Borough Council of King's Lynn & West Norfolk

Air Quality Action Plan

Making King's Lynn a cleaner, more environmentally friendly place to live, work and visit

2015
Version 10

Title	Air Quality Action Plan for the King's Lynn Town Centre & Gaywood Clock Air Quality Management Areas	
Authority	The Borough Council of King's Lynn and West Norfolk	
Reference number	Version 10	
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Approved by	Name	Dave Robson
	Signature	
	Date	2015

Executive summary

The Environment Act 1995 requires all local authorities to review air quality within their districts. If it appears that any air quality 'Objective' prescribed in the regulations and in the National Air Quality Strategy (NAQS) is unlikely to be achieved then the local authority must designate the affected area as Air Quality Management Area (AQMA). The Act then requires that an Air Quality Action Plan (AQAP) be produced for any area designated as an AQMA, setting out the actions that the Borough Council intend to take to achieve the NAQS.

This local AQAP sets out a work programme to improve air quality in and around the King's Lynn Town Centre and Gaywood AQMAs, declared due to exceedences of the NAQS annual mean objectives for nitrogen dioxide (NO_2). This report has been prepared by King's Lynn & West Norfolk Borough Council (hereafter referred to as the Borough Council) in partnership with Norfolk County Council (the local transport authority and hereafter referred to as the County Council). This document is for consultation with the public and other statutory consultees in advance of a final plan being submitted to central Government and the Councils for approval, and subsequently implemented.

The AQAP identifies that the likely dominant source of NO_2 in both AQMAs is from road transport, and in particular from cars and buses. Background levels also contribute significantly.

Based upon 2007 figures used in the 2008 Detailed Assessment of Air Quality In the Kings Lynn AQMA a 20% reduction in traffic emissions of nitrogen oxides (or NO_X, which is a precursor to NO_2) is necessary to achieve the annual mean air quality objective for NO_2. This is equivalent to a 24µg/m^3 reduction in ambient concentrations of NO_X, and approximately equivalent to a 6µg/m^3 (12%) reduction in NO_2.

In the Gaywood AQMA evidence suggests that a 26% reduction in traffic emissions of oxides of nitrogen (or NO_X, which is a precursor to NO_2) is necessary to achieve the annual mean air quality objective for NO_2, based upon 2007-2009 figures used in the '2010 Further Assessment of the Gaywood AQMA'. This is equivalent to a 29.5µg/m^3 reduction in ambient concentrations of NO_X, and approximately equivalent to an 8.2µg/m^3 (17%) reduction in NO_2.

Consequently, the formulation of the AQAP aims to reduce the levels of NOx/NO_2 in the AQMAs by the above amounts. The AQAP considers options to improve air quality and recommends 20 of these for implementation. The AQAP also sets out the partnership working which has been used to develop the options and how they will be progressed and monitored.

The plan aims to reduce transport emissions in the AQMAs by around 9% by 2015. It is anticipated that a reduction of this scale will lead to the achievement of the annual mean NO_2 air quality objective (40µg/m^3) at sensitive receptors in the AQMAs in future years. It is acknowledged that the AQAP is a continuously evolving document involving numerous groups and Authorities, and the Borough Council will continue to review and assess air quality to monitor this situation, and to evaluate the success of the measures implemented using prescribed indicators.

In compiling this AQAP, reference has been made to the Government Guidance, LAQM.PG (09), and the Review and Assessment reports produced by the Borough Council as part of the Local Air Quality Management (LAQM) assessment process. The Action Plan was subject to statutory and public consultation and amended accordingly prior to formal adoption by the Borough Council.

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Table A: Summary of action plan measures for King's Lynn Town Centre & Gaywood Clock AQMA's.

