2017 Air Quality Annual Status Report (ASR)

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

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Executive Summary: Air Quality in Our Area

This Annual Status Report forms part of the eighth round of air quality Review and Assessment carried out by Watford Borough Council. It sets out updated air quality monitoring data and assesses whether any new or proposed developments are likely to have a significant effect on air quality concentrations.

Furthermore, this report fulfils the requirements of the Local Air Quality Management process as set out in Part IV of the Environment Act (1995), the Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2007 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 exceedences are considered likely, the local authority must then 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.

Air Quality Monitoring Data

Across Hertfordshire, where monitoring is undertaken, the concentrations of Nitrogen Dioxide (NO_2) have been declining, which means air quality has been improving. In Watford this trend is also apparent apart from the monitoring location at the Lower High Street.

The real-time analysers located at the Town Hall continue to monitor oxides of nitrogen and PM_{10} particulates. The council was successful in achieving additional funding and began $PM_{2.5}$ monitoring on Tuesday, 8th December 2015. In addition, we have a network of diffusion tubes monitoring long term nitrogen dioxide concentrations. This network now stands at 19 tubes and includes sites that will be able to assess long term trends in concentrations close to the Health Campus and associated link road –which opened in November 2016, as well as concentrations in Gammons Lane, where local concerns about queuing traffic have been raised. Concentrations across all of the nitrogen dioxide diffusion tube monitoring sites

continue to decline and there are now only three existing and one new site where results suggest that the National Air Quality Objective level could be exceeded.

The air quality problem in Watford is predominantly a result of emissions from road vehicles, for example, idling engines at busy junctions.

Not all car journeys made will start or end within the borough boundaries and so it is vital to work with other agencies. Watford is part of the Hertfordshire and Bedfordshire Air Quality Network which meets approximately four times a year at which transport officers from the county council are also in attendance.

A key initiative to improve air quality has been the installation of electric vehicle charging points in various locations in the borough.

Furthermore, a detailed assessment of NO_2 concentrations in each of the AQMA's was carried out and based upon the findings these need to be reviewed and this work is expected to take place in 2017.

The new road connecting to health campus opened in 2016 and this will impact upon traffic flows in the Bushey Arches locality.

Air Quality in Watford

Watford is a concentrated urban area situated to the North West of London, with a population of around 93,700. It is a well established regional shopping centre with major rail and road communication links. It has both mainline and underground train stations, the M1 lies along the northern boundary of the borough and the M25 is situated to the west. The borough is also served by several major trunk roads, including the A41, A411, A412 and A405.

Air pollution is associated with a number of adverse health impacts. It is recognised as a contributing factor in the onset of heart disease and cancer. Additionally, air pollution particularly affects the most vulnerable in society: children and older people, and those with heart and lung conditions. There is also often a strong correlation with

equalities issues, because areas with poor air quality are also often the less affluent areas[1,2].

The annual health cost to society of the impacts of particulate matter alone in the UK is estimated to be around £16 billion[3].

The main pollutants of interest in the borough continue to be NO_2 and PM_{10} particulates. These are mainly associated with road traffic.

From the data gathered during 2016, there was a reduction in NO_2 concentrations across the borough. We will be reviewing our existing AQMA's in 2017.

There are four AQMA's within Watford:

- AQMA 1: St Albans Road.
- AQMA 2: Vicarage Road.
- AQMA 3A: Aldenham Road/Chalk Hill.
- AQMA 5: A405 / Horseshoe Lane.

Further information can be found at:
https://www.watford.gov.uk/info/20010/your_environment/196/local_air_quality

Actions to Improve Air Quality

A key initiative has been the installation of electric vehicle charging points in each of the following car parks:

- Avenue Car Park
- Bushey Arches Car Park
- Gade Car Park

[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

- Longspring Car Park
- Queens Car Park
- Sutton Car Park
- Timberlake Car Park
- Town Hall Car Park
- Watford Business Park Car Park

In addition, a 'Rapid Charging Point' which is able to charge vehicles in approximately 20 minutes, is also available for use in 'Service Road Q', just off the northbound side of Beechen Grove.

Further information can be found at:
https://www.watford.gov.uk/info/20014/parking/58/where_can_i_park_in_watford/5

Figure 1: A charging point located off Beechen Grove.

In addition, in November 2015, due to its success, the e-car scheme was extended for a further two years and further information can be found at: https://ecarclub.co.uk/locations/hertfordshire/watford-history/

As set out in our AQAP other measures were to be implemented including infrastructure improvements. The major projects are the two new link roads:

1. Health Campus link road (http://www.watfordhealthcampus.org/) opened in November 2016. This link road is expected to affect air quality at the Chalk Hill and Hornet's Gyratory/Wiggenhall Rd AQMAs.

The road links Wiggenhall Road and the Campus with Dalton Way. The link road is expected to help alleviate the localised congestion and improve access to the hospital for emergency vehicles, for example in the Chalk Hill and Hornet's Gyratory/Wiggenhall Road AQMAs. In addition, transport improvements associated with the Watford Health Campus include:

- The introduction of pedestrian and cycle routes in new green spaces around the site;
- Increased proportion of journeys made via public transport, with the hope of new bus services being attracted to the site;
- Increased links to London through more direct road and rail provision;
- More accessible car parking for visitors to the site;
- Provision of new access and link roads to the site; and
- Support for the introduction of the Croxley Rail Link for direct access to the site and beyond by train.

2. Watford Junction link road which is expected to significantly improve air quality on St Albans Rd in AQMA 1. This proposal is still in the planning stage.

Other schemes delivered in Watford by the county council were done through the Integrated Transport Programme. These schemes contribute to reducing vehicle pollution through lower speeds, or by encouraging more travel by non-car modes.

The council is also taking actions to implement greener alternatives through the planning process promoting greener alternatives, for example, cycle storage provisions in new developments. Further information can be found here:

https://www.watford.gov.uk/downloads/file/1585/cycle_parking_supplementary_planning_document_3rd_july_2017

https://watford.jdi-consult.net/localplan/readdoc.php?docid=14&chapter=4&docelemid=d314#d314

https://www.watford.gov.uk/downloads/file/1305/watfords_monitoring_report_2016

Local Priorities and Challenges

The high demand for housing has led to a number of new homes being built and this set to increase with a number of number proposed developments within the borough. Meeting the housing demand against the air quality requirements presents a major challenge.

Another priority for Watford is to improve working relationships with stakeholders and partners to continue to drive improvements. In addition, improving the quantity and quality of information available on our air quality webpage will help to inform as well as promote air quality improvements.

Effective partnership working is essential to ensure that we are able to deliver the objectives set out in our AQAP.

How to Get Involved

All our residents, visitors and businesses play a role in improving air quality, for example, walking, cycling or using public transport instead of driving. For those of us who need a car, replacing it with a greener vehicle such as an electric one is a great way of improving air quality. If individuals or businesses are not ready to replace their existing vehicles, they should ensure that at least they are serviced and in particular, tyre pressures are at the appropriate level as doing so will help lower emissions as well as saving money.

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1 Local Air Quality Management

This report provides an overview of air quality in Watford Borough during 2016. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995) and the relevant Policy and Technical Guidance documents.

The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where an exceedance is considered likely the local authority must declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives. This Annual Status Report (ASR) is an annual requirement showing the strategies employed by Watford Borough Council to improve air quality and any progress that has been made.

The statutory air quality objectives applicable to LAQM in England can be found in Table E.1 in Appendix E.

2 Actions to Improve Air Quality

2.1 Air Quality Management Areas

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

A summary of AQMAs declared by Watford Borough Council can be found in

Table 1.1. Further information related to declared or revoked AQMAs, including maps of AQMA boundaries are available online at: https://www.watford.gov.uk/info/20010/your_environment/196/local_air_quality

Following the Ricardo Energy & Environment report (Detailed Assessment of Nitrogen Dioxide in the Watford Air Quality Management Areas (2015), dated Monday, 16th May 2016) In 2017, we will be considering the recommendations to revoke AQMA 1 and AQMA 5 as concentrations have remained below the annual

mean concentration of 40 µg/m3 and amend the remaining AQMA's (see monitoring section).

Table 1.1 – Declared Air Quality Management Areas

AQMA Name	Pollutants and Air Quality Objectives	One Line Description	Action Plan
AQMA 1 St Albans Road	NO_2 annual mean	A combination or residential and commercial buildings along a main road. Queuing traffic and street canyon.	https://watford.jdi-consult.net/documents/pdfs5/Air%20Quality%20Action%20Plan%202011.pdf
Watford AQMA 2 Vicarage Road	NO_2 annual mean	A predominately residential area with a cluster of commercial buildings within and as well as close to the vicinity. Queuing traffic.	
Watford AQMA 3A Aldenham Road/Chalk Hill	NO_2 annual mean	A combination or residential and commercial buildings along a main road within close proximity to Bushey Station. Queuing traffic.	
AQMA 5 A405 / Horseshoe	NO_2 annual mean	A predominately residential area within close proximity to main roads and motorway.	

Lane			

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

Watford Borough Council has taken forward a number of 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 1.2.

Work is being done to revise the existing Local Plan Strategy to include air quality policy requirements that will seek to mitigate through design.

We will be improving the information we provide to our residents and businesses, for example, updating our webpage.

Table 1.2 – Progress on Measures to Improve Air Quality

Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
Road Infrastructure Improvements Ease congestion in St Albans Road AQMA. Further improvements are recommended in the Congestion study	Traffic Management	Strategic highway improvements	HCC/WBC	Complete	Partially complete	Schemes completed	Ease congestion and reduce emissions	Partially complete	On going	Local Sustainable Transport Fund 20 Zone west of St. Albans Road planned New cycle route along St.Albans Road The congestion study was completed 'some time ago' and signals at two junctions have been adjusted. Some permanent loops are in place so there will be some journey time information. St.Albans Road link road on hold Health Campus Link Road due to start construction in January 2015 DEFRA bid submitted to improve access and signage for Abbey Way cycle path (Sept 2014)
Implement the intalink project Increase the integration of public and sustainable transport movements	Transport Planning and Infrastructure	Public transport improvements-interchanges stations and services	HCC/WBC	Complete	Complete / on going	Bus and rail patronage, number of cyclists and pedestrians	Reduce private car use and so reduce emissions. Medium impact.	On going	On going	On going promotion

Watford Junction interchange improvement Increase the accessibility of the rail station	Transport Planning and Infrastructure	Public transport improvements-interchanges stations and services	HCC/WBC	Complete	Partially complete	Completed scheme	High in the vicinity of the junction	Partially complete	On going	Forecourt and other work done as part of national station improvement scheme. No start date as yet for major work such as link road
Promotion of car sharing scheme. Increase car sharing to ease congestion	Alternatives to private vehicle use	Car & lift sharing schemes	WBC	Complete	Complete / on going	Registered members on liftshare Number of private schemes	Low	Complete / on going	Complete / on going	On going promotion through council's commuting officer
Promotion of Travel Plans. Increase in sustainable transport	Transport Planning and Infrastructure	Public transport improvements-interchanges stations and services	WBC	Complete	Complete / on going	Number of travel plans in schools and businesses	Low	Complete / on going	Complete / on going	On going promotion through council's commuting officer
Annual Council vehicle fleet review. Maintain clean Council vehicle fleet	Vehicle Fleet Efficiency	Fleet efficiency and recognition schemes	WBC	On going	On going	Age and Euro standard of Council vehicle fleet	Low	Underway	On going	Corporate procurement policy being developed
Promote air quality within the Borough. Increase awareness of AQ as a health issue and the	Public Information	Other policy	WBC	Complete	On going	"Hits" on Herts&Beds Air Quality website	Low	Complete	Complete	This is being considered across Hertfordshire and HCC Public Health Director has committed funding. We have worked with HCC and other LA's to draft a Hertfordshire Air Quality Strategy. http://www.hertfordshire.gov.uk/docs/pdf/a/airqualitystrategicplan.pdf
Continue to monitor air quality. Maintenance of air quality monitors and data management	Public Information	Other policy	WBC	Complete	Complete	Number of operational monitors	Low	On going	On going	Despite budgetary pressures Watford has continued to fund exisiting monitoring and has also funded the maintenance of new PM 2.5 monitors.

