



***King's Lynn and West Norfolk Borough Council
Updating and Screening Assessment
2012***

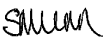
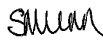
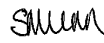





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Document Control Sheet

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Executive Summary

Part IV of the Environment Act 1995 places a statutory duty on local authorities to review and assess the air quality within their area and take account of Government Guidance when undertaking such work. This Updating and Screening Assessment is a requirement of the Fifth Round of Review and Assessment and is a requirement for all local authorities. The Report has been undertaken in accordance with the Technical Guidance LAQM.TG (09) and associated tools (as updated in 2010).

This Updating and Screening Assessment considers all new monitoring data and assesses the data against the Air Quality Strategy objectives. It also considers any changes that may have an impact on air quality.

Updated monitoring showed that there were no exceedences of the Air Quality Objectives outside of existing AQMAs or where relevant exposure was present. With regards to NO₂ both passive and continuous monitoring has shown that there has been a general decrease in concentrations from 2010 to 2011. Continuous monitoring for PM₁₀ has shown a more varied trend with the Leziate monitoring site decreasing, whilst the Southgates monitoring location showing an increase in concentrations.

The USA has identified several new sources within the district. The screening assessment has indicated that a detailed assessment is required in the Page Stair Lane area due to the potential exceedence of both the annual mean and 24-hour mean with regards to PM₁₀.

Proposed actions arising from the USA are as follows:

- Proceed to a Detailed Assessment for particulates on the Page Stair Lane area adjacent to the King's Lynn Docks;
- Continue diffusion tube and continuous monitoring in the district to identify future changes in pollutant concentrations;
- Consider reviewing traffic flow following the completion of the Sainsbury Store and Tesco Store in the Hardwick Road area to determine the impact of the stores upon air quality;
- Consider installing diffusion tubes at the receptor locations predicted to have increased NO₂ concentrations as a result of the Tesco Store development on Hardwick Road;

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- Continue to review the impact of the Reg Bio-Power installation at Freedom Farm to ensure that emissions remain within limits;
- Undertake a screening assessment of the biomass installation on Baptist Road once NOx emission rates are available;
- Proceed to a Progress Report in 2013.

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1 Introduction

1.1 Description of Local Authority Area

The Borough of King's Lynn & West Norfolk covers approximately 550 square miles (142,877 hectares) and is essentially rural in nature. The Borough includes the two market towns of King's Lynn and Downham Market, the Victorian coastal town of Hunstanton, and comprises of more than one hundred villages of varying sizes. The Borough is located about 100 miles north of London and stretches from the north Norfolk coast, along the eastern side of The Wash, through the Marshland, Fens and Brecks to the borders of Lincolnshire, Cambridgeshire and Suffolk. The Borough is the tenth largest district council area in England and Wales. In 2010, the population of King's Lynn & West Norfolk was estimated at approximately 143,631 (source: ONS).

King's Lynn is an important nodal point, where major transport routes converge, including a trunk road (A47) and three principal roads (A10, A17 and A134); a direct, electrified rail service to London and Cambridge; an extensive system of inland navigable waterways; and sea links to the northern and eastern Europe. The town lies some forty miles from the other regional centres of Cambridge, Norwich and Peterborough.

The main source of air pollution in the Borough is road traffic emissions, notably along the A148 (London Road / Gaywood Road / Wootton Road) going through King's Lynn town centre. Other pollution sources, including commercial, industrial and domestic sources, also make a contribution to background pollution concentrations.

Two Air Quality Management Areas (AQMA) have been declared in King's Lynn where exceedences of the annual mean Air Quality Strategy (AQS) objective for nitrogen dioxide (NO₂) were identified, mainly due to traffic congestion.

Another AQMA had previously been declared in 2002 in South Quay, King's Lynn, where the loading of grain onto vessels, highlighted as a potential source of fugitive PM₁₀ emissions, contributed to the exceedence of the PM₁₀ daily mean AQS objective. However, the South Quay AQMA was revoked in 2006 following the implementation of an Air Quality Action Plan and evidence that PM₁₀ levels met the objective.

1.2 Purpose of Report

This report fulfils the requirements of the Local Air Quality Management process as set out in Part IV of the Environment Act (1995), the Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2007 and the relevant Policy and Technical Guidance documents. The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where exceedences are considered likely, the local authority must then declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives.

The objective of this Updating and Screening Assessment is to identify any matters that have changed which may lead to risk of an air quality objective being exceeded. A checklist approach and screening tools are used to identify significant new sources or changes and whether there is a need for a Detailed Assessment. The USA report should provide an update of any outstanding information requested previously in Review and Assessment reports.

1.3 Air Quality Objectives

The air quality objectives applicable to LAQM in **England** are set out in the Air Quality (England) Regulations 2000 (SI 928), The Air Quality (England) (Amendment) Regulations 2002 (SI 3043), and are shown in Table 1.1. This table shows the objectives in units of microgrammes per cubic metre $\mu\text{g}/\text{m}^3$ (milligrammes per cubic metre, mg/m^3 for carbon monoxide) with the number of exceedences in each year that are permitted (where applicable).

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Table 1.1 Air Quality Objectives included in Regulations for the purpose of LAQM in England

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Benzene	16.25 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2003
	5.00 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2010
1,3-Butadiene	2.25 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2003
Carbon monoxide	10.0 mg/m^3	Running 8-hour mean	31.12.2003
Lead	0.5 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2004
	0.25 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2008
Nitrogen dioxide	200 $\mu\text{g}/\text{m}^3$ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2005
Particles (PM ₁₀) (gravimetric)	50 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2004
Sulphur dioxide	350 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

1.4 Summary of Previous Review and Assessments

Between 1999 and 2003, the Borough Council of King's Lynn & West Norfolk undertook its First Round of Review and Assessment of air quality, which concluded that PM₁₀ and NO₂ levels were likely to exceed the AQS objectives at a number of locations in King's Lynn. As a result, the Council declared two AQMA's, one in South Quay (for PM₁₀) in April 2002, and another one in Railway Road (for NO₂) in November 2003. The South Quay AQMA was revoked in June 2006 following the effective implementation of an Air Quality Action Plan for the area.

The Second Round of Review and Assessment began with an Updating and Screening Assessment (USA), completed in 2003. The report concluded that there had been no significant changes since the First Round and that it was not necessary to carry out a Detailed Assessment at that time. However, the subsequent Progress Report (2004) recommended proceeding to a Detailed Assessment of NO₂, following new monitored exceedences of the annual mean objective outside the AQMA in King's Lynn. The Detailed Assessment (2005) confirmed that exceedences were likely to occur at several sites outside the AQMA, and as a result, made the recommendation to extend the AQMA to encompass properties along Railway Road, Blackfriars Road and London Road.

The Third Round of Review and Assessment began with the USA, completed in 2006. The report provided an update with respect to air quality issues within the Borough since the previous round. A number of changes made to the technical guidance for the Review and Assessment process since the Second Round (Technical Guidance LAQM.TG(03)) were taken into account for this assessment. Having considered each pollutant, the USA concluded that the AQS objectives for benzene, 1,3-butadiene, carbon monoxide, lead, PM₁₀ and sulphur dioxide were still being met and that no further assessment was required for these pollutants. The report also recommended (following the conclusions of the Detailed Assessment 2005) that monitoring of NO₂ be continued in the Borough to validate the proposal to extend the Railway Road AQMA in King's Lynn.

The Council approved a variation order (February 2007) to extend the AQMA, which now includes all of Railway Road, Austin Street, Blackfriars Road, St James Road and London Road.

Modelling undertaken by a neighbouring Local Authority, Fenland District Council, also predicted potential exceedences of the NO₂ annual mean AQS objective along Elm High

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Road in Wisbech. The area lies on the border of the Borough of King's Lynn & West Norfolk; therefore, both local authorities deployed additional diffusion tubes in the area to confirm the modelling results.

The Progress Report carried out in 2007 confirmed that NO₂ concentrations were still exceeding the objective at the majority of the monitoring sites in the AQMA; justifying its extension. It also concluded that a Detailed Assessment for NO₂ in Wisbech was not required, as new monitoring results were below the AQS objective. However, new available NO₂ monitoring results showed an exceedence of the objective at the 'Wootton Road 2' diffusion tube in the Gaywood Clock area of King's Lynn. This site is located about 1km east of the extended AQMA in the town centre; therefore, it was recommended that a Detailed Assessment be carried out in this area.

The Detailed Assessment, which also included the Further Assessment of the Railway Road AQMA, was completed in 2008. The report concluded that a new AQMA in the Gaywood Clock area was required, as both updated monitoring data and predicted NO₂ concentrations confirmed that the AQS annual mean objective was likely to be exceeded. The new AQMA was declared in April 2009, for an area encompassing properties at the junction of Wootton Road, Gayton Road and Lynn Road.

The Further Assessment confirmed that the extended Railway Road AQMA in King's Lynn Town Centre was still valid and should remain, as both monitoring and modelling confirmed exceedences of the AQS objective. The source apportionment results showed that cars are the main contributors with respect to high levels of NO₂ in the AQMA, followed by buses, HGVs and LGVs, while background pollution levels also contribute significantly.

The 2009 USA took into consideration changes to the Technical Guidance LAQM.TG(09) and concluded that although exceedences of NO₂ were still recorded in the Borough, these were confined to the existing AQMAs. Pollutant concentrations outside the AQMAs met the objectives and no Detailed Assessment was required.

The Further Assessment of the Gaywood Clock AQMA was completed in July 2010. The report confirmed the need for the AQMA as both monitoring and modelled concentrations still exceeded the NO₂ annual mean objective.

The 2010 and 2011 Annual Progress Reports concluded that no new Detailed Assessment were required as there were no new exceedences recorded outside the existing AQMAs.

Figure 1.1 Map of King's Lynn AQMA 1 – Railway Road (Town Centre)

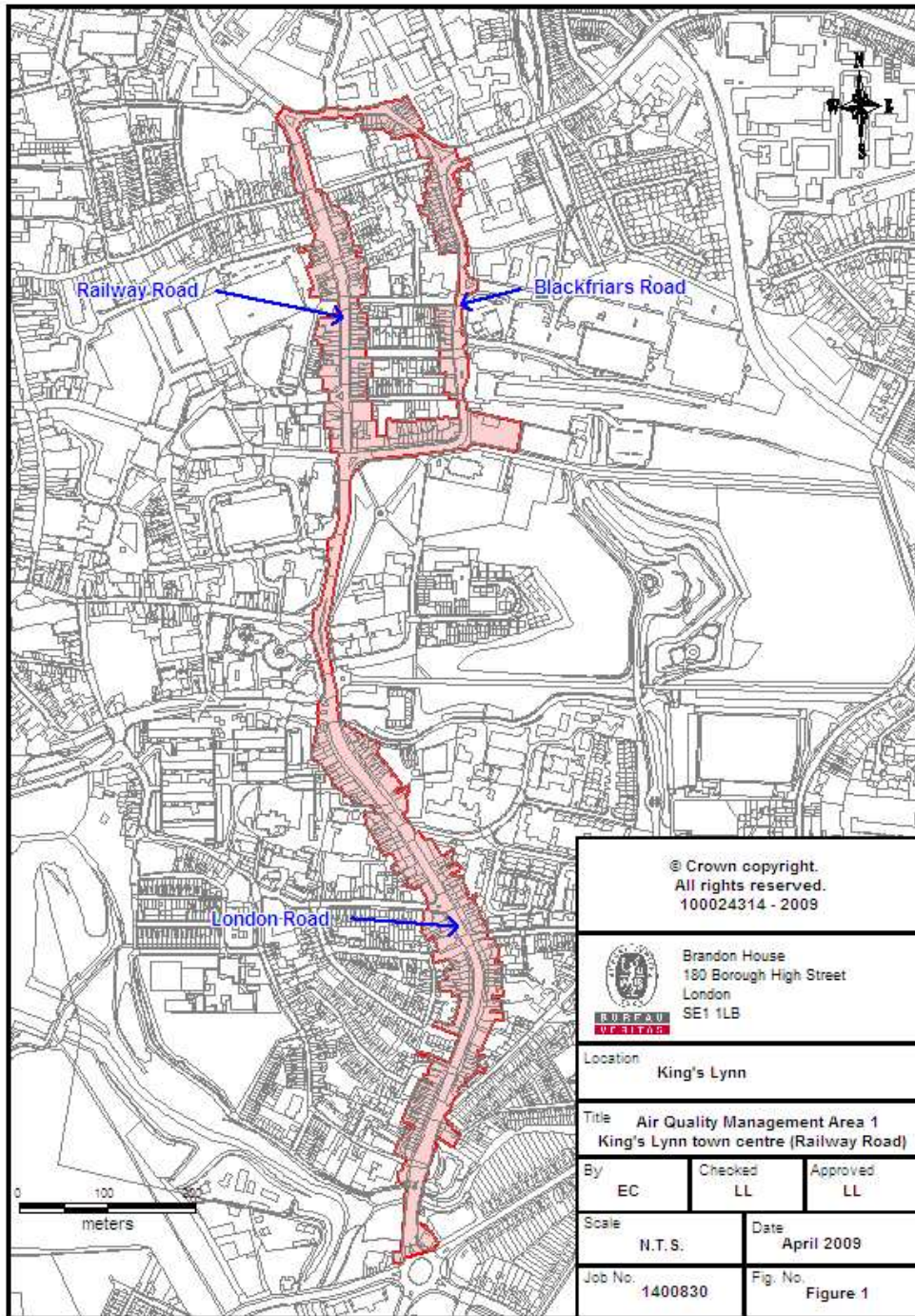
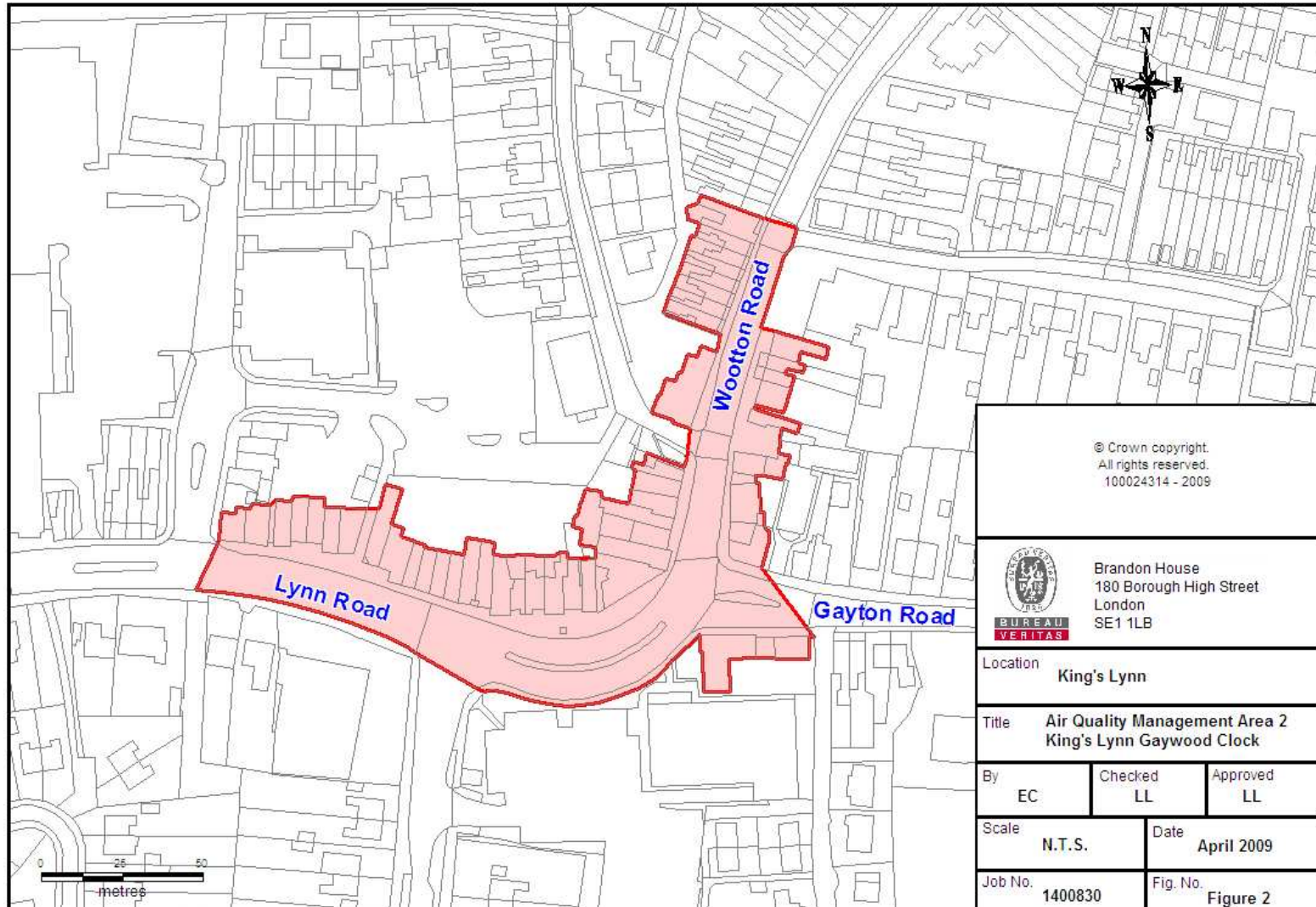


Figure 1.2 Map of King's Lynn AQMA 2 – Gaywood Clock



2 New Monitoring Data

2.1 Summary of Monitoring Undertaken

2.1.1 Automatic Monitoring Sites

The Borough Council of King's Lynn and West Norfolk undertook continuous monitoring of pollutants using reference methods at two locations during 2011: in Southgates, King's Lynn, and in the village of Leziate near a sand quarry site. The Borough Council have also installed a monitoring station in Gaywood, King's Lynn, however no data is available for 2011 due to power and installation issues. The site has been collecting data since January 2012. These sites are shown in Figure 2.1.