No	Measure	Focus	Lead	Planning phase	Implementation phase	Indicator	Target NO2 reduction impact ($\mu g/m^3$)
	POLICY ACTIONS						
1	Consideration of Air Quality Impacts when providing comments on planning applications within an AQMA or where an AQMA could be impacted or created.	Comment on pre-application discussions, advise planners on significance of impacts, agree conditions and S106 agreements	Borough Council (LPA & Env Quality Team)	ongoing	ongoing	Number of pre application discussions and planning applications responded to	Up to 1
2	With regard to National Planning Policy Framework, include air quality considerations in the Local Plans and adopt an air quality Development Management Policy.	Give appropriate weight to air quality in the decision making process	Borough Council (LPA & Env Quality Team)	Completed	2014	Production of documents	Up to 1
3	With regard to National Planning Policy Framework, adopt Norfolk Technical Guidance on Air Quality and provide pre-application advice on planning applications	Raise air quality concerns early in the decision making process and provide a technical framework	Borough Council (LPA & Env Quality Team)	2014	2015	Production of documents	Up to 1
4	Develop Parking Management Plan (linked to 9, 10, 11 & 12)	Smooth out traffic flow over the course of the day Increase car park usage within Town Review car parking provision within King's Lynn layout, type and location Improve traffic flow through AQMA and reduce congestion	County Council/ Borough Council	2014	ongoing	Publication of and implementation of plan	Up to 2

	ROAD TRAFFIC ACTIONS						
5	New access road from Wisbech Road through Friars to Boal Street.	Removal of some traffic from London Road/ Railway Road. Removal of buses, and potential reduction in car movements. Consider use of route by Taxi's & PHV.	County Council/ Borough Council	2010	December 2011	Continued air quality monitoring. Bus flow counts on London Road and new route	2-3
6	Incentivise the use of public transport.	Removal of some traffic from London Road, Railway Road and Gaywood Clock area. Potential reduction in car movements.	County Council	2014	2015	Continued air quality monitoring. Bus usage figures	Up to 1
7	Implementation of Urban Traffic Control system (UTC) at principal junctions within AQMA and adjacent to AQMA	Reduction of emissions within the AQMA from stop/start driving. Improve traffic flow and reduce congestion	County Council	2010	December 2011	Continued air quality monitoring. Queue length at junctions at peak times	2-5
8	Installation of selective vehicle detection (SVD) system	Reduction of emissions within the AQMA from stop/start driving. Improve flow of public transport vehicles	County Council	2011	2012	Number of vehicles fitted with SVD Annual average daily traffic numbers	Up to 1
9	Decriminalisation of parking. Review of parking controls and enforcement in AQMAs and King's Lynn Town Centre (Linked to 4, 10, 11 & 12)	Improve traffic flow through AQMA and reduce congestion Smooth out traffic flow over the course of the day.	Borough Council/ County Council	December 2010 Option validation Jan-March 2011	ongoing	Implementation of enforcement in AQMAs and Town Centre. Continued air quality monitoring.	Up to 1
10	Variable car parking rates (Linked to 4, 9, 11 & 12)	Vary rate for long and short term parking. Even out peak flows but encourage short term trips. Improve traffic flow through AQMA and reduce congestion Smooth out traffic flow over the course of the day	Borough Council	2014	On going	Continued air quality monitoring Car park usage Queue lengths	Up to 1

11	Variable message signs (Linked to 4, 9, 10 & 12)	Provide signage to direct drivers to available parking spaces Improve traffic flow through AQMA and reduce congestion Smooth out traffic flow over the course of the day	Borough Council/County Council	2014	2014	Peak hour parking usage Car park usage Continued air quality monitoring Queue lengths	Up to 1
12	Investigate potential for residents only parking in or close to AQMAs (Linked to 4, 9, 10 & 11)	Develop residents only parking zones Improve traffic flow through AQMA and reduce congestion Smooth out traffic flow over the course of the day Increase car park usage within Town	Borough Council	2014	2015	Peak hour parking usage Car park usage Continued air quality monitoring	Up to 1
13	Support the use of West Lynn ferry	Encourage use of the ferry from West Lynn to the town centre	Borough Council	2012	On going	Number of passengers using ferry	Up to 1
14	Changes to the Road Layout within the King's Lynn Gyratory as proposed by KLATS	Smooth out traffic flow over the course of the day Increase car park usage within Town Improve traffic flow and reduce congestion in AQMAs	County Council	2011 Linked to measure 3	ongoing	Continued air quality monitoring. Daily traffic flow data and queue lengths	2-10
15	Traffic Management at London Road and Southgates	Investigate measures to displace queuing traffic	County Council	2014	2015	Continued air quality monitoring. Queue length at junctions at peak times	1-5
16	Traffic Management at Gaywood clock	Investigate measures to displace queuing traffic	County Council	2014	2015	Continued air quality monitoring. Traffic que lengths	1-5

