



2016 Air Quality Annual Status Report (ASR)

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

June 2016

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Executive Summary: Air Quality in Our Area

Air Quality in Breckland Council

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.

The Breckland area is predominantly rural with five market towns. There is no heavy industry. There are two major roads, the A11 which runs through the district to the south east, and the A47 which runs through the northern half of the district. These roads now bypass the market towns and reduce the volume of traffic in more populated areas. Breckland has two air quality monitoring stations, one in Swaffham measuring nitrogen dioxide (NO₂) only, and one near Thetford measuring NO₂, fine particles (PM10) and Ozone (O₃). There is a network of NO₂ diffusion tubes which covers all the towns and any areas about which the public tell us they are concerned

Generally the air quality across the district is good but there is one area of Swaffham of particular concern. The A1065 runs through the centre of the town and is the main through route for both local traffic and for traffic travelling to North Norfolk. The layout of the town leads to frequent traffic congestion and this leads to elevated concentrations of NO₂. Over the past few years these concentrations have hovered around the Annual Objective of 40ug/m³. Previous AQ reports with full details of all monitoring and results can be found on the Council website

<https://www.breckland.gov.uk/article/2242/Air-Pollution>

The Council has been working with our partners at Norfolk County Council (NCC) to assess measures to improve air quality in the town.

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

Actions to Improve Air Quality

Working with our NCC partners we have been looking at ways to improve traffic flow in the town. Very simply, reducing congestion will to some extent reduce emissions and improve air quality. With a view to this, the traffic lights in central Swaffham were re-phased in 2014 but this was not noticeably effective. After further discussions, Breckland Council commissioned a report from NCC to assess the feasibility of changing the road layout to improve traffic flow. Modelling of the various options predicted a reduction in all oxides of nitrogen (NO_x) of up to 25%. This is not the same as NO₂. Reduction in NO₂ would be significantly less than this but may still be sufficient to avoid further exceedences of the Annual Objective. These options would incur significant cost and require further detailed work to fully assess whether implementation is possible.

Local Priorities and Challenges

We are currently undertaking a Detailed Assessment of air quality for a specific area of Swaffham and will submit this in the coming year. This will consider the above report and the most recent monitoring results and a decision will be made as to whether an Air Quality Management Area (AQMA) will be required. Future action to improve the air quality may be challenging in the current economic climate.

How to Get Involved

Find out more about your local air quality by

- Contacting the Air Quality officer at Breckland (details at the beginning of this report) or email envprotect@breckland.gov.uk.
- Contact your local councillor with any concerns
<http://democracy.breckland.gov.uk/mgMemberIndex.aspx?FN=ALPHA&VW=L IST&PIC=0>
- Consider how and when you use your car, especially at peak times. Consider using public transport where possible for trips into towns and walking or cycling for a non-polluting and healthy alternative.

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1 Local Air Quality Management

This report provides an overview of air quality in Breckland Council during 2015. 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 Breckland 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.

Breckland Council currently does not have any AQMAs. There is no Air Quality Strategy currently in place.

We are considering whether a new AQMA is required in Swaffham (see monitoring section).

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

Breckland Council has taken forward a number of measures during the current reporting year of 2015 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.1. These are most notably -

- Working with Norfolk County Council to consider how to improve traffic flow and reduce static vehicle emissions – already we have looked at the following measures -
- Re-phasing of traffic lights (no observable effect)
- Commissioning of road layout study (included in DA. May achieve reductions but there are cost implications)

Breckland Council's priorities for the coming year are to carefully consider the findings of the Detailed Assessment for Swaffham and determine the most appropriate course of action, which may include the declaration of an Air Quality Management Area.

Table 2.1 – Progress on Measures to Improve Air Quality

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
1	Feasibility Study	Traffic Management	UTC, Congestion management, traffic reduction	Breckland Council	April 2015	September 2015	N/A	N/A	Study Completed	Date	Using findings of study in Detailed Assessment
2	Item in Local Plan	Policy Guidance and Development Control	Other policy	Breckland	2016	2016	N/A	N/A	In consultation	2016/7	Currently in the draft Local Plan under consultation. Will allow air quality to be a "material consideration"

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) as practicable. In doing so they are not required to carry out any additional local review and assessment (including monitoring) but make use of national monitoring.

There is clear evidence that PM_{2.5} has a significant impact on human health, including premature mortality, allergic reactions, and cardiovascular diseases.

Breckland Council is taking the following measures to address PM_{2.5}:

We do not have the facility to measure PM_{2.5} which is a fraction of the PM₁₀ which we do measure. We have not had above the permitted number of exceedences for PM₁₀ for several years. However we will follow guidance on all measures that would be appropriate to reducing exposure to PM_{2.5} although this is largely out of local control. We will consult with Norwich City Council which monitors PM_{2.5} at one site, and Public Health colleagues and be advised by them, and national guidance, on any relevant measures that will reduce exposure. The Local Plan will address PM_{2.5} reduction indirectly

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.

Breckland Council undertook automatic (continuous) monitoring at 2 sites during 2015 Table A.1 in Appendix A shows the details of the sites. 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.

National monitoring results are available at <http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html>

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

Breckland Council undertook non- automatic (passive) monitoring of NO₂ at 28 sites during 2015. Table A.2 in Appendix A shows the details of the sites.

