

BOROUGH COUNCIL OF KING'S LYNN & WEST NORFOLK

**LOCAL AIR QUALITY MANAGEMENT UPDATING AND SCREENING
ASSESSMENT 2009**

AGGX1400830/BV/AQ

APRIL 2009



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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.

The Updating and Screening Assessment (USA) provides an update with respect to air quality issues within the administrative area. There have been a number of changes since the last (third) round of review and assessments which have been taken into account in this assessment; including revised Local Air Quality Management (LAQM) Guidance, modelled background concentration maps, updated NO_x:NO₂ conversion calculator, updated future year calculation tools and updates on specific sources (rail, poultry farms, biomass). The USA has included consideration of new monitoring data and emissions sources, in addition to any significant changes to existing emission sources identified in the previous rounds. The USA considers the seven priority health based air quality objectives as laid down in Regulations and assesses the likelihood that the air quality objectives will be met by their target dates. If the air quality objectives are unlikely to be met, a detailed assessment will be required.

Having considered each emission source and presented evidence to support the assessment of each, it is concluded that the air quality objectives for benzene, 1, 3-butadiene, carbon monoxide, lead, particulates (PM₁₀) and sulphur dioxide will be met. There is no requirement to undertake a Detailed Assessment for these pollutants.

Updated NO₂ monitoring show that the annual mean AQS objective is still exceeded at a number of sites in King's Lynn. However, all the exceedences are monitored within the Air Quality Management Areas declared in King's Lynn for NO₂. Concentrations outside the AQMA's continue to be below the AQS objectives for NO₂. Therefore, there is no requirement to undertake a Detailed Assessment for NO₂.

Summary Table

Pollutant	Detailed assessment required?	Sources/Location
Benzene	No	
1, 3 - butadiene	No	
Carbon monoxide	No	
Lead	No	
Nitrogen dioxide	No	
PM ₁₀	No	
Sulphur dioxide	No	

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 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 2003, the population of King's Lynn & West Norfolk was estimated at approximately 137,900 (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 Objective for nitrogen dioxide (NO₂) were identified, mainly due to traffic congestion.

Another AQMA was previously declared in 2002 in South Quay, King's Lynn, where the loading of grain on to vessels, highlighted as a potential source of fugitive PM₁₀ emissions, contributed to the exceedence of the PM₁₀ daily mean AQS objective. The 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 Local Air Quality Management (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 setting out the measures it intends to put in place in pursuit of the objectives.

Bureau Veritas has been commissioned by the Borough Council of King's Lynn & West Norfolk to undertake the Updating and Screening Assessment (USA) 2009, as part of the fourth round of LAQM Review and Assessment.

The following information has been considered within this assessment:

- Relevant legislative background
- The Council's Review and Assessment of air quality under the LAQM regime
- Traffic data provided by Norfolk County Council (Planning and Transportation). For the purposes of the USA, the Highways Agency's DMRB¹ air quality model has been used to estimate pollutant concentrations from road traffic

¹ Highways Agency's Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 1 Air Quality, May 2007, and accompanying spreadsheet DMRB Screening Method V1,03.xls. July 2007

- Industrial, domestic and other non-traffic related source data provided by the Council
- Monitoring data for 2008 provided by the Council
- Background pollutant concentrations from modelled maps
- Technical guidance and tools provided by Defra²

This report sets out the relevant air quality legislation for air quality, provides a review of local air quality management within the borough, assesses the air quality for all relevant sources and then summarises the findings of the assessment and potential need for further detailed assessment work.

1.3 Air Quality Objectives

The significance of existing and future pollutant levels are assessed in relation to the national air quality standards and objectives, established by Government. The revised Air Quality Strategy (AQS)³ for the UK (released in July 2007) provides the over-arching strategic framework for air quality in the UK and contains national air quality standards and objectives established by the UK Government and devolved administrations to protect human health. The air quality objectives incorporated in the AQS and the UK Legislation are derived from the Limit Values prescribed in the EU Directives transposed into national legislation by member states.

The Clean Air for Europe (CAFE) programme was initiated in the late 1990s to draw together previous directives into a single EU Directive on air quality. The Directive 2008/50/EC⁴ introduces new obligatory standards for PM_{2.5} for Government but places no statutory duty on local Government to work towards achievement of these new standards.

The Air Quality Standards (England) Regulations 2007⁵ came into force on 15th February 2007 in order to align and bring together in one statutory instrument the Governments obligations to fulfil the requirements of the CAFE Directive.

The objectives for ten pollutants (benzene, 1,3-butadiene, carbon monoxide, lead, nitrogen dioxide, sulphur dioxide particulates - PM₁₀ and PM_{2.5}, ozone and Polycyclic Aromatic Hydrocarbons (PAHs)) have been prescribed within the Air Quality Strategy based on The Air Quality Standards (England) Regulations 2007.

Part IV of the Environment Act 1995 places a statutory duty on local authorities to periodically review and assess the current and the future air quality within their area – a process known as Local Air Quality Management (LAQM). The air quality objectives that apply to LAQM are defined in Air Quality Regulations 2000⁶ and Air Quality (England) (Amendment) Regulations 2002⁷ for seven pollutants benzene, 1,3-butadiene, carbon monoxide, lead, nitrogen dioxide, sulphur dioxide, particulates - PM₁₀.

This assessment focuses on those pollutants included in Air Quality (England) (Amendment) Regulations 2002 for the purpose of Local Air Quality Management, in respect of pollutant sources affecting air quality within the Council's administrative area. The objectives set out in the AQS for these pollutants are presented in [Table 1](#).

Deleted: Table 1

The UK Government and the Devolved Administrations have also set new national air quality objectives for PM_{2.5}. These objectives have not been incorporated into LAQM Regulations, and authorities have no statutory obligation to review and assess air quality against them.

² 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

³ The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (2007), Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland

⁴ Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe

⁵ The Air Quality Standards Regulations 2007, Statutory Instrument No 64, The Stationary Office Limited

⁶ The Air Quality (England) Regulations 2000 (Statutory Instrument 928)

⁷ The Air Quality (England) (Amendments) Regulations 2000 (Statutory Instrument 3043)



The locations where the AQS objectives apply are defined in the AQS as locations outside buildings or other natural or man-made structures above or below ground where members of the public are regularly present and might reasonably be expected to be exposed to pollutant concentrations over the relevant averaging period of the AQS objective. Typically these include residential properties and schools/care homes for longer period (i.e. annual mean) pollutant objectives and high streets for short-term (i.e. 1-hour) pollutant objectives.

Table 1– Air Quality Objectives Included in the Air Quality Regulations for the Purpose of Local Air Quality Management

Pollutant	Objective	Concentration measured as	Date to be achieved by and maintained thereafter
Benzene All authorities	16.25 µg/m ³	running annual mean	31.12.2003
Authorities in England and Wales only	5.00 µg/m ³	annual mean	31.12.2010
1,3 Butadiene All authorities	2.25 µg/m ³	running annual mean	31.12.2003
Carbon monoxide Authorities in England, Wales and Northern Ireland only	10.0 µg/m ³	maximum daily running 8-hour mean	31.12.2003
Lead All authorities	0.5 µg/m ³	annual mean	31.12.2004
	0.25 µg/m ³	annual mean	31.12.2008
Nitrogen dioxide ^a All authorities	200 µg/m ³ , not to be exceeded more than 18 times a year	hourly mean	31.12.2005
	40 µg/m ³	annual mean	31.12.2005
Particles (PM₁₀) (gravimetric) ^b All authorities	50 µg/m ³ , not to be exceeded more than 35 times a year	24 hour mean	31.12.2004
	40 µg/m ³	annual mean	31.12.2004
Sulphur dioxide All authorities	350 µg/m ³ not to be exceeded more than 24 times a year	1 hour mean	31.12.2004
	125 µg/m ³ not to be exceeded more than 3 times a year	24 hour mean	31.12.2004
	266 µg/m ³ not to be exceeded more than 35 times a year	15 minute mean	31.12.2005

^a EU Limit values in respect of nitrogen dioxide to be achieved by 1st January 2010. There are, in addition, separate EU limit values for carbon monoxide, sulphur dioxide, lead and PM₁₀, to be achieved by 2005, and benzene by 2010.

^b Measured using the European gravimetric transfer sampler or equivalent.

1.4 Local Air Quality Management (LAQM)

As established by the Environment Act 1995 Part IV, all local authorities in the UK are under a statutory duty to undertake an air quality assessment within their area and determine whether they are likely to meet the air quality objectives set down by Government for a number of pollutants. The process of review and assessment of air quality undertaken by local authorities is set out under the LAQM regime and involves a phased three yearly assessment of local air quality. Where the results of the review and assessment process highlight that problems in the attainment of health-based objectives for air quality will arise, the authority is required to declare an AQMA – a geographic area defined by high levels of pollution and exceedences of health-based standards.

The LAQM regime was first set down in the 1997 National Air Quality Strategy (NAQS)⁸ and introduced the idea of local authority 'Review and Assessment'. The Government subsequently published policy and technical guidance related to the review and assessment processes in 1998. This guidance has since been reviewed and the latest documents include Policy Guidance (LAQM.PG (09))⁹ and Technical Guidance (LAQM.TG(09))¹⁰. The guidance lays down a progressive, but continuous, framework for the local authorities to carry out their statutory duties to monitor, assess and review air quality in their area and produce action plans to meet the air quality objectives.

Defra and the Devolved Administrations released the latest Policy and Technical Guidance in February 2009, in anticipation of the fourth round of review and assessment. The fourth round begins with this USA, required to be completed by local authorities by the end of April 2009, and builds upon the Council's previous work in the first three rounds.

1.5 Summary of Review and Assessment undertaken by the Borough Council of King's Lynn & West Norfolk

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 some locations in King's Lynn. As a result, the Council declared two AQMAs, one in South Quay (for PM₁₀) in April 2002, and the other one in Railway Road (NO₂) in November 2003. The South Quay AQMA was revoked in June 2006 following the effective application of an Air Quality Action Plan for the area¹¹.

The second round of Review and Assessment began with a USA¹², 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 Report¹³ (2004) recommended proceeding to a Detailed Assessment of NO₂, following new monitored exceedences of the objective outside the AQMA in King's Lynn. The Detailed Assessment¹⁴ (2005) confirmed that exceedences were likely to occur at several sites outside the AQMA, and as a result, recommended to extend the AQMA to encompass properties along Railway Road, Blackfriars Road and London Road.

⁸ DoE, 1997, 'The United Kingdom National Air Quality Strategy', The Stationary Office

⁹ Policy Guidance LAQM.PG(09) (2009), Part IV of the Environment Act 1995, Local Air Quality Management, Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland, The Stationary Office

¹⁰ Technical Guidance LAQM.TG (09) (2009), Part IV of the Environment Act 1995, Local Air Quality Management, Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland, The Stationary Office

¹¹ Borough Council of King's Lynn & West Norfolk – Action Plan for Air Quality Management Area (South Quay) – September 2003

¹² Air Quality Updating and Screening Assessment for King's Lynn & West Norfolk Borough Council – August 2003

¹³ Air Quality Review and Assessment Progress Report – November 2004

¹⁴ King's Lynn & West Norfolk – Detailed Assessment of Air Quality – November 2005

The third round of Review and Assessment began with a new USA, completed in 2006¹⁵. 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))¹⁶ 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 have since 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 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 2007¹⁷ 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 1200m 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 AQMA¹⁸, 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 objective was likely to be exceeded. The AQMA has been 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 is still valid and should remain, as both monitoring and modelling confirmed exceedences of the AQS objective. A source apportionment 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 contribute significantly.