Undertake feasibility studies. To investigate the air quality impact of any potential future schemes	Policy Guidance and Development	Other policy	WBC	On going	On going	Not applicable	Not applicable	On going	On going	Site allocation traffic light system put in place with planning policy Constraint information for developers included in planning information
Enforcement of parking policy. Minimise emissions due to reduced traffic flow caused by obstructions	Traffic Management	Enforcement on highway	WBC	Complete	Complete	Number of warnings, fines and prosecutions for such offences	Low	On going	Outstanding	Outstanding
Installation of EV charging points. Encourage the uptake of electric vehicles	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	HCC/WBC	Complete	Complete	Number of charging points installed	Low	Complete	Complete	None
Implement bus strategy. Encourage the increase of bus patronage	Alternatives to private vehicle use	Other	HCC/WBC	Complete / on going	Complete / on going	Bus patronage	Medium	Complete / on going	Complete / on going	Local Sustainable Transport Fund On-going partnerships and promotion with local bus companies through council
Promotion of TravelSmart. Personalised travel planning to reduce car use	Alternatives to private vehicle use	Other	WBC	Complete	Complete	Progress on the Croxley programme	Low	Complete / on going	Complete / on-going	Travelsmart continues to be promoted Croxley Rail link commencement order agreed but currently stalled

Promotion of cycling and walking. Increase sustainable transport	Promoting Travel Alternatives	Promotion of walking	WBC/HCC	Complete	Complete	Number of cyclists and pedestrians	Low	Complete / on going	Complete / on going	New cycle route along St.Albans Road Ebury Road route planned Grand union canal route planned New road signs with pedestrian info being implemented SW Herts cycling strategy Permanent loop monitoring planned DEFRA bid submitted to improve access and signage for Abbey Way cycle path
Develop Supplementary Planning Document for Air Quality. Develop SPD on AQ for inclusion in the 2011 Development Plan Document	Policy Guidance and Development	Air Quality Planning and Policy Guidance	WBC	On going	On going	Publication of SPD; Number of planning applications made using the guidance;	Low	On going	On going	HCC Public Health Director has expressed wish for there to be a county wide strategy. As part of the Local Plan Strategy we will be considering the need for supplementary planning guidance.

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.

Watford Borough Council is taking the following measures to address $PM_{2.5}$:

- Establish an effective partnership working arrangements with Hertfordshire County Council Public Health. This has occurred as a result of three key drivers:
    - Increased evidence and awareness of the harm from exposure to $PM_{2.5}$
    - The transfer of central government funding from a central public health body to County Councils
    - The existence of the Public Health Outcome Indicator (PHOI) for the fraction of mortality attributable to particulate air pollution measured as fine particulate matter $PM_{2.5}$.
- Access to Public Health Funding for each of the ten Hertfordshire Local Authorities to purchase and establish $PM_{2.5}$ monitoring equipment in their areas. Watford has installed a FIDAS monitor on Tuesday, 8th December 2015.
- Watford Council has not yet identified any measures targeted specifically at reducing $PM_{2.5}$ and it is considered unlikely that any such measures will be identified over the coming years. Instead it is anticipated that:
    - Measures to reduce emissions of NOx by encouraging a move away from internal combustion engine vehicles to ultra low emission vehicles (ULEV) will reduce $PM_{2.5}$ emissions from exhausts
    - Measures to reduce road travel altogether will reduce $PM_{2.5}$ emissions from brake and tyre wear and dust re-suspension.

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.

Watford Borough Council undertook automatic (continuous) monitoring at one site during 2016. Table A.1 in Appendix A shows the details of the sites. Further information regarding the monitoring data for this site can be found at
http://www.airqualityengland.co.uk/site/latest?site_id=HB004
http://www.airqualityengland.co.uk/local-authority/?la_id=408

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

A map showing the location of the monitoring site is provided in Appendix D (Fig 3). 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

Watford Borough Council undertook non- automatic (passive) monitoring of NO_2 at 19 sites during 2016. Table A.2 in Appendix A shows the details of the sites.

A map showing the approximate locations of the monitoring sites are provided in Appendix D (Fig2). Further details on Quality Assurance/Quality Control (QA/QC) and bias adjustment for the diffusion tubes are included in Appendix C.

3.2 Individual Pollutants

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

3.2.1 Nitrogen Dioxide (NO_2)

Table A.3 in Appendix A compares the ratified and adjusted monitored NO_2 annual mean concentrations for the past 6 years with the air quality objective of 40µg/m^3.

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

Monitoring along Lower High Street has shown yet another increase in NO_2 concentrations. The council will be deciding upon what action, if any, it will be pursuing following these results.

Owing to the low data capture at Eastbury Road, it is not possible to draw any valid conclusions.

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. There were no exceedences of the NO_2 hourly mean objective of 200 µg/m3 at the Watford Town Hall site in 2016.

The annual average has remained fairly constant in recent years and is below the objective concentration. There were no exceedences of the hourly mean objective in 2016.

In 2016 the council commissioned Ricardo Energy & Environment to carry out a Detailed Assessment of NO_2 within its four AQMA's.

The report issued by Ricardo Energy & Environment made the following comments and recommendations,

- "In AQMA1 there are no predicted exceedances of the 40 µg/m3 annual mean objective at any ground level or 1st floor height locations where there is relevant human exposure present. **Watford Borough Council may wish to consider revoking the boundary of AQMA1.**
- In AQMA2 the results indicate that there may be exceedances of the NO_2 annual mean objective at up to 50 residential properties at ground level, some of which are within the current AQMA boundary. The results also indicate that there are exceedances of the objective at locations on Wiggenhall Road which are not within the existing AQMA boundary. **Watford Borough Council should consider revising the boundary of AQMA2 to include these locations.**
- In AQMA3A the results indicate that there may be exceedances of the NO_2 annual mean objective at up to 55 residential properties at both ground level and first floor height. Most of which are within the existing AQMA3A boundary with the exception of some properties on Lower High St, Pinner Road and Aldenham Road. **Watford Borough Council should consider revising the boundary of AQMA3A to include these locations.**
- In AQMA5 there are no predicted exceedances of the 40 µg/m3 annual mean objective at any ground level or 1st floor height locations where there is relevant exposure. **Watford Borough Council may wish to consider revoking the boundary of AQMA5.**"

The Council will be reviewing these recommendations during 2017 and will also review its Action Plan to ensure that any changes are suitably reflected.

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 6 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 6 years with the air quality objective of 50µg/m^3, not to be exceeded more than 35 times per year.

The annual average has remained fairly constant in recent years and is well below the objective concentration. In addition there were no exceedences of the hourly mean objective in the period 2010 to 2016. There was one exceedence in 2016 which was well below the permitted 35 days.

3.2.3 Particulate Matter ($PM_{2.5}$)

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

It is not possible to make a meaningful comparisson against the national objective owing to a data capture of 18.85%.

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)
WF46	Watford Town Hall	Roadside	510540	196780	NO_2, $PM_{2.5}$, PM_{10}	N	Chemiluminescent, TEOM (oscillating microbalance) and FIDAS (Optical)	N/A	10m	1.5m

(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	Site Height (Metres)	Pollutants Monitored	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	Relevant Exposure?	Distance to kerb of nearest road	Does this location represent worst-case exposure?
WF02	Grove Pumping Station	B	508700	198950	2	NO_2	N	N	N	N/A	N
WF03	Hospital	K	510570	195800	2.4	NO_2	N	N	N	4m	Y
WF06	Woodside Playing Fields	B	510985	200710	3	NO_2	N	N	N	N/A	N
WF29	Pinner Road	K	511940	195320	2.1	NO_2	AQMA3A	N	Y – 6m	2m	Y
WF36	Ravenscroft	I	512240	199910	2.2	NO_2	N	N	Y – 8m	N/A	Y
WF37	358, St. Albans Road	K	510970	198535	2.4	NO_2	AQMA1	N	Y – 5m	1m	Y
WF38	A405 / Horseshoe Lane	K	511680	200700	3	NO_2	AQMA5	N	Y – 2m	4m	Y
WF39	Balmoral Road	K	511000	198270	2.4	NO_2	AQMA1	N	N	1m	Y
WF40	Salisbury Road	K	510930	198000	2.4	NO_2	AQMA1	N	N	2m	Y
WF41	Leavesden Road	K	510850	197780	2.5	NO_2	AQMA1	N	N	1m	Y
WF42	Queens Road	K	511160	197000	2.4	NO_2	N	N	Y – 4m	1m	Y
WF43	Farraline Road	K	510800	196020	2.4	NO_2	AQMA2	N	Y – 4m	2m	Y
WF44	Chalk Hill	K	511920	195450	2.1	NO_2	AQMA3A	N	Y – 6m	2m	Y
WF45	Wellington Road	K	510750	197230	2.3	NO_2	AQMA1	N	Y-10m	4m	Y

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Site Height (Metres)	Pollutants Monitored	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	Relevant Exposure?	Distance to kerb of nearest road	Does this location represent worst-case exposure?
WF46	Town Hall	R	510565	196800	2	NO_2	N	Y	N	6m	Y
WF47	Willow Lane	K	510335	195610	2.4	NO_2	N	N	Y - 3m	1m	Y
WF48	Lower High Street	K	511725	195619	2.4	NO_2	N	N	Y - 4m	1m	Y
WF49	Gammons Lane	K	510499	198454	2.4	NO_2	N	N	Y - 5m	1m	Y

Note: B = background; K = kerbside; I = intermediate; R = roadside.