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

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 (NO₂)

Breckland has a network of diffusion tubes that cover the 5 towns and some additional areas that are of interest to concerned members of the public or to validate modelling. Since October 2015 we have used tube id number 30 for a road in East Harling where residents are concerned over the numbers of HGV traffic. This is primarily due to safety issues but also some concern over air quality. We are not seeing any reason for concern with respect to air quality/

Tube id number D3 has been omitted in 2015 because it is not used for NO₂ arising from traffic but from biomass combustion. A 9MW biomass boiler was installed at a private residence and screening initially indicated a possible exceedence of NO₂. Changes were made to the stack height and this was screened out. The owner has kindly allowed us to use the site to validate the modelling. However measurement shows no reason for concern, with results being similar or less than tube 20, but we will continue for 12 months to see if there is any seasonal change.

There is only one site where the annual objective for NO₂ is exceeded. This is in Swaffham as mentioned above. There are two sites in the town where NO₂ concentrations are at or near the annual objective. This is due to traffic and the layout of the town. Some lengths of the road form a “street canyon” where emissions are

unable to disperse quickly, or a narrow point where traffic queues. These areas are to the north of the traffic lights in the centre of the town (tube S8) and to the south of the market place where the road narrows on London Road (tube S2). All the locations have relevant receptors, meaning that the public can be exposed for the time that the objective is exceeded by (we only have exceedences of the annual objective in 2015).

There is no AQMA at time of writing but we await the completion of the DA which will indicate whether we should declare and to what extent an AQMA would extend.

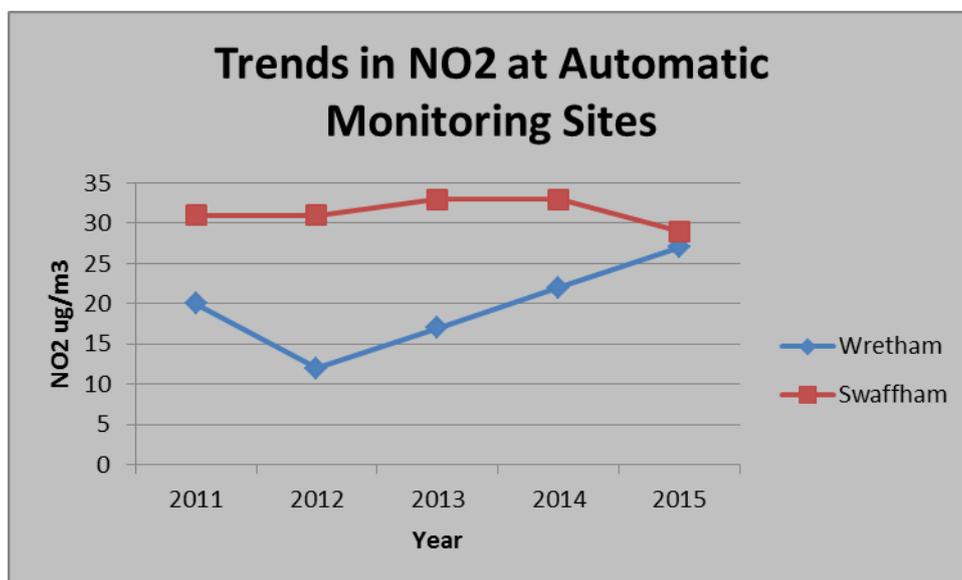


Figure 1 Trends in NO₂ at Automatic Monitoring Sites

This chart shows trends in NO₂ at the automatic monitoring sites in Wretham and Swaffham. Caution should be exercised when interpreting these trends. The upward trend for Wretham is most likely explained by the fact that the instrument contains a source of NO₂ that it uses for internal calibration. It has become apparent that this has been leaking slightly over a long period and causing elevated readings which are higher than actual ambient concentrations. The source has now been removed and we should see a downward trend in 2016. In Swaffham the instrument is used to correct the diffusion tubes in the area and while there is an apparent decrease in NO₂ concentration at this site in 2015 this is likely to be due to factors such as weather. For example, in the last 3 months of 2015 the weather was unusually wet, warm and windy. The warm meant that many people had less heating; the wet and windy

conditions meant that traffic emissions were dispersed far more quickly than in the same months in previous years. This reduced the overall annual concentrations and we see that the annual objective was not exceeded in 2015.

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 2015 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. It is shown that the hourly exceedence has not been breached in 2015.

3.2.2 Particulate Matter (PM₁₀)

Table A.5 in Appendix A compares the ratified and adjusted monitored PM₁₀ annual mean concentrations for the past 5 years with the air quality objective of 40µg/m³. It is shown that we do not exceed this annual objective.

Table A.6 in Appendix A compares the ratified continuous monitored PM₁₀ daily mean concentrations for the past 5 years with the air quality objective of 50µg/m³, not to be exceeded more than 35 times per year. It is shown that there were only two such exceedences at E Wretham in 2015.