The Southgates station, which monitors nitrogen dioxide (NO₂) and particulates (PM₁₀) in King's Lynn town centre AQMA comprises a chemiluminescence NO_x / NO₂ analyser and a Tapered Element Oscillating Microbalance (TEOM) PM₁₀ analyser. Both analysers have been operational since 2006. In June 2011 a new chemiluminescence NO_x / NO₂ monitor was installed to replace the old instrument, which ceased operation in April 2011.

The Leziate monitoring station was established in July 2009 off Station Road near the sand quarry site entrance. From July 2011 the chemiluminescence NO_x / NO₂ analyser has been removed, the equipment was the old analyser from the Southgates station and has now ceased to work. There are no current NO₂ concerns in the Leziate. The station continues to operate with a TEOM PM₁₀ analyser.

In 2011 the Council also monitored particulate levels based on indicative method of Osiris dust and particle analysers across the Borough. Instruments are installed in the village of Stoke Ferry near an industrial site, Page Stair Lane to monitor dust from King's Lynn Docks and at Leziate near a sandy quarry site.

Further details of these monitoring stations are provided in Table 2.1.

Figure 2.1 Map of Automatic Monitoring Sites – King's Lynn






Borough Council of King's Lynn & West Norfolk  Tel. 01553 616200 - Fax. 01553 691663	Title Continuous Air Quality Monitoring Sites King's Lynn		Scale 1:25,000	Legend  Air Quality monitoring site © Crown copyright and database rights 2012 Ordnance Survey 100024314
	Project / Details USA 2012	Date August 2012	Drawn by / Department FAP	
	Drawing / Reference Number Figure 2.1			

Table 2.1 Details of Automatic Monitoring Sites

Site Name	Site Type	X OS GridRef	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Monitoring Technique	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Does this location represent worst-case exposure?
King's Lynn Southgates	Roadside	562227	319198	NO ₂ , PM ₁₀	Yes (NO ₂)	Chemiluminescence, TEOM	N	5m	No
Leziate	Industrial	567090	318257	NO ₂ , PM ₁₀ (TSP, PM ₁₀ , PM _{2.5} , PM ₁)	No	Chemiluminescence, TEOM, Osiris	Y – 25m	41m	No
Furlong Road, Stoke Ferry	Industrial	570339	300083	TSP, PM ₁₀ , PM _{2.5} , PM ₁	No	Osiris	Yes – 5m	1m	Yes
Page Stair Lane	Industrial	561527	320437	TSP, PM ₁₀ , PM _{2.5} , PM ₁	No	Osiris	Yes – 5m	3.3m	Yes

2.1.2 Non-Automatic Monitoring Sites

From May 2011, the Council monitored NO₂ at 64 sites in the Borough, based on passive diffusion tubes. The vast majority of the monitoring sites are located in King's Lynn town centre, including a set of triplicate tubes co-located with the continuous monitoring analyser in Southgates.

Project Atmosphere, an extension of the Council's diffusion tube programme with monitoring on ten school premises, collected additional data until March 2011. The Council has continued to monitor at six of the Project Atmosphere locations as Urban Background sites throughout 2011. The monitoring location at St Michaels School was maintained to form part of a background monitoring network in response to a waste incinerator application at the Willows, Saddlebow Industrial Area.

Overall, 27 diffusion tube sites are located in the town centre AQMA, and 5 other sites are within the Gaywood Clock AQMA.

Three new sites were installed in May 2011 to monitor NO₂ in response to the application for a waste incinerator application at the Willows. All tubes are outside the AQMA boundaries:

- Ferry Square, West Lynn;
- Main Road, West Winch; and
- Saddlebow Caravan Park, King's Lynn.

In relation to the above application four tubes were installed in August 2010, these were;

- 9 Sydney Terrace;
- 5 Burnley Road;
- Mayfield House Lynn Road, Saddlebow; and
- New Farm House, High Road, Saddlebow

Diffusion tubes in 2011 were prepared and analysed by Gradko International Limited. The tube preparation method is 20% TEA in water. Gradko International participates in the Workplace Analysis Scheme for Proficiency (WASP) for NO₂ diffusion tube analysis. This provides strict performance criteria for participating laboratories to meet, thereby ensuring NO₂ concentrations reported are of a high calibre. In WASP data rounds 112 through to 114 (January to September 2011) Gradko International have scored 100%, for round 115

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(October to December 2011) the WASP score was 37.5%. The percentage score reflects the results deemed to be satisfactory based upon the z-score of $< \pm 2$.

Data have been corrected using a bias adjustment factor, which is an estimate of the difference between diffusion tube concentrations and continuous monitoring, the latter assumed to be a more accurate method of monitoring. The technical guidance LAQM.TG (09) provides guidance with regard to the application of a bias adjustment factor to correct diffusion tubes. Triplicate co-location studies can be used to determine a local bias factor based on the comparison of diffusion tube results with data from NO_x / NO_2 continuous analysers. Alternatively, the national database of diffusion tube co-location surveys provides bias factors for the relevant laboratory and preparation method.

There are triplicate co-located tubes in the King's Lynn and West Norfolk Borough Council area. Data capture for the continuous monitor located at Southgates was 83% for the year. The local bias-adjustment factor is 0.79.

As the data capture from the local continuous monitor is less than 90%, and data is unavailable for two months from the year, the National Bias factor for this laboratory and preparation method has been used, for 2011 the bias adjustment factor is 0.89 (March 2012).

For previous data, years 2008 to 2010, the bias adjustment factors have been taken from the Council's previous LAQM annual reports. The factors used were 0.88 (2008), 0.97 (2009) and 0.88 (2010).

The details of the NO_2 monitoring network are shown in table 2.2 and Figure 2.2 through to Figure 2.5.

Figure 2.2 Map of Non-Automatic Monitoring Sites – King's Lynn AQMA 1 and Gaywood Clock AQMA

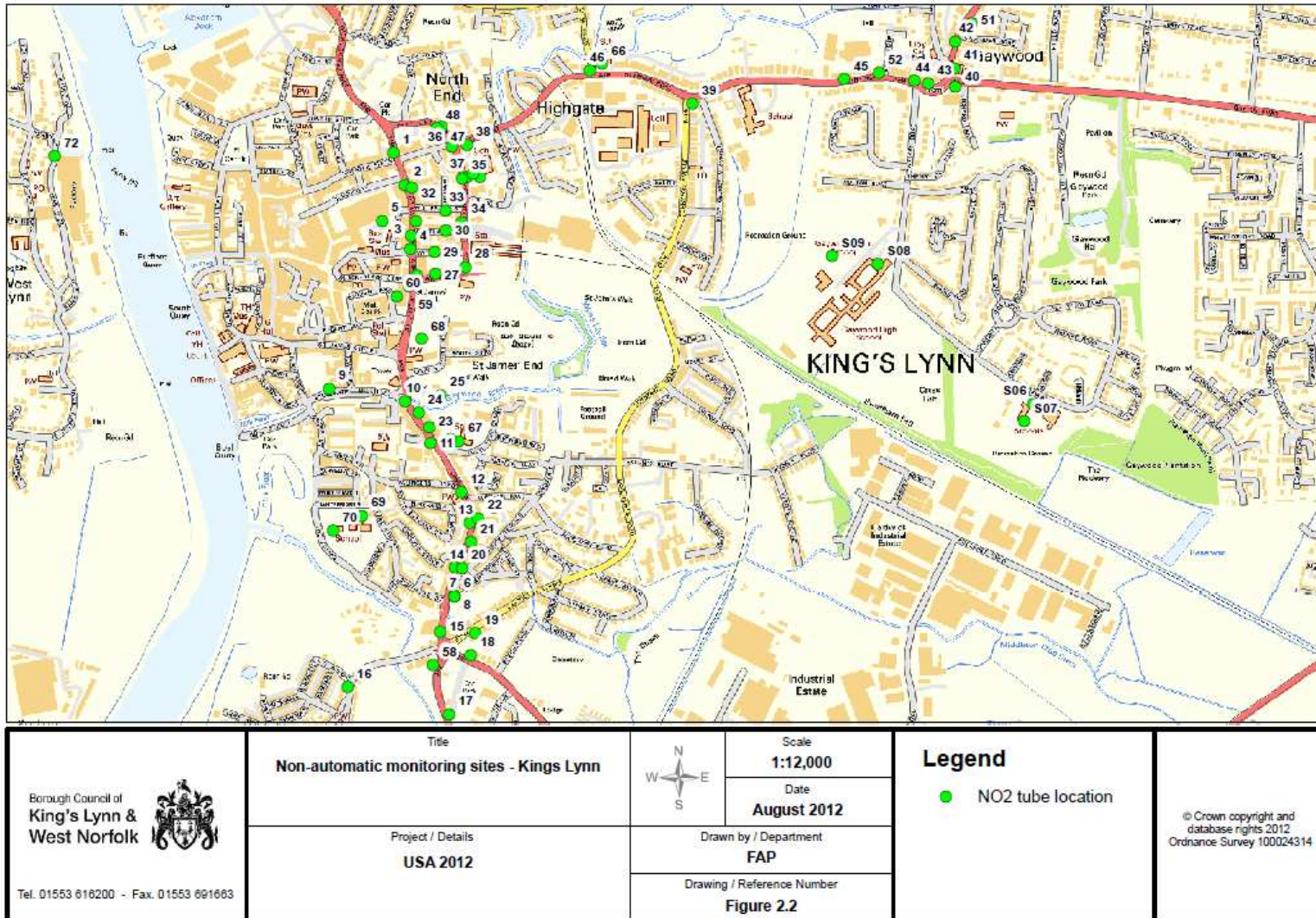


Figure 2.3 Map of Non-Automatic Monitoring Sites - Wisbech

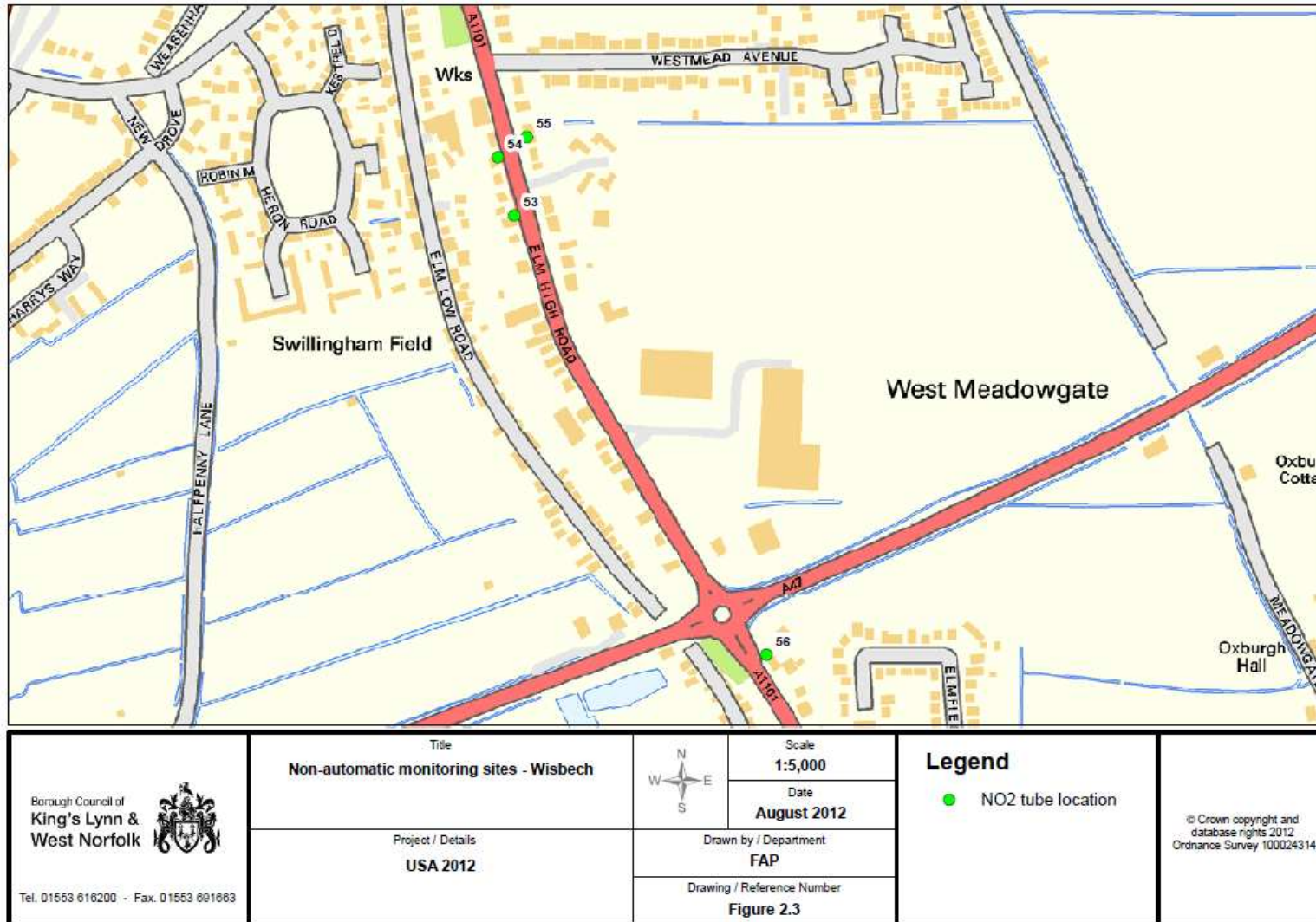
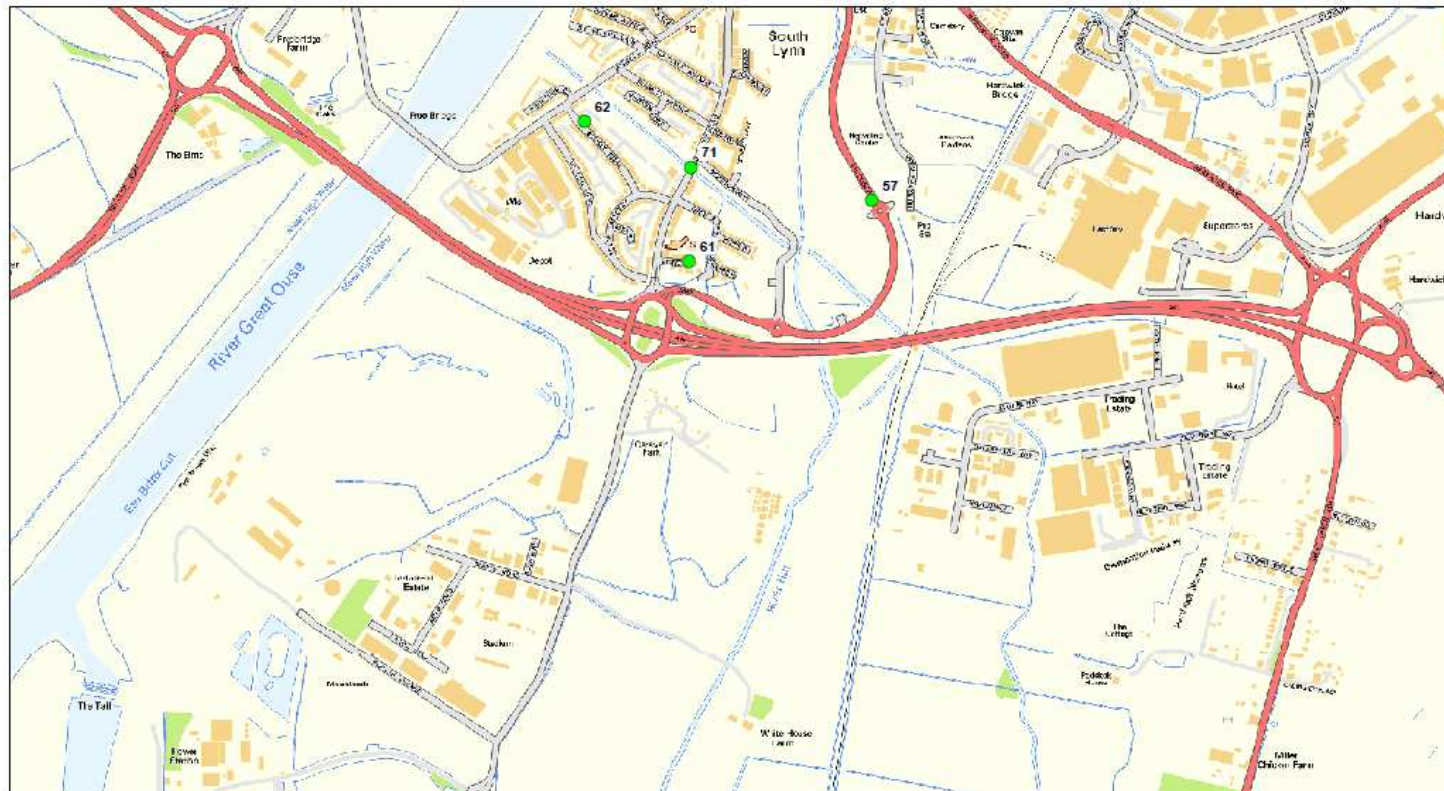


