



WORTHING BOROUGH
COUNCIL

2018 Air Quality Annual Status Report
(ASR)

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

June 2018

Worthing Borough Council

Local Authority Officer	Nadeem Shad
Department	Public Health & Regulation
Address	Portland House, 44 Richmond Road, Worthing, West Sussex, BN11 1HS
Telephone	01273 263331
E-mail	publichealth.regulation@adur-worthing.gov.uk
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Executive Summary: Air Quality in Our Area

Air Quality in Worthing

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 billion³.

This report covers monitoring and actions taken during 2017. There is one Air Quality Management Area (AQMA) within the Worthing Borough: Worthing AQMA No.2 on the A27/A24 in Worthing, declared for exceeding the annual mean objective for Nitrogen Dioxide (NO₂) of 40µg/m³.

Worthing Borough Council undertook automatic (continuous) monitoring of Nitrogen Dioxide (NO₂) at an AURN affiliated site at Grove Lodge (A27) during 2017. Non-automatic (passive) monitoring of NO₂ also took place at 34 sites.

Results reveal a mixed picture. The continuous monitoring site at Grove Lodge recorded a significant drop in the NO₂ annual mean to 35.8 µg/m³. Of the 35 diffusion tubes (at 34 sites), 20 showed a reduction in levels, 10 showed an increase and 4 showed no change over 2016 levels.

Two tube monitoring sites showed an exceedance of the annual mean objective for NO₂ - 4 tubes at N30A and N44A/B/C - all within the Grove Lodge AQMA. However as in 2016 only one exceedance was at a site of relevant exposure, a residential façade at Grove Lodge Cottages (tube N30A). When predicted back to a residential façade this level only decreases slightly to 67.1µg m⁻³. Guidance suggests any site exceeding 60µgm⁻³ risks exceeding the 1-hour mean objective of 200 µgm⁻³. We are currently carrying out a review to consider amending the existing AQMA to

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

incorporate an exceedance of the 1-hour mean objective for NO₂ and plan to make a decision before the end of 2018.

When predicted back to the closest receptors levels the other sites fall well below the annual mean objective.

Levels measured close to Lyons Farm fell in 2017.

The Worthing air quality action plan 2015 (AQAP) relies on partnership work with Highways England (for the A27) and West Sussex County Council to deliver actions to improve traffic flows, encourage alternatives to driving conventional vehicles and therefore improve air quality. We continue to engage with both through an action plan working group which meets a number of times a year. Highways England also have a national Designated Funds budget for air quality, part of which may be able to be used to assist with additional air quality assessments or for potential mitigation measures. We will engage with them to seek access to this fund.

More information is available on our website at <https://www.adur-worthing.gov.uk/environmental-health/pollution/air-quality-and-pollution/local-air-quality-management/#page-content>

Actions to Improve Air Quality

We enhanced our use of the Sussex Air Quality Emissions Mitigation Planning Guidance within the planning process ensuring major developments completed an emissions mitigation assessment in order to provide mitigation schemes. We were successful in negotiating significant sums of money via planning agreements to help fund air quality improvements. We also consulted with planning colleagues at both District and County level to ensure air quality was highlighted during pre-application discussions with developers, the aim being to ensure developers design appropriate mitigation into schemes from the outset. We continued to develop our electric vehicle charge point strategy and this resulted in the provision of replacement public charge points at the High Street and Brooklands car parks. We were successful in a 2017 Defra air quality grant bid through Sussex-air. This will target a few schools and businesses in or close to the AQMA with the aim of reducing idling, increasing walking and cycling rates and reducing local emissions from fixed and mobile plant (from businesses). West Sussex County Council (WSCC) continued their “Walk To”

programme led by Living Streets, working with a number of schools in Worthing. WSCC Public Health actively supported the promotion of the Sussex 'Air Alert' scheme.

We worked with Defra's appointed agents to facilitate PM_{2.5} monitoring equipment at the Worthing Grove Lodge AURN site.

Conclusions and Priorities

Measured concentrations of NO₂ fell to below the annual mean objective at the continuous monitoring site, however levels at Grove Lodge Cottages increased and remain above 60µgm⁻³ meaning the Council will need to reach a conclusion on whether to add exceedance of the 1-hour mean to the existing AQMA. Levels at 20 monitoring sites fell in 2017, which is welcomed.

Specific priority actions for 2018 include delivery of the Defra grant funded school and business anti-idling/behaviour change project through Sussex-air, expansion of the local electric vehicle charging network (funding permitting), working with planning and highway departments at Worthing BC and West Sussex County Council to ensure major developments incorporate appropriate air quality mitigation within their plans at an early stage, a revised Adur & Worthing Council's staff travel plan and simplification and consolidation of the Council's Air Quality information web pages.

There are a number of large developments planned for Worthing, particularly in the town centre. There are also large developments planned for the adjacent Adur District which could impact upon Worthing. Balancing the demand for development with the need to improve (or not worsen) air quality will bring challenges. These developments also bring opportunities to improve infrastructure, especially for walking, cycling and public transport and thus limit the impacts on the existing AQMA. They also need to avoid creating new hotspots.

Local Engagement and How to get Involved

We are engaging with interested parties in the District, including neighbourhood groups, elected members, transport planners, planning policy and other interested parties. We are active members of the Sussex Air Quality Partnership (Sussex-air). The Partnership provides assistance to members and information to the public via

their web-site with air quality data, news updates, educational resources, links and other services such as airAlert. See <http://www.sussex-air.net/> for more information.

With the number and scale of developments planned across both Worthing and neighbouring Adur, it is important that all parties work together to achieve favourable outcomes. The problems of air pollution will only be addressed if all parties work together effectively.

The Council is interested in hearing from residents who may have innovative ideas to reduce traffic congestion/air pollution in and around the District. You may contact us using our online form at <https://www.adur-worthing.gov.uk/environmental-health/pollution/air-quality-and-pollution/local-air-quality-management/#have-your-say>.

Road vehicles produce over 50 per cent of the emissions of nitrogen oxides in the UK.

Before using your car, ask yourself:

- could I walk or cycle instead of taking the car?
- could I take a bus or train?
- are the levels of air pollution high today? (See our website for forecasts: <https://www.adur-worthing.gov.uk/environmental-health/pollution/air-quality-and-pollution/air-quality-monitoring/#airalert>)

You can plan your journey using the West Sussex Journey Planner, which allows you to plan journeys using different modes of transport – see <http://www.travelwestsussex.co.uk/>.

- Using quieter streets when you're on a bike or on foot can lower your exposure to air pollution by 20%.

If you must drive:

- drive smoothly and don't rev your engine unnecessarily. You'll save fuel, and your engine will also pollute less;
- maintain your car. Keep the engine properly tuned and the tyres at the right pressure; and

- turn off your engine when your car is stationary for prolonged periods, particularly at main junctions and level crossings. By turning off your car engine you'll help to make the air cleaner for you, other drivers and pedestrians.

At home

- Buy water-based or low-solvent paints, varnishes, glues and wood preservatives.
- Half of all deliveries to workplaces are personal parcels for staff. By using pick-up points in corner shops or lockers in train stations you can help to reduce pollution from delivery vehicles.
- Open fires and wood-burning stoves have risen in popularity over recent years. This means we now see more smoke from chimneys, which has a negative effect on air quality. This can cause breathing problems such as asthma attacks and contribute to other health conditions. Fuels such as wood and coal can be used as long as the smoke from their combustion does not cause a statutory nuisance to neighbouring properties. However the use of inappropriate fuel can cause problems with local air quality.
The leaflet at the link below provides information and advice for those that use wood burning stoves or open fires, to reduce environmental and health impacts. By following its advice you can help to minimise the effect of your burning: <https://www.adur-worthing.gov.uk/media/media,149513,en.pdf>
- Try to avoid lighting bonfires. If you must have a bonfire only burn dry material and never burn household waste, particularly plastic, rubber, foam or paint. Levels of pollution can be quite high on bonfire night and other events/festivals with bonfires, and sensitive people, including people with respiratory conditions, may notice some effects. However exposure can be considerably reduced by remaining indoors and keeping windows closed. Further information is available on our website - <https://www.adur-worthing.gov.uk/environmental-health/pollution/air-quality-and-pollution/bonfires-and-smoke/>.

Information on Air Quality, including reports and monitoring results, is available on our website at <https://www.adur-worthing.gov.uk/environmental-health/pollution/air-quality-and-pollution/>. Information is also available at <http://www.sussex-air.net/>.

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1 Local Air Quality Management

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

The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where an exceedance is considered likely the local authority must declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives. This Annual Status Report (ASR) is an annual requirement showing the strategies employed by Worthing 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 AQMAs declared by Worthing Borough Council can be found in Table 2.1. Further information related to declared or revoked AQMAs, including maps of AQMA boundaries are available online at <https://www.adur-worthing.gov.uk/environmental-health/pollution/air-quality-and-pollution/local-air-quality-management/#local-aqma> and the LAQM website https://uk-air.defra.gov.uk/aqma/details?aqma_id=1060. 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(s).

Table 2.1 – Declared Air Quality Management Areas

AQMA Name	Date of Declaration	Pollutants and Air Quality Objectives	City / Town	One Line Description	Is air quality in the AQMA influenced by roads controlled by Highways England?	Level of Exceedance (maximum monitored/modelled concentration at a location of relevant exposure)		Action Plan		
						At Declaration	Now	Name	Date of Publication	Link
Worthing Borough Council AQMA No.2	13/07/2010, Amended 15/12/2014	NO ₂ Annual Mean	Worthing	From Crockhurst Hill incorporating Offington Corner Roundabout, Warren Road, Grove Lodge Roundabout, Upper Brighton Road up to and including the Downlands Retail Centre, and Lyons Way	YES	72 µg/m ³	67 µg/m ³	Worthing Air Quality Action Plan	November 2015	https://www.adu.gov.uk/worthing.gov.uk/media/media_138133.en.pdf

Worthing BC 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 Worthing

Defra's appraisal of last year's ASR concluded

1. *The previous reports and 2015 Action Plan make clear, that without significant reduction in traffic emissions from the A27, that there is no immediate likelihood of the air quality objectives being met at Grove Lodge.*
2. *There are no recorded details of whether future options for the A27 have considered options, including traffic management measures to reduce emissions in the vicinity of Grove Lodge.*

Response from Highways England: One of the objectives of the A27 Worthing & Lancing improvement scheme is to improve air quality where possible. We are currently developing the preliminary design for the scheme and will be reassessing the air quality implications of the design. We will be looking at measures including traffic management during the detailed design stage to ensure air quality does not worsen.

3. *The Action Plan has discussed a re-assessment of traffic light sequencing at the Grove Lodge roundabout and other nearby locations that would need consideration in conjunction with West Sussex County Council and Highways England. Further plans for developing schemes on the A27 should be subject to air quality assessments.*

Response from Highways England: Highways England will be looking at ways of working with West Sussex County Council (WSSCC) to ensure that air quality on the A27 does not deteriorate further, rather the opposite, as a result of our interventions.

4. *The outcome of these considered options should be presented as part of the regular updating of action plan measures within future ASR reports. ASR's are expected to monitor the progress with developing measures, particularly those measures expected to have most influence of regulating traffic emissions in key areas.*

Response from Highways England: Highways England has a national Designated Funds budget for air quality, part of which that may be able to be utilised, if a satisfactory funding bid is accepted, to assist with

additional air quality assessments at sites where the need arises or for potential mitigation measures. We can advise WSCC about the Designated Funding process.