17	Promotion of travel plans, school travel plans and promotion of car sharing	Encourage alternatives to car use and to single car occupancy and reduce need to travel for work. Particularly at large employers	County Council/ Borough Council	2014	Ongoing	Continued air quality monitoring. Number of travel plans	Up to 1
18	Improved cycling and walking provision	Improvement of space for walking and cycling such as cycle lanes and pavements. Promotion of Sustrans maps and bicycle user groups	County Council/ Borough Council	2014	ongoing	Cycle usage and walking provision. Number of cycle/foot path improvements	Up to 1
	EMISSIONS ACTIONS						
19	Investigate feasibility and if viable, provide Electric vehicle charging points in car parks and in new developments	Encourage the use of electric vehicles within the town centre	Borough Council	2014	On going	Number & use of EV charging points installed	Up to 1
20	Quality Bus Partnerships and contracts	Contract between the Council and bus operators that include type of bus, level of service and vehicle emissions	County Council	2014	ongoing	Continued air quality monitoring. % buses Euro 3 or better Installation of SVD	Up to 1

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1 Introduction

1.1 Introduction

This document is the Air Quality Action Plan (AQAP) to address the air quality problems identified in the Town Centre Air Quality Management Area (AQMA) and Gaywood Clock AQMA which have been declared in the Borough of King's Lynn & West Norfolk (hereafter referred to as the Borough Council). It is the statutory duty of the Borough Council to develop an AQAP which must be appraised and accepted by DEFRA as being fit for purpose before its final adoption and implementation.

This document has been put together using currently available best evidence and guidance, through discussion within the King's Lynn Area Transport Strategy Group (KLATS) and stakeholders, to draw up measures that will be introduced to make progress in improving air quality in both AQMAs.

A draft AQAP was published for consultation. Comments received during the consultation process have been addressed and, where appropriate, amendments made to the AQAP. This final version of the AQAP has been submitted to DEFRA for appraisal, and has been approved. This document has been adopted as a formal authority plan and will be implemented via the efforts of the Borough and County Councils.

1.2 Benefits

Air Quality is a serious health issue, but the potential solutions presented in the AQAP can be seen as benefitting the town in a wider sense than just health. These include:

- Reduction in greenhouse gases which can contribute to climate change
- Reduction in noise, dust and other pollutants
- An improved environment, making the town centre more attractive
- A smoother flow of traffic making the town centre a more appealing place to live work or visit
- The AQAP takes a more holistic view of related issues such as traffic congestion, parking availability and appeal of urban areas

Rather than bringing more restrictions to traffic and transport there are positive benefits to be gained.

1.3 Recent Developments

Since the commencement of action planning two major supermarket developments have been proposed and air quality assessments have been submitted and reviewed. However, several large scale regeneration projects within King's Lynn, which would potentially have had implications for air quality e.g. a large residential and commercial brownfield development in the Nar Ouse Regeneration Area (NORA) and the Riverside Regeneration Project, have been adversely affected by the economic recession. Development of the NORA site has thus far seen some piecemeal development and the Waterfront Regeneration Project has been put on hold at present with no planning permissions currently being sought.

Some works designed to ease road traffic congestion and hence contribute towards air quality improvements have been carried out. For example, a new 'buses only' access road from Wisbech Road to Boal Street opened in spring 2011. Also a Selective Vehicle Detection (SVD) System has been introduced at four locations within King's Lynn town centre, which will gives priority to buses at four junctions within the AQMA This will have the effect of reducing emissions from stop/start driving within the AQMA and may provide an incentive for people to use bus services. The system was brought into use in 2010.