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)
W1	East Wretham	Urban background	591315	288704	NO ₂ ; PM ₁₀	N	NOx Chemiluminescence PM10 TEOM light-scattering photometer (nephelometer)	0	10	2.5
S 3	Swaffham	Roadside	582093	308469	NO ₂	N	Chemiluminescent	0	2	1.5

(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)
A1	Attleborough	Urban centre	604550	295125	NO ₂	N	4	6	N	2
A2	Attleborough	Urban b'ground	603843	294085	NO ₂	N	2	7	N	2
D1	Dereham	Urban centre	598920	313267	NO ₂	N	1	2	N	2
D2	Dereham	Urban centre	599283	313599	NO ₂	N	2	8	N	2
S1	Swaffham	Urban centre	581986	309031	NO ₂	N	1	5	N	2.5
S2	Swaffham	Urban Centre	582008	308764	NO ₂	N	1.5	3	N	2
S3/S3a/S3b collocated	Swaffham	Urban roadside Colocation	582182	308434	NO ₂	N	3	4	Y	2
S4	Swaffham	Urban roadside	582058	308625	NO ₂	N	2	4	N	2

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)
S5	Swaffham	Urban roadside	582075	308496	NO ₂	N	3	7	N	2
S6	Swaffham	Urban roadside	582048	308609	NO ₂	N	3	5	N	2
S7	Swaffham	Urban roadside	581999	309099	NO ₂	N	3	7	N	2
S8	Swaffham	Urban roadside	581979	309162	NO ₂	N	3	5	N	2
S9	Swaffham	Urban roadside	581959	309057	NO ₂	N	3	4	N	2
S10	Swaffham	Urban roadside	5820670	309058	NO ₂	N	3	3	N	2
S11	Swaffham	Urban roadside	581990	309145	NO ₂	N	3	3	N	2
S12	Swaffham	Urban roadside	581986	309213	NO ₂	N	3	3	N	2
S13	Swaffham	Urban roadside	581978	309312	NO ₂	N	3	3	N	1
S14	Swaffham	Urban roadside	582082	3098566	NO ₂	N	3	3	N	2
T1	Thetford	Urban Roadside	587126	283336	NO ₂	N	3	3	N	2

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)
T2	Thetford	Urban Roadside	586846	282721	NO ₂	N	3	3	N	2
T3	Thetford	Suburban b'ground	587036	284579	NO ₂	N	3	101	N	2
W1	Watton	Urban centre	591747	300796	NO ₂	N	2.5	2.5	N	2
W2	Watton	Urban b'ground	591885	300622	NO ₂	N	2	2	N	2
20/20a/20 b Colocated	Wretham SSSI	Rural Co-location	591315	288704	NO ₂	Y	Y	55	Y	3
30	East Harling	Rural	599403	286353	NO ₂	N	0	2.5	N	2

(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 2015 (%) ⁽²⁾	NO ₂ Annual Mean Concentration (µg/m ³) ⁽³⁾				
					2011	2012	2013	2014	2015
20	Rural Background	Automatic	99	100	20	12	17	22	27
S3	Roadside	Automatic	97.5	100	31	31	33	33	29
S3	Roadside	Diffusion Tube	100	100	40.41	38.75	41.63	40.36	37.68

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

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

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

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

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

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 2015 (%) ⁽²⁾	NO ₂ 1-Hour Means > 200µg/m ³ ⁽³⁾				
					2011	2012	2013	2014	2015
S3	Roadside	Automatic	97.5	100	1	1	0	0	0
20	Rural Background	Automatic	99	100	18	0	0	0	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.

Table A.5 – Annual Mean PM₁₀ Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2015 (%) ⁽²⁾	PM ₁₀ Annual Mean Concentration (µg/m ³) ⁽³⁾				
				2011	2012	2013	2014	2015
20	Rural background	98.2	100	23	17	19	18	16

Notes: Exceedances of the PM₁₀ annual mean objective of 40µg/m³ are shown in **bold**.

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

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

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

Table A.6 – 24-Hour Mean PM₁₀ Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2015 (%) ⁽²⁾	PM ₁₀ 24-Hour Means > 50µg/m ³ ⁽³⁾				
				2011	2012	2013	2014	2015
20	Rural Background	98.2	100	16	3	9	7	2

Notes: Exceedances of the PM₁₀ 24-hour mean objective (50µg/m³ 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.

Table A.7 – PM_{2.5} Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2015 (%) ⁽²⁾	PM _{2.5} Annual Mean Concentration (µg/m ³) ⁽³⁾				
				2011	2012	2013	2014	2015

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

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

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

Breckland Council does not measure PM_{2.5}

Table A.8 – SO₂ Monitoring Results

Site ID	Site Type	Valid Data Capture for monitoring Period (%) ⁽¹⁾	Valid Data Capture 2014 (%) ⁽²⁾	Number of Exceedances (percentile in bracket) ⁽³⁾		
				15-minute Objective (266 µg/m ³)	1-hour Objective (350 µg/m ³)	24-hour Objective (125 µg/m ³)

Notes: Exceedances of the SO₂ objectives are shown in **bold** (15-min mean = 35 allowed a year, 1-hour mean = 24 allowed a year, 24-hour mean = 3 allowed a year)

(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 relevant percentiles are provided in brackets.