5. *It was reported in the previous ASR for 2016, that the single point of exceedance at Grove Lodge also breaches the hourly mean objective by exceeding 60ug/m³. Consideration should be given to declaring the AQMA for exceedance of the hourly mean objective for nitrogen dioxide. This appears to remain as an outstanding action, and should be followed up in future reporting.*
6. *It was also reported in the previous appraisal that, "Examination of the area surrounding Grove Lodge Roundabout, suggests there may be additional locations of relevant exposure close to the roundabout, which should also be investigated if this has not already taken place".*
7. *Furthermore, what is also not clear is to what extent there is public exposure at these locations, this should be made clear in future reports. This has been noted.*
8. *Many of the measures listed within the current action plan Table 2.2 are not currently active and subject to further funding, highlighting the level of measures currently being pursued. The Action Plan table should be updated to reflect progress on developing measures, making clear whether AQAP measures remain with current programmes or not. The current AQAP table does not include KPI's which should be included in future where possible. This has been addressed this year.*
9. *The maps of monitoring sites in Appendix D are not labelled, thus monitoring results cannot be linked to monitoring site maps without labelling. This has been addressed this year by including a link to online mapping.*

Worthing Borough Council has taken forward a number of direct measures during the current reporting year of 2017 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2.

Key completed measures are:

- Greater success in the use of the Sussex Air Quality Emissions Mitigation Planning Guidance as part of the planning process. All major planning applications are required to follow the guidance and produce an Emissions Mitigation Assessment which assesses the local emissions from a development and determines the appropriate level (cost) of mitigation required to help reduce the potential effect on health and/or the local environment. We then negotiate with the developer to ensure appropriate mitigation is provided. The guidance is to be signposted within the draft Worthing Local Plan due for consultation this summer. We were successful in negotiating specific air quality mitigation be included to the value provided by the emissions mitigation assessments as a minimum. We also consulted with planning colleagues at both District and County level to ensure air quality was highlighted during pre-application discussions with developers, the aim being to ensure developers design appropriate mitigation into schemes from the outset.
- We continued developing our electric vehicle charge point strategy for Worthing (and Adur), outlining the Councils approach to the provision of public charge points across the District to facilitate the switch to electric vehicles. This resulted in the provision of replacement twin eV charge points (affiliated to the Pod Point network) at High Street and Brooklands car parks. We also participated in discussions at West Sussex County Council to devise a County-wide ultra-low emissions vehicle strategy (ULEV).
- We were successful in a 2017 Defra air quality grant bid through Sussex-air. The project aims consist of
 - I. An intensive and targeted intervention with 25 schools in the AQMAs across Sussex (including Shoreham) to: reduce idling during school drop-off and pick-up times; increase walking and cycling rates to and from school; and measure the change in walking and cycling rates.
 - II. An intensive targeted intervention with approximately 25 businesses in AQMAs across Sussex to reduce local emissions from fixed and mobile plant; increase walking and cycling rates to and from work, and reduce business mileage; and deliver eco-driver training to staff working in the 25 businesses.

- We worked with Defra's appointed agents to facilitate the installation of monitoring equipment for the measurement of PM_{2.5} at the Worthing Grove Lodge AURN affiliated monitoring site. This was highlighted as a priority for 2017 in last year's ASR.
- The "Walk To" programme led by Living Streets has been working with a number of schools in West Sussex, including Primary and Secondary schools across Worthing. This provides an outreach project officer to work with pupils to encourage them to walk to school. Working with highway authorities, including West Sussex County Council, Living Streets secured funding to continue its previous "Walk To" project through the Department for Transport Access Fund from 2017/18 to 2019/20.
- The LTIP team at West Sussex County Council have been working on schools and community supported improvements that link to the following areas - bus infrastructure, walking and cycling, accessibility, air quality management, school development/expansion and road safety.
- West Sussex County Council Public Health supported the promotion of Air Alert - www.airalert.info - through financial backing and supporting publicity throughout West Sussex.
- Sussex-air (with input from Adur & Worthing Councils) commenced work on updating the Sussex Air Quality & Emissions Mitigation Guidance for Planning, which was published in 2013.
- The District Council continued to work with West Sussex County Council to explore alternatives to car use, including improved walking and cycling improvements through the District, mainly through the planning system.
- Highways England carried out a public consultation between July and September 2017 on a "*proposal to improve the A27 junctions at Worthing and Lancing.*" The consultation stated "Air quality could improve due to a reduction in traffic congestion, though this could be offset by more vehicles using the road. The net effect is currently being assessed. Further consideration of the full scale of the impacts will be undertaken in the next stage of scheme development."

<https://highwaysengland.co.uk/projects/a27-worthing-and-lancing-improvement/>.

We are still awaiting the outcome of the consultation, which was originally due at the start of 2018.

- Our engagement with Highways England has been rather patchy thus far, with officers finding it difficult to engage with them. This is something we wish to address in the coming year.

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

- Delivery of the school and business anti-idling project delivered through Sussex-air. It is our intention to report on the project next year.
- The provision of further electric vehicle charge points in the Worthing area as and when funding allows, in line with Adur & Worthing Council's and West Sussex County Council's emerging electric vehicle/ultra-low emission vehicle strategies. The aim is to encourage the local take-up of electric vehicles and facilitate visitors using low emission vehicles to the area;
- West Sussex County Council trial of electric vehicle pool cars for staff;
- Work in partnership with West Sussex Public Health and West Sussex County Council to raise awareness of the facts around poor air quality, how to reduce the sources of air pollution, focusing on the co-benefits of active travel to health and wellbeing; and how to reduce exposure to air pollution during episodes of poor air quality (air-alert);
- The Council actively supports the Adur and Worthing Walking and Cycling Action group and will be working in partnership with WSCC and the local group to develop a Local Cycling and Walking Infrastructure plan;
- Revised West Sussex County Council Parking Standards, to include provision for electric vehicles;
- Bid(s) from bus operators to the Ultra-Low Emission bus grant from OLEV;
- Revised Sussex Air Quality & Emissions Mitigation Guidance for Planning (Sussex-air);

- Examine incorporating further low emission vehicles into the Council's pool car fleet, possibly through the revised staff travel plan;
- Examine using the Council's pool car fleet to seed a local car club;
- Further implementation and embedding of the Sussex Air Quality Guidance and delivery of effective and meaningful emissions mitigation for local major developments;
- Further embedding air quality into the planning system during the early stages of development discussions (pre application stages);
- A decision from Highways England on the plans for the A27 in Worthing and Lancing;
- Revision and consolidation of the Council's Air Quality information web pages.

Worthing Borough Council's priorities for the coming year are

- Delivery of the school and business anti-idling project through Sussex-air;
- Expand the local electric vehicle charging network and promote the use of low emission vehicles;
- Work with planning and highway departments at Worthing BC and West Sussex County Council to ensure major developments incorporate appropriate air quality mitigation within their plans at an early stage;
- Closer working with Highways England to deliver and add to where necessary, the Action Plan;
- Further implementation of the Sussex Air Quality Guidance to ensure all major developments produce an emissions mitigation assessment and provide appropriate AQ mitigation;
- Ensure electric vehicle charge points are incorporated into major local developments;
- A better, closer working relationship with Highways England, who are responsible for the A27;

- Work in partnership with WSCC and the Adur and Worthing Walking and Cycling Action group to develop a Local Cycling and Walking Infrastructure plan;
- A West Sussex County Council trial of electric vehicle pool cars for staff;
- Embark on a revised Adur & Worthing Council's staff travel plan;
- Revision and consolidation of the Council's Air Quality information web pages to make them easier to navigate.

The principal challenges and barriers to implementation that Adur District Council anticipates facing are

- The largest risks to the school and business anti-idling project are recruiting schools and businesses to take part and fitting in with their timetables. However, the risk of recruitment is considered to be manageable because: 1) WSCC are the Local Education Authority and their Transport teams have engaged with a range of schools over the years through school travel planning and LSTF-funded schemes, so there are well-established existing routes through which to engage schools; 2) there are a range of business support programmes in place across West Sussex through which businesses can be targeted, for instance the Local Enterprise Hubs, which have been set up specifically to broker support to local businesses;
- Failure by Highways England to deliver an effective plan for the A27. Improvements to the road provide the biggest opportunity to bring about pollutant reductions, however there is also a risk that any improvements may attract more vehicles, meaning any potential gains are wiped out;
- Engagement with Highways England has been rather patchy in recent years, so our aim is to ensure we work more closely with them in order to deliver the Action Plan. This relies on Highways England engaging with us;
- Obtaining sufficient resources (personnel) in order to work on and deliver air quality measures;
- Identifying suitable sites for the installation of electric vehicle charge points can be problematic. The sites need to be close to a sufficient electricity supply,

sited to ensure they are likely to be frequently used (i.e. in the correct place) and be in a safe and secure setting;

- Sourcing sufficient funding to install electric vehicle charge points. Budgets are tight so we will need to ensure sound business cases are put forward before any commitments are made by elected Members;
- There are a number of large scale developments planned for Worthing and balancing the demand for development with the need to improve (and not worsen) air quality will bring challenges. These developments also bring opportunities to improve infrastructure, especially for walking, cycling and public transport, and thus limit the impacts on existing AQMA's and avoid creating new hotspots;
- The provision of additional low emission vehicles into the Council's pool car fleet will depend on funding being available.

Progress on the following measures has been slower than expected due to:

- A27 Highway Improvements, This relies solely on Highways England and as yet the results of the 2017 consultation have yet to be published. Improvements to the A27 present the largest opportunity for emission reduction.
- LEZ/CAZ feasibility – As this is a Highways England road and such schemes would require Highways England to fund and/or approve; also finance and enforcement are an issue. There are currently no plans to look into these schemes in the next few years;
- Cut Engine Cut pollution signs – we are targeting queuing traffic exiting Lyons Farm. This is a WSCC road so we have had some limited discussions with them, however concerns over effectiveness and street clutter are delaying implementation;
- Car club – this relies on appropriate funding being made available to secure the vehicles, hence why we will examine the use of our pool car fleet.

Whilst the measures stated above and in Table 2.2 will help to contribute towards compliance, Worthing Borough Council anticipates that further additional measures not yet prescribed will be required in subsequent years to achieve compliance and enable the revocation of Worthing Borough Council AQMA No.2.

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	A27 Highway Improvements	Traffic Management	Strategic highway improvements, Re-prioritising road space away from cars, including Access management, Selective vehicle priority, bus priority, high vehicle occupancy lane	Highways England. Funding: Highways England	2015	2021/22	Reduction in levels of NO2	High	Consultation by Highways England on one option ("to improve the A27 junctions at Worthing and Lancing") took place during Summer 2017. HE state they will be looking at ways of working with WSCC to ensure that air quality on the A27 does not deteriorate further, rather the opposite, as a result of HE interventions.	2022/23	Still awaiting outcome - delayed from early 2018. No AQ assessment was included, so any AQ benefits as yet unquantified by HE.
2	Cut Engine, Cut Pollution Signs	Traffic Management	Anti-idling enforcement	HE/WSCC: Funding HE/WSCC/WBC	2016-18	2018	Local AQ monitoring/reduction in NO2	Low/Med	Discussions with WSCC on feasibility; AQMA signs on hold pending HE A27 consultation outcome. Any signage only likely on exit road from Lyons Farm.	2018	Early discussions with WSCC re. exit from Lyons Farm as traffic can be standing for minutes here; However no residential receptors here; Highway 'clutter' a concern.
3	LEZ/CAZ Feasibility	Promoting Low Emission Transport	Low Emission Zone (LEZ)	HE/WBC/WSCC Funding: HE	2016	2017 onwards	Reduction in older Euro class HGV's/LGV's and buses within the AQMA	High	Yet to progress. Outcome of A27 consultation delaying further discussion	2018 on	As a HE road any CAZ/LEZ problematic. Issues with displacement of vehicles onto surrounding roads; Finance and Enforcement also an issue.