Similarly, signalling and lane improvements to the Southgates roundabout have been completed and are having an effect on traffic flow at the southern end of the AQMA. Additionally improvements were completed in May 2013 to Hardwick Road which will assist in reducing congestion along Hardwick Road and thus help with traffic flow through the Southgate Roundabout and along London Road.

2 Regulatory context and role of the action plan

This chapter sets out local authority duties in relation to Local Air Quality Management (LAQM). These are the tasks that the Borough Council must undertake as a statutory duty.

2.1 Health effects of poor air quality

In the UK, air pollution is currently estimated to reduce the life expectancy of every person by an average of 7-8 months with estimated equivalent health costs of up to £20 billion each year. Air pollution also has a detrimental effect on our ecosystems and vegetation. There are significant benefits to be gained from further improvements.

There are various sources of air pollution in the UK. These can include transport (mainly road transport), the use and production of energy, commercial / industrial premises and natural sources. The Government has identified 8 key pollutants for which health-based limit values / targets are defined in the National Air Quality Strategy (NAQS), as shown in (Appendix 1):

- Nitrogen Dioxide;
- PM_{10} particulates;
- Benzene;
- 1,3 – butadiene;
- Lead;
- Sulphur Dioxide;
- Carbon Monoxide; and
- Ozone.

Whilst this Air Quality Action Plan is primarily aimed at reducing NO_2, the initiatives within it will have a positive effect on the reduction of other air pollutants, especially particulates. The health implications of the two main transport emissions types are as follows:

2.1.1 Nitrogen Oxides (NO_X)

Nitrogen dioxide (NO_2) and nitric oxide (NO) are oxides of nitrogen, collectively known as nitrogen oxides (NO_X). All combustion processes produce NO_X, primarily in the form of NO, which is then converted to NO_2, mainly due to reaction with ozone present in the atmosphere. Road transport is responsible for approximately 50% of the emissions of NO_X in Britain, whilst NO_2 has been identified as having various adverse health effects particularly on the respiratory system in both asthmatics and non-asthmatics. Short term exposure to this pollutant can increase the likelihood of reaction to allergens such as pollen and has been known to increase asthma in some people. Sensitive individuals exposed to this pollutant may have increased risk of respiratory infections.

2.1.2 Particulates

Particles can be produced directly from combustion and other processes, as well as from natural activities. They can also be generated by chemical reaction in the air. Particulate matter with an aerodynamic diameter of 10µm or less, commonly referred to as PM_{10}.

Particles sized with an aerodynamic diameter of 2.5µm are referred to as $PM_{2.5}$ and particles sized 15µm are referred to as PM_1 or nanoparticles. These can enter deep in to the lung tissue and may pass through the lung wall in to the blood stream.

Particles can cause inflammation of the respiratory system and a deterioration of the condition of people with heart and lung diseases.

2.2 The legislative framework for air quality

To protect the health of the population, the Government has set out a National Air Quality Strategy which includes statutory objectives (standards) for some key pollutants. The objectives are expressed as a maximum ambient concentration not to be exceeded, either without exception or with a permitted number of exceedences within a specified timescale (Appendix 1). The objectives have been set throughout the UK and European Union at levels that aim to protect the vulnerable in society from the harmful effects of breathing pollution.

In response, a number of measures have been introduced at an international level (including the UK) to reduce this impact. They include:

- Incremental reductions in emissions from vehicles and industry;
- Climate change programme policies; and
- Local Air Quality Management.

The UK government recognises the important role that local authorities have and continue to play in helping deliver the air quality objectives. “Action taken at the local level can be an effective way of tackling localised air quality problems leading to an overall improvement of air quality.”

