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Progress Report

Air Quality in the Suffolk Coastal District

July 2008

Executive Summary

Part IV of the Environment Act 1995 established a new legal framework for national air quality and includes strategies and policies to be adopted at both the national and local level. It places a duty on all local authorities to periodically review air quality within their districts under the Local Air Quality Management (LAQM) process. This will ensure that local authorities continually assess air quality in their districts, to update their records and determine any areas of concern.

Local authorities must review air quality against health-based standards and objectives set in the Air Quality Regulations 2000 and the Air Quality (Amendment) Regulations 2002. These Regulations set standards and objectives for seven pollutants: benzene, 1,3-butadiene, lead, carbon monoxide, nitrogen dioxide, sulphur dioxide and particulate matter (PM_{10}). If a review indicates locations where any of the Air Quality Objectives are likely to be exceeded, the local authority must designate an Air Quality management Area (AQMA). A written Action Plan must then be drawn up in pursuit of achievement of the objectives.

This third round of review and assessment began in 2005. The Updating and Screening Assessment and Detailed Assessment concluded that the risk of exceedance of the air quality objectives for benzene, 1,3-butadiene, lead and carbon monoxide is unlikely, and no further assessment is necessary. For nitrogen dioxide (NO_2), sulphur dioxide (SO_2) and particles (PM_{10}) the review and assessment concluded that there was a potential risk of the air quality objectives being exceeded. Further investigation was required to assess emissions of NO_2 from traffic using the junction of Lime Kiln Quay Road, The Thoroughfare, and St. John's Street in Woodbridge, and emissions of NO_2, SO_2 and PM_{10} from activities on and associated with the Port of Felixstowe.

Progress Reports are designed to ensure continuity in the LAQM process and are required in years when an Updating and Screening Assessment or Detailed Assessment is not being undertaken. This Progress Report determines whether there have been any changes in the concentrations of the seven prescribed pollutants by examining new monitoring results and new local developments that may affect local air quality.

This Progress Report has determined a number of new developments and proposed future developments that may affect air quality and that will be investigated further in the Updating and Screening Assessment for 2006.

It has been determined for the Suffolk Coastal district that the risk of exceedence of the air quality objectives for benzene, 1,3-butadiene, lead and carbon monoxide is unlikely, and no further assessment is necessary.

An AQMA was declared in March 2006 at the junction of Lime Kiln Quay Road, Thoroughfare and St. John's Street in Woodbridge. This Area was designated in relation to a likely breach of the annual mean nitrogen dioxide (NO_2) objective resulting from traffic using the junction. A Further Assessment has been undertaken for the junction, this has confirmed that the elevated NO_2 concentrations are as a result of local traffic and that AQMA should be retained. Work on production of a draft Action Plan for the junction is continuing. Once completed the draft report will be sent to the Department for Environment, Food and Rural Affairs (Defra) for their approval, and the Council will undertake further public consultation on the contents. Comments received from this consultation will then be fed into formulation of the final Action Plan for the junction.

A Detailed Assessment report was produced in May 2008 setting out the findings of monitoring and modelling of emissions of NO_2, SO_2 and PM_{10} from activities on and associated with the Port of Felixstowe. This report has been sent to Defra for their approval. Once the Detailed Assessment report has been accepted by Defra, public consultation will be undertaken on the findings.

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1 Introduction

This is the air quality Progress Report for Suffolk Coastal District Council. It is required by the Government guidance issued in 2003 (LAQM.TG(03) and LAQM.PRG(03)) under Part IV of the Environment Act 1995, and has been prepared using this guidance. This report should be read in conjunction with the Detailed Assessment report for the junction of Lime Kiln Quay Road, Thoroughfare and St. John's Street, Woodbridge (September 2005) and the Suffolk Coastal Updating and Screening Assessment Report (2006/07).

1.1 Legislative Background

Part IV of the Environment Act 1995 established a new legal framework for national air quality and includes strategies and policies to be adopted at both the national and local level. It places a duty on all local authorities to periodically review air quality within their districts under the Local Air Quality Management (LAQM) process. This will ensure that local authorities continually assess air quality in their districts to update their records and determine any areas of concern.

Local authorities must review air quality against health-based standards and objectives set in the Air Quality Regulations 2000 and the Air Quality (Amendment) Regulations 2002 for seven key pollutants. The pollutants specified in the Regulations, together with their objectives and target dates for achievement can be seen in table 1.1 below.

Table 1.1 Objectives included in the Air Quality Regulations 2000 and the Air Quality (Amendment) Regulations 2002, for the purposes of Local Air Quality Management

Pollutant	Air Quality Objective		Date to be achieved
	Concentration	Measured as	
Benzene	16.25 μg/m^3	Running annual mean	31 December 2003
	5.0μg/m^3	Annual mean	31 December 2010
1,3-butadiene	2.25 μg/m^3	Running annual mean	31 December 2003
Carbon monoxide	10.0 mg/m^3	Maximum daily running 8-hour mean	31 December 2003
Lead	0.5 μg/m^3	Annual mean	31 December 2004
	0.25 μg/m^3	Annual mean	31 December 2008
Nitrogen dioxide (objectives are provisional)	200 μg/m^3 not to be exceeded more than 18 times a year	1-hour mean	31 December 2005
	40 μg/m^3	Annual mean	31 December 2005
Particles (PM_{10}) (gravimetric) (Measured using the European gravimetric transfer sampler or equivalent)	50 μg/m^3 not to be exceeded more than 35 times a year	24-hour mean	31 December 2004
	40 μg/m^3	Annual mean	31 December 2004
Sulphur dioxide	350 μg/m^3 not to be exceeded more than 24 times a year	1-hour mean	31 December 2004
	125 μg/m^3 not to be exceeded more than 3 times a year	24-hour mean	31 December 2004
	266 μg/m^3 not to be exceeded more than 35 times a year	15-minute mean	31 December 2005

In addition to the objectives set out in the Regulations (table 1.1), the European Union has set limit values in respect of nitrogen dioxide to be achieved by 2010, as well as indicative limit values for particles (PM_{10}) also to be achieved by 2010. Local authorities currently have no statutory obligation to assess air quality against these limit values, as they have not yet been transcribed into the Regulations under which LAQM operates. In the review and assessment process no investigations have been undertaken by Suffolk Coastal in respect of these 2010 limits.

If a review indicates locations where any of the Air Quality Objectives are likely to be exceeded, the local authority must designate an Air Quality management Area (AQMA). A written Action Plan must then be drawn up in pursuit of achievement of the objectives.

The first round of review and assessment for Suffolk Coastal was completed in 2001 and consisted of three stages. The findings of the first round were that the Air Quality Objectives for all seven pollutants would be met within the Suffolk Coastal district and no AQMAs were declared.

The second round of review and assessment was completed in 2005, the format of which followed updated guidance. An Updating and Screening Assessment was published in 2003, a Detailed Assessment in 2004 and a Progress Report in 2005. The findings of the second round were that the Air Quality Objectives for benzene, 1,3-butadiene, lead, carbon monoxide would be met within the Suffolk Coastal district and no further assessment was necessary. For nitrogen dioxide (NO_2), sulphur dioxide (SO_2) and particulate matter (PM_{10}) the review and assessment concluded that there was a potential risk of the air quality objectives being exceeded. Further investigation was required to assess emissions of NO_2 from traffic using the junction of Lime Kiln Quay Road, Thoroughfare, and St. John's Street in Woodbridge (Woodbridge junction), and emissions of NO_2, SO_2 and PM_{10} from activities on and associated with the Port of Felixstowe.

This third round of review and assessment began in 2005. A Detailed Assessment for the junction of Lime Kiln Quay Road, Thoroughfare and St. John's Street in Woodbridge was published in September 2005. Following this assessment an Air Quality Management Area was declared for the junction in March 2006 and a Further Assessment published in October 2007. Work on an Action Plan for the junction is continuing. The Updating and Screening Assessment for the Suffolk Coastal district was published in September 2006. The findings from these reviews are detailed in the next Chapter of this report.

The Detailed Assessment investigating emissions from activities on and associated with the Port of Felixstowe was recently completed in 2008 and is currently with Defra awaiting approval.

1.2 Purpose of the Progress Report

Progress Reports are designed to ensure continuity in the LAQM process and are required in years when an Updating and Screening Assessment or Detailed Assessment is not being undertaken. They ensure that local authorities must retain air quality resourcing to maintain the capacity and skills needed to manage LAQM.

The Progress Report is intended to determine whether there have been any changes in the concentrations of the seven prescribed pollutants by examining any new monitoring results and new local developments that may affect local air quality. It also includes any information that may have an effect on future air quality, for example impending planning applications, local transport plans and planning policies.

2 Findings of the Updating and Screening and Detailed Assessment undertaken for the Suffolk Coastal district

2.1 Updating and Screening Assessment findings (September 2006)

The Updating and Screening Assessment for the Suffolk Coastal district determined that the risk of exceedence of the Air Quality Objectives for carbon monoxide, benzene, 1,3-butadiene and lead was unlikely, and no further assessment was necessary.

The Updating and Screening Assessment for the Suffolk Coastal district determined that for NO_2, SO_2 and PM_{10} there was a potential risk of emissions from activities on and associated with the Port of Felixstowe causing exceedence of the air quality objectives at receptor locations. Further investigation, as detailed below, in the form of a Detailed Assessment was necessary.

- Site a continuous analyser for oxides of nitrogen (NO_x) at the Dooley Inn Public House, Ferry Lane, Felixstowe to provide 12 months of monitoring data beginning in January 2007. Collocate diffusion tubes with the analyser to provide bias correction for diffusion tube sites.

- Obtain a 12-month data set for NO_2, SO_2 and PM_{10} at a suitable location near to the Port of Felixstowe boundary using continuous monitoring equipment. Locate additional diffusion tube monitoring sites within Adastral Close to provide information regarding the extent of any objective exceedences.

    - Use of Air dispersion modelling to assess concentrations of NO_2, SO_2 and PM_{10} at receptor locations close to the Port of Felixstowe boundary and along the A14 trunk road. Look at the current situation and also provide future predictions with Felixstowe South Reconfiguration and Bathside Bay Container Port developments in place. Include emissions from all activities on and associated with the Port of Felixstowe. The results from the continuous monitoring, as outlined above, will enable verification of the modelling outputs.

2.2 Findings of the Detailed Assessment for the junction of Lime Kiln Quay Road, Thoroughfare, and St. John's Street in Woodbridge (September 2005)

In September 2005 a Detailed Assessment report was produced for the Woodbridge junction. The findings of the report were that the up-to-date diffusion tube results show that the annual mean NO_2 objective is likely to be exceeded in 2005 and the modelling results also indicate that there is a marginal exceedence for two properties At Melton Hill, Woodbridge. The report recommended that the Council should consider declaring and Air Quality Management Area at the Woodbridge junction which should as a minimum include the area of exceedence.

On 3 March 2006 an Air Quality Management Area Order was made by Suffolk Coastal District Council for the Woodbridge junction, this came into effect on 3 April 2006. The designated area incorporates properties on the Western side of the Thoroughfare and Melton Hill arm of the junction with Lime Kiln Quay Road, in Woodbridge, Suffolk.

This Progress Report provides an update on the review and assessment being undertaken for the Woodbridge junction, which can be seen in section 10 of this report.

3 New Monitoring Data

Since the Updating and Screening Assessment report was produced in September 2006, monitoring of nitrogen dioxide (NO_2) has continued at a number of locations within the district. A 12-month monitoring study for sulphur dioxide (SO_2) and particulate matter (PM_{10}) was also undertaken during 2007. This Progress Report details monitoring data for 2006 and 2007 for all monitoring locations.

3.1 Automatic analyser results

Woodbridge

On 3 January 2006 the automatic NO_x analyser was relocated from 87 Thoroughfare to 93 Thoroughfare in order to obtain measurements from the area indicating maximum NO_2 concentrations (according to diffusion tube results), for a site location map see Appendix C. Additional information regarding the monitoring undertaken is presented later in this report in section 10.

A summary of the average measured concentrations and the maximum hourly mean concentrations of NO_2 for 2006 and 2007 can be seen in table 3.1.1 below. Detailed summary tables and graphs can be seen in Appendix D together with information regarding quality assurance of the data.

Table 3.1.1 Summary of 12-month ratified NO_2 data collected by the automatic analyser located at the junction of Lime Kiln Quay Road, Thoroughfare and St. John's Street in Woodbridge in 2006 and 2007.

	2006 Concentration of NO_2 recorded by analyser	**2007 Concentration of NO_2 recorded by analyser**	**Air Quality Standard**
Average concentration	**44 µg m^{-3}**	**46 µg m^{-3}**	40 µg m^{-3}
Maximum hourly mean	199 µg m^{-3}	**206 µg m^{-3}**	200 µg m^{-3}
Number of exceedences of the hourly mean	0	2	18
Data capture	96.30%	98.40%	n/a

The results in table 3.1.1 show that for 2006 the average annual NO_2 concentration for the site was 44µg/m^3, which is above the annual mean objective of 40 µg/m^3. The maximum hourly mean concentration of 199 µg/m^3 does not exceed the 1-hour objective of 200 µg/m^3 not to be exceeded more than 18 times per year.

The results in table 3.1.1 show that for 2007 the average NO_2 concentration for the site was 46 µg/m^3, which is above the annual mean objective of 40 µg/m^3. The maximum hourly mean concentration was 206 µg/m^3 with 2 exceedences of the 200 µg/m^3 objective. This does not exceed the 1-hour objective of 200 µg/m^3 not to be exceeded more than 18 times per year.

Additional details regarding the monitoring undertaken at this junction and continuing assessment is provided in section 10 later in this report.

Felixstowe – The Dooley Inn, Ferry Lane

Following elevated concentrations of NO_2 recorded by diffusion tubes at The Dooley Inn public house, Ferry Lane, Felixstowe, a continuous NO_x analyser was located at this site in January 2007 to undertake a Detailed Assessment, for a site location map see Appendix D. Further information regarding this site and the monitoring undertaken is presented later in this report in section 11.

A summary of the average measured concentrations and the maximum hourly mean concentrations of NO_2 for 2007 can be seen in table 3.1.2 overleaf. Detailed summary tables and graphs can be seen in Appendix D together with information regarding quality assurance of the data.

The results in table 3.1.2 show that for 2007 the average annual NO_2 concentration for the site was 42µg/m^3, which is above the annual mean objective of 40 µg/m^3. The maximum hourly mean of 199µg/m^3 does not exceed the 1-hour objective of 200 µg/m^3 not to be exceeded more than 18 times per year.

Table 3.1.2 Summary of 12-month ratified NO_2 data collected by the automatic analyser located at the Dooley Inn Public House, Ferry Lane , Felixstowe from 1st January 2007 to 31st December 2007

	Concentration of NO_2 recorded by analyser	**Air Quality Standard**
Average concentration	**42 µg m^{-3}**	40 µg m^{-3}
Maximum hourly mean	199 µg m^{-3}	200 µg m^{-3}
Number of exceedences of the hourly mean	0	18
Data capture	98.20%	n/a

Felixstowe – Adastral Close

Following elevated concentrations of NO_2 recorded by diffusion tubes at Adastral Close, Felixstowe, a continuous NO_x analyser was located at this site in 2007 to undertake a Detailed Assessment, for a site location map see Appendix C. In addition, as part of a Detailed Assessment to confirm concentrations of SO_2 and PM_{10} at receptors close to the Port Of Felixstowe a continuous SO_2 analyser and a beta attenuation monitor to measure particulate matter were located in Adastral Close, for a site location map see Appendix D. Measurements obtained from the beta attenuation monitor were adjusted to provide a gravimetric equivalent concentration by a dividing factor of 1.2 following advice given in the UK Air Quality Archive Air Quality Support FAQ. Further information regarding this site and the monitoring undertaken is presented later in this report in section 11.

A summary of the measured concentrations for 2007 can be seen in table 3.1.3 below. Detailed summary tables and graphs can be seen in Appendix D together with information regarding quality assurance of the data.

Table 3.1.3 Summary of 12-month ratified NO_2 SO_2 and PM_{10} data collected by the automatic analyser located at Adastral Close in Felixstowe from 30th January 2007 to 1st February 2008

SO_2	**Concentration of SO_2 recorded by analyser**	**Air Quality Standard**
Maximum 15-minute mean	229 µg m^{-3}	266 µg m^{-3}
Number of exceedences of the 15-minute mean	0	35
Maximum hourly mean	210 µg m^{-3}	350 µg m^{-3}
Number of exceedences of the hourly mean	0	24
Maximum daily mean	41 µg m^{-3}	125 µg m^{-3}
Number of exceedences of the daily mean	0	3
Data capture	98.20%	n/a

NO_2	**Concentration of NO_2 recorded by analyser**	**Air Quality Standard**
Average concentration	31 µg m^{-3}	40 µg m^{-3}
Maximum hourly mean	143 µg m^{-3}	200 µg m^{-3}
Number of exceedences of the hourly mean	0	18
Data capture	97.90%	n/a

PM_{10}	**Concentration of PM_{10} recorded by analyser**	**Air Quality Standard**
Average concentration	26 µg m^{-3}	40 µg m^{-3}
Maximum daily mean	**96 µg m^{-3}**	50 µg m^{-3}
Number of exceedences of the daily mean	13	35
Data capture	84.00%	n/a

The results in table 3.1.3 show that for **SO_2** in 2007 the maximum 15-minute mean of 229 μg/m^3 does not exceed the 15-minute objective of 266 μg/m^3 not to be exceeded more than 35 times per year. The maximum hourly mean of 210 μg/m^3 does not exceed the 1-hour objective of 350 μg/m^3 not to be exceeded more than 24 times per year, and the maximum daily mean of 41 μg/m^3 does not exceed the 24-hour objective of 125 μg/m^3 not to be exceeded more than 3 times per year

The results in table 3.1.3 show that for 2007 the average annual **NO_2** concentration for the site was 31μg/m^3, which is below the annual mean objective of 40 μg/m^3. The maximum hourly mean of 143μg/m^3 does not exceed the 1-hour objective of 200 μg/m^3 not to be exceeded more than 18 times per year.

The results in table 3.1.3 show that for **PM_{10}** in 2007 the average annual concentration for the site was 26μg/m^3, which is below the annual mean objective of 40 μg/m^3.maximum. The maximum daily mean concentration was 96 μg/m^3 with 13 exceedences of the 50 μg/m^3 objective. This does not exceed the 24-hour mean objective of 50 μg/m^3 not to be exceeded more than 35 times per year.

3.2 Diffusion tube results

The Updating and Screening Assessment report (September 2006) presented diffusion tube data up to the end of 2005, since this time a number of sites have been relocated, removed and added to our survey. Descriptions for sites present in 2006 and 2007 are provided in Appendix B, the location of each site is shown in the maps provided in Appendix C. The changes that have occurred in monitoring locations are summarised for each area below:

Felixstowe and the Trimleys

- Felixstowe 24 a & b (Brandon Road) a duplicate site was reduced to a single tube site in 2006 as NO_2 levels were within the air quality standard.
- Felixstowe 13 a, b & c (drainpipe in the front car park of the Dooley Inn, Ferry Lane) was removed in 2007 as its location at the front of the building at ground level was not representative of the receptor. It was found that cars were parking close to the diffusion tubes and the residents of this property live on the first floor.
- Felixstowe 26 (first floor window over front car park at the Dooley Inn) was increased to a triplicate site in January 2007 to provide a collocation study with an automatic NO_x analyser installed at that time.
- From January 2007 a number of new sites were added in Adastral Close as part of a study of the NO_2 concentrations derived from activities on the Port of Felixstowe in this area. The site at Felixstowe 14 a, b & c (drainpipe of 1 Adastral Close) showed elevated concentrations of NO_2 in 2005 necessitating further investigation in this area. The new sites are designated Felixstowe 29, 30, 31, 32 and 33 a, b & c. The triplicate site at 33 a, b & c was set up to provide a collocation study for a continuous NO_x analyser. Site descriptions for sites present in 2006 and 2007 are provided in Appendix B, the location of each site is shown in the maps provided in Appendix C.

Kesgrave

- Kesgrave 1 (Main Road opposite the High School) was an original long term monitoring location that was removed in 2002 as the concentration of NO_2 was shown to be below the objective levels. This site was reinstated in 2003 on behalf of Suffolk County Council future trends, but since 2005 the levels were found to be well below the air quality standard, and this site was removed in 2006.

Woodbridge

- In March 2006 an Air Quality Management Area (AQMA) was declared at the junction of Lime Kiln Quay Road, Thoroughfare and St. John's Street, Woodbridge and further investigation was required to confirm the extent of the AQMA. Additional diffusion tube sites were located around the junction in January 2006 and were designated Woodbridge 17, 18, 19 and 20. Woodbridge 12 was also reinstated on Lime Kiln Quay Road for this investigation. Site descriptions are provided in Appendix B, the location of each site is shown in the maps provided in Appendix C.

- Woodbridge 15 a,b & c triplicate site in 2005 (on the drainpipe of 87 Thoroughfare) was reduced to a single site following the relocation of the automatic NO_x analyser that was at this site.
- Woodbridge 21 was set up in January 2007 in St. John's Street to confirm NO_2 concentrations following alteration of the traffic signal timings which has lead to increased queuing along this arm of the junction. A site description is provided in Appendix B, and the location is shown on the maps provided in Appendix C.

Melton

- In January 2007 the triplicate site Melton 5 a, b & c (on Melton crossroads) was reduced to a duplicate site as NO_2 levels were within the air quality standard.
- Melton 6 was a new site set up in January 2007 on Melton County Primary School to assess NO_2 concentrations on the south-eastern side of the Melton crossroads. A site description is provided in Appendix B, and the location is shown on the maps provided in Appendix C.

Monitoring was conducted using passive diffusion tubes, exposed on a monthly basis, information regarding the analyst laboratory used and its accreditation details is provided in Appendix B. The annual average concentration of NO_2 was calculated for all sites with 6 months or more of monitoring data. Diffusion tubes can over or under read and the annual average should be corrected for laboratory bias. Bias correction factors for 2006 and 2007 were calculated using results from the collocation studies undertaken in each year and are detailed in Appendix B of this report. These factors were used to correct the annual average concentration recorded for each site, and have been compared with the bias adjustment factor for the analyst laboratory, Harwell Scientifics, obtained from the Review and Assessment Helpdesk website inventory. The monthly results of sampling for 2006 and 2007 together with the bias correction calculations are detailed in Appendix B.

Tables 3.2.1 to 3.2.4 overleaf show the bias corrected annual average results for all sites in 2006 and 2007, for comparison with the objectives, in accordance with the technical guidance LAQM.TG(03). Sites located to provide Urban Background concentrations of NO_2 are marked in the table. The remaining sites are all located at or close to relevant receptor locations on roads and junctions of concern and near to industrial sources of NO_2.

Felixstowe

The results in table 3.2.1 for monitoring locations in Felixstowe show 4 sites in 2006 and 1 site in 2007 which are above the annual mean NO_2 objective level of 40μg/m^3.

Felixstowe 13, 26 and 27 in Ferry Lane are located on the Dooley Inn, the closest receptor location to the Port of Felixstowe and one of its main entrance gates. Felixstowe 13 was located on a drainpipe facing the front car park and was removed at the end of 2006. It was found that cars were parking much closer to the diffusion tube site than originally indicated which may have lead to elevated levels of NO_2 being recorded by the tubes. In addition, the residents of this property live on the first floor and therefore ground level was not representative of the receptor. Felixstowe 26 and 27 are located on the building at the first floor level, Felixstowe 26 is at the front of the building facing the front car park and Felixstowe 27 is at the side of the building facing the Port of Felixstowe. Felixstowe 26 (triplicate site) was collocated with an automatic NO_x analyser during 2007. The results from the collocation study undertaken in 2007 show that the diffusion tubes at the Dooley Inn over-read by a greater amount than those collocated at Adastral Close or the Woodbridge junction. For this reason the ratified diffusion tube results are lower in 2007 than in 2006 (with only Felixstowe 26 exceeding the annual mean air quality standard) as in 2006 the only collocation study available was at Woodbridge where the diffusion tubes and automatic analyser results are much closer.

Felixstowe 14 is located in Adastral Close, another receptor close to the Port of Felixstowe boundary. The concentrations recorded at this site decreased between 2006 and 2007. As above, the results in 2007 were ratified using a collocation study undertaken in Adastral Close rather than in Woodbridge. There is a greater difference between the diffusion tube and automatic analyser results in Adastral Close than in Woodbridge, with the diffusion tubes in Adastral Close over-reading by a greater amount than at Woodbridge. This may be due to the difference in the site types – Woodbridge is a busy road junction with possible street canyon effects and Adastral Close is an open site with the NO2 coming from a number of more diffuse sources on

the Port of Felixstowe. More detailed information regarding the monitoring undertaken at this site is provided in section 11 later in this report.

Table 3.2.1 Bias corrected annual mean nitrogen dioxide concentrations recorded at sites in Felixstowe during 2006 and 2007, figures in micrograms per cubic metre (μg/m^3).

Site	2006 Annual mean using bias correction factor 0.93	2007 Annual mean using bias correction factor obtained from Adastral Close analyser 0.85
Felixstowe 4	24.3	22.7
Felixstowe 12	34	33.6
Felixstowe 13 a,b,c	**47.6**	-
Felixstowe 14 a,b,c	**40.2**	32.7
Felixstowe 17 a,b,c	32.3	29.7
Felixstowe 18 a,b,c	35.8	33.3
Felixstowe 19	29.5	27.3
Felixstowe 20	32.1	28.5
Felixstowe 21	31.3	28.5
Felixstowe 22	29.3	29.1
Felixstowe 23 a,b	35.5	32.4
Felixstowe 24	35.3	34.6
Felixstowe 25	35.2	32.6
Felixstowe 28	36	32.2
Felixstowe 29	-	30.9
Felixstowe 30	-	26.9
Felixstowe 31	-	30.9
Felixstowe 32	-	28.1
Felixstowe 33 a,b,c	-	30.9

Site	2006 Annual mean using bias correction factor 0.93	2007 Annual mean using bias correction factor obtained from Dooley Inn analyser 0.78
Felixstowe 26	**48.7**	**41.8**
Felixstowe 27	**43.9**	36.9

Woodbridge

The results in table 3.2.2 overleaf for monitoring locations in Woodbridge show 5 sites in 2006 and 2007 above the annual mean NO_2 objective level of 40μg/m^3.

Woodbridge 1, 6, 8, 15 and 20 are all located on the junction of Lime Kiln Quay Road / Thoroughfare / St. John's Street in Woodbridge. These sites are on the western side of the Thoroughfare arm of the junction within the decalred Air Quality Management Area. Further details and an update regarding air quality at this junction are provided in section 10 of this report.

Table 3.2.2 Bias corrected annual mean nitrogen dioxide concentrations recorded at sites in Woodbridge in 2006 and 2007, figures in micrograms per cubic metre (μg/m^3).

Site	2006 Annual mean using bias correction factor 0.93	2007 Annual mean using bias correction factor from WBG analyser 0.96
Woodbridge 1 a,b,c	**44**	**45.9**
Woodbridge 3	18.3	18.6
Woodbridge 5 a,b,c	30.2	31.1
Woodbridge 6	**42.4**	**43**
Woodbridge 8	**44.5**	**47.3**
Woodbridge 10	38.4	37.3
Woodbridge 12	31	30
Woodbridge 13	36.7	38.5
Woodbridge 15	**41.5**	**43.9**
Woodbridge 17	34	31.5
Woodbridge 18	38.9	39.7
Woodbridge 19	22.7	23.9
Woodbridge 20	**42.5**	**42.1**
Woodbridge 21	-	23.3

Kesgrave and Melton

The results in tables 3.2.3 and 3.2.4 for monitoring locations in Kesgrave and Melton show all sites in 2006 and 2007 to be within the annual mean objective level of 40μg/m^3.

Table 3.2.3 Bias corrected annual mean nitrogen dioxide concentrations recorded at sites in Kesgrave in 2006 and 2007, figures in micrograms per cubic metre (μg/m^3).

Site	2006 Annual mean using bias correction factor 0.93	2007 Annual mean using bias correction factor from WBG analyser 0.96
Kesgrave 4	20.5	21
Kesgrave 6	29.5	29.3
Kesgrave 9	39.3	39.5

Table 3.2.4 Bias corrected annual mean nitrogen dioxide concentrations recorded at sites in Melton in 2006 and 2007, figures in micrograms per cubic metre (μg/m^3).

Site	2006 Annual mean using bias correction factor 0.93	2007 Annual mean using bias correction factor from WBG analyser 0.96
Melton 2	17.7	16.1
Melton 5 a,b,c	34.7	33.3
Melton 6	-	21.5

4 Trends in Local Air Quality

NO_2 levels have been monitored in Suffolk Coastal since 1993 using diffusion tubes, however most of the original sites have now been relocated or removed. In 1999 the laboratory supplying and analysing the diffusion tubes was changed which caused a marked increase in the NO_2 monitoring results for all sites. Since 1999 the same analyst laboratory has been employed and so monitoring data has only been presented from 1999 onwards for the purpose of obtaining information on air quality trends.

Many of the current diffusion tube sites are in place for short-term assessment of locations of concern and are not relevant for the purpose of obtaining trend information. The graphs in figures 4.1 to 4.4 on the following pages show the annual average concentration of NO_2 recorded at those sites planned, at the current time, to remain in place for the foreseeable future. Only sites with five or more years of data that could provide useful information on trends have been included in the graphs.

All data presented has been corrected for laboratory bias, for the years 1999, 2000 and 2001 this was undertaken using a bias correction factor provided be the laboratory itself. From 2002 onwards the bias correction factor has been calculated from collocation studies undertaken within the Suffolk coastal district. The graphs should, therefore, be viewed with some care as although the same laboratory was used to supply and analyse the tubes the bias correction method has altered from 2002 onwards. In addition, during 2007 two collocation studies were undertaken within Felixstowe which showed diffusion tubes at these locations to be over-reading much more than those at the Woodbridge site. The results for all three sites in Felixstowe have therefore fallen between 2006 and 2007.

There are trends within each of the four areas monitored:

- Felixstowe – the urban background site (FLX 4) and the roadside site (FLX 12) have shown a similar trend since 2003 which is an overall decrease in NO_2 concentrations. The Industrial site shows a different trend with concentrations increasing from 2003 to 2005 and then decreasing since this time.
- Kesgrave - the urban background site (KSG 4) and the roadside site (KSG 6) show a similar stable trend in NO_2 concentrations from 2003 to 2007. The second roadside site (KSG 9) also shows a similar trend to the others except for a noticeable increase in NO_2 concentrations between 2005 and 2006.
- Woodbridge – all sites in Woodbridge follow a similar trend in NO_2 concentrations, decreasing from 1999 to 2000, then increasing to 2002 and stabilising since this time.
- Melton – both sites show a similar trend from 2003 with an increase in NO_2 concentrations from 2004 to 2007.

There are also trends between areas if we look at the same site types:

- Urban background sites – in all areas, with the exception of Melton, NO_2 concentrations have decreased between 1999 and 2000, then shown an increase between 2000 and 2002 and stabilised with a slight overall downwards trend since that time. The site at Melton has shown an increasing trend since 2004.
- Kerbside / Roadside sites – sites in Felixstowe and Woodbridge show a similar downward trend in NO_2 concentrations since 2002/03. Sites in Melton and Kesgrave show a decrease in NO_2 concentrations between 2002/03 and 2004 and then an increase since 2004.
- Industrial site – there is only one industrial site in Felixstowe with enough data for trend analysis, this shows an increase in NO_2 concentrations between 2003 and 2005 and then a decrease in concentrations since this time.

Figure 4.1 Annual mean nitrogen dioxide concentrations measured at permanent diffusion tube sites in Felixstowe between 1999 and 2007

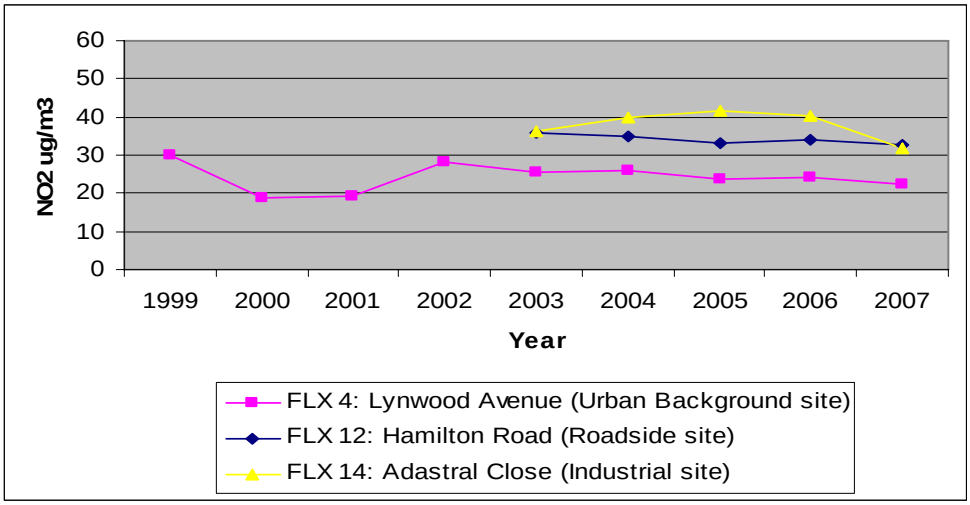


Figure 4.2 Annual mean nitrogen dioxide concentrations measured at permanent diffusion tube sites in Kesgrave between 1999 and 2007

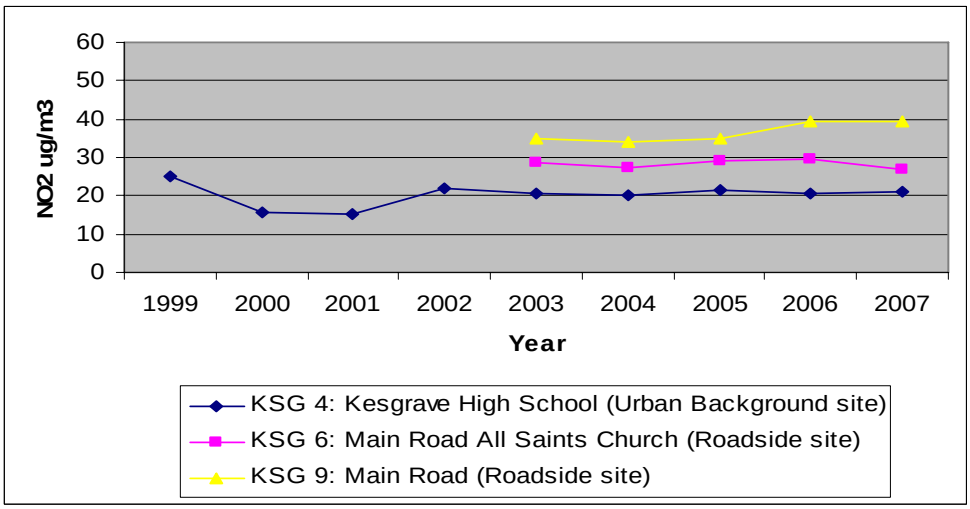


Figure 4.3 Annual mean nitrogen dioxide concentrations measured at permanent diffusion tube sites in Woodbridge between 1999 and 2007

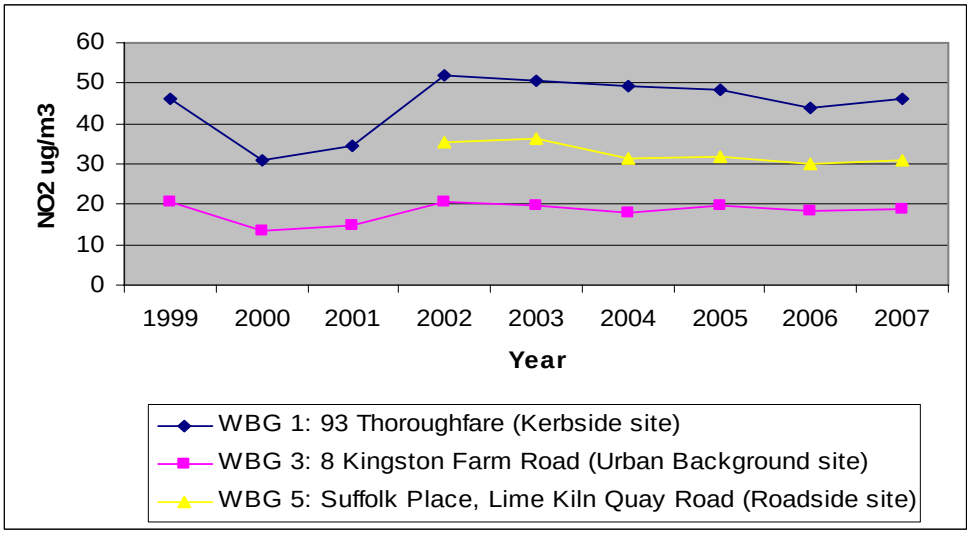
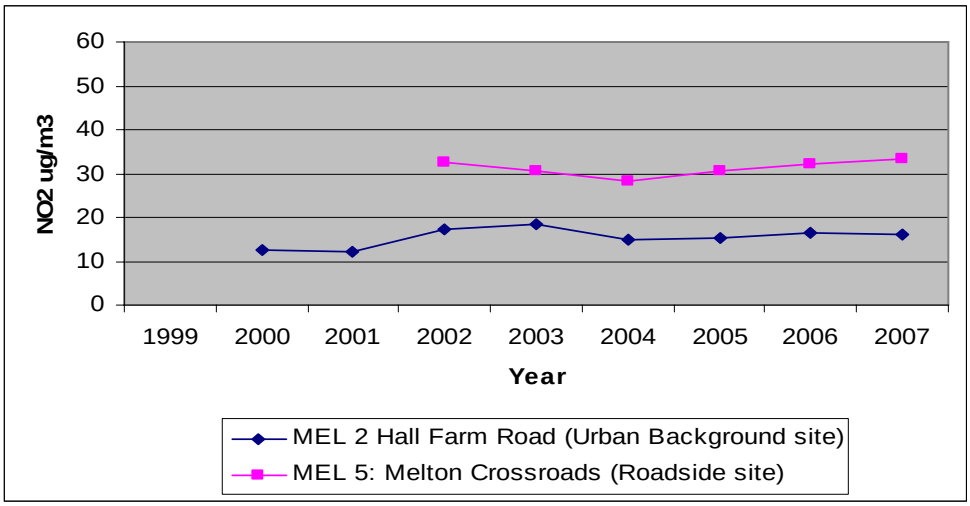


Figure 4.4 Annual mean nitrogen dioxide concentrations measured at permanent diffusion tube sites in Melton between 1999 and 2007



5 New Local Developments

Any new local developments, since the Updating and Screening Assessment Report, that may affect air quality within the Suffolk Coastal district are listed in this Progress Report so that they can be considered in more detail during the next full round of review and assessment, to begin later this year. This includes developments that are now in operation or have been granted planning permission to be brought into operation in the near future.

5.1 New industrial processes

Industrial processes authorised under the Pollution Prevention and Control (England and Wales) Regulations 2000 (as amended) that are likely to require air quality review and assessment are listed in Appendix 2 of the technical guidance LAQM.TG(03). The Progress Report guidance LAQM.PRG(03) states that any new or substantially changed installations that are included in the above mentioned appendix should be listed for future investigation.

There are nine new Part B installations and nineteen new Part A1 installations (regulated by the Environment Agency) that have been authorised since the Updating and Screening Assessment in 2006. Details for each installation are provided in Appendix A, including whether they are classed as a potentially significant emitter of any of the pollutants of concern.

Fourteen of the Part A1 installations are classed as significant emitters of one or more of the pollutants of concern, these are listed below:

- Novera Energy (Part A1 installation)
  Combustion Activity
- Wenhaston Farm (Part A1 installation)
  Intensive Farming Activity
- Crown Chicken Ltd (Part A1 installation)
  Intensive Farming Activity
- Red House, House Farm (Part A1 installation)
  Intensive Farming Activity
- Great Pinners Farm (Part A1 installation)
  Intensive Farming Activity

- Grampian Country Chickens (Rearing) Limited (Framlingham) (Part A1 installation)
  Intensive Farming Activity
- Grampian Country Chickens (Rearing) Limited (Earl Soham) (Part A1 installation)
  Intensive Farming Activity
- Grampian Country Chickens (Rearing) Limited (Peasenhall) (Part A1 installation)
  Intensive Farming Activity
- Grampian Country Chickens (Rearing) Limited (Badingham) (Part A1 installation)
  Intensive Farming Activity
- Gressingham Farms, Loomswood Farms (Debach) (Part A1 installation)
  Intensive Farming Activity
- Gressingham Farms, Mapel Tree Farm (Tuddenham St Martin) (Part A1 installation)
  Intensive Farming Activity
- Crown Chicken Ltd (Part A1 installation)
  Intensive Farming Activity
- Hook 2 Sisters Limited (Part A1 installation)
  Intensive Farming Activity
- Grampian Country Chickens (Rearing) Limited (Framlingham) (Part A1 installation)
  Intensive Farming Activity

Review and assessment of these installations will be undertaken and detailed In the Updating and Screening Assessment report to be produced in 2009.

There is also a previous A1 installation that is continuing to undergo significant alterations:

- Sizewell A Nuclear Power Station, Sizewell - decommissioning.
  This was an existing A1 installation for electricity generation authorised under the Radioactive Substances Act 1993 by the Environment Agency to regulate the discharge of radioactive waste. Emissions were considered in the Detailed Assessment report (April 2004) due to the proximity of Sizewell B Nuclear Power Station, and the possibility of emissions from both installations combining to cause objective exceedances. The report concluded that the objectives were not likely to be exceeded and no further assessment was necessary. Sizewell A Nuclear Power station is now being decommissioned, the reactor was shutdown in 2007 and the Essential Supplies Diesel Generators have now also been shut down. The removal of buildings has now commenced and eventually the site will just house the Reactor Building.

5.2 New developments with an impact on air quality

Any new developments that have been granted planning permission and will have an impact on air quality, especially those that will significantly change traffic flows, should be listed for future investigation. There is one development that has been granted planning permission which may have an impact on air quality. This will be investigated further and detailed in future reports.

- Development of land at Clickett Hill and Blofield Hall, north of Blofield Road / Nicholas Road, Trimley St Mary - Outline Planning Application C98/0290
  This outline planning permission is for earthworks and provision of infrastructure in connection with the use of land for business (B1), industrial (B2) and storage and distribution (B8) purposes. It includes the formation of plateaux, provision of roads, alterations to Blofield Road and its junction with Trinity Avenue, provision of flood ponds, building, structural landscaping and disposal of soil. There are six plateaux A-F included in the outline planning permission; plateaux A,B,E and F have outline permission for any of the planning use classes listed above and plateaux C and D only have permission for planning use class B1 (business) purposes.
  All of the Plateaux have now been formed, no detailed planning applications have been received for Plateaux A-D. Plateaux E and F have been developed for container storage which is operational.

In addition, there are a further three developments in Martlesham Heath, on the Industrial Estate, that have been granted planning permission and are in close proximity to one other. Traffic flows may

increase at the junctions with the A12 in this area due to these developments, but the extent of this is not known. Individually these developments would not significantly affect traffic flows, but they may have a combined effect. These developments will be investigated further.