¹⁵ Borough Council of King's Lynn & West Norfolk – LAQM Updating and Screening Assessment – 2006

¹⁶ Defra (2003) - Technical Guidance LAQM.TG(2003), Part IV of the Environment Act 1995, Local Air Quality Management, The Stationary Office

¹⁷ Air Quality Review and Assessment Progress Report – 2007

¹⁸ Borough Council of King's Lynn & West Norfolk – LAQM Detailed / Further Assessments – July 2008

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

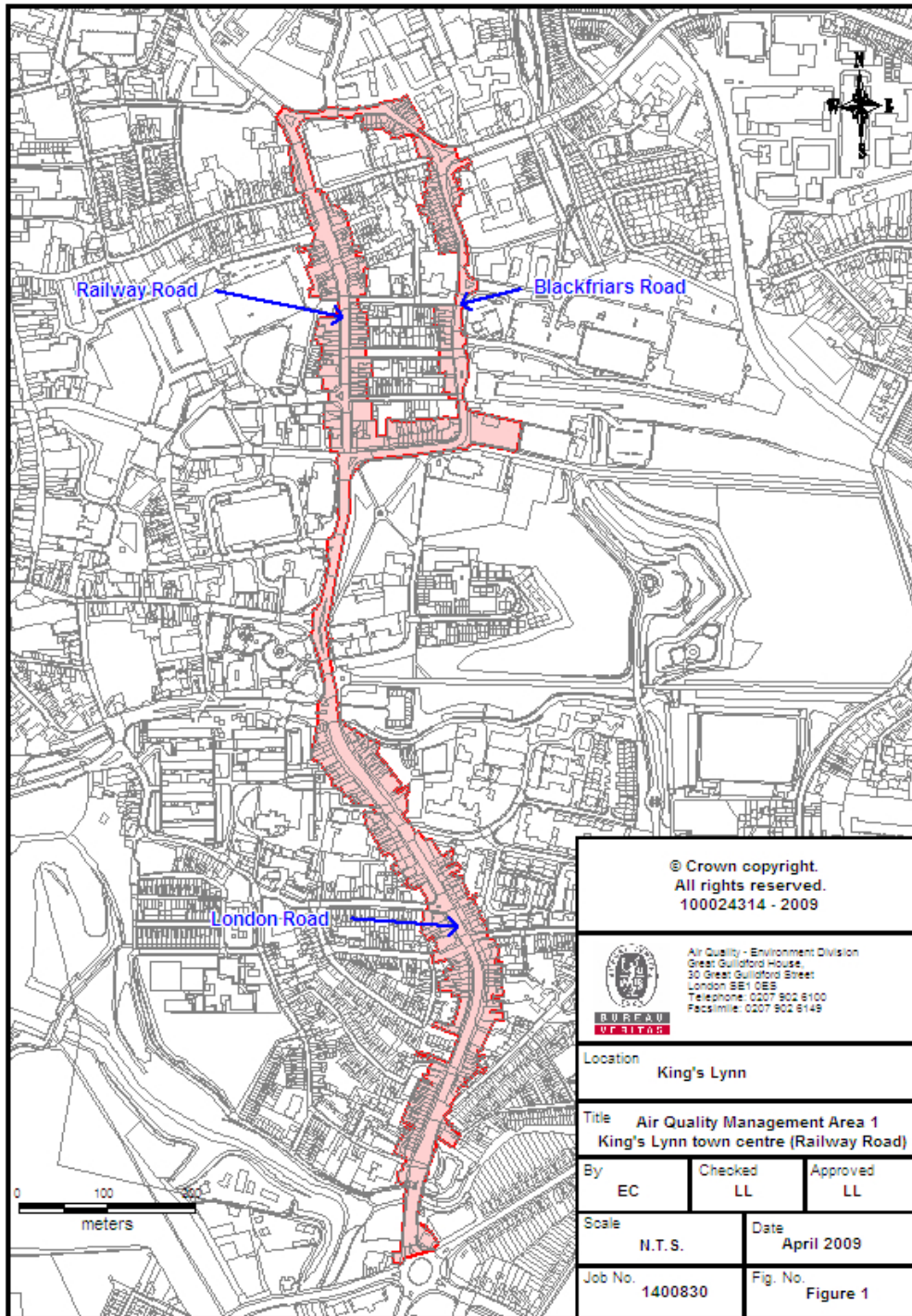
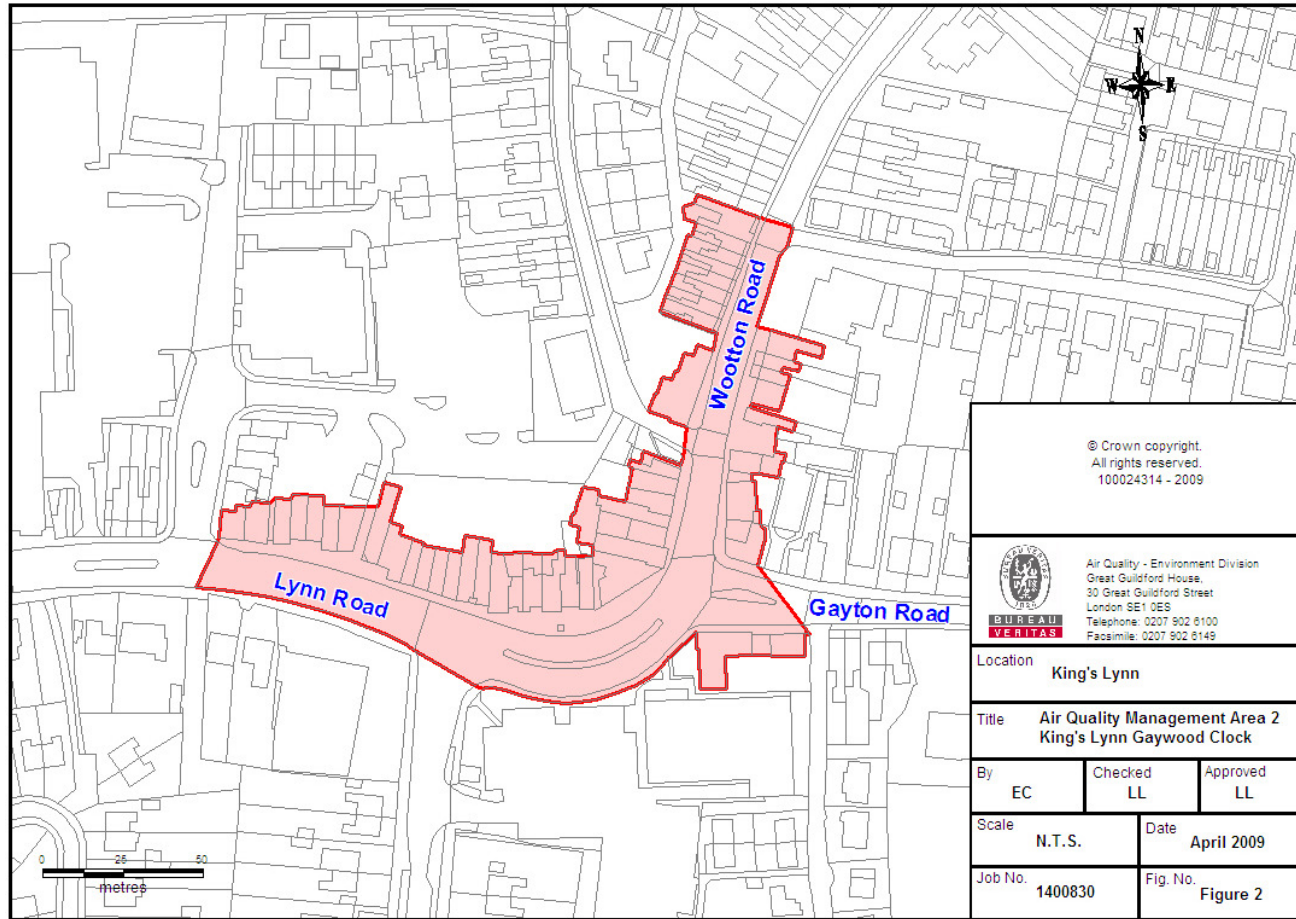


Figure 2 – King's Lynn AQMA 2 – Gaywood Clock



2 Updating and Screening Assessment Methodology

The USA is intended to identify any significant changes that may have occurred since the previous rounds of Review and Assessment were completed. This includes new monitoring data, new or changed emissions sources (either locally or in neighbouring authorities), or any other local changes that might affect air quality e.g. new relevant exposure. The assessment builds on the previous Review and Assessment work undertaken by local authorities.

The USA involves a checklist approach that considers all significant emissions sources relevant to the Air Quality Objectives. The checklists are broadly the same as in the previous rounds, but have been re-ordered so that they follow a source-by-source rather than pollutant-by-pollutant approach. This is to reduce repetition within the screening process for those local authorities that do not have all the listed sources within their area. These can more easily be discounted at an early stage.

A summary of the emission source categories for the Updating and Screening checklists is provided below. The detailed checklists for each source type are then set out in the following sections, as per the methodology provided in Chapter 5 of the Technical Guidance LAQM.TG (09).

The air quality assessment for road traffic emissions sources has been undertaken using the Highways Agency's DMRB¹ air quality model. NO₂ concentrations have been calculated based on the updated NO_x/NO₂ conversion method provided on behalf of Defra as part of the LAQM.TG(09) tools.

For other sources, the checklist approach to screening and relevant LAQM.TG(09) nomograms have been used.

Table 2– Summary of Emission Sources and Relevant Pollutants to be Considered as Part of the USA

Reference No.	Emission Sources to be Assessed	Relevant Pollutants
A. Road Transport Sources		
A.1	Narrow congested streets with residential properties close to the kerb	Nitrogen dioxide
A.2	Busy streets where people may spend 1-hour or more close to traffic	Nitrogen dioxide
A.3	Roads with a high flow of buses and/or HGVs.	Nitrogen dioxide, PM ₁₀
A.4	Junctions (including busy roads and junctions in Scotland and Northern Ireland)	Nitrogen dioxide, PM ₁₀
A.5	New roads constructed since the last round of review and assessment	Nitrogen dioxide, PM ₁₀
A.6	Roads/junctions identified as being close to the objective during the previous round of review and assessment	Nitrogen dioxide, PM ₁₀
A.7	Roads with significantly changed traffic flows	Nitrogen dioxide, PM ₁₀
A.8	Bus and coach stations	Nitrogen dioxide
B: Other transport sources		
B.1	Airports	Nitrogen dioxide
B.2	Railway (diesel and steam trains)	Sulphur dioxide, nitrogen dioxide
B.3	Ports (shipping)	Sulphur dioxide
C: Industrial sources		
C.1	Industrial processes (new processes and those with significantly increased emissions)	Benzene, 1,3-butadiene, lead, nitrogen dioxide, sulphur dioxide, PM ₁₀
C.2	Major petrol storage depots	Benzene
C.3	Petrol Stations	Benzene
C.4	Poultry farms	PM ₁₀
D: Commercial and domestic sources		
D.1	Biomass combustion	Nitrogen dioxide, PM ₁₀
D.2	Domestic solid-fuel burning	Sulphur dioxide
E: Fugitive or uncontrolled sources		
E.1	Quarries, landfill sites, opencast coal mining, waste transfer sites, materials handling (i.e. ports, major construction sites)	PM ₁₀

2.1 Input Data

2.1.1 Traffic data

Norfolk County Council provided the traffic data (annual average daily traffic flows and HDV percentage) used in this assessment. Data were completed with traffic data available from the DfT website¹⁹. Vehicle speed has been based on speed limits, modified according to local conditions to take account of congestion and stop/start vehicle movements at junctions. Where relevant, speeds were reduced at busy junctions to 20kph to reflect the higher emissions of queuing traffic. Appendix 1 contains the traffic data used in the USA.

2.1.2 Background concentrations

The DMRB air quality model calculates the pollutant concentrations due to road traffic emissions only. The user must then add the background concentrations (arising from sources other than traffic) to derive the total pollutant concentrations at the relevant receptors modelled.

The background concentrations can be obtained either from appropriate monitoring stations or from Defra maps of modelled background pollutant concentrations. These maps are available at a resolution of 1x1 km for the entire UK. Maps are provided for future years' background pollutant concentrations. The maps can be obtained from the UK Air Quality Information Archive⁹. The maps have been updated from the previous round of review and assessment as part of the LAQM.TG (09) tools released in February 2009. Background concentrations used in the DMRB air quality model are shown in Appendix 4.

3 New Monitoring Data

Section 3 reviews and assesses all new monitoring data in order to determine whether the air quality objectives are at risk of exceedence.