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4	Embed Air Quality Emissions Mitigation Planning Guidance for Sussex into the planning process/planning policies	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	WBC/WSCC. Funding: WBC/WSCC	2014	2015 on	LE mitigation secured in developments	Low	Guidance to be signposted within the draft Worthing Local Plan, due for consultation Summer 2018. Discussions with WSCC to ensure Guidance and appropriate mitigation is flagged as a requirement at an early stage. Emission mitigation assessments being pursued with developers to ensure meaningful mitigation is proposed. Walking and cycling initiatives and eV charge points secured at	2019	Focus on minimising number of trips made by cars, provision of appropriate and meaningful mitigation and installation of EV chargepoints
6	EV vehicles and infrastructure	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	WBC/WSCC Funding HE/WSCC/WBC	2016/18	2017-20	Number of charge points provided	Low/Med	WBCC provided two replacement twin eV chargepoints at High Street and Brooklands car parks. WSCC is in the early stage of developing an ULEV strategy which is expected to be published by the end of the financial year 2018/19. Discussions continued with developers as part of AQ mitigation packages. Bus operators in West Sussex are considering low emission fuel technologies in thinking about the future of their fleets and local authorities are in dialogue with operators as plans	2025	WBC car parks targeted with replacement of existing outdated charge points first, other land to follow as and when funding allows.

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									develop, including to consider any future funding opportunities.		
7	Worthing Car Club	Alternatives to private vehicle use	Car Clubs	WBC/ADC. Funding: Developer contributions/ WBC	2015-19	2019 on	Number of people using the service/Number of vehicles available	Low	Continue to seek funding via s.106 contributions from local developments. Some discussions on use of Adur & Worthing pool cars when not in use.	2020	V. small reduction, however principle of car sharing is key here. Seed funding vehicles a barrier.
8	Public transport improvement	Transport Planning and Infrastructure	Public transport improvements-interchanges stations and services	WSCC Funding: WSCC	Ongoing	Ongoing	Journey time and passenger number improvements	Low	Through the current Worthing Town Centre Public Realm Improvements design work, and the forthcoming Worthing Road Space Audit and Worthing Area Sustainable Transport Package Studies it is expected that improvements in access to/from public transport gateways will be developed in Worthing. Bus operators in West Sussex are considering low emission fuel technologies in their fleets and local authorities are in dialogue with operators as plans develop, including consideration of any future funding opportunities	Ongoing	Subject to appropriate funding being made available.
9	WBC AND WSCC Staff Travel Planning	Promoting Travel Alternatives	Workplace Travel Planning	WBC/ADC/WSCC. Funding: WBC/ADC/WSCC	2018/19	2019 on	Staff travel surveys reduced commuting and business travel by car	Low	New ways of working implemented. Staff car allowances under review. Public transport staff discount schemes	2019/20	Focus on reducing traffic congestion and promoting sustainable travel for trips to and from work

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									being considered; increase in hybrid pool car provision		
10	Improve Emissions from Council's Vehicle fleet	Promoting Low Emission Transport	Company Vehicle Procurement	WBC/ADC/WSC C Funding: WBC/WSCC	2015	2016 on	No. of vehicles replaced with better Euro standard models	Low	New refuse vehicles procured and in use during 2017 - all Euro VI diesel. Replacement programme ongoing. Hybrids added to pool car fleet.	Ongoing	Council to demonstrate leadership. Low reduction within AQMA
11	Increase availability of AQ information in relation to impacts on Public Health	Public Information	Via the Internet	WBC Funding: WBC	2015	Ongoing	Reduction in levels of NO2/No. of hits on AQ pages	Low	PM2.5 added to Grove Lodge AQM station. AQ information updated on Council's website. Widget added to website to show pollution forecasts for Worthing.	Ongoing	Measure success of AQAP/levels in AQMA. Assist with PM2.5 strategy
12	Embedding AQ in Adur & Worthing Public Health Plan	Policy Guidance and Development Control	Other policy	WBC Funding: WBC	2015	2016/17	Inclusion in each revision of public Health Plan	Low	Air Quality Action Plans included within newly revised Adur & Worthing Public Health Plan.	Ongoing	Ensure AQAP is given added weight and priority.
13	Promotion of Air Alert	Public Information	Via the Internet	WBC Funding: WSCC/WBC	2014	Ongoing	Annual increase in subscriber numbers	Low	West Sussex County Council Public Health supported the promotion of Air Alert - www.airalert.info - through financial backing and supporting publicity in West Sussex.	Ongoing	Push for increased subscribers via West Sussex Public Health Team
14	Re-assess traffic light sequencing in AQMA	Traffic Management	UTC, Congestion management, traffic reduction	HE/WSCC Funding: HE/WSCC	Ongoing	Ongoing	Reduction in levels of NO2	Low	Ongoing optimisation by HE. Measured NO2 reduction at Lyons Farm (Downlands Parade). May be lights?	Ongoing	

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15	Safe Cycling and Walking Routes	Transport Planning and Infrastructure	Cycle network	WSCC/HE Funding: HE/WSCC	Ongoing	Ongoing	Length of new cycle routes provided	Low	West Sussex Walking & Cycling Strategy published Nov.2016. Design work is taking place on a number of cycle route improvements in and around Worthing. Additional improvements to walking and cycling routes are expected to be developed through the Adur and Worthing Cycling and Walking Action Group, the production of a Local Cycling and Walking Infrastructure Plan, and the development of the Worthing Area Sustainable Transport Package Study during 2018/19.	Ongoing	There already exist cycle paths segregated from pedestrians in and around Grove Lodge.
16	Travel plans for significant/major developments	Promoting Travel Alternatives	Other	WSCC/WBC	2015	Ongoing	Number of plans delivered	Low	Discussions ongoing with developers for forthcoming 'major' developments in Worthing. Some mitigation agreed for Aquarena site major development.	Ongoing	Forthcoming draft Worthing Local Plan should add weight to need for travel plans and appropriate mitigation.
17	Car Sharing	Alternatives to private vehicle use	Car & lift sharing schemes	WSCC Funding: WSCC	2015	2015/16	Website hits/journeys planned/Number of registrants/take-up of initiatives	Low	Multi modal online journey planner Travel West Sussex discontinued due to platform no longer being supported by the provider. Car share website - https://liftshare.com/uk/community/westsussexcarshare	Ongoing	Focus on promoting sustainable travel/car reductions

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19	Cycling & Walking promotion	Promoting Travel Alternatives	Promotion of cycling	WSCC/Worthing BC Funding: WSCC/developer contributions	2015	Ongoing	Automatic cycle counters and travel surveys	Low	The "Walk To" programme led by Living Streets is working with a number of schools in West Sussex, including Primary and Secondary schools across Worthing This provides an outreach project officer to work with pupils to encourage them to walk to school. Working with highway authorities, including WSCC, Living Streets secured funding to continue its previous "Walk To" project through the Department for Transport Access Fund from 2017/18 to 2019/20.	Ongoing	Focus on reducing traffic congestion and promoting sustainable travel for trips to and from work. Subject to available funding .
20	WSCC staff travel planning	Promoting Travel Alternatives	Workplace Travel Planning	WSCC Funding: WSCC	2014	Ongoing		Low	Pool cars provided for casual user staff	Ongoing	
21	School Travel Plans	Promoting Travel Alternatives	School Travel Plans	WSCC Funding: WSCC	Ongoing	Ongoing		Low		Ongoing	
22	Business Travel Plans	Promoting Travel Alternatives	Workplace Travel Planning	WBC Funding: Funding: WBC/WSCC	2017	2018 on	No. of plans devised/ revised	Low	No further developments in 2017	Ongoing	Resources an issue. Plans to liaise with WSCC to progress next year.
23	Worthing College Travel Plan Review	Promoting Travel Alternatives	School Travel Plans	WBC/WSCC Funding: Worthing College	2015/16	2016/17	Reduction in use of private cars for trips to/from College/Increase in use of alternative modes of	Low/Med	Review commenced with College in Sept 17. Awaiting revised travel plan.	Ongoing	Awaiting revised travel plan.

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							travel.				
24	HGV/LGV assessment	Transport Planning and Infrastructure	Route Mgt plans/Strategic routing for HGV's	WBC Funding: WBC/WSCC	2016/17	2018-20	Data on Euro Classes	Low	Successful Defra AQ grant funding bid (via Sussex-air) submitted Dec 2017 - part funding for business fleet advice, may include some HGV/LGV's. Some discussions on feasibility with highway authorities. Discussions with Sussex-air on process.	2020/21	By identifying operator and Euro Class we can better target fleets that regularly pass through the AQMA. Subject to identification of suitable funding streams.
25	Ecostars for Local Fleet Operators	Vehicle Fleet Efficiency	Fleet efficiency and recognition schemes	WBC Funding: WBC	2016/17	2018/19	Increase in new euro Class vehicles	Low/Med	Successful Defra AQ grant funding bid (via Sussex-air) submitted Dec 2017 - part funding for business fleet advice.	2020/21	The EcoStars scheme remains an aspiration, but is subject to identification of suitable funding streams.
26	Increase and improve availability of WBC Air Quality Monitoring results	Public Information	Via the Internet	WBC Funding: WBC	2015	2015-18	Reduction in levels of NO2/No. of hits on AQ pages	Low	Website information further improved. Diffusion tube results now on website after Bias correction factors made available..	Ongoing	Further revision and consolidation of webpages planned for 2018, including links to UK-Air.
28	WSCC website and multi-modal journey planner (Travel West Sussex)	Promoting Travel Alternatives	Personalised Travel Planning	WSCC	2014	2015		Low	Multi modal online journey planner Travel West Sussex discontinued due to platform no longer being supported by the provider.	Deleted	Measure deleted

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.

Work carried out by Public Health England as part of the Public Health Outcomes Framework (PHOF) shows that the mortality associated with particulate air pollution within Worthing Borough Council is 4.3 %.

Figure 2-1 shows that the mortality calculated for Worthing Borough Council is less than that calculated for south east England (4.9 %) and England (5.1 %) as a whole.

Figure 2-1 Fraction of mortality attributed to particulate air pollution in Worthing Borough Council



Worthing Borough Council is currently developing its approach to address PM_{2.5} in partnership with West Sussex Public Health and other local authority officers through Sussex-air.

We now monitor levels of PM_{2.5} through our AURN continuous monitoring station at Grove Lodge (A27), which will show us the extent of any PM_{2.5} issue.

We have considered introducing a smoke control area into Worthing. However there are considerable barriers to this, most notably how existing fireplaces achieve compliance. We will continue to look into this.

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

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

Worthing Borough Council undertook automatic (continuous) monitoring at one site during 2017. Table A.1 in Appendix A shows the details of the site. 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. Results from this monitoring site are available at <https://uk-air.defra.gov.uk/data/>. Previous monitoring results are also available at www.sussex-air.net/.

National monitoring results are available at <https://uk-air.defra.gov.uk/data/>.

Maps showing the location of the monitoring sites are provided in Appendix D.

Further details on how the monitors are calibrated and how the data has been adjusted are included in Appendix C.

3.1.2 Non-Automatic Monitoring Sites

Worthing Borough Council undertook non- automatic (passive) monitoring of NO₂ using 35 tubes at 34 sites during 2017. Table A.2 in Appendix A shows the details of the sites.