- Land off Anson Road, Martlesham Heath – Planning Application C03/1571
  A subsidiary of Tesco Stores Ltd owns the land adjoining the Anson Road Tesco site to the south-east. Outline planning permission for the 'erection of non-food retail units (40,000 gross square feet (3,716 m^2)), access road and servicing' was originally approved in April 1993. The permission was subsequently renewed in March 1996 (C96/0048) and again in July 2000. In 2003 planning application C03/1571 was received with detailed plans for the site, a terrace of three retail units with customer parking for 197 cars. This most recent application is awaiting submission of detailed landscaping plans before any final approval can be granted.

- Land adjacent to restaurant and petrol filling station, Anson Road, Martlesham Heath – Planning Application C08/0220
  Planning permission has been granted for the 'construction of a non-food retail unit and associated parking and servicing' at this site. No work has started on the site as yet.

- Land South of Martinside, Beardmore Park, Martlesham Heath – Planning Application C08/0500
  Planning permission has been granted for the 'erection of a non-food retail unit comprising 2,839m^2 of building and 734m^2 external trade yard with car parking and associated landscaping. No work has started on the site as yet.

5.3 New road schemes

Any new roads or road schemes that have been constructed or approved should be listed for future investigation. There have been no new roads constructed or road schemes approved for the Suffolk Coastal district that would significantly change traffic flows and impact on air quality objectives since the Updating and Screening Assessment of 2006.

5.4 New landfill sites, mineral developments etc.

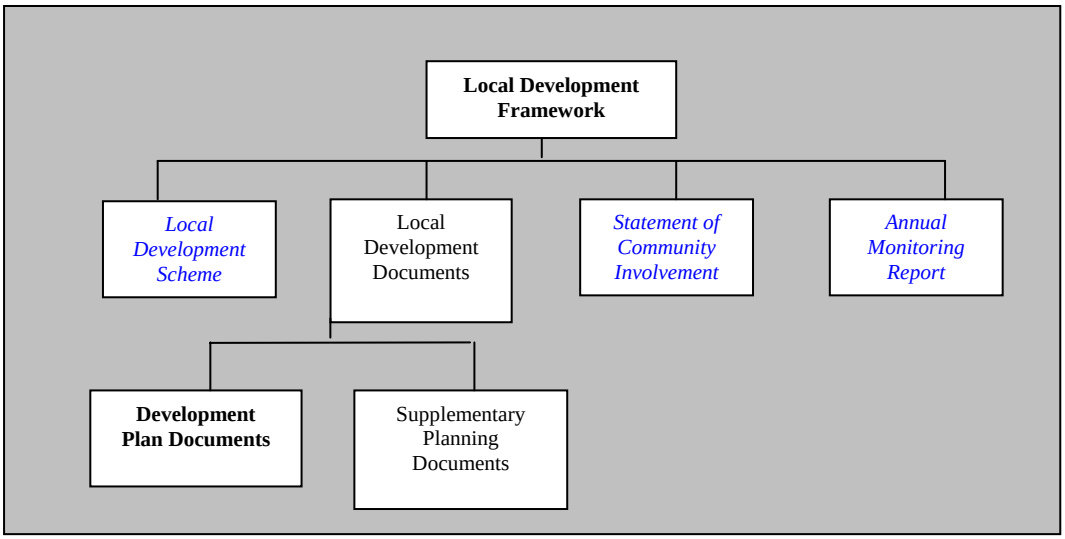
Any new landfill sites, quarries etc. which are in operation, or have been granted planning permission, and which have nearby relevant exposure should be listed for future investigation. There are no new developments of this nature within the Suffolk Coastal district or neighbouring authorities since the Updating and Screening Assessment of 2006.

6 Local Planning Policies relating to air quality

The land use planning system is recognised to play an integral part in improving air quality in the Local Air Quality Management regime. Government policy on planning is set out in The Planning and Compulsory Purchase Act 2004 and associated regulations and circulars. More detailed advice and guidance on a range of topics in the form of Planning Policy Guidance Notes and Planning Policy Statements.

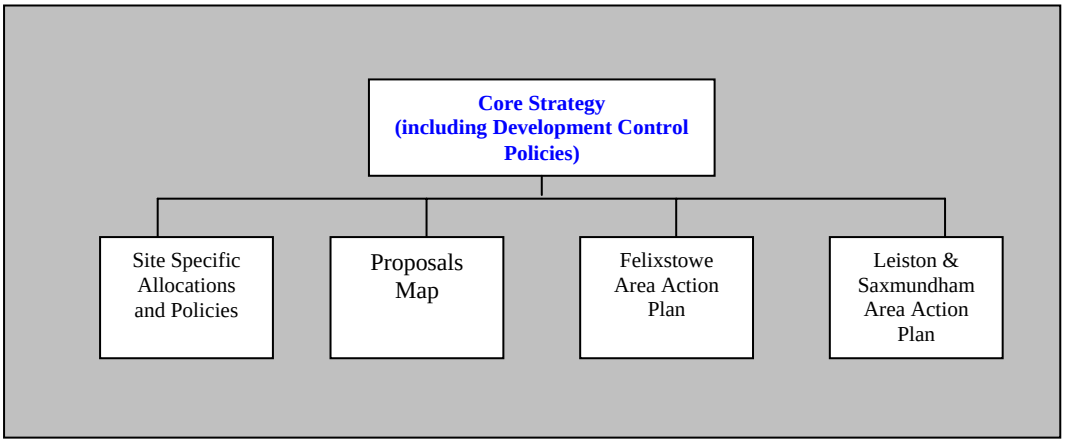
The 2004 Act requires Local Planning Authorities to replace their existing adopted Local Plans with a new Local Development Framework. The new Local Development Framework will comprise a suite of documents as shown in Figures 6.1 and 6.2, and promote a wider spatial approach to the management of development of land than the earlier Local Plan regime.

Figure 6.1 **Summary of the Local Development Framework**



For Suffolk Coastal five Development Plan Documents will be prepared, see Figure 6.2. The most significant of these is the Core Strategy, as this will establish the context for the remainder. It will also contain generic Development Control Policies covering the whole district that will be used in the determination of planning applications. It is currently anticipated that this document will be adopted early 2010.

Figure 6.2 **Summary of the Development Plan Documents for the Suffolk Coastal District**



The Site Specific Allocations and Policies will relate to specific areas or places, eg towns and town centres. Where specific sites are allocated or designated for particular uses these will be shown on the separate Proposals Map.

Area Action Plans will be prepared at a later date. These relate to areas where change is to take place and will set out an implementation plan for that change.

These Development Plan Documents will also be informed by the Regional Spatial Strategy – The East of England Plan (May 2008) which replaced the former Suffolk County Structure Plan.

Under the new planning regime the current advice is that draft policies and proposals will carry no weight in the determination of planning applications until that Development Plan Document is adopted – i.e. it has been proven to be "sound". As noted for the Core Strategy this is not anticipated to be before early 2010.

The Planning Act therefore put in place transitional measures whereby existing policies can be 'saved' where they could still be justified and where they did not merely repeat advice and guidance provided at the national level through Planning Policy Guidance documents and Planning Policy Statements or at the regional level through the Regional Spatial Strategy. There are two policies relevant to air quality which have been 'saved', these are:

- Environmental Objective xii – 'to control or prevent, where within the Council's powers, pollution of the environment.'
- Policy AP159: Rendlesham/Wantsiden (former base): General Principles – 'Development proposals must be … accompanied by an Environmental Management Plan, Environmental Statement, Traffic Impact Assessment …'

Planning Policy Guidance notes (PPGs) are issued to help local authorities in land use planning by providing information from the Government on various themes. PPGs are currently being updated and will be replaced by Planning Policy Statements (PPSs). The advice in the PPG and PPS documents is taken into account when the Local Development Document is produced for the Suffolk Coastal area and is also material in individual planning applications.

The following is a summary of the planning policy, advice and guidance that is relevant to the issue of air quality during the transition period at least until the adoption of the Suffolk Coastal LDF Core Strategy (including development control policies):

- PPS1 - Delivering Sustainable Development
- PPS3 - Housing
- PPS6 - Town Centres and Retail Developments
- PPG13 – Transport
- PPS23 – Planning and Pollution Control

PPS 1 sets out the Governments overarching planning policies on the delivery of sustainable development through the planning system. It states the following of relevance to air quality:
'Planning authorities should seek to enhance the environment as part of development proposals. Significant adverse impacts on the environment should be avoided and alternative options which might reduce or eliminate those impacts pursued.'
'Development plan policies should take account of environmental issues such as … air quality and pollution…'

PPS23 sets out the Governments policies on Planning and Pollution Control and advises that 'any consideration of the quality of land, air or water and potential impacts arising from development, possibly leading to impacts on health, is capable of being a material planning consideration, in so far as it arises or may arise from or may affect any land use.'
Appendix A of the document advises on matters for consideration when preparing Local Development Documents and taking decisions on individual planning applications and lists:

- 'the possible impact of potentially polluting developments (both direct and indirect) on land use, including effects on health, the natural environment or general amenity.'
- 'the existing, and likely future, air quality in an area, including any AQMAs or other areas where air quality is likely to be poor (including the consideration of cumulative impacts of a number of smaller developments on air quality, and the impact of development proposals in rural areas with low existing levels of background air pollution). The findings of air quality reviews and assessments will be important in the consideration of local air pollution problems and the siting of certain types of development.'
- 'the need for compliance with any statutory environmental quality standards (including the Air Quality Objectives prescribed by the Air Quality Regulations 2000 and amendment Regulations 2002 …)'

Further information on air quality policy is set out in Appendix 1B of PPS23.

The Regional Spatial Strategy replaces the Suffolk Structure Plan and has saved some of the policies from it. There are two with links to air quality:

- Policy SS1 - Achieving Sustainable Development
- Policy T1 - Regional Transport Strategy Objectives and Outcomes; To achieve "…improved air quality" and reduced "greenhouse gas emissions".

A system exists whereby all planning applications to Suffolk Coastal District Council are recorded on a Public Register. This comprehensive list is then circulated to the Principal Environmental Health Officer in the Environmental Protection team who assesses which applications will require investigation by the team. Details of these applications are then provided to members of the team for relevant comment on any issues relating to air quality, noise, contaminated land, drainage etc.

7 Proposed Future Developments

There are a number of proposed developments within the Suffolk Coastal district that have not yet had planning permission granted, and which may impact on air quality. It is important that these developments are logged in this Progress Report so that their progress through the planning system can be monitored and any potential impacts on air quality assessed. There are four developments that we are aware of at this time:

- Suffolk Innovation Park, Adastral Park, Martlesham Heath

Of the total 63 hectares making up the entire Martlesham Heath employment area, over 50 per cent (some 42 hectares) comprises the Adastral Park complex. This is a centre for communications and information technology research. It currently supports approximately 3600 jobs and complements the adjoining Business Park which contains more than 60 different companies providing about 500 jobs.

The employment area is a significant and growing source of new businesses. The Council is working with landowners, including BT, to produce a masterplan with the objective of creating a Hi-Tech Cluster comprising:

- redevelopment and new development within Adastral Park itself, including the development of an Innovation Campus. This seeks to replace obsolete and worn out buildings with new buildings of a high quality that meet the needs of BT and other businesses that are already on the site or may be attracted to locate there.
- the development and redevelopment of parts of Martlesham Heath Business Park to create new, high quality premises; and
- the development of a strategic gateway for the Hi-Tech Cluster.

It is estimated that an additional 2500 jobs can be created. The A12 marks the western boundary of the employment area, separating it from the residential areas to the west. The area is served by two junctions with the A12. The majority of the traffic entering and leaving the area passes through these junctions and at present there are moderate capacity problems at peak times.

The future access strategy for the area is intended to meet two main objectives; to reduce the need to travel and to manage the volume and mode of trips, prioritising sustainable travel modes; and to make most efficient use of connections beyond the site boundaries, to the A12 and to the surrounding area. There has been no planning application made yet for the site but the Council is anticipating that one will be made soon which will include housing.

- Woodbridge Riverside area

  There is an adopted and saved Supplementary Planning Guidance document (SPG 12.10) for the Woodbridge Riverside area. The document sets out in more detail how the saved policies of the Suffolk Coastal Local Plan will be implemented in this area. This SPG will be saved until replaced by new policies contained in the Suffolk Coastal Local Development Framework. The area covered in this document is to the east of the East Suffolk Railway line and north of Ferry Quay including the site of the former Whisstocks Boatyard. It extends north of Tide Mill Yacht

Harbour, west of the railway line it encompasses areas to the north and south of Tide Mill Way and includes the former Gas Works site off Quayside. Opposite the gasworks site it also includes the site of the former Quayside Mill between Crown Place and Doric Place. It also includes the Riverside Theatre, Woodbridge Station and its car park, and the former railway goods shed (WR Refrigeration building).

The former Gas Works site and the WR Refrigeration Ltd. building have now been redeveloped. The former Whisstocks Boatyard and the former Quayside Mill sites have been the subject of planning applications that were refused. A new application has been recently been received for the former Quayside Mill site but this has not yet been registered by the planning department. This application will be assessed for any air quality impacts.

- Land at junction of Station Road, Wilford Bridge Road and Girdlestone Pumps, Station Road, Melton – Planning Application C08/0724.
  An application has been made for the development of 78 one, two, three and four storey business units to include offices, workshops, shops and a restaurant/café and associated external works on this site. The application is currently undetermined and is subject to significant local opposition. This application will be assessed for air quality impacts. Specific investigations of increased traffic flows using the crossroads of the A1152 and B1438 at Melton and the junction of Lime Kiln Quay Road, Thoroughfare and St. John's Street in Woodbridge where the Air Quality Management Area has been declared will be undertaken.

- Redevelopment of bus station, reporting centre and 2-4 Langer Road, Felixstowe – Planning Application C08/0949
  An application has recently been made for redevelopment of the site to provide a food store (A1 use) and associated parking and servicing areas. The existing depot, bus station, shop and restaurant would be demolished and there would be a new access onto the Ordnance roundabout. The internal store size would be 1,387m^2, there would be parking for 100 cars and a bus stop would be provided at the front of the store. This application will be assessed for any air quality impacts.

8 Local Air Quality Strategy

Suffolk Coastal District Council has not drawn up a local Air Quality Strategy at the present time. The need for a strategy will be considered as part of our ongoing review of air quality.

9 Local Transport Plan and Strategies

The Local Transport Plan system is a 5-year transport strategy at a local level whereby Local Transport Authorities are required to submit a 5-year Local Transport Plan (LTP) for their area that sets objectives and targets for transport, and strategies for achieving them. The plans must cover all forms of transport and establish strategies to tackle congestion and poor air quality. The LTP provides the basis for allocating resources to the Local Transport Authority in order for them to implement their plans. The Local Transport Authority for Suffolk is Suffolk County Council.

The Department for Transport (Dft) has included air quality as one of four new shared priority areas to be reported in the Second Local Transport Plan (LTP2) which covers the period from 2006 to 2011. This is the first time that air quality has been addressed separately as a priority alongside three other areas which are congestion, accessibility and road safety.

Suffolk County Council's Plan was completed early in 2006 and is available for inspection at http://www.suffolk.gov.uk/TransportAndStreets/Policies/SuffolkLocalTransportPlan2006-2011.htm

A full report on Suffolk's air quality, including reference to the Woodbridge Air Quality Management Area declared in April 2006, has been included in Chapter 8 of the LTP2 together with the County Council's objectives of:

a) To comply with the requirements of the National Air Quality Strategy and

b) To seek to maintain and where possible improve air quality in Suffolk.

As a result of its submission, Suffolk County Council received a rating of "excellent" from the Department for Transport (Dft) for its management of local air quality. This was awarded partly in recognition of the close working relationships developed between the two tier local authorities in Suffolk.

Following submission Dft awarded funding, through the LTP process, to address traffic and transport problems within the Woodbridge AQMA for the three financial years starting April 2008. This money is not ring-fenced and it is important that it is spent to best effect. Following agreement from Suffolk Coastal, Suffolk County Council will integrate the completed Air Quality Action Plan for the Woodbridge Junction into the LTP process at the appropriate biannual delivery report. The linkages with the other priority areas are recognised and funding for measures to address congestion and promote the sustainable transport "soft options" should also have the benefit of maintaining or improving air quality and vice versa.

A number of strategy objectives have been presented as part of the LTP2 Plan Implementation Programme, with the largest impact on Suffolk Coastal potentially arising from the objective to "Support the sustainable development of the ports of Felixstowe, Ipswich and Lowestoft in their roles as gateways to the rest of the county". Local Transport Action Plans are no longer prepared as part of the LTP process and for the future, interventions will be developed against each of the identified strategy objectives.

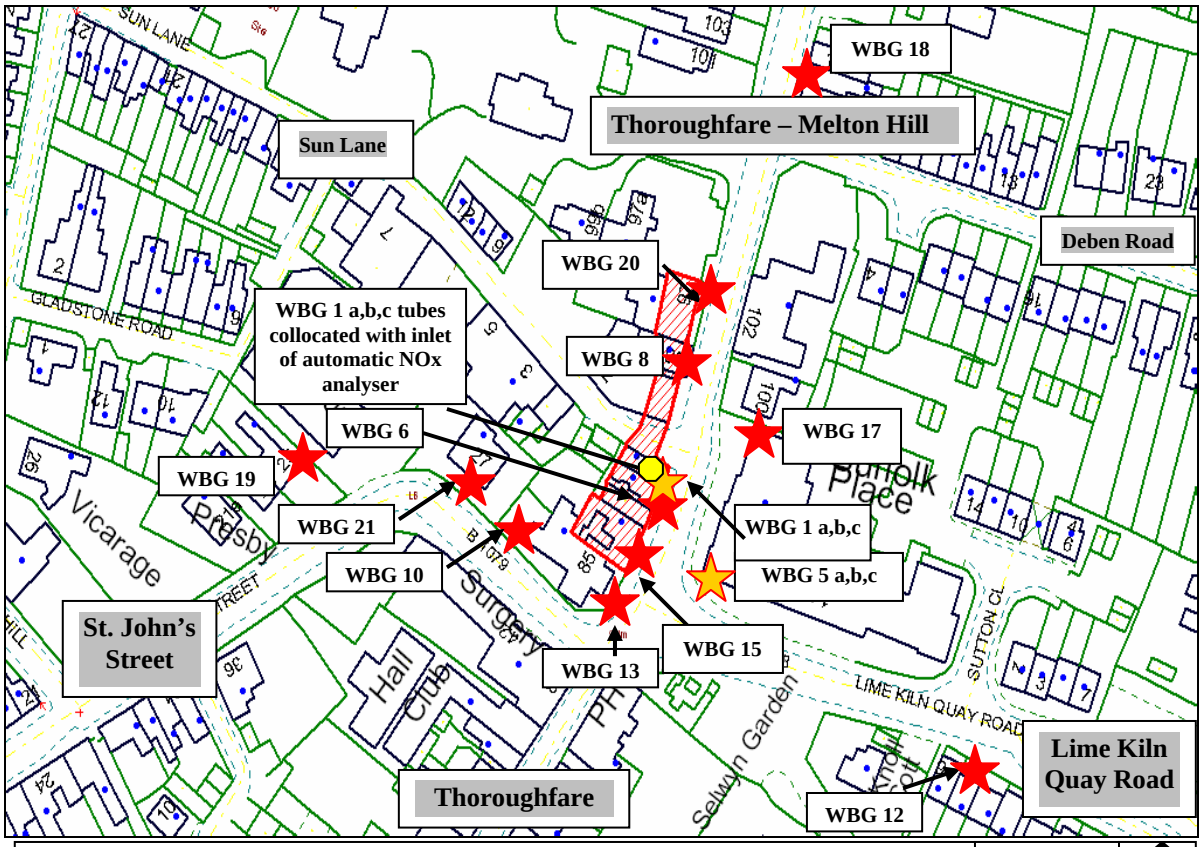
The only major scheme proposed for the Suffolk Coastal district is the A12 Four Villages Bypass. A full investigative study of a number of bypass route options was carried out in 2004 which, although identifying strong economic and safety benefits, highlighted potentially severe environmental impacts. The traffic problems through the four villages of Farnham, Stratford, Glemham and Marlesford are so severe that further work on a range of alternative solutions focussing on traffic management measures to the existing route is to be carried out during the life of the current LTP. If appropriate a bid for funding will be submitted to the Department for Transport.

Works to the A1152/B1438 Melton Crossroads junction have been completed which has enabled traffic to move more freely through the junction to minimise queuing and congestion.

10 Air quality update on the Air Quality Management Area at the junction of Lime Kiln Quay Road, Thoroughfare and St. John's Street in Woodbridge

On 3 March 2006 Suffolk Coastal District Council made an Air Quality Management Area (AQMA) Order at the junction of Lime Kiln Quay Road, Thoroughfare and St. John's Street in Woodbridge, which came into effect on 3 April 2006. This Area was designated in relation to a likely breach of the annual mean nitrogen dioxide (NO_2) objective. A copy of the AQMA Order is provided in Appendix E. The area designated in the Order incorporates seven buildings on the western side of the Thoroughfare / Melton Hill arm of the junction, of which four are residential properties. The extent of the AQMA is shown in the Order and also in Map 10.1 below.

Map 10.1 Location of the Air Quality Management Area, nitrogen dioxide diffusion tubes and automatic NO_x analyser sited at the junction of Lime Kiln Quay Road / Thoroughfare / St. John's Street in Woodbridge



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Not to scale

N

Single Diffusion Tube

Site of automatic NO_x analyser

Triplicate Diffusion Site

AQMA

10.1 Findings of the Further Assessment

In accordance with section 84(1) of the Environment Act 1995, a Further Assessment of existing and likely future annual mean NO_2 concentrations in the AQMA was published in October 2007 and received approval by Defra. The Further Assessment investigates the NO_2 concentrations in 2006 (the base year) and 2010 through modelling exercises and by reference to the monitored air quality data from the junction. The Further Assessment report is attached as Appendix F.

For 2006, both monitoring and modelling indicate continued exceedences of the objective for annual mean NO_2 concentrations at the junction. The hourly mean NO_2 objective is unlikely to be exceeded at any locations on the junction. No exceedences of the objectives for NO_2 concentrations are predicted at the junction in 2010.

Source apportionment, undertaken as part of the Further Assessment, confirms that local traffic accounts for about 90% of the local NO_x concentrations. It concludes that Light Duty Vehicles (LDVs) and Heavy Duty Vehicles (HDVs) account for about half of the traffic emissions each, although the actual percentage of HDVs using the junction is only approximately 5% of the total traffic flow. Of the traffic emissions, 60% are attributed to queuing vehicles and 40% to moving vehicles.

The Further Assessment recommends the following:

- That the AQMA should be retained at the junction in its current form.
- Monitoring should continue at all sites to confirm the predicted trend between now (2006) and 2010 with a few alterations
- Consideration should be given to revoking diffusion tube Woodbridge 19 located in St. John's Street. Annual mean concentrations are within the objective and there are more relevant tubes located in this area at Woodbridge 10 and 21, see Map 10.1.
- A reduction of vehicle emitted NO_x by 16.4% would have eliminated the exceedences to the objective for annual mean NO_2 concentration in 2006. Queuing and Heavy Duty Vehicle reductions will be the keys to improve the air quality at the junction.

10.2 Update on monitoring undertaken at the junction

Automatic NO_x analyser results

On 3 January 2006 the automatic NO_x analyser was relocated from 87 Thoroughfare to 93 Thoroughfare in order to obtain measurements from the area indicating maximum NO_2 concentrations (according to diffusion tube results), for a site location map see Map 10.1 above and Appendix C. Monitoring has continued at this location since this time and 12-month ratified data sets have been collected for 2006 and 2007. Both monitoring periods have data capture greater than 90% as recommended in the technical guidance LAQM.TG(03) for quality assurance of the data produced.

A summary of the average measured concentrations and the maximum hourly mean concentrations of NO_2 for 2006 and 2007 can be seen in table 10.2.1 overleaf. Detailed summary tables and graphs can be seen in Appendix D together with information regarding quality assurance of the data.

The results show that for 2006 the average annual NO_2 concentration for the site was 44$\mu g/m^3$, which is above the annual mean objective of 40$\mu g/m^3$. The maximum hourly mean concentration of 199$\mu g/m^3$ does not exceed the 1-hour objective of 200 $\mu g/m^3$ not to be exceeded more than 18 times per year.

The results show that for 2007 the average NO_2 concentration for the site was 46 $\mu g/m^3$, which is above the annual mean objective of 40 $\mu g/m^3$. The maximum hourly mean concentration was 206$\mu g/m^3$ with 2 exceedences of the 200 $\mu g/m^3$ objective. This does not exceed the 1-hour objective of 200 $\mu g/m^3$ not to be exceeded more than 18 times per year.

The annual mean NO_2 concentration recorded at the site of the continuous NO_x analyser continues to exceed the air quality objective. The automatic analyser will continue to monitor NO_2 concentrations at its current location for the foreseeable future, in order to provide continued information for the Action Plan process.

Table 10.2.1 Summary of 12-month ratified NO_2 data collected by the automatic NO_x analyser located at the junction of Lime Kiln Quay Road, Thoroughfare and St. John's Street in Woodbridge in 2006 and 2007.

	2006 Concentration of NO_2 recorded by analyser	**2007 Concentration of NO_2 recorded by analyser**
Average concentration	**44 µg m^{-3}**	**46 µg m^{-3}**
Maximum hourly mean	199 µg m^{-3}	**206 µg m^{-3}**
Number of exceedences of the hourly mean	0	2
Data capture	96.30%	98.40%

Diffusion tube results

In order to provide spatial information regarding NO_2 concentrations around the junction, monitoring using diffusion tubes has continued at 13 sites. An additional site was added to the study in 2007 in St. John's Street following increased queuing on this arm of the junction once the traffic signals were altered. General details regarding diffusion tube monitoring are provided in section 3.2 in this report.

Diffusion tubes can over or under read and the annual average should be corrected for laboratory bias. Woodbridge 1 was collocated with the automatic analyser in 2006 and 2007 in order to provide a bias correction factor each year for the diffusion tubes. Full details of the analytical technique and laboratory used, monitoring locations, diffusion tube bias adjustment information and breakdown of results on a monthly basis for the monitoring periods can be seen in Appendix B. A summary of the annual mean NO_2 concentration recorded by the diffusion tubes for both 2006 and 2007 at each monitoring site is presented in table 10.2.2 overleaf.

Table 10.2.2 Bias corrected annual mean NO_2 diffusion tube concentrations for a 12-month period undertaken at the Woodbridge junction in 2006 and 2007.

Site	**2006 Annual mean (µg/m^3) using bias correction factor 0.93**	**2007 Annual mean (µg/m^3) using bias correction factor 0.96**
Woodbridge 1 a,b,c	**44**	**45.9**
Woodbridge 3	18.3	18.6
Woodbridge 5 a,b,c	30.2	31.1
Woodbridge 6	**42.4**	**43**
Woodbridge 8	**44.5**	**47.3**
Woodbridge 10	38.4	37.3
Woodbridge 12	31	30
Woodbridge 13	36.7	38.5
Woodbridge 15	**41.5**	**43.9**
Woodbridge 17	34	31.5
Woodbridge 18	38.9	39.7
Woodbridge 19	22.7	23.9
Woodbridge 20	**42.5**	**42.1**
Woodbridge 21	n/a	23.3

The results in Table 10.2.2 show five sites at the junction (highlighted in grey) with an annual mean concentrations above the objective of 40 $\mu g/m^3$ in both 2006 and 2007 – Woodbridge 1, 6, 8, 15 and 20. These sites are all within the designated AQMA, see Map 10.1.

The annual mean NO_2 concentration recorded at diffusion tube monitoring sites within the AQMA continue to exceed the air quality objective.

In April 2008 diffusion tube site Woodbridge 19 was removed as per the recommendation in the Further Assessment. This site has been relocated to a drainpipe on Suffolk Place in Lime Kiln Quay Road in order to provide monitoring data at this location. All other diffusion tube sites are continuing to monitor NO_2 concentrations.

10.3 Air Quality Action Plan

A working group was established in 2006 to look at all possible solutions to decrease the NO_2 concentrations in the AQMA and at the junction in general. The group has drawn up a list of options for the junction including all suggestions received following a public consultation in 2006 and each option is in the process of being assessed for both cost and benefit. Once this task is completed the list of options will be narrowed down for inclusion in the final draft Action Plan. Some options have already been investigated and alterations have been made to the traffic light sequencing in order to try and reduce queuing at the junction. An interim draft Action Plan detailing progress to date was submitted to Defra in November 2007. Defra acknowledged that this was a 'work in progress', and that more work was required to attain a report consistent with Defra guidance on Air Quality Action Plans.

One of the key elements to allow the Council to target the most appropriate options for inclusion in the final Action Plan is collection of additional information related to traffic flows, make-up of the traffic and the origin and destination of traffic using the junction. To this end, a bid for Defra grant funding was submitted in April 2008 and we are waiting to hear if the Council has been successful.

Once the draft Action Plan is completed and sent to Defra the Council will be undertaking further public consultation on the contents of the draft report. Comments received from this consultation will then be fed into formulation of the final Action Plan for the junction.

11 Detailed Assessment of Emissions Generated by the Port of Felixstowe

The findings of the Updating and Screening Assessment 2006, following the approval of both the Felixstowe South Reconfiguration and Bathside Bay, Harwich planning applications, were that a Detailed Assessment would be undertaken for NO_2, SO_2 and PM_{10} at receptor locations close to the Port of Felixstowe and its main access route, the A14 trunk road. The Detailed Assessment would entail the following:

- Siting of a continuous analyser for oxides of nitrogen (NO_x) at the Dooley Inn Public House, Ferry Lane, Felixstowe to provide 12 months of monitoring data beginning in January 2007. Diffusion tubes to be collocated with the analyser in order to provide bias correction.

- Collection of a 12-month data set for NO_2, SO_2 and PM_{10} at a suitable location near to the Port of Felixstowe boundary using continuous monitoring equipment. Location of a number of additional diffusion tube monitoring sites within Adastral Close to provide information regarding the extent of any objective exceedances.

- Undertake air dispersion modelling to assess concentrations of NO_2, SO_2 and PM_{10} at receptor locations close to the Port of Felixstowe boundary and along the A14 trunk road. The modelling will look at the current situation and also provide future predictions with Felixstowe South Reconfiguration and Bathside Bay Container Port developments in place. The modelling will include emissions from all activities on and associated with the Port of Felixstowe and the results from the continuous monitoring, as outlined above, will enable verification of the modelling outputs.

11.1 Update on monitoring - Automatic NO_x analyser results for The Dooley Inn, Ferry Lane, Felixstowe

Following elevated concentrations of NO_2 recorded by diffusion tubes at The Dooley Inn public house, Ferry Lane, Felixstowe, a Model 200E Chemiluminescent continuous oxides of nitrogen analyser was located at this site in January 2007 to undertake a Detailed Assessment, for a site location map see Maps 11.1 and 11.2. A 12-month ratified data set was collected for 2007 with data capture greater than 90% as recommended in the technical guidance LAQM.TG(03) for quality assurance of the data produced.

A summary of the average measured concentrations and the maximum hourly mean concentrations of NO_2 for 2007 can be seen in table 11.1 below. Detailed summary tables and graphs can be seen in Appendix D together with information regarding quality assurance of the data.

Table 11.1 Summary of 12-month ratified NO_2 data collected by the automatic analyser located at the Dooley Inn Public House, Ferry Lane , Felixstowe from 1st January 2007 to 31st December 2007

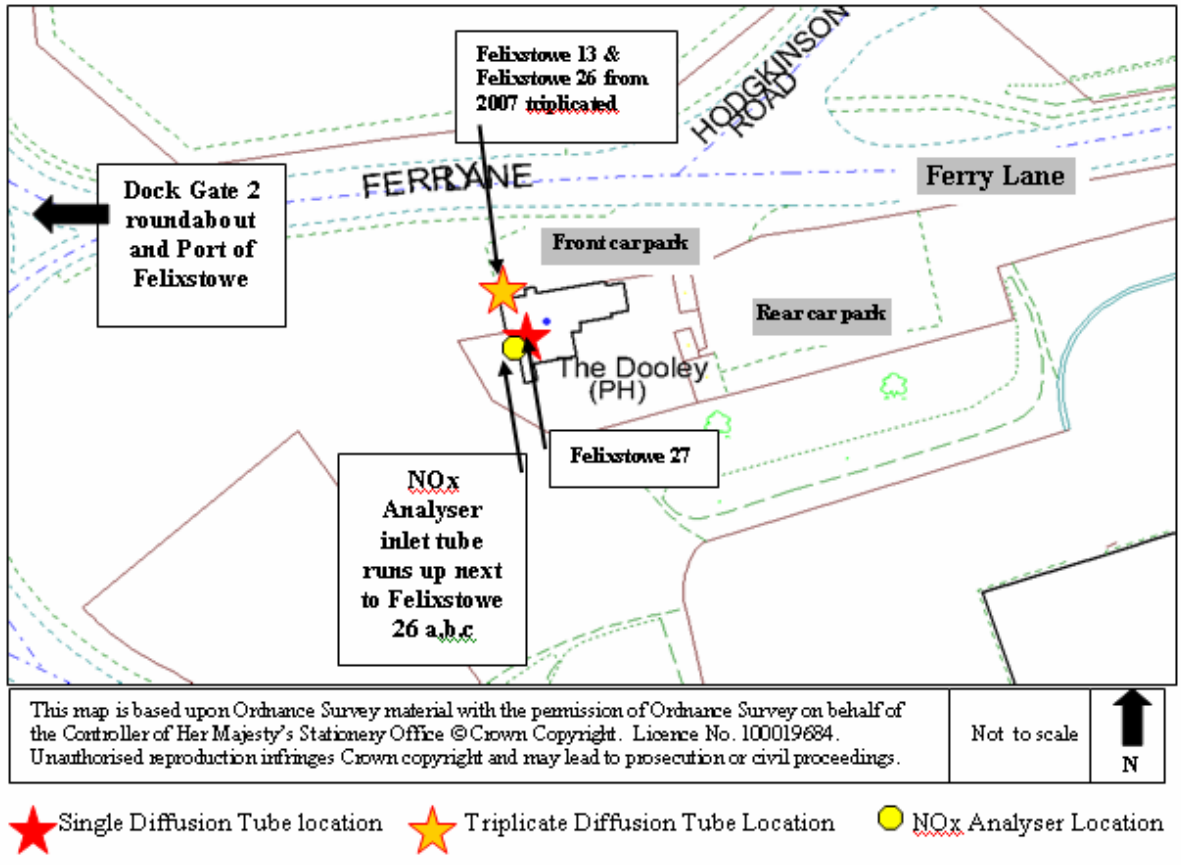
	Concentration of NO_2 recorded by analyser	**Air Quality Standard**
Average concentration	**42 µg m^{-3}**	40 µg m^{-3}
Maximum hourly mean	199 µg m^{-3}	200 µg m^{-3}
Number of exceedences of the hourly mean	0	18
Data capture	98.20%	n/a

The results in table 11.1 show that for 2007 the average annual NO_2 concentration for the site was 42μg/m^3, which is above the annual mean objective of 40 μg/m^3. The maximum hourly mean of 199μg/m^3 does not exceed the 1-hour objective of 200 μg/m^3 not to be exceeded more than 18 times per year.

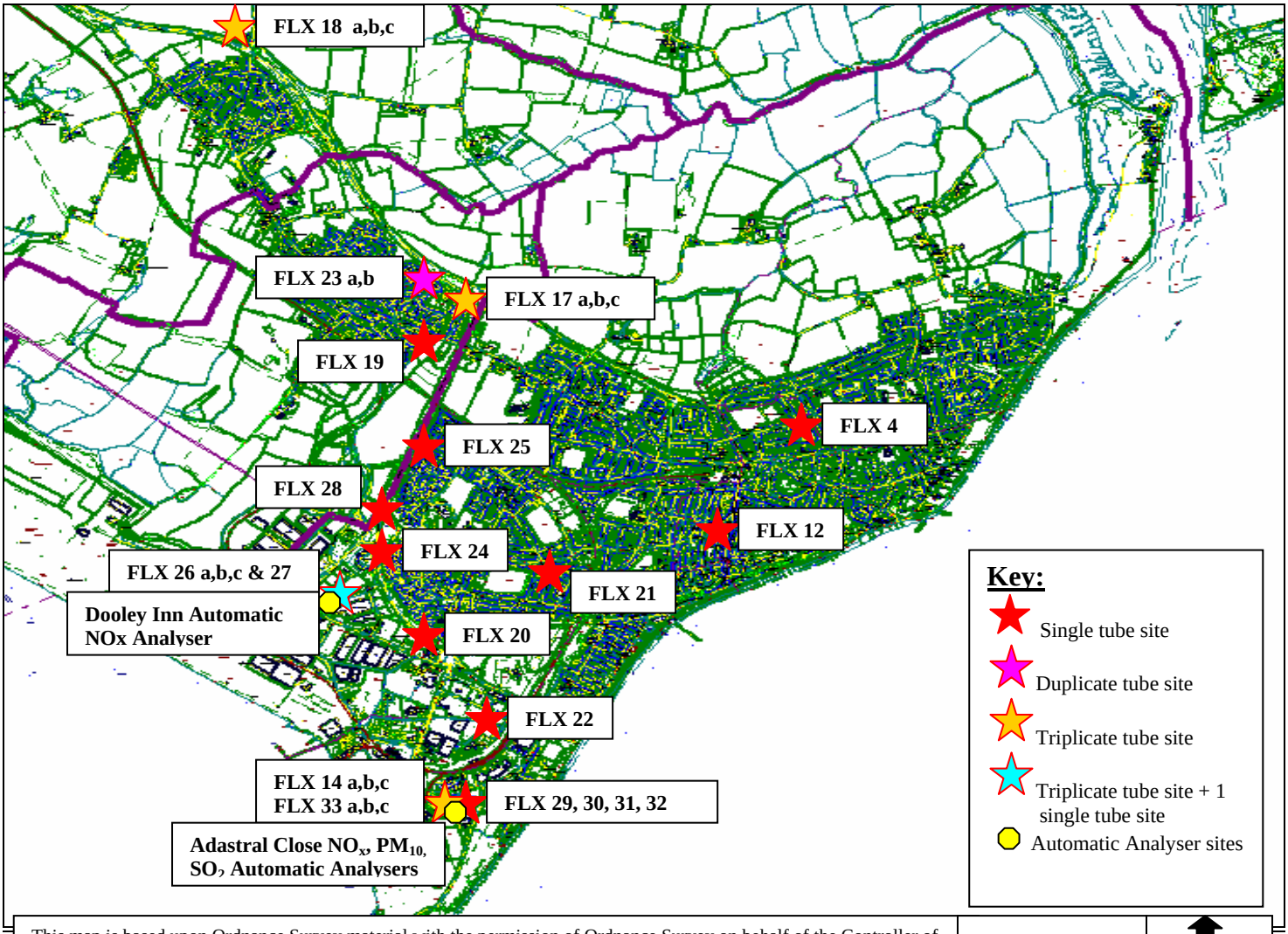
The annual mean NO_2 concentration recorded at the site of the continuous NO_x analyser exceeds the air quality objective.

The automatic analyser will continue to monitor NO_2 concentrations at its current location for the foreseeable future, in order to provide continued information.

Map 11.1 Site map showing location of automatic NO_x analyser and nitrogen dioxide diffusion tubes at The Dooley Inn Public House, Ferry Lane, Felixstowe



Map 11.2 Location of nitrogen dioxide diffusion tubes and automatic NO_x analyser sites in Felixstowe and the Trimleys



Not to scale

N

11.2 Update on monitoring - results of a 12-month monitoring survey of NO_2, SO_2 and PM_{10} concentrations at Adastral Close, Felixstowe

Following elevated concentrations of NO_2 recorded by diffusion tubes at Adastral Close, Felixstowe, a continuous NO_x analyser was located at this site in 2007 to undertake a Detailed Assessment. In addition, as part of a Detailed Assessment to confirm concentrations of SO_2 and PM_{10} at receptors close to the Port of Felixstowe, a continuous SO_2 analyser and a beta attenuation monitor to measure particulate matter were located in Adastral Close. For a site location map see Maps 11.1 and 11.3. Particulate matter measurements obtained from the beta attenuation monitor were adjusted to provide a gravimetric equivalent concentration by a dividing factor of 1.2 following advice given in the UK Air Quality Archive Air Quality Support FAQ.

A summary of the measured concentrations of all three pollutants for 2007 can be seen in table 11.2 overleaf. Detailed summary tables and graphs can be seen in Appendix D together with information regarding quality assurance of the data.