Breckland Council does not measure SO₂

Appendix B: Full Monthly Diffusion Tube Results for 2015

Table B.1 – NO₂ Monthly Diffusion Tube Results - 2015

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 ⁽¹⁾	
	A1	29.82	40.61	29.20	24.30	24.26	23.50	22.85	24.02	25.57	34.43	22.91			25.85
A2	12.39	17.23	12.82	10.04	8.79	7.37	7.54	8.32	9.31	12.68	13.64	11.50	10.97	10.86	
D1	31.99	41.47	32.06	30.37		28.25	30.81	34.42	36.03	40.40	37.08	33.35	34.20	33.86	
D2		37.46	24.88	25.12	32.05	26.14	24.25	25.59	27.82	26.98	27.95	30.44	28.06	27.78	
S1	24.05	26.91	24.69	21.66	20.84	21.51	20.18	23.28	23.1	29.79	20.33	17.71	22.84	22.61	
S2	38.87	53.37	42.92	28.21	38.87	31.58	34.89	37.44	33.52	41.85	34.21	36.07	37.65	37.27	
S3	20.68	34.88	30.35	36.00	24.64	23.52	26.94	33.98	29.29	36.84	26.07	26.96	29.18	28.89	
S3a	25.96	33.82	33.56	31.00	24.62	25.20	30.99	33.84	30.61	37.01	24.96	25.75	29.78	29.48	
S3b	24.49	33.32	33.62	26.49	25.58	25.20	26.13	37.02	30.95	36.50	23.97	27.94	29.27	28.97	
S4	26.40	29.51	29.80	28.80	22.62	22.15	20.58	28.45	26.68	36.49	15.22	19.28	25.50	25.24	
S5	28.03	32.57	30.62	23.32	21.37	23.61	23.55	25.43	27.77	35.55	23.24	19.01	26.17	25.91	
S6	30.80	40.08	32.59	26.55	30.03	26.32	29.73	32.89	27.98	43.08	26.37	30.92	31.45	31.13	
S7	32.25	36.65	34.39	31.18	29.47	29.09	32.74	42.75	38.73	50.65	28.91	35.40	35.18	34.83	
S8	39.85	44.71	36.93	36.83	35.36	34.39	38.94	47.66	34.49		31.08	38.40	38.06	37.68	

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 ⁽¹⁾	
	S9	28.16	30.94	28.03	27.55	23.34	22.66	26.38	25.29	29.74	35.63	23			19.19
S10	25.78	32.92	25.74	21.53	22.74	21.91	24.14	24.64	22.81	25.94	24.84	25.96	24.91	24.66	
S11	29.63	35.30	37.92	34.56	29.89	29.69	35.02	40.38	35.85	49.86	22.61	31.93	34.39	34.04	
S12	28.21	37.07	34.84	27.11	27.36	25.72	27.53	37.94	32.38	39.49	29.45	33.38	31.71	31.39	
S13	24.95	31.10	25.56	26.31	20.65		22.12	26.77	26.58	32.15	19.03	22.34	25.23	24.98	
S14	25.22	27.95			15.88	19.54			21.11	27.83	25.25	22.60	23.17	22.94	
T1	27.19	33.42	27.72	23.95	24.49	22.8	24.31	25.62	26.11	35.33	28.55	26.69	27.18	26.91	
T2	24.78	33.54	28.39	28.47	21.84	21.92	21.52	21.99	25.22	30.93	22.19	24.81	25.47	25.21	
T3	16.53	21.92	16.89	12.46	11.60	9.69	10.86	12.40	11.81	11.82	14.58	15.89	13.87	13.73	
W1	21.06	29.36	25.57	20.80	18.67			23.30	21.71	26.57	24.75	24.43	23.62	23.39	
W2	15.15	18.64	15.46	10.24	7.64	8.92	9.93	9.88	10.66	15.14	13.47	12.60	12.31	12.19	
20	11.54	14.49	11.66	8.66	7.64	7.05	9.16	10.20	9.32	10.81	13.08	10.47	10.34	10.24	
20a	9.97	14.74	11.99	8.48	7.82	7.32	9.09	9.47	7.68	10.99	12.57	12.10	10.19	10.08	
20b	11.25	10.96	11.98	9.04	8.39	7.56	8.72	9.36	9.03	10.82	11.34	11.77	10.02	9.92	
30	25.89	31.58	32.34	26.98		24.66	21.45	16.57	25.79	23.81	13.44	15.76	17.67	17.49	

(1) See Appendix C for details on bias adjustment. Blank space = tube missing

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

Breckland has a network of diffusion tubes that cover the 5 towns and some additional areas that are of interest to concerned members of the public or to validate modelling. In October 2015 we have used tube id number 30 for a road in East Harling where residents are concerned over the numbers of HGV traffic. This is primarily due to safety issues but also some concern over air quality. We are not seeing any reason for concern with respect to air quality.

We have had no new major industrial development that would require air quality monitoring. There have been new housing developments proceeding and we have asked for mitigation measures to be included. Our NCC colleagues have asked for travel plans and will be monitoring these.

Tube id number D3 has been omitted this year because it is not used for NO₂ arising from traffic but from biomass combustion. A 9MW biomass boiler was installed at a private residence and screening initially indicated a possible exceedence of NO₂. Changes were made to the stack height and this was screened out. The owner has kindly allowed us to use the site to validate the modelling. However monitoring for 3 months shows no reason for concern (Highest results 9ug/m³) but we will continue for 12 months to see if there is any seasonal change.