Figure 2.4 Map of Non-Automatic Monitoring Sites – South Lynn





 <p>Borough Council of King's Lynn & West Norfolk</p> <p>Tel. 01553 616200 - Fax. 01553 691663</p>	<p>Title</p> <p>Non-automatic monitoring sites - South Lynn</p>		<p>Scale</p> <p>1:12,000</p>	<p>Legend</p> <p>● NO2 tube location</p>	<p>© Crown copyright and database rights 2012. Ordnance Survey 100024314</p>
	<p>Project / Details</p> <p>USA 2012</p>		<p>Date</p> <p>August 2012</p>		
	<p>Drawn by / Department</p> <p>FAP</p>		<p>Drawing / Reference Number</p> <p>Figure 2.4</p>		

Figure 2.5 Map of Non-Automatic Monitoring Sites - Saddlebow and West Winch





 <p>Borough Council of King's Lynn & West Norfolk</p> <p>Tel. 01553 616200 - Fax. 01553 691663</p>	<p>Title</p> <p>Non-automatic monitoring sites – Saddlebow & W Winch</p>		<p>Scale</p> <p>1:12,000</p>	<p>Legend</p> <p>● NO2 tube location</p>	<p>© Crown copyright and database rights 2012 Ordnance Survey 100024314</p>
	<p>Project / Details</p> <p>USA 2012</p>		<p>Date</p> <p>August 2012</p>		
		<p>Drawn by / Department</p> <p>FAP</p>			
		<p>Drawing / Reference Number</p> <p>Figure 2.5</p>			

Table 2.2 Details of Non-Automatic Monitoring Sites

Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Does this location represent worst-case exposure?
1	Kerbside	562073	320304	NO ₂	Y – Town Centre	N	Y - 3m	2m	Y
2	Roadside	562100	320222	NO ₂	Y – Town Centre	N	Y - 0m	2m	Y
3	Roadside	562117	320095	NO ₂	Y – Town Centre	N	Y - 0m	1.5m	Y
4	Kerbside	562115	320062	NO ₂	Y – Town Centre	N	Y - 2.5m	1m	Y
5	Roadside (Bus Station)	562055	320137	NO ₂	N	N	N	N/A	Y
6,7,8	Roadside	562113	320043	NO ₂	Y – Town Centre	Y	No but property façade 4m from kerb further north	5m	Y
9	Roadside	562227	319198	NO ₂	N	N	No but property façade 4m from kerb in same street	4m	Y
10	Roadside	561900	319707	NO ₂	Y	N	Y - 2.5m	3m	Y

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Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Does this location represent worst-case exposure?
11	Roadside	562101	319679	NO ₂	Y – Town Centre	N	Y - 0m	3m	Y
12	Roadside	562154	319594	NO ₂	Y – Town Centre	N	Y - 1m	3m	Y
13	Roadside	562242	319452	NO ₂	Y – Town Centre	N	Y - 0m	4.5m	Y
14	Roadside	562264	319375	NO ₂	Y – Town Centre	N	Y - 0.5m	4m	Y
15	Roadside	562226	319263	NO ₂	Y – Town Centre	N	Y - 1m	0.5m	Y
17	Roadside	561958	318963	NO ₂	N	N	Y - 0m	11m	Y
18	Roadside	562209	318924	NO ₂	N	N	Y - 0m	7m	Y
19	Roadside	562266	319043	NO ₂	N	N	Y - 0m	6m	Y
20	Kerbside	562244	319261	NO ₂	Y – Town Centre	N	Y - 0m	3.5m	Y
22	Roadside	562285	319386	NO ₂	Y – Town Centre	N	Y - 0m	5m	Y
23	Roadside	562162	319614	NO ₂	Y – Town Centre	N	Y - 0m	4.5m	Y
24	Roadside	562136	319651	NO ₂	Y – Town Centre	N	Y - 0m	5.5m	Y
25	Urban	562191	319695	NO ₂	N	N	Y - 0m	75m	Y

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Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Does this location represent worst-case exposure?
	Background								
26	Roadside	562131	319996	NO ₂	Y – Town Centre	N	Y - 0m	2m	Y
27	Roadside	562178	319999	NO ₂	Y – Town Centre	N	Y - 3m	2m	Y
28	Roadside	562253	320016	NO ₂	Y – Town Centre	N	Y - 0m	1.5m	Y
29	Kerbside	562175	320055	NO ₂	N	N	Y - 2.5m	1m	Y
30	Kerbside	562204	320108	NO ₂	N	N	Y - 2.5m	1m	Y
31	Kerbside	562129	320132	NO ₂	Y – Town Centre	N	Y - 0m	2m	Y
32	Roadside	562119	320216	NO ₂	Y – Town Centre	N	Y - 0m	2m	Y
33	Kerbside	562203	320159	NO ₂	N	N	Y - 2.5m	0.5m	Y
34	Roadside	562244	320129	NO ₂	Y – Town Centre	N	Y - 0m	2.5m	Y
35	Roadside	562248	320239	NO ₂	Y – Town Centre	N	Y - 3m	1.5m	Y
36	Roadside	562219	320319	NO ₂	Y – Town Centre	N	Y - 0m	2m	Y
37	Roadside	562257	320243	NO ₂	Y – Town Centre	N	No	2m	Y

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Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Does this location represent worst-case exposure?
38	Roadside	562257	320323	NO ₂	Y – Town Centre	N	Y - 0m	2.5m	Y
39	Roadside	562822	320427	NO ₂	N	N	Y - 0m	7m	Y
40	Roadside	563480	320470	NO ₂	Y – Gaywood Clock	N	Y - 0m	2m	Y
41	Roadside	563478	320515	NO ₂	Y – Gaywood Clock	N	Y - 0m	2m	Y
42	Roadside	563480	320582	NO ₂	Y – Gaywood Clock	N	Y - 0m	3m	Y
43	Roadside	563412	320477	NO ₂	Y – Gaywood Clock	N	Y - 0m	5m	Y
44	Roadside	563377	320484	NO ₂	Y – Gaywood Clock	N	Y - 0m	2m	Y
45	Roadside	563202	320488	NO ₂	N	N	Y - 0m	4.5m	Y
46	Roadside	562565	320509	NO ₂	N	N	Y - 0m	6.5m	Y
47	Roadside	562193	320369	NO ₂	Y – Town Centre	N	Y - 0.5m	1m	Y
48	Roadside	562180	320365	NO ₂	Y – Town Centre	N	Y - 0m	2m	Y
51	Roadside	563515	320628	NO ₂	N	N	Y - 6m	1.5m	Y
52	Roadside	563288	320499	NO ₂	N	N	Y - 5.5m	1m	Y
53	Roadside	546947	308215	NO ₂	N	N	Y - 0m	2m	Y

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Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Does this location represent worst-case exposure?
54	Roadside	546940	308207	NO ₂	N	N	Y - 0m	2m	Y
55	Roadside	546945	308216	NO ₂	N	N	Y - 0m	2m	Y
58	Roadside	562186	319031	NO ₂	N	N	Y - 18m	2m	Y
61	Roadside	561854	318272	NO ₂	N	N	Y - 0m	3.5m	Y
62	Roadside	561615	318591	NO ₂	N	N	Y - 0m	7m	Y
63	Roadside	560593	315712	NO ₂	N	N	Y - 0m	15m	N
64	Roadside	560917	316766	NO ₂	N	N	Y - 0m	22m	N
S1	Urban Background	562296	320278	NO ₂	N	N	Y - 0m	N/A	Y
S2	Urban Background	562296	320278	NO ₂	N	N	Y - 0m	N/A	Y
S3	Urban Background	564696	321958	NO ₂	N	N	Y - 0m	N/A	Y
S4	Urban Background	563965	322509	NO ₂	N	N	Y - 0m	N/A	Y
66 (previously be S5)	Urban Background	562601	320516	NO ₂	N	N	Y - 0m	N/A	Y
S6	Urban Background	563699	319679	NO ₂	N	N	Y - 0m	N/A	Y
S7	Urban Background	563699	319679	NO ₂	N	N	Y - 0m	N/A	Y

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Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Does this location represent worst-case exposure?
S8	Urban Background	563296	319988	NO ₂	N	N	Y - 0m	N/A	Y
S9	Urban Background	563296	319988	NO ₂	N	N	Y - 0m	N/A	Y
S10	Urban Background	562222	319576	NO ₂	N	N	Y - 0m	N/A	Y
67 (previously S11)	Urban Background	562222	319576	NO ₂	N	N	Y - 0m	N/A	Y
68 (previously S12)	Urban Background	562208	319493	NO ₂	N	N	Y - 0m	N/A	Y
69 (previously S13)	Urban Background	562215	319502	NO ₂	N	N	Y - 0m	N/A	Y
70 (previously S14)	Urban Background	562215	319502	NO ₂	N	N	Y - 0m	N/A	Y
71 (previously S15)	Urban Background	561846	318514	NO ₂	N	N	Y - 0m	N/A	Y
72	Roadside	561223	320295	NO ₂	N	N	Y – 0.5m	1.5m	Y
73	Urban Background	563161	315848	NO ₂	N	N	Y – 10m	11m	Y

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Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Does this location represent worst-case exposure?
74	Roadside	561754	317910	NO ₂	N	N	Y – 5m	1m	Y

2.2 Comparison of Monitoring Results with AQ Objectives

2.2.1 Nitrogen Dioxide

There are two Air Quality Objectives for nitrogen dioxide, namely:

- the annual mean of $40\mu\text{g}/\text{m}^3$, and
- the 1-hour mean of $200\mu\text{g}/\text{m}^3$ not to be exceeded more than 18 times a year.

Automatic Monitoring Data

The Council monitored NO_2 at two locations during 2011, Southgates and Leziate (monitored up to July). Data capture was limited at both sites during the period due to communications issues and as such the data has been annualised and the 99.8th percentile of NO_2 hourly means has also been reported.

The ratified monitoring data can be seen in table 2.3 and 2.4 below.

Results for 2011 indicate that both the annual mean and the 1-hour objectives for NO_2 were met. There were no exceedences of the 1-hour mean objective recorded in 2011.

Figure 2.6 shows the trend in NO_2 concentration from 2008 through to 2011 at the Southgates monitoring site. This shows that concentrations peaked in 2009, following this there have been year on year decreases in the NO_2 concentration.

Table 2.3 Results of Automatic Monitoring of Nitrogen Dioxide: Comparison with Annual Mean Objective

Site ID	Site Type	Within AQMA?	Valid Data Capture for period of monitoring %	Valid Data Capture 2011 %	Annual Mean Concentration $\mu\text{g}/\text{m}^3$				
					2007	2008	2009	2010	2011
King's Lynn Southgates	Roadside	Y	83.0	83.0	-	27.2	30.4	26.5	22.5
Leziate	Industrial	N	74.3	41.6	-	-	-	-	21.5 _a

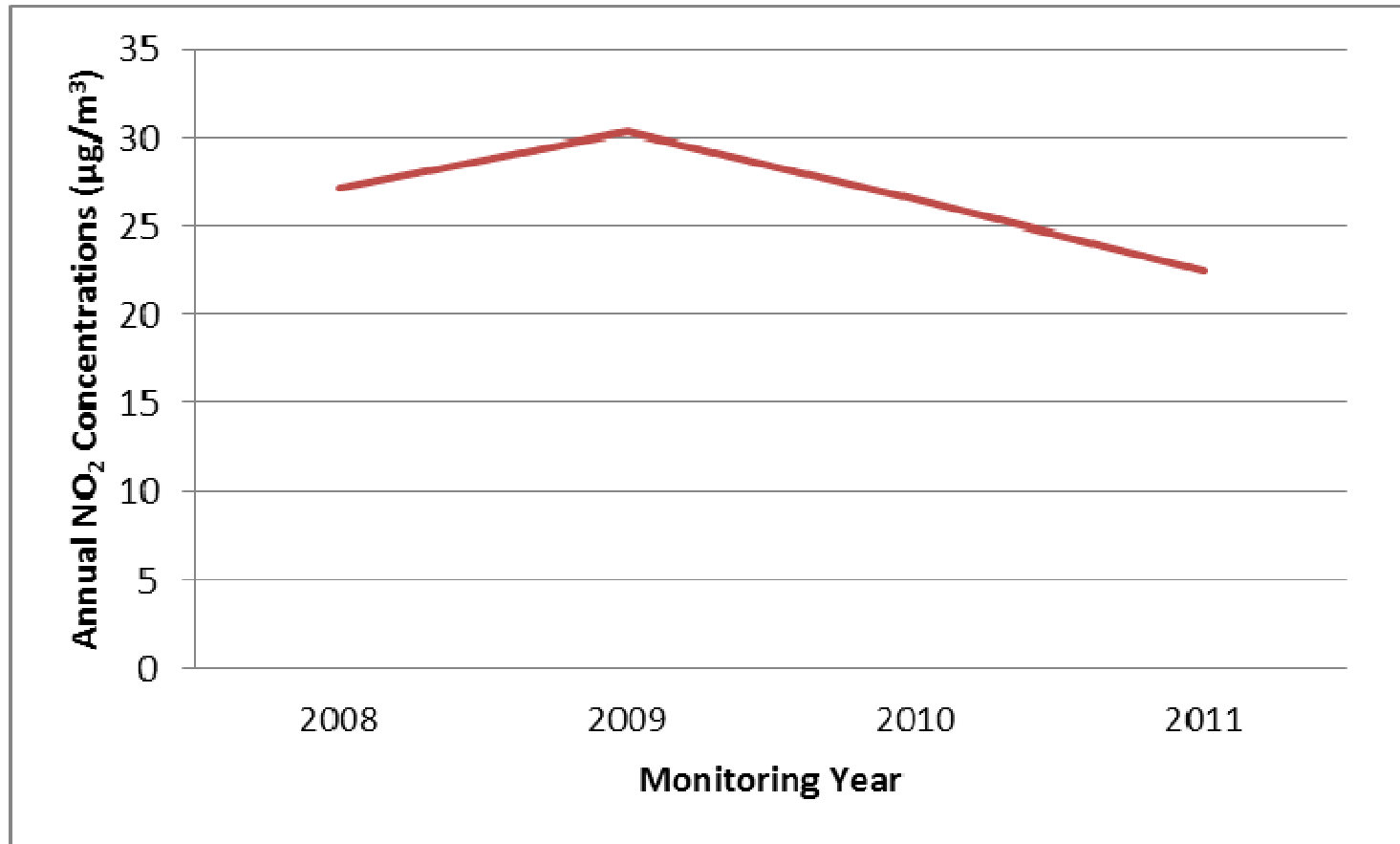
^a Data has been annualised as in Box 3.2 of TG(09) Leziate monitoring 01/01/2011 – 24/07/2011

Table 2.4 Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with 1-hour mean Objective

Site ID	Site Type	Within AQMA?	Valid Data Capture for period of monitoring %	Valid Data Capture 2011 %	Number of Exceedences of Hourly Mean ($200 \mu\text{g}/\text{m}^3$)				
					2007	2008	2009	2010	2011
King's Lynn Southgates	Roadside	Y	58.2	58.2	-	0	0	0	0
Leziate	Industrial	N	41.6	41.6	-	-	-	-	0 (83)

99.8th percentile of hourly means in brackets

Figure 2.6 Trends in Annual Mean Nitrogen Dioxide Concentrations measures at Automatic Monitoring Sites



The above figure shows the trend in annual NO₂ concentration at the Southgates monitoring site. From this it can be seen that NO₂ concentrations have steadily fallen from their peak in 2009. For all monitored years the annual mean concentration has been below the AQS Objective for this monitoring site. There is insufficient data available for trend analysis for the Leziate monitoring station.