Map 11.3 Location of NO_2 diffusion tubes and automatic NO_x, SO_2 and PM_{10} analysers at Adastral Close, Felixstowe

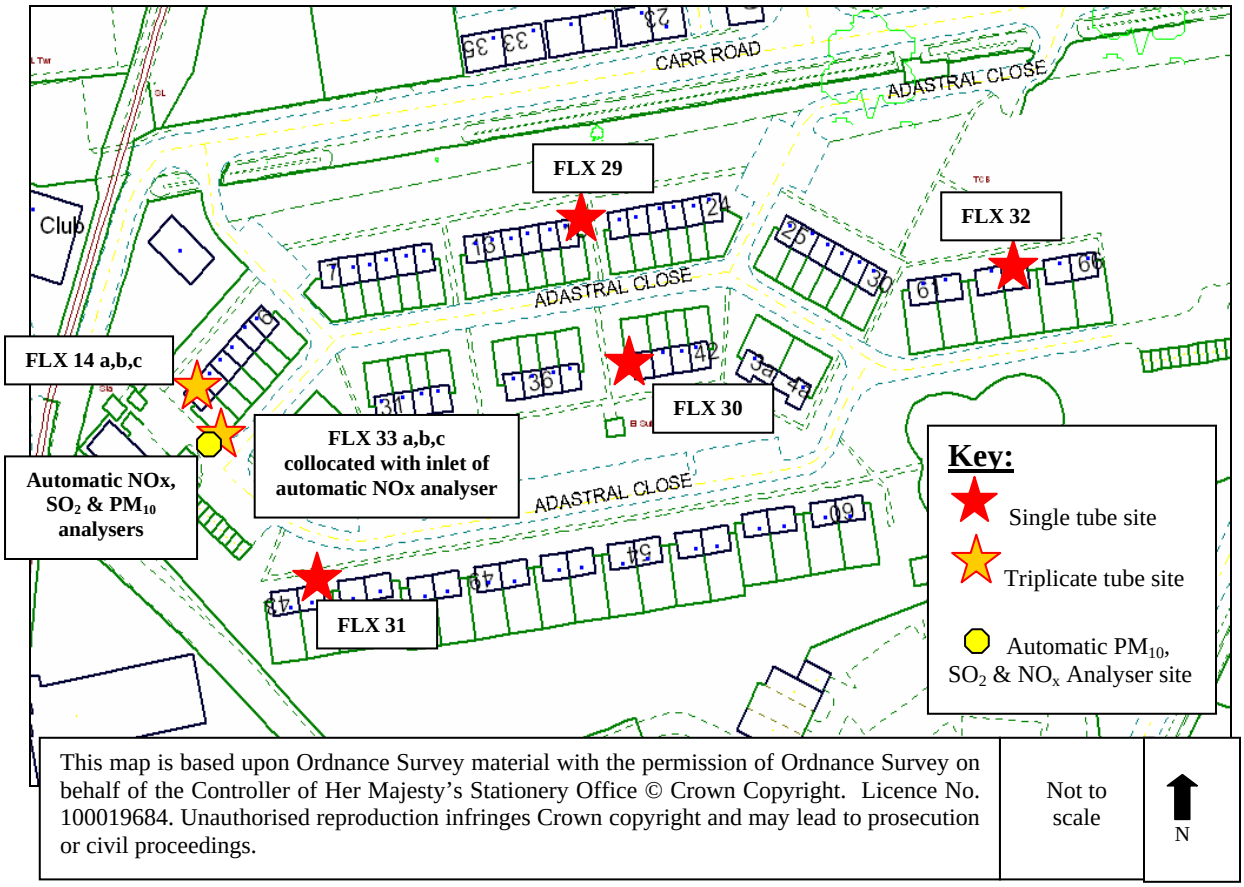


Table 11.2 Summary of 12-month ratified NO_2 SO_2 and PM_{10} data collected by the automatic analyser located at Adastral Close in Felixstowe from 30th January 2007 to 1st February 2008

SO_2	**Concentration of SO_2 recorded by analyser**	**Air Quality Standard**
Maximum 15-minute mean	229 µg m^{-3}	266 µg m^{-3}
Number of exceedences of the 15-minute mean	0	35
Maximum hourly mean	210 µg m^{-3}	350 µg m^{-3}
Number of exceedences of the hourly mean	0	24
Maximum daily mean	41 µg m^{-3}	125 µg m^{-3}
Number of exceedences of the daily mean	0	3
Data capture	98.20%	n/a

NO_2	**Concentration of NO_2 recorded by analyser**	**Air Quality Standard**
Average concentration	31 µg m^{-3}	40 µg m^{-3}
Maximum hourly mean	143 µg m^{-3}	200 µg m^{-3}
Number of exceedences of the hourly mean	0	18
Data capture	97.90%	n/a

PM_{10}	**Concentration of PM_{10} recorded by analyser**	**Air Quality Standard**
Average concentration	26 µg m^{-3}	40 µg m^{-3}
Maximum daily mean	**96 µg m^{-3}**	50 µg m^{-3}
Number of exceedences of the daily mean	13	35
Data capture	84.00%	n/a

The results in table 11.2 show that for **SO_2** in 2007 the maximum 15-minute mean of 229 μg/m^3 does not exceed the 15-minute objective of 266 μg/m^3 not to be exceeded more than 35 times per year. The maximum hourly mean of 210 μg/m^3 does not exceed the 1-hour objective of 350 μg/m^3 not to be exceeded more than 24 times per year, and the maximum daily mean of 41 μg/m^3 does not exceed the 24-hour objective of 125 μg/m^3 not to be exceeded more than 3 times per year

The results in table 11.2 show that for 2007 the average annual **NO_2** concentration for the site was 31μg/m^3, which is below the annual mean objective of 40 μg/m^3. The maximum hourly mean of 143μg/m^3 does not exceed the 1-hour objective of 200 μg/m^3 not to be exceeded more than 18 times per year.

The results in table 11.2 show that for **PM_{10}** in 2007 the average annual concentration for the site was 26μg/m^3, which is below the annual mean objective of 40 μg/m^3.maximum. The maximum daily mean concentration was 96 μg/m^3 with 13 exceedences of the 50 μg/m^3 objective. This does not exceed the 24-hour mean objective of 50 μg/m^3 not to be exceeded more than 35 times per year.

Following collection of data for the 12-month survey the monitoring equipment was removed from this location.

11.3 Update on monitoring - diffusion tube results

In order to provide spatial information regarding NO_2 concentrations at locations around the Port of Felixstowe and its main access route the A14 trunk road, monitoring using diffusion tubes has been undertaken at a number of sites. In 2007 five additional sites were added to the diffusion tube survey in order to provide spatial information regarding NO_2 concentrations in Adastral Close alongside the continuous monitoring that was occurring. General details regarding diffusion tube monitoring are provided in section 3.2 in this report.

Diffusion tubes can over or under read and the annual average should be corrected for laboratory bias. Felixstowe 26 was collocated with the automatic analyser at the Dooley Inn in 2007 in order to provide a bias correction factor each year for the diffusion tubes. Also Felixstowe 33 was collocated with the automatic analyser at Adastral Close. Full details of the analytical technique and laboratory used, monitoring locations, diffusion tube bias adjustment information and breakdown of results on a monthly basis for the monitoring periods can be seen in Appendix B. A summary of the annual mean NO_2 concentration recorded by the diffusion tubes for both 2006 and 2007 at each monitoring site is presented in table 11.3 overleaf.

The results in table 11.3 show four sites in 2006 (Felixstowe 13, 14, 26 and 27) and one site in 2007 (Felixstowe 26) with an annual mean concentration above the objective of 40 μg/m^3.

Felixstowe 13, 26 and 27 in Ferry Lane are located on the Dooley Inn, the closest receptor location to the Port of Felixstowe and one of its main entrance gates. Felixstowe 13 was located on a drainpipe facing the front car park and was removed at the end of 2006. It was found that cars were parking much closer to the diffusion tube site than originally indicated which may have lead to elevated levels of NO_2 being recorded by the tubes. In addition, the residents of this property live on the first floor and therefore ground level was not representative of the receptor. Felixstowe 26 and 27 are located on the building at the first floor level, Felixstowe 26 is at the front of the building facing the front car park and Felixstowe 27 is at the side of the building facing the Port of Felixstowe. Felixstowe 26 (triplicate site) was collocated with an automatic NO_x analyser during 2007. The results from the collocation study undertaken in 2007 show that the diffusion tubes at the Dooley Inn over-read by a greater amount than those collocated at Adastral Close or the Woodbridge junction. For this reason the ratified diffusion tube results are lower in 2007 than in 2006 (with only Felixstowe 26 exceeding the annual mean air quality standard) as in 2006 the only collocation study available was at Woodbridge where the diffusion tubes and automatic analyser results are much closer.

Felixstowe 14 is located in Adastral Close, another receptor close to the Port of Felixstowe boundary. The concentrations recorded at this site decreased between 2006 and 2007. As above, the results in 2007 were ratified using a collocation study undertaken in Adastral Close rather than in Woodbridge. There is a greater difference between the diffusion tube and automatic analyser results in Adastral Close than in Woodbridge, with the diffusion tubes in Adastral Close over-reading by a greater amount than at Woodbridge. This may be due to the difference in the site types – Woodbridge is a busy road junction with possible street canyon effects and Adastral Close is an open site with the NO_2 coming from a number of more diffuse sources on the Port of Felixstowe.

Table 11.3 Bias corrected annual mean nitrogen dioxide concentrations recorded at sites in Felixstowe during 2006 and 2007, figures in micrograms per cubic metre ($\mu g/m^3$).

Site	2006 Annual mean using bias correction factor - 0.93	2007 Annual mean using bias correction factor obtained from Adastral Close analyser - 0.85
Felixstowe 4	24.3	22.7
Felixstowe 12	34	33.6
Felixstowe 13 a,b,c	**47.6**	-
Felixstowe 14 a,b,c	**40.2**	32.7
Felixstowe 17 a,b,c	32.3	29.7
Felixstowe 18 a,b,c	35.8	33.3
Felixstowe 19	29.5	27.3
Felixstowe 20	32.1	28.5
Felixstowe 21	31.3	28.5
Felixstowe 22	29.3	29.1
Felixstowe 23 a,b	35.5	32.4
Felixstowe 24	35.3	34.6
Felixstowe 25	35.2	32.6
Felixstowe 28	36	32.2
Felixstowe 29	-	30.9
Felixstowe 30	-	26.9
Felixstowe 31	-	30.9
Felixstowe 32	-	28.1
Felixstowe 33 a,b,c	-	30.9

Site	2006 Annual mean using bias correction factor - 0.93	2007 Annual mean using bias correction factor obtained from Dooley Inn analyser - 0.78
Felixstowe 26	**48.7**	**41.8**
Felixstowe 27	**43.9**	36.9

In 2007 one site located at The Dooley Inn public house, Ferry Lane, Felixstowe continues to show annual mean NO_2 concentrations above the objective level of 40 $\mu g/m^3$.

11.4 Detailed Assessment

Monitoring was undertaken during 2007, as detailed above, using diffusion tubes at a number of locations and automatic analysers at two locations – Ferry Lane and Adastral Close. Additional data was collected regarding activities on and associated with the Port of Felixstowe and this, together with the monitoring results, was used to undertake detailed air dispersion modelling.

A Detailed Assessment report was produced in May 2008 setting out the findings of the above monitoring and modelling. This report has been sent to Defra for their approval. Once the Detailed Assessment report has been accepted by Defra, public consultation will be undertaken on the findings.

12 Summary and Recommendations

Progress Reports are designed to ensure continuity in the Local Air Quality Management process and are required in years when an Updating and Screening Assessment or Detailed Assessment is not being undertaken. This Progress Report determines whether there have been any changes in the concentrations of the seven prescribed pollutants by examining new monitoring results and new local developments that may affect local air quality.

It has been determined that there are a number of new developments and proposed future developments within the Suffolk Coastal district that may affect air quality, these will be investigated further in the Updating and Screening Assessment for 2009.

It has been determined for the Suffolk Coastal district that the risk of exceedance of the air quality objectives for benzene, 1,3-butadiene, lead and carbon monoxide is unlikely, and no further assessment is necessary.

An Air Quality Management Area (AQMA) was declared in March 2006 at the junction of Lime Kiln Quay Road, Thoroughfare and St. John's Street in Woodbridge. This Area was designated in relation to a likely breach of the annual mean nitrogen dioxide (NO_2) objective resulting from traffic using the junction. A Further Assessment has been undertaken for the junction, this has confirmed that the elevated NO_2 concentrations are as a result of local traffic and that Air Quality Management Area should be retained. Work on production of a draft Action Plan for the junction is continuing, once completed it will be sent to Defra for their approval and the Council will undertake further public consultation on the contents of the draft report. Comments received from this consultation will then be fed into formulation of the final Action Plan for the junction.

A Detailed Assessment report was produced in May 2008 setting out the findings of monitoring and modelling of emissions of NO_2, SO_2 and PM_{10} from activities on and associated with the Port of Felixstowe. This report has been sent to Defra for their approval. Once the Detailed Assessment report has been accepted by Defra, public consultation will be undertaken on the findings.

13 References

1. *Environment Act 1995*, Chapter 25. HMSO, 1997.

2. *Air Quality Regulations 1997* – S.I 1997, No 3043. HMSO, 1997.

3. *Air Quality (England) Regulations 2000* – S.I 2000, No 928. HMSO, 2000.

4. *Air Quality (England) Amendment Regulations 2002* – S.I 2002, No. 3043. HMSO, 2002.

5. *Pollution Prevention and Control (England & Wales) Regulations 2000* – S.I 2000, No. 1973. HMSO, 2000.

6. *Pollution Prevention and Control (England & Wales) (Amendment) Regulations 2001* – S.I 2001, No. 503. HMSO, 2001.

7. *Part IV of the Environment Act 1995, Local Air Quality Management, Progress Report Guidance. LAQM.PRG(03).* Report by the Department of Environment, Food and Rural Affairs, Scottish Executive, National Assembly for Wales and the Department of the Environment in Northern Ireland. DEFRA Publications, February 2003.

8. *Part IV of the Environment Act 1995, Local Air Quality Management, Technical Guidance. LAQM.TG(03).* Report by the Department of Environment, Food and Rural Affairs, Scottish Executive, National Assembly for Wales and the Department of the Environment in Northern Ireland. DEFRA Publications, February 2003

9. *Part IV of the Environment Act 1995, Local Air Quality Management, Policy Guidance. LAQM.PG(03).* Report by the Department of Environment, Food and Rural Affairs, Scottish Executive, National Assembly for Wales and the Department of the Environment in Northern Ireland. DEFRA Publications, February 2003.

10. *Report on the Updating and Screening Assessment of Air Quality in the Suffolk Coastal District.* Produced by Suffolk Coastal District Council, September 2006.

11. *Suffolk Coastal District Council website* – all air quality reports produced by Suffolk Coastal District Council can be viewed at http://www.suffolkcoastal.gov.uk

12. *Planning Policy Statement 1: Delivering Sustainable Development*. HMSO, 2005.

13. *Planning Policy Guidance 3: Housing*. HMSO, March 2000.

14. *Planning Policy Statement 6: Planning for Town Centres*. HMSO, 2005.

15. *Planning Policy Guidance 13: Transport*. HMSO, March 1994.

16. *Planning Policy Statement 23: Planning and Pollution Control*. HMSO, 2004.

17. *Suffolk County Council Local Transport Plan 2006 - 2011*. Produced by Suffolk County Council.

Appendix A

Processes regulated under the Pollution Prevention and Control (England and Wales) Regulations 2000 (as amended) within the Suffolk Coastal district that are new since the Updating and Screening Assessment 2006.

Table A-1 List of new processes since 2006 regulated under the Pollution Prevention and Control (England and Wales) Regulations 2000 (as amended) within the Suffolk Coastal district, and indication of whether they are classed as a potentially significant emitter of any pollutant specified in LAQM.TG(03).

Table A-1 List of new processes since 2006 regulated under the Pollution Prevention and Control (England and Wales) Regulations 2000 (as amended) within the Suffolk Coastal district, and indication of whether they are classed as a potentially significant emitter of any pollutant specified in LAQM.TG(03).

Name and address of authorised process	Authority issuing authorisation (Public Register file reference – where applicable)	Grid reference for process	Installation Activity Section number and Process Guidance (PG) note under which process is authorised	Process description	Pollutants (if any) for which this process is a potentially significant emitter, as specified in LAQM.TG(03) *
L F Geater & Sons Ltd West End Nurseries, Westward Ho, Leiston	Suffolk Coastal District Council (PPC 07)	64380 26321	Combustion Activity SED Directive PG 1.12 (2004)	Straw Burning between 0.4 and 3 MW	~
Hazlewood Hand Laundry Aldeburgh Road, Aldringham, Leiston	Suffolk Coastal District Council (PPC 08)	64471 26033	Solvent Activity SED Directive PG 6/46 (2004)	Dry Cleaning	~
Johnsons The Cleaners Ltd 67 Hamilton Road, Felixstowe	Suffolk Coastal District Council (PPC 09)	63032 23467	Solvent Activity SED Directive PG 6/46 (2004)	Dry Cleaning	~
Fairway Launderers & Dry Cleaners 5 Saxmundham Road, Aldeburgh	Suffolk Coastal District Council (PPC 10)	64581 25712	Solvent Activity SED Directive PG 6/46 (2004)	Dry Cleaning	~
West End Dry Cleaners Unit 12, Undercliff Road West, Felixstowe	Suffolk Coastal District Council (PPC 11)	62969 23411	Solvent Activity SED Directive PG 6/46 (2004)	Dry Cleaning	~
Prim Dry Cleaners Unit 3 Tesco Store, Ropes Drive, Kesgrave, Ipswich	Suffolk Coastal District Council (PPC 12)	62196 24538	Solvent Activity SED Directive PG 6/46 (2004)	Dry Cleaning	~
Castle Cleaners 10A Church Street, Framlingham	Suffolk Coastal District Council (PPC 13)	62860 26353	Solvent Activity SED Directive PG 6/46 (2004)	Dry Cleaning	~
R J Welham Plant Ltd Clappits Pit, Woodbridge Road, Newbourne	Suffolk Coastal District Council (PPC 14)	62741 24381	Other Mineral Activities PG 3/16 (1996)	Crushing, grinding or size reduction of bricks, tiles or concrete (mobile)	~

* Any installations operating an 'Intensive Farming Activity' are only classed as potentially significant emitters of PM_{10} where they are farming poultry (defined as chicken laying hens and broilers, turkeys, ducks and guinea fowl)

Name and address of authorised process	Authority issuing authorisation (Public Register file reference – where applicable)	Grid reference for process	Installation Activity Section number and Process Guidance (PG) note under which process is authorised	Process description	Pollutants (if any) for which this process is a potentially significant emitter, as specified in LAQM.TG(03) *
V W Anticks 2-4 The Forge, Bredfield	Suffolk Coastal District Council (PPC 15)	62661 25218	Combustion Activity Section 1.1 PG 1/1 (1995)	Waste Oil Burner; Less than 0.4MW	~
Novera Energy Foxhall Generation Plant, Foxhall Landfill Site, Foxhall Road, Brightwell	Environment Agency (IPPC 05)	62380 24400	Combustion Activity Section 1.1 A (1) (b) (iii)	Part A1 activity	CO, NO_x, PM, SO_2, lead, benzene & 1,3-butadiene
Sewell Hewitt Farms Ltd Hill Farm, Chillesford	Environment Agency (IPPC 06)	63951 25230	Intensive Farming Activity Section 6.9 A(1) (a) (i)	Part A1 activity Pigs	~
Wenhaston Farm The Broiler Site, Bartholomews Lane, Blackheath, Wenhaston	Environment Agency (IPPC 07)	64146 27504	Intensive Farming Activity Section 6.9 A(1) (a) (i)	Part A1 activity Poultry	PM_{10}
Countess Wells Breeding Limited Pig Breeding Unit, New Road, Framlingham	Environment Agency (IPPC 08)	66286 22649	Intensive Farming Activity Section 6.9 A(1) (a) (i)	Part A1 activity Pigs	~
Crown Chicken Ltd Heveningham Poultry Site, Irongate Farm, Heveningham	Environment Agency (IPPC 09)	63333 27163	Intensive Farming Activity Section 6.9 A(1) (a) (i)	Part A1 activity Poultry	PM_{10}
Red House House Farm Red House Road Badingham	Environment Agency (IPPC 10)	63194 26923	Intensive Farming Activity Section 6.9 A(1) (a) (i)	Part A1 activity Poultry	PM_{10}
Great Pinners Farm Clopton Road, Tuddenham St Martin	Environment Agency (IPPC 11)	66196 22499	Intensive Farming Activity Section 6.9 A(1) (a) (i)	Part A1 activity Poultry/ Ducks	PM_{10}
Grampian Country Chickens (Rearing) Limited, Otley Poultry Farm, Hall Lane, Otley	Environment Agency (IPPC 12)	62090 25650	Intensive Farming Activity Section 6.9 A(1) (a) (i)	Part A1 activity Poultry	PM_{10}
Grampian Country Chickens (Rearing) Limited, Lampard Brook, Framlingham	Environment Agency (IPPC 13)	62740 26200	Intensive Farming Activity Section 6.9 A(1) (a) (i)	Part A1 activity Poultry	PM_{10}

* Any installations operating an 'Intensive Farming Activity' are only classed as potentially significant emitters of PM_{10} where they are farming poultry (defined as chicken laying hens and broilers, turkeys, ducks and guinea fowl)

Name and address of authorised process	Authority issuing authorisation (Public Register file reference – where applicable)	Grid reference for process	Installation Activity Section number and Process Guidance (PG) note under which process is authorised	Process description	Pollutants (if any) for which this process is a potentially significant emitter, as specified in LAQM.TG(03) *
Grampian Country Chickens (Rearing) Limited, Earl Soham, Poplar Cottage, Bedfield Road, Earl Soham	Environmen Agency (IPPC 14)	62438 26470	Intensive Farming Activity Section 6.9 A(1) (a) (i)	Part A1 activity Poultry	PM_{10}
Grampian Country Chickens (Rearing) Ltd, High House Farm, Heveningham Long Lane, Peasenhall	Environment Agency (IPPC 15)	63450 27082	Intensive Farming Activity Section 6.9 A(1) (a) (i)	Part A1 activity Chickens	PM_{10}
Grampian Country Chickens (Rearing) Ltd, Green Poultry Farm, Badingham	Environment Agency (IPPC 16)	63220 26870	Intensive Farming Activity Section 6.9 A(1) (a) (i)	Part A1 activity Chickens	PM_{10}
P.R. & R.H. Leggett Ltd Walnut Tree Farm, Ashbocking	Environment Agency (IPPC 17)	61859 225449	Intensive Farming Activity Section 6.9 A(1) (a) (i)	Part A1 activity Pigs	~
Gressingham Farms Loomswood Farms, Debach	Environment Agency (IPPC 18)	62437 25334	Intensive Farming Activity Section 6.9 A(1) (a) (i)	Part A1 activity Ducks	PM_{10}
Gressingham Farms Mapel Tree Farm, Clopton Road, Tuddenham St Martin	Environment Agency (IPPC 19)	61946 25059	Intensive Farming Activity Section 6.9 A(1) (a) (i)	Part A1 activity Ducks	PM_{10}
Crown Chicken Ltd Darsham Poultry Farm, The Street, Thorington	Environment Agency (IPPC 20)	64103 27198	Intensive Farming Activity Section 6.9 A(1) (a) (i)	Part A1 activity Poultry	PM_{10}
Hook 2 Sisters Limited Driftway Farm, Cratfield Road, Linstead Magna	Environment Agency (IPPC 21)	63070 27725	Intensive Farming Activity Section 6.9 A(1) (a) (i)	Part A1 activity Chickens	PM_{10}
Woodlark Farming Ltd Chediston Hall Pig Unit, Chediston Hall, Chediston	Environment Agency (IPPC 22)	63697 27759	Intensive Farming Activity Section 6.9 A(1) (a) (i)	Part A1 activity Pigs	~
R.H. & R. Paul Broxtead Estate, Sutton	Environment Agency (IPPC 23)	63123 24580	Intensive Farming Activity Section 6.9 A(1) (a) (i)	Part A1 activity Pigs	~
Grampian Country Chickens (Rearing) Limited, Lampard Brook, Framlingham	Environment Agency (IPPC 24)	63570 26860	Intensive Farming Activity Section 6.9 A(1) (a) (i)	Part A1 activity Poultry	PM_{10}

* Any installations operating an 'Intensive Farming Activity' are only classed as potentially significant emitters of PM_{10} where they are farming poultry (defined as chicken laying hens and broilers, turkeys, ducks and guinea fowl)

Appendix B

Nitrogen dioxide (NO_2) diffusion tube information; bias adjustment calculations; site descriptions; and concentrations recorded at sites in Felixstowe, Kesgrave, Woodbridge, and Melton in 2006 and 2007.

Figure B-1 **Information regarding NO_2 diffusion tubes, including analyst laboratory details and site descriptions for diffusion tube locations.**

Figure B-2 **Bias adjustment calculations for diffusion tube data recorded in 2004.**

Table B-1 **Monthly and annual mean nitrogen dioxide (NO_2) concentrations recorded at sites in Felixstowe during 2005, figures in micrograms per cubic metre (μ/m^3). Annual mean concentration ratified where relevant to correct for diffusion tube bias.**

Table B-2 **Monthly and annual mean nitrogen dioxide (NO_2) concentrations recorded at sites in Kesgrave during 2005, figures in micrograms per cubic metre (μ/m^3). Annual mean concentration ratified where relevant to correct for diffusion tube bias.**

Table B-3 **Monthly and annual mean nitrogen dioxide (NO_2) concentrations recorded at sites in Woodbridge during 2005, figures in micrograms per cubic metre (μ/m^3). Annual mean concentration ratified where relevant to correct for diffusion tube bias.**

Table B-4 **Monthly and annual mean nitrogen dioxide (NO_2) concentrations recorded at sites in Melton during 2005, figures in micrograms per cubic metre (μ/m^3). Annual mean concentration ratified where relevant to correct for diffusion tube bias.**

Figure B-1

Information regarding NO_2 diffusion tubes, including analyst laboratory details and site descriptions for diffusion tube locations.

Analyst laboratory details and general NO_2 diffusion tube information

Local monitoring of monthly concentrations of NO_2 has been undertaken at a large number of locations within the Suffolk Coastal district since March 1993. This Updating and Screening Assessment Report provides an update on data collected in 2005. Monitoring for NO_2 was conducted using Palmes passive diffusion tubes, with an absorbent of 50% triethanloamine (TEA) in acetone, which were exposed on a monthly basis. The analytical laboratory used for supply and analysis of diffusion tubes was Harwell Scientifics. The laboratory is formally accredited for analysis of NO_2 diffusion tubes under the United Kingdom Accreditation Scheme (UKAS). Harwell Scientifics participate in the Workplace Analysis Scheme for Proficiency (WASP) for analysis of diffusion tubes. This is an inter laboratory comparison study for analysing spiked diffusion tubes and the results show Harwell Scientifics as a Category 'Good' laboratory.

Site descriptions for diffusion tube locations.

Diffusion tubes were located at numerous sites to assess concentrations of NO_2 from road traffic, industrial emissions and background concentrations for these areas. Monthly and annual mean NO_2 concentrations were recorded at each site. In order to provide a reasonable estimate of the annual mean concentration at a monitoring site, concentrations for at least 6 months of the year are needed, therefore, the annual means have not been presented where there are less than 6 months of data.

There are eight 'site types', as defined in LAQM.TG(03), for diffusion tube monitoring. Several of these 'site types' were located within the Suffolk Coastal district during 2005. Definitions for each site type located within the Suffolk Coastal district are as follows;

- **Urban background site** – an urban location distanced from sources and therefore broadly representative of city-wide background conditions, e.g. urban residential areas.
- **Roadside site** – a site sampling between 1 metre of the kerbside of a busy road and the back of the pavement. Typically this will be within 5 metres of the road, but could be up to 15 metres.
- **Kerbside site** – a site sampling within 1 metre of the kerb of a busy road.
- **Industrial site** – an area where industrial sources make an important contribution to the total pollution burden.

All diffusion tubes were sited using the following local siting criteria, outlined in LAQM.TG(03); tubes were located in an open setting in relation to any surrounding buildings; the tubes were open to the sky immediately above with no overhanging trees or buildings; and the tubes were located at a height of between 1.4 and 4 metres. A more specific site description for each location is detailed below and maps showing diffusion tube locations are in Appendix C of this report.

Felixstowe and the Trimleys (FLX)

FLX 4 – Urban background site: located to provide background concentrations of NO_2 for comparison with other sites in Felixstowe. Sited on a lamp-post in Lynwood Avenue, a quiet residential street located approximately 140 metres from the nearest busy road.

FLX 12 – Roadside site: to record NO_2 concentrations derived from road traffic emissions on Hamilton Road in Felixstowe. This is a busy high street in Felixstowe often with very slow moving traffic due to congestion. Hamilton Road is fairly wide, there are shops with residential flats above

them along either side of the road which are set back approximately 5 metres from the kerb. Site is near the junction with York Road on a shop front approximately 5 metres from the kerb, located at relevant receptor.

FLX 14 a, b & c – Industrial site: to record NO_2 concentrations derived from emissions at the Port of Felixstowe at another of the nearest relevant receptor locations. The Port of Felixstowe has a number of potential sources of NO_2 emissions, the main one being heavy goods vehicles using the Port with other potential emissions from shipping, and on site equipment and activities. Triplicate site located on a residential property on 1 Adastral Close, approximately 40 metres from the Port of Felixstowe boundary.

FLX 17 a, b & c – Roadside site: a new site in 2004 set up to record NO_2 concentrations derived from road traffic emissions on the A14 trunk road at the Dock Spur roundabout. The traffic using this road is predicted to increase in the future due to development of the Port of Felixstowe, this site will provide current information on concentrations of NO_2 before the traffic increases begin. Triplicate site located on the closest residential property to the roundabout in Spriteshall Lane, Trimley St. Mary, approximately 31 metres from the kerb.

FLX 18 a, b & c - Roadside site: a new site in 2004 set up to record NO_2 concentrations derived from road traffic emissions on the A14 trunk road. The traffic using this road is predicted to increase in the future due to development of the Port of Felixstowe, this site will provide current information on concentrations of NO_2 before the traffic increases begin. Triplicate site located on a lamp-post adjacent to, and at the same distance as, the closest residential property to the kerb in Kirton Road, Trimley St. Martin, approximately 23 metres from the kerb.

FLX 19 - Urban background site: a new site in 2004 set up to provide background concentrations of NO_2 for comparison with concentrations recorded at above the roadside sites monitoring A14 road traffic emissions. Sited on a lamp-post in Welbeck Close, Trimley St Mary, a quiet residential street located approximately 140 metres from the nearest busy road.

FLX 20 – Industrial / Roadside site: a new site in 2005 set up to record NO_2 concentrations derived from emissions at the Port of Felixstowe at a housing estate close to the A14 trunk Road / Port of Felixstowe Road and Dock Gate 1, one of the main site entrances. The Port of Felixstowe has a number of potential sources of NO_2 emissions, the main one being heavy goods vehicles using the Port with other potential emissions from shipping, and on site equipment and activities. The traffic using this road is predicted to increase in the future due to development of the Port of Felixstowe. This site will provide current information on concentrations of NO_2 before the traffic increases begin. Sited in rear garden of one of the closest residential properties on this housing estate to the Port of Felixstowe boundary in Glemsford Close, Felixstowe approximately 200 metres from the boundary of the Port of Felixstowe near Dock Gate 1.

FLX 21 – Urban Background site: a new site in 2005 set up to provide background concentrations of NO_2 for comparison with concentrations recorded close to the A14 trunk road and the Port of Felixstowe boundary. Sited on a lamp-post in Kings Fleet Road, Felixstowe a quiet residential street located approximately 190 metres from the nearest busy road.

FLX 22 – Industrial site: a new site in 2005 set up to record NO_2 concentrations derived NO_2 from emissions at the Port of Felixstowe to the East of the site. This site will provide current information on concentrations of NO_2 in this locality before the Port expansion begins. Sited on drainpipe of residential property in Levington Road, Felixstowe approximately 50 metres from the boundary of the Port of Felixstowe. Site is also only 27 metres from the South rail line serving the Port.

FLX 23 a & b – Roadside site: a new site in 2005 set up to record NO_2 concentrations derived from road traffic emissions on the A14 trunk road in Trimley St. Mary. The traffic using this road is predicted to increase in the future due to development of the Port of Felixstowe, this site will provide current information on concentrations of NO_2 before the traffic increases begin. Duplicate site located

on the rear of the closest residential property to the A14 trunk road at this location in Heathgate Piece, Trimley St. Mary, approximately 25 metres from the kerb.

FLX 24 – Roadside site: a new site in 2005 set up to record NO_2 concentrations derived from road traffic emissions on the A14 trunk road / Port of Felixstowe Road at the end of the exit slip road for Dock Gate 2. At this location the A14 trunk road is at a higher level than the houses and the exit road at a lower level than the houses. The traffic using these roads is predicted to increase in the future due to development of the Port of Felixstowe, this site will provide current information on concentrations of NO_2 before the traffic increases begin. Located on the rear of the closest residential property to the A14 trunk road and the Dock Gate 2 exit at this location in Brandon Road, Felixstowe, approximately 52 metres from the A14 and 32 metres from the exit road.

FLX 25 - Roadside site: a new site in 2005 set up to record NO_2 concentrations derived from road traffic emissions on the A14 trunk road / Port of Felixstowe Road at one of the closest residential properties to the kerbside. At this location properties are elevated above the A14. The traffic using this road is predicted to increase in the future due to development of the Port of Felixstowe, this site will provide current information on concentrations of NO_2 before the traffic increases begin. Located on the side of the closest residential property to the A14 / Port of Felixstowe Road in Rendlesham Road, Felixstowe, approximately 23 metres from the kerbside.

FLX 26 a, b & c – Industrial / Roadside site: to provide additional information regarding NO_2 concentrations at The Dooley Inn Public House. Site changed from a single to a triplicate site in January 2007 to provide a collocation study with a continuous analyser. Located on a drainpipe of The Dooley Inn at the height of the first floor windows of the building. This site is elevated away from the direct exhaust emissions of cars using the car park at the very front of the building and at the height of the residential part of the building.

FLX 27 – Industrial / Roadside site: To provide additional information regarding NO_2 concentrations at The Dooley Inn Public House (FLX 13). Single site located on the south-west side of the building away from the car park at the front of the pub, facing towards the Port of Felixstowe and Dock Gate 2 roundabout, and at the height of the first floor windows of the building - the residential part of the building. Site collocated with a continuous analyser from January 2007.

FLX 28 – Roadside site: A new site in 2005 set up to record NO_2 concentrations derived from road traffic emissions on the A14 trunk road / Port of Felixstowe Road at the start of the exit slip road for Dock Gate 2. At this location the A14 trunk road is at a higher level than the houses and the exit road at the same level as the houses. The traffic using these roads is predicted to increase in the future due to development of the Port of Felixstowe, this site will provide current information on concentrations of NO_2 before the traffic increases begin. Located on the closest residential property to the A14 trunk road and the Dock Gate 2 exit at this location in Blyford Way, Felixstowe, approximately 70 metres from the A14 and 38 metres from the exit road.

FLX 29 – Industrial site: A new site set up in January 2007 to record NO_2 concentrations derived from emissions at the Port of Felixstowe within the Adastral Close residential area. The Port of Felixstowe has a number of potential sources of NO_2 emissions, the main one being heavy goods vehicles using the Port with other potential emissions from shipping, and on site equipment and activities. A single site located on a residential property drainpipe approximately 200 metres from the Port of Felixstowe boundary.

FLX 30 – Industrial site: A new site set up in January 2007 to record NO_2 concentrations derived from emissions at the Port of Felixstowe within the Adastral Close residential area. The Port of Felixstowe has a number of potential sources of NO_2 emissions, the main one being heavy goods vehicles using the Port with other potential emissions from shipping, and on site equipment and activities. A single site located on a residential property drainpipe approximately 200 metres from the Port of Felixstowe boundary.

FLX 31 – Industrial site: A new site set up in January 2007 to record NO_2 concentrations derived from emissions at the Port of Felixstowe within the Adastral Close residential area. The Port of Felixstowe has a number of potential sources of NO_2 emissions, the main one being heavy goods vehicles using the Port with other potential emissions from shipping, and on site equipment and activities. A single site located on a residential property drainpipe approximately 50 metres from the Port of Felixstowe boundary to the south-west of the site.

FLX 32 – Industrial site: A new site set up in January 2007 to record NO_2 concentrations derived from emissions at the Port of Felixstowe within the Adastral Close residential area. The Port of Felixstowe has a number of potential sources of NO_2 emissions, the main one being heavy goods vehicles using the Port with other potential emissions from shipping, and on site equipment and activities. A single site located on a residential property drainpipe approximately 250 metres from the Port of Felixstowe boundary to the west and south-west of this site.

FLX 33 a, b & c – Industrial site: A new site set up in January 2007 to record NO_2 concentrations derived from emissions at the Port of Felixstowe within the Adastral Close residential area. The Port of Felixstowe has a number of potential sources of NO_2 emissions, the main one being heavy goods vehicles using the Port with other potential emissions from shipping, and on site equipment and activities. A triplicate site collocated with a continuous analyser next to residential properties, approximately 75 metres from the Port of Felixstowe boundary.

Kesgrave (KSG)

KSG 4 – Urban background site: located to provide background concentrations of NO_2 for comparison with other sites in Kesgrave. Sited on a drainpipe within Kesgrave High School and located approximately 65 metres from the A1214.

KSG 6 – Roadside site: to record NO_2 concentrations derived from road traffic emissions on the A1214 in Kesgrave near the junction with Bell Lane. This section of the A1214 is approximately 125 metres from the junction with Bell Lane, which is controlled by traffic lights, it experiences stationary traffic queuing at peak times and is fairly narrow with a mix of domestic houses and retail outlets along either side. Site located on a drainpipe of The Bell Inn Public House, the closest receptor on this side of the A1214, 2.6 m from kerb.

KSG 9 – Roadside site: to record NO_2 concentrations derived from road traffic emissions on the A1214 in Kesgrave near the junction with Bell Lane. This section of the A1214 is approximately 125 metres from the junction with Bell Lane, which is controlled by traffic lights, it experiences stationary traffic queuing at peak times and is fairly narrow with a mix of domestic houses and retail outlets along either side. Site located on the opposite side of the road to KSG 6, on a lamp-post 1-2 metres from the kerb. The closest residential property on this side of the road is approximately 2 metres from the kerb.

Woodbridge (WBG)

WBG 1 a, b & c - Kerbside site: to record NO_2 concentrations derived from road traffic emissions at the junction of Lime Kiln Quay Road, Thoroughfare, and St. John's Street in Woodbridge. This junction is controlled by traffic lights and is characterised by standing traffic on all arms at peak times. The junction has a mix of residential properties and retail shops. Triplicate site on the drainpipe of a shop which has a residential flat above it, in Thoroughfare near Sun Lane, approximately 1 metre from the kerb and 14 metres from the traffic lights at the junction. This area of the junction is very narrow and enclosed by tall buildings, creating a canyon effect. Site collocated with a continuous analyser from January 2006.

WBG 3 - Urban background site: located to provide background concentrations of NO_2 for comparison with the roadside sites at the junction of Lime Kiln Quay Road, Thoroughfare, and St.

John's Street in Woodbridge. Sited on a lamp-post in Kingston Farm Road, a quiet residential street approximately 100 metres from any busy roads.

WBG 5 a, b & c - Roadside site: to record NO_2 concentrations derived from road traffic emissions at the junction of Lime Kiln Quay Road, Thoroughfare, and St. John's Street in Woodbridge. This junction is described above. Triplicate site on the drainpipe of a residential home in Lime Kiln Quay Road, approximately 2-3 metres of the kerb. Site parallel with the traffic lights in Thoroughfare, on the corner building of the junction, area is more open in character.

WBG 6 – Roadside site: to record NO_2 concentrations derived from road traffic emissions at the junction of Lime Kiln Quay Road, Thoroughfare, and St. John's Street in Woodbridge. This junction is described above. Sited on the drainpipe of a residential receptor location, in Thoroughfare near Sun Lane, approximately 2 metres from the kerb and 9 metres from WBG 1, towards the traffic lights. This area of the junction is very narrow and enclosed by tall buildings, creating a canyon effect.

WBG 8 – Roadside site: to record NO_2 concentrations derived from road traffic emissions at the junction of Lime Kiln Quay Road, Thoroughfare, and St. John's Street in Woodbridge. This junction is described above. Sited on the drainpipe of a residential receptor location, approximately 3 metres from the kerb on Thoroughfare going away from the junction itself past Sun Lane, approximately 38 metres from the traffic lights and 21 metres from WBG 1. This area of the junction is still narrow and enclosed by tall buildings, creating a canyon effect. Traffic regularly queues up to and past this location.

WBG 10 – Roadside site: to record NO_2 concentrations derived from road traffic emissions at the junction of Lime Kiln Quay Road, Thoroughfare, and St. John's Street in Woodbridge. This junction is described above. Sited on a signpost in St John's Street approximately 2 metres from the kerb, the same distance as the closest receptor location. Site is approximately 12 metres from the traffic lights at the junction. This area of the junction is also narrow with queuing traffic up to and beyond this point at most times.

WBG 12 – Roadside site: A pre-existing site that was rein-stated in January 2006. It was set up to monitor road traffic emissions of NO_2 from the Woodbridge junction and the Lime Kiln Road. Sited on the Drainpipe on the building at 8 Lime Kiln Quay Road on the south side of the road. This site is approximately 70 metres away from the traffic lights and about 5 metres from the kerbside. This was set up to monitor the tail-end emissions from the traffic waiting at the traffic lights heading up to Melton or to St. Johns Street.

WBG 13 – Roadside site: to record NO_2 concentrations derived from road traffic emissions at the junction of Lime Kiln Quay Road, Thoroughfare, and St. John's Street in Woodbridge. This junction is described above. Sited on traffic lights at the junction itself, at the boundary of a residential property garden in Thoroughfare, approximately 2-3 metres from the kerb. This area of the junction is more open and the traffic usually free flowing as it is on the junction itself.

WBG 15 – Roadside site: A new site in 2004 to record NO_2 concentrations derived from road traffic emissions at the junction of Lime Kiln Quay Road, Thoroughfare, and St. John's Street in Woodbridge. This junction is described above. This was a triplicate site from April 2004 to December 2005 located on the inlet of a continuous analyser providing a collocation study at this junction. Sited on the first floor guttering of a residential receptor location, in Thoroughfare near Sun Lane, approximately 2 metres from the kerb and 14 metres from WBG 1, towards the traffic lights. This area of the junction is very narrow and enclosed by tall buildings, creating a canyon effect.

WBG 17 – Roadside site: A new site set up in January 2006 to record NO_2 concentrations emitted from road traffic at the junction of Lime Kiln Quay Road, Thoroughfare, and St. John's Street in Woodbridge, specifically from the Thoroughfare / Melton Hill arm. This is a single site located on a drainpipe on the northern end of the residential home building on the north-eastern end of the junction. Sited approximately 7-8 metres from the kerbside, this area is more open and is just east of the intersection between the Thoroughfare and Sun Lane.

WBG 18 – Roadside site: A new site set up in January 2006 to record NO_2 concentrations derived from road traffic emissions at the junction of Lime Kiln Quay Road, Thoroughfare, and St. John's Street in Woodbridge, specifically the Thoroughfare / Melton Hill arm. Located approximately 100 metres to the north of the junction on a residential property drainpipe, and approximately 1-2 metres from the kerbside on Melton Hill.

WBG 19 – Roadside site: A new site set up in January 2006 to record NO_2 concentrations derived from road traffic emissions at the junction of Lime Kiln Quay Road, Thoroughfare, and St. John's Street in Woodbridge, specifically the St. John's Street arm. Sited approximately 70 metres from the traffic lights and 12 metres from the kerbside in the driveway of a residential property on St. John's Street.

WBG 20 – Roadside site: A new site set up in February 2006 to record NO_2 concentrations derived from road traffic emissions at the junction of Lime Kiln Quay Road, Thoroughfare, and St. John's Street in Woodbridge, specifically from the traffic on the Thoroughfare / Melton Hill arm. Sited on a residential property on the west side of the Thoroughfare / Melton Hill, approximately 1-2 metres from the kerbside.

WBG 21 – Roadside site: A new site set up in January 2007 to record NO_2 concentrations derived from road traffic emissions at the junction of Lime Kiln Quay Road, Thoroughfare, and St. John's Street in Woodbridge, specifically the St. John's Street arm. Sited on a residential property approximately 32 metres from the traffic lights and about 5 metres from the kerbside.

Melton (MEL)

MEL 2 – Urban background site: Located to provide background concentrations of NO_2 for comparison with the roadside site at the junction of the A1152 and B1438 in Melton. Sited on the drainpipe of a residential building in Hall Farm Road, a quiet residential street approximately 430 metres from the junction and 350 metres from any other busy roads.

MEL 5 a & b - Roadside site: To record NO_2 concentrations derived from road traffic emissions at the junction of the A1152 and B1438 in Melton. This junction is controlled by traffic lights, and all arms of the junction experience traffic queues at peak times. The junction has domestic housing and a primary school located on it. A now duplicate site from January 2007 from a (triplicate) in 2006, located at the closest receptor location to the junction, on the garden boundary of a domestic property 3.9 metres from the kerb.