We carried out a review of tube sites at the end of 2016 and as monitoring results had shown levels consistently well below 40 , the following were removed for 2017:

- (UK4) N1 Chapel Road
- N1 The Steyne
- N9 Honeysuckle Lane
- N15 Chippers Walk
- N17 Chapel Road
- N50 Teville Gate
- N51 Newland Street

We added one new site for 2017

- N59 Ham Road/ Lyndhurst Road

We also relocated 3 sites

- N21 relocated on 2/2/17 to Forest Lane
- N48 relocated on 2/2/17 to other side of road (which was deemed a safer location for tube changeovers)
- N54 relocated on 1/11/2017 to the other side of road due to construction works and lamp post removal – therefore results up to this date have been included for 2017.

Maps showing the location of the monitoring sites are provided in Appendix D.

Scalable maps are also available at <https://www.adur-worthing.gov.uk/maps/general-map/> (tick the Air Quality Management Areas box to the left side of the map).

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 (NO₂)

Table A.3 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.

For diffusion tubes, the full 2017 dataset of monthly mean values is provided in Appendix B.

Table A.4 in Appendix A compares the ratified continuous monitored NO₂ hourly mean concentrations for the past 5 years with the air quality objective of 200µg/m³, not to be exceeded more than 18 times per year.

Results from 2017 show a mixed picture. The continuous monitoring site at Grove Lodge recorded a significant drop of 12.2 µg/m³ over the annual mean for 2016. Of the 35 diffusion tubes used in 2017 20 showed a reduction ranging from 0.1 to

17 $\mu\text{g}/\text{m}^3$, 10 showed an increase ranging from 0.1 to 14.5 $\mu\text{g}/\text{m}^3$ and 4 showed no change over 2016 levels.

Two monitoring sites showed an exceedance of the annual mean objective for NO_2 (4 tubes at N30A, N44A/B/C and the continuous monitoring site WT2). All were within the Grove Lodge AQMA, however as in 2016 only one exceedance was at a site of relevant exposure, a residential façade at Grove Lodge Cottages (N30A).

Automatic Continuous monitoring

Fig A1.1 shows the annual average NO_2 since 2013, measured at the automatic monitoring site located on the A27 trunk road at Grove Lodge. This is a strategic road through Worthing and traffic speeds tend to be low for prolonged periods during the day. NO_2 peaked at 51.4 $\mu\text{g}/\text{m}^3$ in 2014, decreased to 37.4 $\mu\text{g}/\text{m}^3$ in 2015, increased again in 2016 to 48 $\mu\text{g}/\text{m}^3$ and decreased significantly to 35.8 $\mu\text{g}/\text{m}^3$ in 2017. It is not known why concentrations fluctuate so wildly. We suspect the Worthing College site adjacent to the AQMA, which opened in Autumn 2013 may have led to the increase in 2014. However the large drop in 2015, subsequent increase in 2016 and large drop again in 2017 appear to counter this view. As stated in last year's ASR, a change in Highways England traffic data database during 2015 meant there is no directly comparable data covering 2015 and 2016. We stated we will review traffic data for 2016 and 2017 in our 2018 ASR. We are still awaiting this data from Highways England.

If the level measured at the roadside monitor is predicted back to the closest relevant receptor (a residential facade), the exposure reduces to 25.8 $\mu\text{g}/\text{m}^3$, well below 40 $\mu\text{g}/\text{m}^3$.

Diffusion tubes

Of the 35 monitoring tubes used in 2017 20 (at 18 sites) showed a reduction over levels measured in 2016, 10 showed an increase and 4 showed no change.

The full 2017 dataset of monthly mean values is provided in Appendix B.

All measured exceedances of the annual mean objective occurred in the AQMA. The highest level of 68.2 $\mu\text{g}/\text{m}^3$ was again measured at N30A Grove Lodge Cottages adjacent to the westbound carriageway of the A27. This is an increase over last

year's result. This site is just over 2 metres from a residential façade so the level only decreases slightly when predicted back (to $67.1\mu\text{g m}^{-3}$).

Guidance suggests any site exceeding $60\mu\text{g m}^{-3}$ risks exceeding the 1-hour mean objective of $200\mu\text{g m}^{-3}$. This site has exceeded $60\mu\text{g m}^{-3}$ for many years, Figure A.1.3 shows the 5 year trend. Feedback from Defra following previous ASR's advises the Council to consider amending the existing AQMA to incorporate exceedance of the 1-hour mean objective for NO_2 . In last year's ASR we stated we would consider this matter in the coming year. We are currently carrying out a review and plan to make a decision before the end of 2018.

Interestingly the continuous analyser on the other side of the road has recorded no exceedances of the one hour mean objective.

The other tubes to record exceedances of the annual mean objective were the co-located tubes at the continuous analyser, with an average of $40.7\mu\text{g m}^{-3}$. Interestingly this is $5\mu\text{g m}^{-3}$ higher than that recorded by the continuous analyser. The difference could be explained by the margin of error generally associated with the diffusion tube monitoring method (up to $\pm 20\%$). When predicted back to the nearest receptor the level reduces to $28.1\mu\text{g m}^{-3}$.

Site 6N Gainsborough Avenue reduced from last year's exceedance of $40.7\mu\text{g m}^{-3}$ to $38.1\mu\text{g m}^{-3}$. A 5 year trend graph is included in Figure A.1.6. When predicted back to the closest receptor this level falls to $27.7\mu\text{g m}^{-3}$, comfortably below the annual mean objective.

In 2014 monitoring at Downlands Parade (site N29) close to the Lyons Farm junction on the A27 showed exceedances of the annual mean at residential receptors. Levels have since been decreasing, with a level of $32\mu\text{g m}^{-3}$ last year, comfortably below the annual mean objective. This is welcomed and we believe signal timings at the Lyons Farm junction may be having a positive effect.

As reported last year the 2013 Further Assessment identified Lyndhurst Road near the gas holder station as a potential site of exceedance. Diffusion tube results here since 2016 (site N57) show levels at $27.6\mu\text{g m}^{-3}$, well below the annual mean objective and suggesting this is not an area giving any concerns. With a number of major developments in this area we will continue to monitor for any changes at this location.

Fall-off calculations of NO₂ concentration with distance from kerbside are shown in Appendix C.

Figures A.1.1 to A.1.6 in Appendix A show 5 year trends in NO₂ concentration at the continuous monitoring site WT2 and diffusion tube sites N30A, N44, N29, and 6N.

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)
WT2	Grove Lodge	Roadside	514184	104963	NO2	YES	Chemiluminescence	18.3	2.9	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)
4N	Heene Way (UK02)	Urban Background	513609	102557	NO2	NO	5.5	1.5	NO	1.5
5N	Cleveland Road (UK01)	Urban Background	512702	105560	NO2	NO	6.3	2.0	NO	2.0
6N	Gainsborough Avenue (UK06)	Roadside	515190	105122	NO2	NO	11.4	2.0	NO	2.0
N1C	High Street East	Urban Centre	515114	102670	NO2	NO	0.0	3.3	NO	2.0
N3	Cricketers Parade	Roadside	514501	104548	NO2	NO	22.3	2.3	NO	3.5
N5	First Avenue	Roadside	514495	105020	NO2	NO	15.3	2.4	NO	1.5
N8	Littlehampton Rd	Roadside	513236	104651	NO2	NO	14.1	1.5	NO	3.5
N11	Dawes Cl	Urban Background	515812	103309	NO2	NO	8.2	1.4	NO	1.5
N18A	Kinnall Court, Upper Brighton Road	Suburban	515315	105141	NO2	NO	0.0	12.0	NO	2.0
N21	Greenwood Cottage, A27	Roadside	509777	105696	NO2	NO	7.3	2.6	NO	3.0
N22	Falmer Close, C-Dust monitor	Urban Background	511010	102226	NO2	NO	14.6	2.2	NO	1.5
N24	152 Upper Brighton Road	Roadside	515151	105109	NO2	NO	0.0	8.0	NO	2.0
N25	Warren Ct	Suburban	513846	105184	NO2	NO	0.0	19.3	NO	2.0

	House									
N27	Tarring Road, Crossing	Roadside	513380	103352	NO2	NO	0.0	3.2	NO	2.5
N28	Chapel Road/Teville Road	Roadside	514740	103173	NO2	NO	1.4	3.2	NO	2.5
N29	Downlands Parade	Roadside	515014	105099	NO2	NO	0.0	7.3	NO	4.0
N30A	Grove Lodge Cottages	Roadside	514183	104948	NO2	YES	0.2	2.3	NO	2.5
N31	South Farm Road, roundabout	Roadside	514317	103329	NO2	NO	4.0	0.9	NO	2.5
N35	30 Upper Brighton Rd House	Roadside	514266	104961	NO2	YES	0.0	11.5	NO	2.0
N39	SW of Roundabout at Grove lodge	Roadside	514088	104907	NO2	YES	44.0	2.5	NO	4.0
N42	Norfolk House	Roadside	514742	103234	NO2	NO	0.0	3.6	NO	2.0
N43	23 Upper Brighton Road	Suburban	514199	104982	NO2	YES	0.0	19.2	NO	2.0
N44A	NOx Analyser 21 Upr Brighton Rd	Roadside	514184	104963	NO2	YES	18.3	2.9	YES	2.0
N44B	NOx Analyser 21 Upr Brighton Rd	Roadside	514184	104963	NO2	YES	18.3	2.9	YES	2.0
N44C	NOx Analyser 21 Upr Brighton Rd	Roadside	514184	104963	NO2	YES	18.3	2.9	YES	2.0
N45	11 Hill Barn Lane	Suburban	514126	105063	NO2	YES	0.0	13.0	NO	2.0

N48	Shaftesbury Avenue	Roadside	512080	103361	NO2	NO	12.5	2.2	NO	2.0
N52	Newland Road	Kerbside	514973	103335	NO2	NO	4.5	0.3	NO	2.0
N53	Offington Corner	Roadside	513278	105623	NO2	YES	18.6	6.0	NO	2.0
N54	The Aquarena	Roadside	515593	102707	NO2	NO	10.0	3.7	NO	3.0
N55	Varey Road / Fulbeck Ave	Suburban	510766	104875	NO2	NO	66.0	3.2	NO	3.0
N56	Titnore Way	Roadside	510318	104506	NO2	NO	11.2	1.2	NO	3.0
N57	Lyndhurst Road	Roadside	515114	102975	NO2	NO	0.0	3.5	NO	2.5
N58	Yeoman Road	Kerbside	510931	104026	NO2	NO	18.9	2.3	NO	3.0
N59	Ham Road / Lyndhurst Road	Roadside	516177	103227	NO2	NO	3.0	2.7	NO	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 NO₂ Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2017 (%) ⁽²⁾	NO ₂ Annual Mean Concentration (µg/m ³) ⁽³⁾				
					2013	2014	2015	2016	2017
WT2	Roadside	Automatic	99	99	40.9	51.1	37.4	48.0	35.8
4N	Urban Background	Diffusion tube	90	90	14.8	13.0	11.0	13.8	14.5
5N	Urban Background	Diffusion tube	100	100	18.8	15.1	13.4	16.0	15.9
6N	Roadside	Diffusion tube	93	93	42.0	36.5	38.0	40.7	38.1
N1C	Urban Centre	Diffusion tube	100	100	32.1	29.8	27.5	30.3	26.8
N3	Roadside	Diffusion tube	100	100	34.4	34.6	31.1	34.0	33.2
N5	Roadside	Diffusion tube	83	83	31.6	30.8	28.8	30.2	31.0
N8	Roadside	Diffusion tube	83	83	28.4	27.2	28.2	30.0	30.7
N11	Urban Background	Diffusion tube	100	100	15.6	14.2	12.7	15.5	15.6
N18A	Suburban	Diffusion tube	100	100	25.4	23.8	21.6	25.3	24.5
N21	Roadside	Diffusion tube	100	100	33.2	33.0	28.9	34.1	17.2
N22	Urban Background	Diffusion tube	100	100	14.3	12.0	10.4	13.3	13.3
N24	Roadside	Diffusion tube	83	83	26.0	25.1	22.4	25.8	25.9
N25	Suburban	Diffusion tube	100	100	21.5	22.1	20.7	22.2	20.7
N27	Roadside	Diffusion tube	100	100	28.3	24.4	21.6	25.7	24.7