Diffusion Tube Monitoring Data

The nitrogen dioxide diffusion tube data are summarised in Table 2.5. The full dataset (monthly mean values) are included in Appendix A.

Data capture for 2011 was good, with annualisation required only for those sites which were discontinued or started part way through the year. Full details regarding the annualisation can be found in Appendix A.

For the 2011 data set there were four sites where the annual mean Air Quality Objective was exceeded.

Three sites were located within the Town Centre AQMA – Railway Road 4, Railway Road 5, and London Road 1. These sites have shown exceedences in previous years and two locations have shown an increasing trend. This shows that the AQMA is still required in the Town Centre.

Site 5, Bus Station 1 was the only site to exceed the Air Quality Objectives outside of an existing AQMA. The site has exceeded the objective in previous years. As mentioned in previous reports the site is not relevant of public exposure with regards to the NO₂ annual mean objective. With respect to the hourly NO₂ objective, there could be a potential risk of exceedence where the annual mean concentration is greater than 60µg/m³. From the 2011 results it is unlikely that the hourly mean objective will be exceeded at this site.

Table 2.5 Results of Nitrogen Dioxide Diffusion Tubes in 2011

Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2011 (Number of Months or %)	Data with less than 9 months has been annualised (Y/N)	Confirm if data has been distance corrected (Y/N)	Annual mean concentration (Bias Adjustment factor = 0.89)
								2011 ($\mu\text{g}/\text{m}^3$)
1	Railway Road 1	Kerbside	Y – Town Centre	N	12	N	N	35.7
2	Railway Road 4	Roadside	Y – Town Centre	N	10	N	N	50.3
3	Railway Road 5	Roadside	Y – Town Centre	N	12	N	N	45.4
4	Railway Road 6	Kerbside	Y – Town Centre	N	12	N	N	36.9
5	Bus Station 1	Roadside (Bus Station)	N	N	10	N	N	42.5
6,7,8	Southgates Monitoring Station	Roadside	Y – Town Centre	Y	12	N	N	25.2
9	Mill Fleet 1	Roadside	N	N	11	N	N	22.3
10	London Road 1	Roadside	Y – Town Centre	N	12	N	N	42.1
11	London Road 2	Roadside	Y – Town Centre	N	12	N	N	30.6
12	London Road 3	Roadside	Y – Town Centre	N	10	N	N	33.9
13	London Road 4	Roadside	Y – Town Centre	N	12	N	N	32.0

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Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2011 (Number of Months or %)	Data with less than 9 months has been annualised (Y/N)	Confirm if data has been distance corrected (Y/N)	Annual mean concentration (Bias Adjustment factor = 0.89)
								2011 ($\mu\text{g}/\text{m}^3$)
14	London Road 5	Roadside	Y – Town Centre	N	12	N	N	34.3
15	Southgates	Roadside	Y – Town Centre	N	12	N	N	36.7
17	Nora 1	Roadside	N	N	12	N	N	27.1
18	Hardwick Rd	Roadside	N	N	12	N	N	28.2
19	Vancouver Avenue 1	Roadside	N	N	12	N	N	25.3
20	London Road 10	Kerbside	Y – Town Centre	N	12	N	N	30.6
22	London Road 6	Roadside	Y – Town Centre	N	12	N	N	34.7
23	London Road 7	Roadside	Y – Town Centre	N	12	N	N	34.3
24	London Road 8	Roadside	Y – Town Centre	N	12	N	N	31.8
25	The Walks	Urban Background	N	N	12	N	N	17.3
26	Railway Road 7	Roadside	Y – Town Centre	N	11	N	N	37.7
27	St John's Terrace	Roadside	Y – Town Centre	N	12	N	N	32.5
28	St John's Terrace/Blackfriar's	Roadside	Y – Town Centre	N	10	N	N	32.1

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Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2011 (Number of Months or %)	Data with less than 9 months has been annualised (Y/N)	Confirm if data has been distance corrected (Y/N)	Annual mean concentration (Bias Adjustment factor = 0.89)
								2011 ($\mu\text{g}/\text{m}^3$)
29	Waterloo Street	Kerbside	N	N	12	N	N	23.1
30	Portland Street	Kerbside	N	N	12	N	N	26.5
31	Railway Road 2	Kerbside	Y – Town Centre	N	11	N	N	35.4
32	Railway Road 3	Roadside	Y – Town Centre	N	12	N	N	33.4
33	Wellsley Street	Kerbside	N	N	11	N	N	30.4
34	Blackfriars 2	Roadside	Y – Town Centre	N	12	N	N	33.8
35	Blackfriars 1	Roadside	Y – Town Centre	N	12	N	N	30.6
36	Norfolk Street	Roadside	Y – Town Centre	N	12	N	N	31.7
37	Blackfriars 3	Roadside	Y – Town Centre	N	12	N	N	32.3
38	Littleport Street	Roadside	Y – Town Centre	N	12	N	N	36.7
39	Gaywood Road 2	Roadside	N	N	12	N	N	28.9
40	The Swan Gayton Road	Roadside	Y – Gaywood Clock	N	12	N	N	35.7

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Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2011 (Number of Months or %)	Data with less than 9 months has been annualised (Y/N)	Confirm if data has been distance corrected (Y/N)	Annual mean concentration (Bias Adjustment factor = 0.89)
								2011 ($\mu\text{g}/\text{m}^3$)
41	Wootton Road 2	Roadside	Y – Gaywood Clock	N	12	N	N	38.8
42	Wootton Road 1	Roadside	Y – Gaywood Clock	N	12	N	N	30.6
43	Lynn Road 1	Roadside	Y – Gaywood Clock	N	12	N	N	29.4
44	Lynn Road 2	Roadside	Y – Gaywood Clock	N	12	N	N	35.5
45	Gaywood Road 3	Roadside	N	N	11	N	N	31.5
46	Gaywood Road 1	Roadside	N	N	12	N	N	27.3
47	Austin Street 1	Roadside	Y – Town Centre	N	9	N	N	38.3
48	Austin Street 2	Roadside	Y – Town Centre	N	12	N	N	33.7
51	Wootton Road 3	Roadside	N	N	12	N	N	20.7
52	Lynn Road 3	Roadside	N	N	12	N	N	29.6
53	Wisbech Rd Elm 3	Roadside	N	N	11	N	N	26.9
54	Wisbech Rd Elm 4	Roadside	N	N	12	N	N	23.3
55	Wisbech Rd Elm 5	Roadside	N	N	12	N	N	18.9

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Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2011 (Number of Months or %)	Data with less than 9 months has been annualised (Y/N)	Confirm if data has been distance corrected (Y/N)	Annual mean concentration (Bias Adjustment factor = 0.89)
								2011 ($\mu\text{g}/\text{m}^3$)
58	NORR 2	Roadside	N	N	11	N	N	26.2
61	9 Sydney Terrace	Roadside	N	N	12	N	N	18.2
62	5 Burnley Road	Roadside	N	N	12	N	N	17.8
63	Mayfield House, Lynn Road	Roadside	N	N	12	N	N	11.2
64	New Farm House, High Road, Saddlebow	Roadside	N	N	12	N	N	11.6
S1	Eastgate 1 Primary School	Urban Background	N	N	3	Y	N	19.9
S2	Eastgate 2 Primary School	Urban Background	N	N	3	Y	N	23.3
S3	Reffley Community School	Urban Background	N	N	3	Y	N	15.7
S4	South Wootton Junior School	Urban Background	N	N	2	N*	N	22.0
66	Highgate Primary School	Urban Background	N	N	10	N	N	22.8
S6	Howard 1 Junior School	Urban Background	N	N	3	Y	N	14.4
S7	Howard 2 Junior School	Urban Background	N	N	1	N*	N	14.0
S8	Park 1 High School	Urban Background	N	N	3	Y	N	15.4

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Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2011 (Number of Months or %)	Data with less than 9 months has been annualised (Y/N)	Confirm if data has been distance corrected (Y/N)	Annual mean concentration (Bias Adjustment factor = 0.89)
								2011 ($\mu\text{g}/\text{m}^3$)
S9	Park 2 High School	Urban Background	N	N	2	N*	N	21.6
S10	Greyfriars 1 Primary School	Urban Background	N	N	3	Y	N	21.4
67	Greyfriars 2 Primary School	Urban Background	N	N	12	N	N	18.7
68	Nursery School	Urban Background	N	N	9	N	N	25.0
69	Whitefriars 1 Primary School	Urban Background	N	N	12	N	N	15.2
70	Whitefriars 2 Primary School	Urban Background	N	N	11	N	N	15.0
71	St Michael's Primary School	Urban Background	N	N	9	N	N	18.3
72	Ferry Square West Lynn	Roadside	N	N	8	Y	N	13.9
73	Main Road, West Winch	Urban Background	N	N	8	Y	N	21.2
74	Saddlebow Caravan Park, King's Lynn	Roadside	N	N	8	Y	N	15.5

* Data capture less than 3 months therefore cannot be annualised. Annual mean shown has not been annualised.

Table 2.6 Results of Nitrogen Dioxide Diffusion Tubes (2008 to 2011)

Site ID	Site Type	Within AQMA?	Annual mean concentration (adjusted for bias) $\mu\text{g}/\text{m}^3$			
			2008 (Bias Adjustment Factor = 0.88)	2009 (Bias Adjustment Factor = 0.97)	2010 (Bias Adjustment Factor = 0.88)	2011 (Bias Adjustment Factor = 0.89)
1	Kerbside	Y – Town Centre	44.4	46.7	37.4	35.7
2	Roadside	Y – Town Centre	51.5	56.6	46.8	50.3
3	Roadside	Y – Town Centre	46.8	53.1	45.6	45.4
4	Kerbside	Y – Town Centre	37.5	41.1	38.3	36.9
5	Roadside (Bus Station)	N	40.0	41.6	38.1	42.5
6,7,8	Roadside	Y – Town Centre	28.9	29.5	27.1	25.2
9	Roadside	N	23.4	24.4	24.6	22.3
10	Roadside	Y	41.1	45.8	40.0	42.1
11	Roadside	Y – Town Centre	31.6	34.6	31.9	30.6
12	Roadside	Y – Town Centre	38.5	39.6	33.5	33.9
13	Roadside	Y – Town Centre	36.0	38.5	32.7	32.0

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			Annual mean concentration (adjusted for bias) $\mu\text{g}/\text{m}^3$			
Site ID	Site Type	Within AQMA?	2008 (Bias Adjustment Factor = 0.88)	2009 (Bias Adjustment Factor = 0.97)	2010 (Bias Adjustment Factor = 0.88)	2011 (Bias Adjustment Factor = 0.89)
14	Roadside	Y – Town Centre	39.1	37.5	37.5	34.3
15	Roadside	Y – Town Centre	42.1	44.3	43.8	36.7
17	Roadside	N	20.3	21.7	25.4	27.1
18	Roadside	N	30.0	31.5	28.4	28.2
19	Roadside	N	24.6	29.0	26.3	25.3
20	Kerbside	Y – Town Centre	32.2	36.2	33.7	30.6
22	Roadside	Y – Town Centre	37.2	38.8	38.6	34.7
23	Roadside	Y – Town Centre	35.5	35.9	39.0	34.3
24	Roadside	Y – Town Centre	32.2	36.6	34.1	31.8
25	Urban Background	N	18.8	20.1	17.9	17.3
26	Roadside	Y – Town Centre	40.7	43.0	37.8	37.7
27	Roadside	Y – Town Centre	31.9	37.7	33.8	32.5
28	Roadside	Y – Town Centre	33.9	36.8	29.5	32.1

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			Annual mean concentration (adjusted for bias) $\mu\text{g}/\text{m}^3$			
Site ID	Site Type	Within AQMA?	2008 (Bias Adjustment Factor = 0.88)	2009 (Bias Adjustment Factor = 0.97)	2010 (Bias Adjustment Factor = 0.88)	2011 (Bias Adjustment Factor = 0.89)
29	Kerbside	N	24.8	25.8	23.5	23.1
30	Kerbside	N	25.2	28.4	24.4	26.5
31	Kerbside	Y – Town Centre	36.8	43.5	38.5	35.4
32	Roadside	Y – Town Centre	33.8	37.9	33.4	33.4
33	Kerbside	N	32.7	35.2	30.7	30.4
34	Roadside	Y – Town Centre	35.4	39.4	32.9	33.8
35	Roadside	Y – Town Centre	33.1	37.6	34.3	30.6
36	Roadside	Y – Town Centre	34.9	36.9	30.8	31.7
37	Roadside	Y – Town Centre	32.1	37.4	34.0	32.3
38	Roadside	Y – Town Centre	39.5	44.5	37.5	36.7
39	Roadside	N	27.8	31.5	29.0	28.9
40	Roadside	Y – Gaywood Clock	36.6	39.0	33.7	35.7

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			Annual mean concentration (adjusted for bias) $\mu\text{g}/\text{m}^3$			
Site ID	Site Type	Within AQMA?	2008 (Bias Adjustment Factor = 0.88)	2009 (Bias Adjustment Factor = 0.97)	2010 (Bias Adjustment Factor = 0.88)	2011 (Bias Adjustment Factor = 0.89)
41	Roadside	Y – Gaywood Clock	40.4	45.1	42.4	38.8
42	Roadside	Y – Gaywood Clock	31.6	35.4	31.2	30.6
43	Roadside	Y – Gaywood Clock	30.0	32.7	32.0	29.4
44	Roadside	Y – Gaywood Clock	34.1	38.6	35.8	35.5
45	Roadside	N	30.8	33.3	34.4	31.5
46	Roadside	N	28.2	30.4	28.7	27.3
47	Roadside	Y – Town Centre	41.0	43.8	39.5	38.3
48	Roadside	Y – Town Centre	33.4	38.3	30.6	33.7
51	Roadside	N	21.4	23.6	20.5	20.7
52	Roadside	N	30.7	37.0	32.1	29.6
53	Roadside	N	26.9	31.1	28.7	26.9
54	Roadside	N	23.8	28.2	25.1	23.3
55	Roadside	N	20.0	21.9	21.9	18.9

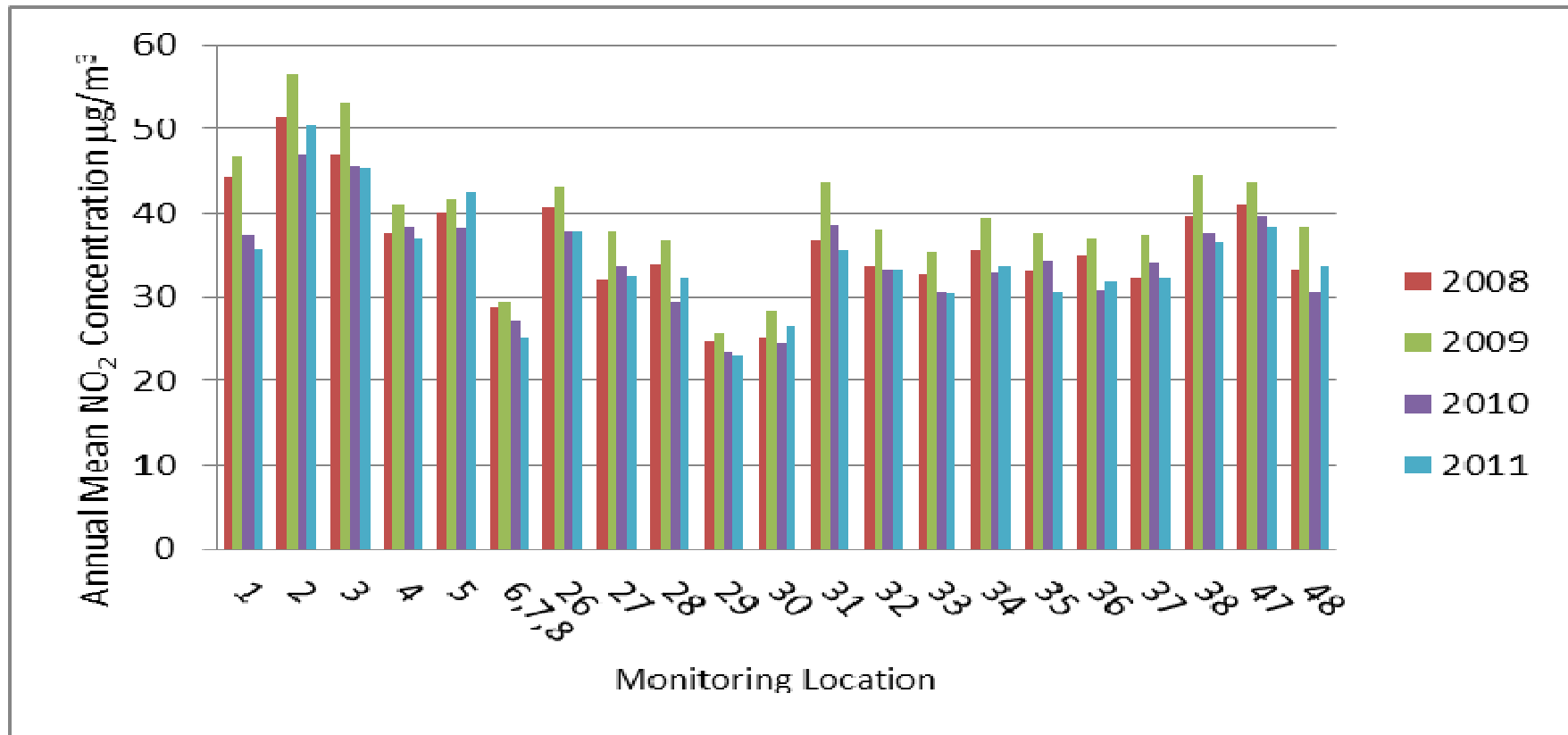
King's Lynn and West Norfolk Borough Council