Air Quality Monitoring Data QA/QC

Checking Precision and Accuracy of Triplicate Tubes

From the AEA group

Diffusion Tubes Measurements										
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 $\mu\text{g m}^{-3}$	Tube 2 $\mu\text{g m}^{-3}$	Tube 3 $\mu\text{g m}^{-3}$	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean	
1	07/01/2015	06/02/2015	20.7	26.0	24.5	24	2.7	11	6.8	
2	06/02/2015	05/03/2015	34.9	38.8	33.3	36	2.8	8	7.0	
3	05/03/2015	01/04/2015	30.4	33.6	33.6	33	1.9	6	4.6	
4	01/04/2015	01/05/2015	36.0	31.0	26.5	31	4.8	15	11.8	
5	01/05/2015	28/05/2015	24.5	24.6	25.6	25	0.6	2	1.5	
6	28/05/2015	29/06/2015	25.3	25.2	25.2	25	0.1	0	0.2	
7	29/06/2015	30/07/2015	26.9	31.0	26.1	28	2.6	9	6.5	
8	30/07/2015	27/08/2015	34.0	33.8	37.0	35	1.8	5	4.5	
9	27/08/2015	01/10/2015	29.3	30.6	31.0	30	0.9	3	2.2	
10	01/10/2015	29/10/2015	36.8	37.0	36.5	37	0.3	1	0.6	
11	29/10/2015	01/12/2015	26.1	25.0	24.0	25	1.1	4	2.6	
12	01/12/2015	04/01/2016	27.0	25.8	29.7	27	2.0	7	5.0	
13										

Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
30.4	99.8	Good	Good
36.9	99.8	Good	Good
33.4	99.8	Good	Good
34	95.9	Good	Good
21	99.8	Good	Good
21	86.3	Good	Good
26	93.9	Good	Good
30	99.9	Good	Good
31	99.8	Good	Good
36	99.4	Good	Good
27.8	96.4	Good	Good
23.9	98.7	Good	Good

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

Overall survey --> Good precision Good Overall DC

(Check average CV & DC from Accuracy calculations)

Site Name/ID: SWAFFHAM

Accuracy (with 95% confidence interval)	
without periods with CV larger than 20%	
Bias calculated using 12 periods of data	
Bias factor A	0.99 (0.91 - 1.08)
Bias B	1% (-7% - 10%)
Diffusion Tubes Mean:	30 $\mu\text{g m}^{-3}$
Mean CV (Precision):	6
Automatic Mean:	29 $\mu\text{g m}^{-3}$
Data Capture for periods used:	97%
Adjusted Tubes Mean:	29 (27 - 32) $\mu\text{g m}^{-3}$

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

Accuracy (with 95% confidence interval)	
WITH ALL DATA	
Bias calculated using 12 periods of data	
Bias factor A	0.99 (0.91 - 1.08)
Bias B	1% (-7% - 10%)
Diffusion Tubes Mean:	30 $\mu\text{g m}^{-3}$
Mean CV (Precision):	6
Automatic Mean:	29 $\mu\text{g m}^{-3}$
Data Capture for periods used:	97%
Adjusted Tubes Mean:	29 (27 - 32) $\mu\text{g m}^{-3}$

Jaume Targa, for AEA
Version 04 - February 2011

Table C1 Diffusion tube bias adjustment spread sheet for Swaffham 2015. (Factor is 0.99)

PM Monitoring Adjustment

Kings College VCM model used.

QA/QC of diffusion tube monitoring

Quality Control Procedures for Monitoring NO₂

1 Diffusion Tube Monitoring

The diffusion tube network exposes each set of diffusion tubes to the atmosphere for approximately 4 weeks. Care is taken with the storage, handling and analysis of the tubes. All the diffusion tubes are stored in air tight bags under refrigerated conditions prior to use and used within the expiry date. Upon collection, the date, site and times are recorded. These tubes are then individually stored in sealed bags.

On the day of collection, the tubes are sent to Gradko International Limited for analysis, together with an unexposed tube as a blank 'control'. The tubes are then collected and analysed by Gradko International Limited, in accordance with a quality control procedure.

Gradko adopt the following procedures, to ensure the results of the analysis are within the accepted accuracy range:-

- Prior to each tube analysis undertaken, nitrite solutions ranging from 1-2ppm made up from a standard stock solution are run and checked against a calibration graph.
- Every month a full range of nitrite standard solutions ranging from 0.5-4ppm are measured and compared against the instrument calibration graph.
- Periodically, samples of tubes prepared for exposure are spiked with known concentrations of nitrite solution and measured. Blank tube values are also monitored from each new batch of tubes prepared.
- Once per month, a stock solution containing a known amount of nitrite, is received from AEA Technology Environment and measured. The results are used as part of the UK NO₂ Survey QA/QC Scheme. This stock solution is then used by Gradko to check the u.v. spectrophotometer calibration graph. The values are blank corrected, using blank "control" diffusion tubes provided by Breckland Council.

The accuracy of the measurements made by Gradko are also monitored by participation in an external laboratory measurement proficiency scheme AIR. This is an independent analytical proficiency-testing (PT) scheme, operated by LGC Standards and supported by the Health and Safety Laboratory (HSL). AIR PT is a new scheme, started in April 2014, which combines two long running PT schemes: LGC Standards STACKS PT scheme and HSL WASP PT scheme.

Diffusion tubes are spiked using a working nitrite solution prepared from a stock solution. The concentration of this stock solution is initially assayed using a titrimetric procedure. All steps in the subsequent test sample production process, involving gravimetric and volumetric considerations, are undertaken using calibrated instruments employing traceable standards. As an additional cross check, 12 spiked Palmes tubes are picked at random from each spike loading level and submitted to a third party laboratory which is accredited to ISO 17025 to undertake this analysis using an ion chromatographic procedure.

The table below gives the results of the AIR PT scheme showing Gradko laboratory performance.