3.1 Summary of Monitoring Undertaken

Figure 3 – Map of monitoring sites in King's Lynn - 1

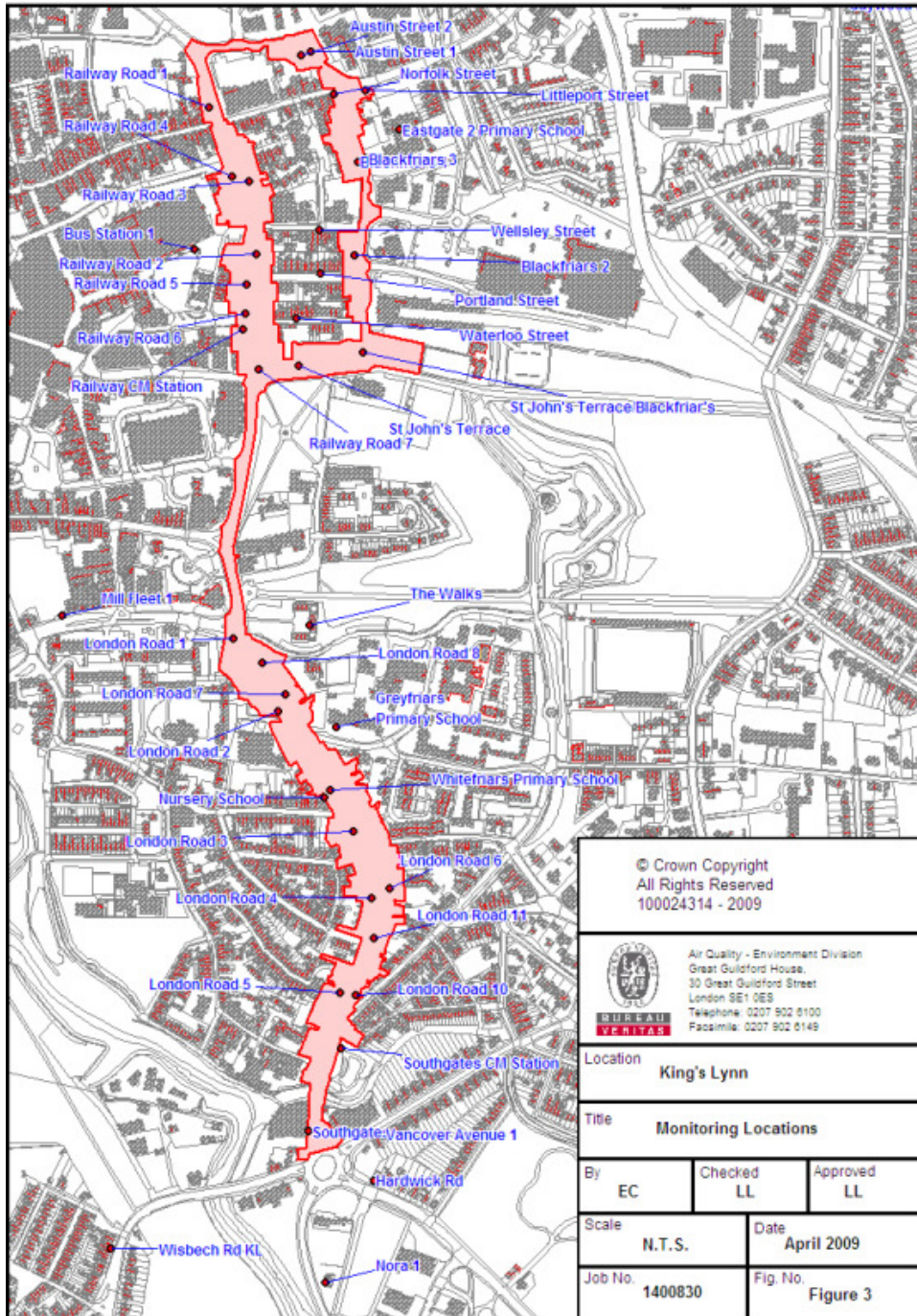
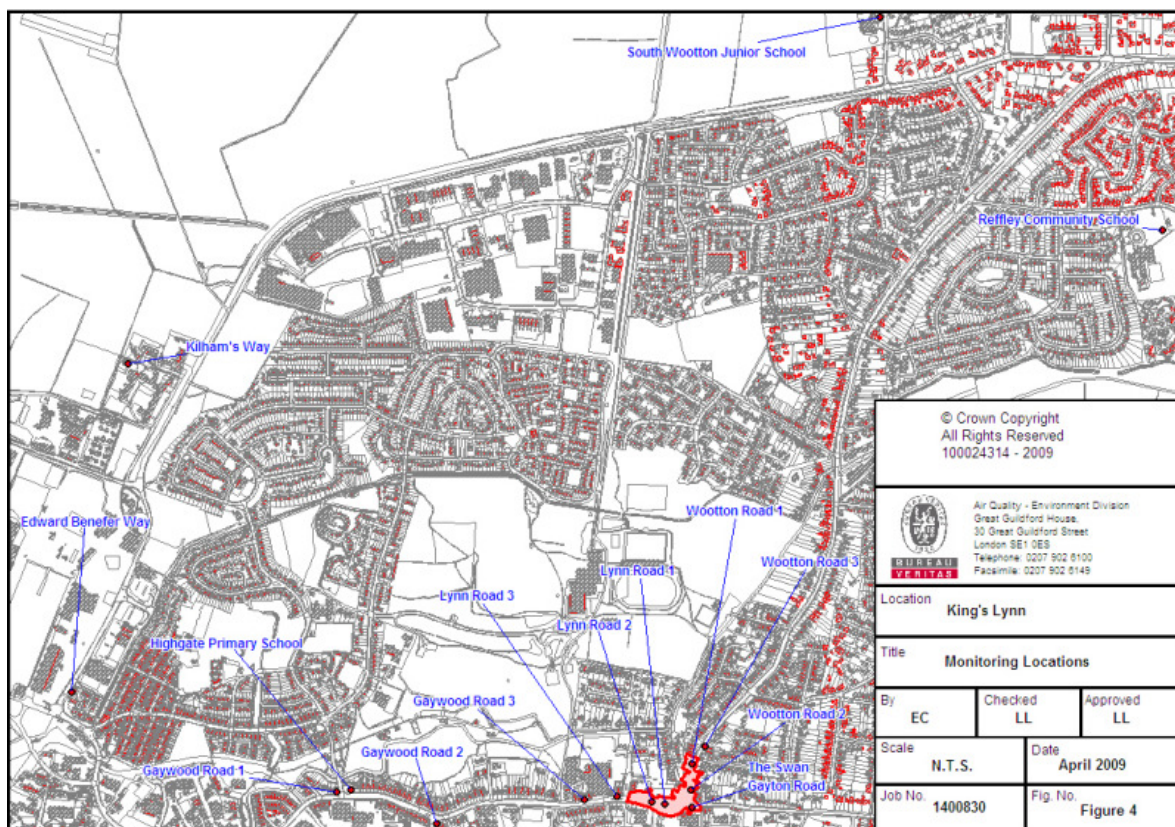


Figure 4 – Map of monitoring sites in King’s Lynn - 2



3.1.1 Automatic and Semi-Automatic Monitoring Sites

This section provides details of automatic monitoring carried out in 2008, the year covered by this report.

Table 3 – Details of Automatic and Semi-Automatic Monitoring Sites

Site Name	Site Type	OS Grid Ref (x,y)	Pollutants Monitored	In AQMA ?	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Worst-case Location?
King's Lynn Southgates (previously Railway Road)	Roadside	562227, 319198	NO ₂ , PM ₁₀ (TEOM)	Yes (NO ₂)	No but property façade 4m from kerb further north	5m	No

There is currently automatic monitoring of nitrogen dioxide (NO₂) and particles (PM₁₀) undertaken by King's Lynn and West Norfolk BC at Southgates in King's Lynn AQMA. The monitoring station, previously located further north on Railway Road in the AQMA, was relocated at a roadside site in Southgates in June 2008.

The monitoring station comprises a chemiluminescence NO_x / NO₂ analyser and a Tapered Element Oscillating Microbalance (TEOM) PM₁₀ analyser. Both analysers have been operational since 2006. The site is part of the National Automatic Monitoring Calibration Club, where data are managed to the same QA procedures and standards as AURN sites.

3.1.2 Non-Automatic Monitoring Data

King's Lynn and West Norfolk BC also monitors NO₂ based on a network of diffusion tubes. Four sites in King's Lynn also monitored benzene in 2007-2008, based on benzene diffusion tubes. Details of the non-automatic monitoring undertaken in the Borough are shown below.

3.1.2.1 Nitrogen dioxide diffusion tube data

King's Lynn and West Norfolk BC undertook monitoring at 70 NO₂ diffusion tube sites in 2008, including 14 new sites installed at a number of schools in King's Lynn as part of the Project Atmosphere (see section below). The vast majority of the monitoring sites is located in King's Lynn (64), including a set of triplicate tubes co-located with the continuous monitoring station in Southgates. 7 sites were removed in March 2008 in King's Lynn on Tennyson Avenue, Mill Fleet and Wisbech Road, and in near Wisbech on Elm High Road.

The diffusion tubes are supplied and analysed by Gradko Laboratories using the 20% v/v Triethanolamine (TEA) in water preparation method. Gradko Laboratories participate in the Workplace Analysis Scheme for Proficiency (WASP) for NO₂ diffusion tube analysis and the Annual Field Inter-Comparison Exercise. These provide strict performance criteria for participating laboratories to meet, thereby ensuring NO₂ concentrations reported are of a high calibre. The laboratory follows the procedures set out in the Harmonisation Practical Guidance.

The technical guidance LAQM.TG (09) and the air quality Review and Assessment Helpdesk provide 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 / NO₂ continuous analysers. Alternatively, the national database of diffusion tube co-location surveys²⁰ provides bias factors for the relevant laboratory and preparation method.

King's Lynn and West Norfolk BC has a set of (triplicate) diffusion tubes co-located with the continuous monitoring analyser in Southgates, King's Lynn. A local bias adjustment factor of 0.88, derived from the triplicate tubes, was used to adjust the diffusion tube results²¹.

For 2006 and 2007 data, the bias adjustment factors have been taken from the Council's previous LAQM annual reports. These were 0.98 for 2006 and 0.89 for 2007, both derived from the national database of co-location surveys.

Project Atmosphere

During 2008, the Borough Council in partnership with Norfolk County Council School Travel Plans Team and various schools in the King's Lynn area launched a diffusion tube survey on school premises, as an extension of the Council's diffusion tube programme. Each of the schools is sent, on a monthly basis, a copy of the results for their own school together with results from other schools for comparison. The aim of the programme is to raise awareness of air quality matters for pupils and provide additional monitoring in and around the King's Lynn AQMAs. As part of the project, Officers from the Council's Environmental Quality Team are available to speak to schools regarding pollution matters in general and local air pollution in particular. At present the schools involved in Project Atmosphere are:

²⁰ www.uwe.ac.uk/aqm/review/mguidance

²¹ The national bias adjustment factor derived from the co-located surveys is 0.90 for 2008 (for this laboratory and preparation method), which is consistent with the local bias factor.

- Eastgate Primary School
- Greyfriars Primary School
- Highgate Primary School
- Howard Junior School
- King's Lynn Nursery School
- Park High School
- Reffley Community School
- South Wootton Junior School
- Whitefriars Primary School

Table 4– Details of Non- Automatic Monitoring Sites – NO₂

Site No.	Location	Site Type	X	Y	Pollutant Monitored	In AQMA ?	Relevant Exposure ? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Worst-case Location ?
1	Railway Road 1	Kerbside	562073	320304	NO ₂	Y	Y - 3m	2m	Y
2	Railway Road 4	Roadside	562100	320222		Y	Y - 0m	2m	Y
3	Railway Road 5	Roadside	562117	320095		Y	Y - 0m	1.5m	Y
4	Railway Road 6	Kerbside	562115	320062		Y	Y - 2.5m	1m	Y
5	Bus Station 1	Bus Station	562055	320137		N	N	N/A	Y
6,7,8	Railway Road Monitoring Station (closed June 2008)	Roadside	562113	320043		Y	Y - 5.5m	4.5m	Y
6,7,8	Southgates Monitoring Station (started June 2008)	Roadside	562227	319198		Y	No but property façade 4m from kerb further north	5m	Y
9	Mill Fleet 1	Roadside	561900	319707		N	No but property façade 4m from kerb in same street	4m	Y
10	London Road 1	Roadside	562101	319679		Y	Y - 2.5m	3m	Y
11	London Road 2	Roadside	562154	319594		Y	Y - 0m	3m	Y
12	London Road 3	Roadside	562242	319452		Y	Y - 1m	3m	Y
13	London Road 4	Roadside	562264	319375		Y	Y - 0m	4.5m	Y
14	London Road 5	Roadside	562226	319263		Y	Y - 0.5m	4m	Y
15	Southgates	Kerbside	562190	319102		Y	Y - 1m	0.5m	Y
16	Wisbech Rd KL	Roadside	561958	318963		N	Y - 0m	5m	Y
17	Nora 1	Roadside	562209	318924		N	Y - 0m	11m	Y
18	Hardwick Rd	Roadside	562266	319043		N	Y - 0m	7m	Y
19	Vancouver Avenue 1	Roadside	562277	319098		N	Y - 0m	6m	Y