N28	Roadside	Diffusion tube	75	75	35.3	36.9	25.7	21.5	36.0
N29	Roadside	Diffusion tube	85	85	36.9	40.3	33.5	34.6	32.4
N30A	Roadside	Diffusion tube	100	100	<u>76.5</u>	<u>71.7</u>	<u>66.1</u>	<u>64.1</u>	<u>68.2</u>
N31	Roadside	Diffusion tube	83	83	30.0	30.3	24.3	27.5	26.8
N35	Roadside	Diffusion tube	100	100	30.5	30.4	29.9	28.6	28.5
N39	Roadside	Diffusion tube	100	100	37.9	32.8	31.1	33.5	32.0
N42	Roadside	Diffusion tube	81	81	28.4	27.6	24.2	25.9	25.1
N43	Suburban	Diffusion tube	100	100	24.5	23.7	21.2	23.1	23.1
N44A	Roadside	Diffusion tube	100	100	39.4	42.2	39.2	42.0	40.5
N44B	Roadside	Diffusion tube	100	100	42.4	41.9	40.3	41.5	40.3
N44C	Roadside	Diffusion tube	92	92	41.8	41.7	39.8	41.6	41.2
N45	Suburban	Diffusion tube	100	100	18.0	18.4	16.0	17.2	17.2
N48	Roadside	Diffusion tube	100	100	32.3	27.6	25.6	30.1	27.0
N52	Kerbside	Diffusion tube	100	100	23.6	23.7	21.8	24.9	24.8
N53	Roadside	Diffusion tube	100	100	<u>N/A</u>	32.5	29.0	32.1	34.9
N54	Roadside	Diffusion tube	50	50	<u>N/A</u>	<u>N/A</u>	22.4	26.0	24.6
N55	Suburban	Diffusion tube	100	100	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	15.0	14.8
N56	Roadside	Diffusion tube	100	100	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	25.2	25.6

N57	Roadside	Diffusion tube	100	100	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	27.6	27.6
N58	Kerbside	Diffusion tube	100	100	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	22.8	25.1
N59	Roadside	Diffusion Tube	100	92	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	28.8

Diffusion tube data has been bias corrected

Annualisation has been conducted where data capture is <75% (no sites >75%)

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 Boxes 7.9 and 7.10 in LAQM.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Figure A.8 – Trends in Annual Mean NO₂ Concentrations 2013-2017