Breckland Council

The following table lists those UK laboratories undertaking LAQM activities that have participated in recent AIR NO₂ PT rounds and the percentage (%) of results submitted which were subsequently determined to be **satisfactory** based upon a z-score of $\leq \pm 2$ as defined above.

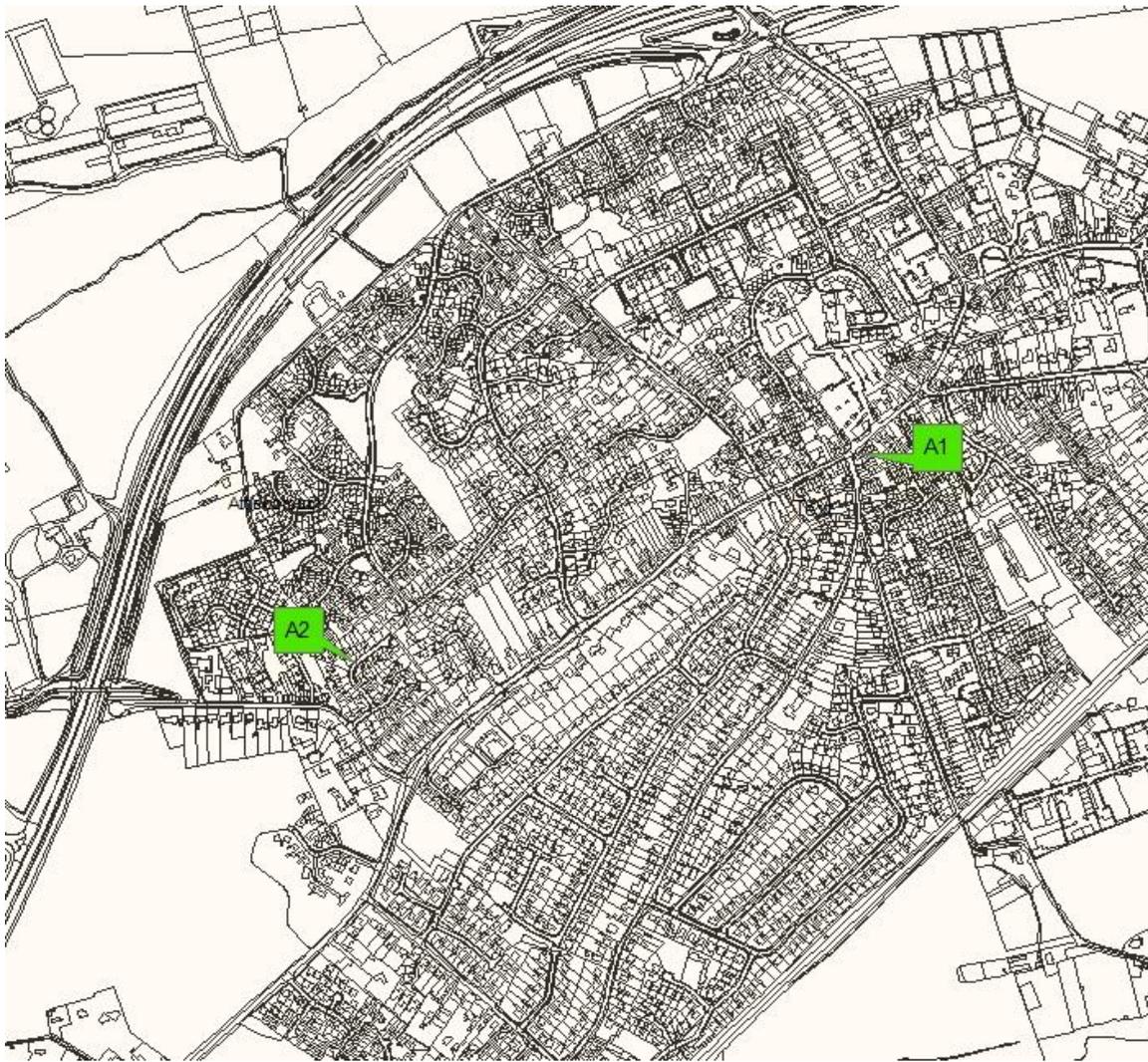
AIR PT Round	AR001	AR003	AR004	AR006	AR007	AR009	AR010	AR012
Round conducted in the period	April – May 2014	July – August 2014	October – November 2014	January – February 2015	April – May 2015	July – August 2015	October – November 2015	January – February 2016
Aberdeen Scientific Services	100 %	100 %	100 %	100 %	100 %	75 %	100 %	100 %
Cardiff Scientific Services	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Edinburgh Scientific Services	100 %	100 %	100 %	75 %	100 %	100 %	100 %	100 %
Environmental Services Group, Didcot [1]	100 %	100 %	100 %	87.5 %	100 %	100 %	100 %	100 %
Exova (formerly Clyde Analytical)	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Glasgow Scientific Services	100 %	100 %	100 %	100 %	100 %	100 %	100 %	75 %
Gradko International [1]	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Kent Scientific Services	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Kirklees MBC	100 %	100 %	100 %	75 %	100 %	100 %	100 %	100 %
Lambeth Scientific Services	50 %	100 %	100 %	25 %	100 %	100 %	100 %	100 %
Milton Keynes Council	100 %	100 %	75 %	100 %	100 %	100 %	100 %	50 %
Northampton Borough Council	100 %	0 %	0 %	100 %	100 %	100 %	100 %	50 %
Somerset Scientific Services	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
South Yorkshire Air Quality Samplers	100 %	100 %	100 %	100 %	100 %	100 %	75 %	100 %
Staffordshire County Council	100 %	25 %	100 %	100 %	100 %	75 %	75 %	75 %
Tayside Scientific Services (formerly Dundee CC)	NR [2]	100 %	100 %	100 %	NR [2]	NR [2]	NR [2]	100 %
West Yorkshire Analytical Services	75 %	100 %	75 %	100 %	75 %	75 %	75 %	75 %

[1] Participant subscribed to two sets of test samples (2 x 4 test samples) in each AIR PT round.