			Annual mean concentration (adjusted for bias) $\mu\text{g}/\text{m}^3$			
Site ID	Site Type	Within AQMA?	2008 (Bias Adjustment Factor = 0.88)	2009 (Bias Adjustment Factor = 0.97)	2010 (Bias Adjustment Factor = 0.88)	2011 (Bias Adjustment Factor = 0.89)
58	Roadside	N	30.8	34.3	29.1	26.2
61	Roadside	N	-	-	17.2	18.2
62	Roadside	N	-	-	18.8	17.8
63	Roadside	N	-	-	13.7	11.2
64	Roadside	N	-	-	12.2	11.6
S1	Urban Background	N	20.0	21.8	19.3	19.9
S2	Urban Background	N	26.1	25.6	24.2	23.3
S3	Urban Background	N	14.8	17.5	16.2	15.7
S4	Urban Background	N	16.8	18.1	17.0	22.0
66	Urban Background	N	26.2	26.0	24.0	22.8
S6	Urban Background	N	15.3	14.9	13.6	14.4
S7	Urban Background	N	15.5	15.2	14.7	14.0
S8	Urban Background	N	15.1	16.7	15.9	15.4
S9	Urban Background	N	16.1	19.1	16.7	21.6
S10	Urban Background	N	22.2	23.0	20.1	21.4
67	Urban Background	N	21.5	21.9	18.8	18.7
68	Urban Background	N	23.8	25.3	22.8	25.0
69	Urban Background	N	17.5	18.5	16.1	15.2
70	Urban Background	N	16.5	17.0	17.3	15.0

King's Lynn and West Norfolk Borough Council

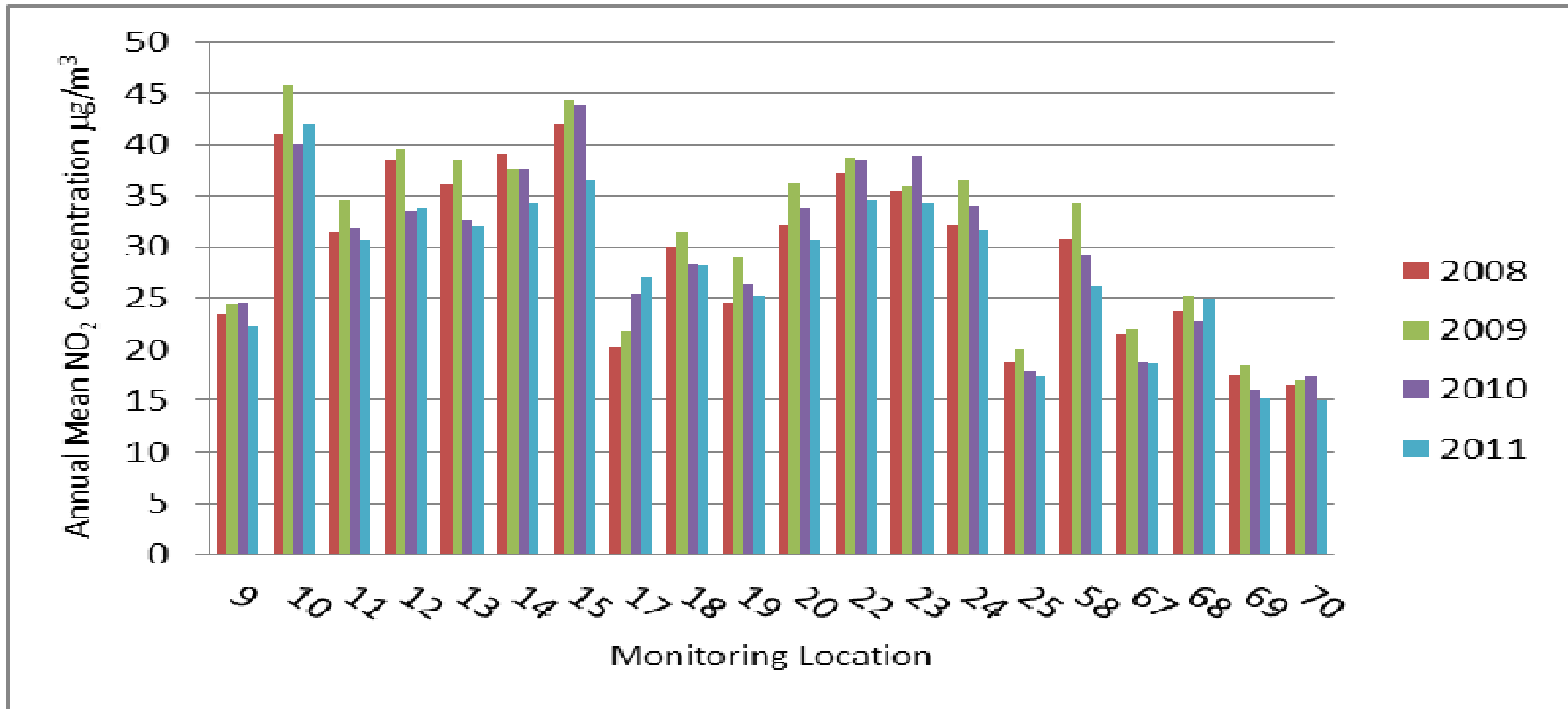
			Annual mean concentration (adjusted for bias) $\mu\text{g}/\text{m}^3$			
Site ID	Site Type	Within AQMA?	2008 (Bias Adjustment Factor = 0.88)	2009 (Bias Adjustment Factor = 0.97)	2010 (Bias Adjustment Factor = 0.88)	2011 (Bias Adjustment Factor = 0.89)
71	Urban Background	N	-	-	17.2	18.3
72	Roadside	N	-	-	-	13.9
73	Urban Background	N	-	-	-	21.2
74	Roadside	N	-	-	-	15.5

Figure 2.7 Trends in Annual Mean Nitrogen Dioxide Concentrations at Diffusion Tube Monitoring Sites King's Lynn AQMA 1 – North



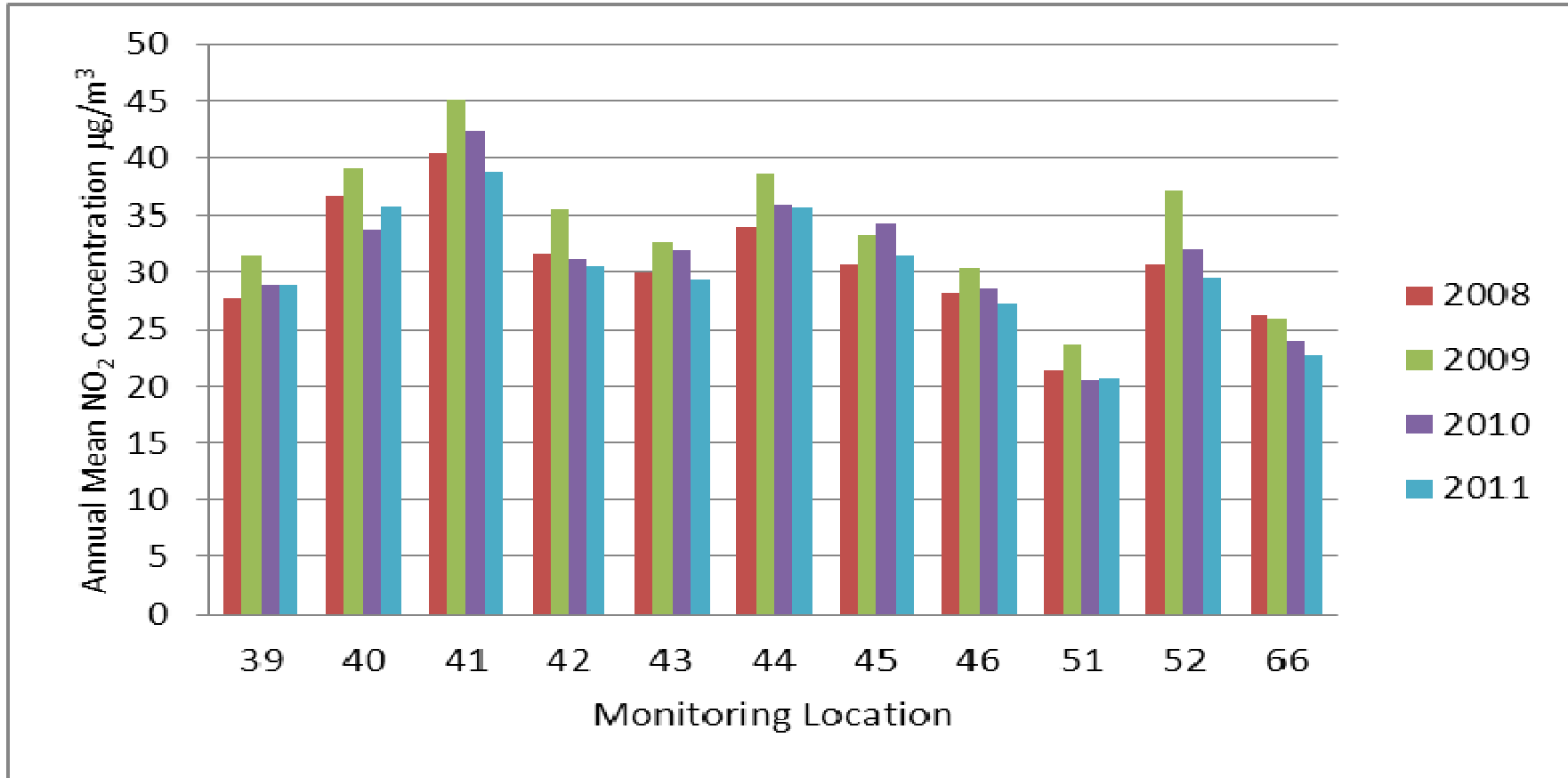
The above figure shows the trend in NO₂ concentration for those sites located in the North of the Town Centre and AQMA. For the majority of sites concentrations have fallen in 2011 when compared to the 2010 data. Of the sites where there has been an increase in concentration, all were inside the existing AQMA with the exception of Site 30. The graph shows that in the North of the town there were 3 locations (Sites 2, 3 and 5) where the concentration exceeded the annual mean of 40 µg/m³.

Figure 2.8 Trends in Annual Mean Nitrogen Dioxide Concentrations at Diffusion Tube Monitoring Sites King's Lynn AQMA 1 - South



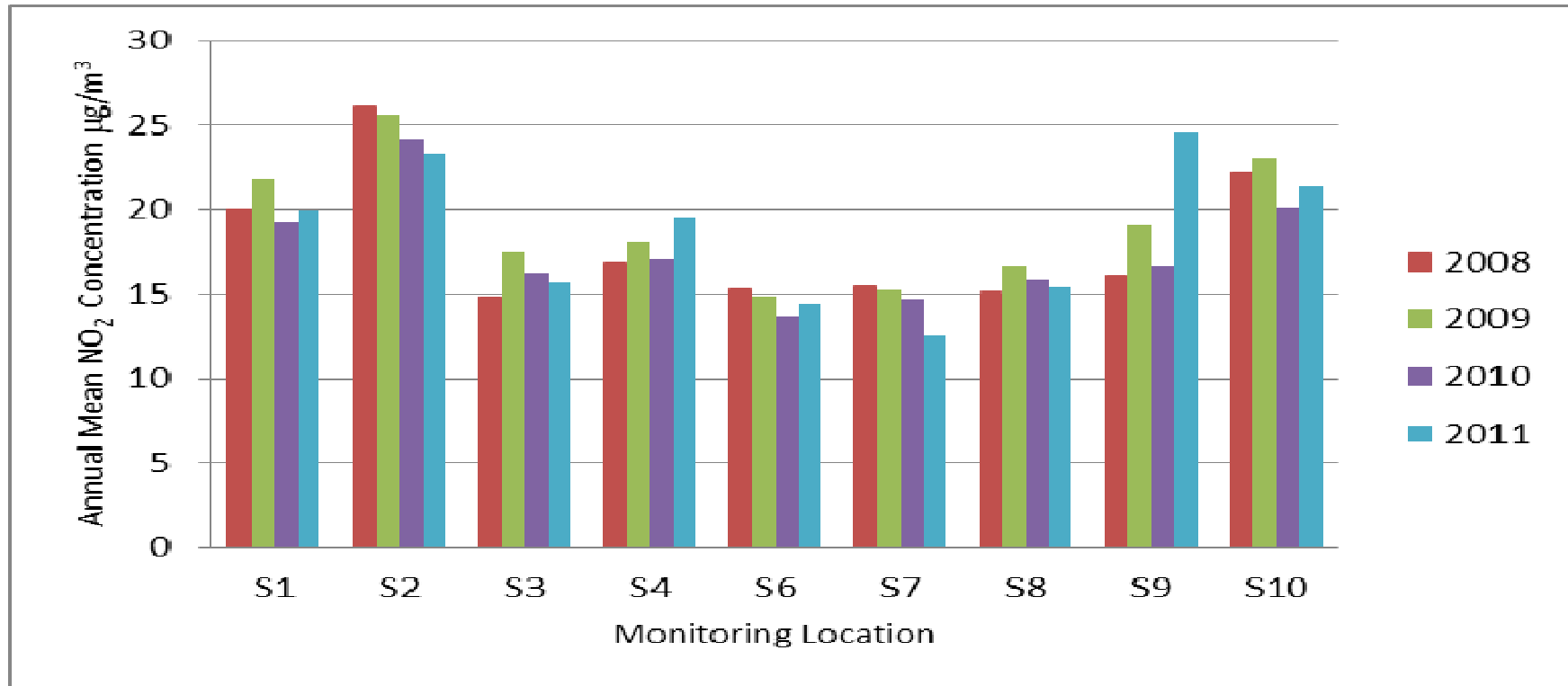
The above figure shows the trend in NO₂ concentration for those sites located in the South of the Town Centre and AQMA. For the majority of sites concentrations have fallen in 2011 when compared to the 2010 data. Of the sites where there has been an increase in concentration, two were in the existing AQMA (10 and 12), and two were outside (68 and 17). Site 17 has shown a year on year increase in annual mean concentrations since 2008. The graph shows that in the South of the town there was one location, Site 10, where the concentration exceeded the annual mean of 40 µg/m³.

Figure 2.9 Trends in Annual Mean Nitrogen Dioxide Concentrations at Diffusion Tube Monitoring Sites Gaywood Clock



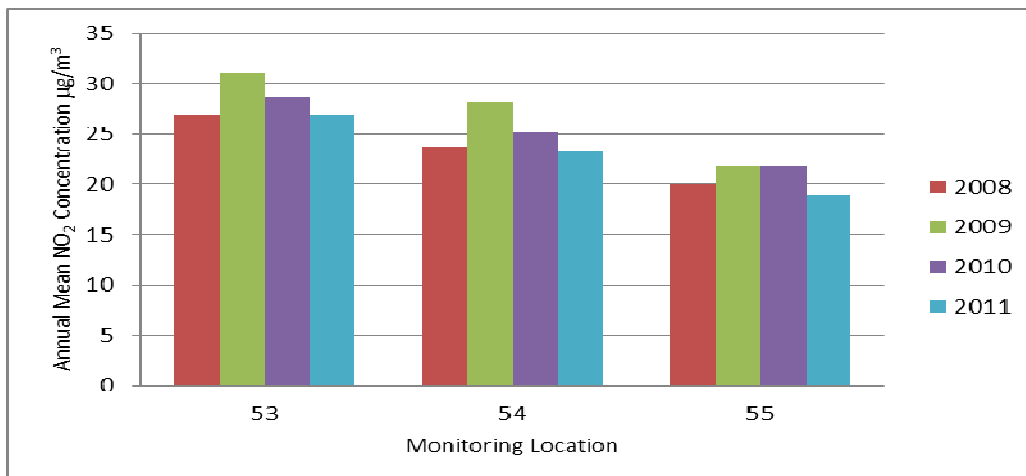
The above figure shows the trend in NO₂ concentration for those sites located in the Gaywood Clock AQMA and surrounding area. For the majority of sites concentrations have fallen in 2011 when compared to the 2010 data. Of the sites where there has been an increase in concentration, one is in the existing AQMA (40), and one was located outside (Site 51). The graph shows that in the Gaywood Clock area there were no monitoring locations where the concentration exceeded the annual mean of 40 µg/m³.