Site No.	Location	Site Type	X	Y	Pollutant Monitored	In AQMA ?	Relevant Exposure ? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Worst-case Location ?
20	London Road 10	Kerbside	562244	319261		Y	Y - 0m	3.5m	Y
21	London Road 11	Roadside	562267	319327		Y	Y - 3m	1.5m	Y
22	London Road 6	Roadside	562285	319386		Y	Y - 0m	5m	Y
23	London Road 7	Roadside	562162	319614		Y	Y - 0m	4.5m	Y
24	London Road 8	Roadside	562136	319651		Y	Y - 0m	5.5m	Y
25	The Walks	Urban Background	562191	319695		N	Y - 0m	75m	Y
26	Railway Road 7	Roadside	562131	319996		Y	Y - 0m	2m	Y
27	St John's Terrace	Roadside	562178	319999		Y	Y - 0m	5.5m	Y
28	St John's Terrace/Blackfriars	Roadside	562253	320016		Y	Y - 0m	1.5m	Y
29	Waterloo Street	Kerbside	562175	320055		N	Y - 2.5m	1m	Y
30	Portland Street	Kerbside	562204	320108		N	Y - 2.5m	1m	Y
31	Railway Road 2	Kerbside	562129	320132		Y	Y - 0m	2m	Y
32	Railway Road 3	Roadside	562119	320216		Y	Y - 0m	2m	Y
33	Wellsley Street	Kerbside	562203	320159		N	Y - 2.5m	0.5m	Y
34	Blackfriars 2	Roadside	562244	320129		Y	Y - 0m	2.5m	Y
35	Blackfriars 1	Roadside	562248	320239		Y	Y - 3m	1.5m	Y
36	Norfolk Street	Roadside	562219	320319		Y	Y - 0m	2m	Y
37	Blackfriars 3	Roadside	562257	320243		Y	No	2m	Y
38	Littleport Street	Roadside	562257	320323		Y	Y - 0m	2.5m	Y
39	Gaywood Road 2	Roadside	562822	320427		N	Y - 0m	7m	Y
40	The Swan Gayton Road	Roadside	563480	320470		Y	Y - 0m	2m	Y
41	Wootton Road 2	Roadside	563478	320515		Y	Y - 0m	2m	Y
42	Wootton Road 1	Roadside	563480	320582		Y	Y - 0m	3m	Y
43	Lynn Road 1	Roadside	563412	320477		Y	Y - 0m	5m	Y
44	Lynn Road 2	Roadside	563377	320484		Y	Y - 0m	2m	Y
45	Gaywood Road 3	Roadside	563202	320488		N	Y - 0m	4.5m	Y
46	Gaywood Road 1	Roadside	562565	320509		N	Y - 0m	6.5m	Y
47	Austin Street 1	Roadside	562193	320369		Y	Y - 0.5m	1m	Y
48	Austin Street 2	Roadside	562180	320365		Y	Y - 0m	2m	Y
49	Edward Benefer Way	Roadside	561881	320768		N	Y - 0m	7m	Y



Site No.	Location	Site Type	X	Y	Pollutant Monitored	In AQMA ?	Relevant Exposure ? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Worst-case Location ?
50	Kilham's Way	Urban Background	562026	321615		N	Y - 0m	140m	Y
51	Wootton Road 3	Roadside	563515	320628		N	Y - 6m	1.5m	Y
52	Lynn Road 3	Roadside	563288	320499		N	Y - 5.5m	1m	Y
53	Wisbech Rd Elm 3	Roadside	546947	308215		N	Y - 0m	2m	Y
54	Wisbech Rd Elm 4	Roadside	546940	308207		N	Y - 0m	2m	Y
55	Wisbech Rd Elm 5	Roadside	546945	308216		N	Y - 0m	2m	Y
56	Wisbech Road Elm 2	Roadside	547235	307645		N	Y - 0m	2m	Y
57	NORR 1					N			Y
58	NORR 2					N			Y
S1	Eastgate 1 Primary School	Urban Background	562296	320278		N	Y - 0m	N/A	Y
S2	Eastgate 2 Primary School	Urban Background	562296	320278		N	Y - 0m	N/A	Y
S3	Reffley Community School	Urban Background	564696	321958		N	Y - 0m	N/A	Y
S4	South Wootton Junior School	Urban Background	563965	322509		N	Y - 0m	N/A	Y
S5	Highgate Primary School	Urban Background	562601	320516		N	Y - 0m	N/A	Y
S6	Howard 1 Junior School	Urban Background	563699	319679		N	Y - 0m	N/A	Y
S7	Howard 2 Junior School	Urban Background	563699	319679		N	Y - 0m	N/A	Y
S8	Park 1 High School	Urban Background	563296	319988		N	Y - 0m	N/A	Y
S9	Park 2 High School	Urban Background	563296	319988		N	Y - 0m	N/A	Y
S10	Greyfriars 1 Primary School	Urban Background	562222	319576		N	Y - 0m	N/A	Y
S11	Greyfriars 2 Primary School	Urban Background	562222	319576		N	Y - 0m	N/A	Y

Primary School Background
Bureau Veritas Air Quality
AGGX1400830/BV/AQ

Site No.	Location	Site Type	X	Y	Pollutant Monitored	In AQMA ?	Relevant Exposure ? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Worst-case Location ?
		d							
S12	Nursery School	Urban Background	562208	319493		N	Y - 0m	N/A	Y
S13	Whitefriars 1 Primary School	Urban Background	562215	319502		N	Y - 0m	N/A	Y
S14	Whitefriars 2 Primary School	Urban Background	562215	319502		N	Y - 0m	N/A	Y

3.1.2.2 Benzene diffusion tube data

Four benzene diffusion tubes (BTEX) were installed from October 2007 to March 2008 near the PACE Petroleum storage depot on Eastuary Road, King's Lynn. The tubes were changed monthly and analysed to obtain an average benzene concentration over that period.

3.2 Comparison of Monitoring Results with AQ Objectives

3.2.1 Nitrogen dioxide

There are two AQS 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.

3.2.1.1 Automatic Monitoring Data

NO₂ monitoring results for the last 3 years (2006-2008) at the air quality continuous monitoring station in King's Lynn are presented in [Table 5](#). Both the NO₂ annual mean and the number of hourly means > $200\mu\text{g}/\text{m}^3$ are reported. When data capture was less than 90%, the 99.8th percentile of NO₂ hourly means has been reported as well, in accordance with technical guidance LAQM.TG(09). As the station was relocated from Railway Road to Southgates in June 2008, results at both sites are presented for this year.

Deleted: Table 5

Results for 2008 at Railway Road are consistent with results from previous years and show that both the NO₂ annual mean and hourly mean objectives were met at the station. Results for Southgates are even lower, with an annual mean of $27.2\mu\text{g}/\text{m}^3$, which shows that the AQS objectives for NO₂ are unlikely to be breached at this site.

Table 5– Results of Automatic Monitoring for NO₂

Location	Within AQMA ?	Description	Year		
			2006	2007	2008
King's Lynn AQM Station (Railway Road) ⁽¹⁾	Yes	Annual Mean NO ₂ ($\mu\text{g}/\text{m}^3$) ⁽³⁾	32	31.1	32.1
		NO ₂ Hourly Mean > $200\mu\text{g}/\text{m}^3$	0	3	0
		99.8th percentile of NO ₂ hourly means ($\mu\text{g}/\text{m}^3$)	84	84	101
		% Data Capture	87%	77%	86%
King's Lynn AQM Station (Southgates) ⁽²⁾	Yes	Annual Mean NO ₂ ($\mu\text{g}/\text{m}^3$) ⁽³⁾	Not installed		27.2
		NO ₂ Hourly Mean > $200\mu\text{g}/\text{m}^3$	Not installed		0
		99.8th percentile of NO ₂ hourly means ($\mu\text{g}/\text{m}^3$)	Not installed		82
		% Data Capture	Not installed		91%

1. Railway Road monitoring data from 01/01/08 to 12/06/08
2. Southgates monitoring data from 25/12/2008 to 31/12/08
3. Data annualised based on the 3 closest background AURN monitoring stations (Wicken Fen, Northampton and Market Harborough)

3.2.1.2 Diffusion Tube Monitoring Data

The nitrogen dioxide diffusion tube data are summarised in [Table 6](#). The full dataset (monthly mean values) are included in Appendix 3.

Deleted: Table 6

The NO₂ annual mean AQS objective of $40\mu\text{g}/\text{m}^3$ was exceeded at 9 sites in King's Lynn in 2008, including:

- 7 sites within the AQMA in King's Lynn town centre, located along Railway Road, London Road, Southgates and Austin Street. These sites also exceeded the objective in 2006 and 2007, and show that the AQMA in the town centre is still required.
- 1 site within the new Gaywood Clock AQMA on Wootton Road ($40.5\mu\text{g}/\text{m}^3$ monitored at site "Wootton Road 2" in 2008). This site also exceeded the objective in 2006 and 2007, and was the reason why a Detailed Assessment was carried out in 2007, concluding that a new AQMA was required for this area.
- The diffusion tube installed at King's Lynn bus station ("Bus Station 1"). This site had exceeded the objective in 2006 ($43\mu\text{g}/\text{m}^3$) and was below but very close to the objective in 2007 ($39.4\mu\text{g}/\text{m}^3$). As mentioned in the Progress Report 2007, this site is not relevant of public exposure with regards to the NO_2 annual mean AQS objective. With respect to the hourly NO_2 objective, there could be a potential risk of exceedence of this short-term objective where the annual mean NO_2 concentration is $>60\mu\text{g}/\text{m}^3$. Therefore, this site is unlikely to exceed the hourly mean objective.

Several sites also show an annual mean below but close to the AQS objective (above $36\mu\text{g}/\text{m}^3$). All these sites are located within the town centre AQMA (Railway Road, London Road, Littleport Street) or the Gaywood Clock AQMA (The Swan – Gayton Road).

All other sites outside the AQMAs are well below the NO_2 annual mean AQS objective. Therefore, a Detailed Assessment is not required at this time.

Table 6– Results of Nitrogen Dioxide Diffusion Tubes

Site No.	Location	Within AQMA ?	Data Capture 2008 (months)	NO ₂ Annual Mean Concentration (µg/m ³) - Bias Adjusted		
				2006 (Bias Factor: 0.98)	2007 (Bias Factor: 0.89)	2008 (Bias Factor: 0.88)
1	Railway Road 1	Y	12	44	44.0	44.4
2	Railway Road 4	Y	12	56	55.0	51.5
3	Railway Road 5	Y	12	51	50.4	46.8
4	Railway Road 6	Y	12	39	38.3	37.5
5	Bus Station 1	N	11	43	39.4	40.0
6,7,8	Railway Road Monitoring Station	Y	6	33	31.3	31.3
6,7,8	Southgates Monitoring Station	Y	6	NI	NI	28.9
9	Mill Fleet 1	N	12	26	26.7	23.4
10	London Road 1	Y	12	43	44.6	41.1
11	London Road 2	Y	12	36	34.9	31.6
12	London Road 3	Y	12	39	39.2	38.5
13	London Road 4	Y	12	40	40.5	36.0
14	London Road 5	Y	12	41	42.3	39.1
15	Southgates	Y	12	43	47.1	42.1
16	Wisbech Rd KL	N	12	27	28.2	24.4
17	Nora 1	N	12	23	21.4	20.3
18	Hardwick Rd	N	12	31	31.7	30.0
19	Vancouver Avenue 1	N	12	30	28.0	24.6
20	London Road 10	Y	12	35	35.2	32.2
21	London Road 11	Y	12	41	39.9	34.6
22	London Road 6	Y	12	40	39.9	37.2
23	London Road 7	Y	12	38	40.1	35.5
24	London Road 8	Y	12	37	34.3	32.2
25	The Walks	N	12	22	19.9	18.8
26	Railway Road 7	Y	10	43	44.4	40.7

Site No.	Location	Within AQMA ?	Data Capture 2008 (months)	NO ₂ Annual Mean Concentration (µg/m ³) - Bias Adjusted		
				2006 (Bias Factor: 0.98)	2007 (Bias Factor: 0.89)	2008 (Bias Factor: 0.88)
27	St John's Terrace	Y	12	35	36.3	31.9
28	St John's Terrace/Blackfriars	Y	10	33	33.7	33.9
29	Waterloo Street	N	10	27	26.3	24.8
30	Portland Street	N	12	27	27.1	25.2
31	Railway Road 2	Y	11	39	39.2	36.8
32	Railway Road 3	Y	12	38	36.6	33.8
33	Wellsley Street	N	11	36	35.8	32.7
34	Blackfriars 2	Y	11	38	40.4	35.4
35	Blackfriars 1	Y	12	37	38.3	33.1
36	Norfolk Street	Y	12	37	35.7	34.9
37	Blackfriars 3	Y	12	48	34.1	32.1
38	Littleport Street	Y	11	36	39.5	39.5
39	Gaywood Road 2	N	12	31	29.7	27.8
40	The Swan Gayton Road	Y	12	36	36.9	36.6
41	Wootton Road 2	Y	11	42	45.1	40.4
42	Wootton Road 1	Y	12	35	35.2	31.6
43	Lynn Road 1	Y	11	33	34.6	30.0
44	Lynn Road 2	Y	9	38	39.8	34.1
45	Gaywood Road 3	N	11	32	34.0	30.8
46	Gaywood Road 1	N	12	29	29.7	28.2
47	Austin Street 1	Y	12	41	44.1	41.0
48	Austin Street 2	Y	12	36	36.6	33.4
49	Edward Benefer Way	N	12	25	25.0	24.1
50	Kilham's Way	N	12	16	13.7	14.2
51	Wootton Road 3	N	12	26	22.3	21.4
52	Lynn Road 3	N	10	23	33.2	30.7
53	Wisbech Rd Elm 3	N	12	21	27.0	26.9

Site No.	Location	Within AQMA ?	Data Capture 2008 (months)	NO ₂ Annual Mean Concentration (µg/m ³) - Bias Adjusted		
				2006 (Bias Factor: 0.98)	2007 (Bias Factor: 0.89)	2008 (Bias Factor: 0.88)
54	Wisbech Rd Elm 4	N	12	25	25.3	23.8
55	Wisbech Rd Elm 5	N	12	22	20.7	20.0
56	Wisbech Road Elm 2	N	12	30	31.7	28.7
57	NORR 1	N	12	NI	31.1	24.4
58	NORR 2	N	11	NI	38.9	30.8
S1	Eastgate 1 Primary School	N	4	NI	NI	20.0
S2	Eastgate 2 Primary School	N	8	NI	NI	26.1
S3	Reffley Community School	N	9	NI	NI	14.8
S4	South Wootton Junior School	N	8	NI	NI	16.8
S5	Highgate Primary School	N	8	NI	NI	26.2
S6	Howard 1 Junior School	N	8	NI	NI	15.3
S7	Howard 2 Junior School	N	7	NI	NI	15.5
S8	Park 1 High School	N	7	NI	NI	15.1
S9	Park 2 High School	N	4	NI	NI	16.1
S10	Greyfriars 1 Primary School	N	7	NI	NI	22.2
S11	Greyfriars 2 Primary School	N	7	NI	NI	21.5
S12	Nursery School	N	8	NI	NI	23.8
S13	Whitefriars 1 Primary School	N	3	NI	NI	17.5
S14	Whitefriars 2 Primary School	N	3	NI	NI	16.5

In bold, exceedence of the NO₂ annual mean AQS objective (40µg/m³)
For results with less than 9 month data capture, annualisation was undertaken using background AURN sites Wicken Fen, Northampton and Market Harborough
NI = Not Installed

3.2.2 Particles (PM₁₀)

There are two AQS 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.