[2] NR No results reported

[3] Kent Scientific Services, Cardiff Scientific Services and Exova (formerly Clyde Analytical) no longer carry out NO₂ diffusion tube monitoring and therefore did not submit results.

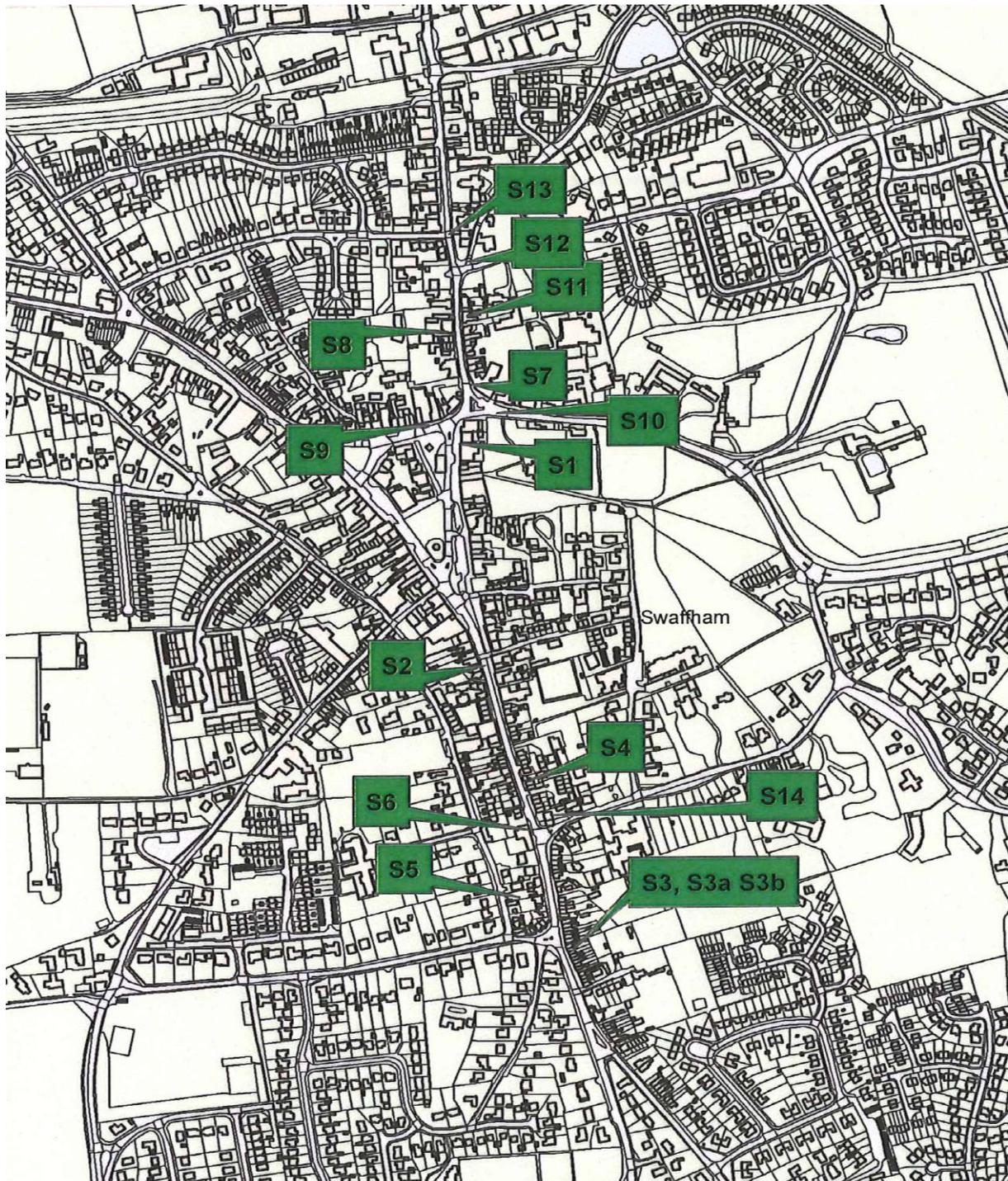
Table C2. AIR PT scheme (Gradko Highlighted)