Figure 2.10 Trends in Annual Mean Nitrogen Dioxide Concentrations at Diffusion Tube Monitoring Sites - Project Atmosphere



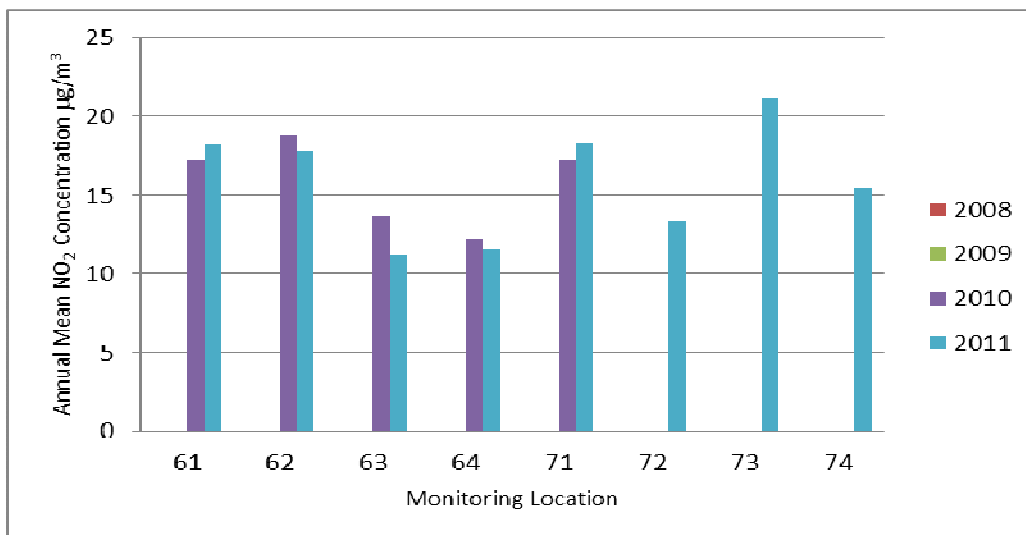
The above figure shows the trend in NO₂ concentration for those sites monitored as part of Project Atmosphere. These sites were monitored for 3 months in 2011, and as such the results for 2011 have been annualised. There have been a mix in trends observed for these sites, with some showing a decrease from 2010 concentrations and others increasing, with Site S9 showing the largest increase in concentration. For all sites the concentration remained below the annual mean objective of 40 µg/m³.

Figure 2.11 Trends in Annual Mean Nitrogen Dioxide Concentrations at Diffusion Tube Monitoring Sites - Wisbech



The above figure shows the trend in NO₂ concentration for those sites monitored in Wisbech in the east of the Borough. All three monitoring locations have shown a decrease in concentrations in 2011 when compared to the 2010 results. For all sites the concentration remained below the annual mean objective of 40 µg/m³.

Figure 2.12 Trends in Annual Mean Nitrogen Dioxide Concentrations at Diffusion Tube Monitoring Sites - The Willows EfW Application



The above figure shows the trend in NO₂ concentration for those sites monitored as background sites as part of the planning application submitted for an Energy from Waste incinerator at The Willows Industrial Estate. Of those sites installed in 2010, some have shown decreased concentrations (Site 62, 63 and 64) and others have increased (Site 61 and 71). For all sites the concentration remained below the annual mean objective of 40 µg/m³.

2.2.2 PM₁₀

There are two Air Quality Objectives for PM₁₀, namely:

- the annual mean of 40µg/m³; and
- the 24-hour mean of 50µg/m³ not to be exceeded more than 35 times a year.

The Council undertook monitoring of PM₁₀ based on TEOM analysers at two locations during 2011. Osiris dust and particles analysers were also installed at three locations in 2011. Results for the TEOMs have been VCM¹ corrected by AQDM who conduct the data management for the Council. Results for the Leziate monitoring site has been annualised as data capture was less than 75%. Details of the annualisation are provided in Appendix A. When data capture is below 90% the 90th percentile of PM₁₀ 24-hour means is also reported.

The 2011 results show that the annual mean and the 24-hour mean continue to be met at both monitoring locations within the district. The 2011 pollutant levels show a continuing increasing trend at Southgates and a continuing decreasing trend at Leziate.

There is a greater uncertainty in Osiris monitoring results as they are an indicative monitoring method only. Of the three sites, Leziate and Furlong Road show compliance with the annual mean and 24-hour mean AQS objective, however the Osiris located on Page Stair Lane is shown to exceed the annual mean and the 24-hour mean AQS objective.

¹ Volatile Correction Model – Used to correct TEOM measurements for the loss of volatile components of particulate matter that occur due to the high sampling temperatures employed by this instrument

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Table 2.7 Results of Automatic Monitoring of PM₁₀: Comparison with Annual Mean Objective

Site ID	Site Type	Within AQMA?	Valid Data Capture for monitoring Period %	Valid Data Capture 2011 %	Confirm Gravimetric Equivalent (Y or NA)	Annual Mean Concentration $\mu\text{g}/\text{m}^3$				
						2007	2008	2009	2010	2011
King's Lynn Southgates	Roadside	Y	87.0	87.0	Y	-	19.0	20.1	20.8	22.0
Leziate	Industrial	N	47.7	47.7	Y	-	-	27.1	21.3	20.5 ^a
Leziate - Osiris	Industrial	N	69.3	69.3	N	-	-	-	-	25
Furlong Road, Stoke Ferry	Industrial	N	74.2	74.2	N	-	-	16.5	19.5	37
Page Stair Lane	Industrial	N	82.8	82.8	N	-	-	-	-	42

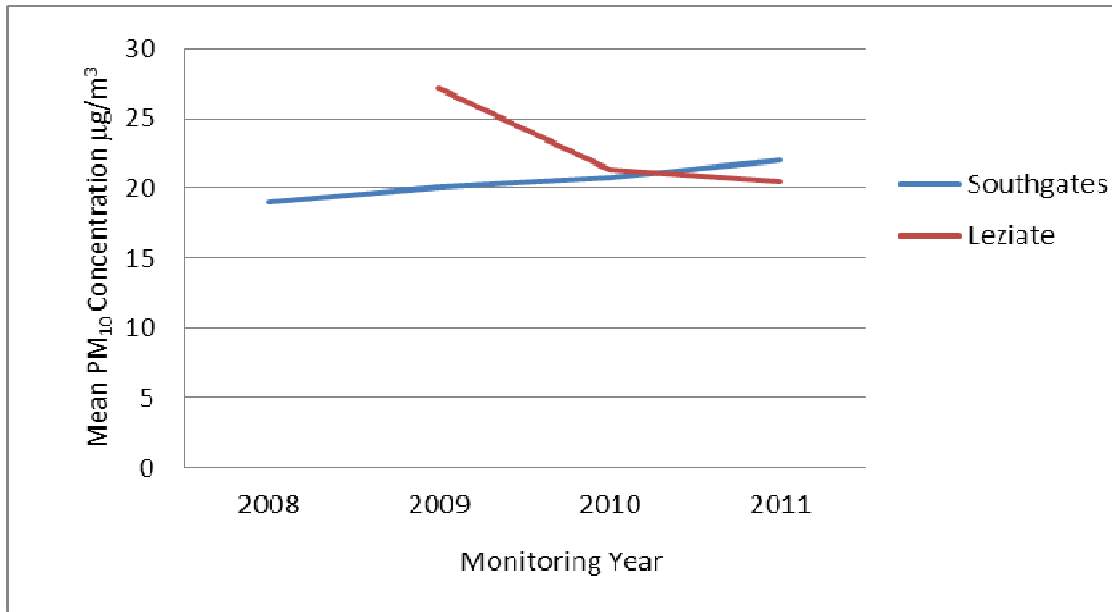
^a "annualised" as in Box 3.2 of TG(09)

Table 2.8 Results of Automatic Monitoring for PM₁₀: Comparison with 24-hour mean Objective

Site ID	Site Type	Within AQMA?	Valid Data Capture for monitoring Period %	Valid Data Capture 2011 %	Confirm Gravimetric Equivalent	Number of Exceedences of 24-Hour Mean ($50 \mu\text{g}/\text{m}^3$)				
						2007	2008	2009	2010	2011
King's Lynn Southgates	Roadside	Y	87.0	87.0	Y	-	1	3	1 (31.7)	3
Leziate	Industrial	N	47.7	47.7	Y	-	-	1	2 (31.9)	6 (41) ^a
Leziate - Osiris	Industrial	N	69.3	69.3	N	-	-	-	-	16
Furlong Road, Stoke Ferry	Industrial	N	74.2	74.2	N	-	-	-	-	22
Page Stair Lane	Industrial	N	82.8	82.8	N	-	-	-	-	78

^a if data capture is less than 90%, include the 90th percentile of 24-hour means in brackets

Figure 2.13 Trends in Annual Mean PM₁₀ Concentrations



The above figure shows the annual mean concentration of PM₁₀ from 2008 through to 2011. This shows that at the Southgates monitoring station PM₁₀ has been gradually increasing since 2008. The Leziate monitoring station has shown a different trend with a large decrease between 2009 and 2010 and a gradual decrease between 2010 and 2011.

2.2.3 Sulphur Dioxide

There is currently no Sulphur Dioxide monitoring undertaken by King's Lynn and West Norfolk Borough Council.

2.2.4 Benzene

There is currently no Benzene monitoring undertaken by King's Lynn and West Norfolk Borough Council.

2.2.5 Summary of Compliance with AQS Objectives

There were four NO₂ diffusion tube locations where the annual mean AQS Objective was exceeded in 2011, three of which were inside the existing Town Centre AQMA. The fourth site was located at the Bus Station 1 monitoring location. This site is not relevant of public exposure with regards to the annual mean NO₂ objective. From the 2011 data it is unlikely that the hourly NO₂ objective would be exceeded at this location as the annual mean is less than 60µg/m³.

With regards to PM₁₀, the 2011 results show that the annual mean and the 24-hour mean continued to be met at both monitoring locations within the district. One of the Osiris monitoring locations, Page Stair Lane, has shown there to be an exceedence of the 24-hour mean AQS Objective.

King's Lynn and West Norfolk Borough Council has measured concentrations of PM₁₀ above the 24-hour objective at relevant locations outside of the AQMA and **will need to proceed to a Detailed Assessment**, for the Page Stair Lane area.

3 Road Traffic Sources

3.1 Narrow Congested Streets with Residential Properties Close to the Kerb

Technical Guidance TG(09) defines narrow congested streets to have the following:

Daily traffic flow (AADT) of around 5,000 vehicles per day

- Congested street is one that has slow moving traffic that is frequently stopping and starting throughout the day.
- A narrow street is one with residential properties within 2 m of the kerb and buildings on both sides of the road

King's Lynn and West Norfolk Borough Council confirms that there have been no newly identified narrow streets with a vehicle flow of greater than 5,000 vehicles per day.

Three roads have previously been identified as narrow streets with traffic flows of greater than 5,000 vehicles per day.

- A148 Railway Road
- A148 London Road
- A148 Wootton Road, near the junction with Gayton Road and Lynn Road

These roads are all located within existing AQMAs.

King's Lynn and West Norfolk Borough Council confirms that there are no new/newly identified congested streets with a flow above 5,000 vehicles per day and residential properties close to the kerb, that have not been adequately considered in previous rounds of Review and Assessment.

3.2 Busy Streets Where People May Spend 1-hour or More Close to Traffic

There will be some street locations where individuals may regularly spend 1-hour or more close to busy traffic. For example, streets with many shops and streets with outdoor cafes and bars. The assessment considers areas not assessed adequately in previous rounds of review and assessment for the nitrogen dioxide objectives.

King's Lynn and West Norfolk Borough Council confirms that there are no new/newly identified busy streets where people may spend 1 hour or more close to traffic.

3.3 Roads with a High Flow of Buses and/or HGVs.

Traffic data assessed for the Updating and Screening Assessment show no roads with high flows of buses and heavy goods vehicles >20%.

King's Lynn and West Norfolk Borough Council confirms that there are no new/newly identified roads with high flows of buses/HDVs.

3.4 Junctions

The Technical Guidance TG(09) states that if a junction requires assessment the following criteria will be met.

- 'Busy' Junctions are those with more than 10,000 vehicles per day.
- Relevant exposure within 10 m of the kerb

Kings' Lynn and West Norfolk Borough Council has not identified any new junctions that have not been adequately considered in previous rounds.

King's Lynn and West Norfolk Borough Council confirms that there are no new/newly identified busy junctions/busy roads.

3.5 New Roads Constructed or Proposed Since the Last Round of Review and Assessment

King's Lynn and West Norfolk Borough Council confirms there are no new/proposed roads.

3.6 Roads with Significantly Changed Traffic Flows

Roads with significantly changed traffic flow (since the last round of review and assessment) should take into account the following:

- Daily traffic flow is 10,000 vehicles per day or more
- The increase in traffic flow is 25% or more

From 2009 through to 2011 there have been works undertaken in the Borough as part of the King's Lynn South Transport Major Scheme. The works have included junction improvements to Southgates roundabout with additional lanes and traffic light controls, the widening of the Nar Ouse Way at the A47 exit and upgrade of traffic signals as part of the new bus route and upgraded traffic signals at the following junctions; the St James Street, Regent Way and Blackfriars Road junction and the Railway Road and John Kennedy Road junction.

The aims of the scheme are to reduce congestion at the Southgates roundabout and reduce the number of car trips into the Air Quality Management Area by improving public transport, thereby contributing to improvements in air quality.

Air Quality has been considered as part of the approval process. For the Nar Ouse Regeneration Area (NORA) Bus and Cycle route the overall impact upon air quality has been assessed as neutral. Air quality will be slightly affected in the area due to an increase in bus use; however the works will improve air quality in other areas. The assessment for the Southgates roundabout found the impact upon air quality to be neutral as there may be marginal air quality improvements from the reduction in congestion. A slight beneficial outcome was given for the King's Lynn Town Centre area due to the improvements to pedestrian and cycle access and the measures to improve the flow of buses reducing the stop-start movements.

Whitefriars Primary School has been identified as the closest relevant receptor to the new bus route. There are three tubes currently monitoring which are in proximity of the bus route. These are tubes 69 and 70 (Whitefriars Primary School) and 58 (NORR2), which are 120m, 80m and 150m from the route respectively. Monitoring data from 2011 shows that NO₂ concentrations were below the AQS Objective at all three locations. It is expected that the use of the bus route will remove some buses from the AQMA in London Road. Passive and automatic monitoring will continue along London Road. Monitoring around the new bus route and in London Road area can be used to evaluate the impact that the bus route is having upon air quality in the area.

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In addition to the above works three planning applications have been granted which may have the potential to increase traffic flow in the area; a new Sainsbury Store, Hardwick Roundabout and Tesco Store on the Hardwick Road, King's Lynn and a Travelodge, Public House and retail units on the A148 Nar Ouse Way.

Sainsbury Store, Hardwick Roundabout

Planning permission has been granted for a new Sainsbury Store and associated improvements to the Hardwick Roundabout to improve access and traffic flow. The site is located on the A149 a road which using the latest available data from the Department for Transport website has greater than 10,000 vehicle movements per day. The planning application included transport plans to help reduce the number of vehicle movements made by staff. Once the site is completed updated traffic data and or diffusion tube monitoring should be considered to determine the impact upon air quality of the development.

Tesco Store, Hardwick Road

Planning permission has been granted for the development of a Tesco Store on land to the south of Hardwick Road. As part of the planning application an Air Quality Assessment was undertaken. The potential impacts of the development were assessed using ADMS Roads. The assessment has predicted that there will be slight increases in NO₂ at all identified receptors assessed, but concentrations still remain below the AQS Annual Mean Objective and some receptors will have slightly increased PM₁₀ concentrations. The overall assessment is that the development will not lead to a significant increase in emissions. As part of the applications highway improvements will be undertaken with the aim to mitigate the increase in car traffic. The improvements include the creation of two lanes in each direction along Hardwick Road and a central hatched area for right turning traffic between Scania Way and Campbells Meadow, widening of the Hardwick roundabout, improved signage and road markings, re-location of the bus lay-by and an improved cycleway. The aim of the improvements is to aid traffic flow. King's Lynn and West Norfolk Borough Council should consider installing diffusion tubes at locations highlighted in the air quality assessment as having the potential for increased NO₂ concentrations.

