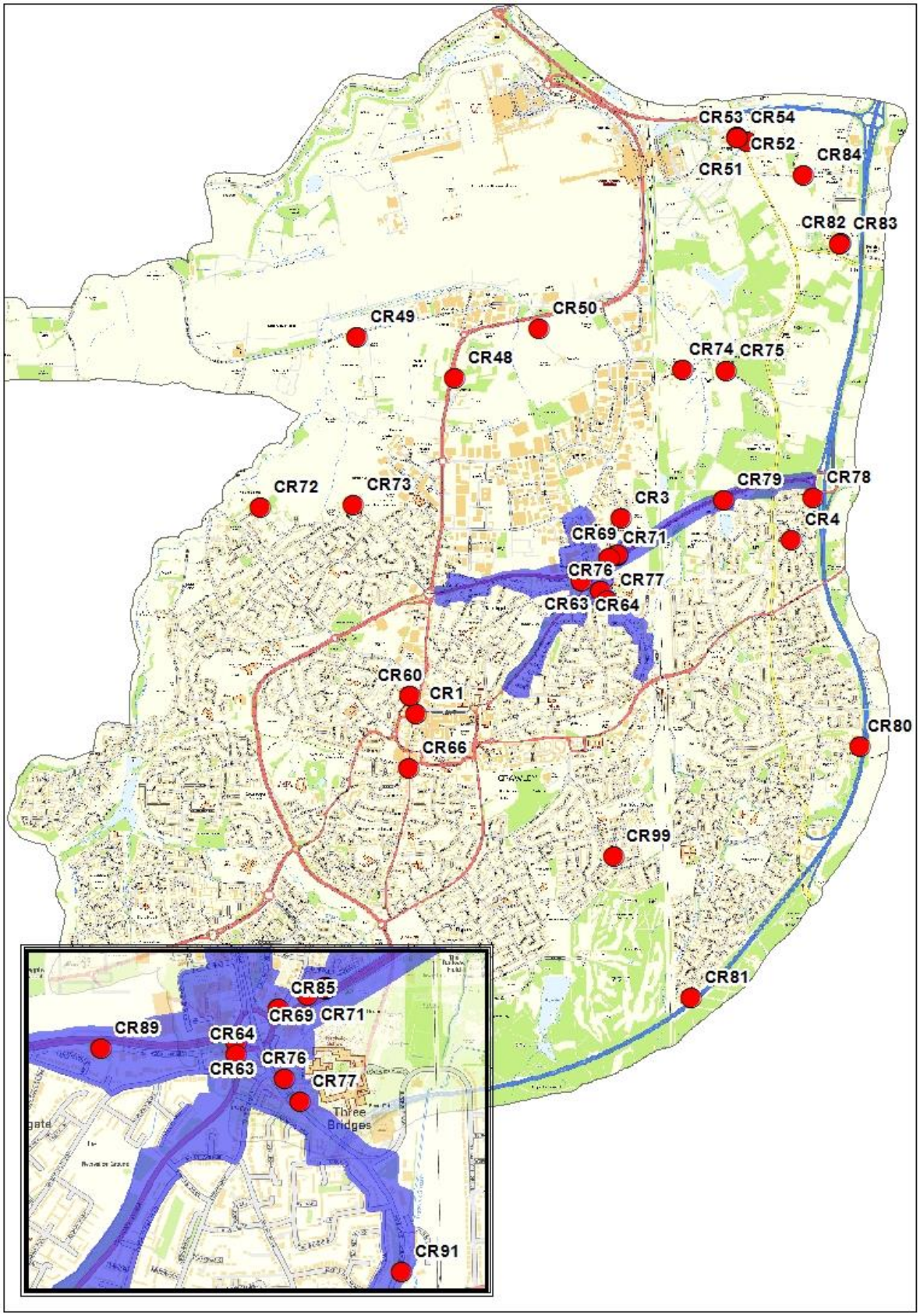


Fig D.3 Monitoring Sites in Hazelwick AQMA

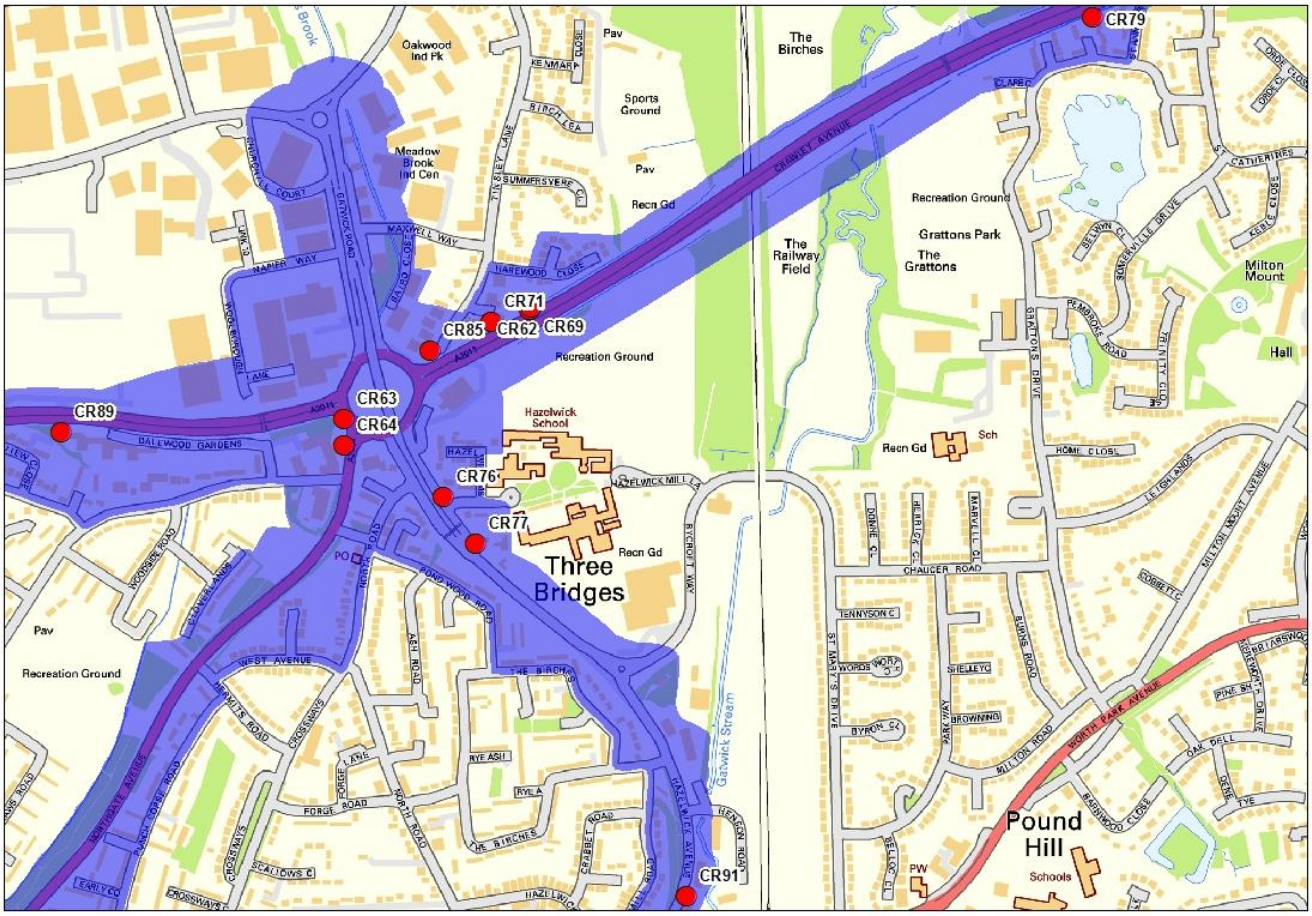
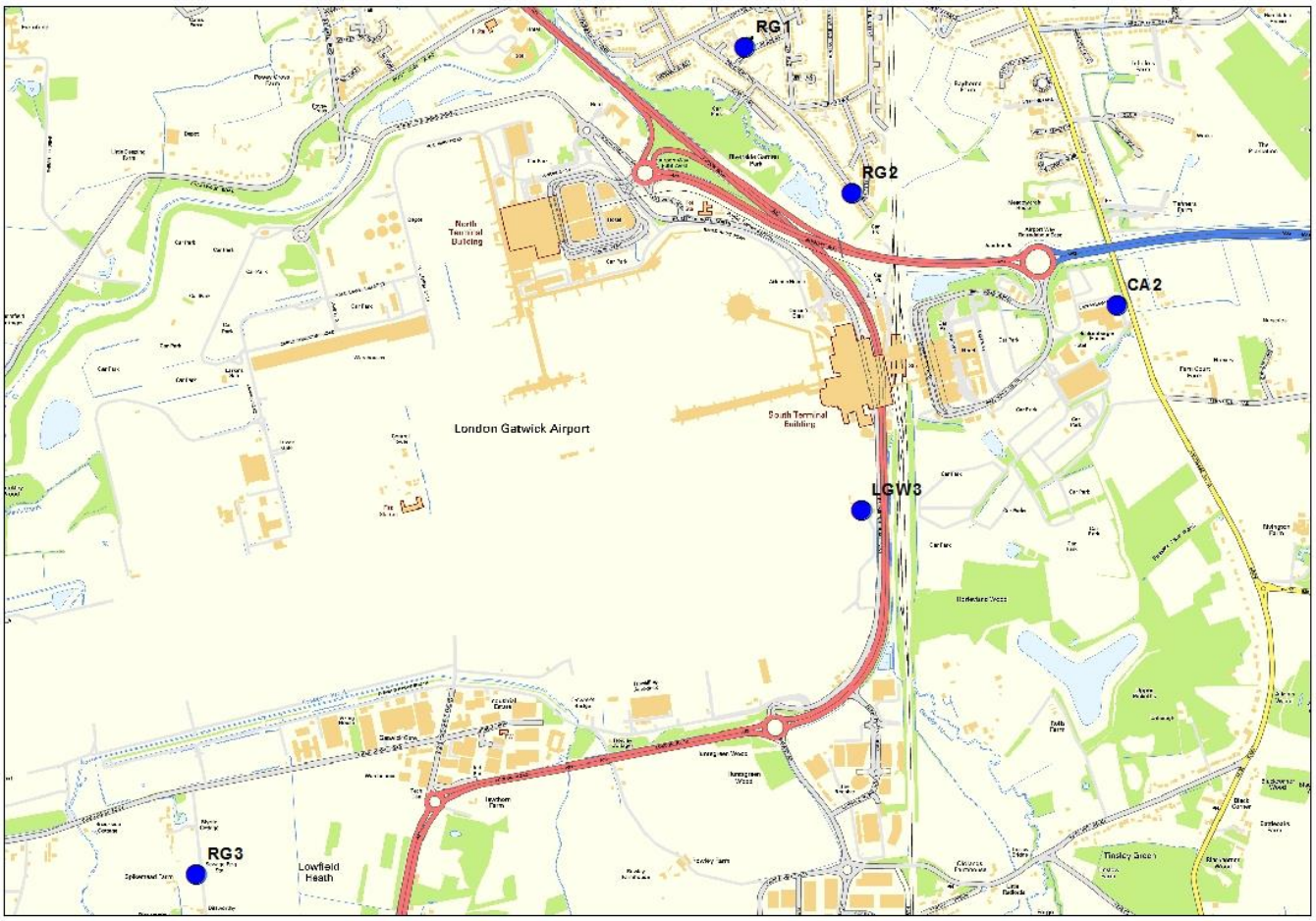


Fig D.4 Automatic Monitoring Sites Around Gatwick Airport



Appendix E: 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 micrograms of pollutant per cubic metre of air (µg/m^3).

Glossary of Terms

Abbreviation	Description
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the local authority intends to achieve air quality limit values'
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
CBC	Crawley Borough Council

References

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

Sussex Air Quality Emissions Mitigation Guidance 2013

Crawley Borough Council Local Plan 2015

Crawley Growth Programme 2016

Crawley Town Centre Regeneration Programme 2016

National bias adjustment factor spreadsheet:
http://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html

Tube precision spreadsheet:
www.airquality.co.uk/archive/laqm/tools/AEA_DifTPAB_v03.xls

Volatile Correction Model website:

http://www.volatile-correction-model.info/

Air Quality Consultants: Nitrogen Dioxide Distance from Road Calculator (Issue 4)