2.2.1 Local Air Quality Management

The Environment Act 1995 gives local authorities duties and responsibilities that are designed to secure improvements in air quality, particularly at the local level. These include the review and assessment of key pollutants in their area in a series of reports which alternate every three years. If it appears that any of the air quality objectives set by government are unlikely to be achieved and members of the public are being exposed to the pollution, the local authority must by order designate any part of its area so affected, as an Air Quality Management Area (AQMA). They must then prepare and implement a remedial Air Quality Action Plan (AQAP) of measures to reduce air pollution levels in that AQMA. A Review and Assessment round of reports consists of local authorities initially undertaking an Updating and Screening Assessment (USA) and then carrying out the following stages if any objectives are found to be exceeded:

- Detailed Assessment of those areas identified in the USA as potential AQMAs;
- Designation of AQMA;
- Further Assessment of air pollution in the AQMA;
- Amendment if necessary of AQMA boundaries;
- Action Plan ; and
- Annual Action Plan Progress Reports.

Chapter 3 includes an outline of the main findings of previous rounds of the LAQM Review and Assessment process.

3 Air Quality in King's Lynn & West Norfolk Borough

3.1 King's Lynn Town Centre AQMA

The King's Lynn town centre AQMA was originally declared for exceedences of the nitrogen dioxide (NO_2) Air Quality Strategy (AQS) objectives on Railway Road in November 2003, following the findings of the first round of the Local Air Quality Management (LAQM) Review and Assessment of air quality.

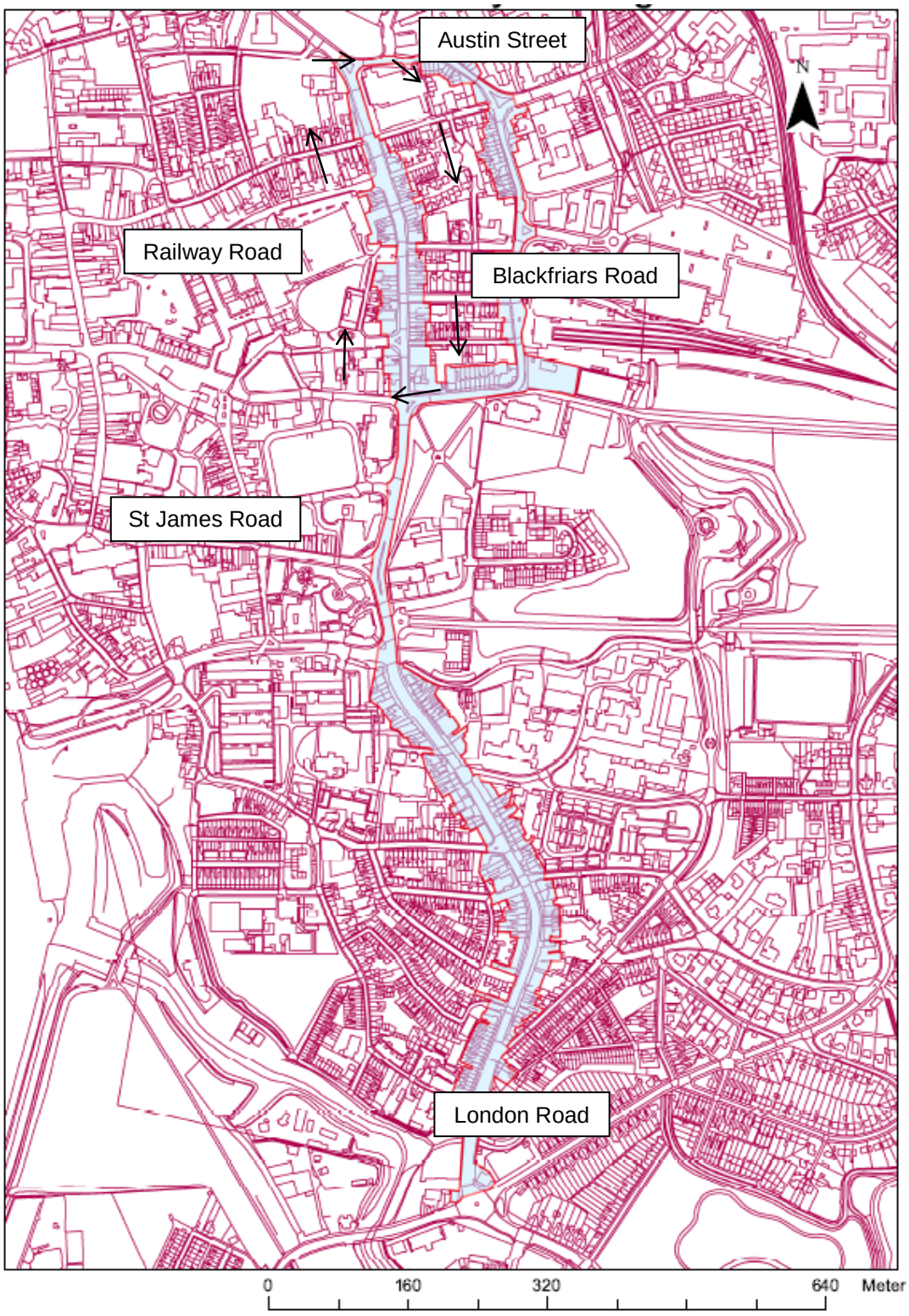
The 2005 Detailed Assessment modelling and updated monitoring data led to the extension of the AQMA in February 2007, to include the one-way system in the town centre (Railway Road, Austin Street and Blackfriars Road), as well as St. James' Road and London Road to the South Gates roundabout.