MEL 6 – Roadside site: To record NO_2 concentrations derived from road traffic emissions at the junction of the A1152 and B1438 in Melton. This junction is controlled by traffic lights, and all arms of the junction experience traffic queues at peak times. A single site located on the east facing Drainpipe of the Primary School, it is approximately 70 metres away from the Melton junction and about 18 metres form the kerbside.

Figure B-2

Bias adjustment calculations for diffusion tube data recorded in 2006 and 2007

Diffusion tubes can under or over read and the technical guidance (LAQM.TG(03)) recommends that, where possible, local authorities should verify their nitrogen dioxide diffusion tubes by collocating them with a continuous analyser to ascertain a correction factor for any inaccuracies. This process in known as ratification or bias adjustment of the diffusion tube data and will increase the accuracy of the results. Further advice posted on the Review and Assessment Helpdesk website (www.uwe.ac.uk/aqm/review) recommends that in many situations local authorities should use the combined results of a number of collocation studies, so as to minimise the uncertainty associated with any single study. To assist with this, an inventory of bias adjustment factors has been compiled by Air Quality Consultants Limited (on behalf of Defra and the Devolved Administrations) and is published on the Review and Assessment Helpdesk website. A combined bias adjustment factor can be obtained for a particular analyst laboratory in a specified year by using this inventory.

2006

Three diffusion tubes were co-located with an automatic chemiluminesence NO_x analyser, sited in Woodbridge, from January to December 2006. The collocated diffusion tubes were at site Woodbridge 1, see Figure B-1, and Table B-3 in this appendix for site description and monitoring results, and Map C-6 in Appendix C for site location. Details regarding the automatic analyser and diffusion tubes are provided in the main body of this report.

In order to calculate a bias correction factor for diffusion tubes collocated with the automatic NO_x analyser a 12-month data set for 2006 was produced for the analyser. For the diffusion tubes and the NO_x analysers we have good data capture for 2006. The diffusion tubes exposed at this site recorded an average NO_2 concentration of 47 $\mu g/m^3$ over the 12-month period in 2006. Over the same time period the continuous analyser recorded an average NO_2 concentration of 44 $\mu g/m^3$ with a 96.5 % data capture.

The diffusion tube bias adjustment factor was calculated as stated in box 6.4 of the technical guidance LAQM.TG(03) as follows:

Annual mean continuous NO_x analyser concentration ÷ Annual mean diffusion tube concentration

Therefore: 44 $\mu g/m^3$ ÷ 47 $\mu g/m^3$ = **0.93**

The bias adjustment factor for the analyst laboratory, Harwell Scientifics, was obtained from the Review and Assessment Helpdesk website inventory (as outlined above) for comparison purposes. The inventory bias adjustment factor used the results from 12 other local authority collocation studies and was calculated as 0.78, individual local authority factors ranging from 0.66 to 0.96.

The bias adjustment factor for the Woodbridge collocation study of 0.93 was used to correct all of the diffusion tube data as this was obtained from a local monitoring study within our district and was also the more conservative of the two factors.

The diffusion tube bias adjustment factor used for 2006 was 0.93, and results from all diffusion tube sites were multiplied by this adjustment factor to correct for the over read of the diffusion tubes. Bias adjustment of annual mean results for each diffusion tube site is shown in tables B-1 to B-4 later in this appendix.

2007

During 2007 there were three collocation studies undertaken within the Suffolk Coastal district. Three diffusion tubes were co-located with each automatic chemiluminesence NO_x analyser. The analysers were sited in Woodbridge; Ferry Lane, Felixstowe; and Adastral Close, Felixstowe. Details regarding the automatic analysers and diffusion tubes are provided in the main body of this report.

In Woodbridge, the collocated diffusion tubes were at site Woodbridge 1, see Figure B-1, and Table B-7 in this appendix for site description and monitoring results, and Map C-6 in Appendix C for site location.

In Ferry Lane, Felixstowe the collocated diffusion tubes were at site Felixstowe 26, see Figure B-1, and Table B-5 in this appendix for site description and monitoring results, and Map C-2 in Appendix C for site location.

In Adastral Close, Felixstowe the collocated diffusion tubes were at site Felixstowe 33, see Figure B-1, and Table B-5 in this appendix for site description and monitoring results, and Map C-2 and C-5 in Appendix C for site location.

In order to calculate a bias correction factor for each site, a 12-month data set for 2007 was produced for each analyser. The site at Adastral Close, Felixstowe did not begin collecting data until February 2007 due to technical difficulties and so only 11 months of analyser and diffusion tube data were used to calculate the bias correction factor for this site. For the diffusion tubes and the NO_x analysers we have good data capture for 2007 at all sites.

Woodbridge

The diffusion tubes exposed at this site recorded an average NO_2 concentration of 47.8 $\mu g/m^3$ over the 12-month period in 2007. Over the same time period the continuous analyser recorded an average NO_2 concentration of 46 $\mu g/m^3$ with a 98.4 % data capture.

The diffusion tube bias adjustment factor was calculated as stated in box 6.4 of the technical guidance LAQM.TG(03) as follows:

Annual mean continuous NO_x analyser concentration ÷ Annual mean diffusion tube concentration

Therefore, diffusion tube bias correction factor : 46 $\mu g/m^3$ ÷ 47.8 $\mu g/m^3$ = **0.96**

Dooley Inn, Ferry Lane, Felixstowe

The diffusion tubes exposed at this site recorded an average NO_2 concentration of 53.6 $\mu g/m^3$ over the 12-month period in 2007. Over the same time period the continuous analyser recorded an average NO_2 concentration of 42 $\mu g/m^3$ with a 98.2 % data capture.

The diffusion tube bias adjustment factor was calculated as stated in box 6.4 of the technical guidance LAQM.TG(03) as follows:

Annual mean continuous NO_x analyser concentration ÷ Annual mean diffusion tube concentration

Therefore, diffusion tube bias correction factor : 42 $\mu g/m^3$ ÷ 53.6 $\mu g/m^3$ = **0.78**

Adastral Close, Felixstowe

The diffusion tubes exposed at this site recorded an average NO_2 concentration of 36.3 μg/m^3 over the 11-month period in 2007. Over the same time period the continuous analyser recorded an average NO_2 concentration of 31 μg/m^3 with a 98.2 % data capture.

The diffusion tube bias adjustment factor was calculated as stated in box 6.4 of the technical guidance LAQM.TG(03) as follows:

Annual mean continuous NO_x analyser concentration ÷ Annual mean diffusion tube concentration

Therefore, diffusion tube bias correction factor : 31 μg/m^3 ÷ 36.3 μg/m^3 = **0.85**

The bias adjustment factor for the analyst laboratory, Harwell Scientifics, was obtained from the Review and Assessment Helpdesk website inventory (as outlined above) for comparison purposes. The inventory bias adjustment factor used the results from 12 other local authority collocation studies and was calculated as 0.81, individual local authority factors ranging from 0.65 to 0.96. The bias adjustment factors for the three collocation studies within Suffolk Coastal have been used for ratification of diffusion tubes as they provide local data which is likely to be more accurate.

The **three** bias correction factors obtained for the Suffolk Coastal district were from very different locations within the district and none individually are representative of all the diffusion tube locations.

For the diffusion tube sites in **Woodbridge, Melton** and **Kesgrave** (areas monitoring traffic related emissions of NO_2) the correction factor of **0.96 obtained from the Woodbridge analyser** is most the most representative correction factor for these locations and has been used.

For the diffusion tube sites in **Felixstowe** there are two possible correction factors that could be used. The Dooley Inn site is not typical of all the diffusion tube locations in Felixstowe as it is very close to one of the main entrances to the Felixstowe Docks and also to Dock Gate 2 roundabout, which is very busy and can become congested at peak times. The difference between the diffusion tube and analyser measurements is larger than at the Adastral Close site and therefore the **Dooley Inn bias correction factor of 0.78 has only been used for the Dooley Inn diffusion tubes** - Felixstowe 26 a,b,c and 27.

For **all other diffusion tube sites in Felixstowe** the correction factor of **0.85 obtained from the Adastral Close analyser** is most the most representative correction factor for these locations and has been used.

Bias adjustment of annual mean results for each diffusion tube site is shown in tables B-5 to B-8 later in this appendix.

Table B-1 Monthly and annual mean nitrogen dioxide (NO_2) concentrations recorded at sites in Felixstowe during 2006, figures in micrograms per cubic metre ($\mu g/m^3$). Annual mean concentration ratified where relevant.

Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual mean ($\mu g/m^3$)	Ratification of annual mean using bias correction factor (#0.93) ($\mu g/m^3$)
FLX 4	20.3	30.9	23.7	29.1	26.7	23.2	18.6	16.5	21.9	33.1	31.0	38.1	**26.1**	**24.3**
FLX 12	37.0	42.3	33.5	40.1	38.4	35.4	30.1	26.6	40.5	41.9	43.2	29.8	**36.6**	**34**
FLX 13a	38.1	51.3	50.6	59.5	55.9	51.7	48.1	44.2	53.9	46.2	61.7	60.4	see FLX 13 mean	n/a
FLX 13b	46.1	52.1	47.3	52.6	52.6	54.8	50.2	46.9	51.4	45.5	71.6	51.8	see FLX 13 mean	n/a
FLX 13c	49.0	54.2	48.7	54.9	54.5	50.1	39.7	48.1	53.8	51.7	34.1	58.9	see FLX 13 mean	n/a
FLX 13 a,b,c - mean	44.4	52.5	48.9	55.7	54.3	52.2	46.0	46.4	53.0	47.8	55.8	57.0	**51.2**	**47.6**
FLX 14a	37.8	57.1	~	42.7	46.2	43.7	34.2	36.9	38.8	41.7	51.1	51	see FLX 14 mean	n/a
FLX 14b	27.9	50.0	37.3	48.0	41.3	39.3	31.0	47.1	44.0	42.7	54.3	52.2	see FLX 14 mean	n/a
FLX 14c	36.3	52.0	42.5	43.0	45.1	35.4	30.2	40.6	39.7	47.5	56.6	51.7	see FLX 14 mean	n/a
FLX 14 a,b,c - mean	34.0	53.0	39.9	44.6	44.2	39.5	31.8	41.5	40.8	44.0	54.0	51.6	**43.2**	**40.2**
FLX 17a	30.8	39.3	33.9	33.6	30.4	37.8	33.6	24.7	32.2	34.2	46.4	44.2	see FLX 17 mean	n/a
FLX 17b	36.7	38.0	30.8	34.9	31.9	38.9	30.6	25.2	37.2	38.3	45.6	43.1	see FLX 17 mean	n/a
FLX 17c	19.6	38.4	32.5	34.1	35.3	36.5	31.8	22.7	32.8	36.5	32.2	43.3	see FLX 17 mean	
FLX 17 a,b,c - mean	29.0	38.6	32.4	34.2	32.5	37.7	32.0	24.2	34.1	36.3	41.4	43.5	**34.7**	**32.3**
FLX 18a	38.7	36.4	37.3	31.7	31.6	33.7	18.8	30.8	43.5	45.8	48.2	47.1	see FLX 18 mean	n/a
FLX 18b	40.4	39.3	32.6	40.7	36.8	35.0	26.0	33.0	44.2	47.2	58.0	46.7	see FLX 18 mean	n/a
FLX 18c	41.2	42.8	29.8	38.5	33.0	36.9	27.7	22.1	38.4	47.7	55.4	50.0	see FLX 18 mean	n/a
FLX 18 a,b,c - mean	40.1	39.5	33.2	37.0	33.8	35.2	24.2	28.6	42.0	46.9	53.9	47.9	**38.5**	**35.8**
FLX 19	29.2	35.2	28.3	26.6	27.1	29.4	22.5	17.0	31.6	38.2	47.8	47.5	**31.7**	**29.5**
FLX 20	32.2	34.0	31.7	31.7	31.9	32.4	24.9	40.0	34.5	38.4	46.8	35.4	**34.5**	**32.1**
FLX 21	35.6	35.9	29.4	34.5	34.7	no data	20.1	25.1	31.1	no data	47.2	43.7	**33.7**	**31.3**
FLX 22	27.1	30.7	29.1	31.3	29.3	27.8	22.4	28.1	29.2	34.4	44.8	44.3	**31.5**	**29.3**
FLX 23a	41.1	39.5	37.4	36.8	38.1	43.9	45.3	26.3	39.2	40.2	34.8	42	see FLX 23 mean	n/a
FLX 23b	31.4	41.0	35.4	36.5	38.2	39.4	42.2	27.7	37.3	39	41.9	42.6	see FLX 23 mean	n/a
FLX 23 a,b - mean	36.3	40.3	36.4	36.7	38.2	41.7	43.8	27.0	38.3	39.6	38.35	42.3	**38.2**	**35.5**
FLX 24	36.2	43.6	32.4	35.2	38.2	35.5	26.6	32.3	35.6	42.4	55.9	40.6	**37.9**	**35.3**
FLX 25	28	37.4	34.1	36.2	39.0	35.2	31.5	32.5	41.4	37	53.1	47.8	**37.8**	**35.2**
FLX 26	48.3	54.6	52.0	57.5	50.2	52.0	45.5	44.3	55.3	59.5	56.0	54.1	**52.4**	**48.7**
FLX 27	44.9	47.4	41.8	49.3	46.9	45.3	42.6	42.3	43.4	48.8	60.6	52.6	**47.2**	**43.9**
FLX 28	34.1	39.8	34.5	41.4	39.0	36.4	31.2	32.9	38.2	39.5	50.8	47	**38.7**	**36**

Key:			
	FLX 4	Urban background site	Lamp-post outside 37 Lynwood Avenue, Felixstowe
	FLX 12	Roadside site	Drainpipe at 119 Hamilton Road, 'Ford bros. Bike Shop', Felixstowe.
	FLX 13 a, b & c	Industrial / Roadside site	Drainpipe on The Dooley Inn Public House, Ferry Lane, Felixstowe **(triplicate site).**
	FLX 14 a, b & c	Industrial site	Drainpipe on 1 Adastral Close, Felixstowe **(triplicate site).**
	FLX 17 a, b & c	Roadside site	Drainpipe on 38 Spriteshall Lane, Trimley St. Mary **(triplicate site).**
	FLX 18 a, b & c	Roadside site	Lamp-post at 67 Kirton Road, Trimley St. Martin **(triplicate site).**
	FLX 19	Urban background site	Lamp-post at 4 Welbeck Close, Trimley St. Mary.
	FLX 20	Industrial / Roadside site	Rear garden of 73 Glemsford Close, Felixstowe. **New site from January 2005.**
	FLX 21	Urban background site	Lamp-post at 4 Kings Fleet Road, Felixstowe. **New site from January 2005.**
	FLX 22	Industrial site	Drainpipe on 13 Levington Road, Felixstowe. **New site from January 2005.**
	FLX 23 a & b	Roadside site	Drainpipe on 23 Heathgate Piece, Trimley St. Mary. **New site from January 2005 (duplicate site).**
	FLX 24	Roadside site	Rear garden of 22 Brandon Road, Felixstowe. **New site from January 2005. (Was a duplicate now a single site)**
	FLX 25	Roadside site	Drainpipe on 46 Rendlesham Road, Felixstowe. **New site from February 2005.**
	FLX 26	Industrial / Roadside site	First floor window over front car park at The Dooley Inn, Ferry Lane, Felixstowe. **New site from April 2005.**
	FLX 27	Industrial / Roadside site	First floor front window facing the Docks at The Dooley Inn, Ferry Lane, Felixstowe. **New site from February 2005.**
	FLX 28	Roadside site	Rear garden of 63 Blyford Way, Felixstowe. **New site from April 2005.**

Diffusion tube annual mean is ratified to improve accuracy. The bias adjustment factor for the diffusion tubes must either be obtained from the analyst laboratory or calculated from a collocation study with a continuous analyser by the authority themselves. In 2006 a collocation study was undertaken by Suffolk Coastal District Council using results from a continuous NO_x analyser located at a site in Woodbridge. The bias correction factor for 2006 was calculated, from this study, as 0.93 and details are available in Figure B-2 in this appendix. Annual mean diffusion tube concentrations were, therefore, multiplied by a factor of 0.93.

Table B-2 Monthly and annual mean nitrogen dioxide (NO_2) concentrations recorded at sites in Kesgrave during 2006, figures in micrograms per cubic metre ($\mu g/m^3$). Annual mean concentration ratified where relevant.

Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual mean ($\mu g/m^3$)	Ratification of annual mean using bias correction factor (# 0.93) ($\mu g/m^3$)
KSG 4	25.2	27.0	19.7	20.0	17.2	18.9	13.9	13.8	22.3	25	31.1	29.4	**22.0**	**20.5**
KSG 6	29.7	36.6	28.8	29.3	29.0	29.9	27.8	27.3	33.4	34.6	37.9	35.8	**31.7**	**29.5**
KSG 9	41.4	39.9	31.7	42.6	38.2	39.5	36.6	30.4	45.9	48.8	61.9	49	**42.2**	**39.3**

Key:			
	KSG 4	Urban background site	Kesgrave High School, Main Road, Kesgrave
	KSG 6	Roadside site	All Saints Church / The Bell Inn, Main Road, Kesgrave.
	KSG 9	Roadside site	Roadside lamp-post outside 118 Main Road, Kesgrave.

Diffusion tube annual mean is ratified to improve accuracy. The bias adjustment factor for the diffusion tubes must either be obtained from the analyst laboratory or calculated from a collocation study with a continuous analyser by the authority themselves. In 2006 a collocation study was undertaken by Suffolk Coastal District Council using results from a continuous NO_x analyser located at a site in Woodbridge. The bias correction factor for 2006 was calculated, from this study, as 0.93 and details are available in Figure B-2 in this appendix. Annual mean diffusion tube concentrations were, therefore, multiplied by a factor of 0.93.

Table B-3 Monthly and annual mean nitrogen dioxide (NO_2) concentrations recorded at sites in Woodbridge during 2006, figures in micrograms per cubic metre ($\mu g/m^3$). Annual mean concentration ratified where relevant.

Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual mean ($\mu g/m^3$)	Ratification of annual mean using bias correction factor (# 0.93) ($\mu g/m^3$)
WBG 1a	47.1	53.7	40.5	50.1	46.1	42.2	33.0	39.7	49.8	48	57.8	52.2	see WBG 1 mean	n/a
WBG 1b	40.1	50.5	45.1	49.1	49.6	48.6	41.6	41.5	51.3	50.3	54.7	52.7	see WBG 1 mean	n/a
WBG 1c	41.7	51.6	43.4	53.4	46.2	46.4	44.5	41.0	no data	46.6	56.3	44.7	see WBG 1 mean	n/a
WBG 1 a,b,c - mean	43.0	51.9	43.0	50.9	47.3	45.7	39.7	40.7	50.6	48.3	56.3	49.9	**47.3**	**44**
WBG 3	24.7	22.3	18.0	16.7	17.9	17.8	10.6	11.9	19.6	23.1	28.1	25.1	**19.7**	**18.3**
WBG 5a	39.9	36.1	34.3	30.5	29.7	33.2	35.4	19.6	32.6	34.9	35.7	36.6	see WBG 5 mean	n/a
WBG 5b	41.6	38.7	34.0	33.2	32.8	33.6	27.9	21.4	28.5	32	39.2	38.3	see WBG 5 mean	n/a
WBG 5c	31.9	36.9	29.5	27.5	28.3	29.8	27.7	20.8	32.7	34.3	37.2	34.6	see WBG 5 mean	n/a
WBG 5 a,b,c - mean	37.8	37.2	32.6	30.4	30.3	32.2	30.3	20.6	31.3	33.7	37.4	36.5	**32.5**	**30.2**
WBG 6	40.7	50.2	43.2	46.7	44.9	45.6	45.2	36.7	48.0	47.5	51.6	46.8	**45.6**	**42.4**
WBG 8	41.8	50.7	45.1	51.3	48.5	no data	45.8	34.7	no data	49.5	59.2	51.3	**47.8**	**44.5**
WBG 10	41.3	42.2	39.6	37.3	41.0	49.2	49.5	30.6	41.7	41.5	41.6	39.6	**41.3**	**38.4**
WBG 12	30.8	36.5	32.0	34.5	33.8	26.4	27.3	27.6	34.2	32.4	44.3	39.9	**33.3**	**31**
WBG 13	41.2	42.2	36.2	37.2	36.2	42.2	41.2	30.7	41.7	38.4	44.0	42.5	**39.5**	**36.7**
WBG 15	43.5	51.8	36.0	48.7	42.4	42.1	35.5	42.2	47.0	48.0	50.2	47.7	**44.6**	**41.5**
WBG 17	39.1	37.4	35.2	34.8	33.1	41.3	34.4	26.0	38.0	39.1	44.5	34.7	**36.5**	**34**
WBG 18	45.4	43.0	38.8	38.9	40.6	43.7	44.8	29.4	43.2	46.1	46.8	41.4	**41.8**	**38.9**
WBG 19	24.7	30.3	21.4	22.9	20.4	21.8	15.0	15.7	29.4	no data	35.3	31.5	**24.4**	**22.7**
WBG 20	~	45.6	41.3	51.2	44.1	45.9	35.7	41.9	49.4	40.7	59	47.6	**45.7**	**42.5**

Key:			
	WBG 1a,b,c	Kerbside site	signpost outside 93 Thoroughfare, Woodbridge (collocation with continuous monitor from January 2006) (Triplicate site)
	WBG 3	Urban Background site	lampost outside 8 Kingston Farm Road, Woodbridge
	WBG 5a,b,c	Roadside site	drainpipe on corner of Suffolk Place, Lime Kiln Quay Road, Woodbridge (Triplicate site)
	WBG 6	Roadside site	drainpipe on 87 Thoroughfare, Woodbridge
	WBG 8	Roadside site	drainpipe on 95 Thoroughfare, Woodbridge
	WBG 10	Roadside site	signpost in St. John's Street (opposite Surgery), Woodbridge
	WBG 12	Roadside site	drainpipe on 8 Lime Kiln Quay Road, Woodbridge. **Site reinstated from January 2006**
	WBG 13	Roadside site	traffic lights at front of 85 Thoroughfare, Woodbridge
	WBG 15	Roadside site	drainpipe on 87 Thoroughfare, Woodbridge
	WBG 17	Roadside site	drainpipe at front Northern end of Suffolk Place, Lime Kiln Quay Road, Woodbridge. **New site from January 2006**
	WBG 18	Roadside site	Roadside site, drainpipe between 106 / 108 Thoroughfare, Woodbridge. **New site from January 2006**
	WBG 19	Roadside site	Roadside site, front porch of 25 St. John's Street, Woodbridge. **New site from January 2006**
	WBG 20	Roadside site	drainpipe on 97 Thoroughfare, Woodbridge. **New site from February 2006**

Diffusion tube annual mean is ratified to improve accuracy. The bias adjustment factor for the diffusion tubes must either be obtained from the analyst laboratory or calculated from a collocation study with a continuous analyser by the authority themselves. In 2006 a collocation study was undertaken by Suffolk Coastal District Council using results from a continuous NO_x analyser located at a site in Woodbridge. The bias correction factor for 2006 was calculated, from this study, as 0.93 and details are available in Figure B-2 in this appendix. Annual mean diffusion tube concentrations were, therefore, multiplied by a factor of 0.93.

Table B-4 Monthly and annual mean nitrogen dioxide (NO_2) concentrations recorded at sites in Melton during 2006, figures in micrograms per cubic metre ($\mu g/m^3$). Annual mean concentration ratified where relevant.

Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual mean ($\mu g/m^3$)	Ratification of annual mean using bias correction factor (# 0.93) ($\mu g/m^3$)
MEL 2	21.8	15.8	16.7	16.5	16.1	16.3	9.8	11.1	17.0	21.4	25.9	23.7	**17.7**	**16.5**
MEL 5a	24.3	40.8	30.7	39.0	33.5	32.1	25.1	30.4	34.5	35.5	48.9	40	see MEL 5 mean	n/a
MEL 5b	32.6	39.9	35.8	34.9	33.3	30.2	28.1	29.2	35.2	37	46.3	38	see MEL 5 mean	n/a
MEL 5c	27.9	38.2	33.8	34.8	33.7	31.2	23.5	30.0	34.1	35.3	49.0	41.2	see MEL 5 mean	n/a
MEL 5a,b,c - mean	28.3	39.6	33.4	36.2	33.5	31.2	25.6	29.9	34.6	35.9	48.1	39.7	**34.7**	**32.3**

Key:

MEL 2	Urban background site	Drainpipe on 106 Hall Farm Road, Melton
MEL 5 a, b, & c	Roadside site	6 The Street, Melton **(triplicate site)**

Diffusion tube annual mean is ratified to improve accuracy. The bias adjustment factor for the diffusion tubes must either be obtained from the analyst laboratory or calculated from a collocation study with a continuous analyser by the authority themselves. In 2006 a collocation study was undertaken by Suffolk Coastal District Council using results from a continuous NO_x analyser located at a site in Woodbridge. The bias correction factor for 2006 was calculated, from this study, as 0.93 and details are available in Figure B-2 in this appendix. Annual mean diffusion tube concentrations were, therefore, multiplied by a factor of 0.93.

Table B-5 Monthly and annual mean nitrogen dioxide (NO_2) concentrations recorded at sites in Felixstowe during 2007, figures in micrograms per cubic metre (µg/m^3). Annual mean concentration ratified where relevant.

Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual mean (µg/m^3)	Ratification of annual mean (µg/m^3) using bias correction factor (# 0.85 obtained from Adastral Close analyser)
FLX 4	32.1	39	26.9	19.6	5.9	14.8	19.8	16.8	19.8	28.7	35.9	40.5	**25.0**	**22.7**
FLX 12	43.0	46.9	40.0	36.6	10.9	29.9	32.3	34.2	36.2	42.4	49.5	43	**37.1**	**33.6**
FLX 14a	48	46.4	52.1	37.4	31.1	19.9	27.7	27.2	32.9	39.3	51.1	43.5	see FLX 14 mean	n/a
FLX 14b	51.1	49.9	42.9	no data	29.7	25.3	26.0	32.1	33.9	43.8	54.6	41.6	see FLX 14 mean	n/a
FLX 14c	48.1	48.3	38.3	36.8	no data	22.7	31.4	30.6	30.2	43.8	53.7	46	see FLX 14 mean	n/a
FLX 14 a,b,c - mean	49.1	48.2	44.4	37.1	30.4	22.6	28.4	30.0	32.3	42.3	53.1	43.7	**38.5**	**32.7**
FLX 17a	38.6	40	38.7	36.8	31	22.5	29.7	30.9	31.1	37.5	42.6	44.6	see FLX 17 mean	n/a
FLX 17b	37.3	45.9	31.8	34.7	31	26.6	29.4	30.8	30	33.1	39.8	42.5	see FLX 17 mean	n/a
FLX 17c	35.1	44	35	34.8	31.9	23.6	29.1	30.7	30.5	41	41.2	43.4	see FLX 17 mean	n/a
FLX 17 a,b,c - mean	37.0	43.3	35.2	35.4	31.3	24.2	29.4	30.8	30.5	37.2	41.2	43.5	**34.9**	**29.7**
FLX 18a	51	58.3	42.5	32.4	39.9	35.6	39.5	31.6	23.1	38.3	51.1	49.9	see FLX 18 mean	n/a
FLX 18b	41.1	53.6	35	25.3	36.8	26.7	37.1	30.9	25.5	39.5	50.5	49.3	see FLX 18 mean	n/a
FLX 18c	42.4	55.5	39	33.1	37.8	28.7	40.1	31.5	28.5	36.3	51.4	43.6	see FLX 18 mean	n/a
FLX 18 a,b,c - mean	44.8	55.8	38.8	30.3	38.2	30.3	38.9	31.3	25.7	38.0	51.0	47.6	**39.2**	**33.3**
FLX 19	42.2	44.9	29.8	25.6	27.8	22.9	25.0	25.0	27.7	35	33.2	46	**32.1**	**27.3**
FLX 20	45	42.7	32.4	26.6	27.4	27.7	32.0	28.8	23.2	34.9	43.1	38.7	**33.5**	**28.5**
FLX 21	40.6	42.1	29.2	27.9	23.6	19.8	no data	no data	27.1	35.4	43.6	45.5	**33.5**	**28.5**
FLX 22	43.5	43.2	35.7	28.3	28.3	21.3	29.2	25.9	29.9	36.9	48.2	40	**34.2**	**29.1**
FLX 23a	38.5	42.3	40.9	41.3	29.9	27.2	27.2	38.8	31.6	47.1	36.6	44.6	see FLX 23 mean	n/a
FLX 23b	36.6	41.7	38.8	43.8	36.9	29.3	27.8	37.9	39.3	52.5	42	41.7	see FLX 23 mean	n/a
FLX 23 a,b - mean	37.6	42.0	39.9	42.6	33.4	28.3	27.5	38.4	35.5	49.8	39.3	43.15	**38.1**	**32.4**
FLX 24	46.1	46.4	42.1	31.9	40.8	31.1	32.8	37.9	35.8	47.1	53.5	42.3	**40.7**	**34.6**
FLX 25	45.8	44	45.3	36	39.0	27.9	34.8	36.1	38.3	31.9	36.4	45.1	**38.4**	**32.6**
FLX 26a	56.7	63.4	65.5	53.8	54.4	49.2	52.3	51.1	49.4	58.9	66	52.9	See FLX 26 Mean	n/a
FLX 26b	63.7	57.4	59.2	46.5	47.4	38.9	49.7	51.4	54.0	64.4	65.2	58.9	See FLX 26 Mean	n/a
FLX 26c	36.4	60.4	57.5	43.3	43.2	42.8	48.2	49.2	49.9	55.6	57.5	54.2	See FLX 26 Mean	n/a
FLX 26 a,b,c - mean	52.3	60.4	60.7	47.9	48.3	43.6	50.1	50.6	51.1	59.6	62.9	55.3	**53.6**	**41.8* use correction factor 0.78 for Dooley Inn analyser**
FLX 27	48.4	58.9	56.5	37.9	47.6	32.2	41.7	45.3	45.6	50.3	54.5	49.1	**47.3**	**36.9* use correction factor 0.78 for Dooley Inn analyser**
FLX 28	49.3	46.7	42.0	32.2	34.6	31.4	34.8	32.2	27.5	37	44.6	42.9	**37.9**	**32.2**

FLX 29	50.1	34.2	40.6	33.1	28.5	23.7	29.5	26.4	37.4	36.9	49.1	46.5	**36.3**	**30.9**
FLX 30	40.3	42.5	32.5	25.4	23.7	20.2	26.2	24.7	30.0	37.2	-	44.6	**31.6**	**26.9**
FLX 31	49.2	47.3	40.6	29.2	28	23.7	30.6	30	37.5	37.5	50.8	32.7	**36.4**	**30.9**
FLX 32	39.1	43.8	26.7	32.2	25.4	20.2	21.0	26.2	no data	37.6	46.3	44.5	**33.0**	**28.1**
FLX 33a	no data	52.4	37.0	27	31.3	23.7	30.9	29.4	31.1	39.1	-	41.8	See FLX 33 Mean	n/a
FLX 33b	no data	49.2	33.9	27.1	32.3	23.5	29.6	29.2	36.3	45.6	53.2	45.3	See FLX 33 Mean	n/a
FLX 33c	no data	47.3	36.8	29.9	25.9	23.8	26.9	28.2	35.0	41.2	58.5	40.6	See FLX 33 Mean	n/a
FLX 33 a,b,c -mean	no data	49.6	35.9	28.0	29.8	23.7	29.1	28.9	34.1	42.0	55.9	42.6	**36.3**	**30.9**

Key:			
	FLX 4	Urban Background site	lampost outside 37 Lynwood Avenue, Felixstowe
	FLX 12	Roadside site	drainpipe at 119 Hamilton Road, 'Ford Bros. Bike Shop' Felixstowe
	FLX 14 a,b,c	Roadside site	drainpipe on 1 Adastral Close, Felixstowe. **(Triplicate site)**
	FLX 17 a,b,c	Roadside site	drainpipe on 38 Spriteshall Lane, Trimley St. Mary. **(Triplicate site)**
	FLX 18 a,b,c	Roadside site	lampost at 67 Kirton Road, Trimley St. Martin. **(Triplicate site)**
	FLX 19	Urban Background site	lampost at 4 Welbeck Close, Trimley St. Mary
	FLX 20	Industrial/Roadside site	rear garden of 73 Glemsford Close, Felixstowe
	FLX 21	Industrial/Roadside site	lampost at 4 Kings Fleet Road, Felixstowe
	FLX 22	Industrial Site	drainpipe on 13 Levington Road, Felixstowe
	FLX 23 a,b	Roadside site	drainpipe on 23 Heathgate Piece, Trimley St. Mary **(duplicate site)**
	FLX 24	Roadside site	rear garden of 22 Brandon Road, Felixstowe
	FLX 25	Roadside site	drainpipe on 46 Rendlesham Road, Felixstowe
	FLX 26 a,b,c	Industrial/Roadside site	first floor window over front car park at The Dooley Inn, Ferry Lane, **Felixstowe (Collocated with analyser. Sited January 2007)**
	FLX 27	Industrial/Roadside site	first floor front window facing the Docks at The Dooley Inn, Ferry Lane, Felixstowe
	FLX 28	Roadside site	rear garden of 63 Blyford Way, Felixstowe
	FLX 29	Industrial Site	18 Adastral Close, Felixstowe **(New Site January 2007)**
	FLX 30	Industrial Site	39 Adastral Close, Felixstowe **(New Site January 2007)**
	FLX 31	Industrial Site	44 Adastral Close, Felixstowe **(New Site January 2007)**
	FLX 32	Industrial Site	64 Adastral Close, Felixstowe **(New Site January 2007)**
	FLX 33 a,b,c	Industrial Site	Verge adjacent to 1 Adastral Close , Felixstowe **(Triplicate site collocated with analyser. New Site February 2007)**

Diffusion tube annual mean is ratified to improve accuracy. The bias adjustment factor for the diffusion tubes must either be obtained from the analyst laboratory or calculated from a collocation study with a continuous analyser by the authority themselves. In 2007 several collocation studies were undertaken by Suffolk Coastal District Council using results from continuous NO_x analysers located at sites in Felixstowe (Dooley Inn), Felixstowe (Adastral Close) and Woodbridge. For diffusion tube sites in Felixstowe the most relevant of the 2 bias correction factors for the Felixstowe analysers were used. Details are available in Figure B-2 in this appendix to explain the bias correction factors chosen for each site. The bias correction factor for the Dooley Inn analyser of 0.78 was used to correct the results for the 2 diffusion tubes at this location, and the bias correction factor for the Adastral Close analyser of 0.85 was used to correct the results for all other diffusion tubes located in Felixstowe. Annual mean diffusion tube concentrations were, therefore, multiplied by a factor of 0.85 or 0.78 depending on location.

Table B-6 Monthly and annual mean nitrogen dioxide (NO_2) concentrations recorded at sites in Kesgrave during 2007, figures in micrograms per cubic metre ($\mu g/m^3$). Annual mean concentration ratified where relevant.

Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual mean ($\mu g/m^3$)	Ratification of annual mean ($\mu g/m^3$) using bias correction factor (# 0.96 obtained from Woodbridge analyser)
KSG 4	25.5	31.0	24.0	19.7	12.6	13.3	15.8	no data	13.5	23.2	34.7	27.9	**21.9**	**21**
KSG 6	30.1	41	25.4	29.4	no data	23.1	no data	28.3	28.3	43.9	47.5	36.8	**33.4**	**27**
KSG 9	43.5	51.6	35.4	34.5	35.4	no data	41.1	31.0	29.0	43.2	62	45.5	**41.1**	**39.5**

Key:			
	KSG 4	Urban background site	Kesgrave High School, Main Road, Kesgrave
	KSG 6	Roadside site	All Saints Church / The Bell Inn, Main Road, Kesgrave.
	KSG 9	Roadside site	Roadside lamp-post outside 118 Main Road, Kesgrave.

Diffusion tube annual mean is ratified to improve accuracy. The bias adjustment factor for the diffusion tubes must either be obtained from the analyst laboratory or calculated from a collocation study with a continuous analyser by the authority themselves. In 2007 a collocation study was undertaken by Suffolk Coastal District Council using results from a continuous NO_x analyser located at a site in Woodbridge. The bias correction factor for 2007 was calculated, from this study, as 0.96 and details are available in Figure B-2 in this appendix. Annual mean diffusion tube concentrations were, therefore, multiplied by a factor of 0.96.

Table B-7 Monthly and annual mean nitrogen dioxide (NO_2) concentrations recorded at sites in Woodbridge during 2007, figures in micrograms per cubic metre ($\mu g/m^3$). Annual mean concentration ratified where relevant.

Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual mean ($\mu g/m^3$)	Ratification of annual mean ($\mu g/m^3$) using bias correction factor (# 0.96 obtained from Woodbridge analyser)
WBG 1a	47.8	55.1	48.8	43.0	45.9	37.5	43.2	39.6	44.2	57.1	59.6	51	see WBG 1 mean	n/a
WBG 1b	40.0	47.3	50.3	48.5	48.6	44.3	41.3	43.9	49.1	57.7	58.4	54.7	see WBG 1 mean	n/a
WBG 1c	49.7	47.8	50	46.8	36.8	35.9	42	46.9	49.5	54.5	58	44.9	see WBG 1 mean	n/a
WBG 1 a,b,c - mean	45.8	50.1	49.7	46.1	43.8	39.2	42.2	43.5	47.6	56.4	58.7	50.2	**47.8**	**45.9**
WBG 3	18.4	29.9	20.1	15.2	12.7	11.9	12.8	12.9	15.2	24.2	28.7	30.2	**19.4**	**18.6**
WBG 5a	30.3	39.1	34.0	31	29.7	25.1	23.0	27.6	30.9	40.5	38.2	36	see WBG 5 mean	n/a
WBG 5b	34.1	42.1	37.4	36	26.9	27.5	23.1	28.2	29.7	42.3	38.3	40.1	see WBG 5 mean	n/a
WBG 5c	29.2	39.4	29.2	34.4	28.9	23.9	22.7	25.3	27.5	41.2	32.4	40.1	see WBG 5 mean	n/a
WBG 5 a,b,c - mean	31.2	40.2	33.5	33.8	28.5	25.5	22.9	27.0	29.4	41.3	36.3	38.73	**32.4**	**31.1**
WBG 6	38.6	39.3	45.6	44	45.2	37.8	35.8	43.4	44.2	56.8	57.4	49.9	**44.8**	**43**
WBG 8	46.6	58	48.1	46.8	42.1	47.3	42.7	46.2	44.2	55.6	59.2	54.9	**49.3**	**47.3**
WBG 10	33.7	48.7	38.9	38.2	39.5	28.5	27.7	31.1	36.0	50.7	46.3	48	**38.9**	**37.3**
WBG 12	29.7	39.9	31.8	27.3	26.3	22.6	28.4	25.9	29.0	33.7	40.2	39.8	**31.2**	**30**
WBG 13	36.1	47.9	42.1	43.1	34.2	31.6	30.3	34.8	35.1	48.7	49.7	47.9	**40.1**	**38.5**
WBG 15	40.1	54.1	46.3	45.9	44.3	25.6	37.1	45.4	44.7	57.6	59.5	47.8	**45.7**	**43.9**
WBG 17	34.2	40.6	35.1	30.8	32.6	22.6	30.8	30.1	32.4	37	39.2	28.7	**32.8**	**31.5**
WBG 18	37.1	41.3	40.2	41.3	41.9	32.6	35.0	39.6	39.4	50.9	45.6	51.4	**41.4**	**39.7**
WBG 19	26.8	37.1	26.8	21.8	19.1	16.5	17.7	16.8	19.9	26.6	34.2	36	**24.9**	**23.9**
WBG 20	46.7	52.1	40.3	39.0	44.2	36.1	37.5	40.7	44.6	49.5	56.2	40.3	**43.9**	**42.1**
WBG 21	27.8	33.9	23.1	20.2	19.7	16.7	16.9	17.2	19.8	29.5	32.4	33.9	**24.3**	**23.3**

Key:

WBG 1a,b,c	Kerbside site	signpost outside 93 Thoroughfare, Woodbridge **(collocation with continuous monitor from January 2006) (Triplicate site)**
WBG 3	Urban Background site	lampost outside 8 Kingston Farm Road, Woodbridge
WBG 5a,b,c	Roadside site	drainpipe on corner of Suffolk Place, Lime Kiln Quay Road, Woodbridge **(Triplicate site)**
WBG 6	Roadside site	drainpipe on 87 Thoroughfare, Woodbridge
WBG 8	Roadside site	drainpipe on 95 Thoroughfare, Woodbridge
WBG 10	Roadside site	signpost in St. John's Street (opposite Surgery), Woodbridge
WBG 12	Roadside site	drainpipe on 8 Lime Kiln Quay Road, Woodbridge. **Site reinstated from January 2006**
WBG 13	Roadside site	traffic lights at front of 85 Thoroughfare, Woodbridge
WBG 15	Roadside site	drainpipe on 87 Thoroughfare, Woodbridge
WBG 17	Roadside site	drainpipe at front Northern end of Suffolk Place, Lime Kiln Quay Road, Woodbridge. **New site from January 2006**
WBG 18	Roadside site	Roadside site, drainpipe between 106 / 108 Thoroughfare, Woodbridge. **New site from January 2006**
WBG 19	Roadside site	Roadside site, front porch of 25 St. John's Street, Woodbridge. **New site from January 2006**
WBG 20	Roadside site	drainpipe on 97 Thoroughfare, Woodbridge. **New site from February 2006**
WBG 21	Roadside site	drainpipe on the front of 27 St John Street, Woodbridge. **New Site from January 2007**

Diffusion tube annual mean is ratified to improve accuracy. The bias adjustment factor for the diffusion tubes must either be obtained from the analyst laboratory or calculated from a collocation study with a continuous analyser by the authority themselves. In 2007 a collocation study was undertaken by Suffolk Coastal District Council using results from a continuous NO_x analyser located at a site in Woodbridge. The bias correction factor for 2007 was calculated, from this study, as 0.96 and details are available in Figure B-2 in this appendix. Annual mean diffusion tube concentrations were, therefore, multiplied by a factor of 0.96.

Table B-8 Monthly and annual mean nitrogen dioxide (NO_2) concentrations recorded at sites in Melton during 2007, figures in micrograms per cubic metre ($\mu g/m^3$). Annual mean concentration ratified where relevant.

Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual mean ($\mu g/m^3$)	Ratification of annual mean ($\mu g/m^3$) using bias correction factor (# 0.96 obtained from Woodbridge analyser)
MEL 2	17.9	23.9	18.9	14.2	11.4	10.8	14.5	12.5	13.3	17.1	21.9	25.6	**16.8**	**16.1**
MEL 5a	39.1	46.0	28.8	28.1	32.0	26.5	26.8	29.3	35.0	40.5	46.7	44.7	see MEL 5 mean	n/a
MEL 5b	40.5	47.6	35.9	28.5	29.4	26.8	31.8	30.4	30.6	39.1	46.9	35.8	see MEL 5 mean	n/a
MEL 5a,b, - mean	39.8	46.8	32.4	28.3	30.7	26.7	29.3	29.9	32.8	32.2	46.8	40.25	**34.7**	**33.3**
MEL 6	20.2	31.5	22.4	19	16.6	10.4	15.4	20	20.4	29.5	31.9	31.6	**22.4**	**21.5**

MEL 2	Urban Background site	drainpipe on 106 Hall Farm Road, Melton
MEL 5a & b	Roadside site	6 The Street, Melton **(Triplicate site)**
MEL 6	Roadside site	Melton CPS (drainpipe), Melton Road, Melton. **(New site from January 2007)**

Diffusion tube annual mean is ratified to improve accuracy. The bias adjustment factor for the diffusion tubes must either be obtained from the analyst laboratory or calculated from a collocation study with a continuous analyser by the authority themselves. In 2007 a collocation study was undertaken by Suffolk Coastal District Council using results from a continuous NO_x analyser located at a site in Woodbridge. The bias correction factor for 2007 was calculated, from this study, as 0.96 and details are available in Figure B-2 in this appendix. Annual mean diffusion tube concentrations were, therefore, multiplied by a factor of 0.96.

Appendix C

Maps detailing the location of nitrogen dioxide diffusion tube monitoring sites and automatic analysers within the Suffolk Coastal district

Map C-0 **Location of nitrogen dioxide (NO_2) diffusion tubes in Felixstowe**

Map C-1 **Location of nitrogen dioxide (NO_2) diffusion tubes at Hamilton Road (Roadside site), and Lynwood Avenue (Urban Background site), Felixstowe**

Map C-2 **Location of NO_2 diffusion tubes at Ferry Lane (Industrial / Roadside sites), Adastral Close, Levington Road and Glemsford Close (Industrial sites), Felixstowe**

Map C-3 **Location of NO_2 diffusion tubes at Brandon Road, Rendlesham Road, Blyford Way (Roadside sites) and Kings Fleet Road (Urban Background site), Felixstowe**

Map C-4 **Location of NO_2 diffusion tubes at Spriteshall Lane, Heathgate Piece (Roadside sites) and Welbeck Close (Urban Background site) in Trimley St. Mary, and Kirton Road (Roadside site) in Trimley St. Martin**

Map C-5 **Location of NO_2 diffusion tubes and automatic NO_x, SO_2 and PM_{10} analyser at Adastral Close, in the southern Felixstowe area near to the Docks**

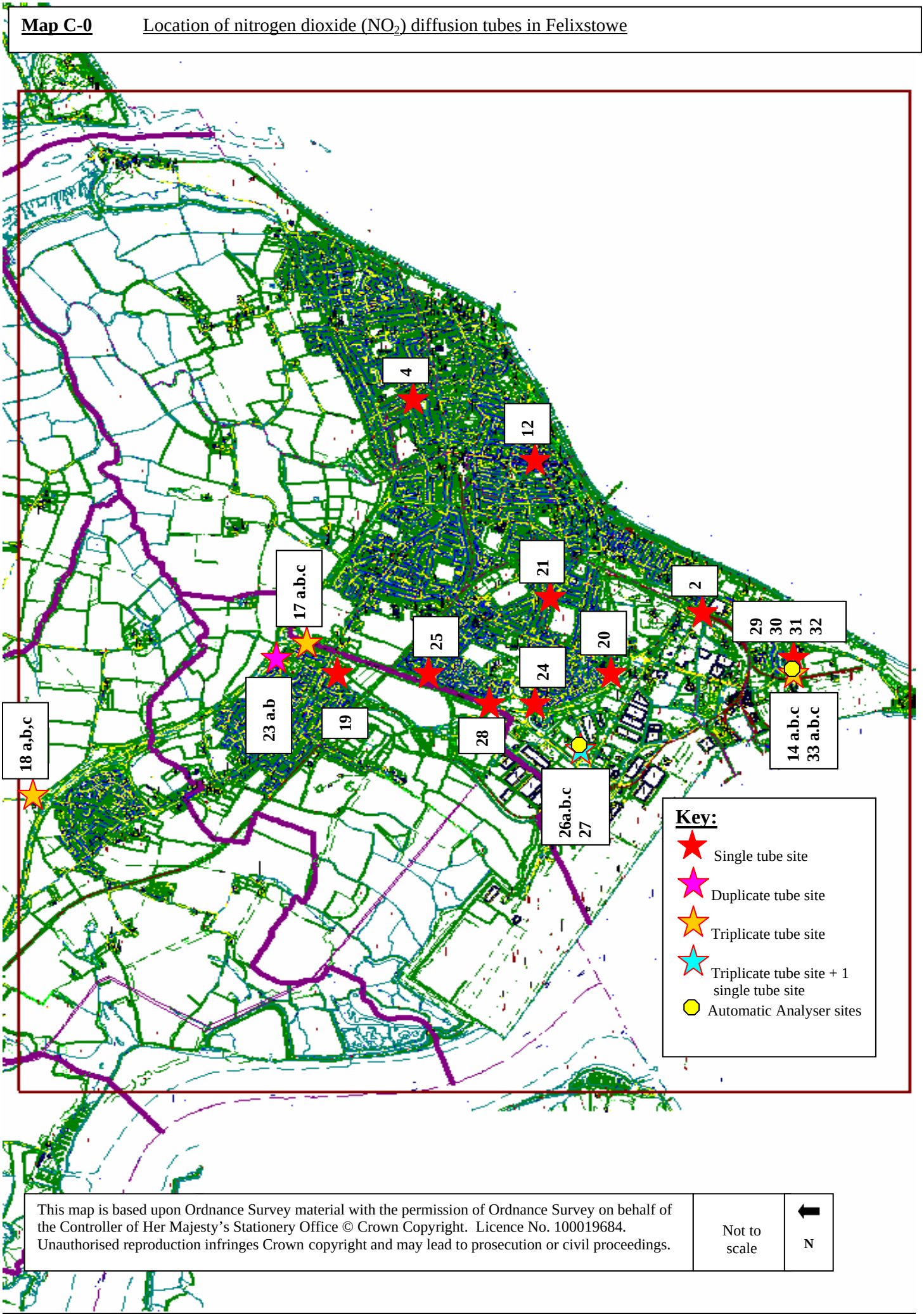
Map C-6 **Location of NO_2 diffusion tubes and automatic NO_x analyser sited at the junction of Lime Kiln Quay Road / Thoroughfare / St. John's Street (Kerbside and Roadside sites) in Woodbridge**

Map C-7 **Location of NO_2 diffusion tube sited at Kingston Farm Road (Urban Background site), Woodbridge**

Map C-8 **Location of NO_2 diffusion tubes sited at Main Road (Roadside) and Kesgrave High School (Urban Background site), Kesgrave**

Map C-9 **Location of NO_2 diffusion tubes sited at the Melton Crossroads (Roadside site) and Hall Farm Road (Urban Background site), Melton**

Map C-0 Location of nitrogen dioxide (NO_2) diffusion tubes in Felixstowe



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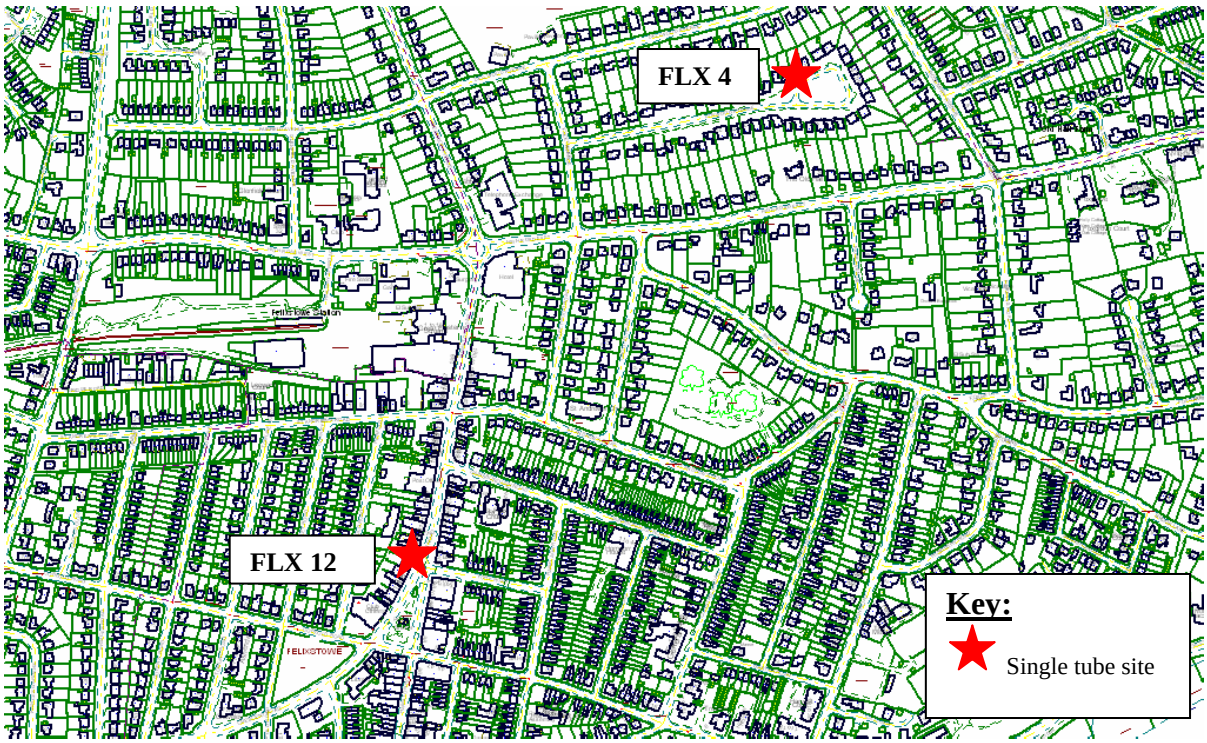
Map C-1 Location of nitrogen dioxide (NO_2) diffusion tubes at Hamilton Road (Roadside site), and Lynwood Avenue (Urban Background site), Felixstowe.



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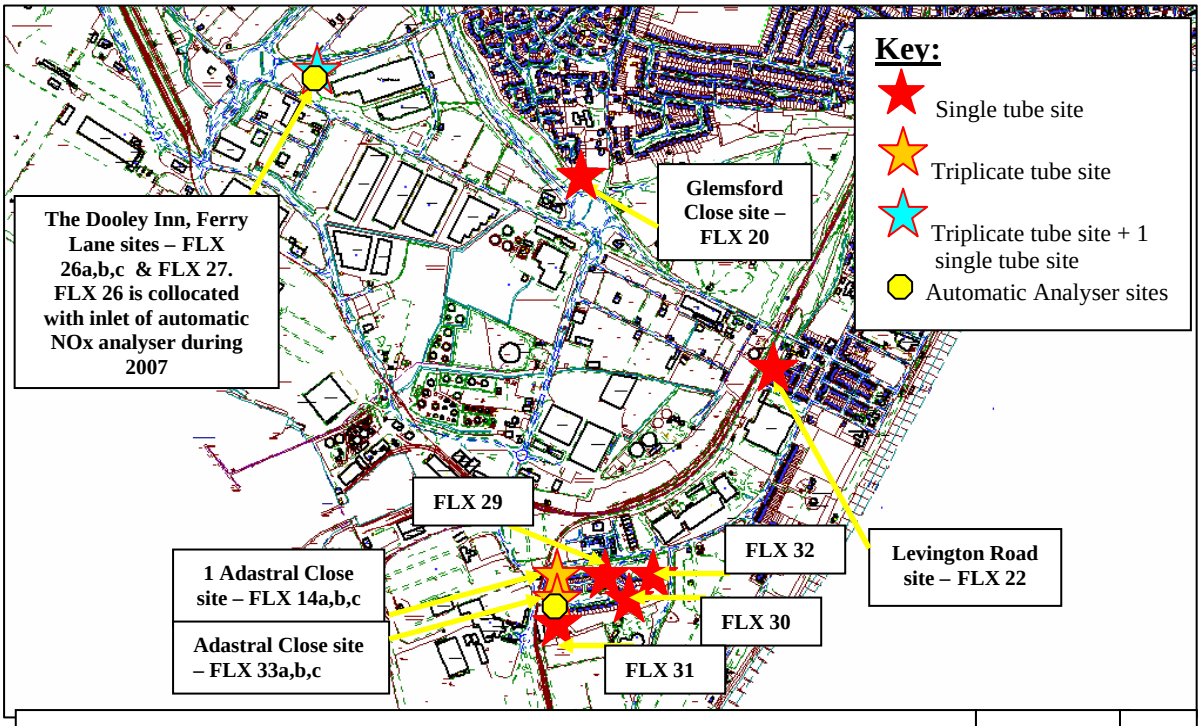
Map C-2 Location of NO_2 diffusion tubes at Ferry Lane (Industrial / Roadside sites), Adastral Close, Levington Road and Glemsford Close (Industrial sites), Felixstowe.



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Not to scale

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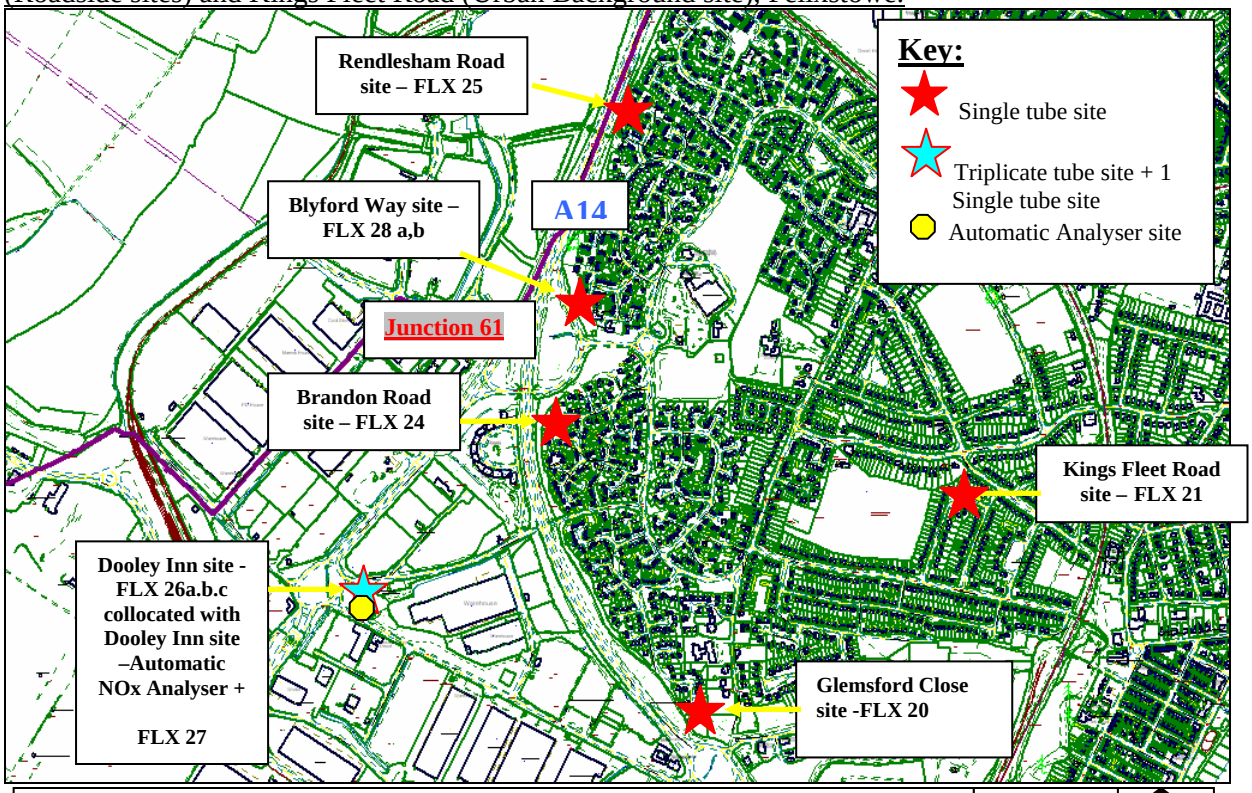
Map C-3 Location of NO_2 diffusion tubes at Brandon Road, Rendlesham Road, Blyford Way (Roadside sites) and Kings Fleet Road (Urban Background site), Felixstowe.



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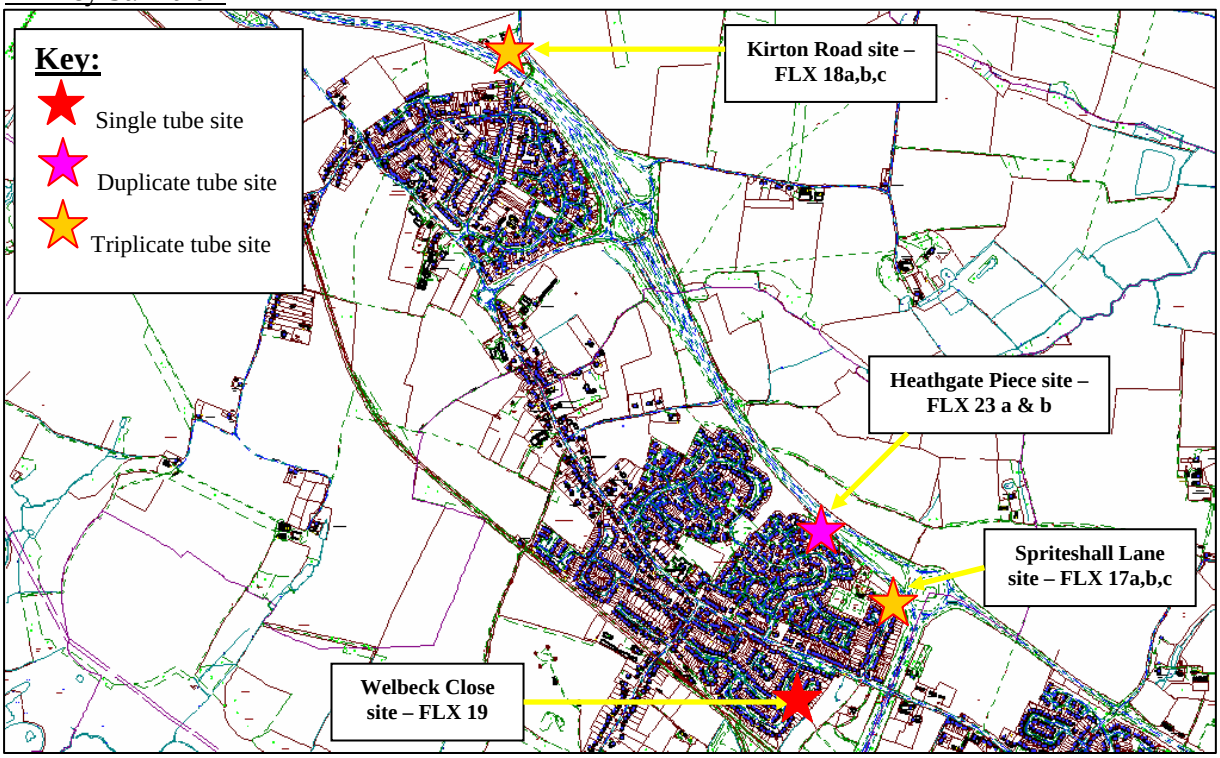
Map C-4 Location of NO_2 diffusion tubes at Spriteshall Lane, Heathgate Piece (Roadside sites) and Welbeck Close (Urban Background site) in Trimley St. Mary, and Kirton Road (Roadside site) in Trimley St. Martin



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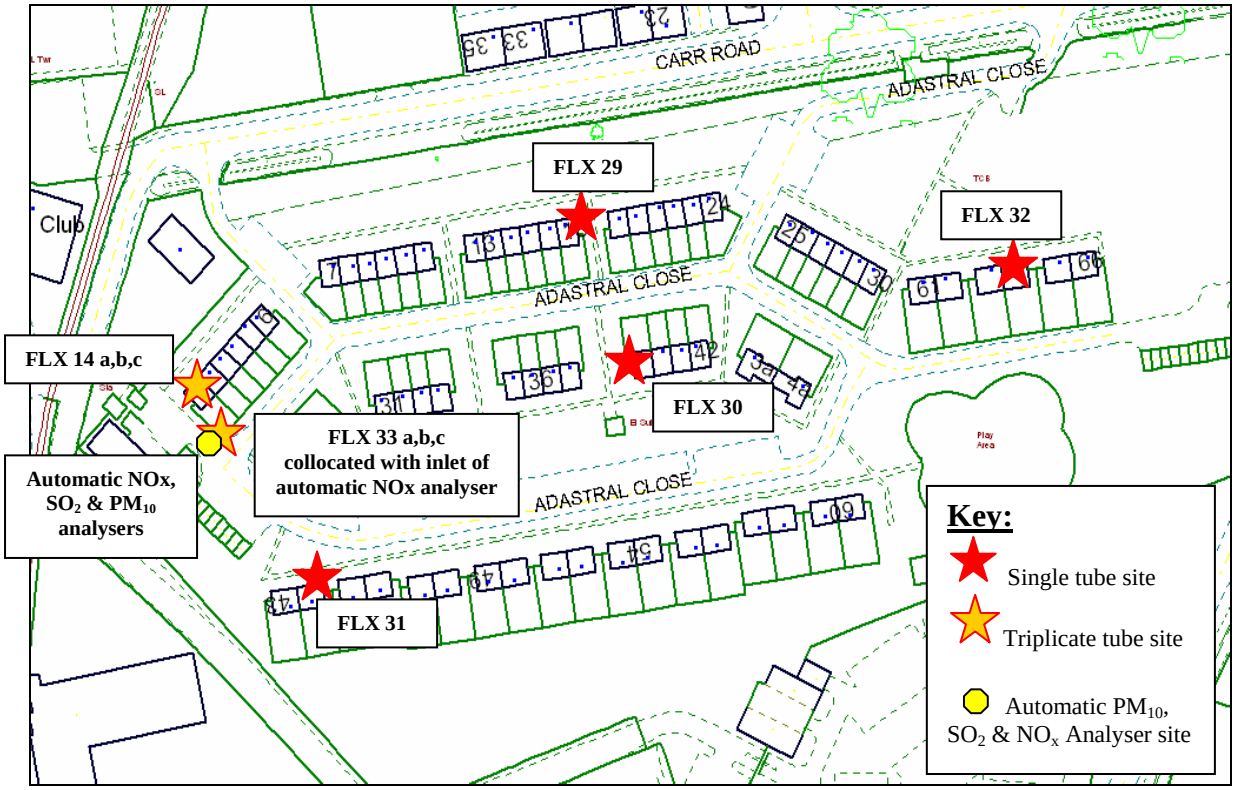
Map C-5 Location of NO_2 diffusion tubes and automatic NO_x, SO_2 and PM_{10} analyser at Adastral Close, in the southern Felixstowe area near to the Docks



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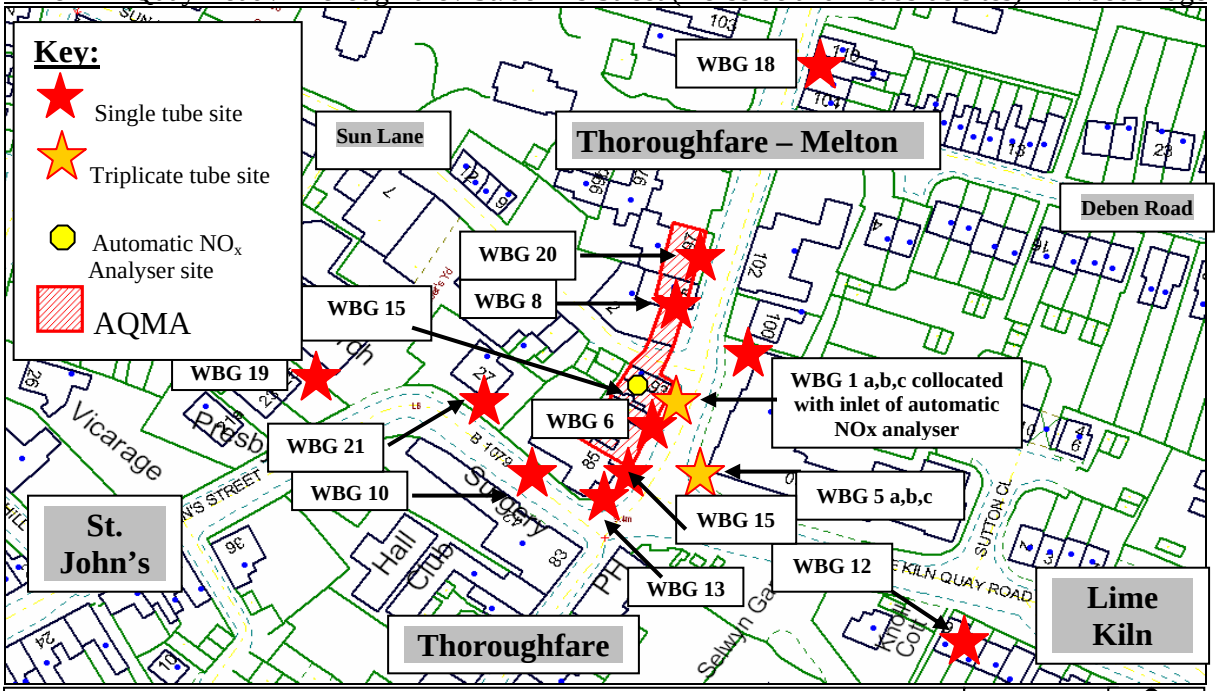
Map C-6 Location of NO_2 diffusion tubes and automatic NO_x analyser sited at the junction of Lime Kiln Quay Road / Thoroughfare / St. John's Street (Kerbside and Roadside sites) in Woodbridge



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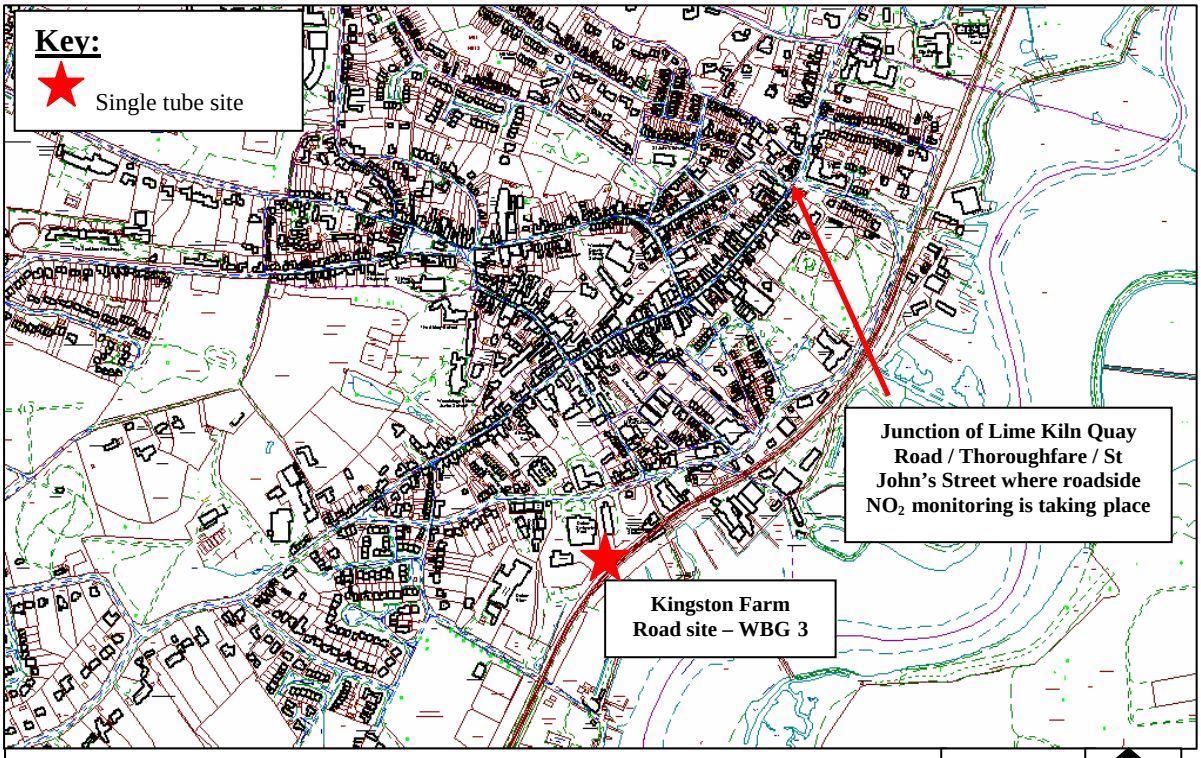
Map C-7 Location of NO_2 diffusion tube sited at Kingston Farm Road (Urban Background site), Woodbridge.



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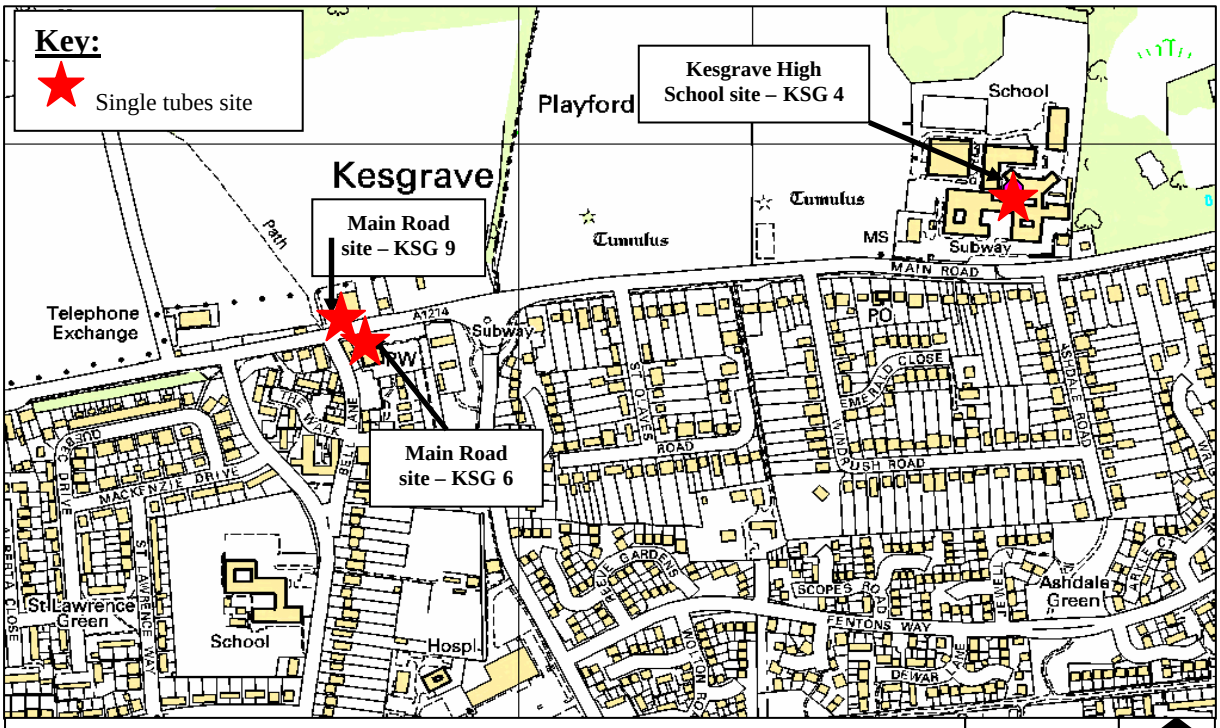
Map C-8 Location of NO_2 diffusion tubes sited at Main Road (Roadside) and Kesgrave High School (Urban Background site), Kesgrave



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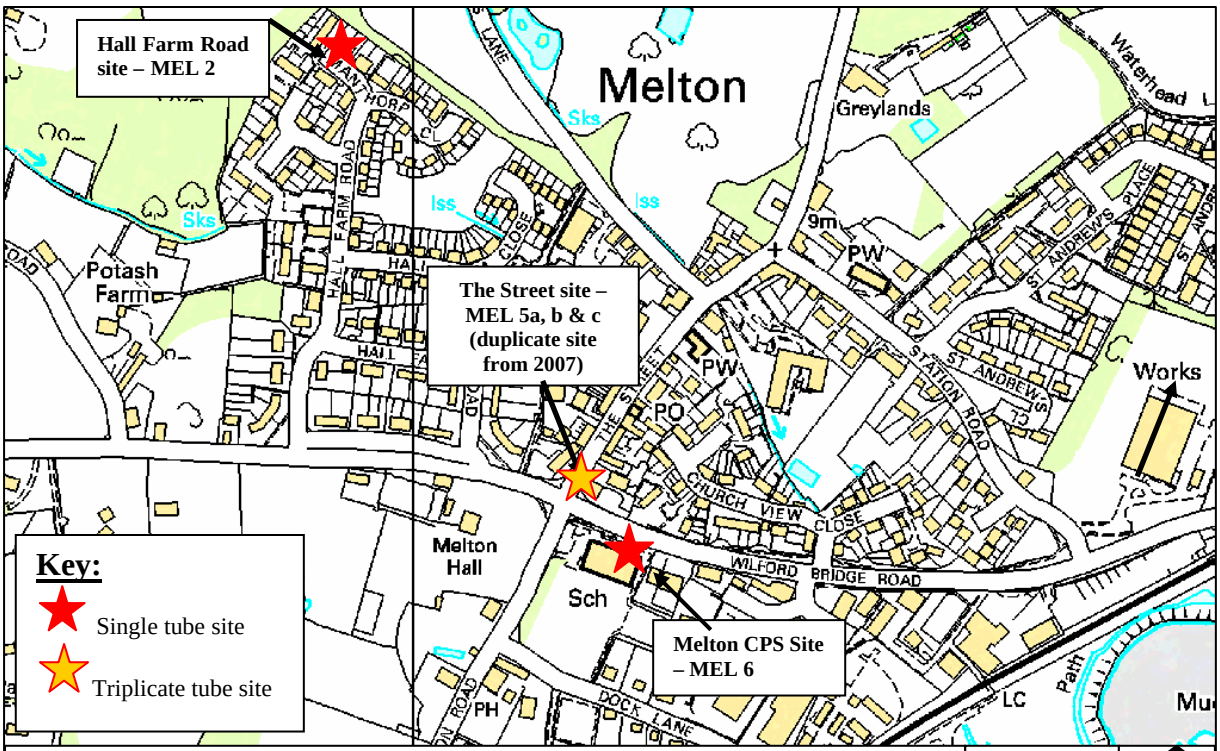
Map C-9 Location of NO_2 diffusion tubes sited at the Melton Crossroads (Roadside site) and Hall Farm Road (Urban Background site), Melton



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Appendix D

Quality assurance information for, and summary and graphical representation of data output from automatic analysers sited within the Suffolk Coastal district during 2006 and 2007.

Quality assurance information for automatic analysers sited within the Suffolk Coastal district during 2006 and 2007.

Nitrogen dioxide concentrations were monitored at the continuous analyser sites by ozone chemiluminescence. Sulphur dioxide concentrations were measured by ultra violet fluorescence. Particulate matter concentrations were measured by unheated beta attenuation.

Quality assurance of the data from the continuous monitoring stations was carried out by AEA Energy and Environment following the same procedures used for sites within the Government's Automatic Urban and Rural Network. The procedures adopted for the calibrations were modelled on those developed by AEA Energy & Environment for use in the national monitoring networks. The calibrations were undertaken using certified calibration gas provided by Air Liquide UK Limited with traceability to National Metrology Standards obtained via regular UKAS Quality Control Audits. The audits provide a range of information that is utilised within the data management process for the data sets.

Audit tests undertaken include accredited audit zero and span calibrations, linearity, NO_x converter efficiency, flow and leak checks as well as checks of the instruments sampling system. Data presented in this report have been fully ratified by AEA Technology. The ratified data reports are included in this appendix.

The data sets were screened, scaled and validated using all available routine site calibrations, audit results and service engineer records. This was an ongoing process with checks made daily to ensure high data capture is achieved. A final process of data ratification ensures that the data provide the most accurate record of the pollution concentrations across the measurement period. The data management process adopted is that evolved and implemented by AEA Energy & Environment within the data management programme of the AURN UK national monitoring network. This process is expected to deliver data sets that meet the EU Data Quality Objective of a measurement uncertainty of better than 15%.

Produced by AEA Energy & Environment on behalf of Suffolk Coastal District Council

SUFFOLK COASTAL WOODBRIDGE
01 January to 31 December 2006

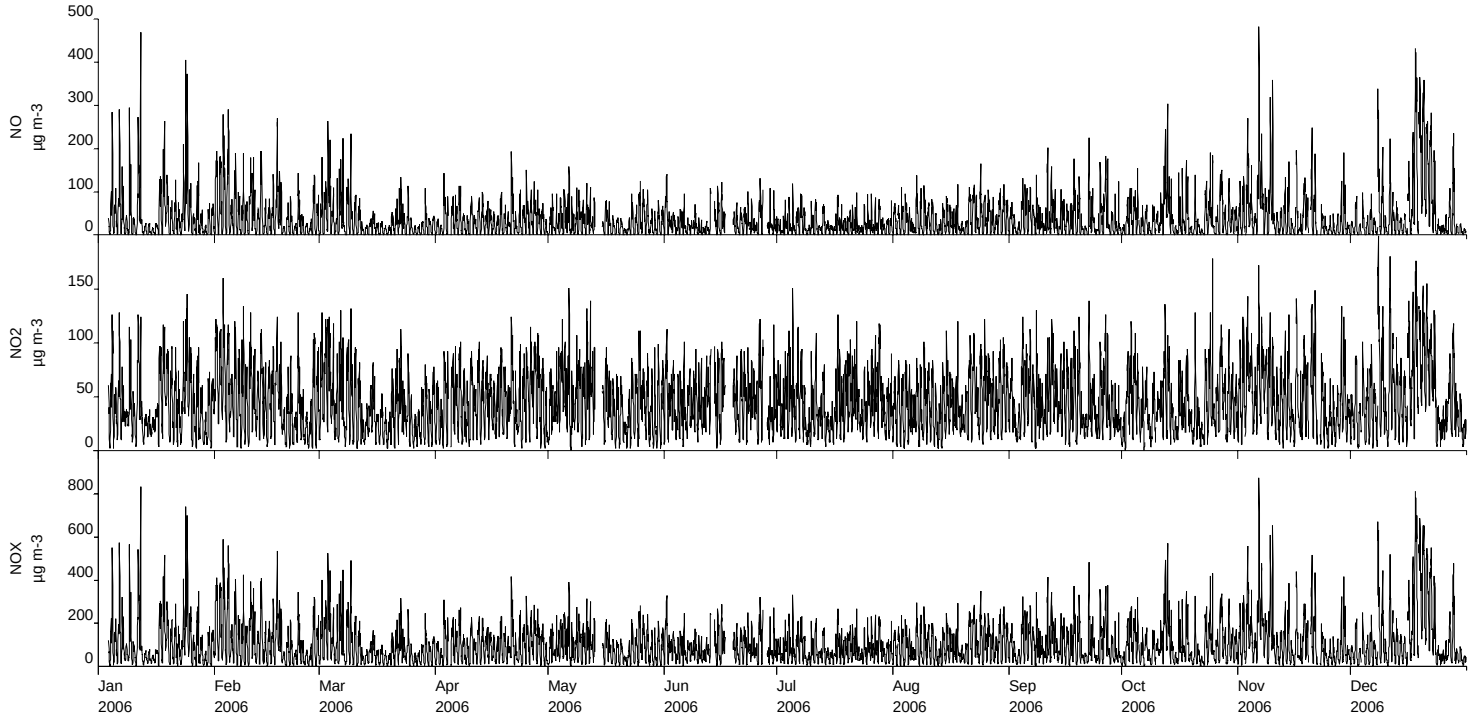
These data have been fully ratified by AEA Energy & Environment

POLLUTANT	NO	NO_2	NO_X
Number Very High	-	0	-
Number High	-	0	-
Number Moderate	-	0	-
Number Low	-	8434	-
Maximum 15-minute mean	628 µg m^{-3}	419 µg m^{-3}	1092 µg m^{-3}
Maximum hourly mean	483 µg m^{-3}	199 µg m^{-3}	875 µg m^{-3}
Maximum running 8-hour mean	364 µg m^{-3}	154 µg m^{-3}	700 µg m^{-3}
Maximum running 24-hour mean	218 µg m^{-3}	100 µg m^{-3}	425 µg m^{-3}
Maximum daily mean	217 µg m^{-3}	95 µg m^{-3}	421 µg m^{-3}
Average	36 µg m^{-3}	44 µg m^{-3}	99 µg m^{-3}
Data capture	96.3 %	96.3 %	96.3 %

All mass units are at 20'C and 1013mb
NO_X mass units are NO_X as NO_2

Pollutant	Air Quality (England) Regulations 2000 and (Amendment) Regulations 2002	Exceedences	Days
Nitrogen Dioxide	Annual mean > 40 µg m^{-3}	1	0
Nitrogen Dioxide	Hourly mean > 200 µg m^{-3}	0	0

Produced by AEA Energy & Environment on behalf of Suffolk Coastal District Council



Suffolk Coastal Woodbridge
Hourly Mean Data for 01 January to 31 December 2006

Produced by netcen on behalf of Suffolk Coastal District Council

Sean Christiansen
Environmental Quality
AEA Technology
Building 551
Harwell
Didcot
Oxfordshire
OX11 0QJ

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Direct facsimile 0870 190 6377
e-mail sean.christiansen@aeat.co.uk