Figure A.9.1 – Site WT2 Automatic Continuous Analyser

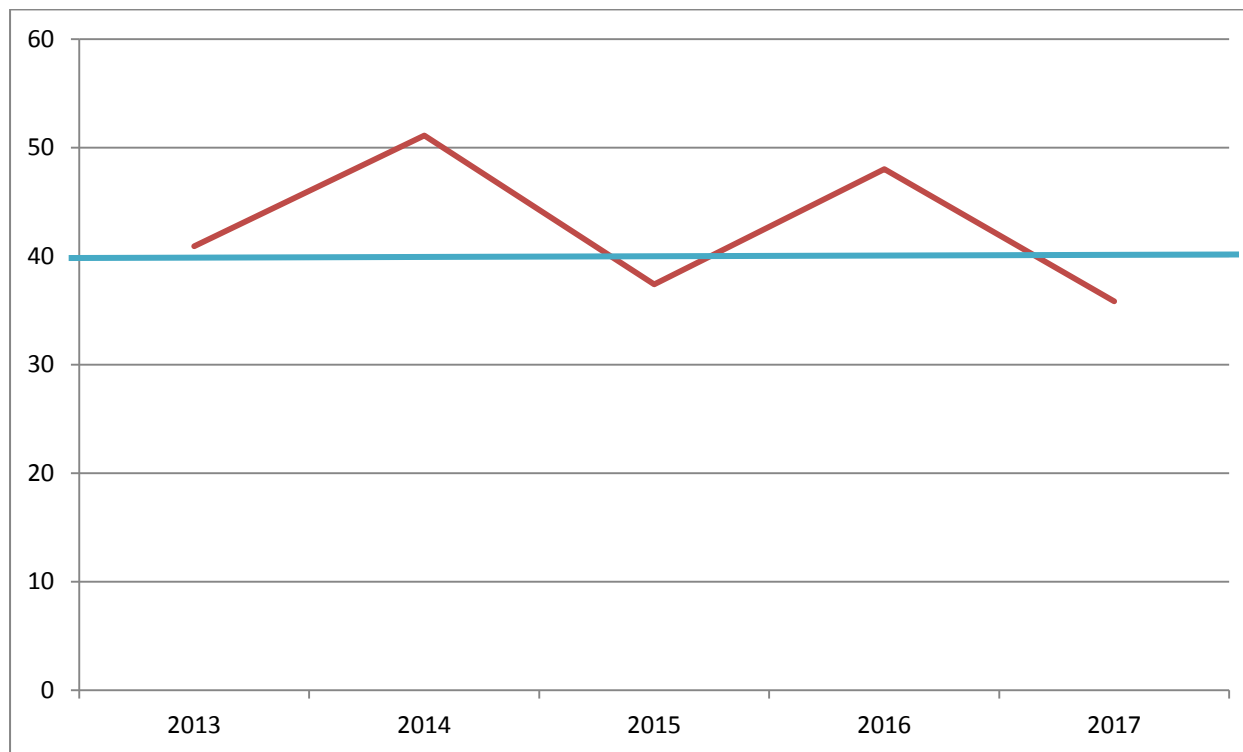


Figure A.10.2 – Site N44 Average of 3 co-located tubes

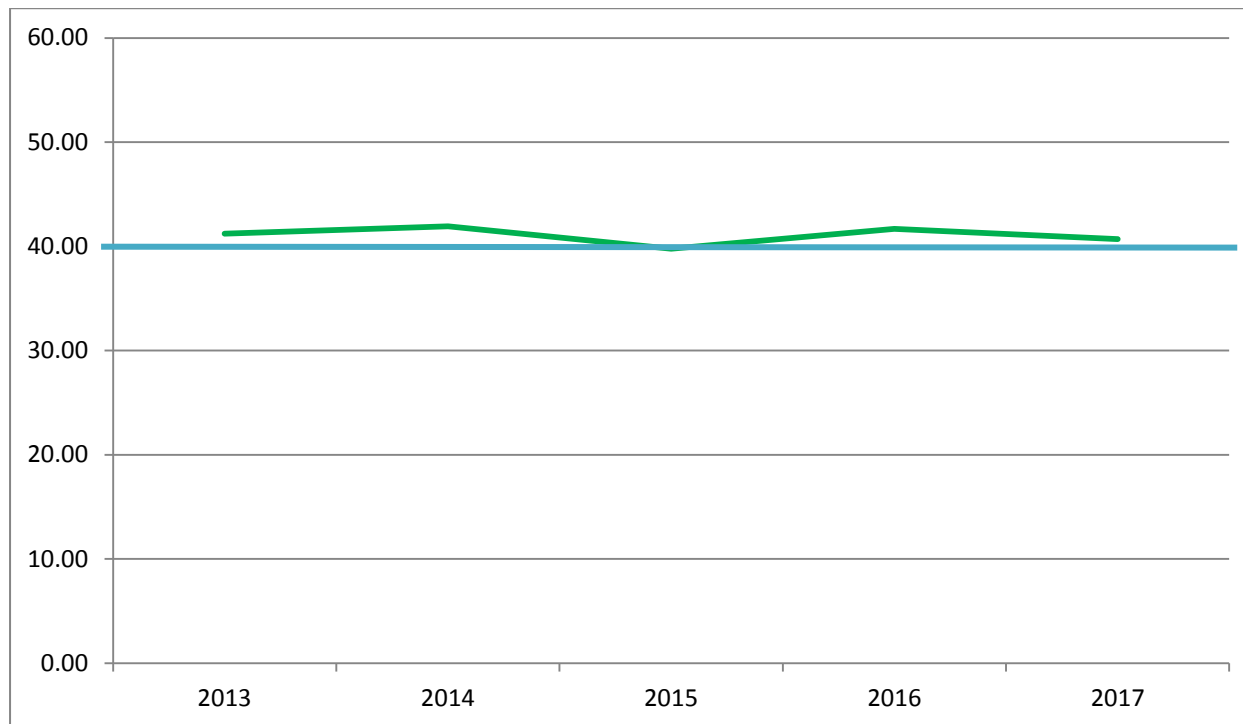


Figure A.11.3 – Site N44 Distance corrected average of 3 co-located tubes

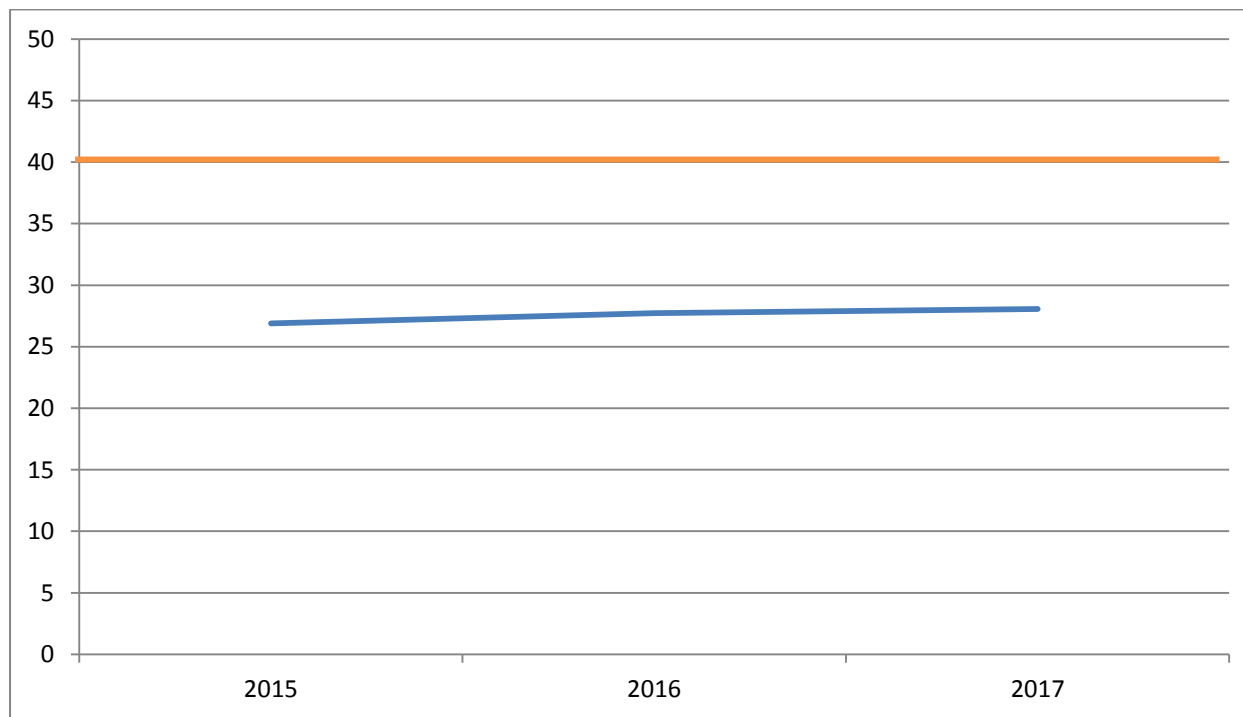


Figure A.12.4 – Site N30A Grove Lodge Cottages

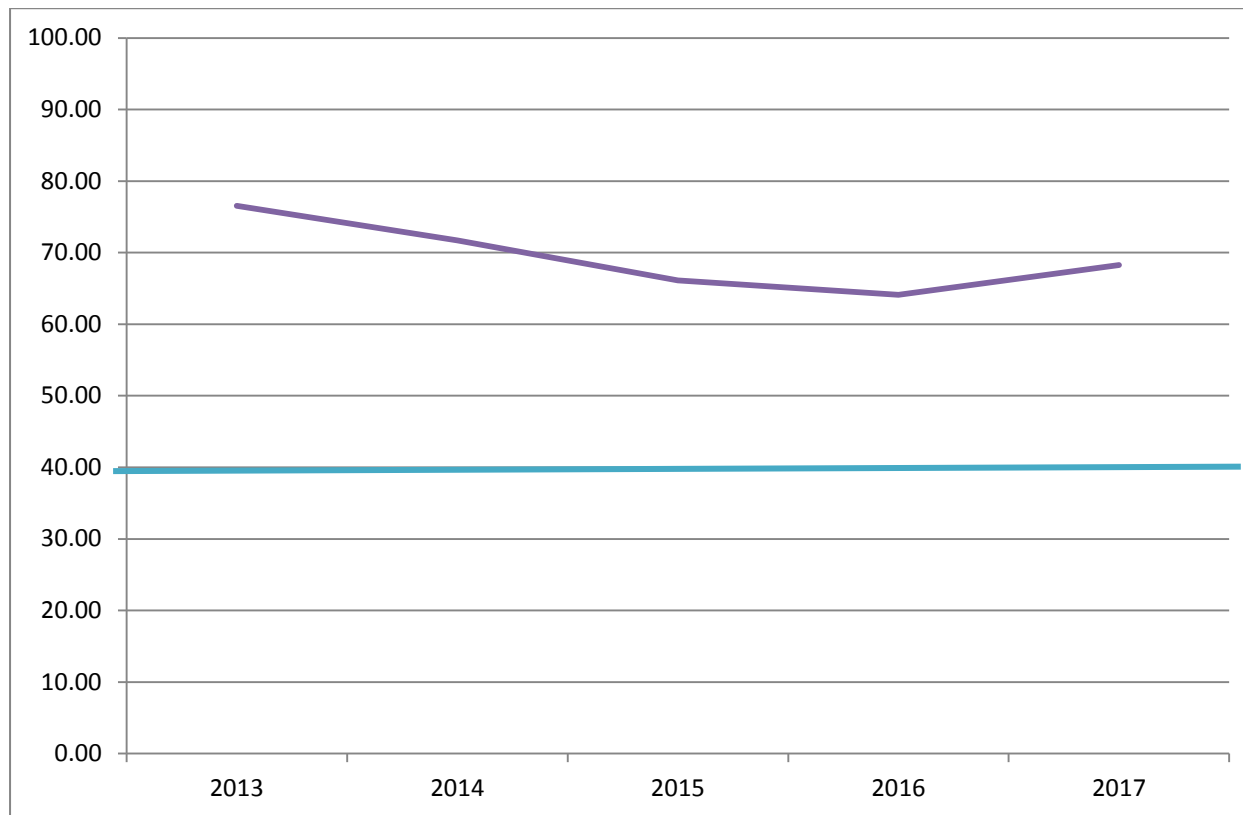


Figure A.13.5 – Site N29 Downlands Parade

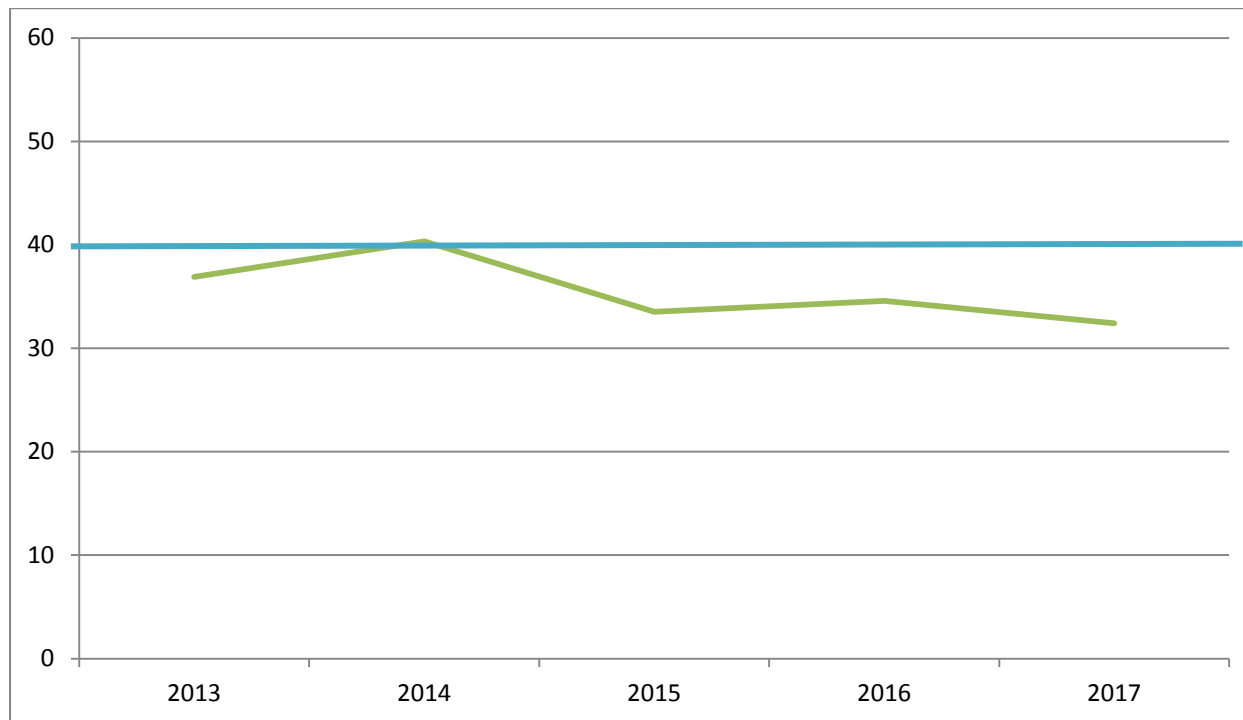


Figure A.14.6 – Site 6N Gainsborough Avenue

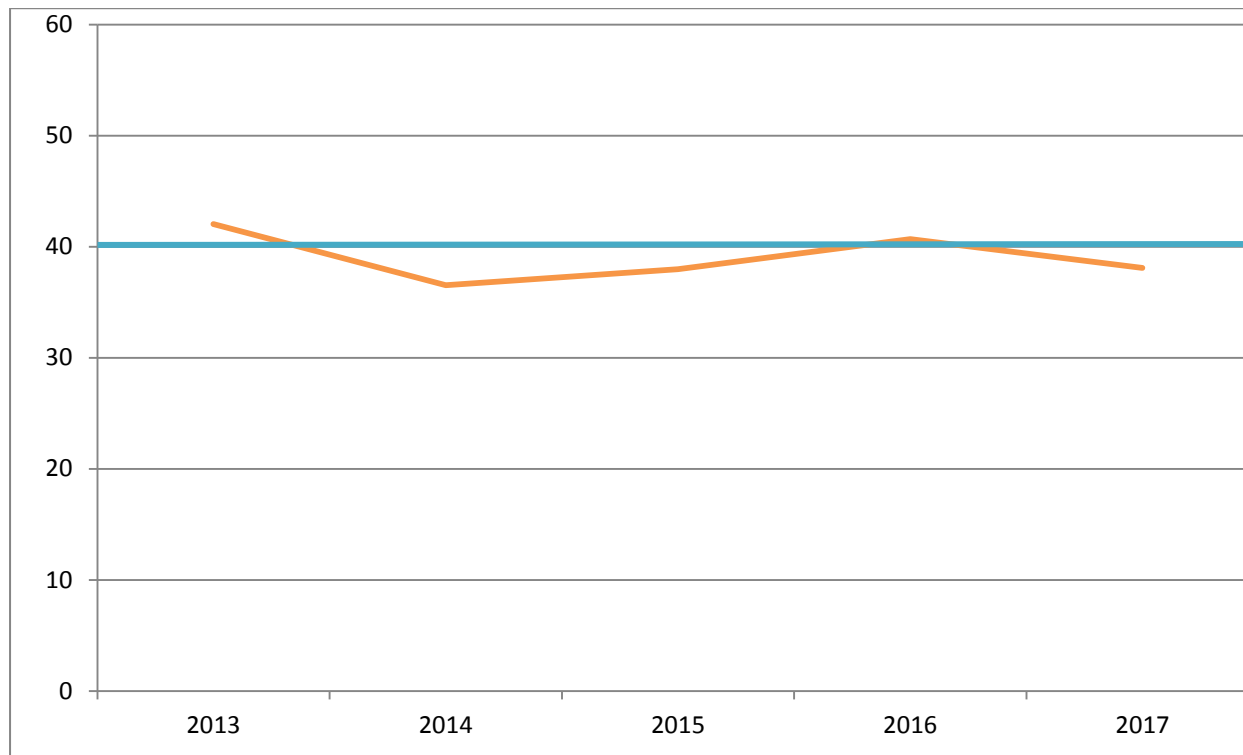


Table A.4 – 1-Hour Mean NO₂ Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2017 (%) ⁽²⁾	NO ₂ 1-Hour Means > 200µg/m ³ ⁽³⁾				
					2013	2014	2015	2016	2017
WT2, Grove Lodge	Roadside	Automatic	99	99	0	14	2	10	0

Notes:

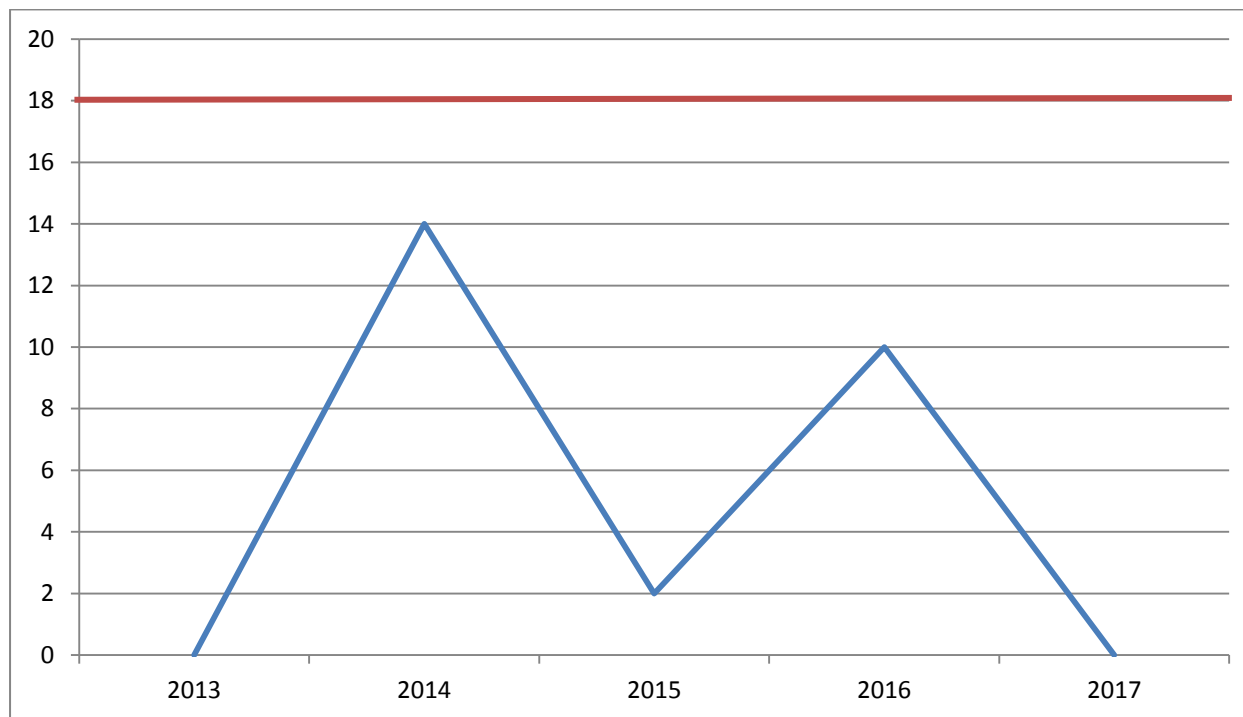
Exceedances of the NO₂ 1-hour mean objective (200µg/m³ not to be exceeded more than 18 times/year) are shown in **bold**.