(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.3 – Annual Mean NO_2 Monitoring Results

Site ID	Site Type	In AQMA?	Period of monitoring	Valid Data Capture 2016	Annual Mean Concentration μg/m^3						
					2010	2011	2012	2013	2014	2015	2016
Watford Town Hall	Roadside	N	Full year	98.26%	39	39	38	39	40	35	36

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

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

Results of Automatic Monitoring for NO_2: Comparison with 1-hour Mean Objective

Site ID	Site Type	In AQMA?	Period of monitoring	Valid Data Capture 2016	Number of Exceedences of hourly mean (200 µg/m3)						
					2010	2011	2012	2013	2014	2015	2016
Watford Town Hall	Roadside	N	Full year	**98.26%**	0	0	1	0	0	0	0

Notes: Exceedances of the NO_2 1-hour mean objective (200µg/m^3 not to be exceeded more than 18 times/year) are shown in **bold.**

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

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

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

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

Site ID	Site Type	Within AQMA?	Valid Data Capture 2016	Confirm Gravimetric Equivalent	Annual Mean Concentration μg/m^3						
					2010	2011	2012	2013	2014	2015	2016
Watford Town Hall	Roadside	N	99.18%	Y	24	25	22	24	21	22	14

Data capture was above 90% for all years

Table A.6 – Results of Automatic Monitoring for PM_{10}: Comparison with 24-hour mean Objective

Site ID	Site Type	Within AQMA?	Valid Data Capture 2016	Confirm Gravimetric Equivalent	Number of Exceedences of 24-Hour Mean (50 μg/m^3)						
					2010	2011	2012	2013	2014	2015	2016
Watford Town Hall	Roadside	N	99.18%	Y	7	20	13	7	6	5	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.

Data capture was above 90% in all years

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

Site ID	Site Type	Valid Data Capture 2016 (%) (1)	$PM_{2.5}$ Annual Mean Concentration (µg/m3) (2)					
			2011	2012	2013	2014	2015	2016
Watford Town Hall	Roadside	18.85%	-	-	-	-	10	14

(1) 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%).

(2) All means have been "annualised" as per Technical Guidance LAQM.TG16, valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Appendix B: Full Monthly Diffusion Tube Results for 2016

Table B.1 – NO_2 Monthly Diffusion Tube Results - 2016

Site ID	Site Type	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)
WF02	Grove Pumping Station Hempstead Road	25.6	26	24	22.3	Missing	16.4	12.6	14.1	17.6	22	28.5	33.9	24	18.7
WF03	Hospital Vicarage Road	51.8	52.3	44.5	48.8	37.3	36.3	Missing	27	42.4	49.3	53.2	57.3	45.4	35.5
WF06	Woodside Playing Fields	9.4 cap split	30.1	25.3	24.7	19	19.1	16	17.3	22.9	26.2	34.3	41.3	25.1	19.6
WF29	Pinner Road	70	70.1	68.5	70.1	58.1	52.3	52.4	51.9	62.3	65.2	65.9	73.4	63.4	49.4
WF36	Ravenscroft	34.1	40.3	26.4	31.2	31.4	27.7	22.9	26.1	34.6	38.9	40.8	45.9	33.6	26
WF37	o/S 358 St Albans Rd	53.3	60.6	52.9	48.2	45	40	31.4	30.6	45.2	55.4	54.4	64.1	48.7	38
WF38	A405 Horseshoe Lane	53.8	59.2	55.3	49.9	52.3	48.3	43.3	49.2	61.3	53.8	53.8	62	53.5	41.7

Site ID	Site Type	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)
WF 39	Balmoral Road	52.8	54.8	55.3	52.8	37.6	44.4	35	37.1	49.5	54.1	53.4	60.5	48.9	38.1
WF 40	Salisbury Road	50.1	48	48.5	45	39.3	43.4	29.6	30.7	44.3	51.5	63.1	67.6	46.8	36.5
WF 41	Leavesden Road	48.1	51.9	44.6	43.5	45.5	39.7	28.4	Missing	51.9	Missing	61	67.6	48.2	37.6
WF 42	Queens Road	44.1	47.4	40.8	44.4	34.4	34.7	28.4	28.9	37	46.8	50.2	Missing	39.7	31
WF 43	Farraline Road	64.7	65.6	64.4	64.1	56.6	52.7	54.6	44.3	60.7	67.7	82	84.1	63.5	49.5
WF 44	Chalk Hill	95.6	89.7	102.8	102.8	93.6	94.3	89.2	87.4	88.8	Missing	92.3	100.8	94.3	73.6
WF 45	Wellington Road	47.9	45.7	42.3	43.5	37.2	Missing	30.5	29.6	46.1	48	56.4	64.3	44.7	34.9
WF 46	Town Hall no 2 Colocation	45.4	47.8	41.7	42.9	39.7	29.4	29.4	32.7	39.7	Missing	41.5	56.3	40.6	31.7
WF 47	Willow Lane	29.8	46.6	42.3	Missing	Missing	36.7	30.1	29.6	40.4	46.1	44.1	47.8	39.4	30.7
WF 48	High Street	80.4	86	66.5	63.6	55.8	52.1	56.7	26.1	72	68.3	69	82.8	64.9	50.6
WF 49	Gammons Lane (o/s 67)	45.5	Missing	21.1	39	31.6	32.7	26	37.9	37.3	37.4	Missing	Missing	34.3	26.8

Site ID	Site Type	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)
WF 50	Eastbury Road (Oxhey Early Years)	NOT IN PLACE						37.8	Missing	Missing	58	132.8	64.2	73.2	57

(1) See Appendix C for details on bias adjustment

Table B.2 Results of Nitrogen Dioxide Diffusion Tubes (2010 to 2015)

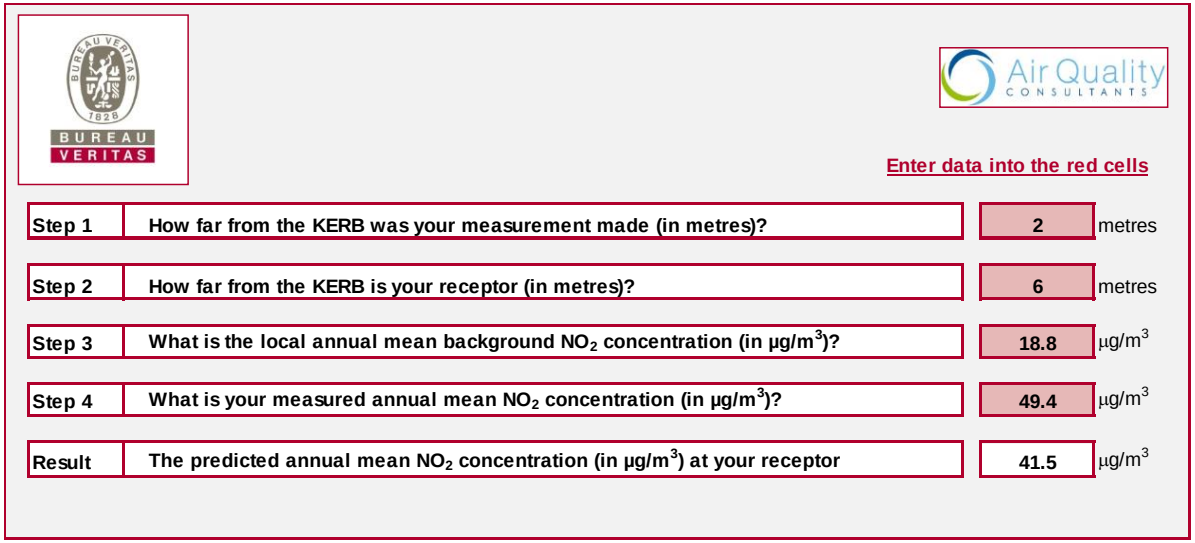
Site ID	Site Type	Within AQMA?	Annual mean concentration (adjusted for bias) µg/m^3						
			2010* (Bias Adjustment Factor = 0.86)	2011 (Bias Adjustment Factor = 0.83)	2012 (Bias Adjustment Factor = 0.79)	2013 (Bias Adjustment Factor = 0.80)	2014 (Bias Adjustment Factor = 0.81	2015 (Bias Adjustment Factor = 0.8)	2016 (Bias Adjustment Factor=0.78)
WF02	Grove Pumping Station	N	22	18	21	18	16	15.4	18.7
WF03	Hospital, Vicarage Road	N	44	38	38	36	33	34.8	35.5
WF06	Woodside Leisure Centre	N	27	22	25	21	20	18.9	19.6
WF29	Pinner Road	AQMA 3A	62	52	56	51	49	48.2	49.4
WF36	Ravenscroft	N	34	30	25	29	30	25.4	26
WF37	St Albans Road 2	AQMA 1	46	36	40	35	36	31.8	38

Site ID	Site Type	Within AQMA?	Annual mean concentration (adjusted for bias) µg/m^3						
			2010* (Bias Adjustment Factor = 0.86)	2011 (Bias Adjustment Factor = 0.83)	2012 (Bias Adjustment Factor = 0.79)	2013 (Bias Adjustment Factor = 0.80)	2014 (Bias Adjustment Factor = 0.81	2015 (Bias Adjustment Factor = 0.8)	2016 (Bias Adjustment Factor=0.78)
WF38	A405 Horseshoe Lane	AQMA 5	45	38	40	37	39	40.9	41.7
WF39	Balmoral Road	AQMA 1	51	45	(45)	43	37	36.3	38.1
WF40	Salisbury Road	AQMA 1	48	41	42	39	35	33.1	36.5
WF41	Leavesden Road	AQMA 1	40	33	36	36	36	32.2	37.6
WF42	Queens Road	N	39	33	(37)	34	32	31.7	31
WF43	Farraline Road	AQMA 2	58	48	55	49	46	44.8	49.5
WF44	Chalk Hill	AQMA 3A	91	83	(84)	84	80	70.7	73.6
WF45	Wellington Road	AQMA 1	42	36	40	35	33	31.6	34.9
WF46	Town Hall collocation	N	39	37	37	34	33	32.0	31.7
WF47	Willow Lane	N	n/a	n/a	35	35	32	29.6	30.7
WF48	Lower High Street	N	n/a	n/a	n/a	n/a	42	44.5	50.6
WF49	Gammons Lane (o/s 67)	N	-	-	-	-	-	-	26.8
WF50	Eastbury Road (Oxhey Early Years)	N	-	-	-	-	-	-	57

Note: Bias adjusted annual means in excess of the 40 µg/m^3 annual mean NO_2 objective are shaded grey.
Annual means > 60 µg/m^3 are underlined, indicating a potential exceedence of the NO_2 hourly mean objective
Figures in brackets are those for which data capture was below 75%

Distance adjustment calculations:

Pinner Road:



Enter data into the red cells

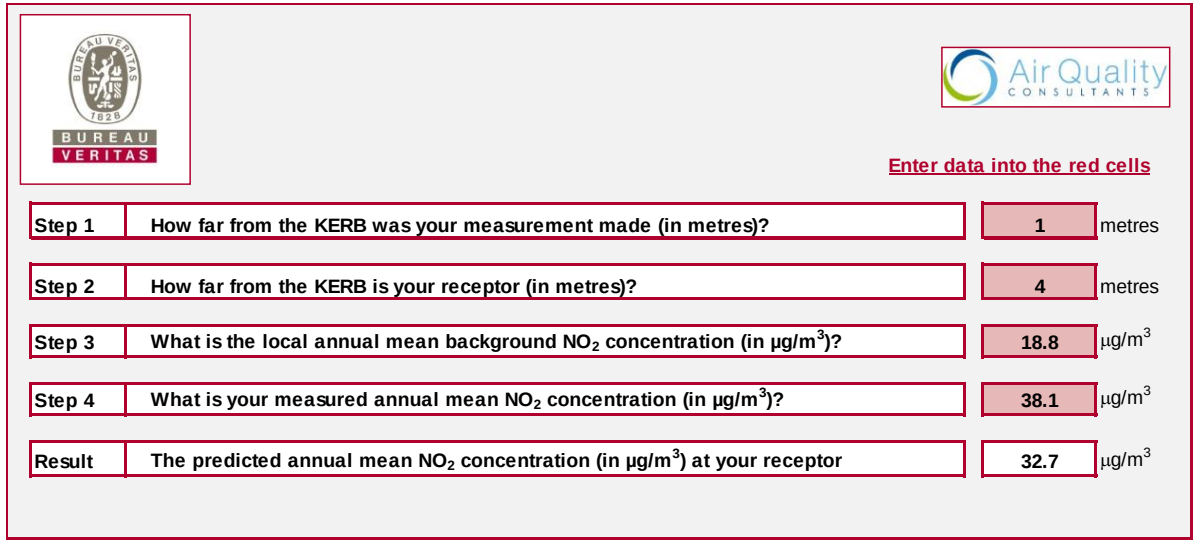
Step 1	How far from the KERB was your measurement made (in metres)?	2	metres
Step 2	How far from the KERB is your receptor (in metres)?	6	metres
Step 3	What is the local annual mean background NO_2 concentration (in $\mu g/m^3$)?	18.8	$\mu g/m^3$
Step 4	What is your measured annual mean NO_2 concentration (in $\mu g/m^3$)?	49.4	$\mu g/m^3$
Result	The predicted annual mean NO_2 concentration (in $\mu g/m^3$) at your receptor	41.5	$\mu g/m^3$

Outside 358 Saint Albans Road:

Enter data into the red cells

Step 1	How far from the KERB was your measurement made (in metres)?	1	metres
Step 2	How far from the KERB is your receptor (in metres)?	5	metres
Step 3	What is the local annual mean background NO_2 concentration (in µg/m^3)?	18.8	µg/m^3
Step 4	What is your measured annual mean NO_2 concentration (in µg/m^3)?	38	µg/m^3
Result	The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor	31.8	µg/m^3

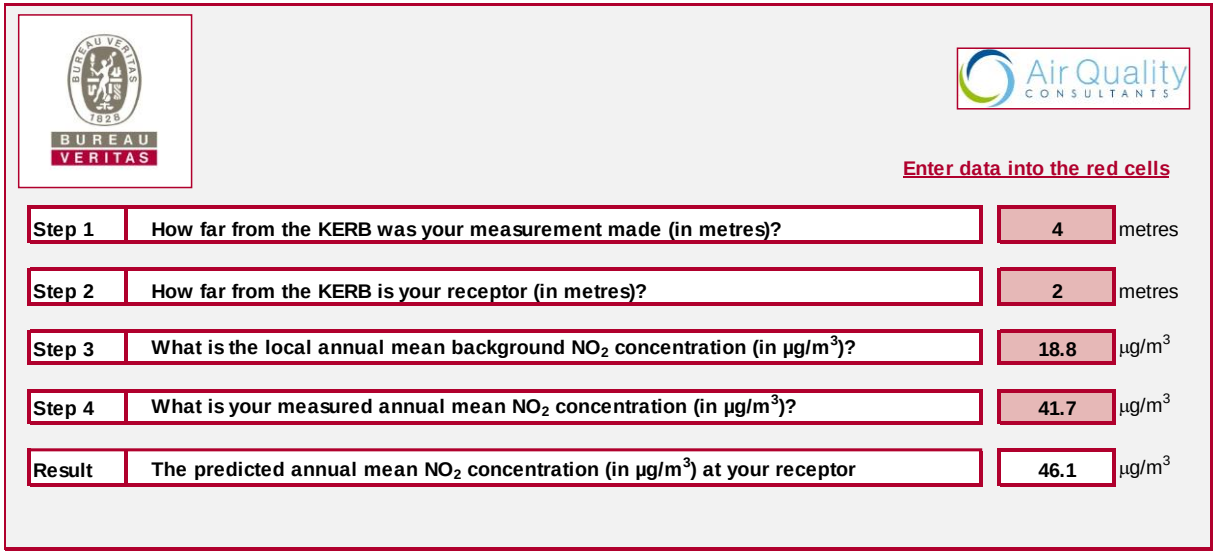
Balmoral Road:



Enter data into the red cells

Step 1	How far from the KERB was your measurement made (in metres)?	1	metres
Step 2	How far from the KERB is your receptor (in metres)?	4	metres
Step 3	What is the local annual mean background NO_2 concentration (in µg/m^3)?	18.8	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	32.7	µg/m^3

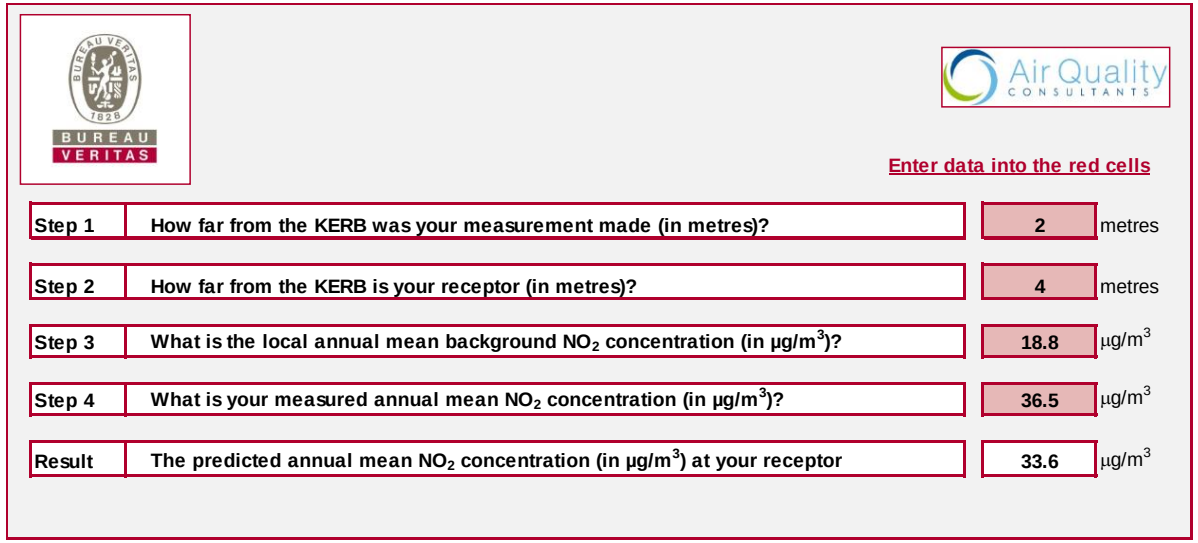
A405 Horseshoe Lane:



Enter data into the red 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)?	2	metres
Step 3	What is the local annual mean background NO_2 concentration (in µg/m^3)?	18.8	µg/m^3
Step 4	What is your measured annual mean NO_2 concentration (in µg/m^3)?	41.7	µg/m^3
Result	The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor	46.1	µg/m^3

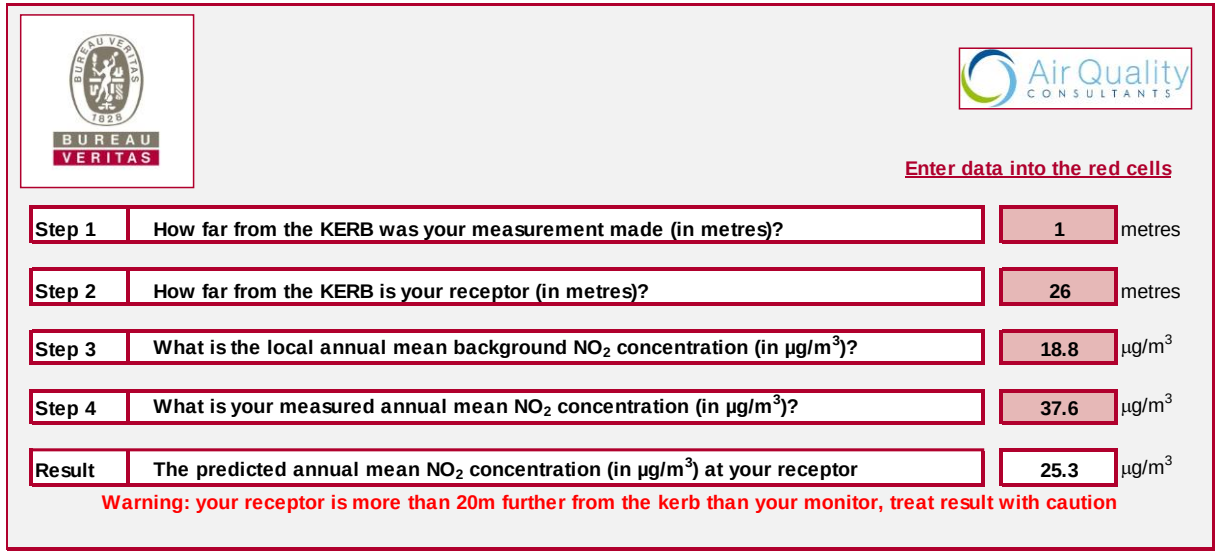
Salisbury Road:



Enter data into the red 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)?	4	metres
Step 3	What is the local annual mean background NO_2 concentration (in µg/m^3)?	18.8	µg/m^3
Step 4	What is your measured annual mean NO_2 concentration (in µg/m^3)?	36.5	µg/m^3
Result	The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor	33.6	µg/m^3

Leavesden Road:



Enter data into the red cells

Step 1	How far from the KERB was your measurement made (in metres)?	1	metres
Step 2	How far from the KERB is your receptor (in metres)?	26	metres
Step 3	What is the local annual mean background NO_2 concentration (in µg/m^3)?	18.8	µg/m^3
Step 4	What is your measured annual mean NO_2 concentration (in µg/m^3)?	37.6	µg/m^3
Result	The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor	25.3	µg/m^3