PM₁₀ results for the last 3 years (2006-2008) at the air quality continuous monitoring station in King's Lynn are presented in [Table 8](#). LAQM.TG(09) sets out the calculation required for TEOM results using the Volatile Correction Model (VCM) to estimate gravimetric equivalent. This replaces use of the previous 1.3 factor. Data for 2008 has been corrected using the VCM model (see details in Table 7). Data for previous years has been taken from previous LAQM reports corrected with the 1.3 factor.

Deleted: Table 8

Table 7 - Summary Sheet from the Volatile Correction Model

Summary	Text	Value
Site Name	Kings Lynn	
Organisation	Kings Lynn and West Norfolk BC	
Start Date	01/01/2008	
End Date	01/01/2009	
TEOM data already corrected with 1.3 factor	No	
EPA Constant A		3
EPA Constant B		1.03
Instrument Temperature		20
Instrument Pressure		1013
Instrument reports to local ambient readings	No	
Timescale	Hourly	
Pressure Site	Broxbourne (Roadside) (BB1)	
Pressure Site Warning	Distant site (122km).	
Temperature Site	Broxbourne (Roadside) (BB1)	
Temperature Site Warning	Distant site (122km).	
FDMS Site 1	Leicester Centre (LC0)	
FDMS Site 1 Warning	Correction includes unratified data. Distant site (104km).	
FDMS Site 2	Nottingham Centre (NT0)	
FDMS Site 2 Warning	Correction includes unratified data. Distant site (106km).	
FDMS Site 3	Hull Freetown (HU0)	
FDMS Site 3 Warning	Correction includes unratified data. Distant site (121km).	

When data capture was less than 90%, the 90.4th percentile of PM₁₀ daily means has been reported as well, in accordance with technical guidance LAQM.TG(09). As the station was relocated from Railway Road to Southgates in June 2008, results at both sites are presented for this year.

The 2008 results show that the PM₁₀ AQS objectives were met at the Railway Road monitoring station, which is consistent with results from previous years. Results at Southgates also show that the PM₁₀ AQS objectives are unlikely to be breached at this site.

Table 8– Results of PM₁₀ Automatic Monitoring

Site	Within AQMA ?	Description	Year		
			2006	2007	2008 (TEOM _{VCM})
King's Lynn AQM Station (Railway Road) ⁽²⁾	No ⁽¹⁾	Annual Mean PM ₁₀ (µg/m ³)	26	24.4	19.7 ⁽⁴⁾
		PM ₁₀ Daily Mean > 50µg/m ³	9	6	6
		90.4th percentile of PM ₁₀ daily means (µg/m ³)	Not required	N/A	41.6
		% Data Capture	92%	77%	87%
King's Lynn AQM Station (Southgates) ⁽³⁾	No ⁽¹⁾	Annual Mean PM ₁₀ (µg/m ³)	Not Installed		19.0 ⁽⁴⁾
		PM ₁₀ Daily Mean > 50µg/m ³			1
		90.4 th percentile of PM ₁₀ daily means (µg/m ³)			27.8
		% Data Capture			96%

1. AQMA in King's Lynn town centre is declared for NO₂ only
2. Railway Road monitoring data from 01/01/08 to 12/06/08
3. Southgates monitoring data from 25/12/2008 to 31/12/08
4. Data annualised based on Chesterfield Urban Background AURN monitoring station (no other background PM₁₀ site available)

3.2.3 Benzene

The AQS objective for benzene is an annual mean of $5\mu\text{g}/\text{m}^3$ to be achieved by 31 December 2010. Results for the 6-month monitoring period in 2007-2008 are shown in [Table 9](#). Results were annualised based on available data from the three closest monitoring stations part of the Non-Automatic Hydrocarbon Monitoring Network²², located in Leicester, Nottingham and Northampton, using an average annualisation factor of 0.71²³. The estimated 2008 benzene annual mean was between $0.75\mu\text{g}/\text{m}^3$ and $1.40\mu\text{g}/\text{m}^3$ at all sites, which is well below the AQS objective.

Deleted: Table 9

Table 9 - Results of benzene diffusion tubes

Site	Monitoring Period	Data Capture (%)	Benzene Concentration ($\mu\text{g}/\text{m}^3$)							
			Oct 07	Nov 07	Dec 07	Jan 08	Feb 08	Mar 08	Period Average	2008 Annual Mean
PACE Fence	October 2007 to March 2008	100	0.97	0.75	1.22	1.04	1.37	1.41	1.16	0.83
PACE Gantry		100	0.92	1.89	2.62	1.52	2.07	1.71	1.96	1.40
Development Centre		100	1.05	0.96	1.21	0.86	1.2	0.98	1.04	0.75
St Edmund's School		100	1.19	0.95	1.23	0.81	1.2	0.96	1.03	0.74

Data annualised based on Leicester, Nottingham and Northampton stations (part of the non-automatic hydrocarbon monitoring network)

²² Data available on the Air Quality Archive website - www.airquality.co.uk

²³ The annualisation factor for each site was 0.69, 0.75 and 0.70 respectively

4 Road Traffic Sources

The air quality assessment for road traffic emissions sources has been undertaken using the Highways Agency's DMRB¹ air quality model. The DMRB inputs and results are shown in Appendix 4.

4.1 Narrow congested streets with residential properties close to the kerb

Narrow congested streets to take into account should match all criteria listed below:

- Daily traffic flow (AADT) is around 5,000 vehicles/day or more.
- A congested street will be one with slow moving traffic that is frequently stopping and starting due to pedestrian crossings, parked vehicles etc throughout much of the day (not just during rush hours). The average speed is likely to be less than about 25 kph (15 mph).
- A narrow street will be one with residential properties within 2 m of the kerb, and buildings on both sides of the road (the buildings on the other side of the road can be further from the road than 2 m).

The assessment need only consider NO₂.

There are no new/newly identified narrow congested streets with a flow above 5,000 vehicles per day and residential properties close to the kerb identified by King's Lynn & West Norfolk BC. However, as the criteria for assessment has changed since the previous round of Review and Assessment, this source has been reassessed.

Three roads were identified as narrow streets where the traffic flows are >5000 vehicles/day.

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

These roads are already part of the AQMAs declared in King's Lynn. Monitoring is already being undertaken along these roads and measured concentrations of NO₂ still exceed the annual mean AQS objective; therefore, the AQMAs should remain.

There are no other roads that meet the criteria in the Borough.

4.2 Busy streets where people may spend 1-hour or more close to traffic

Busy streets to take into account should match all criteria listed below:

- Daily traffic flow (AADT) is around 10,000 vehicles/day or more.
- Individuals may be exposed within 5m of the kerb.

The assessment need only consider NO₂.

All relevant streets were assessed in the previous USA. The main shopping streets in King's Lynn are pedestrianised with no relevant exposure to traffic. There are no new / newly identified busy streets where people may spend 1 hour or more close to traffic.

4.3 Roads with a high flow of buses and/or Heavy Goods Vehicles

The roads to take into account should match all following criteria:

- The percentage of HDVs is greater than 20%.

The assessment need to consider NO₂ and PM₁₀.

King's Lynn & West Norfolk BC has not identified any road with a high flow of buses and / or HGVs that have not been adequately considered in previous rounds. Based on updated traffic flows, the maximum percentage of HDVs is 16%-17% on the A134 Lynn Road and the A134 Stoke Ferry Bypass. These roads were assessed in the previous USA. There is no need to proceed to a Detailed Assessment.

4.4 Junctions

Busy junctions to take into account should match all following criteria:

- Daily traffic flow (AADT) is around 10,000 vehicles/day or more.
- There is relevant exposure within 10m of the kerb, or 20m from the kerb in major conurbations (assumed to be a city with a population in excess of 2 million)

The assessment need to consider NO₂ and PM₁₀.

The following busy junctions were assessed in the last USA:

- Hardwick Road / London Road
- Gaywood Clock (Gayton Road / Lynn Road / Wootton Road)
- Saddlebow Road / A47 (East of Roundabout)
- Hardwick roundabout (Queen Elizabeth Way / Hardwick Road / Winch Road)
- New Inn junction (Low Road / Wootton Road)

King's Lynn & West Norfolk BC has not identified any new junctions that have not been adequately considered in previous rounds.

4.5 New roads constructed or proposed since the last round of Review and Assessment

The assessment need to consider NO₂ and PM₁₀.

The Nar Ouse Way (part of the NORA scheme - Nar Ouse Regeneration Area) has been open for some time now. The road links Saddlebow Roundabout on the A47 to the South Gate. There are currently no receptors relevant of public exposure along the road, as the land remains undeveloped. There is ongoing NO₂ monitoring along Nar Ouse Way, with two diffusion tubes installed (tubes 56, NORR1 and 57, NORR2). The 2008 NO₂ annual mean was 24.4µg/m³ (NORR1) and 30.8µg/m³ (NORR), which is well below the AQS objective.

There is also a proposed new bus route between Wisbech Road and Boal Quay, which is part of the recent Community Infrastructure Fund bid proposal. There is no air quality assessment available for this scheme at present. It is hoped that this new route will help towards reducing NO₂ levels within the King's Lynn AQMAs.

4.6 Roads with significantly changed traffic

Roads with significantly changed traffic (since the last USA) to take into account should match the following criteria:

- Daily traffic flow (AADT) is around 10,000 vehicles/day or more.
- The increase in traffic flow is 25% or more.

The assessment need to consider NO₂ and PM₁₀.

King's Lynn and West Norfolk BC has not identified any roads with significantly changed traffic flows of 25% or more since the last round of Review and Assessment. Based on updated traffic data, the highest increase in traffic flows is 16% on the A134 Lynn Road, with a total AADT of about 6700 vehicles/day. This road was assessed in the previous USA.

The following roads were not assessed in the previous USA.

- A1101 Elm High Road.
- A47 Wisbech Bypass (North of the junction with B198 Lynn Road)
- A47 Wisbech Bypass (West of New Road bridge)
- A47 Wisbech Bypass (East of Tilney High End)

NO₂ and PM₁₀ concentrations at the nearest properties have been determined based on the DMRB air quality model. The results, as shown in Appendix 4, indicate concentrations at the nearest receptors are well below the NO₂ and PM₁₀ AQS objectives. Therefore, there is no need to proceed to a Detailed Assessment.

4.7 Bus and coach stations

The bus / coach stations to take into account should match the following criteria:

- The station or sections of the station are not enclosed.
- There is relevant exposure within 10m of any part of the station, where buses / coaches are present.
- The number of bus / coach movements is greater than 2,500 per day.

The assessment need to consider both NO₂ annual and hourly mean concentrations.

King's Lynn Bus Station was assessed in the previous USA. The number of bus movements in and out of the station was unlikely to be above 1,000 per day. There has been no significant increase in bus movements since the last round.

Monitoring is already being undertaken at the station, and measured concentrations of NO₂ were close to or slightly exceeded 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. With respect to the hourly NO₂ objective, there could be a potential risk of exceedence of this short-term objective where the annual mean NO₂ concentration is >60µg/m³. Therefore, this site is unlikely to exceed the hourly mean objective and there is no need to proceed to a Detailed Assessment.

5 Other Transport Sources

5.1 Airports

Airports to take into account should match the following criteria:

- The passenger throughput is 10 million passengers per annum (mppa).
- There is relevant exposure within 1km of the airport boundary.
- The background NO₂ concentration near the airport is above 25µg/m³.