(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.

Figure A.15 – Trends in Number of NO₂ 1-Hour Means > 200µg/m³ 2013-2017



Appendix B: Full Monthly Diffusion Tube Results for 2017

Table B.1 – NO₂ Monthly Diffusion Tube Results - 2017

INSTRUCTIONS

Please fill in Table B.1 with details of NO₂ diffusion tube monitoring results. This should contain:

- Full month by month raw data (state if different exposure periods from the suggested calendar available via the LAQM website here: <https://laqm.defra.gov.uk/diffusion-tubes/data-entry.html>)
- The raw data annual mean
- The bias adjusted annual mean – This should also be an annualised annual mean if data capture is below 75%.
- The distance corrected annual mean – If the location is not relevant to public exposure and meets the criteria specified in para 7.78 of TG16. If the monitoring location is relevant to annual mean public exposure, please leave the final column blank or add a dash.

Ensure the Site IDs match those provided in Column A of Table A.2.

Please delete this box when the document is finished

Site ID	NO ₂ Mean Concentrations (µg/m ³)												Annual Mean		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Raw Data	Bias Adjusted (0.97) and Annualised ⁽¹⁾	Distance Corrected to Nearest Exposure ⁽²⁾
4N	26.3	18.0	14.2	12.7	7.9	16.6	7.7	11.3	13.5	-	18.2	18.2	15.0	14.5	13.4
5N	27.2	18.7	15.7	13.6	12.3	16.7	10.0	12.4	16.3	14.4	19.5	20.0	16.4	15.9	14.4

Worthing Borough Council

6N	53.3	-	43.2	41.1	34.4	32.1	28.3	33.5	37.2	40.5	46.5	41.9	39.3	38.1	27.7
N1C	40.8	29.9	30.2	29.0	29.7	27.3	21.7	25.8	22.3	22.1	28.9	24.4	27.7	26.8	26.8
N3	41.0	36.5	35.5	29.7	29.7	33.4	26.8	30.0	31.4	35.7	41.5	40.1	34.3	33.2	21.9
N5	38.6	38.9	33.9	28.5	27.8	30.6	25.7	29.0	30.7	36.0	-	-	32.0	31.0	21.2
N8	41.9	37.2	30.9	26.0	29.2	-	-	26.8	29.2	29.1	35.0	31.3	31.7	30.7	21.1
N11	26.6	20.3	17.0	12.0	11.6	13.1	9.9	12.6	12.5	14.6	21.8	20.8	16.1	15.6	15.0
N18A	32.5	29.3	24.2	25.1	18.9	20.0	18.4	22.9	23.4	25.6	31.8	31.3	25.3	24.5	24.5
N21	45.0	37.6	13.2	13.4	10.8	14.1	8.5	10.1	13.7	13.2	17.7	15.0	17.7	17.2	16.0
N22	24.8	15.9	14.1	10.3	8.7	15.1	7.6	10.1	13.3	11.0	17.7	15.7	13.7	13.3	12.1
N24	35.4	-	26.5	23.1	22.7	22.6	19.2	23.2	32.0	34.9		27.7	26.7	25.9	25.9
N25	27.5	26.3	24.5	19.9	17.7	20.3	14.6	17.5	19.7	20.4	23.3	24.2	21.3	20.7	20.7
N27	38.5	27.4	23.1	25.8	27.3	24.9	16.9	20.7	22.4	22.8	29.8	26.0	25.5	24.7	24.7
N28	36.0	37.8	39.6	35.5	30.7	-	34.3	35.6	-	43.1	-	41.6	37.1	36.0	33.9
N29	45.1	-	35.7	36.0	35.4	37.2	30.9	33.4	23.5	25.0	31.9	-	33.4	32.4	32.4
N30A	80.4	71.8	67.7	64.8	62.2	90.8	66.1	69.5	64.1	70.5	77.5	58.9	70.4	68.2	67.1
N31	37.7	31.3	-	25.0	21.6	29.2	22.1	25.5	23.4	-	31.8	29.1	27.7	26.8	22.5
N35	39.4	32.1	30.0	27.6	25.6	27.3	24.5	25.9	26.2	29.2	33.9	31.5	29.4	28.5	28.6
N39	44.8	37.6	31.1	32.3	30.0	32.0	26.0	27.1	31.5	31.5	41.2	31.3	33.0	32.0	19.6
N42	37.5	31.5	21.5	25.4	-	28.2	19.2	23.4	21.4	-	27.8	23.1	25.9	25.1	25.1
N43	32.4	26.1	24.9	24.1	20.4	22.3	20.2	20.3	24.6	23.0	24.2	23.8	23.8	23.1	23.1
N44A	49.8	42.0	39.9	46.7	35.6	46.1	34.7	37.4	40.0	41.4	47.1	40.9	41.8	40.5	26.7
N44B	48.1	47.8	43.9	43.5	39.6	38.9	27.2	39.6	43.0	43.9	42.1	41.7	41.6	40.3	26.6
N44C	49.2	43.0	43.2	45.0	38.6	40.3	39.0	39.8	-	42.6	47.9	38.8	42.5	41.2	27.0
N45	26.5	20.1	20.7	14.0	13.3	14.7	13.5	14.8	15.8	18.5	20.6	20.0	17.7	17.2	17.2
N48	41.1	32.3	28.0	27.0	20.9	31.5	21.3	22.6	23.7	27.6	31.6	26.5	27.8	27.0	19.5
N52	37.6	25.0	24.9	22.1	19.6	25.9	16.7	21.7	22.5	24.9	34.3	31.6	25.6	24.8	19.8
N53	40.6	37.8	31.9	36.4	33.0	41.4	33.4	34.9	32.7	38.3	33.3	37.4	35.9	34.9	24.5

Worthing Borough Council

N54	38.2	-	24.3	24.0	-	23.0	19.9	-	-	-	26.9	-	25.4	24.6	19.7
N55	23.4	19.3	15.5	11.3	14.2	13.6	11.7	12.9	15.0	12.6	17.6	16.0	15.2	14.8	10.7
N56	30.6	27.2	26.0	22.1	26.6	31.6	25.1	25.9	26.2	28.1	26.6	20.4	26.4	25.6	17.5
N57	35.5	30.7	24.1	27.5	23.8	30.7	21.6	24.5	26.1	28.0	35.3	33.8	28.5	27.6	27.6
N58	36.5	29.8	24.0	25.9	20.7	32.5	18.2	16.5	23.7	24.3	31.9	27.2	25.9	25.1	16.5
N59	-	35.8	32.1	29.8	27.6	29.0	24.2	27.0	27.6	31.2	31.6	31.3	29.7	28.8	25.8

National bias adjustment factor used

Where applicable, data has been distance corrected for relevant exposure

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) 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

Automatic Monitoring Site

The automatic continuous monitoring site at Grove Lodge is part of the national Automatic Urban and Rural Network (AURN) and complies with the EU Directive on ambient air quality (2008/50/EC). The site is audited and serviced every 6 months and Local Site Operator (LSO) routine calibrations are completed by Worthing Borough Council every 2 weeks.

Diffusion Tube Bias Adjustment Factors

NO₂ diffusion tubes are provided and analysed by Gradko laboratory. The NO₂ tube preparation method used is 50% triethanolamine (TEA) in Acetone.


Data from the NO₂ diffusion tubes has been compared and bias corrected to the factors produced from the UK co-location data-base available from Defra, <http://laqm.defra.gov.uk/bias-adjustment-factors/bias-adjustment.html>

The bias adjustment factor used for 2017, obtained via tools at the aforementioned website, was **0.97**.

QA/QC of diffusion tube monitoring

All diffusion monitoring data has been ratified following the methods described in LAQM.TG(16). A quality assurance / quality control (QA/QC) programme including field duplicates and blanks, and instrument calibration with standard gases has been followed (AEAT, 2000).


Figure C.1 Fall-off calculation for N30A, Grove Lodge Cottages



Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	2.3	metres
Step 2	How far from the KERB is your receptor (in metres)?	2.5	metres
Step 3	What is the local annual mean background NO ₂ concentration (in µg/m ³)?	13.4	µg/m ³
Step 4	What is your measured annual mean NO ₂ concentration (in µg/m ³)?	68.25	µg/m ³
Result	The predicted annual mean NO ₂ concentration (in µg/m ³) at your receptor	67.1	µg/m ³


Figure C.2 Fall-off calculation for WT2, Continuous Analyser



Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	4	metres
Step 2	How far from the KERB is your receptor (in metres)?	21	metres
Step 3	What is the local annual mean background NO ₂ concentration (in µg/m ³)?	14.3	µg/m ³
Step 4	What is your measured annual mean NO ₂ concentration (in µg/m ³)?	35.8	µg/m ³
Result	The predicted annual mean NO ₂ concentration (in µg/m ³) at your receptor	25.8	µg/m ³

Figure C.3 Fall-off calculation for 6N Gainsborough Avenue



Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	2	metres
Step 2	How far from the KERB is your receptor (in metres)?	10.5	metres
Step 3	What is the local annual mean background NO ₂ concentration (in µg/m ³)?	11.4	µg/m ³
Step 4	What is your measured annual mean NO ₂ concentration (in µg/m ³)?	38.1	µg/m ³
Result	The predicted annual mean NO ₂ concentration (in µg/m ³) at your receptor	27.7	µg/m ³

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

The AQMA is hatched in red.