Travelodge, Nar Ouse Way

Planning permission has been granted for the development of land on the Nar Ouse Way for a Travelodge Hotel, public house and retail units. The planning application considered the air quality impacts of the development, both in the construction phase and the operational including the impact the development would have upon increased traffic flows. The

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assessment concluded that the change in vehicle flows along the A148 Nar Ouse Way, A148 London Road and A149 Hardwick Road would all be less than a 5% increase, leading to an imperceptible change in ambient concentrations of NO₂ and PM₁₀.

King's Lynn and West Norfolk Borough Council has assessed new/newly identified roads with significantly changed traffic flows, and concluded that it will not be necessary to proceed to a Detailed Assessment.

3.7 Bus and Coach Stations

The assessment considers both nitrogen dioxide and PM₁₀ emissions at bus stations that are not enclosed with >2500 movements per day.

King's Lynn and West Norfolk Borough Council confirms that the bus movements into and out of the station are less than 2,500 per day.

Monitoring for NO₂ is currently undertaken at the station. Measured concentrations have exceeded or been close to exceeding the annual mean AQS Objective over the past years. However the site is not relevant of public exposure with regards to the annual mean objective. There could be a potential risk of exceeding the hourly objective if the annual mean concentration was greater than 60µg/m³, the 2011 annual mean concentration was 42.5µg/m³, therefore the site is unlikely to exceed the hourly mean objective and there is no need to proceed to a Detailed Assessment.

King's Lynn and West Norfolk Borough Council has assessed the existing bus station, and concluded that it will not be necessary to proceed to a Detailed Assessment.

4 Other Transport Sources

4.1 Airports

King's Lynn and West Norfolk Borough Council confirms that there are no airports in the Local Authority area.

4.2 Railways (Diesel and Steam Trains)

The assessment for stationary trains considers sulphur dioxide emissions, while the assessment for moving diesel trains considers nitrogen dioxide emissions. If there are no railways carrying diesel or steam trains in the Local Authority area, there is no need to proceed further with this part.

4.2.1 Stationary Trains

Passenger services in King's Lynn are electric; however the freight trains using the King's Lynn to Middleton minerals line are diesel powered. This has been previously assessed with no requirement for a detailed assessment. There has been no significant change since the last round of review and assessment and therefore there is no need to proceed to a detailed assessment.

King's Lynn and West Norfolk Borough Council confirms that there are no locations where diesel or steam trains are regularly stationary for periods of 15 minutes or more, with potential for relevant exposure within 15m.

4.2.2 Moving Trains

Rail lines with a heavy traffic of diesel passenger trains are listed in the Technical Guidance TG (09).

King's Lynn and West Norfolk Borough Council confirms that there are no locations with a large number of movements of diesel locomotives, and potential long-term relevant exposure within 30m.

4.3 Ports (Shipping)

The assessment for shipping considers SO₂ emissions at busy ports with between 5,000 and 15,000 movements per year and relevant exposure within 250 meters.

During 2011 there were 532 ship movements at King's Lynn docks. In addition to this there are around fifty small fishing boats in the King's Lynn Fisher Fleet.

King's Lynn and West Norfolk Borough Council confirms that there are no ports or shipping that meet the specified criteria within the Local Authority area.

5 Industrial Sources

5.1 Industrial Installations

The assessment of industrial installations considers all of the regulated pollutants, although those most at risk of requiring further work are sulphur dioxide, NO₂, PM₁₀ and benzene

5.1.1 New or Proposed Installations for which an Air Quality Assessment has been Carried Out

There are several proposed installations in the Borough for which air quality is a consideration.

The Willows Energy from Waste facility

The proposed installation is a waste to energy plant located at The Willows Business Park, Saddlebow Road, King's Lynn. As part of the planning and permitting applications an air quality assessment has been submitted and assessed. The Borough Council employed Air Quality Consultants to provide peer review of the material submitted. A number of concerns were raised as part of the peer review and additional information was submitted and reviewed. The air quality assessment was based on detailed dispersion modelling of a number of pollutants including NO₂, SO₂ and PM₁₀ and potential impacts on relevant receptors and the Kings Lynn and Gaywood AQMAs.

The report concluded that the effects of the proposed facility are not significant in accordance with the H1 criteria, with the maximum long and short term concentrations below the criteria for all pollutants, except for three. Ground level concentrations of NO₂, cadmium and arsenic are predicted above the 1% screening level for the annual environmental assessment level (EAL). These levels have been compared with background concentrations and the maximum total predicted concentration of all three pollutants are all well below the relevant EAL. Therefore it was concluded there is a minimal risk to human health. Atmospheric dispersion modelling (ADM) showed that the levels of NO₂ and PM₁₀ would not lead to an extension of the existing AQMAs nor create an additional AQMA.

The air quality assessment took account of combined traffic and stack impacts and the cumulative impact with other industrial sources. ADM shows a contribution of NO₂ in an area of South Lynn above the 1% screening threshold and a maximum predicted increase at the Saddlebow Caravan Park. However, combined with the existing background, the annual mean concentration from traffic and stack sources will be well below the AQS objective. The maximum predicted cumulative impact of King's Lynn Power Stations A & B (proposed), and

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Palm Paper and Palm Paper sludge combustor (proposed) was considered and is below the EAL. The maximum predicted NO₂ (annual mean) cumulative impact is at Saddlebow Caravan Park. However, when added to the existing low background level the overall annual mean is well below the AQS objective.

The Environment Agency has published their decision and has granted the application. The environmental permit will not require offsite air quality monitoring. The Borough Council's monitoring programme does not cover areas where the largest ground level increases are predicted to occur. There remains public anxiety over these types of emissions. As a result the Borough Council recommended that should planning permission be granted that the operator be required to fund air quality monitoring around the site.

At the time of writing Norfolk County Council has granted planning permission for this proposal but has not required air quality monitoring as a condition or planning obligation.

The Extension of Centrica Power Station (King's Lynn B)

The Environment Agency has granted approval for a new Combined Cycle Gas Turbine Power Station on land adjacent to the existing power station within the Willows Business Park. The air quality assessment for the proposed development has found that for both the short term and long term AQS objectives for NO₂, SO₂ or PM₁₀ the development will not have a significant impact or lead to any exceedences.

The cumulative impacts of this development and the Willows have been considered and are discussed in the above section.

British Sugar Bioenergy, Wisington

The proposal is to utilise 60% of the pressed sugar beet pulp produced as part of the sugar manufacturing process. As part of the planning application an air quality assessment has been undertaken as part of the Environmental Impact Assessment. The assessment considered both the construction and the operational phases of the development, taking into account pollutants such as particulates and NO₂. With regards to the construction phase the dust impact has been considered at identified receptor sites. This assessment identified that there was a medium risk to the following sites during construction, the public bridleway, Prospect Farm and Gills Farm. As such a series of mitigation measures have been identified to reduce the impact upon these sensitive receptors. With regards to the operational phase of the facility a H1 assessment has been undertaken. The results of which showed that the highest ground level concentrations were within the Bioenergy or existing Sugar Factory

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boundaries and that ground concentrations outside of these areas are below air quality objectives. Fugitive dust and odour emissions have also been considered; as such the operational activities of the facility have been designed to reduce the impact of such emissions. The site will be operating under an Environmental Permit which will include requirements for the monitoring of both point source and fugitive emissions.

King's Lynn and West Norfolk Borough Council has assessed new/proposed industrial installations, and concluded that it will not be necessary to proceed to a Detailed Assessment.

5.1.2 Existing Installations where Emissions have Increased Substantially or New Relevant Exposure has been Introduced

There are three installations in Kings Lynn and West Norfolk Borough Council which have shown increased emissions. TG.09 considers a substantial increase to be one which is greater than 30%.

PIL Membranes, Estuary Road, Riverside Industrial Estate, PE30 2HS

Records from the Environment Agency show that there has been a 460% increase in Dichloromethane emissions and a 137% increase in Dimethylformamide emissions since 2009. Neither of these pollutants are part of the pollutants set out in the Air Quality Strategy. Therefore a Detailed Assessment is not required as part of the LAQM for this installation.

The installation is a permitted process; as such the emissions from the installation will continue to be monitored through the permit process. Further information from the Environment Agency is that the emissions from this installation are often varied with higher concentrations recorded in the past.

Palm Paper Ltd, Poplar Avenue, King's Lynn, PE34 3AL

This installation has shown increased emissions of CO₂ (76%), Particulate Matter (42%), SO₂ (241%) from 2010 emissions. The installation was permitted in 2009, with commissioning during the final quarter of 2009. The Environment Agency considers the 2011 emissions to be the first year of representative data, therefore the increases observed are not true to operating conditions. In addition the installation was considered in the 2009 USA. The Air Quality Assessment submitted as part of the planning process assessed NO₂, SO₂ and PM₁₀ using dispersion modelling. The report concluded that the impact of pollutant emissions

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generated from the plant would not be significant and that it would not lead to any exceedence of the AQS objectives. Emissions from this installation will be monitored through the permit process.

National Grid Gas Plc, King's Lynn Compressor Station, Walton Road, PE32 1HI

Emissions from the National Grid Gas Compressor Station have shown an increase of 61% in Methane from 2009 emissions. The Environment Agency reports the increase in emissions due to increased maintenance at the installation. Methane is not one of the pollutants set out in the Air Quality Strategy, therefore a Detailed Assessment is not required as part of the LAQM for this installation. Emissions from the process will continue to be monitored as part of the permitting process.

King's Lynn and West Norfolk Borough Council confirms that there are no industrial installations with substantially increased emissions relevant to the AQS or new relevant exposure in their vicinity within its area or nearby in a neighbouring authority.

5.1.3 New or Significantly Changed Installations with No Previous Air Quality Assessment

King's Lynn and West Norfolk Borough Council confirms that there are no new or proposed industrial installations for which planning approval has been granted within its area or nearby in a neighbouring authority.

5.2 Major Fuel (Petrol) Storage Depots

This assessment considers Benzene, with respect to the 2010 objective.

There are major fuel (petrol) storage depots within the Local Authority area, but these have been considered in previous reports.

5.3 Petrol Stations

The specified criteria for petrol stations requiring assessment as stated in the Technical Guidance TG (09) is a petrol station with the following:

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- Annual throughput of more than 2,000m³ of petrol per annum
- A busy road nearby, with more than 30,000 vehicles per day

King's Lynn and West Norfolk Borough Council confirms that there are no petrol stations meeting the specified criteria.

5.4 Poultry Farms

Studies have been conducted by the Environment Agency, Department for Environment Northern Ireland and a local authority. From the studies the following guidance has been produced as to assessment of poultry farms.

- Farms housing in excess of:
 - 400,000 birds if mechanically ventilated
 - 200,000 birds if naturally ventilated
 - 100,000 birds for any turnkey unit
- Relevant exposure within 100m of the poultry units.

King's Lynn and West Norfolk Borough Council confirms that there are no poultry farms meeting the specified criteria.

6 Commercial and Domestic Sources

6.1 Biomass Combustion – Individual Installations

There are three Biomass Combustion installations in the Borough which meet the criteria specified in TG(09); these are Reg Bio-Power Ltd Freedom Farm, National Construction College Stanhoe Road and the Glasshouses on Baptist Road.

Reg Bio-Power Ltd, Freedom Farm

Background and emissions monitoring have previously been undertaken by the site as part of the permitting requirements. The 2012 emissions monitoring shows that the emissions of Particulates and NO_x are below those stipulated as permit limits. The 2011 ambient air quality monitoring carried out at two locations showed that NO₂ concentrations were below the annual mean AQS Objective of 40µg/m³. King's Lynn and West Norfolk Borough Council have requested that monitoring is continued at the site as part of planning consent given by Norfolk County Council as the process is no longer under environmental permitting.

National Construction College, Stanhoe Road

For the above installation there has been no monitoring or air quality assessment undertaken. Therefore the installation has been screened using the Biomass Calculator Tool available on the LAQM website. The below have been used as the input parameters:

Table 6.1 National Construction College Biomass Data

Required Parameter	Input
Building Height (Tallest building within 5 x stack height)	7m
Stack Diameter	0.35m
Stack Height	8.1m
PM ₁₀ Annual Mean Background	15.18µg/m ³
NO ₂ Annual Mean Background	10.31µg/m ³
Emission Rate Particulates (g/s)	0.0131
Emission Rate NO _x (g/s)	0.0427

The calculator gave a target emission rate for PM₁₀ of 0.014g/s; therefore the actual emission rate does not exceed the target. With regards to NO₂ emissions, the target emission rate is 0.0727g/s for the annual mean and 0.0352g/s for the hourly mean. The calculated actual

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emission rate is greater than the target emission rate, indicating that there is a risk of exceedence of the hourly mean objective.

Further screening modelling has therefore been undertaken using ADMS Screen. This indicates that the maximum hourly impact close to the plant is less than $200\mu\text{g}/\text{m}^3$. The nearest receptor to the installation is a residential property located 105m away. Therefore the hourly mean objective is unlikely to be exceeded at this location.

Glasshouses, 52 Baptist Road, Upwell

The installation located in the above premises have not had any monitoring or air quality assessment undertaken. The installation has a maximum output of 1.5MW and therefore requires screening.

Table 6.2 Glasshouses Biomass Data

Required Parameter	Input
Building Height (Tallest building within 5 x stack height)	4.2m
Stack Diameter	0.3m
Stack Height	10.5m
PM ₁₀ Annual Mean Background	17.13 $\mu\text{g}/\text{m}^3$
NO ₂ Annual Mean Background	11.34 $\mu\text{g}/\text{m}^3$
Emission Rate Particulates (g/s)	0.02
Emission Rate NOx (g/s)	Not available

The calculator gave a target emission rate for PM₁₀ of 0.079g/s; therefore the actual emission rate does not exceed the target. There is currently no information relating to NOx emissions available. It is recommended that further information is obtained in relation to the NOx emissions. Once this information is obtained the screening exercise should be repeated in order to determine the impact upon NO₂ concentrations in the area.

King's Lynn and West Norfolk Borough Council has assessed the biomass combustion plant, and concluded that it will not be necessary to proceed to a Detailed Assessment.

6.2 Biomass Combustion – Combined Impacts

King's Lynn and West Norfolk Borough Council have 16 recorded domestic properties which have a biomass installation.

When mapped across the Borough there is a maximum of 1 installation per 500m², covering a total area of approximately 80m². This gives an emission density of approximately 161.50 kg/yr based on a single wood burning stove. This is well below the threshold value where a detailed assessment would be required.

King's Lynn and West Norfolk Borough Council has assessed the biomass combustion plant, and concluded that it will not be necessary to proceed to a Detailed Assessment.

6.3 Domestic Solid-Fuel Burning

The assessment considers sulphur dioxide emissions (only) from significant areas of residential properties that use solid fuel to heat their houses. 'Significant' areas are those of about 500m x 500m with more than 50 houses burning coal/smokeless fuel as their primary source of heating.

Domestic solid fuel burning has been assessed in previous rounds of Review and Assessment, which concluded that it is unlikely that there are any areas with 50 houses using these fuels in a 500m x 500m square. The Council is not aware of any changes on this matter since the last round of Review and Assessment.

King's Lynn and West Norfolk Borough Council has previously assessed areas of significant domestic solid fuel use, and concluded that it will not be necessary to proceed to a Detailed Assessment.

7 Fugitive or Uncontrolled Sources

There are several installations within the Borough where there is the potential for fugitive emissions to arise.

WBB Minerals, Leziate

WBB Minerals plant located in Leziate is the largest producer of silica and sand in the UK with production increased by 30% since the autumn of 2011. King's Lynn and West Norfolk Borough Council have automatic monitoring at the site using a TEOM and an Osiris. The results from both instruments for 2011 show that PM₁₀ concentrations are below the annual and 24-hour mean Air Quality Objectives. Therefore there is no need to undertake a Detailed Assessment for this site, however King's Lynn and West Norfolk Borough Council will continue to monitor for fugitive emissions.

Browns Fen, Stoke Ferry

The proposal is to extract 20,000 to 25,000 tonnes per year of soil, sand and loam from the site for a period of six years and restoration of the land in the seventh year. The assessment of fugitive sources found that there is the potential for moderately significant impacts resulting from the extraction process at 3 receptor locations all within 100m of the extraction boundary. As such the site has identified operational mitigations measures to reduce the impact upon the identified sensitive receptors. The 2010 background maps give the PM₁₀ background for the area to be 16.4µg/m³ as such receptors within 200m should be considered. At the current time there are no concerns with regards to dust and the operation of the facility, therefore there is no need to proceed to a detailed assessment. King's Lynn and West Norfolk Borough Council should monitor the site to ensure mitigation measures are in operation and reducing the dust emissions.