Produced by AEA Energy & Environment on behalf of Suffolk Coastal DC

SUFFOLK COASTAL WOODBRIDGE
01 January to 31 December 2007

These data have been fully ratified by AEA Energy & Environment

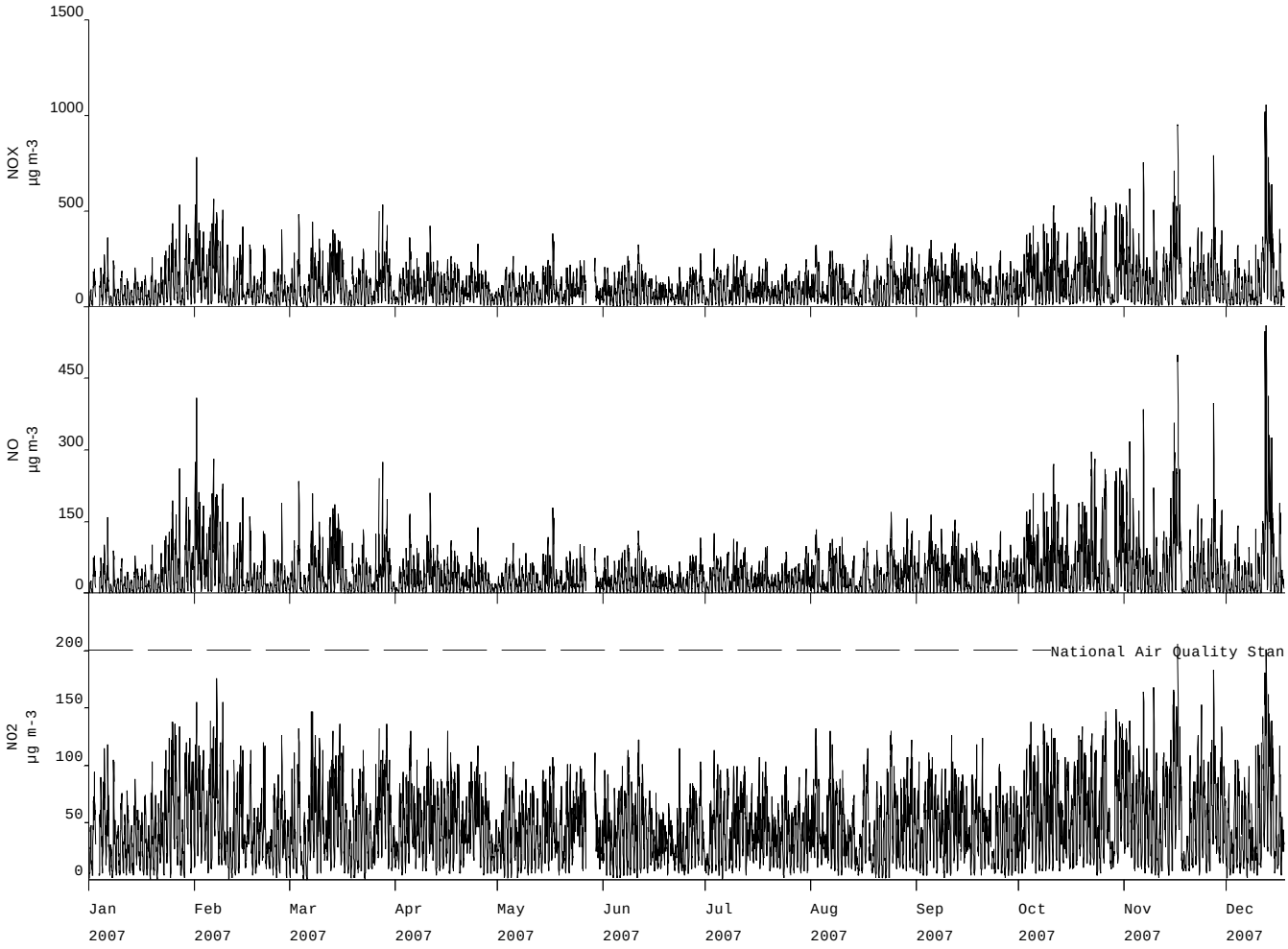
POLLUTANT	NO_X	NO	NO_2
Number Very High	-	-	0
Number High	-	-	0
Number Moderate	-	-	0
Number Low	-	-	8618
Maximum 15-minute mean	1296 µg m^{-3}	703 µg m^{-3}	298 µg m^{-3}
Maximum hourly mean	1056 µg m^{-3}	560 µg m^{-3}	206 µg m^{-3}
Maximum running 8-hour mean	758 µg m^{-3}	394 µg m^{-3}	162 µg m^{-3}
Maximum running 24-hour mean	485 µg m^{-3}	246 µg m^{-3}	110 µg m^{-3}
Maximum daily mean	484 µg m^{-3}	246 µg m^{-3}	109 µg m^{-3}
Average	106 µg m^{-3}	39 µg m^{-3}	46 µg m^{-3}
Data capture	98.4 %	98.4 %	98.4 %

All mass units are at 20'C and 1013mb
NO_X mass units are NO_X as NO_2 µg m-3

Pollutant	Air Quality (England) Regulations 2000 and (Amendment) Regulations 2002	Exceedences	Days
Nitrogen Dioxide	Annual mean > 40 µg m^{-3}	1	-
Nitrogen Dioxide	Hourly mean > 200 µg m^{-3}	2	2

Produced by AEA Energy & Environment on behalf of Suffolk Coastal DC

Suffolk Coastal Woodbridge Air Monitoring
Hourly Mean Data for 01 January to 31 December 2007



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Produced by AEA Energy & Environment on behalf of Suffolk Coastal DC

FELIXSTOWE - ADASTRAL CLOSE
30 January 2007 to 01 February 2008

These data have been fully ratified by AEA Energy & Environment

POLLUTANT	NO_X	NO	NO_2	SO_2	PM_{10}*+
Number Very High	-	-	0	0	0
Number High	-	-	0	0	17
Number Moderate	-	-	0	0	172
Number Low	-	-	8648	34683	7284
Maximum 15-minute mean	1433 µg m^{-3}	839 µg m^{-3}	168 µg m^{-3}	229 µg m^{-3}	161 µg m^{-3}
Maximum hourly mean	1232 µg m^{-3}	713 µg m^{-3}	143 µg m^{-3}	210 µg m^{-3}	161 µg m^{-3}
Maximum running 8-hour mean	890 µg m^{-3}	504 µg m^{-3}	120 µg m^{-3}	93 µg m^{-3}	138 µg m^{-3}
Maximum running 24-hour mean	431 µg m^{-3}	228 µg m^{-3}	82 µg m^{-3}	42 µg m^{-3}	104 µg m^{-3}
Maximum daily mean	358 µg m^{-3}	185 µg m^{-3}	76 µg m^{-3}	41 µg m^{-3}	96 µg m^{-3}
Average	60 µg m^{-3}	19 µg m^{-3}	31 µg m^{-3}	10 µg m^{-3}	26 µg m^{-3}
Data capture	97.9 %	97.9 %	97.9 %	98.2 %	84.0 %

+ PM_{10} as measured by a BAM using a factor of 0.83333 for Indicative Gravimetric Equivalent

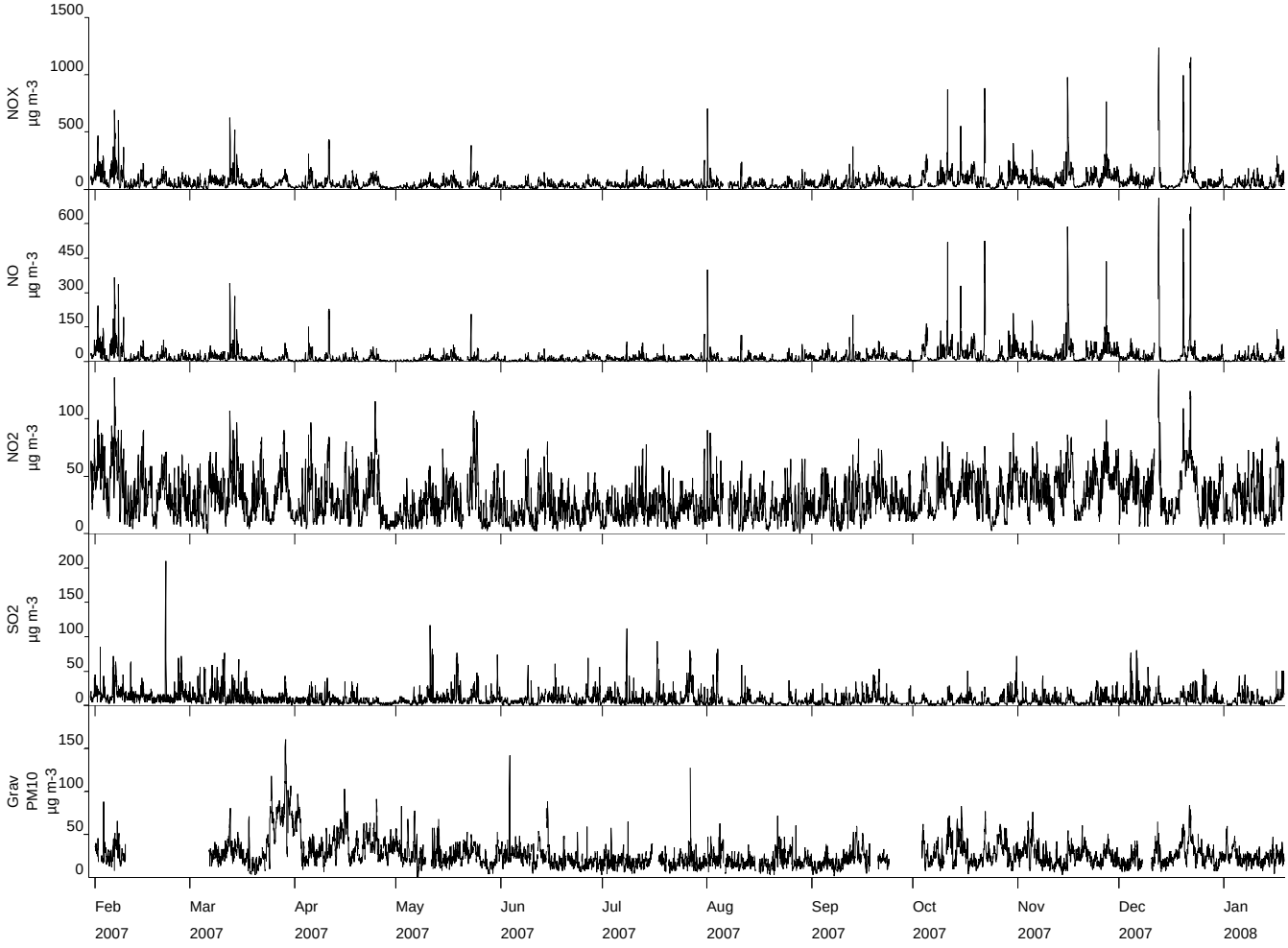
All mass units are at 20'C and 1013mb

NO_X mass units are NO_X as NO_2 µg m-3

Pollutant	Air Quality (England) Regulations 2000 and (Amendment) Regulations 2002	Exceedences	Days
Nitrogen Dioxide	Annual mean > 40 µg m^{-3}	0	-
Nitrogen Dioxide	Hourly mean > 200 µg m^{-3}	0	0
Sulphur Dioxide	15-minute mean > 266 µg m^{-3}	0	0
Sulphur Dioxide	Hourly mean > 350 µg m^{-3}	0	0
Sulphur Dioxide	Daily mean > 125 µg m^{-3}	0	0
PM_{10} Particulate Matter (Gravimetric)	Daily mean > 50 µg m^{-3}	13	13
PM_{10} Particulate Matter (Gravimetric)	Annual mean > 40 µg m^{-3}	0	-

Produced by AEA Energy & Environment on behalf of Suffolk Coastal DC

Felixstowe - Adastral Close Air Monitoring
Hourly Mean Data for 30 January 2007 to 01 February 2008



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Produced by AEA Energy & Environment on behalf of Suffolk Coastal DC

FELIXSTOWE – DOOLEY INN, FERRY LANE
01 January to 31 December 2007

These data have been fully ratified by AEA Energy & Environment

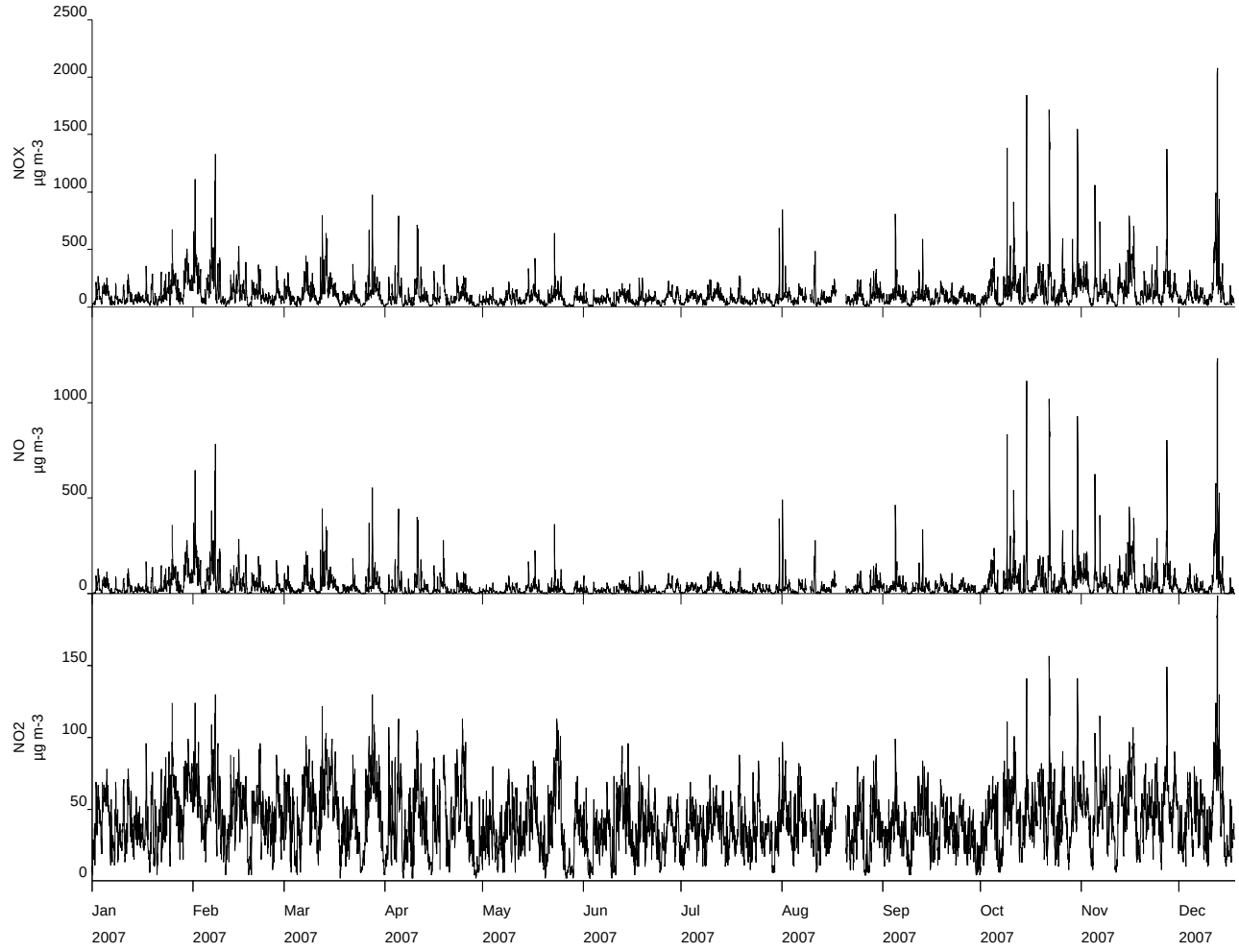
POLLUTANT	NO_X	NO	NO_2
Number Very High	-	-	0
Number High	-	-	0
Number Moderate	-	-	0
Number Low	-	-	8598
Maximum 15-minute mean	2815 µg m^{-3}	1723 µg m^{-3}	269 µg m^{-3}
Maximum hourly mean	2078 µg m^{-3}	1230 µg m^{-3}	199 µg m^{-3}
Maximum running 8-hour mean	1358 µg m^{-3}	795 µg m^{-3}	144 µg m^{-3}
Maximum running 24-hour mean	843 µg m^{-3}	482 µg m^{-3}	107 µg m^{-3}
Maximum daily mean	843 µg m^{-3}	482 µg m^{-3}	107 µg m^{-3}
Average	108 µg m^{-3}	44 µg m^{-3}	42 µg m^{-3}
Data capture	98.2 %	98.4 %	98.2 %

All mass units are at 20'C and 1013mb
NO_X mass units are NO_X as NO_2 µg m-3

Pollutant	Air Quality (England) Regulations 2000 and (Amendment) Regulations 2002	Exceedences	Days
Nitrogen Dioxide	Annual mean > 40 µg m^{-3}	1	-
Nitrogen Dioxide	Hourly mean > 200 µg m^{-3}	0	0

Produced by AEA Energy & Environment on behalf of Suffolk Coastal DC

Felixstowe – Dooley Inn, Ferry Lane Air Monitoring
Hourly Mean Data for 01 January to 31 December 2007



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Appendix E

The Suffolk Coastal District Council Air Quality Management Area Order no. 1, 2006 (for the junction of Lime Kiln Quay Road, Thoroughfare and St. John's Street in Woodbridge).

Environment Protection Act 1995, Part IV section 83(1)

Suffolk Coastal District Council

Air Quality Management Area Order

THE SUFFOLK COASTAL DISTRICT COUNCIL AIR QUALITY MANAGEMENT AREA ORDER NO 1, 2006

Suffolk Coastal District Council, in exercise of the powers conferred upon it by Section 83(1) of the Environment Act 1995, hereby makes the following Order

This Order may be referred to as '**The Suffolk Coastal District Council Air Quality Management Area Order No 1, 2006',** and shall come into effect on the **3rd April 2006**

The area shown on the attached map hatched in red is to be designated as an air quality management area (the designated area). **The designated area incorporates properties on the Western side of the Thoroughfare and Melton Hill arm of the junction with Lime Kiln Quay Road, in Woodbridge, Suffolk.**

The map may be viewed at the Council Offices, at Melton Hill, Woodbridge, between the hours of 08.45am to 5.15pm Mondays to Thursdays, and 08.45am to 4.45pm on Fridays.

This Area is designated in relation to a likely breach of the nitrogen dioxide (annual mean) objective as specified in the Air Quality Regulations (England)(Wales) 2000.

This order shall remain in force until it is varied or revoked by a subsequent order.

Dated; this Third day of March 2006

The Common Seal of Suffolk Coastal District Council was affixed in the presence of;

Ian S de Prez

……..

Authorised Officer

And

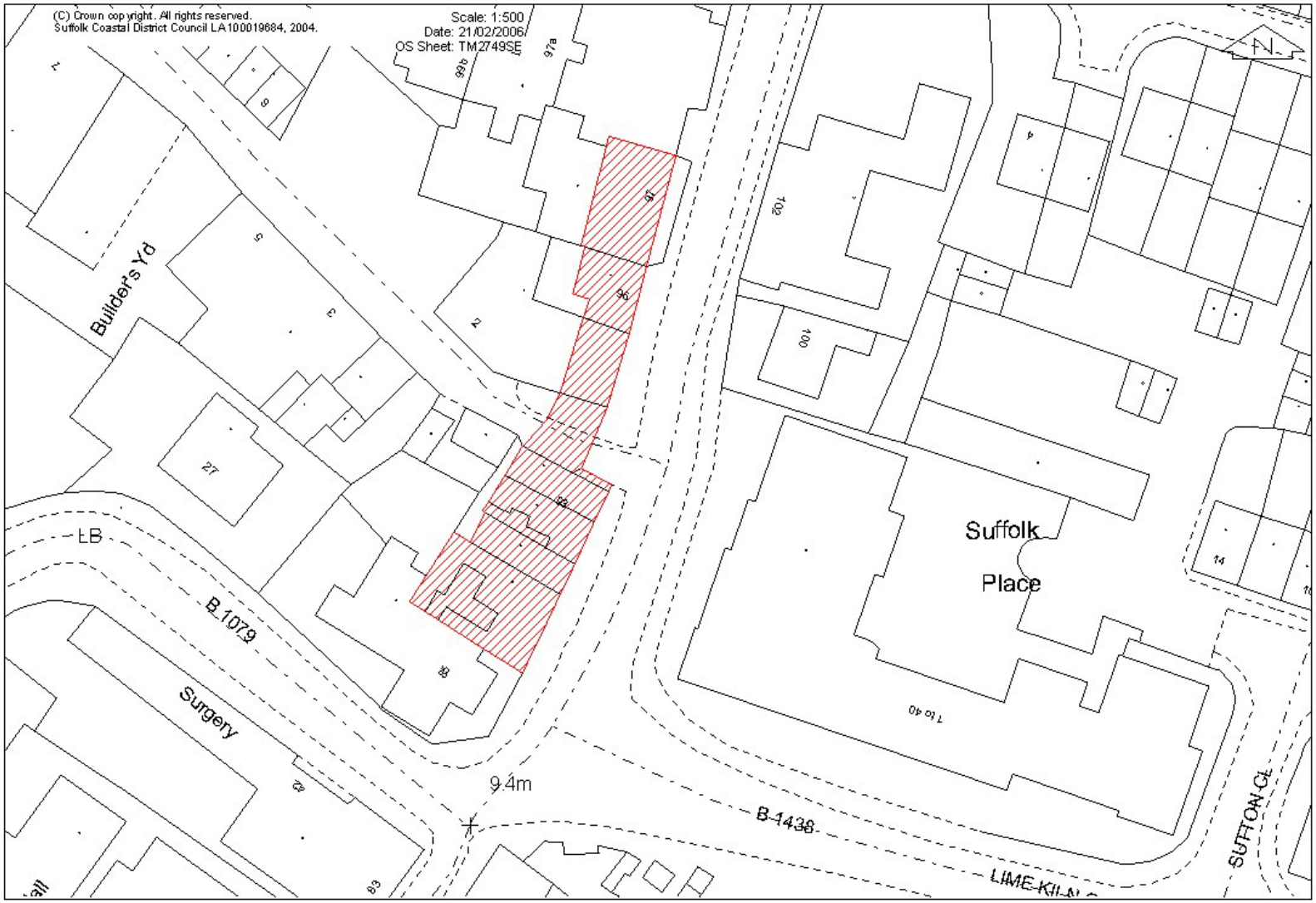
Simon Burridge

…… **CS** 9281

Authorised Officer

Dated 3rd March 2006

THE SUFFOLK COASTAL DISTRICT COUNCIL AIR QUALITY MANAGEMENT AREA ORDER NO 1, 2006



Appendix F

Air Quality Review and Assessment: Further Assessment for Woodbridge Junction, Woodbridge

Suffolk Coastal District Council

Air Quality Review and Assessment

Further Assessment for Woodbridge Junction, Woodbridge

Revised October 2007

Prepared by AEA Technology plc under contract to Suffolk Coastal District Council

Title	Air Quality Review and Assessment – Further Assessment for

	Woodbridge Junction, Woodbridge
Customer	Suffolk Coastal District Council
Customer reference	ED05333
Confidentiality, copyright and reproduction	Commercial in confidence
File reference	
Reference number	AEAT/ENV/R/2413

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Author	Name	Yongfu Xu
Approved by	Name	Beth Conlan
	Signature	
	Date	12 June 2007

Executive summary

The UK Government published its strategic policy framework for air quality management in 1995 establishing national strategies and policies on air quality, which culminated in the Environment Act, 1995. The Air Quality Strategy provides a framework for air quality control through air quality management and air quality standards. These and other air quality standards[1] and their objectives[2] have been enacted through the Air Quality Regulations in 1997 and 2000 and the Air Quality (Amendment) Regulations 2002. The Environment Act 1995 requires Local Authorities to undertake an air quality review. In areas where the air quality objective is not anticipated to be met, Local Authorities are required to establish Air Quality Management Areas to improve air quality.

The intention is that local authorities should only undertake a level of assessment that is proportionate to the risk of air quality objectives being exceeded. The first step in the second round of review and assessment is an Updating and Screening Assessment (USA), which is to be undertaken by all authorities. Where the USA has identified a risk that an air quality objective will be exceeded, the authority is required to undertake a detailed assessment.

Following the previous round of Detailed Air Quality Assessment, Suffolk Coastal District Council has declared an air quality management area (AQMA) for nitrogen dioxide in the Woodbridge junction area as:

- Woodbridge Junction, Woodbridge (junction of Lime Kiln Quay Rd, Thoroughfare and St John's St)

Following the declaration, Suffolk Coastal District Council has commissioned **AEA Energy & Environment** to undertake a Further Assessment for nitrogen dioxide (NO_2) in this declared Air Quality Management Area.

This report therefore constitutes a Further Assessment for Suffolk Coastal District Council. Only the impact of nitrogen dioxide emissions is considered in this report. This report investigates the nitrogen dioxide levels in 2006 (the base year) and 2010 through modelling exercises and by reference to the latest monitored air quality data.

- **Summary of the modelling predictions**
-

For 2006, both monitoring and modelling indicate continued exceedences of the objective for annual mean NO2 concentrations at the Woodbridge junction, and the hourly mean objective is unlikely to have been exceeded.

No exceedences of the objectives for NO_2 concentrations are predicted at the junction in 2010.

The source apportionment analysis shows that local traffic contributes about 90% of the total local NOx and vehicles waiting in queues produce about 60% of the traffic NOx at the junction.

[1] Refers to standards recommended by the Expert Panel on Air Quality Standards. Recommended standards are set purely with regard to scientific and medical evidence on the effects of the particular pollutants on health, at levels at which risks to public health, including vulnerable groups, are very small or regarded as negligible.

[2] Refers to objectives in the Strategy for each of the eight pollutants. The objectives provide policy targets by outlining what should be achieved in the light of the air quality standards and other relevant factors and are expressed as a given ambient concentration to be achieved within a given timescale.

Recommendations

- Suffolk Coastal District Council should retain the AQMA declared at the junction.
- Suffolk Coastal District Council should continue monitoring at all sites to confirm the predicted trend between now and 2010 with a few alterations.
- Suffolk Coastal District Council should consider revoking diffusion tube WBG 19 in St John Street.
- A reduction of vehicle emitted NOx by 16.4% would have eliminated the exceedences to the objective for annual mean NO_2 concentration in 2006. Queuing and HDV reductions will be the keys to improve air quality at the junction.

• Maps reproduced within this document

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Acronyms and definitions used in this report

AADTF	Annual Average Daily Traffic Flow
ADMS	an atmospheric dispersion model
AQDD	an EU directive (part of EU law) - Common Position on Air Quality Daughter Directives, commonly referred to as the Air Quality Daughter Directive
AQMA	Air Quality Management Area
AQS	Air Quality Strategy
AURN	Automatic Urban and Rural Network (Defra funded network)
base case	In the context of this report, the emissions or concentrations predicted at the date of the relevant air quality objective (2005 for nitrogen dioxide)
CO	Carbon monoxide
d.f.	degrees of freedom (in statistical analysis of data)
DETR	Department of the Environment Transport and the Regions (now Defra)
Defra	Department of the Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges
EA	Environment Agency
EPA	Environmental Protection Act
EPAQS	Expert Panel on Air Quality Standards (UK panel)
EU	European Union
GIS	Geographical Information System
HDV	All commercial vehicles, including HGV , buses and coaches
HGV	Vehicles > 7.5T
kerbside	0 to 1 m from the kerb
LGV	Vehicles 3.5 –7.5 T
Limit Value	An EU definition for an air quality standard of a pollutant listed in the air quality directives
NAEI	National Atmospheric Emission Inventory
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
NRTF	National Road Traffic Forecast
ppb	parts per billion (1 ppb is 1 volume of pollutant in 10^9 volumes of air
PSG	All buses and coaches
r	the correlation coefficient (between two variables)
receptor	In the context of this study, the relevant location where air quality is assessed or predicted (for example, houses, hospitals and schools)
roadside	1 to 5 m from the kerb
SD	standard deviation (of a range of data)
SEPA	Scottish Environment Protection Agency
SO_2	Sulphur dioxide
TEA	Triethanolamine
TEMPRO	A piece of software produced by the Defra used to forecast traffic flow increases
TEOM	Tapered Element Oscillating Microbalance
TEOM (Grav.)	TEOM Measurements expressed as the equivalent value from a gravimetric monitor
V/V	Volume ratio

Introduction

Purpose of the study

Suffolk Coastal District Council have completed a 'Detailed' assessment which concluded that they needed to declare an air quality management area (AQMA) for NO_2 at the following location in the district:

- Woodbridge Junction, Woodbridge (junction of Lime Kiln Quay Rd, Thoroughfare and St John's St)

Following the declaration of this AQMA Suffolk Coastal District Council is required to complete a 'Further' assessment for NO_2 at this location in order to confirm the conclusions of the 'Detailed' assessment, to conduct source apportionment analysis and to assess potential measures which could be considered in the Council's Action Plan. The Council will then be required to proceed to completion of an Action Plan aimed at bringing about the required improvements in air quality.

General Approach taken

The approach taken in this study was to:

- Collect and interpret additional data to that already used in previous assessments, in order to support the Further Assessment, including more detailed traffic flow data around the areas outlined above;
- Utilise the monitoring data from the Council's monitoring campaign to assess the ambient concentrations resulting from road traffic emissions, and to validate the output of the modelling studies;
- Model the concentrations of NO_2 around the AQMA in 2006 and in 2010 concentrating on the locations (receptors) where people might be exposed over the relevant averaging times of the air quality objectives;
- Present the concentrations as contour plots and assess the uncertainty in the predicted concentrations;
- Undertake source apportionment analysis, where exceedences are predicted.

Version of the Pollutant Specific Guidance used in this assessment

This report has used the latest guidance in LAQM.TG(03), published in February 2003.

Numbering of figures and tables

The numbering scheme is not sequential, and the figures and tables are numbered according to the chapter and section that they relate to.

Units of concentration

The units throughout this report are presented in μg m^{-3} (which is consistent with the presentation of the new AQS objectives), unless otherwise noted.

Structure of the report

This document is a further air quality review and assessment for Suffolk Coastal District Council for nitrogen dioxide at the Woodbridge Junction.

Chapter 1 has summarised the need for the work and the approach to complete the study.

Chapter 2 of the report describes developments in the UK's Air Quality Strategy (AQS). In addition, it discusses when implementation of an AQMA is required.

Chapter 3 contains details of the information used to conduct this Further Assessment for Suffolk Coastal District Council.

Chapter 4 introduces the latest standards and objectives for nitrogen dioxide, summarises the monitoring of NO_2 that has taken place in the area of concern and model validation against these monitoring data.

Chapter 5 describes the results of the modelling assessment and discusses whether the nitrogen dioxide objectives will be exceeded in 2006 (the base case) and in 2010. The results of the analysis are displayed as contour plots. Source apportionment is presented to illustrate the contributions from different sources of pollutants to the predicted exceedences.

Chapter 6 summarises the recommendations from this study.

GIS data used

Suffolk Coastal District Council provided the Ordnance Survey landline data for use in this project.

Explanation of the modelling output

The contour maps generated in the modelling for this report are an indication of the predicted pollutant concentrations around the area modelled. They are not lines of absolute values and should not be considered as such. Care should also be taken, in cases where contours join up as enclosed loops. This is common, for example along a section of road. The contours may appear to circle a section of the road, rather than extend all the way along it. This is due to the input area over which the model was run being only a section of the road in question. No assumptions of pollutant concentrations can be made on locations outside of the area being modelled.

The updated Air Quality Strategy

The need for an Air Quality Strategy

The Government published its proposals for review of the National Air Quality Strategy in early 1999 (DETR, 1999). These proposals included revised objectives for many of the regulated pollutants. A key factor in the proposals to revise the objectives was the agreement in June 1998 at the European Union Environment Council of a Common Position on Air Quality Daughter Directives (AQDD).

Following consultation on the Review of the National Air Quality Strategy, the Government prepared the Air Quality Strategy for England, Scotland, Wales and Northern Ireland for consultation in August 1999. It was published in January 2000 (DETR, 2000).

The Environment Act (1995) provides the legal framework for requiring LA's to review air quality and for implementation of an AQMA. The main constituents of this Act are summarised in Table 2.1 below.

Table 2.1 Major elements of the Environment Act 1995

Part IV Air Quality	Commentary
Section 80	Obliges the Secretary of State (SoS) to publish a National Air Quality Strategy as soon as possible.
Section 81	Obliges the Environment Agency to take account of the strategy.
Section 82	Requires local authorities, any unitary or Borough, to review air quality and to assess whether the air quality standards and objectives are being achieved. Areas where standards fall short must be identified.
Section 83	Requires a local authority, for any area where air quality standards are not being met, to issue an order designating it an air quality management area (AQMA).
Section 84	Imposes duties on a local authority with respect to AQMAs. The local authority must carry out further assessments and draw up an action plan specifying the measures to be carried out and the timescale to bring air quality in the area back within limits.
Section 85	Gives reserve powers to cause assessments to be made in any area and to give instructions to a local authority to take specified actions. Authorities have a duty to comply with these instructions.
Section 86	Provides for the role of County Councils to make recommendations to a district on the carrying out of an air quality assessment and the preparation of an action plan.
Section 87	Provides the SoS with wide ranging powers to make regulations concerning air quality. These include standards and objectives, the conferring of powers and duties, the prohibition and restriction of certain activities or vehicles, the obtaining of information, the levying of fines and penalties, the hearing of appeals and other criteria. The regulations must be approved by affirmative resolution of both Houses of Parliament.
Section 88	Provides powers to make guidance which local authorities must have regard to.

Overview of the principles and main elements of the National Air Quality Strategy

The main elements of the AQS can be summarised as follows:

- The use of a health effects based approach using national air quality standards and objectives.
- The use of policies by which the objectives can be achieved and which include the input of important factors such as industry, transportation bodies and local authorities.
- The predetermination of timescales with target dates of 2003, 2004, 2005, 2008 and 2010 for the achievement of objectives and a commitment to review the Strategy every three years.

It is intended that the AQS will provide a framework for the improvement of air quality that is both clear and workable. In order to achieve this, the Strategy is based on several principles which include:

- the provision of a statement of the Government's general aims regarding air quality;
- clear and measurable targets;
- a balance between local and national action and
- a transparent and flexible framework.

Co-operation and participation by different economic and governmental sectors is also encouraged within the context of existing and potential future international policy commitments.

National Air Quality Standards

At the centre of the AQS is the use of national air quality standards to enable air quality to be measured and assessed. These also provide the means by which objectives and timescales for the achievement of objectives can be set. Most of the proposed standards have been based on the available information concerning the health effects resulting from different ambient concentrations of selected pollutants and are the consensus view of medical experts on the Expert Panel on Air Quality Standards (EPAQS). These standards and associated specific objectives to be achieved between 2003 and 2010 are shown in Table 2.2. The table shows the standards in ppb and $\mu g\ m^{-3}$ with the number of exceedences that are permitted (where applicable) and the equivalent percentile.

Specific objectives relate either to achieving the full standard or, where use has been made of a short averaging period, objectives are sometimes expressed in terms of percentile compliance. The use of percentiles means that a limited number of exceedences of the air quality standard over a particular timescale, usually a year, are permitted. This is to account for unusual meteorological conditions or particular events such as November 5th. For example, if an objective is to be complied with at the 99.9th percentile, then 99.9% of measurements at each location must be at or below the level specified.

Table 2.2 Air Quality Objectives in the Air Quality Regulations (2000) and (Amendment) Regulations 2002 for the purpose of Local Air Quality Management.

Pollutant	Concentration limits		Averaging period	Objective [number of permitted exceedences a year and equivalent percentile]	
	($\mu g\ m^{-3}$)	(ppb)		($\mu g\ m^{-3}$)	date for objective
Benzene	16.25	5	**running annual** mean	**16.25**	by 31.12.2003
	5	1.5	**Annual mean**	**5**	by 31.12.2010
1,3-butadiene	2.25	1	**running annual** mean	**2.25**	by 31.12.2003
CO	10,000	8,600	**running 8-hour** mean	**10,000**	by 31.12.2003
Pb	0.5	-	**annual** mean	**0.5**	by 31.12.2004
	0.25	-	**annual** mean	**0.25**	by 31.12.2008
NO_2 (see note)	200	105	**1 hour** mean	**200** [maximum of 18 exceedences a year or equivalent to the 99.8th percentile]	by 31.12.2005
	40	21	**annual** mean	**40**	by 31.12.2005
PM_{10} gravimetric (see note)	50	-	**24-hour** mean	**50** [maximum of 35 exceedences a year or ~ equivalent to the 90th percentile]	by 31.12.2004
	40	-	**annual** mean	**40**	by 31.12.2004
SO_2	266	100	**15 minute** mean	**266** [maximum of 35 exceedences a year or equivalent to the 99.9th percentile]	by 31.12.2005
	350	132	**1 hour** mean	**350** [maximum of 24 exceedences a year or equivalent to the 99.7th percentile]	by 31.12.2004
	125	47	**24 hour** mean	**125** [maximum of 3 exceedences a year or equivalent to the 99th percentile]	by 31.12.2004

Notes

1. Conversions of ppb and ppm to ($\mu g\ m^{-3}$) correct at 20°C and 1013 mb.
2. The objectives for nitrogen dioxide are provisional.

PM_{10} measured using the European gravimetric transfer standard or equivalent.

Relationship between the UK National Air Quality Standards and EU air quality Limit Values

As a member state of the EU, the UK must comply with EU Directives.

There are three EU ambient air quality directives that the UK has transposed in to UK law. These are:

- **96/62/EC** Council Directive of 27 September 1996 on ambient air quality assessment and management (the Ambient Air Framework Directive).

- **1999/30/EC** Council Directive of 22 April 1999 relating to limit values for sulphur dioxide, nitrogen dioxide, oxides of nitrogen, particulate matter and lead in ambient air (the First Daughter Directive).

- **2000/69/EC** Directive of the European Parliament and the Council of 16 Nov 2000 relating to limit values for benzene and carbon monoxide in ambient air (the Second Daughter Directive).

The first and second daughter directives contain air quality Limit Values for the pollutants that are listed in the directives. The United Kingdom (i.e. Great Britain and Northern Ireland) must comply with these Limit Values. The UK air quality strategy should allow the UK to comply with the EU Air Quality Daughter Directives, but the UK air quality strategy also includes some stricter national objectives for some pollutants, for example, the 15-minute sulphur dioxide objective.

The Government is ultimately responsibility for achieving the EU limit values. However, it is important that Local Air Quality Management is used as a tool to ensure that the necessary action is taken at local level to work towards achieving the EU limit values by the dates specified in those EU Directives.

New particle objectives (not included in Regulations[3])

For particulates (as PM10) new objectives are proposed.

- For all parts of the UK, except London and Scotland, a 24 hour mean of 50 $\mu g/m^3$ not to be exceeded more than 7 times a year and an annual mean of 20 $\mu g/m^3$, both to be achieved by the end of 2010;
- For London, a 24 hour mean of 50 $\mu g/m^3$ not to be exceeded more than 10 times a year and an annual mean of 23 $\mu g/m^3$, both to be achieved by the end of 2010;
- For Scotland, a 24 hour mean of 50 $\mu g/m^3$ not to be exceeded more than 7 times a year and an annual mean of 18 $\mu g/m^3$, both to be achieved by the end of 2010.

Policies in place to allow the objectives for the pollutants in AQS to be achieved

The policy framework to allow these objectives to be achieved is one that that takes a local air quality management approach. This is superimposed upon existing national and international regulations in order to effectively tackle local air quality issues as well as issues relating to wider spatial scales. National and EC policies that already exist provide a good basis for progress towards the air quality objectives set for 2003 to 2008. For example, the Environmental Protection Act 1990 allows for the monitoring and control of emissions from industrial processes and various EC Directives have ensured that road transport emission and fuel standards are in place. These policies are being developed to include more stringent controls. Developments in the UK include the announcement by the Environment Agency in January 2000 of controls on emissions of SO_2 from coal and oil fired power stations. This

[3] The exception is the Scottish Executive which has incorporated the new PM10 objectives in their Regulations.

system of controls means that by the end of 2005 coal and oil fired power stations were expected to meet the air quality standards set out in the AQS.

Local air quality management provides a strategic role for local authorities in response to particular air quality problems experienced at a local level. This builds upon current air quality control responsibilities and places an emphasis on bringing together issues relating to transport, waste, energy and planning in an integrated way. This integrated approach involves a number of different aspects. It includes the development of an appropriate local framework that allows air quality issues to be considered alongside other issues relating to polluting activity. It should also enable co-operation with and participation by the general public in addition to other transport, industrial and governmental authorities.

An important part of the Strategy is the requirement for local authorities to carry out air quality reviews and assessments of their area against which current and future compliance with air quality standards can be measured. Over the longer term, these will also enable the effects of policies to be studied and therefore help in the development of future policy. The Government has prepared guidance to help local authorities to use the most appropriate tools and methods for conducting a review and assessment of air quality in their District. This is part of a package of guidance being prepared to assist with the practicalities of implementing the AQS. Other guidance covers air quality and land use planning, air quality and traffic management and the development of local air quality action plans and strategies.

Timescales to achieve the objectives

In most local authorities in the UK, objectives will be met for most of the pollutants within the timescale of the objectives shown in Table 2.2. It is important to note that the objectives for NO_2 remain provisional. The Government has recognised the problems associated with achieving the standard for ozone and this will not therefore be a statutory requirement. Ozone is a secondary pollutant and transboundary in nature and it is recognised that local authorities themselves can exert little influence on concentrations when they are the result of regional primary emission patterns.

Air Quality Reviews

A range of Technical Guidance has been issued to enable air quality to be monitored, modelled, reviewed and assessed in an appropriate and consistent fashion. This includes LAQM.TG(03), on 'Local Air Quality Management: Technical Guidance, February 2003. This review and assessment has considered the procedures set out in the guidance.

The primary objective of undertaking a review of air quality is to identify any areas that are unlikely to meet national air quality objectives and ensure that air quality is considered in local authority decision-making processes. The complexity and detail required in a review depends on the risk of failing to achieve air quality objectives and it has been proposed in the second round that reviews should be carried out in two stages. Every authority is expected to undertake at least a first stage Updating and screening Assessment (USA) of air quality in their authority area. Where the USA has identified a risk that an air quality objective will be exceeded at a location with relevant public exposure, the authority will be required to undertake a Further assessment. The Stages are briefly described in the following table, Table 2.3.

Table 2.3: The phased approach to review and assessment.

Level of assessment	Objective	Approach
Updating and screening assessment (USA)	To identify those matters that have changed since the last review and assessment, which might lead to a risk of the air quality objective being exceeded.	Use a checklist to identify significant changes that require further consideration. Where such changes are identified, apply simple screening tools to decide whether there is sufficient risk of an exceedence of an objective to justify a Further assessment
Detailed assessment	To provide an accurate assessment of the likelihood of an air quality objective being exceeded at locations with relevant exposure. To recommend designation or amendment of AQMAs when needed.	Use quality-assured monitoring and validated modelling methods to determine current and future pollutant concentrations in areas where there is a significant risk of exceeding an air quality objective.
Further assessment	To confirm boundaries of identified areas of exceedence using the latest and most detailed input information available. To provide source apportionment information to identify primary emissions sources contributing to exceedences so that action planning measures can be targeted. To test out the likely impact of potential action planning scenarios if possible.	Use quality-assured monitoring and validated modelling methods to determine current and future pollutant concentrations in areas where there is a significant risk of exceeding an air quality objective.

Locations that the review and assessment must concentrate on

For the purpose of review and assessment, the authority should focus their work on locations where members of the public are likely to be exposed over the averaging period of the objective. Table 2.4 summarises the locations where the objectives should and should not apply.

Table 2.4 Typical locations where the objectives should and should not apply (England only)

Averaging Period	Pollutants	Objectives *should* apply at …	Objectives should *not* generally apply at …
Annual mean	• 1,3 Butadiene • Benzene • Lead • Nitrogen dioxide • Particulate Matter (PM_{10})	• All background locations where members of the public might be regularly exposed.	• Building façades of offices or other places of work where members of the public do not have regular access.
		• Building façades of residential properties, schools, hospitals, libraries etc.	• Gardens of residential properties.
			• Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
24 hour mean and 8-hour mean	• Carbon monoxide • Particulate Matter (PM_{10}) • Sulphur dioxide	• All locations where the annual mean objective would apply.	• Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.

- Gardens of residential properties.