The assessment for airports needs to consider NO₂ only.

There are no airports matching these criteria in the Borough or close to the boundary, and therefore there is not need to proceed further with this part.

5.2 Railways (diesel and steam trains)

The railway stations or depots to take into account should match the following criteria:

- There are stationary locomotives for 15 minutes or more.
- There is relevant exposure within 15m.
- The background NO₂ concentration nearby is above 25µg/m³.

The assessment for stationary trains considers SO₂ emissions, while the assessment for moving diesel trains considers NO₂ 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.

The mainline from King's Lynn railway station is electrified. There are diesel trains from / to the quarry in King's Lynn. These were assessed in the previous USA. The report confirmed that they were no locations where diesel or steam trains were regularly stationary for periods of 15 minutes or more, with potential for relevant exposure within 15m. There has been no significant change since the last round, and therefore, there is no need to proceed to a Detailed Assessment.

5.3 Ports (shipping)

The assessment for shipping considers SO₂ emissions at busy ports with 5,000 and 15,000 movements per year and relevant exposure within 250 metres. If there are no ports or shipping, there is no need to proceed further with this part.

The port of King's Lynn was assessed in the previous USA. The number of vessels entering and leaving the Docks is less than 1,000 movements per year. There have been no significant changes since the last round, and therefore, there is no need to proceed to a Detailed Assessment.

6 Industrial Sources

6.1 Industrial Installations

The assessment of industrial installations considers all of the regulated pollutants, although those most at risk of requiring further work are SO₂, NO₂, PM₁₀ and benzene.

There are currently 76 industrial installations listed as Part B processes, and 2 installations listed as Part A2 processes in the Borough. Furthermore, there are 17 installations regulated by the Environment Agency (Part A1). A list of all industrial processes in the Borough is provided in Appendix 5.

6.1.1 New or Proposed Installations for which an Air Quality Assessment has been carried out

There has been no new built installation since the previous round of review and assessment. There is a pending planning application for a car crushing process in the King's Lynn port area, which will need to be considered with regards to PM₁₀ emissions in the next air quality Progress Report. There are also new significant industrial developments proposed / in construction in the Borough:

New Palm Paper Plant, Saddlebow

The new Palm Paper newsprint paper mill is currently being built in Saddlebow, less than 1km southwest of King's Lynn. The plant is expected to be operational in September 2009. An air quality impact assessment was submitted as part of the Environmental Statement in 2007. The assessment was based on detailed dispersion modelling of a number of pollutants, including NO₂, SO₂ and PM₁₀. The report concluded that the impact of pollutant emissions generated by the plant on nearby sensitive receptors would not be significant, and that it would not lead to any exceedence of the AQS objectives.

Future Gas Power Station, King's Lynn

Planning permission has been granted in February 2009 for the construction of the future Gas Power Station in King's Lynn. The power station, which will be built by Centrica, should include a 1200MW combined cycle gas turbine. Final decision is expected in 2012, with the site likely to be operational by 2016. The impact of the power station in relation to LAQM should be assessed in the next round of review and assessment.

Anglian Water Sewage Treatment Works, West Walton

A stack height calculation has been submitted following plans for a Combined Heat and Power (CHP) plant to be installed at the Anglian Water Sewage Treatment Works in West Walton. The application has not been granted yet. The outcome of the installation in relation to LAQM will be reviewed and reported in the LAQM air quality Progress Report 2010.

6.1.2 Existing Installations where emissions have increased substantially or new relevant exposure has been introduced

The installations to take into account should match one of the following criteria:

- The installation experienced substantially increased emissions (> 30%), or
- There is new relevant exposure in the vicinity.

Bespak Europe Ltd, located in the North Lynn Industrial Estate in King's Lynn, had a Part B permit for surface cleaning. Since the last USA, they have increased their throughput of solvents (ethanol) from 110 tonnes per annum to 260 tonnes per annum and are now an A2 process. However, emissions are ozone depleting substances (ODS), which are not 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.

King's Lynn and West Norfolk BC 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

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

There have been 12 new Part B processes permitted by King's Lynn and West Norfolk BC since the last round of review and assessment. These include:

- 2 waste oil burners < 0.4 MW
- 1 petrol station
- 1 timber processing
- 1 vehicle refinishing
- 1 pet food manufacturer
- 1 di-isocyanate process
- 5 dry cleaners

There are no significant emission releases from these processes relevant to the AQS objectives.

6.2 Major fuel (petrol) storage depots

The assessment considers benzene, with respect to the 2010 objective.

There are no new major fuel (petrol) storage depots within the Borough. The existing Pace Petroleum fuel storage depot was considered in the USA 2006. The activity at the site has decreased over the past few years. Therefore, there is no need to proceed further for this source.

6.3 Petrol stations

The petrol stations to take into account should match all following criteria:

- The annual throughput is more than 2,000 m³ of petrol (2 million litres per annum).
- There is a busy road nearby with more than 30,000 annual average daily traffic (AADT) flows.
- There is relevant exposure within 10m of the pumps.

The assessment considers benzene, with respect to the 2010 objective. Petrol stations fitted with Stage 2 recovery systems can be ignored.

The previous round of Review and Assessment considered all (19) petrol filling stations in the Borough. Conclusions were that none of them met the above criteria. There has been 1 new petrol station opening in the Borough since the last USA, which was assessed in the Progress Report 2007. Conclusions were that the station does not meet the above criteria.

6.4 Poultry farms

Farms housing in excess of: 400,000 birds if mechanically ventilated, 200,000 birds if naturally ventilated, and 100,000 birds for any turkey unit, require consideration in this assessment, to establish whether there is relevant exposure within 100m of the poultry units. The assessment needs to consider only PM₁₀.

There are a few poultry farms in the Borough. However, these are small-scale farms, and none of them meets the above criteria. Therefore, there is no need to proceed to a Detailed Assessment.

7 Commercial and Domestic Sources

7.1 Biomass combustion

7.1.1 Biomass combustion - individual installations

The biomass combustion installations to take into account are the plants burning biomass in 50kW to 20MW units. The assessment considers both PM₁₀ and nitrogen dioxide objectives.

King's Lynn and West Norfolk BC confirms that there are no biomass combustion plants in the Borough, which match this criterion.

7.1.2 Biomass combustion - combined impacts (PM₁₀ emissions)

This section should consider the combined effects of small biomass combustion installations. The assessment considers PM₁₀ only.

King's Lynn and West Norfolk BC confirms that there are no biomass combustion plants in the Borough, which meet this criterion.

7.2 Domestic solid-fuel burning (sulphur dioxide emissions)

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. PM₁₀ from domestic solid fuel burning is covered under the Biomass combustion – combined impacts section above.

Domestic solid fuel burning was assessed in the 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.

8 Fugitive or Uncontrolled Sources

The assessment of fugitive and uncontrolled sources considers the PM₁₀ objectives. This includes consideration to quarries, landfill sites, opencast coal mining, waste transfer sites, and materials handling (i.e. ports, major construction sites). Only locations not covered in the previous rounds of Review and Assessment, or where there is new relevant exposure, require consideration. In the case of proposed new sources, these only need to be considered if planning approval has been granted. Relevant exposure near the source is defined as follows:

- Within 1000m for a local PM₁₀ background concentration > 28µg/m³;
- Within 400m for a local PM₁₀ background concentration between 26µg/m³ and 28µg/m³; and
- Within 200m for a local PM₁₀ background concentration < 26µg/m³.

2008 PM₁₀ background maps show that the maximum PM₁₀ annual mean in King's Lynn & West Norfolk is 20µg/m³. Therefore, only properties within 200m of fugitive PM₁₀ sources need to be considered.

Stoke Ferry Feed Mill

Fugitive dust emissions from the VION feed mill (formerly Grampian Country Feeds) in Furlong Road, Stoke Ferry, have been monitored in 2008 based on a screening instrument (Osiris Dust Monitor). The PM₁₀ average for the period (January to July) was 18.7µg/m³. Therefore, a risk of exceeding the annual mean PM₁₀ objective is unlikely at this location.

Quarries and landfill sites

Existing quarries and landfill sites within the Borough have been assessed in the previous rounds of Review and Assessment. Conclusions were that there was no significant risk identified with relation to PM₁₀. There have been no new quarries or extensions to existing quarries since the last USA and there is no new relevant exposure. No dust complaints have been received.

Concerns have been expressed with relation to potential dust from silica sand extraction, following plans for new mineral extraction sites across the Borough. As part of the Norfolk Minerals and Waste Development Framework, Norfolk County Council will submit the Minerals and Waste Core Strategy and Development Control Document for consultation in summer 2009, with the examination by the Planning Inspectorate and a final decision expected by the end of 2010. Fugitive dust emissions and potential change in relevant exposure will be reviewed in the next LAQM reports.

Major Construction sites

The only major construction site is the New Palm Paper Plant currently under construction in Saddlebow. Dust and odour monitoring, and mitigation measures have been put in place, following the recommendations of the Site Environmental Management Plan (SEMP), which was submitted with the planning application. No dust complaints have been received since the start of the construction phase.

9 Conclusions and Proposed Actions

9.1 Conclusions from new monitoring data

The USA review of new monitoring data has shown that NO₂ concentrations still exceed the annual mean AQS objective at a number of locations in King's Lynn. All exceedences are monitored within the Air Quality Management Areas, and are consistent with NO₂ levels monitored in previous years. The Council is currently working with Norfolk County Council to produce an Air Quality Action Plan, which will include potential mitigation measures to tackle NO₂ exceedences in King's Lynn.

NO₂ levels at all sites outside the AQMAs continue to be below the objectives.

Results for 2008 at the continuous monitoring station in Railway Road show that both NO₂ and PM₁₀ AQS objectives were met at the station. Results at Southgates, where the station was relocated mid-2008, were even lower, which shows that the AQS objectives for these pollutants are unlikely to be breached at this site.

Results for the 6-month monitoring period of benzene between 2007 and 2008 near the PACE Petroleum storage depot on Eastuary Road in King's Lynn showed that all sites met the benzene AQS objective.

Based on these results, there is no requirement to proceed to a Detailed Assessment.

9.2 Conclusions from assessment of sources

9.2.1 Road Sources

All road sources were assessed in the previous USA, apart from the A1101 Elm High Road in Wisbech, and the A47 Wisbech Bypass. DMRB results show that both NO₂ and PM₁₀ concentrations are well below the AQS objectives for these pollutants. No new road or significant change in existing roads has been identified since the last USA. Therefore, there is no need to proceed to a Detailed Assessment.

9.2.2 Other Sources

All other potential sources have been assessed. There have been no significant changes since the last round of Review and Assessment, apart from the new Palm Paper newsprint paper mill, which is currently being built in Saddlebow and should be operational by the end of 2009. An air quality impact assessment was submitted as part of the Environmental Statement in 2007, which concluded that the impact of pollutant emissions generated by the plant on nearby sensitive receptors would not be significant, and that it would not lead to any exceedence of the AQS objectives.

The future Gas Power Station in King's Lynn has been granted planning permission in February 2009, with the site likely to be operational by 2016. The impact of the power station in relation to LAQM will be assessed in the next round of review and assessment.

There are plans for new mineral extraction sites across the Borough, as part of the Norfolk Minerals and Waste Development Framework, developed by Norfolk County Council. Final decision with regards to the proposed sites is expected by the end of 2010. Any new site will need to be assessed in the next LAQM reports with regards to PM₁₀ fugitive emissions.

9.3 Proposed Actions

Proposed actions arising from the USA are as follows:

- Continue to monitor NO₂ in King's Lynn AQMAs to provide updated information for the 2010 Annual Progress Report;
- Finalise the Air Quality Action Plan, identifying mitigation measures to help reduce NO₂ levels in the AQMAs and meet the AQS objectives.