Page Stair Lane

King's Lynn and West Norfolk Borough Council installed an Osiris on Page Stair Lane. The annual mean PM₁₀ concentration for this site was 42µg/m³ showing a potential exceedence of the Air Quality Objective. The Osiris data has also shown that there were 78 days during 2011 where the PM₁₀ concentrations exceeded 50µg/m³, indicating that there is a potential that the Air Quality Objective for 24-hour mean may be exceeded in this area. Caution should be taken with respect to the concentrations given by the Osiris as these are no indicative instruments only.

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The area where the instrument is sited contains residential dwellings with industrial buildings, which are within 200m from the docks located to the north and north-east. To the south of the site there is a car park and then into the mixed commercial space of the town centre.

King's Lynn and West Norfolk Borough Council have completed some initial investigations into the wind direction at time of recorded exceedences and correlated these against activity in the docks up to October 2011. From these initial investigations for approximately half of the exceeding days the wind direction has been from the north through to east, indicating that the docks may be the source of the raised particulate levels. For the remainder of the exceedence periods the predominant wind direction was found to be the south-east through to the west, indicating that there is an alternative source of particulate matter. King's Lynn and West Norfolk Borough Council have not identified any industrial processes to the south of the monitoring location.

From the Osiris data obtained and the relevant exposure in the area it will need necessary to proceed to a detailed assessment.

King's Lynn and West Norfolk Borough Council has identified potential sources of fugitive particulate matter that meet specified criteria, and **will need to proceed to a Detailed Assessment for PM₁₀**.

8 Conclusions and Proposed Actions

8.1 Conclusions from New Monitoring Data

The review of new monitoring data has identified four locations with the AQS annual NO₂ objective was exceeded in 2011, three of which were within existing AQMA locations. The other exceeding site was located inside the Bus Station and therefore had no relevant exposure.

Continuous data for 2011 showed that the annual mean and 1-hour objective for NO₂ was met at all monitoring locations.

With regards to PM₁₀ monitoring the annual mean and the 24-hour mean continue to be met at both the Southgates and Leziate monitoring locations.

8.2 Conclusions from Assessment of Sources

8.2.1 Road Traffic Sources

The works undertaken as part of the King's Lynn South Major Transport Scheme have now been completed. These works included junction improvements and the introduction of a bus and cycle route along the Nar Ouse Way. Air Quality assessments undertaken as part of the application have not identified any significant impacts upon air quality. The works should result in decreased bus movements on London Road. Monitoring should continue along the new bus route and in the Town Centre to assess the overall impact upon air quality of the scheme.

Planning permission has been granted for a new Tesco Store on the Hardwick Road. The air quality assessment has predicted that there may be slight increases in NO₂ and PM₁₀ concentrations at some locations as a result of the development, although the overall assessment is that the development will not lead to significant increases in emissions. King's Lynn and West Norfolk Borough Council should consider monitoring at the receptor locations identified as having the potential for increased NO₂ concentrations.

Planning permission has been granted for a new Sainsbury Store at the Hardwick Roundabout. Once the store is operational King's Lynn and West Norfolk Borough Council should consider completing traffic counts to establish the impact of this store and the Tesco store upon traffic volume in the area.

Permission has also been granted for the development of a Travelodge, public house and retail units on the Nar Ouse Way. Traffic projects suggest that the development will increase traffic by less than 5% and therefore have no significant impact upon air quality.

8.2.2 Industrial Sources

There are currently two industrial processes which have recently been granted approval by the Environment Agency; these are the Willows Energy from Waste installation, and the extension to the Centrica Power Station. There is also an application which is currently being considered by King's Lynn and West Norfolk Borough Council, which is the British Sugar Bioenergy plant at Wissington. All of the applications have considered the impacts of the process upon air quality with no significant impacts being identified.

With regards to The Willows Energy from Waste application, due to the highest predicted concentrations being outside the Borough Council's current monitoring program, it was recommended by the Borough Council that should planning permission be granted the operator should fund air quality monitoring around the site. Currently Norfolk County Council has granted planning permission for the proposal but has not required air quality monitoring as a condition or planning obligation.

There are three installations in Kings Lynn and West Norfolk Borough Council which have shown substantially increased emissions. Of the three sites two of which, PIL Membranes and the National Grid Gas Compressor Stations have shown increases in emissions outside of the Air Quality Strategy, and as such will not require a Detailed Assessment. The other installation, Palm Paper, has shown increases in PM₁₀, NO₂ and SO₂, however 2011 is considered to be the first year of representative data as in previous years the plant was being commissioned. An Air Quality Assessment completed for the plant predicted the emissions not to be significant to identified receptors and would not lead to any exceedences of the AQS Objectives. All the above mentioned installations will continue to be monitored as part of the permitting process.

8.2.3 Biomass Combustion – Individual Installations

There are several biomass installations within the Borough, 3 of which exceed the 50kW criteria for assessment. The installation at Reg Bio-Power at Freedom Farm has undertaken monitoring as part of its previous permit purposes, the latest monitoring shows that the plant

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is operating within its allowed limits. The installation is now out of permitting; as such King's Lynn and West Norfolk Borough Council have requested that monitoring continue at the site.

A biomass boiler has been installed at the National Construction College on Stanhoe Road. A screening assessment of the particulate and NO_x emissions has identified that it is unlikely that the AQS objectives will be exceeded.

The installation at 52 Baptist Road has also been screened against PM₁₀ emissions. There is currently no NO_x data available to screen against this. It is recommended therefore that data be obtained regarding NO_x emissions and the installation be re-screened.

8.2.4 Fugitive Emissions

Current particulate monitoring undertaken in Leziate indicate that current activity at the WBB Minerals Quarry is not resulting in any exceedences of either the annual mean or the 24-hour AQS objectives.

An application for soil extraction at Browns Fen, Stoke Ferry included an assessment of the impacts upon air quality. The assessment found that with mitigation there would be minimal impacts from the operation.

King's Lynn and West Norfolk Borough Council have an Osiris located on Page Stair Lane. The 2011 results show that there is potential that both the annual mean and the 24-hour mean are being exceeded in the area. The instrument is located within a residential area with the nearest receptor being 5m from the monitoring location. Initial investigations show some correlation to ship activity in the docks to the north of the monitoring location; however there are other periods of high PM₁₀ concentrations where the pollution originates from the south-east through to west. There are no currently identified industrial processes in this direction. It is therefore necessary to undertake a detailed assessment.

8.3 Proposed Actions

Proposed actions arising from the USA are as follows:

- Continue diffusion tube and continuous monitoring in the district to identify future changes in pollutant concentrations;

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- Consider reviewing traffic flow following the completion of the Sainsbury Store and Tesco Store in the Hardwick Road area to determine the impact of the stores upon air quality;
- Consider installing diffusion tubes at the receptor locations predicted to have increased NO₂ concentrations as a result of the Tesco Store development on Hardwick Road;
- Continue to review the impact of the Reg Bio-Power installation at Freedom Farm to ensure that emissions remain within limits;
- Undertake a screening assessment of the biomass installation on Baptist Road once NOx emission rates are available;
- Undertake a Detailed Assessment for particulates on the Page Stair Lane area adjacent to the King's Lynn Docks
- Proceed to a Progress Report in 2013.

9 References

- Local Air Quality Management Technical Guidance LAQM.TG(09). February 2009. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland
- King's Lynn and West Norfolk Borough Council 2009 Updating and Screening Assessment
- King's Lynn and West Norfolk Borough Council 2011 Local Air Quality Management Annual Progress Report
- Norfolk County Council, King's Lynn South Major Transport Scheme – Full Business Case, October 2008
- RPS, Environmental Permit Application (Appendix C – Air Quality Assessment) Willows Power and Recycling Centre
- Parsons Brinckerhoff Environmental Permit Application (Appendix C – Air Dispersion Modelling Survey) Centrica King's Lynn
- Gem Air Quality Ltd, Former Lorry Park, Nar Ouse Way: Air Quality Assessment, July 2011
- Resource and Environmental Consultants Ltd, Ambient Air Monitoring Survey, Freedom Recycling Facility Hockwold, Norfolk, September 2011
- Resource and Environmental Consultants Ltd, Monitoring of the Emissions from the Volvo TWD 1643GE Engine, January 2012
- Golder Associates, Environmental Statement Bioenergy Facility, Wissington Sugar Factory, August 2011
- The Landscape Partnership, Assessment of Dust Nuisance Browns Fen, Stoke Ferry, Norfolk, January 2011
- CHQ Partnership, Sainsbury's Hardwick Roundabout, King's Lynn – Design and Access Statement, October 2011
- Levington Environmental, Emissions Monitoring Test Report LE730002, 2010

Appendices

Appendix A: QA/QC Data

Appendix A: QA:QC Data

Factor from Local Co-location Studies (if available)

King's Lynn and West Norfolk Borough Council do operate a continuous analyser and have a triplicate co-located tubes, the Local Bias Adjustment Factor is 0.76.

Location	Diffusion Tube Data capture	Diffusion Tube Annual Mean * ($\mu\text{g}/\text{m}^3$)	Continuous Monitor Annual Mean ** ($\mu\text{g}/\text{m}^3$)	Ratio
Southgates	83%	30	23	0.76

Diffusion Tube Bias Adjustment Factors

The diffusion tubes are supplied and analysed by Gradko International Ltd utilising the 20% Triethanolamine (TEA) in water preparation method. The bias adjustment factor for 2011 is 0.89 (based on 26 studies, version 03_12) as derived from the national bias adjustment calculator.

Discussion of Choice of Factor to Use

It has been decided to use the National Bias adjustment factor due to data capture for the Southgates continuous analyser being less than 90% and two periods in the year where data capture was less than 10%.

PM Monitoring Adjustment

Particulate monitoring adjustment is completed by Air Quality Data Management (AQDM).

Short-term to Long-term Data adjustment

Leziate PM₁₀

Site	Site Type	Annual Mean	Period Mean	Ratio
Norwich Lakenfields	Urban Background	19.78	22.85	0.87
Leciester Centre	Urban Background	17.45	20.73	0.84
Chesterfield	Urban Background	21.79	23.23	0.94
			Average	0.88

Leziate NO₂

Site	Site Type	Annual Mean	Period Mean	Ratio
Norwich	Urban	13.09	13.40	1.01

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Lakenfields	Background			
Wicken Fen	Rural Background	11.50	11.44	0.98
Chesterfield	Urban Background	14.94	16.06	0.93
			Average	0.97

Diffusion Tube Annualisation

Monitoring Location	Uncorrected diffusion tube concentration	Wicken Fen annualisation factor	Norwich Lakenfields annualisation factor	Chesterfield annualisation factor	Average annualisation factor
S1	25.3	0.877	0.885	0.690	0.817
S2	29.7	0.877	0.885	0.690	0.817
S3	20.0	0.877	0.885	0.690	0.817
S6	18.3	0.877	0.885	0.690	0.817
S8	19.7	0.877	0.885	0.690	0.817
S10	27.3	0.877	0.885	0.690	0.817
72	14.3	1.039	1.077	1.182	1.099
73	22.5	1.039	1.077	1.182	1.099
74	16.5	1.039	1.077	1.182	1.099

QA/QC of automatic monitoring

The site is part of the National Automatic Monitoring Calibration Club, where data are managed to the same QA procedures and standards as the UK Automatic Urban and Rural Network (AURN) sites. The data are ratified by AEA.

QA/QC of diffusion tube monitoring

Gradko International Limited currently holds UKCAS accreditation and participates in the Workplace Analysis Scheme for Proficiency (WASP) for NO₂ diffusion tube analysis and the NO₂ Annual Field Inter-Comparison Exercise. These provides strict performance criteria for participating laboratories to meet, thereby ensuring NO₂ concentrations reported are of a high calibre. In WASP data rounds 112 through to 114 (January to September 2011) Gradko International have scored 100%, for round 115 (October to December 2011) the WASP score was 37.5%. The percentage score reflects the results deemed to be satisfactory based upon the z-score of ± 2. The tube precision for the NO₂ Annual Field Inter-comparison at Marylebone Road was rated as 'Good'

Monthly Diffusion Tube Results

Site Ref	NO ₂ Concentrations µg/m ³											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	49	45	36	37	33	41	35	36	41	37	47	45
2	M	51	55	M	49	67	48	54	69	49	57	66
3	62	46	62	62	43	61	24	46	52	49	50	55
4	51	47	45	43	33	42	39	36	38	38	48	37
5	M	53	50	45	M	45	39	39	53	47	56	50
6	40	29	31	22	23	29	24	26	28	26	35	27
7	34	32	23	27	19	21	19	20	23	25	33	/
8	60	48	48	48	39	55	40	44	48	39	53	45
9	45	39	30	32	30	35	29	33	38	35	36	31
10	48	37	33	34	33	41	31	38	42	M	44	M
11	50	42	33	34	35	29	35	34	37	30	41	31
12	54	20	39	38	39	51	36	36	44	34	40	32
13	54	45	44	21	36	42	42	41	39	40	53	38
14	49	45	36	37	33	41	35	36	41	37	47	45
15	M	51	55	M	49	67	48	54	69	49	57	66
17	47	33	21	33	23	30	22	24	33	28	41	30
18	45	33	30	33	27	33	25	21	33	30	38	32
19	38	31	27	25	25	29	21	25	31	29	33	27
20	44	39	35	31	29	34	30	34	35	33	44	24
22	55	44	36	40	30	39	38	35	38	36	47	30
23	53	44	43	41	30	35	39	35	34	36	48	25
24	46	38	38	43	32	32	36	32	36	33	40	23
25	31	15	20	18	14	18	13	16	20	21	25	22
26	58	38	40	49	40	41	37	41	41	38	43	M
27	48	41	33	39	30	39	32	33	36	35	36	36
28	46	34	36	43	30	35	31	M	M	34	36	36
29	37	25	29	29	21	25	18	21	24	23	30	30
30	38	31	50	27	21	36	20	23	25	26	32	28
31	50	43	30	44	32	43	36	38	M	41	47	34
32	48	39	37	38	34	40	35	33	35	33	40	38
33	M	41	35	31	33	33	26	33	38	31	40	35
34	44	41	33	42	31	41	28	38	40	36	40	42
35	44	34	30	38	26	40	30	32	36	32	35	35
36	44	42	44	36	27	32	26	28	39	34	39	37

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Site Ref	NO ₂ Concentrations µg/m ³											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
37	50	34	48	40	35	41	31	27	30	29	38	32
38	53	53	32	42	30	37	31	33	48	45	51	40
39	39	33	39	33	29	34	26	29	29	34	35	29
40	53	42	49	36	38	41	31	36	41	40	39	36
41	56	51	42	52	43	45	36	37	33	46	47	35
42	51	36	35	0.79	49	38	25	34	38	32	36	38
43	45	33	33	36	31	35	32	33	27	30	31	31
44	54	42	38	42	34	43	34	39	33	41	47	32
45	47	34	44	41	31	37	32	M	26	32	36	29
46	45	27	33	38	24	28	27	26	33	27	31	29
47	53	47	46	41	35	45	M	M	M	37	48	35
48	46	44	34	36	32	38	26	33	43	37	43	42
51	34	27	22	24	19	22	15	19	22	25	28	22
52	49	37	39	38	33	37	16	31	29	36	33	21
53	42	35	51	37	28	34	28	26	25	M	6	21
54	33	29	29	27	23	24	22	22	25	26	31	23
55	32	23	20	21	17	21	15	17	20	22	26	21
58	36	31	35	29	23	20	24	24	31	26	45	M
61	27	27	21	19	18	17	12	16	21	21	26	21
62	27	22	23	18	17	18	11	16	21	19	27	21
63	19	15	14	13	11	10	7	10	10	12	18	12
64	19	13	11	14	10	11	8	10	13	13	21	13
S1	30	25	21	/	/	/	/	/	/	/	/	/
S2	37	27	25	/	/	/	/	/	/	/	/	/
S3	20	23	17	/	/	/	/	/	/	/	/	/
S4	22	22	M	/	/	/	/	/	/	/	/	/
66	36	27	30	25	24	26	18	M	M	28	13	29
S6	26	16	13	/	/	/	/	/	/	/	/	/
S7	M	M	14	/	/	/	/	/	/	/	/	/
S8	24	19	16	/	/	/	/	/	/	/	/	/
S9	29	26	M	/	/	/	/	/	/	/	/	/
S10	32	27	23	/	/	/	/	/	/	/	/	/
67	28	23	22	20	16	20	14	17	22	21	25	24
68	33	24	24	28	M	46	M	M	20	25	27	26
69	25	22	17	18	14	13	11	13	17	18	23	14

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Site Ref	NO ₂ Concentrations µg/m ³											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
70	23	M	21	16	16	12	9	12	19	17	26	15
71	LOD	52	21	19	16	15	10	15	18	19	M	M
72					12	12	8	11	15	16	25	15
73					8	24	27	26	21	24	37	13
74					15	15	14	15	14	17	24	18