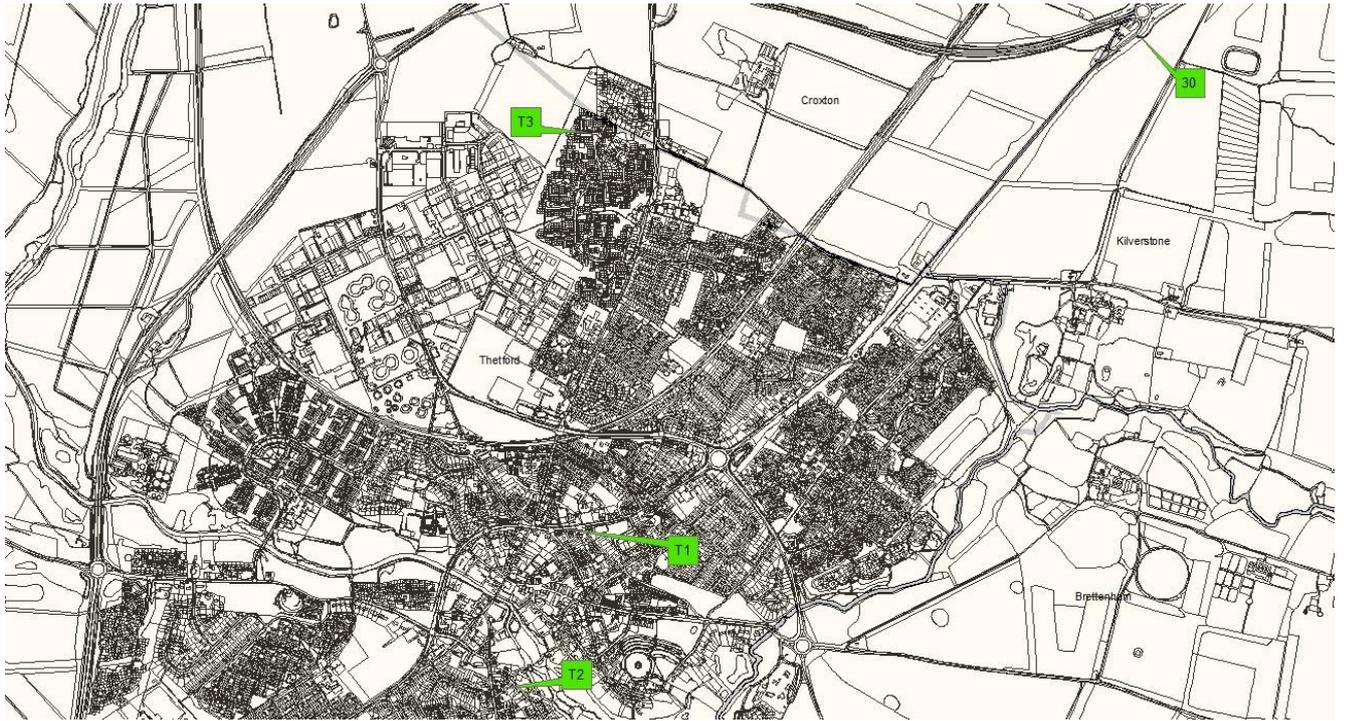
Map to show locations of diffusion tubes in Attleborough



Map to show locations of diffusion tubes in Dereham



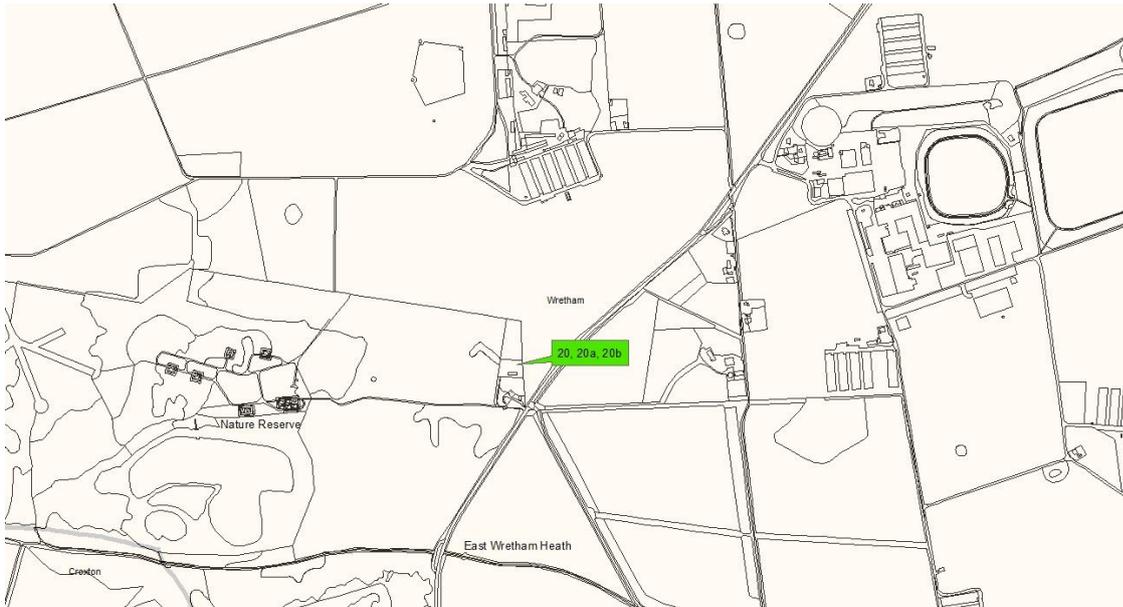
Map of Swaffham showing continuous monitoring site (S3) and diffusion tube sites



Map to show locations of diffusion tubes in Thetford



Map to show locations of diffusion tubes in Watton



Map to show locations of diffusion tubes and continuous analysers in East Wretham

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
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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