The 2008 Further Assessment of air quality in the King's Lynn town centre AQMA assessed updated monitoring data and the results of a detailed dispersion modelling study of the area. The analysis confirmed the continuing need for the extended AQMA, and showed that the annual mean objective for NO_2 was likely to be breached at the façades of residential properties.

The boundaries of the town centre AQMA are shown in Figure 1 with road names and the one-way system identified. The figure has been adapted from the King's Lynn and West Norfolk Borough Council website[1].

[1] King's Lynn and West Norfolk Borough Council website; http://www.west-norfolk.gov.uk/

Figure 1: King's Lynn town centre AQMA



3.1.2 Monitoring data

A National Automatic Monitoring Calibration Club air quality continuous monitoring station was situated at a roadside location, within the town centre AQMA on Railway Road (2002-8). The monitoring equipment was relocated to Southgates Park, London Road in June 2008, still within the town centre AQMA. Replacement monitoring equipment was installed at Southgates Park in April 2011. NO_X and NO_2 are recorded at the site using a chemiluminescent NO_X/NO_2 automatic analyser, co-located with diffusion tubes which are present in triplicate. Data taken from the 2012 Progress Report for the Borough[2] are presented in Table 1 below. Concentrations presented for 2008 at the two sites were 'annualised' based upon the 3 closest background Automatic Urban and Rural Network (AURN) monitoring sites.

Table 1: Continuous monitoring of NO2 in the Borough of King's Lynn & West Norfolk

Site location	Annual mean NO_2 concentration / µg/m^3 (NO_2 Hourly Mean > 200 µg/m^3)						
	2006	2007	2008[a]	2009	2010	2011	2012
Railway Road	32.0 (0)	31.1 (3)	32.1 (0)	n/a	n/a	n/a	n/a
Southgates	n/a	n/a	27.2 (0)	30.4 (0)	26.5 (0)	23.0 (0)	25.0 (0)

Note: [a] Data annualised based upon the 3 closest background AURN monitoring sites (Wicken Fen, Northampton and Market Harborough).

The hourly and annual mean objectives for NO_2 were met in 2006 - 2012 with measured concentrations below, the annual mean objective of 40µg/m^3. Concentrations of NO_2 recorded at locations representative of personal exposure within the AQMA using passive diffusion tubes, however, have consistently exceed the annual mean objective of 40µg/m^3. Monitored concentrations at selected diffusion tube locations are presented in Table 2.

3.1.3 Source apportionment

Dispersion modelling for the 2008 Further Assessment[3] predicted annual mean NO_2 concentrations for 2007 and 2010 at locations around the town centre AQMA, including diffusion tube monitoring sites, of which 27 receptors could be considered 'sensitive', and representative of public exposure e.g. at the façades of residential properties. Of these sites, exceedences of the annual mean AQS objective of 40µg/m^3 were predicted at 12 sites in 2007 and at 6 sites in 2010.