Figure D.1 Monitoring Sites

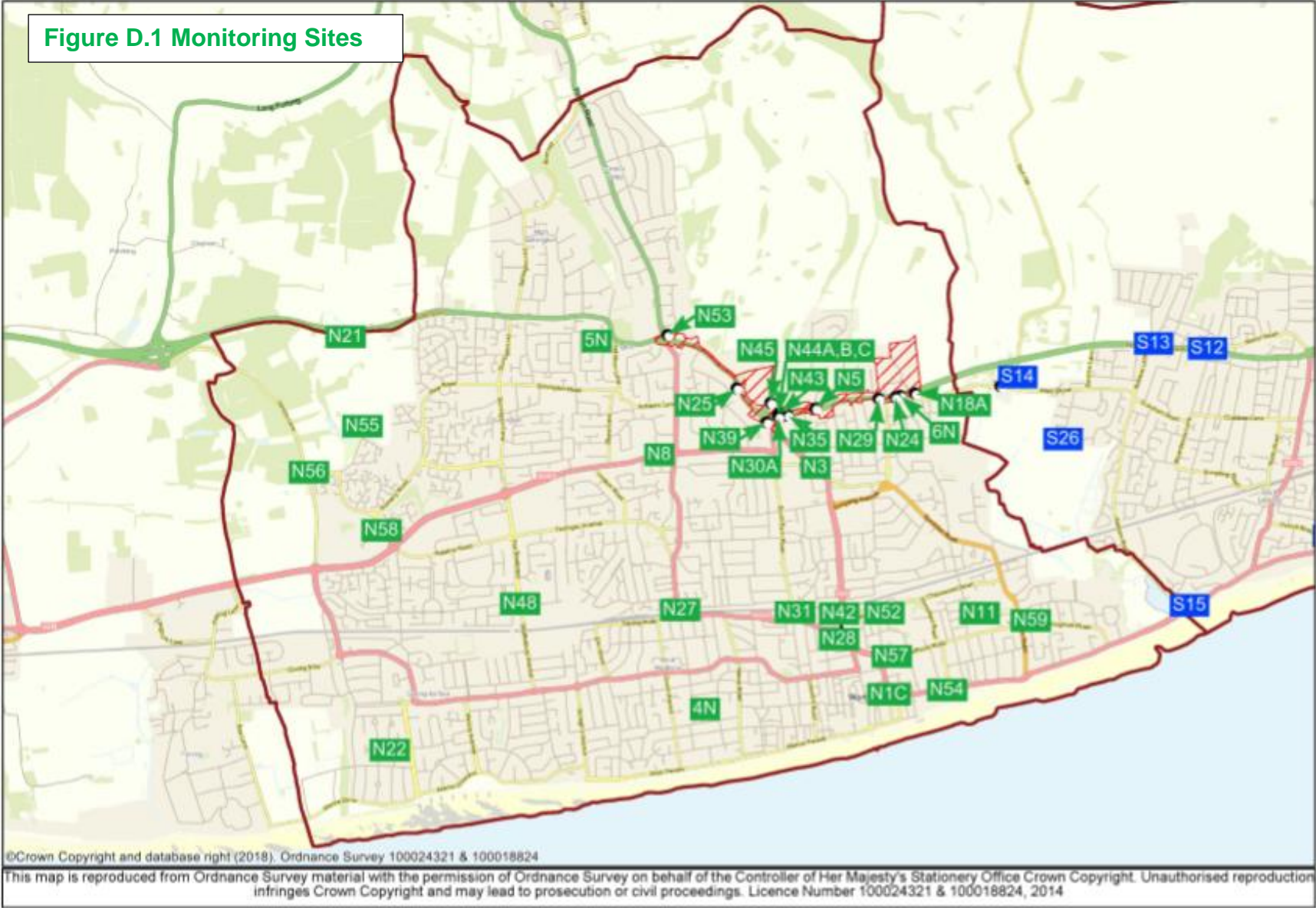


Figure D.2 Monitoring Sites – Central and East Worthing

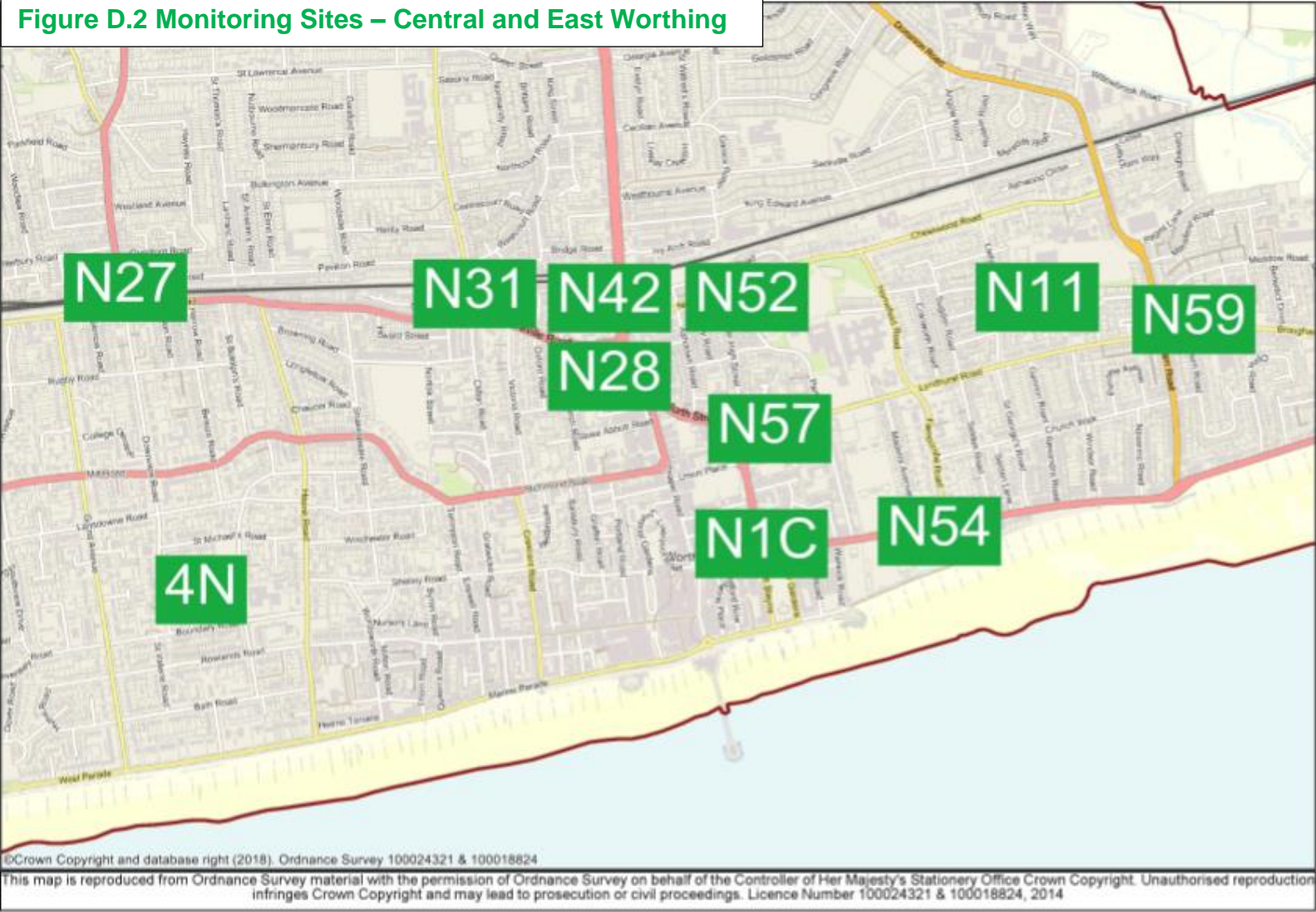
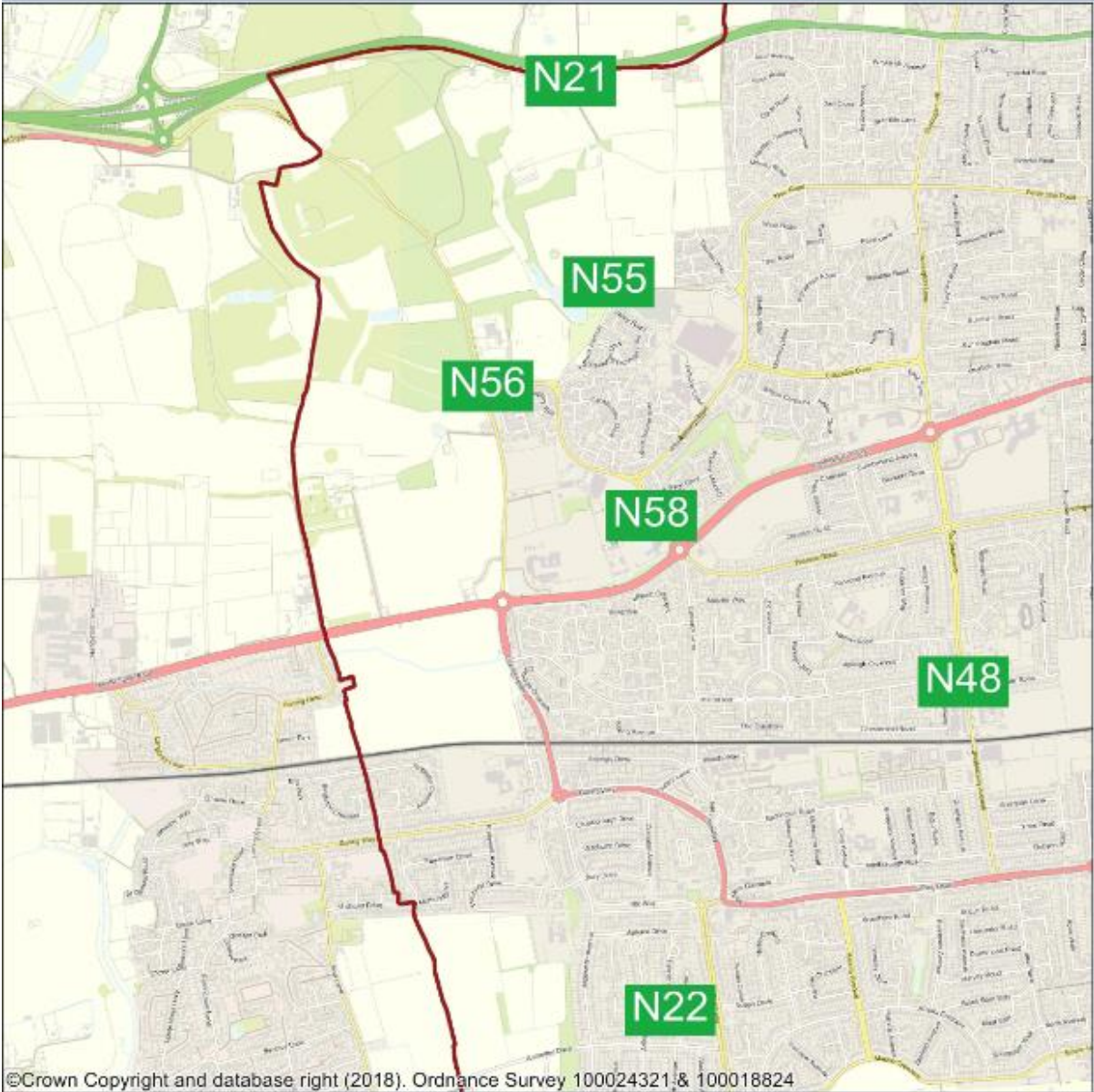


Figure D.3 Monitoring Sites – West Worthing



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 microgrammes of pollutant per cubic metre of air (µg/m³).

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
HE	Highways England
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
WSCC	West Sussex County Council

References

Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006, Defra, Report Number AEAT/ENV/R/2170. Available from UK-AIR https://uk-air.defra.gov.uk/assets/documents/reports/cat09/0701110944_AQinequalitiesFNL_AEAT_0506.pdf

Local Air Quality Management Technical Guidance (TG16), Defra
Available from <https://laqm.defra.gov.uk/documents/LAQM-TG16-April-16-v1.pdf>

Local Air Quality Management Policy Guidance (PG16), Defra
Available from
https://consult.defra.gov.uk/communications/laqm_changes/supporting_documents/LAQM%20Policy%20Guidance%202016.pdf

Air Quality and Emission Mitigation Guidance for Sussex (2013)
Available from <https://www.adur-worthing.gov.uk/environmental-health/pollution/air-quality-and-pollution/air-quality-and-planning/>

NO₂ Fall-Off with Distance Calculator available from:
<http://laqm.defra.gov.uk/tools-monitoring-data/no2-falloff.html>

Defra Background Maps for Worthing
<https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2013>