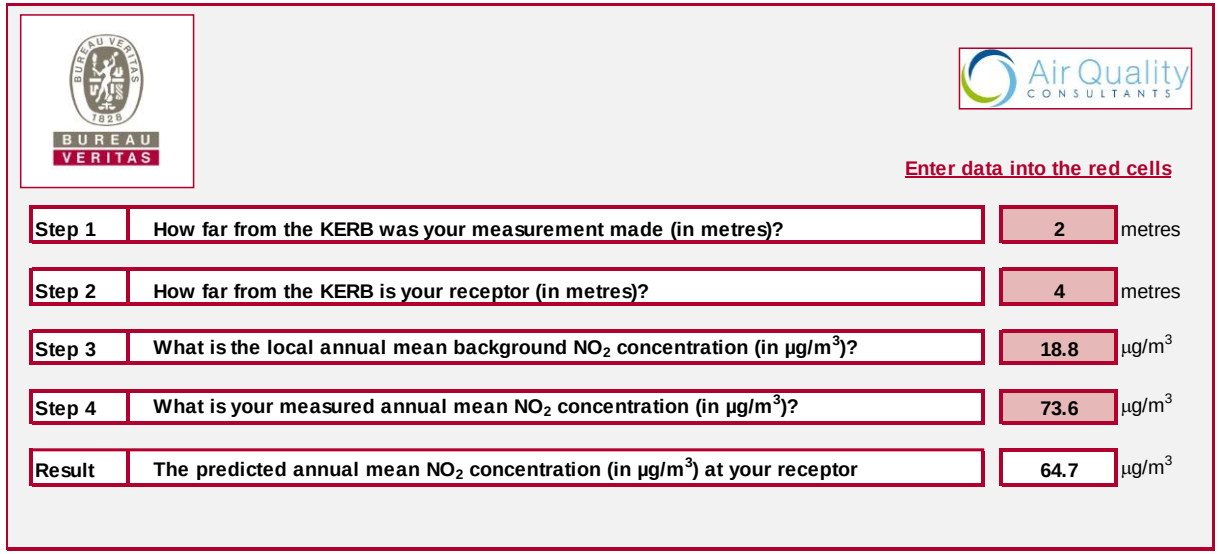
Warning: your receptor is more than 20m further from the kerb than your monitor, treat result with caution

Farraline Road:

Enter data into the red cells

Step 1	How far from the KERB was your measurement made (in metres)?	1	metres
Step 2	How far from the KERB is your receptor (in metres)?	4	metres
Step 3	What is the local annual mean background NO_2 concentration (in µg/m^3)?	18.8	µg/m^3
Step 4	What is your measured annual mean NO_2 concentration (in µg/m^3)?	49.5	µg/m^3
Result	The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor	40.9	µg/m^3

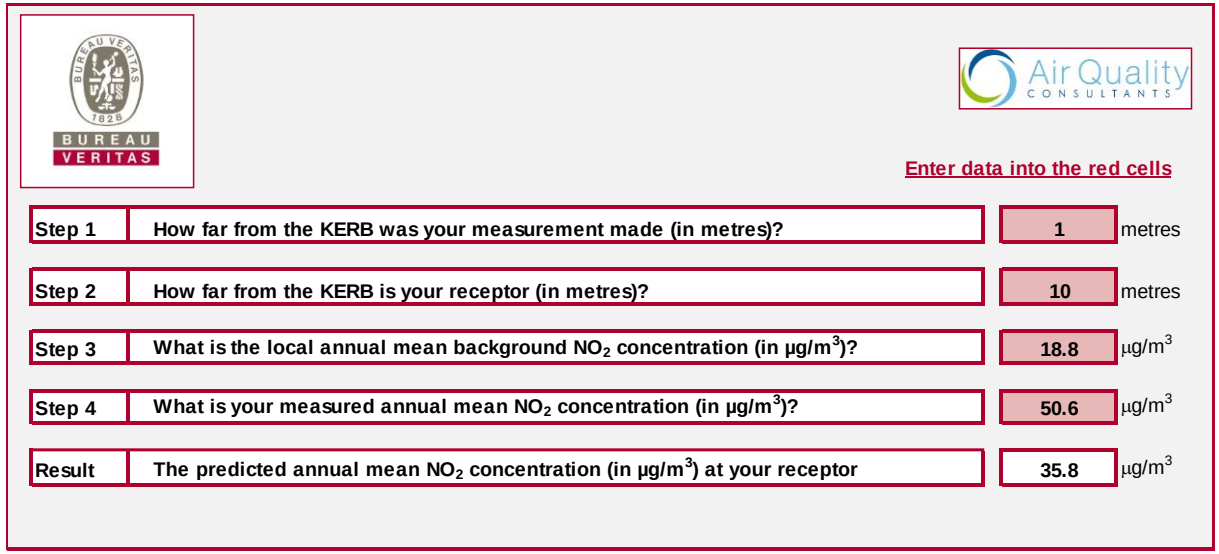
chalk Hill:



Enter data into the red 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)?	4	metres
Step 3	What is the local annual mean background NO_2 concentration (in $\mu g/m^3$)?	18.8	$\mu g/m^3$
Step 4	What is your measured annual mean NO_2 concentration (in $\mu g/m^3$)?	73.6	$\mu g/m^3$
Result	The predicted annual mean NO_2 concentration (in $\mu g/m^3$) at your receptor	64.7	$\mu g/m^3$

Lower High Street:



Enter data into the red cells

Step 1	How far from the KERB was your measurement made (in metres)?	1	metres
Step 2	How far from the KERB is your receptor (in metres)?	10	metres
Step 3	What is the local annual mean background NO_2 concentration (in $\mu g/m^3$)?	18.8	$\mu g/m^3$
Step 4	What is your measured annual mean NO_2 concentration (in $\mu g/m^3$)?	50.6	$\mu g/m^3$
Result	The predicted annual mean NO_2 concentration (in $\mu g/m^3$) at your receptor	35.8	$\mu g/m^3$

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

The following analysers have been in operation at Watford Town Hall:

1. API M200E chemiluminescent NOX analyser from Envirotechnology; and
2. Rupprecht & Patashnick TEOM analyser, gathering PM10 data.
3. In December 2015 a Fidas 200 system replaced the TEOM analyser and monitored PM_{10} and $PM_{2.5}$:

https://www.ecotech.com/wp-content/uploads/2015/03/Product-Brochure-Fidas-200.pdf

The monitoring station is classified as a Roadside monitoring site, and is situated approximately 10 metres from the kerb of Rickmansworth Road.

Until October 2011, data was collected via modem by the King's College London Environmental Research Group (ERG). Since October 2011, since has been collected by Air Quality Data Management (AQDM), where the data is also validated and reported. Ricardo Energy & Environment took over this role in October 2016. Real time data, as well as weekly month and annual reports are available from Herts & Beds Air Pollution Monitoring Network website;

http://www.airqualityengland.co.uk/local-authority/?la_id=408

Since December 2014 servicing and maintenance had been overseen by Envirotechnology. Periodic calibration of the equipment is overseen by Kings College London.

PM10 data collected using the TEOM instrument is converted by AQDM to reference equivalence using the volatile correction method (VCM).

Tubes are supplied and analysed by Environmental Scientifics Group (ESG) Didcot, formerly Harwell Scientific Services, a UKAS accredited laboratory. The tubes are prepared using 50% TEA (triethanolamine) in acetone.

The ESG laboratory participates in the field intercomparison scheme and the Workplace Analysis Scheme for Proficiency (WASP) programme, operated by the Health and Safety Laboratory (HSL). This compares results from diffusion tube monitoring and analysis with those from automatic monitoring. For the period presented, ESG / Harwell Scientific demonstrated 'good' performance in the WASP scheme for analysis of NO2 diffusion tubes. Results and bias corrections factors can be seen at:

http://laqm.defra.gov.uk/diffusion-tubes/diffusion-tubes.html

The bias correction factors used are shown in Table 2.3, and the national spread sheet can be found at:

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

"**Diffusion tube: bias adjustment:**
Analysed by: ESG Didcot
Tube preparation method: acetone:triethanolamine (50:50)
Year: 2016
Your bias adjustment figure is: **0.78**"

Appendix D: Map(s) of Monitoring Locations

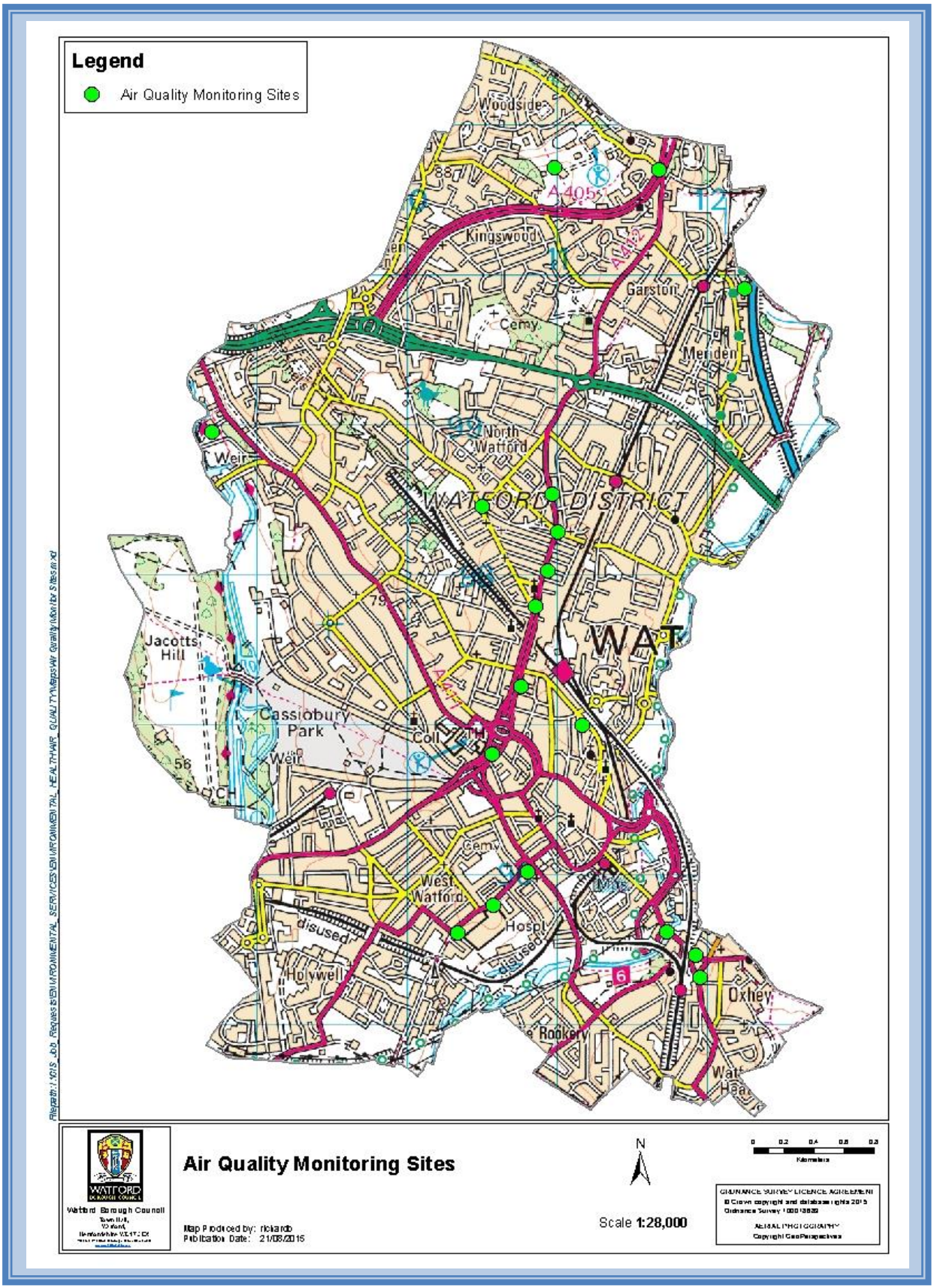


Figure 2 Approximate location of nitrogen dioxide diffusion tube monitoring sites