Table 2 gives the locations of the 12 sensitive receptors at which exceedences of the NO_2 annual mean objective were predicted to occur in 2007, together with observed concentrations for the period 2007-8, and 2007 and 2010 predicted annual mean concentrations. The locations of the sensitive receptors are shown in figure 2. It should be noted that whilst the observed and modelled concentrations are presented in Table 2 are not in exact agreement, the modelling study was verified by comparing modelled and monitored results from far more sites than presented in Table 3. Reference should be made to the 2008 Detailed and Further Assessment for detailed information.

A source apportionment study was undertaken as part of the 2008 Detailed and Further Assessment in order to identify the dominant sources of NO_2 at the sensitive receptors. The following road vehicle classifications were disaggregated in the source apportionment study:

- Cars;
- Light goods vehicles (LGVs);
- Heavy goods vehicles (HGVs); and
- Buses and coaches.

[2] 2009 King's Lynn and West Norfolk Borough Council Updating and Screening Assessment of Air Quality
[3] 2008 King's Lynn and West Norfolk Borough Council Detailed and Further Assessment of Air Quality

Table 2: Observed and modelled annual mean NO_2 (µg/m^3) at sensitive receptors

Sensitive receptor (Tube number: location)	OS coordinates		Annual mean NO_2 (µg/m^3)			
			Observed		Modelled	
	X (m)	Y (m)	2007	2008	2007	2010
Tube number 32: Blackfriars Road	562253	320016	33.7	33.9	46.2	43.0
Tube number 17: Southgates	562190	319102	47.1	42.1	45.7	42.6
Tube number 14: London Road	562243	319452	39.2	38.5	45.2	42.3
Tube number 16: London Road	562226	319263	42.3	39.1	44.1	41.1
Tube number 22: London Road	562244	319261	35.2	32.2	43.6	40.7
Tube number 3: Railway Road	562117	320095	50.4	46.8	43.2	40.3
Tube number 23: London Road	562267	319327	39.9	34.6	42.1	39.0
Tube number 35: Railway Road	562129	320132	39.2	36.8	41.2	38.6
Tube number 12: London Road	562101	319679	44.6	41.1	41.0	38.3
Tube number 15: London Road	562264	319375	40.5	36.0	41.0	38.0
Tube number 38: Blackfriars Road	562244	320129	40.4	35.4	40.7	38.4
Tube number 30: Railway Road	562131	319996	44.4	40.7	40.5	38.0

Note: Shading denotes exceedences of the Air Quality Strategy NO_2 annual mean objective.

Table 3 gives the details of the source apportionment study at those sensitive receptors where exceedences of the annual mean objective were predicted in 2007 in the King's Lynn town centre AQMA. Figure 3 shows the average source apportionment of NO_X in the town centre AQMA at sensitive receptors where the annual mean NO_2 objective is exceeded.

Table 3 shows the modelled NO_X and NO_2 annual mean concentrations at the 12 receptors, with the percentage contribution to the annual mean NO_X concentration from background, cars, LGVs, HGVs and buses. The table also shows the quantity by which the modelled concentration would need to be decreased to achieve the annual mean NO_2 objective of 40µg/m^3, and the corresponding percentage of the total modelled[4].