Table 2.4 (contd.) Typical locations where the objectives should and should not apply (England only)

Averaging Period	Pollutants	Objectives should apply at …	Objectives should generally not apply at …
1 hour mean	• Nitrogen dioxide • Sulphur dioxide	• All locations where the annual mean and 24 and 8-hour mean objectives apply.	• Kerbside sites where the public would not be expected to have regular access.
		• Kerbside sites (e.g. pavements of busy shopping streets).	
		• Those parts of car parks and railway stations etc. which are not fully enclosed.	
		• Any outdoor locations to which the public might reasonably expected to have access.	
15 minute mean	• Sulphur dioxide	• All locations where members of the public might reasonably be exposed for a period of 15 minutes or longer.	

It is unnecessary to consider exceedences of the objectives at any location where public exposure over the relevant averaging period would be unrealistic, and the locations should represent non-occupational exposure.

Key Points

- The Environment Act 1995 has required the development of a National Air Quality Strategy for the control of air quality.
- A central element in the Strategy is the use of air quality standards and associated objectives based on human health effects that have been included in the Air Quality Regulations.
- The Strategy uses a local air quality management approach in addition to existing national and international legislation. It promotes an integrated approach to air quality control by the various factors and agencies involved.
- Air quality objectives, with the exception of ozone, are to be achieved by specified dates up to the end of 2010.

Information used to support this assessment

This chapter summarises the information used to support this review and assessment.

MAPS

Suffolk Costal District Council provided OS Landline data for the area, which needed to be modelled. This enabled accurate road widths and the distance of the housing to the kerb to be determined.

Road traffic data

AADT flow, hourly fluctuations in flow, speed and fraction of HDVs.

As suggested by the previous detailed assessment, Suffolk Costal District Council carried out an 11-hour and a 14-day traffic survey in the Woodbridge junction area in November/December 2005. The survey results are summarised in Tables A1.1 - A1.3 in Appendix 1. The 11-hour manual survey data was scaled up to predict AADTs using a factor of 1.207 provided by the council. Where discrepancies occurred between the estimated AADTs based on these two traffic surveys, the higher values were used in this assessment as the conservative estimations.

Table A1.4 in Appendix 1 summaries the additional traffic flows at the Woodbridge junction due to committed developments which will be completed before 2010, but are not included in the traffic surveys. The committed developments include:

- Annington Development, Sutton
- RAF Woodbridge Airfield Barracks
- Rendlesham Enterprise Park and New Rendlesham development
- Deben Mill development, Woodbridge
- Oak Lane Car Park development, Woodbridge
- Redevelopment of Woodbridge Primary School, New Street, Woodbridge
- Redevelopment of Woodbridge Library Site, New Street, Woodbridge
- Notcutts Garden Centre, Ipswich Road, Woodbridge
- Former Gas works site, Station Road, Woodbridge
- Former Goods Shed – W R Refrigeration Ltd building, Station Road, Woodbridge
- Snape Maltings expansion, Snape

The TEMPRO growth factors for the Woodbridge area are given in Table A1.5 in Appendix 1.

Suffolk County Council carried out detailed hourly traffic counts at Woodbridge junction between 24th November 2005 and 27th November 2005, as summarised in Table A1.6 in Appendix 1, and the results were used to determine the hourly fluctuations of traffic flow in the model.

Meteorological data used in the dispersion modelling

Hourly sequential meteorological data for the nearest suitable meteorological station with adequate data capture was obtained in Mildenhall for 2006 and was used for this assessment. The meteorological data provided information on wind speed and direction and the extent of cloud cover for each hour of the year.

Ambient monitoring

Nitrogen dioxide concentrations are monitored:

- By a continuous automatic monitor outside 93 Thoroughfare at the junction. The monitor has been managed by AEA Energy & Environment since 2004 and has been at its current location since 04/01/2006. The air quality report of this monitor in 2006 is given in table A2.1 of Appendix 2.

- By 17 diffusion tubes at 13 sites in the area. Diffusion tube results are available at 12 roadside locations (two of them are triplicate sites) and one rural background site in 2006. The tubes were supplied and analysed by Harwell Scientific Services. The unadjusted monthly diffusion tube data and their average concentrations in 2006 are given in table A2.2 of Appendix 2.

- A collocation study was undertaken at the site of the automatic monitor, i.e. outside 93 Thoroughfare with diffusion tubes WBG 1a,b,c.

- The regional background NO_2 concentrations were taken from the nearest rural AURN site at St Osyth (OS co-ordinates 610200 213200).

Computer modelling

The modelling programmes used in this assessment make a number of assumptions during the calculations. These include no consideration of terrain relief, or direct consideration of buildings over the surface being modelled. Modelling of pollutant concentrations on roads can sometimes provide misleading information on produced contour maps. For example, polygons and circles on certain areas of the contour maps, e.g. roundabouts or the centres of roads, can be generated. This is not a deficiency in the model – it is an artefact of the data. As such, these additional features should be ignored and the wider context and implications of the contour maps be considered.

Nitrogen Dioxide Monitoring and Model Bias

Introduction

Nitrogen oxides are formed during high temperature combustion processes from the oxidation of nitrogen in the air or fuel. The principal source of nitrogen oxides, nitric oxide (NO) and nitrogen dioxide (NO_2), collectively known as NO_x, is road traffic, which is responsible for approximately half the emissions in Europe. NO and NO_2 concentrations are therefore greatest in urban areas where traffic is heaviest. Other important sources are power stations, heating plant and industrial processes.

Nitrogen oxides are released into the atmosphere mainly in the form of NO, which is then readily oxidised to NO_2 by reaction with ozone. Elevated levels of NO_x occur in urban environments under stable meteorological conditions, when the air mass is unable to disperse.

Nitrogen dioxide has a variety of environmental and health impacts. It is a respiratory irritant, may exacerbate asthma and possibly increase susceptibility to infections. In the presence of sunlight, it reacts with hydrocarbons to produce photochemical pollutants such as ozone. In addition, nitrogen oxides have a lifetime of approximately 1-day with respect to conversion to nitric acid. This nitric acid is in turn removed from the atmosphere by direct deposition to the ground, or transfer to aqueous droplets (e.g. cloud or rainwater), thereby contributing to acid deposition.

Latest standards and objectives for nitrogen dioxide

The National Air Quality Regulations (1997) set two provisional objectives to have been achieved by 2005 for nitrogen dioxide:

- An annual average concentration of 40 μg m^{-3} (21 ppb);
- A maximum hourly concentration of 286 μg m^{-3} (150 ppb).

In June 1998, the Common Position on Air Quality Daughter Directives (AQDD) agreed at Environment Council included the following objectives to be achieved by 31 December 2005 for nitrogen dioxide:

- An annual average concentration of 40 μg m^{-3} (21 ppb);
- 200 μg m^{-3} (100 ppb) as an hourly average with a maximum of 18 exceedences in a year.

The National Air Quality Strategy was reviewed in 1999. The Government proposed that the annual objective of 40 μg m^{-3} be retained as a provisional objective and that the original hourly average be replaced with the AQDD objective. The revised Air Quality Strategy for England, Scotland, Wales and Northern Ireland (DETR, 1999; 2000) included the proposed changes. Modelling studies suggest that in general achieving the annual mean of 40 μg m^{-3} is more demanding than achieving the hourly objective. If the annual mean is achieved, the modelling suggests the hourly objectives will also be achieved.

The National Perspective

The main source of NO_x in the United Kingdom is road transport, which, in 2003 accounted for approximately 40% of emissions. Power generation contributed approximately 29% and domestic sources 5%. In urban areas, the proportion of local emissions due to road transport sources is larger (NAEI, 2005).

National measures are expected to produce reductions in NO_x emissions and achieve the objectives for NO_2 in many parts of the country. However, the results of the analysis set out in the National Air Quality Strategy suggested that for NO_2 a reduction in NO_x emissions over and above that achievable by national measures would be required to ensure that air quality objectives were achieved everywhere by the end of 2005. Local authorities with major roads, or highly congested roads, which have the potential to result in elevated levels of NO_2 in relevant locations, are expected to identify a need to progress to a Further Assessment for this pollutant.

Summary of the 2005 detailed assessment

Diffusion tube results for 2004 showed exceedences at sites WBG 1, WBG 6 and WBG 8 (as shown in Figure 4.1a). It was predicted that WBG1 and WBG 6 were also likely to exceed the objective in 2005 (Beth Conlan, 2005).

The modelling results of the 2005 detailed assessment showed that it was at most ***probable*** (with probability between 50% and 80%) that an exceedence of the annual objective would occur in 2005 at:

- Woodbridge Junction, Woodbridge

At all receptor locations it was assessed that the risk of the UK objective for hourly NO_2 in 2005 being exceeded was at most ***unlikely*** (with probability between 5% and 20%).

The modelling results also indicated that there was a marginal exceedence for two properties at Melton Hill, Woodbridge. Owing to the high concentrations measured along the western pavement of Melton Hill, it was recommended that the Council should undertake traffic surveys at this location to further characterise traffic flows along this road. In particularly, detailed observation with regards to traffic congestion, queuing, location of delivery points and frequency should be taken adjacent to monitoring locations.

Figure 4.1a Monitoring sites around the Woodbridge Junction area in 2006

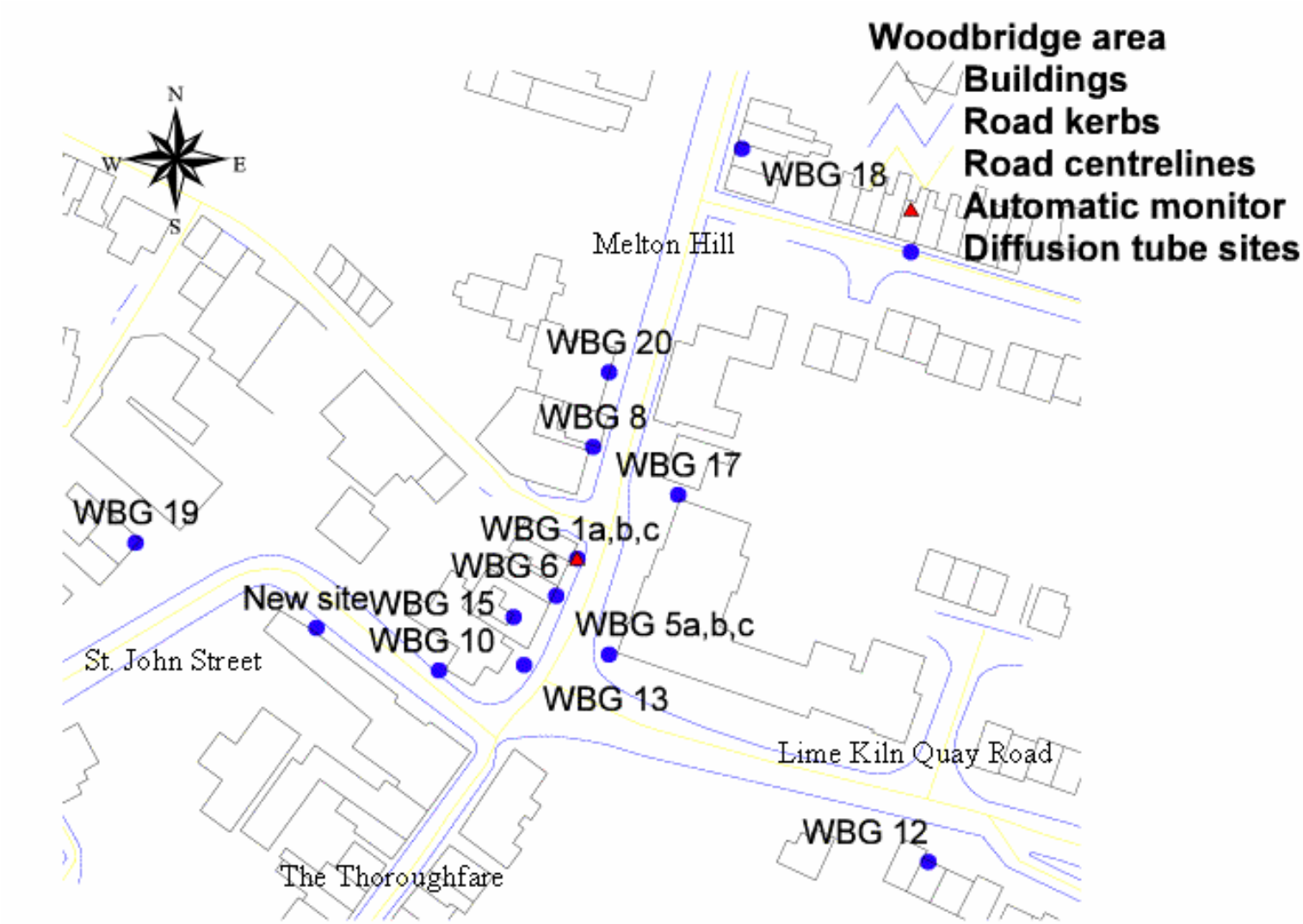
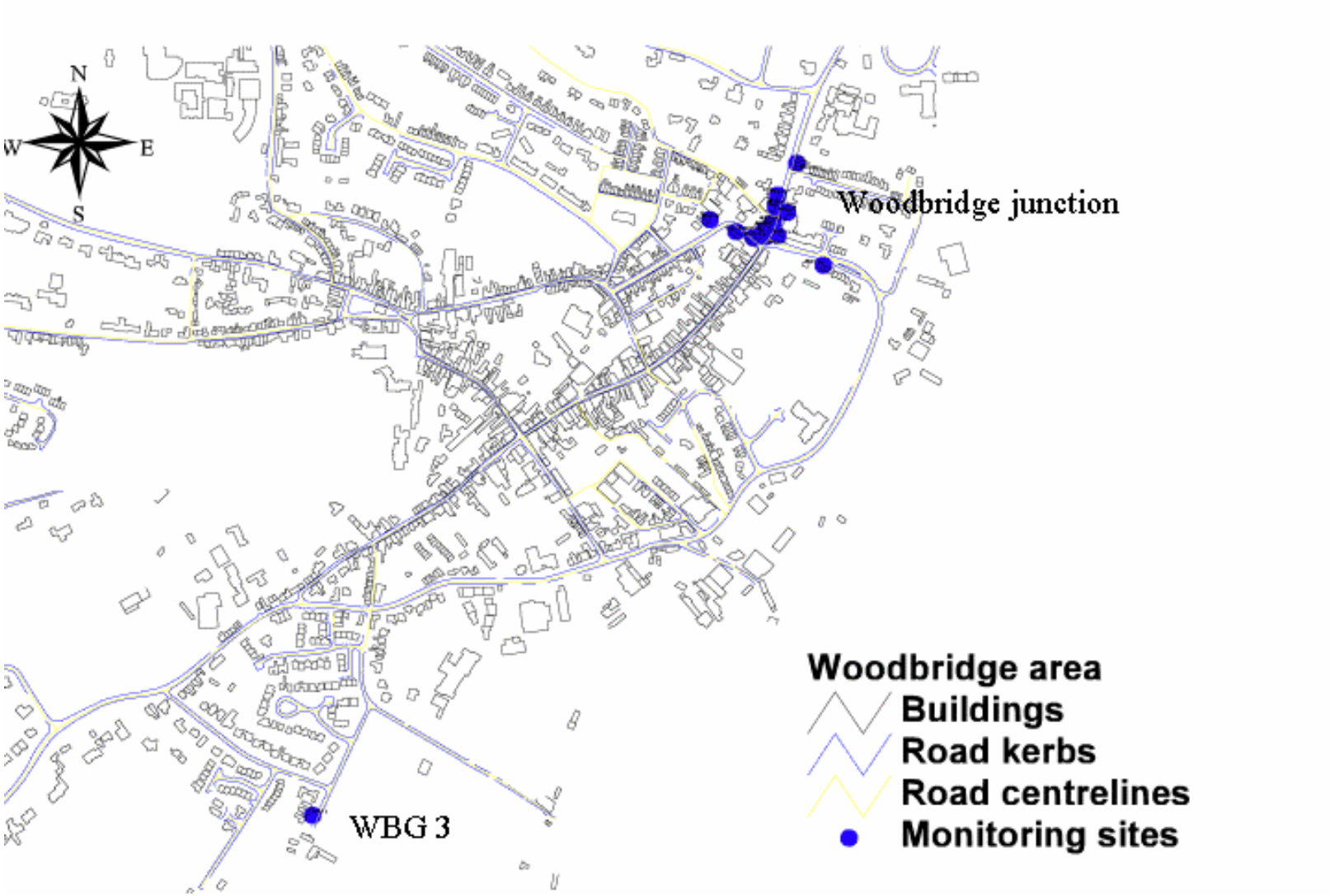


Figure 4.1b The background Monitoring site near to the Woodbridge Junction area in 2006



Monitoring data

In 2006, nitrogen dioxide concentrations were monitored at one site at the Woodbridge junction by continuous monitoring and by 17 diffusion tubes at 12 roadside sites and one rural background site as shown in Figures 4.1a and 4.1b.

Continuous automatic monitoring

The automatic monitor is collocated with diffusion tubes WBG 1a,b,c and its OS coordinates are (627597, 249261)

Measurement technique and QA/QC of the automatic monitor

For the measurement of NO2 the recommended method for Detailed Assessments, under the LAQM regime, is Ozone chemiluminescence. This is also the reference method specified by CEN for NO2 monitoring under the first Daughter Directive.

To help ensure that the data is of acceptably high quality routine calibrations of the instrument were undertaken on a fortnightly basis by Suffolk Coastal District Council. The procedures adopted for the calibrations were modelled on those developed by AEA Energy & Environment for use in the national monitoring networks. The calibrations were undertaken using certified calibration gas provided by Air Liquide with traceability to National Metrology Standards obtained via regular UKAS Quality Control Audits. The audits provide a range of information that is utilised within the data management process for the data sets. Audit tests undertaken include accredited audit zero and span calibrations, linearity, NOx converter efficiency, flow and leak checks as well as checks of the instruments sampling system.

The data sets were screened, scaled and validated using all available routine site calibrations, audit results and service engineer records. This was an ongoing process with checks made daily to ensure high data capture is achieved. A final process of data ratification ensures that the data provide the most accurate record of the pollution concentrations across the measurement period. The data management process adopted is that evolved and implemented by AEA Energy & Environment within the data management programme of the AURN UK national monitoring network. This process is expected to deliver data sets that meet the EU Data Quality Objective of a measurement uncertainty of better than 15%.

Measurements of the automatic monitor in 2006

Table 4.1 shows the measured NO_2 concentrations by the automatic monitor in 2006. The measured annual mean concentration was 44 $\mu g/m^3$, so the annual mean objective for nitrogen dioxide was not met at the Woodbridge junction in 2006. Based on this measurement, the predicted annual mean concentration of NO_2 in 2010 is 37.5 $\mu g/m^3$, so no exceedence is predicted for 2010.

Table 4.1 Summary of the ratified NO_2 data recorded by the automatic monitor between 01 Jan 2006 to 31 Dec 2006

	Values
Annual mean	**44** µg/m^3
Maximum hourly mean	199 µg/m^3
Data capture	96.3%

Diffusion tubes

Diffusion tube results are available at 12 roadside locations and one rural background location in the Woodbridge junction area as shown in Figures 4.1a & 4.1b. WBG 1 and WBG 5 are triplicate sites and WBG 3 is a rural background site. The automatic monitor is collocated with diffusion tubes WBG 1a,b,c. The unadjusted monthly diffusion tube data for 2006 are given in tables A2.1 of Appendix 2. The diffusion tubes were supplied and analysed by Harwell Scientific Services using 50% TEA in Acetone.

Diffusion tubes can under or over-read and if possible should be bias adjusted to the results of continuous monitoring. The Review & Assessment Helpdesk in UWE has collated bias adjustment factors determined from collocation studies throughout the UK and these data are available as a spreadsheet from their website. There are only two collocation studies for this preparation method in 2006 in the database by the time of this assessment, without including the site at Woodbridge junction, and both of them are single tube sites. The results of these three studies indicate bias adjustment factors in the range of 0.93- 0.96, as shown in Table 4.2, and an overall adjustment factor of 0.94. There are 15 collocation studies for this preparation method in 2005 in the database and the averaged adjustment factor is 0.88.

The local bias adjustment factor at Woodbridge junction is at the low end of the narrow range indicated by the three collocation studies available for 2006, but it is higher than the mean adjustment factor of 15 studies in 2005. Because of limited data for 2006 and the availability of local collocation result at a triplicate site, it was decided to use the local bias adjustment factor to adjust the diffusion tube data in this study. The measurements and the adjusted diffusion tube data using the local adjustment factor of 0.93 in 2006 are summarised in Table 4.3 below.

It should be taken into account that diffusion tubes are spot measurements and may be very sensitive to distance from the road as concentrations change rapidly with distance from the kerbside when comparing them with modelled results.

Table 4.2 Collation studies for the preparation method used at Woodbridge junction in 2006 and the estimated local bias adjustment factor for diffusion tubes at the junction

Analysed By	Method	Year	Site Type	Local Authority	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) (µg/m3)	Automatic Monitor Mean Conc. (Cm) (µg/m3)	Bias (B)	Tube Precision	Bias Adjustment Factor (A) (Cm/Dm)
Harwell Scientific Services	50% TEA in Acetone	2006	Industrial	Watford BC	9	39	37	6.9%	Single	**0.94**
Harwell Scientific Services	50% TEA in Acetone	2006	Roadside	Cambridge CC	11	47	45	4.1%	Single	**0.96**
Harwell Scientific Services	50% TEA in Acetone	2006	Roadside	Suffolk Coastal DC Woodbridge	11	47	44	7.00%	Triple	**0.93**
					Overall adjustment factor					**0.94**
					Adjustment factor of the Woodbridge collocation study					**0.93**

Table 4.3 Nitrogen dioxide diffusion tube data for 2006

Site	Annual mean (mg/m^3)	Data Capture %	Bias adjusted annual mean (mg/m^3)	Projected 2010 annual mean (mg/m^3)
WBG 1 mean	**47.3**	100.0	**44.0**	37.4
WBG 3	19.7	100.0	18.3	15.6
WBG 5 mean	32.5	100.0	30.2	25.7
WBG 6	**45.6**	100.0	**42.4**	36.0
WBG 8	**47.8**	83.3	**44.4**	37.8
WBG 10	**41.3**	100.0	38.4	32.6
WBG 12	33.3	100.0	31.0	26.3
WBG 13	39.5	100.0	36.7	31.2
WBG 15	**44.6**	100.0	**41.5**	35.2
WBG 17	36.5	100.0	33.9	28.8
WBG 18	41.8	100.0	38.9	33.1
WBG 19	24.4	91.7	22.7	19.3
WBG 20	**45.7**	91.7	**42.5**	36.1

Figures in bold indicate exceedences.

Comparison of monitoring data with AQ objectives

The automatic monitoring shows that nitrogen dioxide concentration at the site was above the annual mean objective for NO_2 in 2006.

Diffusion tube data shown in Table 4.3 indicates NO_2 concentrations were above the annual mean objective for NO_2 in 2006 at five locations as:

- WBG 1a,b,c. The kerbside tubes at the signpost outside 93 Thoroughfare.
- WBG 6. The roadside tube at the front drainpipe on 87 Thoroughfare.
- WBG 8. The roadside tube at drainpipe on 95 Thoroughfare.
- WBG15. The roadside tube at the back drainpipe on 87 Thoroughfare.
- WBG 20. The roadside tube at drainpipe on 97 Thoroughfare.

There is no additional predicted exceedence at the Woodbridge junction even if the slightly higher national bias adjustment factor of 0.94 is used.

No exceedence is predicted in 2010 at the junction based on the measurements in 2006.

As the measured concentrations are well below $60\mu g/m^3$ it is considered unlikely that the hourly mean objective for NO_2 is exceeded and therefore it should not be necessary to further assess concentrations at the kerbside.

Modelling methodology

The air quality impact from road traffic emissions in this modelling was calculated using the proprietary urban model developed at AEA Energy & Environment. There are two parts to this model:

- ***The Local Area Dispersion System (LADS) model.*** This model was used to calculate background concentrations of oxides of nitrogen on a 1 km x 1 km grid. Estimates of emissions of oxides of nitrogen for each 1 km x 1 km area grid square were obtained

from the 2004 National Atmospheric Emission Inventory disaggregated inventory, projected forward to 2005 and 2010 using factors in the **Defra** Technical Guidance.

- ***The LADS-URBAN model.*** This model is a tool for calculating atmospheric dispersion using a point-source kernel. Estimates of emissions from vehicles were calculated using the latest emission factors. The dispersion kernels for the LADS-URBAN model were derived from model runs using ADMS V3.3. The detailed hourly traffic counts at Woodbridge junction between 24th November 2005 and 27th November 2005 was used as the daily time varying emission factor of the site in the model.

This advanced two-component model is suitable for modelling road traffic emissions as defined in "Review and assessment: Selection and Use of Dispersion Models, LAQM.TG3 (00)", and in the Technical Guidance LAQM.TG(03).

Concentrations of NO_2 from road traffic emissions were assessed using a high-resolution approach, with air quality modelled at 10 m intervals along all of the roads assessed. This high spatial resolution is recommended in LAQM.TG3 (00) and in the Technical Guidance LAQM.TG (03).

Traffic modelling summary

In this study, the concentrations of NO_2 at receptors close to the roads and junctions of interest have been modelled using ADMS-3.3 as a dispersion kernel model.

The roads were defined as volume sources, 3m high, and were broken up in to a series of adjoining segments. The length of these segments was dictated by the way in which the OS LandLine data was digitised and varied from one or two metres in length (where the road rapidly changed direction) to hundreds of metres in length (where the road was essentially straight). The OS LandLine data was used to provide the co-ordinates of the centre line of the road, and the road widths. Therefore, the positions of the volume sources (here the roads) were accurate to approximately a metre.

Where queuing of vehicles was reported (as shown in Table A1.3 in Appendix 1), emissions from stationary vehicles were estimated on the basis that the engine power output and hence emissions were the same as those at a speed of 5 kph. Queuing vehicles were assumed to be 5 m apart (including the vehicle).

Sources of background (non-traffic) emissions data

Background emissions of oxides of nitrogen (NO_x) from sources not modelled in detail have been taken from the 2004 UK National Atmospheric Emissions Inventory (www.naei.org.uk) and scaled to the year of interest where necessary following the recommended procedure in LAQM. TG(03). The contribution to emissions from the roads modelled in detail has been omitted where this would lead to double counting of the local impact of emissions.

Model bias

A comparison was undertaken between the measured and predicted annual mean NO_2 concentrations at the locations of the automatic monitor and the NO_2 diffusion tubes in Table 4.4.

The model has generally under-predicted the annual mean NO_2 concentrations at the junction, apart from at the rural background site WBG 3. The under-prediction is 33% at the automatic monitoring site and 26% for the average of all roadside diffusion tubes.

There are a number of possible explanations for the under-prediction by the model. Since the model has predicted the rural background concentration well at the diffusion tube site WBG3 as shown in Figure 4.1b (within 10% as shown in Table 4.4), the under-predictions are most likely related to local traffic emissions. Uncertainty regarding traffic speeds and queuing and congestion and parking are likely to have led to some errors in the calculation of emissions.

Table 4.4: Comparison of modelled and measured concentrations by the automatic monitor and diffusion tubes for 2006 (Base Year)

X	Y	Site Location	2006 Measured Mean (adjusted)	2006 Predicted	Difference %
627597	249261	Signpost outside 93 Thoroughfare**(co-location site)**	**44.00**	29.53	-33%
626990	248480	Lampost outside 8 Kingston Farm Road	18.33	18.63	2%
627603	249243	Drainpipe on corner of Suffolk Place, Lime Kiln Quay Road	30.23	27.49	-9%
627593	249254	Drainpipe on 87 Thoroughfare	**42.42**	30.14	-29%
627595	249282	Drainpipe on 95 Thoroughfare	**44.47**	27.55	-38%
627569	249240	Signpost in St. John's Street (opposite Surgery)	38.42	28.57	-26%
627663	249204	Drainpipe on 8 Lime Kiln Quay Road	30.98	22.36	-28%
627587	249241	Traffic lights at front of 85 Thoroughfare	36.74	27.14	-26%
627585	249250	Drainpipe on 87 Thoroughfare	**41.30**	25.49	-38%
627616	249269	Drainpipe at front Northern end of Suffolk Place	34.05	26.31	-23%
627628	249338	Drainpipe between 106 / 108 Thoroughfare	38.88	24.50	-37%
627514	249258	Front porch of 25 St. John's Street	22.70	21.28	-6%
627603	249296	Drainpipe on 97 Thoroughfare	**42.51**	25.08	-41%
		Average	**35.77**	**25.70**	**-26%**

Figures in **bold** indicate predicted exceedences of the UK objective in 2006

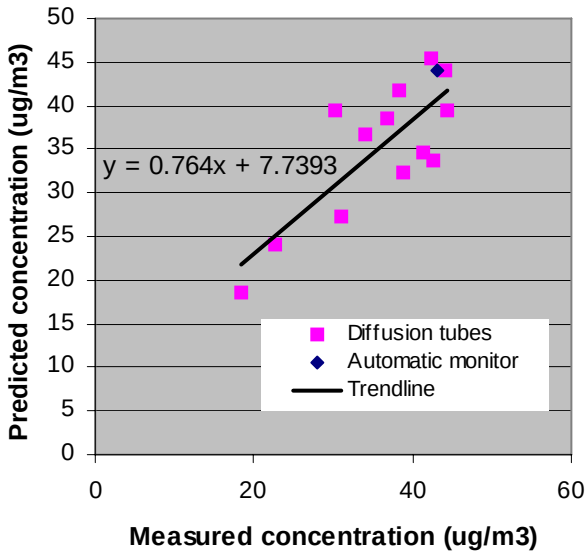
To compensate for the under-predictions at the junction, the predicted traffic NOx was adjusted until the predicted NO_2 concentration at the automatic site matched the measurement. Table 4.5 shows the comparison between the measurements and model predictions with and without the adjustment to traffic NOx. The adjustment factor derived is 2.41. The same adjustment factor was then applied to the predicted concentrations of traffic NOx at all other locations at the junction.

Figure 4.2 shows the comparison between the predictions of the adjusted model and the measurements by diffusion tubes in 2006. The prediction at the rural background site still agrees well with measurement, and the correlation between the predictions and measurements are satisfactory at all other sites. The overall under-prediction of all diffusion tube sites by the adjusted model is only 1%, reduced from 26% of the unadjusted model as shown in Table 4.4. The adjusted model was then used in this Further Assessment.

Table 4.5 Adjusting the model predictions to the measurements of the automatic monitor in 2006

	Total NOx (ug/m^3)	Traffic NOx (ug/m^3)	NO_2 (ug/m^3)	Differerce between measured and predicted NO_2
Measured by the automatic monitor	99	na	44	
Model predictions without adjustment	51.1	25.06	29.53	-33%
Model predictions with adjustment of the traffic NOx	86.3	60.4	44	0%
Adjustment factor for the predicted traffic Nox		2.41		

Figure 4.2 Regression analysis of modelled and diffusion tube measured annual mean concentrations of nitrogen dioxide



Model validation

In simple terms, model validation is where the model is tested at a range of locations and is judged suitable to use for a given application. The modelling approach used in this assessment has been validated, and used in numerous air quality review and assessments. Statistical techniques have been used to assess the likelihood that there will be an exceedence of the air quality objectives given the modelled concentration. The validation statistics are given in Appendix 3. Confidence limits for the predicted concentrations were calculated based on the validation studies by applying statistical techniques based on Student's t distribution. The confidence limits took account of uncertainties resulting from:

- Model errors at the receptor site;
- Model errors at the reference site;
- Uncertainty resulting from year to year variations in atmospheric conditions.

The confidence limits have been used to estimate the likelihood of exceeding the objectives at locations close to the roads. The following descriptions have been assigned to levels of risk of exceeding the objectives.

It would be recommended that Suffolk Coastal District Council generally consider declaring or reconfirming an AQMA where the probability of exceedence in 2005 is greater than 50% ("Probable").

Table 4.6: Uncertainties in the modelled concentrations for NO_2.

Description	Chance of exceeding objective	Modelled annual average concentrations, μg/m^3	
		Likelihood of exceeding annual average objective	Likelihood of exceeding hourly average objective
Very unlikely	Less than 5%	<28	<38
Unlikely	5-20%	28-34	38-52
Possible	20-50%	34-40	52-67
Probable	50-80%	40-46	67-82
Likely	80-95%	46-52	82-95
Very likely	More than 95%	>52	>95

The confidence limits for the 'probable' and 'likely' annual average and hourly objective concentrations have been set equal to those for 'possible' and 'unlikely', respectively. In reality, the intervals of concentration increase in size as the probability of exceeding the annual and hourly objective increases from 'unlikely' to 'likely'. The advantage to setting symmetrical concentration intervals is that the concentration contours on the maps become simpler to interpret. This is a mildly conservative approach to assessing the likelihood of exceedences of the NO_2 objectives since a greater geographical area will be included using the smaller confidence intervals.

A simple linear relationship can be used to predict the 99.8th hourly percentile concentration of NO_2 from the annual concentration: the 99.8th percentile is three times the annual mean at kerbside/roadside locations. Therefore, plots of the modelled annual mean NO_2 concentrations can be used to show exceedences of both the annual and hourly NO_2 objectives. However, the magnitude of the concentrations used to judge exceedences of the hourly objective need to be adjusted so they may be used directly with the plots of annual concentration. This has been performed by simply dividing the concentrations of the confidence limits by three.

Verification of the model involves comparison of the modelled results with any local monitoring data at relevant locations. Appendix 3 provides a comparison of modelled and measured nitrogen dioxide concentrations.

Modelling results for nitrogen dioxide

2006 NO_2 modelling results (Base Case)

The model developed for this Further Assessment includes all the major roads approaching the Woodbridge junction. Emissions from traffic movements on other roads in Woodbridge and outside the Council have not been explicitly modelled, but are all included in the modelled background concentrations. Figures 5.1 shows the modelled annual mean NO_2 concentrations for 2006. The adjusted model has predicted that the annual average objective of 40μg/m^3 for nitrogen dioxide has been exceeded at the junction in Lime Kiln Quay Road and in Thoroughfare/Melton Hill behind the traffic lights in 2006. The predicted distributions are very similar to that predicted for 2005 in the 2005 detailed assessment (Beth Conlan, 2005).

Within the Woodbridge Junction, the model predicts that it is ***probable*** (with a probability of 50- 80%) that the annual average objective has been exceeded in 2006 (as illustrated in Table 4.6), and it is ***unlikely*** (with a probability of 5- 20%) the hourly mean objective to have been exceeded in 2006 (Table 4.6).

When analysing the predicted results, attention was focused on the areas with predicted concentrations exceeding the objective for annual mean NO_2 concentrations and, particularly, on building facades within these areas (i.e. the relevant locations).

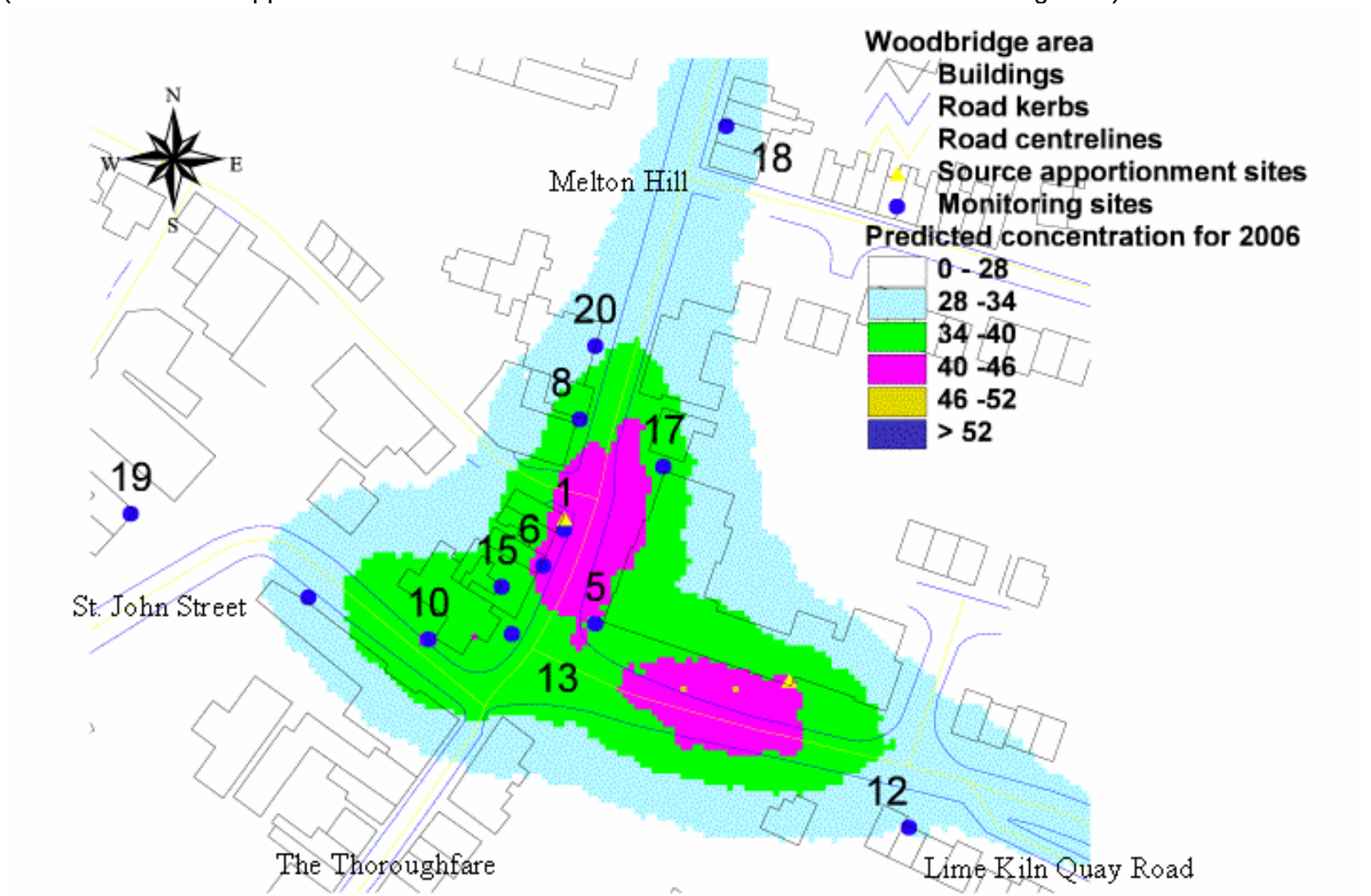
Table 5.1 below summaries the highest annual mean NO_2 concentrations predicted at relevant locations at the junction. As identified in the 2005 detailed assessment, there is still a marginal exceedence for two properties at Thoroughfare/Melton Hill in 2006. There may be also a marginal exceedence in Lime Kiln Quay Road in 2006 as indicated in Table 5.1 and Figure 5.1. The highest predicted NO_2 concentration is 43.5μg/m^3 at a relevant location near to the automatic monitor. The largest exceedence predicted is 8%, as shown in Table 5.1. Source apportionment has been undertaken at these relevant locations with predicted exceedences.

Table 5.1 The highest NO_2 concentrations predicted at relevant locations at the Woodbridge junction in 2006

Area	The relevant location with the highest predicted concentration		Total NO_2 ug/m^3	Exceedence
	X	Y		
Thoroughfare/Melton Hill	627597	249263	**43.5**	8%
Lime Kiln Quay Road	627640	249232	**41.9**	5%

Figures in **bold** indicate predicted exceedences of the UK objective in 2006
% Figures are rounded to the nearest whole number

Figure 5.1 Modelled contours of annual mean NO_2 concentration at the Woodbridge junction for 2006
(See Table A2.3 in Appendix 2 for the names and locations of the numbered monitoring sites)



2010 NO_2 modelling results

Figure 5.2 shows the modelled annual mean NO_2 concentrations for 2010 at the Woodbridge junction and Table 5.2 summaries the highest annual mean NO_2 concentrations predicted at relevant locations at the junction.

The adjusted model has predicted no exceedence of the annual average objective of 40μg/m^3 for nitrogen dioxide at the Woodbridge junction in 2010. The highest predicted NO_2 concentration is only 38.4 μg/m^3 at the relevant location near to the automatic monitor.

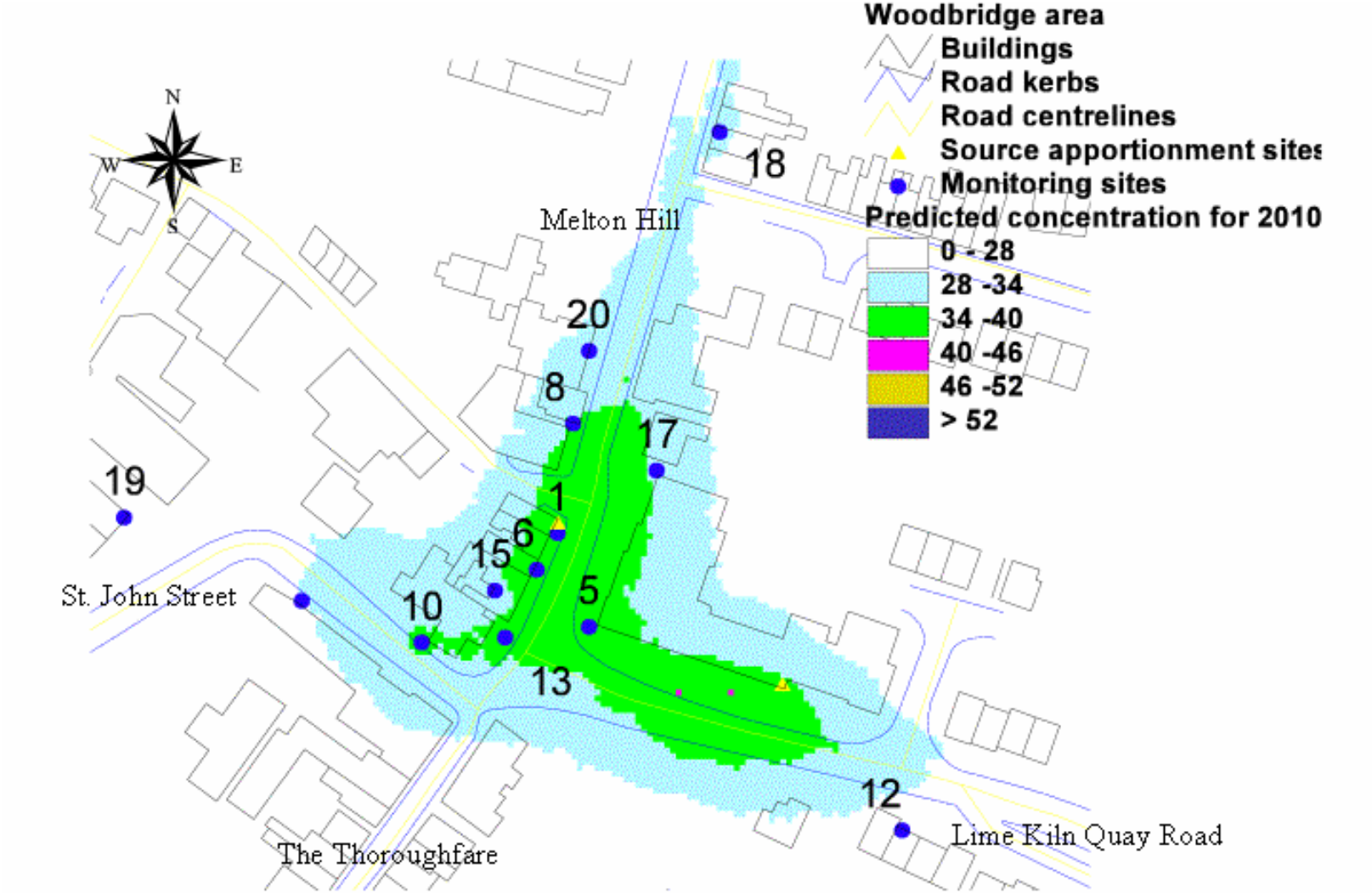
Within the Woodbridge junction area, the model predicts that it is ***possible*** (with a probability of 20- 50%) that the annual average objective will be exceeded in 2010 and it is ***very unlikely*** (with a probability less than 5%) the hourly mean objective to be exceeded in 2010 (Table 4.6).