Details of Automatic Monitoring Sites

Site Name	OS Grid Ref	Pollutants Monitored	In AQMA?	Relevant Exposure?	Distance to kerb of nearest road	Worst-case Location?
Watford Town Hall	X 510540 Y 196780	NO_2, PM_{10}	N	N	10m	Y

Figure 3 Location of Watford Town Hall automatic monitoring station

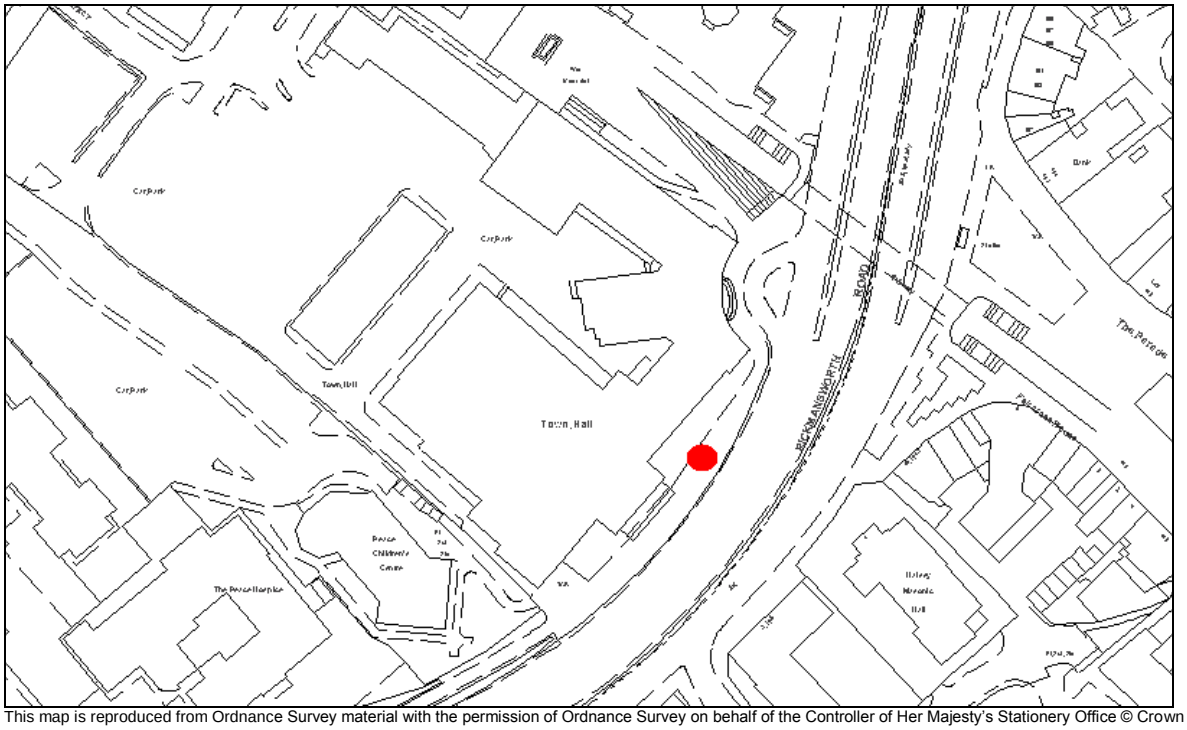


Figure 4: Photograph showing the automatic monitoring at Watford Town Hall.

Current Air Quality Management Areas:

Figures 5,6,7,8,9 Maps showing St. Albans Road Air Quality Management Area No.1

Figure 5:

Figure 6:


Legend
AQMA 2011
73.2m
LB
134
177
173
167
165
Hille House
132
130
126 to 128
124
Shelter
Hall
Elim
Church
ST ALBANS ROAD
El Sub Sta
Filling Station
Depot
155
Bedford Cottages
4a 3a 2a 1a
72.5m
112
114
153
151
149
20
12
4
2
1
11
Air Quality Management Area 1
St.Albans Road Map 2
Produced by Environmental Services, May 2011
Scale:1:750
at A4
N
Watford Borough Council

Figure 7:

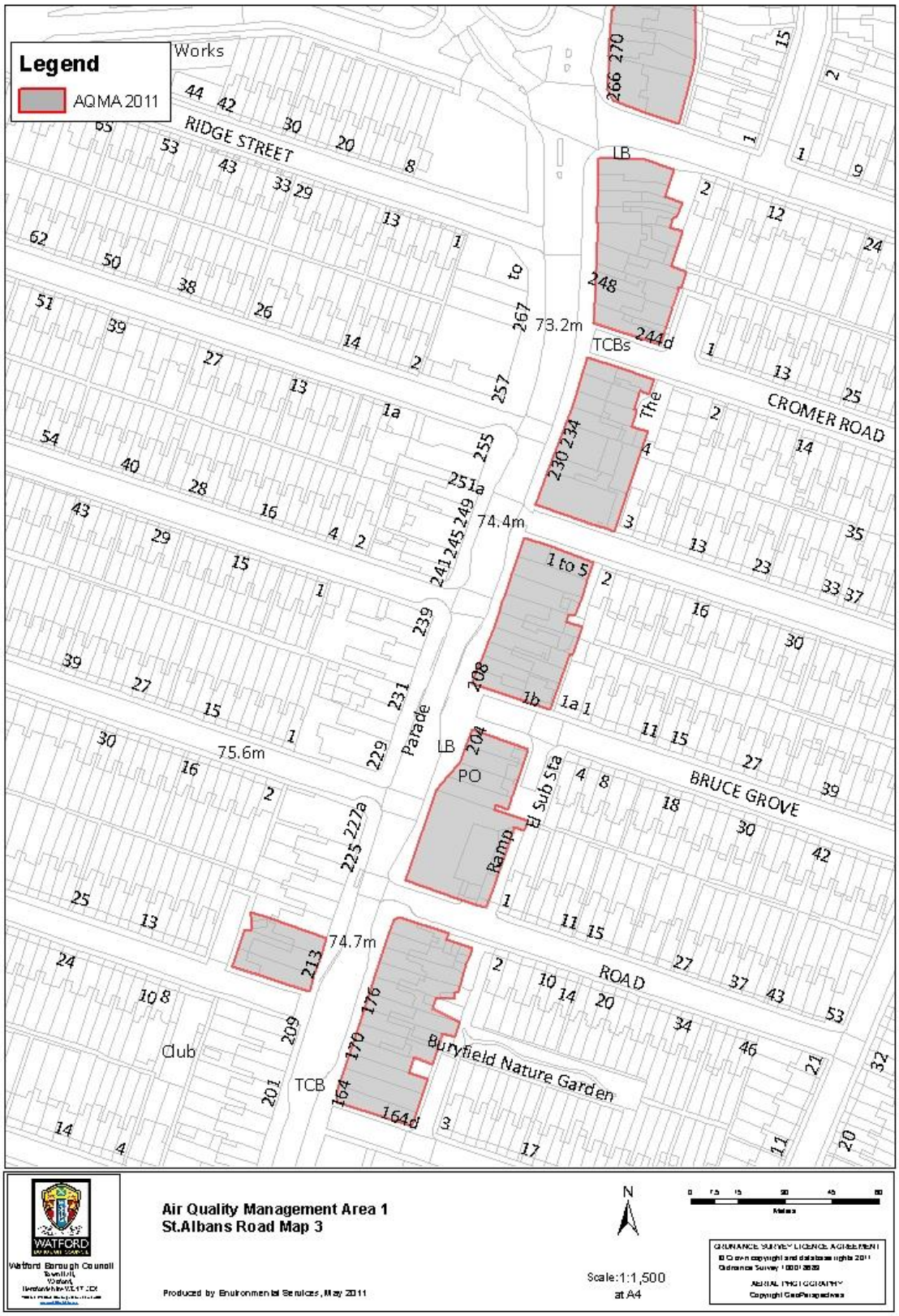

Legend
AQMA 2011
Works
RIDGE STREET
CROMER ROAD
BRUCE GROVE
ROAD
Parade
Ramp
PO
LB
TCBs
TCB
Club
73.2m
74.4m
75.6m
74.7m
Buryfield Nature Garden
Air Quality Management Area 1
St.Albans Road Map 3
Produced by Environmental Services, May 2011
Scale:1:1,500
at A4
N

Figure 8:

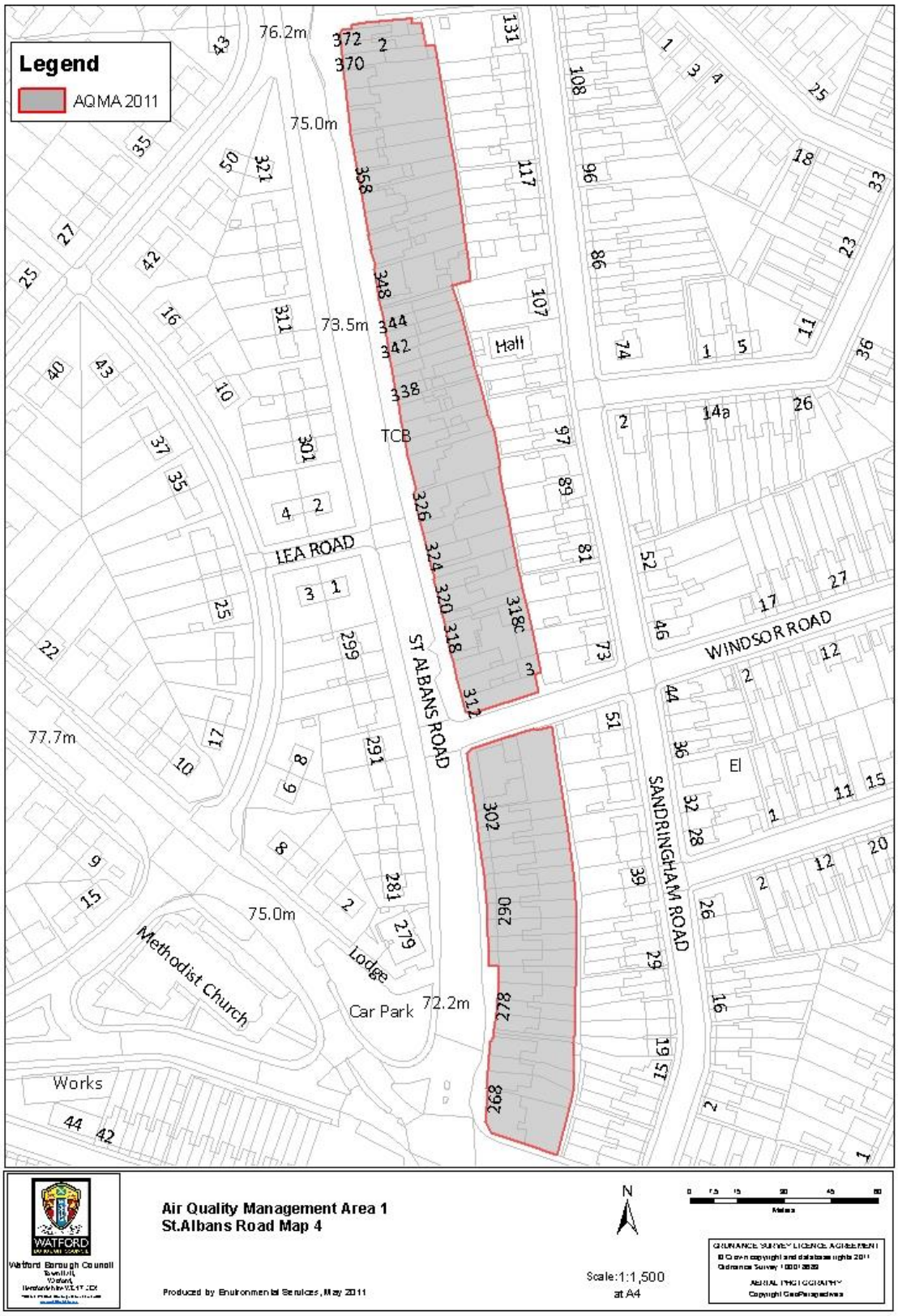
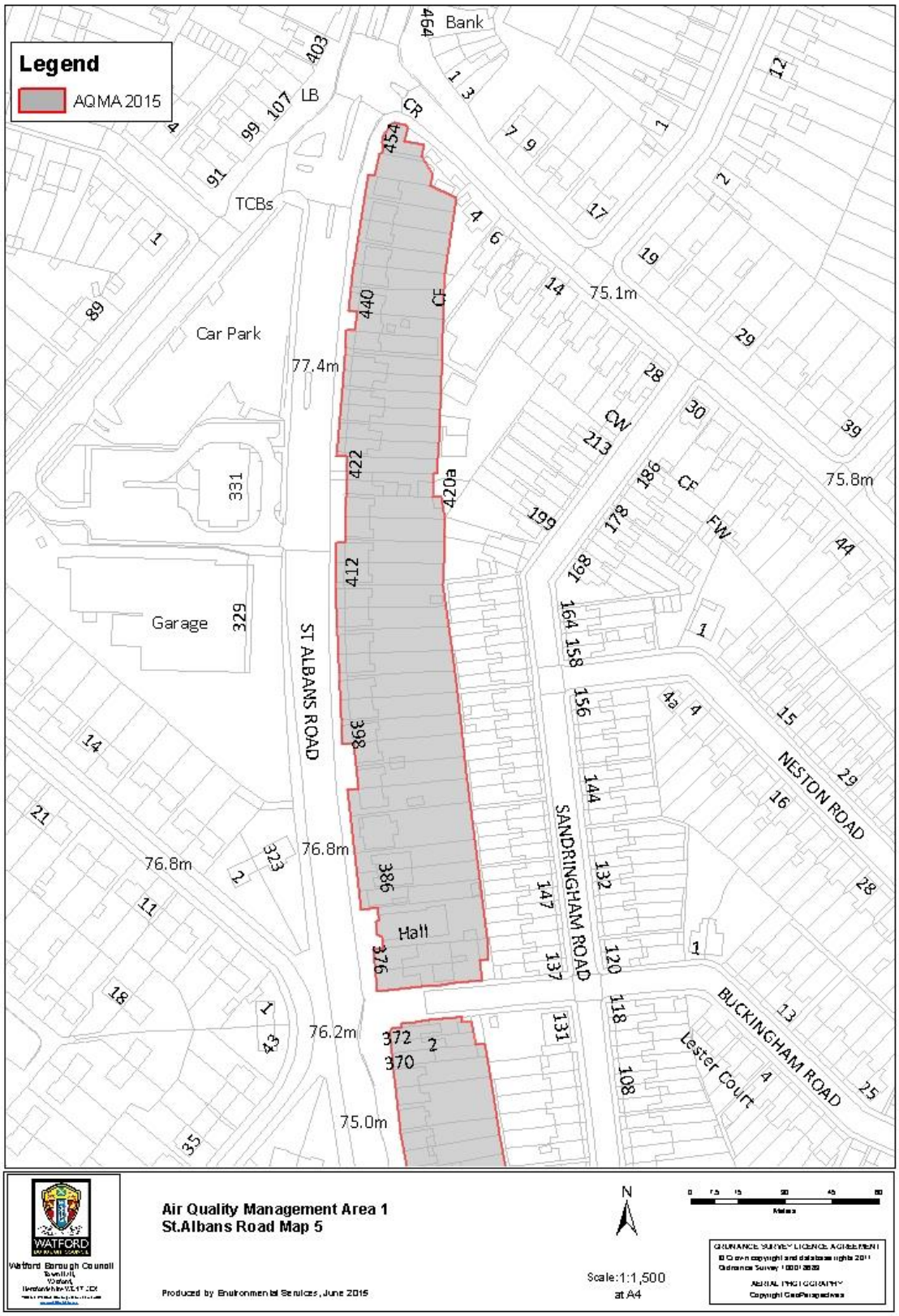

Legend
AQMA 2011
ST ALBANS ROAD
LEA ROAD
WINDSOR ROAD
SANDRINGHAM ROAD
Methodist Church
Lodge
Car Park
Works
Hall
TCB
76.2m
75.0m
73.5m
77.7m
72.2m
Air Quality Management Area 1
St.Albans Road Map 4
Produced by Environmental Services, May 2011
Scale:1:1,500
at A4
N

Figure 9:


Legend
AQMA 2015
Bank
TCBs
Car Park
Garage
Hall
ST ALBANS ROAD
SANDRINGHAM ROAD
NESTON ROAD
BUCKINGHAM ROAD
Lester Court
77.4m
76.8m
76.8m
76.2m
75.0m
75.1m
75.8m
Air Quality Management Area 1
St.Albans Road Map 5
Produced by Environmental Services, June 2015
Scale:1:1,500
at A4
Watford Borough Council

Figures 10 and 11: Maps showing Vicarage Road / Hornet Air Quality Management Area No.2

Figure 10:

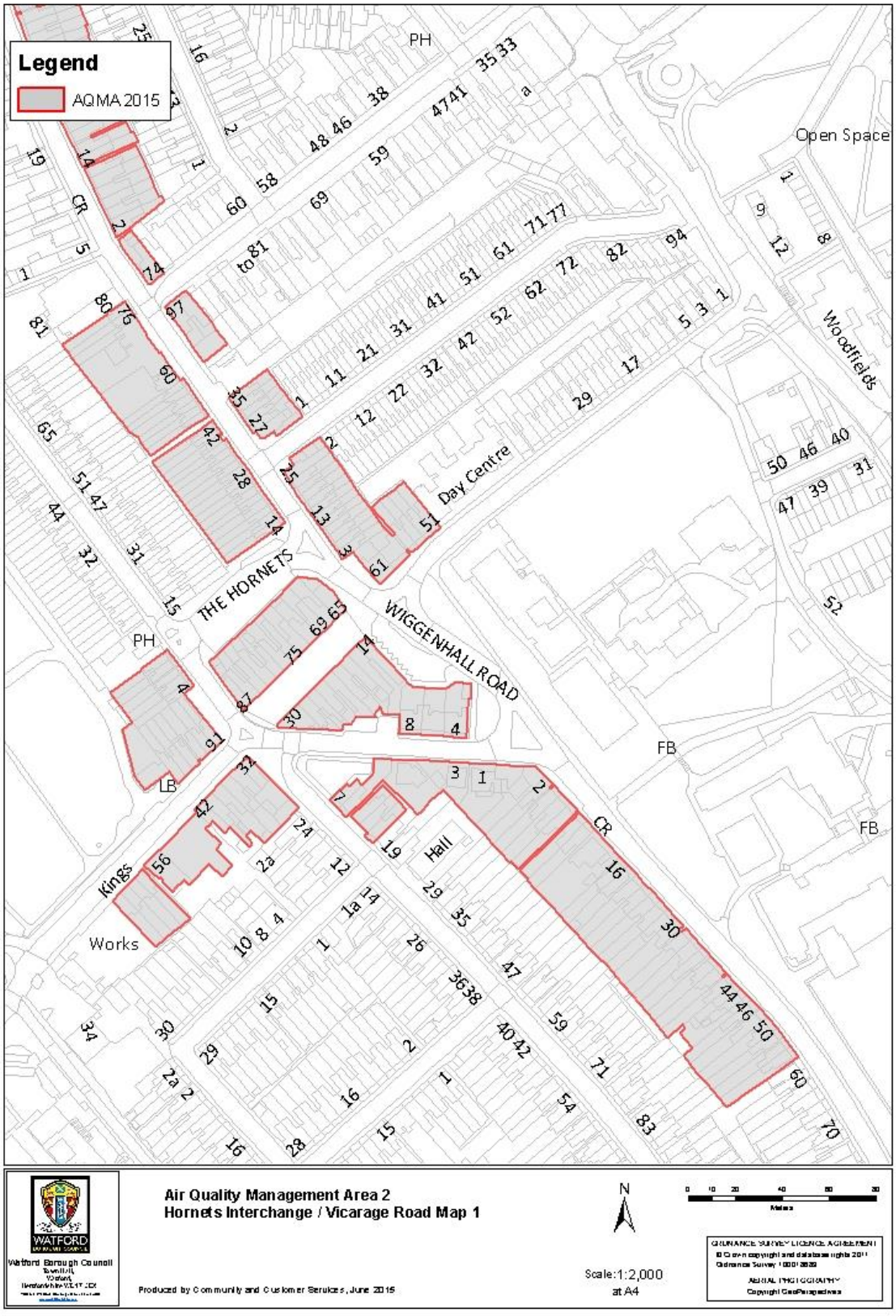


Figure 11:

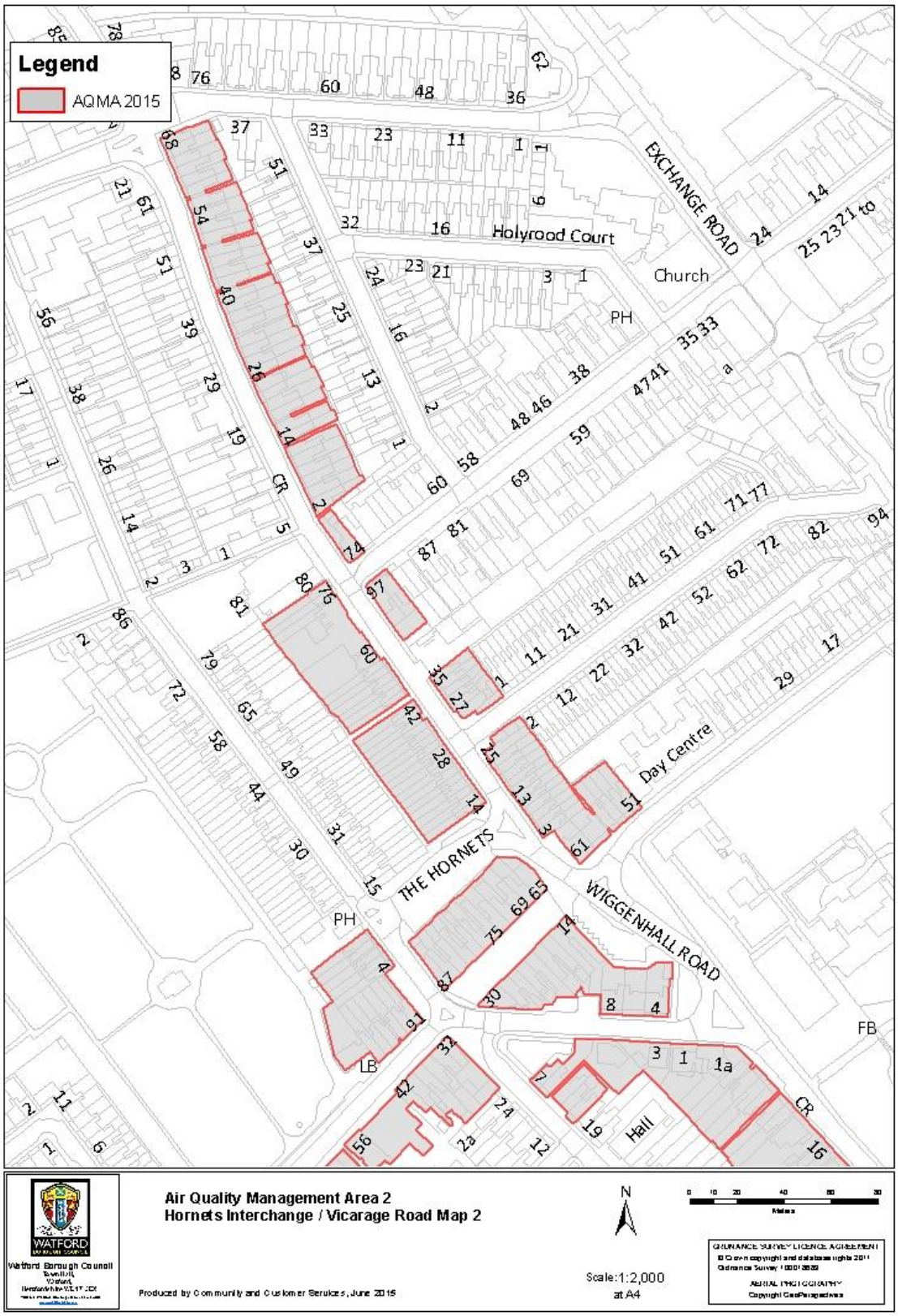

Legend
AQMA 2015
EXCHANGE ROAD
Holyrood Court
Church
PH
CR
Day Centre
THE HORNETS
WIGGENHALL ROAD
PH
LB
FB
Hall
Air Quality Management Area 2
Hornets Interchange / Vicarage Road Map 2
Watford Borough Council
Produced by Community and Customer Services, June 2015
N
Scale:1:2,000
at A4

Figure 12: Map showing Chalk Hill / Pinner Road Air Quality Management Area No.3A

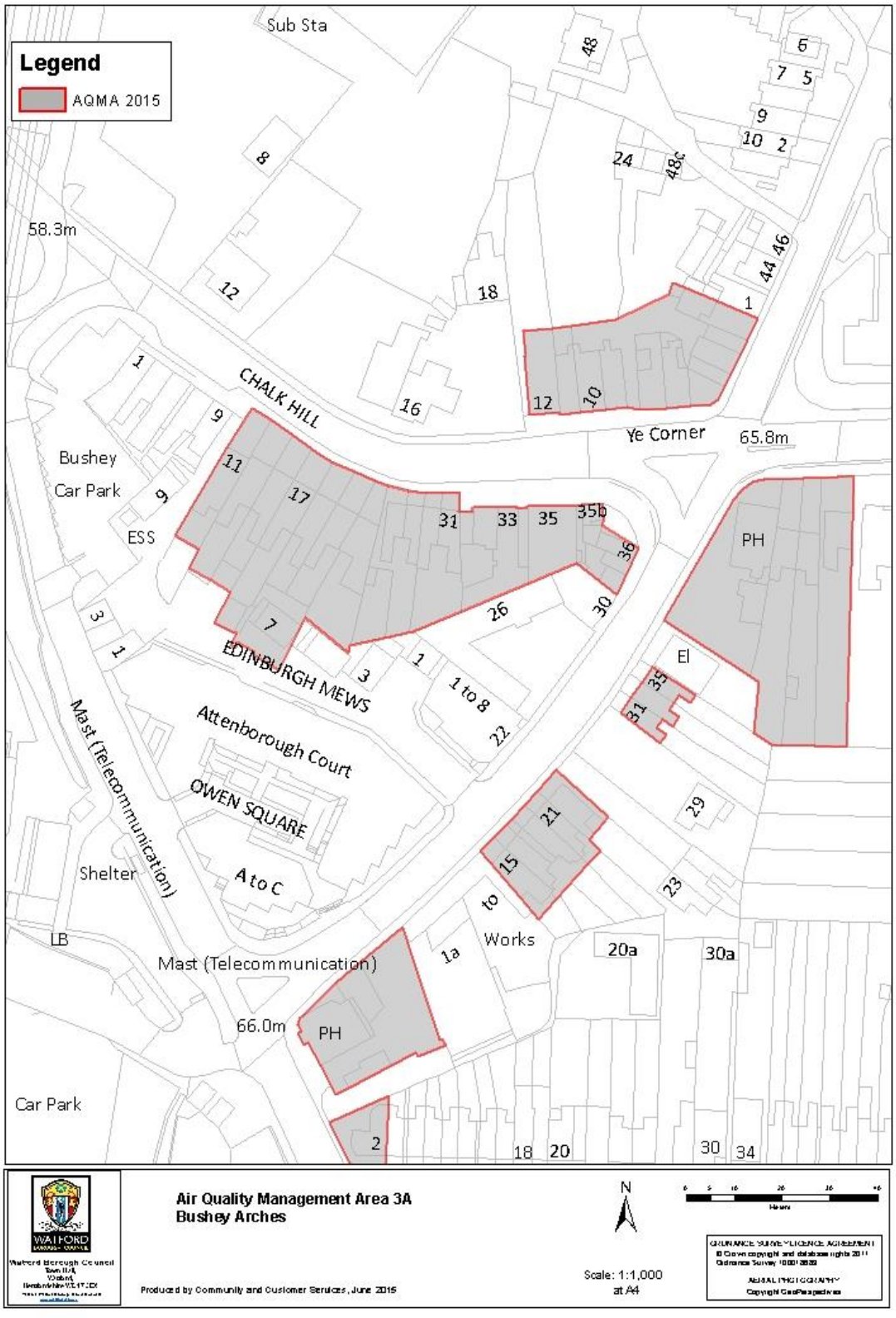
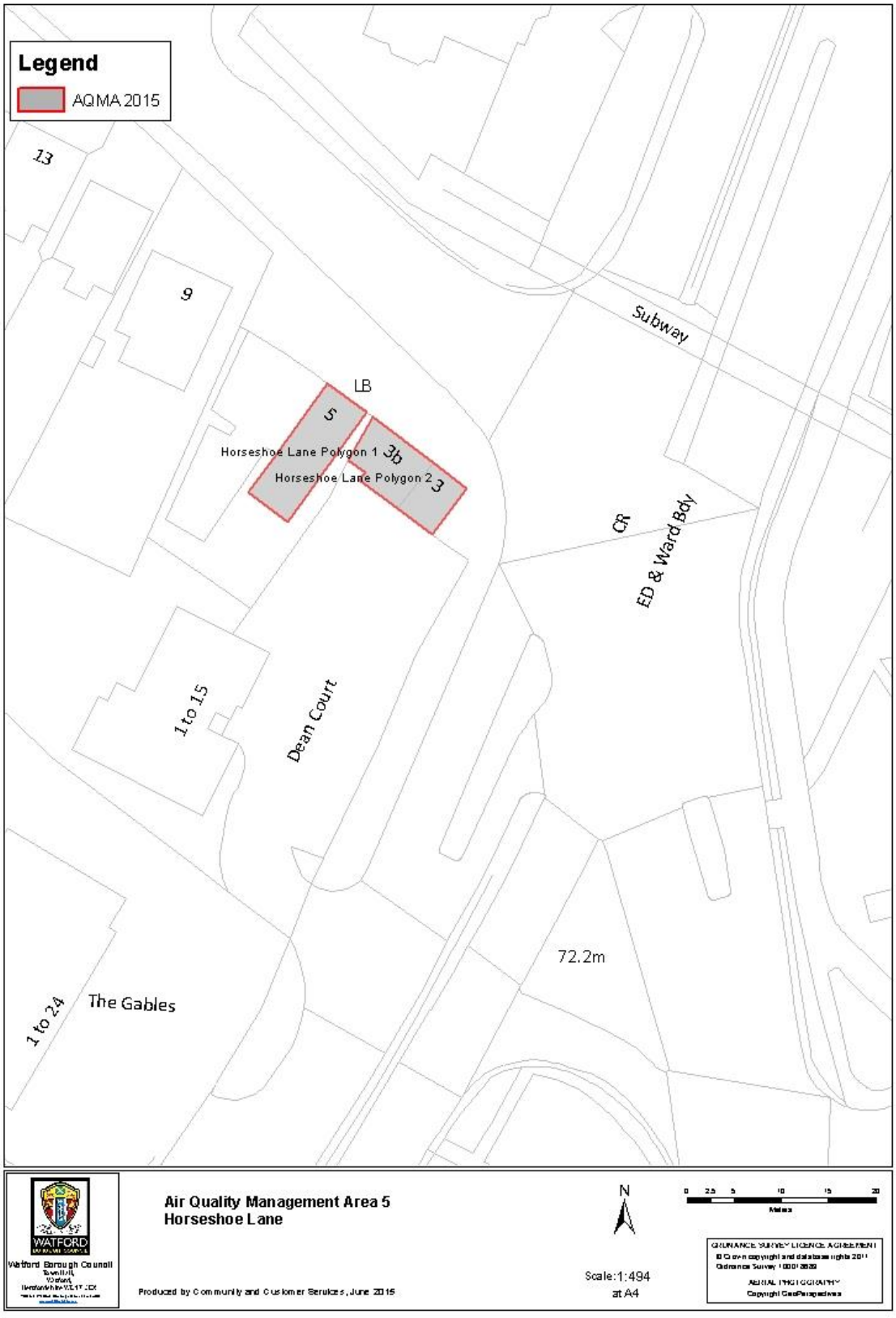


Figure 13: Map showing Horseshoe Lane / A405 Air Quality Management Area No.5



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

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

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