10 References

- Highways Agency's Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 1 Air Quality, May 2007, and accompanying spreadsheet DMRB Screening Method V1,03.xls. July 2007
- 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
- Local Air Quality Management Policy Guidance LAQM.PG(09). February 2009. Published by Defra
- Borough Council of King's Lynn & West Norfolk 2008 Local Air Quality Management - Detailed & Further Assessments
- Borough Council of King's Lynn & West Norfolk 2007 Local Air Quality Management - Annual Progress Report
- Borough Council of King's Lynn & West Norfolk 2006 Local Air Quality Management - Updating and Screening Assessment

APPENDICES

Appendix 1 – Traffic Data

Data Source	Location	X	Y	AADT 2008	% HDV*	Previously Assessed ?	Substantial change since USA 2006 (25%) ?	Assessed in USA 2009 using DMRB ?	Reason for assessment
DfT	A134 Lynn Road	565812	307935	6689	16.1%	Yes	No	No	
NCC	A10 Main Road (West Winch)	563455	314883	17656	9.6%	Yes	No	No	-
NCC	A149 Hardwick Road	562851	318565	23556	1.6%	Yes	No	No	-
DfT	A1101 Wash Road	553210	293000	3095	8.8%	Yes	No	No	-
NCC	A149 Queen Elizabeth Way (South of hospital)	563885	318676	25825	6.2%	Yes	No	No	-
NCC	A149 Eastern Bypass (North of hospital)	565779	321207	22206	6.0%	Yes	No	No	-
DfT	A1101 Wisbech Road	550578	300205	3824	6.6%	Yes	No	No	-
NCC	A1078 Edward Benefer Way / Low Road	564173	322367	16501	4.6%	Yes	No	No	-
DfT	A1122 Station Road	560100	303270	8327	6.1%	Yes	No	No	-
NCC	A148 Lynn Road West of Hillington	571028	325301	9226	8.5%	Yes	No	No	-
DfT	A1122 Bexwell Road	563299	303576	11181	10.0%	Yes	No	No	-
NCC	A47 West of Hardwick Rbt	562029	318071	28480	14.2%	Yes	No	No	-
DfT	A134 Stoke Ferry By-pass	571126	300123	7778	17.1%	Yes	No	No	-
DfT	A1122 Swaffham Road	568792	306411	6360	10.3%	Yes	No	No	-
NCC	A17 Kings Lynn Bypass (West Lynn)	560028	319139	15850	14.6%	Yes	No	No	-
DfT	A10 Lynn Road	563542	309630	10540	5.7%	Yes	No	No	-
DfT	A149 Lynn Road	568300	335920	12820	2.0%	Yes	No	No	-
DfT	A10 Downham Market Eastern Bypass	562580	303135	11776	8.9%	Yes	No	No	-
DfT	A1101 Isle Road	551242	303642	7154	5.3%	Yes	No	No	-
DfT	A47 Lynn Road	570054	316130	13052	10.8%	Yes	No	No	-
NCC	A148 Wootton Road	564003	321816	11709	0.8%	Yes	No	No	-
DfT	A1101 Outwell Road	549800	305420	9208	11.8%	Yes	No	No	-
NCC	A148 London Road / St James Road	562104	319731	20876	1.5%	Yes	No	No	-

Data Source	Location	X	Y	AADT 2008	% HDV*	Previously Assessed ?	Substantial change since USA 2006 (25%) ?	Assessed in USA 2009 using DMRB ?	Reason for assessment
DfT	A1078 Austin Street	562081	320372	13976	1.5%	Yes	No	No	-
DfT	A148 Railway Road	562100	320220	16043	1.2%	Yes	No	No	-
NCC	A148 Lynn Road (Gaywood Rd)	563254	320488	23647	0.6%	Yes	No	No	-
DfT	A1078 Blackfriars Road	562250	320128	10590	1.6%	Yes	No	No	-
NCC	A148 Grimston Road	565142	322496	14778	4.8%	Yes	No	No	-
NCC	A1076 Gayton Road	565150	320245	14855	0.9%	Yes	No	No	-
DfT	A148 Fakenham Road	572815	325673	8938	7.2%	Yes	No	No	-
NCC	A47 Kings Lynn By-pass (Ouse Bridge)	560860	318650	32944	11.6%	Yes	No	No	-
DfT	A149 Hunstanton Road	578941	344195	2802	1.4%	Yes	No	No	-
DfT	A148 Fakenham Road	579747	326943	7050	9.1%	Yes	No	No	-
DfT	A1101 Elm High Road	547006	308010	17604	6.3%	No	-	Yes	Not assessed previously
DfT	A47 Wisbech Bypass (North of jct with B198 Lynn Rd)	549334	312198	18530	0.3%	No	-	Yes	Not assessed previously
DfT	A47 Wisbech Bypass (West of New Road bridge)	554553	315090	18579	0.3%	No	-	Yes	Not assessed previously
DfT	A47 Wisbech Bypass (East of Tilney High End)	557480	317120	18649	0.3%	No	-	Yes	Not assessed previously

* Heavy duty vehicles (HDV) >20% is considered as an unusually high proportion, which would warrant assessment if not previously considered

Appendix 2 - Bias Adjustment Factor Calculations

Location	Month	Diffusion Tubes Measurements	Automatic Monitoring Site			Bias Adjustment
		Period Mean (NO ₂ - µg/m ³)	Period Mean (NO ₂ - µg/m ³)	Data Capture (%)	Automatic Monitor Data Capture Check	
Railway Road	January	41	35.3	88.9	Good	0.9
	February	38	43.8	98.7	Good	1.2
	March	34	29.3	89.1	Good	0.9
	April	36	40.2	67.4	Poor Data Capture	1.1
	May	38	29.9	82.3	Good	0.8
	June	29	30.9	40.8	Poor Data Capture	1.1
Southgates	July	25	19.7	94.4	Good	0.8
	August	29	18.5	74.3	Poor Data Capture	0.6
	September	21	24.0	97.6	Good	1.1
	October	37	26.1	99.6	Good	0.7
	November	37	31.3	87.0	Good	0.8
	December	40	34.8	80.8	Good	0.9
					Overall Bias Adjustment Factor	0.88

Appendix 3 - Nitrogen dioxide diffusion tube results 2008

Site Ref	Location	X	Y	Site type	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Average	Annualised ? (Y - value / N)	Corrected Annual Mean 2008 (Bias Factor 0.88)
1	Railway Road 1	562073	320304	Kerbside	48	64	49	40	48	39	50	53	57	51	55	51	50.4	No	44.4
2	Railway Road 4	562100	320222	Roadside	70	59	52	63	46	63	60	60	37	64	59	68	58.4	No	51.5
3	Railway Road 5	562117	320095	Roadside	56	52	39	62	50	52	51	49	40	61	66	60	53.2	No	46.8
4	Railway Road 6	562115	320062	Kerbside	42	45	41	40	46	38	41	35	40	45	51	47	42.6	No	37.5
5	Bus Station 1	562055	320137	Bus Station	52	54	42	53	37	39	46		23	53	52	48	45.4	No	40.0
6,7,8	Railway Road Monitoring Station	562113	320043	Roadside	41	38	34	36	38	29							36.0	Yes - 35.5	31.3
6,7,8	Southgates Monitoring Station	562227	319198	Roadside						23	25	29	21	37	37	40	30.3	Yes - 32.7	28.9
9	Mill Fleet 1	561900	319707	Roadside	28	36	25	24	29	22	19	20	24	25	31	36	26.6	No	23.4
10	London Road 1	562101	319679	Roadside	51	54	39	46	43	41	33	52	40	53	50	58	46.7	No	41.1
11	London Road 2	562154	319594	Roadside	40	42	26	34	34	34	37	39	26	38	42	39	35.9	No	31.6
12	London Road 3	562242	319452	Roadside	45	53	42	49	33	36	40	42	44	47	44	50	43.8	No	38.5
13	London Road 4	562264	319375	Roadside	49	43	42	35	29	37	32	38	41	47	52	45	40.8	No	36.0
14	London Road 5	562226	319263	Roadside	43	52	36	54	36	47	40	43	33	53	49	47	44.4	No	39.1
15	Southgates	562190	319102	Kerbside	43	51	32	56	61	48	52	40	35	54	48	53	47.8	No	42.1
16	Wisbech Rd KL	561958	318963	Roadside	32	33	25	23	23	23	25	26	18	34	33	37	27.7	No	24.4
17	Nora 1	562209	318924	Roadside	25	29	21	22	21	18	17	17	22	27	27	30	23.0	No	20.3
18	Hardwick Rd	562266	319043	Roadside	33	39	34	40	40	28	25	30	25	37	40	38	34.1	No	30.0
19	Vancouver Avenue 1	562277	319098	Roadside	31	36	27	29	25	10	27	29	18	33	33	37	27.9	No	24.6
20	London Road 10	562244	319261	Kerbside	40	23	34	35	44	27	40	34	41	38	39	43	36.5	No	32.2
21	London Road 11	562267	319327	Roadside	39	42	38	46	41	36	35	37	36	45	46	30	39.3	No	34.6
22	London Road 6	562285	319386	Roadside	37	0.05	89	43	51	35	33	32	47	45	45	49	42.2	No	37.2
23	London Road 7	562162	319614	Roadside	33	45	33	41	61	42	41	30	32	41	37	48	40.3	No	35.5

Site Ref	Location	X	Y	Site type	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Average	Annualised ? (Y - value / N)	Corrected Annual Mean 2008 (Bias Factor 0.88)
24	London Road 8	562136	319651	Roadside	32	36	32	42	50	35	36	29	35	37	39	35	36.5	No	32.2
25	The Walks	562191	319695	Urban Background	26	28	20	19	13	16	17	19	17	26	27	28	21.3	No	18.8
26	Railway Road 7	562131	319996	Roadside		45	40	47	49	45	47	41	47		52	49	46.2	No	40.7
27	St John's Terrace	562178	319999	Roadside	37	23	40	41	41	38	33	33	25	44	44	35	36.2	No	31.9
28	St John's Terrace/Blackfriar's	562253	320016	Roadside	42	43			29	37	28	37	42	39	41	47	38.5	No	33.9
29	Waterloo Street	562175	320055	Kerbside	36	33	27	30			20	22	14	29	33	37	28.1	No	24.8
30	Portland Street	562204	320108	Kerbside	33	34	28	30	25	23	21	22	23	32	35	37	28.6	No	25.2
31	Railway Road 2	562129	320132	Kerbside	39	46	36	43	64	44	39	34	47		45	23	41.8	No	36.8
32	Railway Road 3	562119	320216	Roadside	38	42	39	42	44	35	27	36	22	38	49	48	38.3	No	33.8
33	Wellsley Street	562203	320159	Kerbside	38	37		37	37	31	28	35	42	40	38	45	37.1	No	32.7
34	Blackfriars 2	562244	320129	Roadside	39	47	40	38	33	42		44	21	43	45	50	40.2	No	35.4
35	Blackfriars 1	562248	320239	Roadside	41	45	40	35	36	35	31	37	17	42	47	45	37.6	No	33.1
36	Norfolk Street	562219	320319	Roadside	43	50	36	41	38	33	40	33	31	43	44	43	39.6	No	34.9
37	Blackfriars 3	562257	320243	Roadside	43	44	35	36	26	33	31	31	24	46	42	46	36.4	No	32.1
38	Littleport Street	562257	320323	Roadside	56	44	39	45	45	36	46	48	38		43	53	44.8	No	39.5
39	Gaywood Road 2	562822	320427	Roadside	28	35	29	34	32	28	28	25	28	36	35	41	31.6	No	27.8
40	The Swan Gayton Road	563480	320470	Roadside	49	43	41	48	36	34	36	34	44	44	43	47	41.6	No	36.6
41	Wootton Road 2	563478	320515	Roadside		52	42	53	60	38	35	28	55	44	45	52	45.8	No	40.4
42	Wootton Road 1	563480	320582	Roadside	36	42	37	28	33	47	23	28	28	40	43	45	35.8	No	31.6
43	Lynn Road 1	563412	320477	Roadside	30	39	34	36		38	30	25	26	38	40	39	34.1	No	30.0
44	Lynn Road 2	563377	320484	Roadside	40			41		41	42	30	29	41	41	43	38.7	No	34.1
45	Gaywood Road 3	563202	320488	Roadside	33	39	30	35	52		28	24	26	34	39	45	35.0	No	30.8
46	Gaywood Road 1	562565	320509	Roadside	34	37	26	36	33	21	28	24	33	34	38	40	32.0	No	28.2
47	Austin Street 1	562193	320369	Roadside	39	52	39	52	61	44	46	42	38	48	49	49	46.6	No	41.0
48	Austin Street 2	562180	320365	Roadside	40	48	38	41	29	34	40	32	29	36	42	46	37.9	No	33.4