Table 5.2 The highest NO_2 concentrations predicted at relevant locations in the Woodbridge junction area in 2010

Area	The relevant location with the highest predicted concentration		Total NO_2 ug/m^3	Exceedence
	X	Y		
Thoroughfare/Melton Hill	627597	249263	38.4	No
Lime Kiln Quay Road	627640	249232	36.3	No

The above results predict a significant decline in NO_2 levels between 2006 and 2010 due to national measures to reduce NOx emissions. This decline is based on predicted future vehicle NOx emissions, and on predicted future declines in background NO_2 and NOx provided in TG(03). Current evidence suggests that these predicted declines towards 2010 are optimistic and that in fact, in urban areas at least, NO_2 levels may be declining more slowly than previously anticipated. The reasons for this are subject to current investigation. One possible reason may be that primary emissions of NO_2 from vehicles, especially those fitted with particulate traps, are higher than previously thought. For now it is recommended that decisions regarding air quality and NO_2 be made based on the results predicted for 2006, and that the results for 2010 be treated with caution and treated as indicative only.

Figure 5.2 Modelled contours of annual mean NO_2 concentration at the Woodbridge junction in 2010
(See Table A2.3 in Appendix 2 for the names and locations of the numbered monitoring sites)



Source apportionment of the predicted exceedences

Source apportionment is the process whereby the contributions from different sources of a pollutant are determined. In local air quality of Woodbridge, the relevant sources could include: road traffic; local background; industrial and domestic. Contributions from the different types of vehicles (for example, cars, lorries and buses) can also be considered to highlight which class of vehicle is contributing most to the emissions from traffic. Source apportionment allows the most important source or sources to be identified and options to reduce ambient concentrations of pollutants can then be considered and assessed.

Source apportionment analysis should:

- Confirm that exceedences of NO_2 are due to road traffic
- Determine the extent to which different vehicle types are responsible for the emission contributions to NO_2 within predicted areas of exceedence. This will allow traffic management scenarios to be modelled/tested to reduce the exceedences
- Quantify what proportion of the exceedences of NO_2 is due to background emissions, or local emissions from busy roads in the local area. This will help determine whether local traffic management measures could have a significant impact on reducing emissions in the area of exceedence, or, whether national measures would be a suitable approach to achieving the air quality objectives

Receptors considered

When analysing the predicted results, attention was focused on areas with predicted concentrations exceeding the objective for annual mean NO_2 concentrations and, particularly, on building facades within these areas. Source apportionment had been considered for NOx at the two relevant locations with predicted exceedences in 2006 (as shown in Table 5.1 and Figure 5.1).

Sources of pollution considered

We have considered the effect of the following sources in this assessment at the receptors considered:

- Background concentrations used in the assessment
- Traffic - Light Duty Vehicles on main roads in the junction area
- Traffic - Heavy Duty Vehicles on main roads in the junction area
- Traffic in queues at the junction

It should be noted that the modelling has particularly considered traffic on the busiest roads. Reference in Tables 5.3-5.6 below to ‘vehicles’ refers to the contribution to pollutant concentrations by traffic movements on these roads. Emissions from traffic movements on other roads in Suffolk Coastal District Council and outside the Council have not been explicitly modelled. However, their contribution to pollutant concentrations in the Woodbridge area is included in the modelled background concentrations. The background concentrations in Tables 5.3 - 5.4 therefore include contributions from traffic on roads other than those modelled in this study.

The concentration of NO_2 at a given location is determined by a number of factors, including the magnitude and proximity of NOx emission sources, dispersion of the emissions and the processes that determine which proportion of NOx is in the form of NO_2, and they are all considered in the model. The concentrations apportioned to each source category and the fractions of the total concentrations of NOx are shown in Tables 5.3 – 5.6.

Table 5.3: Source apportionment at the relevant site in Thoroughfare/Melton Hill according to source category

Thoroughfare/Melton Hill (627597, 249263) Source category	NOx Concentration ug/m3	NOx Contribution %
Light Duty Vehicles (LDV)	31.17	47%
Heavy Duty Vehicles (HDV)	28.69	44%
Local background	5.93	9%
Local total	65.80	100%

% Figures are rounded to the nearest whole number

Table 5.4: Source apportionment at the relevant site in Thoroughfare/Melton Hill according to vehicle state at the junction

Thoroughfare/Melton Hill (627597, 249263) Vehicle state	NOx Concentration ug/m3	NOx Contribution %
Moving vehicles	24.44	41%
Vehicles in the queues	35.43	59%
Local traffic total	59.86	100%

% Figures are rounded to the nearest whole number

Table 5.5: Source apportionment at the relevant site in Lime Kiln Quay Road accordingt to source categoty

Lime Kiln Quay Road (627640, 249232) Source category	NOx Concentration ug/m3	NOx Contribution %
Light Duty Vehicles (LDV)	27.43	45%
Heavy Duty Vehicles (HDV)	28.14	46%
Local background	5.69	9%
Local total	61.26	100%

% Figures are rounded to the nearest whole number

Table 5.6: Source apportionment at the relevant site in Lime Kiln Quay Road accordingt to vehicle state at the junction

Lime Kiln Quay Road (627640, 249232) Vechicle state	NOx Concentration ug/m3	NOx Contribution %
Moving vehicles	20.94	38%
Vehicles in the queues	34.63	62%
Local traffic total	55.58	100%

% Figures are rounded to the nearest whole number

From the above source apportionment, it can be seen that local traffic accounts for about 90% of the local NOx concentrations at the two locations analysed, HDVs and LDVs account for about half of the traffic contribution each, as shown in Tables 5.3 & 5.5. In the traffic emitted NOx at the two sites analysed (i.e. the total concentration of LDVs and HDVs), about 60% of them are produced by vehicles waiting in the queues on Lime Kiln Quay Road and on Thoroughfare/Melton Hill, as shown in Tables 5.4 & 5.6.

After knowing the contributions from different sources to the exceedences predicted, proper measures could be formulated to target the primary sources to eliminate these exceedences. At the source apportionment sites where marginal exceedences were predicted for 2006 (as shown in Table 5.1), the model shows that a reduction of vehicle emitted NOx by 16.4% would have eliminated these exceedences to the objective for annual mean NO_2 concentration in 2006. Queuing and HDV reductions will be the keys to achieve the NOx reduction.

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Recommendations

Summary of modelling predictions

For 2006, both monitoring and modelling indicate continued exceedences of the objective for annual mean NO2 concentrations at the Woodbridge junction. The model predicts that it is ***probable*** (with a probability of 50- 80%) that the annual average objective has been exceeded in 2006 and it is ***unlikely*** (with a probability of 5- 20%) the hourly mean objective to have been exceeded in 2006 (Table 4.6).

No exceedence of the objectives for NO_2 concentration is predicted at the junction in 2010.

The source apportionment analysis shows that local traffic contributes about 90% of the total local NOx and vehicles waiting the queues produce about 60% of the traffic NOx at the junction.

Recommendations

Below are our recommendations for the areas assessed in this report:

- Suffolk Coastal District Council should retain the AQMA declared at the junction.
- Suffolk Coastal District Council should continue monitoring at all sites to confirm the predicted trend between now and 2010 with a few alterations.
- Suffolk Coastal District Council should consider revoking diffusion tube WBG19. The readings by this tube were quite low in 2006 and a new site has been established nearby in St. John Street, as illustrated in Figure 4.1a.
- A reduction of vehicle emitted NOx by 16.4% would have eliminated these exceedences to the objective for annual mean NO_2 concentration in 2006. Queuing and HDV reductions will be the keys to improve the air quality at the junction.

Further actions to be taken

Should Suffolk Coastal District Council be satisfied and in agreement with the contents of this report, it should be then be forwarded to Defra for approval. Defra will then forward the report to their external assessors who will comment on the work. Defra will then return the critique of the work to Suffolk Coastal District Council.

Suffolk Coastal District Council should then forward a copy of this critique to **AEA Energy and Environment.** Suffolk Coastal District Council should also consider if they could answer any of the questions directly.

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Appendices

Appendix 1: Traffic data
Appendix 2: Monitoring data
Appendix 3: Model validations: Nitrogen dioxide roadside concentrations

Appendix 1

Traffic Data

CONTENTS

-- Summary of the Woodbridge/Melton traffic surveys
(Tables A1.1 – A1.3)
-- Additional traffic due to committed development in the Woodbridge area
(Table A 1.4)
-- TEMPRO traffic growth factor for the Woodbridge area (Table A1.5)

Table A1.1 – Summary of the 11-hour traffic survey on 24th November 2005 (Data source: Woodbridge/Melton traffic surveys, 2005)

		Car/ MC	LGV	HGV	BUS	AADT
Lime Kiln	Southbound	4189	409	89	74	4761
Quay Rd	Northbound	3066	348	63	53	3530
St. John St	Eastbound	2442	227	45	14	2728
	Westbound	463	40	5	0	508
Melton Hill	Southbound	3478	404	73	61	4016
	Northbound	3802	416	77	54	4349
Thoroughfare	Southbound	532	114	11	0	657

Table A1.2 – Summary of the 14-day traffic survey between 23rd November and 6th December 2005 (Data source: Woodbridge/Melton traffic surveys, 2005)

		Cars/ LGV	HGV	AADT	Average speed (mph)
Lime Kiln	Southbound	5040	141	5192	24
Quay Rd	Northbound	3819	147	3965	26
St. John St	Eastbound	2921	152	3192	15
	Westbound	1296	11	1449	8
Melton Hill	Southbound	4629	227	4975	27
	Northbound	5076	230	5455	26
Thoroughfare	Southbound	NS	NS	NS	12*

NS: Not surveyed

* No average speed was recorded for Thoroughfare and it was assumed to be the average speed observed in nearby St. John Street.

Table A1.3 – Summary of average number of vehicles queuing at the Woodbridge Junction between 8.00-18.00 hours on 23rd November 2005 (Data source: Woodbridge/Melton traffic surveys, 2005)

	St John Street	Lime Kiln Quay Rd	Melton Hill/Thoroughfare
08.00 – 09.00	11.7	8.9	8.7
09.00 – 10.00	7.3	8.1	6.9

10.00 – 11.00	5.7	7.0	4
11.00 – 12.00	7.9	12.4	7.5
12.00 – 13.00	7.5	10.3	4.6
13.00 – 14.00	7.6	10.5	5.1
14.00 – 15.00	5.8	7.7	5.5
15.00 – 16.00	8	8.0	5.5
16.00 – 17.00	11.2	8.9	7.8
17.00 – 18.00	8.5	10.3	6.8
10-hour average	8.12	9.21	6.23

Table A1.4 Additional traffic flow at the Woodbridge junction due to committed developments to be completed before 2010

Road	Additional AADT
Lime Kiln Quay Rd	489
St. John St	257
Melton Hill	2154

Table A1.5 TEMPRO growth factors for the Woodbridge area

From	To	NRTF Central	Suffolk Coastal Growth Central
2005	2006	1.017	1.013
2005	2007	1.032	1.029
2005	2008	1.048	1.045
2005	2009	1.063	1.061
2005	2010	1.079	1.076

Table A1.6 Averaged hourly traffic flows at Woodbridge junction between 24th November 2005 and 27th November 2005

Time of day	Weekday	Saturday	Sunday
00:00	9	27	26
01:00	3	10	10
02:00	2	5	4
03:00	3	8	3
04:00	7	7	5
05:00	12	13	3
06:00	45	24	8
07:00	154	53	26
08:00	329	150	68
09:00	335	264	110
10:00	322	361	216
11:00	335	409	271
12:00	344	361	289
13:00	322	311	243
14:00	354	312	237
15:00	348	306	226
16:00	358	266	175
17:00	302	210	109
18:00	206	144	101
19:00	177	154	83
20:00	106	87	54
21:00	85	67	32
22:00	70	60	42
23:00	45	53	15

Appendix 2

Monitoring Data

CONTENTS

-- Automatic monitoring data (Table A2.1)
-- Unadjusted monthly diffusion tube monitoring data (Tables A2.2)
-- Locations of the monitoring sites (Table A2.3)

2.1 Automatic monitoring data

Air Pollution Report

Produced by AEA Energy & Environment on behalf of Suffolk Coastal District Council

SUFFOLK COASTAL WOODBRIDGE 2
01 January to 31 December 2006

These data have been fully ratified by AEA Energy & Environment

POLLUTANT	NO	NO_2	NO_X
Number Very High	-	0	-
Number High	-	0	-
Number Moderate	-	0	-
Number Low	-	8434	-
Maximum 15-minute mean	628 µg m^{-3}	419 µg m^{-3}	1092 µg m^{-3}
Maximum hourly mean	483 µg m^{-3}	199 µg m^{-3}	875 µg m^{-3}
Maximum running 8-hour mean	364 µg m^{-3}	154 µg m^{-3}	700 µg m^{-3}
Maximum running 24-hour mean	218 µg m^{-3}	100 µg m^{-3}	425 µg m^{-3}
Maximum daily mean	217 µg m^{-3}	95 µg m^{-3}	421 µg m^{-3}
Average	36 µg m^{-3}	44 µg m^{-3}	99 µg m^{-3}
Data capture	96.3 %	96.3 %	96.3 %

All mass units are at 20'C and 1013mb
NO_X mass units are NO_X as NO_2

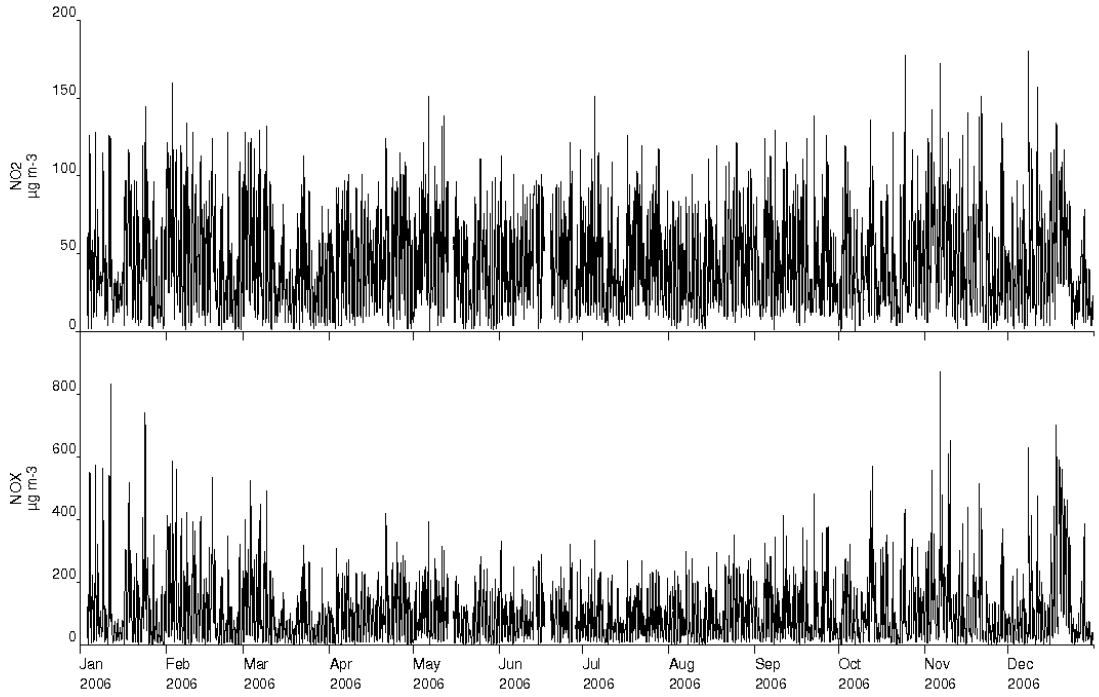
Pollutant	Air Quality (England) Regulations 2000 and (Amendment) Regulations 2002	Exceedences	Days
Nitrogen Dioxide	Annual mean > 40 µg m^{-3}	1	0
Nitrogen Dioxide	Hourly mean > 200 µg m^{-3}	0	0

AEA Energy & Environment
From the AEA group

Air Pollution Report

Produced by AEA Energy & Environment on behalf of
Suffolk Coastal District Council

Suffolk Coastal Woodbridge 2 Air Monitoring
Hourly Mean Data for 01 January to 31 December 2006



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From the AEA group

Table A2.2 Unadjusted monthly diffusion tube data in the Woodbridge area in 2006 (μg/m^3)

Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
WBG 1a	47.1	53.7	40.5	50.1	46.1	42.2	33.0	39.7	49.8	48	57.8	52.2
WBG 1b	40.1	50.5	45.1	49.1	49.6	48.6	41.6	41.5	51.3	50.3	54.7	52.7
WBG 1c	41.7	51.6	43.4	53.4	46.2	46.4	44.5	41.0	no data	46.6	56.3	44.7
WBG 1 mean	43.0	51.9	43.0	50.9	47.3	45.7	39.7	40.7	50.6	48.3	56.3	49.9
WBG 3	24.7	22.3	18.0	16.7	17.9	17.8	10.6	11.9	19.6	23.1	28.1	25.1
WBG 5a	39.9	36.1	34.3	30.5	29.7	33.2	35.4	19.6	32.6	34.9	35.7	36.6
WBG 5b	41.6	38.7	34.0	33.2	32.8	33.6	27.9	21.4	28.5	32	39.2	38.3
WBG 5c	31.9	36.9	29.5	27.5	28.3	29.8	27.7	20.8	32.7	34.3	37.2	34.6
WBG 5 mean	37.8	37.2	32.6	30.4	30.3	32.2	30.3	20.6	31.3	33.7	37.4	36.5
WBG 6	40.7	50.2	43.2	46.7	44.9	45.6	45.2	36.7	48.0	47.5	51.6	46.8
WBG 8	41.8	50.7	45.1	51.3	48.5	no data	45.8	34.7	no data	49.5	59.2	51.3
WBG 10	41.3	42.2	39.6	37.3	41.0	49.2	49.5	30.6	41.7	41.5	41.6	39.6
WBG 12	30.8	36.5	32.0	34.5	33.8	26.4	27.3	27.6	34.2	32.4	44.3	39.9
WBG 13	41.2	42.2	36.2	37.2	36.2	42.2	41.2	30.7	41.7	38.4	44.0	42.5
WBG 15	43.5	51.8	36.0	48.7	42.4	42.1	35.5	42.2	47.0	48.0	50.2	47.7
WBG 17	39.1	37.4	35.2	34.8	33.1	41.3	34.4	26.0	38.0	39.1	44.5	34.7
WBG 18	45.4	43.0	38.8	38.9	40.6	43.7	44.8	29.4	43.2	46.1	46.8	41.4
WBG 19	24.7	30.3	21.4	22.9	20.4	21.8	15.0	15.7	29.4	no data	35.3	31.5
WBG 20	~	45.6	41.3	51.2	44.1	45.9	35.7	41.9	49.4	40.7	59	47.6

N/A: Not available at the time when this assessment was done

Key:

WBG 1a,b,c	Kerbside site, signpost outside 93 Thoroughfare, Woodbridge **(co-location with continuous monitor from January 2006)**
WBG 3	Urban Background site, lampost outside 8 Kingston Farm Road, Woodbridge
WBG 5a,b,c	Roadside site, drainpipe on corner of Suffolk Place, Lime Kiln Quay Road, Woodbridge **(Triplicate site)**
WBG 6	Roadside site, drainpipe on 87 Thoroughfare, Woodbridge
WBG 8	Roadside site, drainpipe on 95 Thoroughfare, Woodbridge
WBG 10	Roadside site, signpost in St. John's Street (opposite Surgery), Woodbridge
WBG 12	Roadside site, drainpipe on 8 Lime Kiln Quay Road, Woodbridge. **Site reinstated from January 2006**
WBG 13	Roadside site, traffic lights at front of 85 Thoroughfare, Woodbridge
WBG 15	Roadside site, drainpipe on 87 Thoroughfare, Woodbridge
WBG 17	Roadside site, drainpipe at front Northern end of Suffolk Place, Lime Kiln Quay Road. **New site from January 2006**
WBG 18	Roadside site, drainpipe between 106 / 108 Thoroughfare, Woodbridge. **New site from January 2006**
WBG 19	Roadside site, front porch of 25 St. John's Street, Woodbridge. **New site from January 2006**
WBG 20	Roadside site, drainpipe on 97 Thoroughfare, Woodbridge. **New site from February 2006**

Table A2.3 Locations of the monitoring sites

Site No	X	Y	Site Name
1	627597	249261	WBG 1a,b,c
3	626990	248480	WBG 3
5	627603	249243	WBG 5a,b,c
6	627593	249254	WBG 6
8	627600	249282	WBG 8
10	627571	249240	WBG 10
12	627663	249204	WBG 12
13	627587	249241	WBG 13
15	627585	249250	WBG 15
17	627616	249273	WBG 17
18	627628	249338	WBG 18
19	627514	249264	WBG 19
20	627603	249296	WBG 20
New site	627548	249248	New site

Appendix 3

Model validation
Nitrogen dioxide roadside concentrations

CONTENTS

Introduction
Model application
Results
Discussion

INTRODUCTION

The dispersion model ADMS-3 was used to predict nitrogen dioxide concentrations at roadside locations. ADMS-3 is a PC-based model that includes an up-to-date representation of the atmospheric processes that contribute to pollutant dispersion.

The model was used to predict

- the local contribution to pollutant concentrations from roads; and
- The contribution from urban background sources.

The contribution from urban background sources was calculated from the ADMS-3 output using the NETCEN Local Area Dispersion System (LADS) model. The LADS model provides efficient algorithms for applying the results of the dispersion model over large areas.

The model was verified by comparison with monitoring data obtained at a number of roadside, kerbside or near-road monitoring sites in London.

- London Marylebone
- Camden Roadside
- Haringey Roadside
- London Bloomsbury
- London North Kensington
- London A3 Roadside

London Marylebone site is located in a purpose built cabin on Marylebone Road opposite Madame Tussauds. The sampling point is located at a height of 3 m, around 1 m from the kerbside. Traffic flows of over 80,000 vehicles per day pass the site on six lanes. The road is frequently congested. The surrounding area forms a street canyon and comprises of education buildings, tourist attractions, shops and housing

Camden Roadside site (TQ267843) is located in a purpose built cabin on the north side of the Swiss Cottage Junction. The site is at the southern end of a broad street canyon. Sampling points are approximately 1 m from the kerbside of Finchley Road at a height of 3 m. Traffic flows of 37,000 vehicles per day pass the site and the road is often congested. Pedestrian traffic is also high. The surrounding area mainly consists of shops and offices.

London North Kensington site (TQ240817) is located within the grounds of Sion Manning School. The sampling point is located on a cabin, in the school grounds next to St Charles Square, at a height of 3 m. The surrounding area is mainly residential.

London A3 monitoring station (TQ193653) is within a self-contained, air-conditioned housing immediately adjacent to the A3 Kingston Bypass (6 lane carriageway). Traffic flow along the bypass is approximately 112,000 vehicles per day and is generally fast and free flowing with little congestion. The manifold inlet is approximately 2.5 m from the kerbside at a height of approximately 3 m. The surrounding area is generally open and comprises residential dwellings and light industrial and commercial properties.

London Bloomsbury monitoring station (TQ302820) is within a self-contained, air-conditioned housing located at within the southeast corner of central London gardens. The gardens are generally laid to grass with many mature trees. All four sides of the gardens are surrounded by a busy (35,000 vehicles per day), 2/4 lane one-way road system which is subject to frequent congestion. The nearest road lies at a distance of approximately 35 metres from the station. The manifold inlet is approximately 3 metres high. The area in the vicinity of the manifold is open, but there are mature trees within about 5 metres.

London Haringey site (TQ339906) is located in a purpose built cabin within the grounds of the Council Offices. The sampling point is at a height of 3 m located 5 m from High Road Tottenham (A1010) with traffic flows of around 20,000 vehicles per day. The road is frequently congested. The surrounding area consists of shops, offices and housing.

MODEL APPLICATION

Study area

Two study areas were defined- a local study area and an urban background study area. The local study area was defined for each of the monitoring sites extending 200 m in each direction (NSEW) from the monitoring site. Roads in the study area were identified. Each road in the study are was then treated as a quadrilateral volume source with depth 3 m, with spatial co-ordinates derived from OS maps. The urban background study area extended over an 80 km x 80 km area covering the London area. The background study area was divided into 1 km x 1 km squares-each 1 km square was then treated as a square volume source with depth 10 m.

Traffic flows in the local study area

Traffic flows, by vehicle category, on each of the roads within the local study area for 1996 were obtained from the DETR traffic flow database. The traffic flows were scaled to 1998 by factors shown in Table A3.1 obtained by linear interpolation from Transport Statistics GB, 1997.

Table A3.1 Traffic growth 1998:1996

	Growth factor
Cars	1.05
Light goods vehicles	1.05
Heavy goods vehicles	1.04
Buses	1.00
Motorcycles	1.00

Traffic flows follow a diurnal variation. Table A3.2 shows the assumed diurnal variation in traffic flows.

Table A3.2 Assumed diurnal traffic variation

Hour	Normalised traffic flow
0	0.20
1	0.11
2	0.10
3	0.07
4	0.08
5	0.18
6	0.49
7	1.33
8	1.97
9	1.50
10	1.33
11	1.46
12	1.47
13	1.51
14	1.62
15	1.74
16	1.94
17	1.91
18	1.53
19	1.12
20	0.88
21	0.68
22	0.46
23	0.33

Vehicle speeds in the local study area

Vehicle speeds were estimated on the basis of TSGB, 1997 data for central area, inner area and outer area average traffic speeds in London, 1968-1995 and for non-urban and urban roads for 1996. Table A3.3 shows the traffic speeds applied to each of the sites. The low speeds in Central London reflect the generally high levels of congestion in the area.

Table A3.3 Traffic speeds used in the modelling

Site	Road class	Vehicle speed, kph
London Marylebone	Central London	17.5
Camden Roadside	Central London	17.5
London Bloomsbury	Central London	17.5
London A3 Roadside	Non-urban dual carriageway	88
London Haringey	Outer London	32
London North Kensington	Background site	Not applicable

Vehicle emissions in the local study area
Vehicle emissions of oxides of nitrogen were estimated using the Highways Agency Design Manual for Roads and Bridges, 1999 (DMRB). DMRB provides a series of monograms that allow the effect on emission rates of the proportion of heavy goods vehicles and the average vehicle speed to be taken into account. The estimated emissions are based on average speeds and take account of the variations in emissions that follow from normal patterns of acceleration and deceleration. DMRB provides estimates of the emissions of particulate material from vehicle exhausts.

Emissions in the urban background study area
Emission estimates for each 1 km square in the urban background study area were obtained from two emission inventories. The London inventory for 1995/6 (LRC, 1997) was used for most of the urban background study area: the National Atmospheric Emission Inventory, 1996 was used for areas within the urban background study area not covered by the London inventory.

The emission estimates for each square for 1996 were scaled to 1998 using factors taken from DMRB.

Meteorological data
Meteorological data for Heathrow Airport 1998 was used to represent meteorological conditions. The data set included wind speed and direction and cloud cover for each hour of the year. It was assumed that a surface roughness of 0.5 m was representative of the suburban area surrounding Heathrow Airport.

The meteorological conditions over London are affected by heat emissions from buildings and vehicles. This “urban heat island” effect reduces the frequency and severity of the stable atmospheric conditions that often lead to high pollutant concentrations. In order to take this into account the Monin-Obukhov length (a parameter used to characterise atmospheric stability in the model) has been assigned a lower limit as shown in Table A3.4.

Table A3.4: Monin-Obukhov limits applied

Site	Limit, m	Note
London Marylebone	100	Large conurbation
Camden Roadside	100	Large conurbation
London Bloomsbury	100	Large conurbation
London A3 Roadside	30	Mixed urban/industrial
London Haringey	30	Mixed urban/industrial
London North Kensington	100	Large conurbation
Small towns <50,000	10	
Urban background area	100	
Rural	1	

Surface roughness
The surface roughness is used in dispersion modelling to represent the roughness of the ground. Table A3.5 shows the surface roughness values applied.

Table A3.5 Surface roughness

Site	Surface roughness, m	Note
London Marylebone	2	Street canyon
Camden Roadside	1	City
London Bloomsbury	1	City
London A3 Roadside	0.5	Suburban
London Haringey	1	City
London North Kensington	1	Suburban
Urban background area	1	

Model output
The local model was used to estimate:

- Annual average road contribution of oxides of nitrogen ;
- road contribution to oxides of nitrogen concentrations for each hour of the year.

The urban background model was used to estimate:

- the contribution from urban background sources to annual average oxides of nitrogen concentrations;
- the contribution from roads considered in the local model to urban background concentrations;
- the contribution from urban background sources to oxides of nitrogen concentrations for each hour of the year.

Background concentrations
A rural background concentration of 20 μg m^{-3} was added to the urban background oxides of nitrogen concentration.

Calculation of annual average nitrogen dioxide concentrations
Nitrogen dioxide is formed as the result of the oxidation of nitrogen oxides in air, primarily by ozone. The relationship between oxides of nitrogen concentrations and nitrogen dioxide concentrations is complex; an empirical approach has been adopted.

The contribution from locally modelled roads to urban background oxides of nitrogen concentrations was first subtracted from the calculated urban background concentration. The annual average urban background nitrogen dioxide concentration was then calculated from the corrected annual average urban background oxides of nitrogen concentration using the following empirical relationship based on monitoring data from AUN sites:

For NO_x>23.6 μg m^{-3}

$$NO_2 = 0.348.NO_x + 11.48 \ \mu g\ m^{-3}$$

For NO_x<23.6 μg m^{-3}

$$NO_2 = 0.833.NO_x \ \mu g\ m^{-3}$$

The contribution of road sources to nitrogen dioxide concentrations was then calculated using the following empirical relationship (Stedman):

$$NO_2 = 0.162.NO_x$$

The contributions from road and background sources to annual average nitrogen dioxide concentrations were then summed.

The calculated value was then corrected so that there was agreement between modelled and measured concentrations at a reference site (London North Kensington (LNK)):

NO_2(corrected, site)= NO_2(modelled, site)+ NO_2(measured, LNK)- NO_2(modelled, LNK)

Calculation of 99.8th percentile hourly average concentrations
A simple approach has been used to estimate 99.8th percentile values. The approach relies on an empirical relationship between 99.8th percentile of hourly mean nitrogen dioxide and annual mean concentrations at kerbside/roadside sites, 1990-1998:

NO_2(99.8th percentile)=3.0 NO_2(annual mean)

99.8 th percentile values were calculated on the basis of the modelled annual mean.

The calculated value was then corrected so that there was agreement between modelled and measured concentrations at a reference site (London North Kensington (LNK)):

NO_2(corrected, site)= NO_2(modelled, site)+ NO_2(measured, LNK)- NO_2(modelled, LNK)

RESULTS

Modelled results are shown in Table A3.6. Fig. A3.1 shows modelled annual average nitrogen dioxide concentrations plotted against the measured values. Similarly Fig. A3.2 shows modelled 99.8th percentile average nitrogen dioxide concentrations plotted against measured values.

Table A3.6 Comparison of modelled and measured concentrations

Site	Nitrogen dioxide concentration, ppb			
	Annual average		99.8th percentile hourly	
	Modelled	Measured	Modelled	Measured
London A3	32	30	94	73
North Kensington	24	24	70	70
Bloomsbury	28	34	83	78
Camden	32	33	95	89
London Marylebone	45	48	134	121
Haringey	22	28	65	77

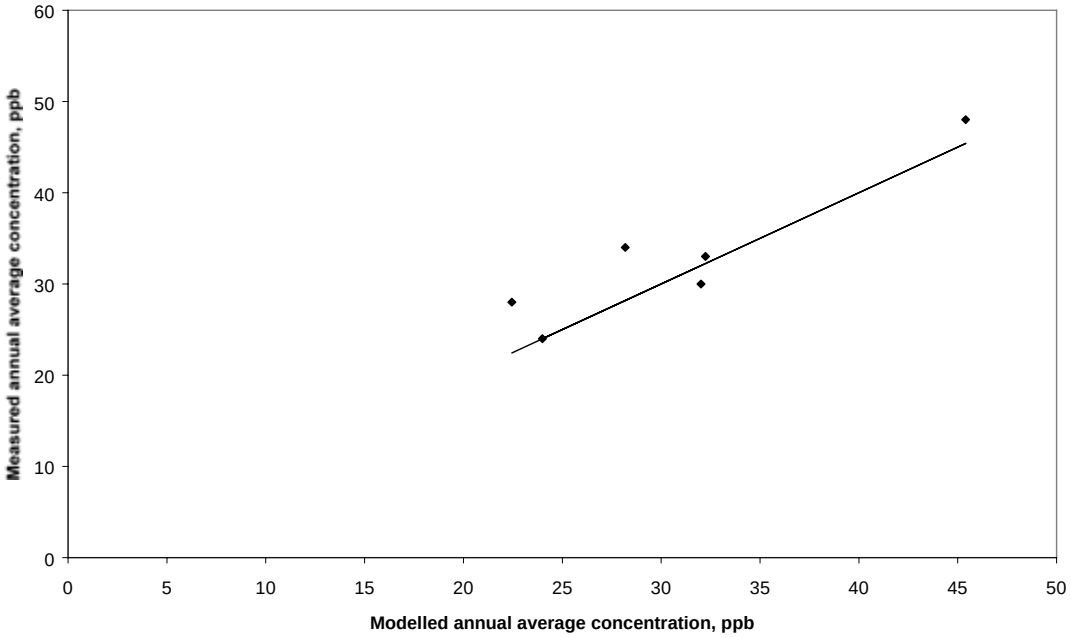

Fig. A3.1 Comparison of modelled and measured annual average nitrogen dioxide concentrations

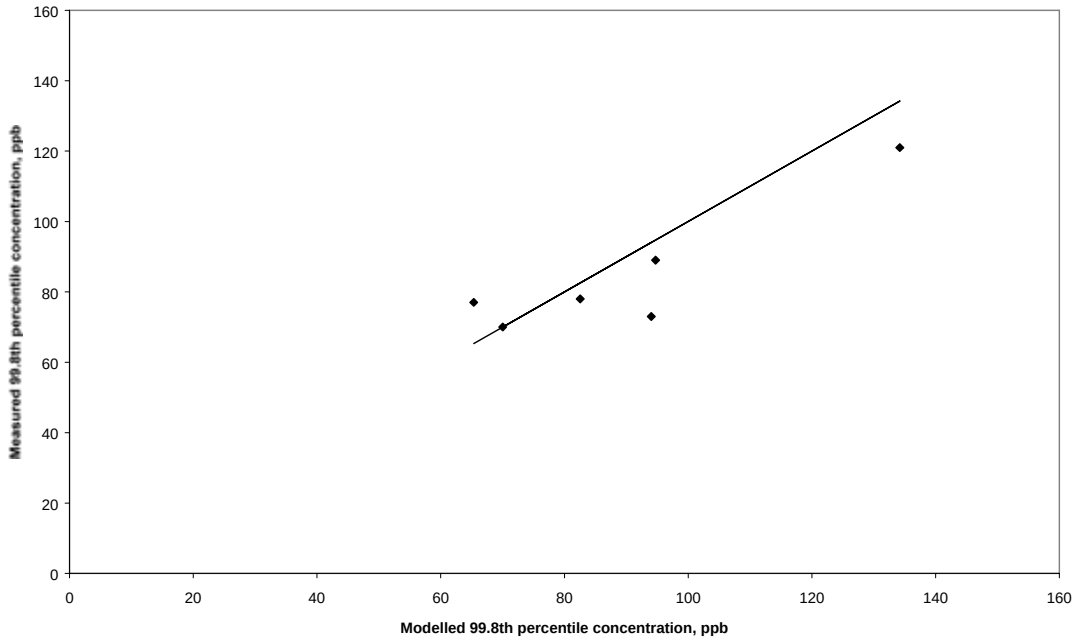

Fig. A3.2 Comparison of modelled and measured 99.8th percentile hourly average nitrogen dioxide concentrations

DISCUSSION

Model errors

The error in the modelled annual average at each site was calculated as a percentage of the modelled value. The standard deviation of the errors was then calculated: it was 12% with five degrees of freedom.

The error in the 99.8 th percentile concentration at each site was calculated as a percentage of the modelled value. The standard deviation of the errors was then calculated: it was also 12% with five degrees of freedom.

Year to year variation in background concentrations

Nitrogen dioxide concentrations at monitoring sites show some year-to-year variations. Reductions in emissions in the United Kingdom are responsible for some of the variation, but atmospheric influences and local effects also contribute to the variation.

In order to quantify the year-to-year variation monitoring data from AUN stations with more than 75% data in the each of the years 1996-1998 was analysed using the following procedure.

First, the expected concentrations in 1997 and 1996 were calculated from the 1998 data.

$$c_e = \frac{d_{1998}}{d_y}.c_{1998}$$

where c_{1996} is the concentration in 1998;

d_{1998}, d_y are correction factors to estimate nitrogen dioxide concentrations in future years (1996=1, 1997=0.95, 1998=0.91) from DETR guidance;

The difference between the measured value and the expected value was then determined for each site and normalised by dividing by the expected value. The standard deviation of normalised differences was determined for each site. A best estimate of the standard deviation from all sites was then calculated. The standard deviation of the annual mean was 0.097 with 2 degrees of freedom. The standard deviation of the 99.8th percentile hourly concentration was 0.21 with 2 degrees of freedom.

Short periods of monitoring data

Additional errors can be introduced where monitoring at the reference site (used to calibrate the modelling results against) takes place over periods less than a complete year, typically of three or six months.

In this case, a whole year of data was available at the monitoring site (1999 in Glasgow Centre), and so no correction was necessary for short periods of monitoring.

Confidence limits

Upper confidence limits for annual mean and 99.8th percentile concentrations were estimated statistically from the standard deviation of the model error and the year-to-year standard deviation:

$$u = c + \sqrt{(t_m s_m)^2 . \left(1 + \frac{1}{k}\right) + (t_y s_y)^2 + \sum (t_p s_p)^2 / k}$$

where:

s_m, s_y, s_p are the model error standard deviation , the year to year standard deviation and the standard error introduced using part year data;

c is the concentration calculated for the modelled year;

t_m, t_y, t_p are the values of Student's t distribution for the appropriate number of degrees of freedom at the desired confidence level;

k is the number of reference sites used in the estimation of the modelled concentration.

In many cases, the concentration estimate is based on a single reference site (k=1). However, improved estimates can be obtained where more than one reference site is used.

Table A3.7 shows confidence levels for predictions as a percentage of modelled values

Table A3.7 Upper confidence levels (k=1) for modelled concentrations for future years

Confidence level	Annual mean	99.8th percentile
80 %	+19%	+27%
90%	+31%	+47%
95%	+44%	+70%

In practical terms,

- there is less than 1:5 chance (i.e.100-80=20%) that the 40 μg m^{-3} objective will be exceeded if the modelled annual average concentration in 2005 is less than 34 μg m^{-3} (i.e. 40/1.19);
- there is less than 1:20 (i.e. 100-5=5%) chance that the objective will be exceeded if the modelled roadside concentration is less than 28 μg m^{-3} (i.e. 40/1.44).

- Similarly, there is less than 1:5 chance that the 200 μg m^{-3} 99.8th percentile concentration will be exceeded if the modelled concentration for 2005 is less than 157 μg m^{-3};
- there is less than 1:20 chance that the objective will be exceeded if the modelled concentration in 2005 is less than 117 μg m^{-3}.

In the figures shown in the report, the intervals of confidence limits for the 'probable' and 'likely' annual average and hourly objective concentrations have been set equal to those for 'possible' and 'unlikely', respectively. In reality, the intervals of concentration increase as the probability of exceeding the annual and hourly objective increases from 'unlikely' to 'likely'. The advantage to setting symmetrical concentration intervals is that the concentration contours on the maps become simpler to interpret. This is a mildly conservative approach to assessing the likelihood of exceedences of the NO_2 objectives since a greater geographical area will be included using the smaller confidence intervals.

A simple linear relationship can be used to predict the 99.8th percentile concentration of NO_2 from the annual concentration: the 99.8th percentile is three times the annual mean at kerbside/roadside locations. Therefore, plots of the modelled annual mean NO_2 concentrations can be used to show exceedences of both the annual and hourly NO_2 objectives. However, the magnitude of the concentrations used to judge exceedences of the hourly objective need to be adjusted so they may be used directly with the plots of annual concentration. This has been performed by simply dividing the concentrations of the confidence limits by three.

The following table shows the difference between assigning symmetrical confidence intervals and assigning intervals based directly on the statistics.

Table A3.8a Confidence levels for modelled concentrations for future years based on symmetrical concentration intervals and concentration intervals derived purely from the statistics

Description	Chance of exceeding objective	Confidence limits for the modelled annual average concentrations ($\mu g\ m^{-3}$)			
		Annual average objective (symmetrical intervals)	Symmetrical intervals	Annual average objective (intervals based on statistics)	Interval
Very unlikely	Less than 5%	< 28		< 28	
Unlikely	5 to	28 to 34	6.0	28 to	6.0
Possible	20 to 50%	34 to 40	6.3	34 to	6.3
Probable	50 to	40 to 46	6.3	40 to	7.5
Likely	80 to	46 to 52	6.0	47 to	10.3
Very likely	More than 95%	> 52		> 58	

Table A3.8b Confidence levels for modelled concentrations for future years based on symmetrical concentration intervals and concentration intervals derived purely from the statistics

Description	Chance of exceeding objective	Confidence limits for the modelled annual average concentrations ($\mu g\ m^{-3}$)			
		Hourly average objective (symmetrical intervals)	Symmetrical intervals	Hourly average objective (intervals based on statistics)	Interval
Very unlikely	Less than 5%	< 39		< 39	
Unlikely	5 to 20%	39 to 52	13.2	39 to 52	13.2
Possible	20 to 50%	52 to 67	14.3	52 to 67	14.3
Probable	50 to 80%	67 to 81	14.3	67 to 85	18.1
Likely	80 to 95%	81 to 94	13.2	85 to 113	28.7
Very likely	More than 95%	> 94		> 113	