Site Ref	Location	X	Y	Site type	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Average	Annualised ? (Y - value / N)	Corrected Annual Mean 2008 (Bias Factor 0.88)
49	Edward Benefer Way	561881	320768	Roadside	30	37	29	23	22	23	20	24	27	30	32	31	27.3	No	24.1
50	Kilham's Way	562026	321615	Urban Background	21	26	15	15	10	9	11	12	14	20	19	21	16.1	No	14.2
51	Wootton Road 3	563515	320628	Roadside	28	28	21	26	23	18	19	18	20	29	28	33	24.3	No	21.4
52	Lynn Road 3	563288	320499	Roadside	37	39	37	39			31	29	19	37	41	40	34.9	No	30.7
53	Wisbech Rd Elm 3	546947	308215	Roadside	32	36	24	31	30	22	31	26	32	36	33	34	30.6	No	26.9
54	Wisbech Rd Elm 4	546940	308207	Roadside	24	33	28	28	30	23	20	20	28	28	29	33	27.0	No	23.8
55	Wisbech Rd Elm 5	546945	308216	Roadside	25	28	24	23	14	19	16	17	18	26	29	34	22.8	No	20.0
56	Wisbech Road Elm 2	547235	307645	Roadside	32	37	29	37	29	36	29	28	22	34	35	43	32.6	No	28.7
57	NORR 1	562073	320304		27	36	21	27	33	17	22	23	29	30	29	38	27.7	No	24.4
58	NORR 2	562100	320222		30		35	40	42	25	28	26	31	40	44	44	35.0	No	30.8
S1	Eastgate 1 Primary School	562117	320095	Urban Background				21				20			29	26	24.0	Yes - 22.7	20.0
S2	Eastgate 2 Primary School	562115	320062	Urban Background				25	19	22		24	23	32	42	37	28.0	Yes - 29.7	26.1
S3	Reffley Community School	562055	320137	Urban Background				17	11	12	22	10	14	19	20	26	16.8	No	14.8
S4	South Wootton Junior School	562113	320043	Urban Background				20	2		25	10	15	19	21	27	17.4	Yes - 19.1	16.8
S5	Highgate Primary School	562227	319198	Urban Background				29	24		13	24	23	30	34	40	27.1	Yes - 29.8	26.2
S6	Howard 1 Junior School	561900	319707	Urban Background					9	10	12	12	15	20	21	26	15.6	Yes - 17.4	15.3
S7	Howard 2 Junior School	562101	319679	Urban Background						10	11	12	14	19	21	27	16.3	Yes - 17.6	15.5
S8	Park 1 High School	562154	319594	Urban Background					13	10		9	14	22	20	24	16.0	Yes - 17.1	15.1
S9	Park 2 High School	562242	319452	Urban Background					14		11	13	12				12.5	Yes - 18.3	16.1
S10	Greyfriars 1 Primary School	562264	319375	Urban Background						19	13	22	20	27	31	31	23.3	Yes - 25.2	22.2



Site Ref	Location	X	Y	Site type	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Average	Annualised ? (Y - value / N)	Corrected Annual Mean 2008 (Bias Factor 0.88)
S11	Greyfriars 2 Primary School	562226	319263	Urban Background						18	20	21	18	26	27	28	22.6	Yes - 24.4	21.5
S12	Nursery School	562190	319102	Urban Background					10	23	19	24	20	30	33	36	24.4	Yes - 27.1	23.8
S13	Whitefriars 1 Primary School	561958	318963	Urban Background										22	24	27	24.3	Yes - 19.8	17.5
S14	Whitefriars 2 Primary School	562209	318924	Urban Background										23	20	26	23.0	Yes - 18.7	16.5

Appendix 4 - DMRB Assessment

1 – Input Data

Road Name	Nearest receptor (façade to centre of road, m)	AADT (2008)	% HDV	Speed (kph)	Street canyon ?	Background Concentrations ($\mu\text{g}/\text{m}^3$ - 2008)		
						NO _x	NO ₂	PM ₁₀
A1101 Elm High Road	8	17604	6.3%	30	No	20.2	14.3	18.6
A47 Wisbech Bypass (North of jct with B198 Lynn Rd)	32	18530	0.3%	80	No	15.7	11.5	17.2
A47 Wisbech Bypass (West of New Road bridge)	45	18579	0.3%	80	No	14.4	10.7	16.9
A47 Wisbech Bypass (East of Tilney High End)	12	18649	0.3%	80	No	14.8	10.9	17.0

2 – Results

Road Name	DMRB Assessment Results			
	2008 NO _x Annual Mean ($\mu\text{g}/\text{m}^3$)	2008 NO ₂ * Annual Mean ($\mu\text{g}/\text{m}^3$)	2008 PM ₁₀ Annual Mean ($\mu\text{g}/\text{m}^3$)	2008 Number of exceedences of 24 hour PM ₁₀
A1101 Elm High Road	48.2	26.8	21.9	6
A47 Wisbech Bypass (North of jct with B198 Lynn Rd)	22.0	14.6	18.0	1
A47 Wisbech Bypass (West of New Road bridge)	19.0	12.9	17.5	1
A47 Wisbech Bypass (East of Tilney High End)	25.6	16.1	18.4	2

* NO₂ concentrations calculated from NO_x using the LAQM.TG (09) NO_x:NO₂ conversion calculator

Appendix 5 – List of Industrial Processes

Type	Process ID	Process Name	Process Type	New source since USA 2006?	Existing process with new exposure?	Substantial change >30%?	Complaints?	Detailed Assessment Required?
Part B	LAPPC318	ADR Autos Ltd	Waste Oil Burner <0.4 MW	No	No	No	No	No
Part B	LAPPC301	Allens Garage	Waste Oil Burner <0.4 MW	No	No	No	No	No
Part B	LAPPC308	Auto Salvage	Waste Oil Burner <0.4 MW	No	No	No	No	No
Part B	LAPPC310	Auto Techniques Ltd	Waste Oil Burner <0.4 MW	No	No	No	No	No
Part B	LAPPC317	Central Garage	Waste Oil Burner <0.4 MW	No	No	No	No	No
Part B	LAPPC312	Eau Brink Farm	Waste Oil Burner <0.4 MW	No	No	No	No	No
Part B	LAPPC315	Favorit Motor Co	Waste Oil Burner <0.4 MW	No	No	No	No	No
Part B	LAPPC305	Kings Lynn Conservancy Board	Waste Oil Burner <0.4 MW	No	No	No	No	No
Part B	LAPPC316	Leziate Drove Garage	Waste Oil Burner <0.4 MW	No	No	No	No	No
Part B	LAPPC314	Ray Bramner Vehicle Repairs	Waste Oil Burner <0.4 MW	No	No	No	No	No
Part B	LAPPC031	Red Pumps Garage	Waste Oil Burner <0.4 MW	No	No	No	No	No
Part B	LAPPC303	Setch Transport Ltd	Waste Oil Burner <0.4 MW	No	No	No	No	No
Part B	LAPPC030	Silena Automotive	Waste Oil Burner <0.4 MW	No	No	No	No	No
Part B	LAPPC033	SRV Motors	Waste Oil Burner <0.4 MW	No	No	No	No	No
Part B	LAPPC029	Terrington Service Station	Waste Oil Burner <0.4 MW	No	No	No	No	No
Part B	LAPPC304	Tilney Service Station	Waste Oil Burner <0.4 MW	No	No	No	No	No
Part B	LAPPC311	Truck East Ltd	Waste Oil Burner <0.4 MW	No	No	No	No	No
Part B	LAPPC319	Tuxhill Farm	Waste Oil Burner <0.4 MW	Yes	No	-	No	No
Part B	LAPPC309	Wilton Garage	Waste Oil Burner <0.4 MW	No	No	No	No	No
Part B	LAPPC320	King's Lynn Volkswagen	Waste Oil Burner <0.4 MW	Yes	No	-	No	No
Part B	LAPPC520	AMG Vauxhall	Petrol Station	No	No	No	No	No
Part B	LAPPC501	Bloom & Wake Ltd	Petrol Station	No	No	No	No	No
Part B	LAPPC502	Tesco Express	Petrol Station	No	No	No	No	No
Part B	LAPPC503	Broomhill Service Station/Downham Petroleum	Petrol Station	No	No	No	No	No

Type	Process ID	Process Name	Process Type	New source since USA 2006?	Existing process with new exposure?	Substantial change >30%?	Complaints?	Detailed Assessment Required?
Part B	LAPPC504	Leftleys of Wells	Petrol Station	No	No	No	No	No
Part B	LAPPC505	Hylton Gott Service Station	Petrol Station	No	No	No	No	No
Part B	LAPPC511	Jet Budgens Express	Petrol Station	No	No	No	No	No
Part B	LAPPC507	Kings Lynn Service Station	Petrol Station	No	No	No	No	No
Part B	LAPPC508	Lavender Hill Services	Petrol Station	No	No	No	No	No
Part B	LAPPC509	Mick Peake Motors	Petrol Station	No	No	No	No	No
Part B	LAPPC510	Morrisons Petrol Station	Petrol Station	No	No	No	No	No
Part B	LAPPC519	Pace Stone Cross	Petrol Station	No	No	No	No	No
Part B	LAPPC514	R J Stainsby	Petrol Station	No	No	No	No	No
Part B	LAPPC512	Rainbow Filling Station	Petrol Station	No	No	No	No	No
Part B	LAPPC513	Shell Gaywood	Petrol Station	No	No	No	No	No
Part B	LAPPC515	Tesco Filling Station	Petrol Station	No	No	No	No	No
Part B	LAPPC516	Tesco Garage	Petrol Station	No	No	No	No	No
Part B	LAPPC517	West Winch Service Station	Petrol Station	No	No	No	No	No
Part B	LAPPC518	Wisbech Service Station	Petrol Station	No	No	No	No	No
Part B	LAPPC521	Burnham Motors Garage Ltd	Petrol Station	Yes	No	-	No	No
Part B	LAPPC017	C & G Concrete	Concrete Batcher	No	No	No	No	No
Part B	LAPPC022	G M Concrete	Concrete Batcher	No	No	No	No	No
Part B	LAPPC021	C&H Quick Mix Ltd	Concrete Batcher	No	No	No	No	No
Part B	LAPPC023	CEMEX	Concrete Batcher	No	No	No	No	No
Part B	LAPPC018	The Concrete Company	Concrete Batcher	No	No	No	No	No
Part B	LAPPC019	The Concrete Company	Concrete Batcher	No	No	No	No	No
Part B	LAPPC001	The Bed Base Company	Timber Processing	No	No	No	No	No
Part B	LAPPC003	Finnforest UK Ltd	Timber Processing & Adhesive Coating	No	No	No	No	No
Part B	LAPPC002	Patrick & Thompson	Timber Processing &	No	No	No	No	No

Type	Process ID	Process Name	Process Type	New source since USA 2006?	Existing process with new exposure?	Substantial change >30%?	Complaints?	Detailed Assessment Required?
			Incineration of Waste					
Part B	LAPPC006	Timber & Component Supplies Ltd	Timber Processing	No	No	No	No	No
Part B	LAPPC004	Travis Perkins	Timber Processing	No	No	No	No	No
Part B	LAPPC059	M&S (Softwoods) Ltd	Manufacture of Timber & Wood-Based Products	Yes	No	-	No	No
Part B	LAPPC046	H & C Bearts Ltd	Animal Feed	No	No	No	No	No
Part B	LAPPC047	Green's of Southery	Pet Food Manufacture	No	No	No	No	No
Part B	LAPPC035	Bennetts Motor Company	Vehicle Refinishing	No	No	No	No	No
Part B	LAPPC036	Gladwins Body Repair Centre	Vehicle Refinishing	No	No	No	No	No
Part B	LAPPC054	Overtons	Vehicle Refinishing	Yes	No	-	No	No
Part B	LAPPC025	Concrete Co	Mobile Concrete Batching Plant	Yes	No	-	No	No
Part B	LAPPC015	Frimstone Ltd	Concrete Crusher	No	No	No	No	No
Part B	LAPPC013	Middleton Aggregates Ltd	Concrete Crusher	No	No	No	No	No
Part B	LAPPC040	Cooper Roller Bearings Co. Ltd	Ferous Metals	No	No	No	No	No
Part B	LAPPC042	CPC (Kings Lynn) Ltd	Printing Process	No	No	No	No	No
Part B	LAPPC011	Tarmac Heavy Building Materials	Roadstone Coating	No	No	No	No	No
Part B	LAPPC007-1	Associated British Ports	Coal storage	No	No	No	No	No
Part B	LAPPC044	Fosters Refrigeration (UK) Ltd	Di-isocyanate	No	No	No	No	No
Part B	LAPPC049	Williams Refrigeration Ltd	Di-isocyanate	Yes	No	No	No	No
Part B	LAPPC010	Mintlyn Crematorium	Cremation	No	No	No	No	No
Part B	LAPPC043	Pace Petroleum	Storage of Petrol at Terminal	No	No	No	No	No
Part B	LAPPC005	Peaceful Pets	Animal Remains Incineration	No	No	No	No	No
Part B	LAPPC009	Transco	Gassification	No	No	No	No	No
Part B	LAPPC008	WBB Minerals	Sand Drying & Sand	No	No	No	No	No



Type	Process ID	Process Name	Process Type	New source since USA 2006?	Existing process with new exposure?	Substantial change >30%?	Complaints?	Detailed Assessment Required?
			Coating					
Part B	LAPPC204	Clock Clean Dry Cleaners	Dry Cleaners	Yes	No	-	No	No
Part B	LAPPC202	Johnsons Cleaners	Dry Cleaners	Yes	No	-	No	No
Part B	LAPPC206	St James Street Laundrette & Dry Cleaners	Dry Cleaners	Yes	No	-	No	No
Part B	LAPPC203	Johnsons Cleaners	Dry Cleaners	Yes	No	-	No	No
Part B	LAPPC201	The Laundry Basket	Dry Cleaners	Yes	No	-	No	No
Part A2	IPPC A2 001	Decorative Sleeves	Printing Process	No	No	No	No	No
Part A2	IPPC A2 002	Bespak	Surface Cleaning	No	No	Yes	No	No – Not AQS pollutants