Table 3: Results from 2008 Detailed Assessment source apportionment study

Site	Modelled annual mean 2007 (µg/m^3)		Estimated contribution to 2007 NO_X annual mean (%)					Reduction in NO_2 required to meet objective	
	NO_X	NO_2	Background	Cars	LGV	HDV		µg/m^3	%
						HGVs	Buses		
Tube number 32: Blackfriars Road	124.6	46.2	24%	28%	11%	15%	22%	6.2	13%
Tube number 17: Southgates	122.3	45.7	24%	26%	12%	19%	19%	5.7	12%
Tube number 14: London Road	120.3	45.2	25%	26%	11%	18%	19%	5.2	12%
Tube number 16: London Road	115.1	44.1	26%	26%	11%	18%	19%	4.1	9%
Tube number 22: London Road	112.9	43.6	26%	26%	11%	18%	18%	3.6	8%
Tube number 3: Railway Road	111.2	43.2	27%	20%	8%	21%	25%	3.2	7%
Tube number 23: London Road	106.7	42.1	28%	27%	13%	16%	16%	2.1	5%
Tube number 35: Railway Road	102.9	41.2	29%	19%	7%	20%	24%	1.2	3%
Tube number 12: London Road	102.0	41.0	29%	25%	10%	19%	17%	1.0	2%
Tube number 15: London Road	101.9	41.0	29%	27%	12%	15%	16%	1.0	2%
Tube number 38: Blackfriars Road	101.0	40.7	30%	24%	8%	16%	22%	0.7	2%
Tube number 30: Railway Road	100.0	40.5	30%	19%	7%	21%	23%	0.5	1%

Note: LGV = light goods vehicles; HGV = heavy goods vehicles; HDV = heavy duty vehicles

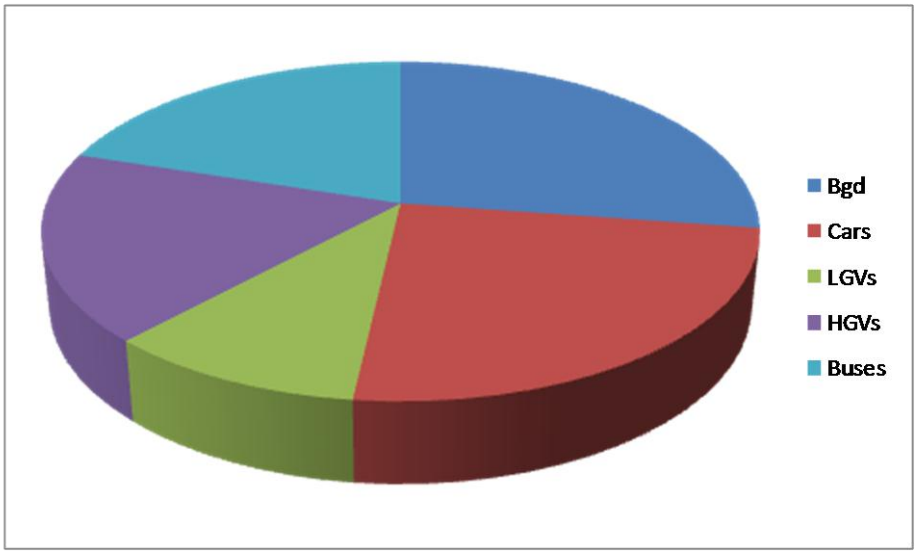
[4] The relationship between oxides of nitrogen (NO_X) and one of its components, nitrogen dioxide (NO_2) is complex and non-linear. Essentially a greater than proportionate reduction in NO_X is required to achieve a given percentage reduction in NO_2. For example, if a 10% reduction in NO_2 concentration is needed at a given location, the local emissions of NO_X must be reduced by more than 10% in order to achieve this.

The highest NO_2 concentration was modelled at receptor 32 (46.2µg/m^3), at the junction of St John's Terrace and Blackfriars. Here, emissions from cars were the dominant source of NO_X from road traffic, accounting for 28% of the annual mean. At the majority of sites, and following assessment of all modelled concentrations within King's Lynn town centre AQMA, cars are the dominant source of NO_X from road traffic, accounting for > 20% of the annual mean NO_X concentrations.

Whilst buses and HGVs contribute approximately 20% each to the annual mean NO_X concentration, a large contribution is from the background NO_X concentration, > 25%, as can be seen in Figure 3.

The greatest reduction in NO_2 required at a modelled sensitive receptor to comply with the Air Quality Strategy objective in the town centre AQMA is approximately 6µg/m^3 (equivalent to a 13% reduction in NO_2). Measures formulated in the AQAP therefore aim to reduce levels of NO_2 within the town centre the AQMA by this amount, principally aiming at the dominant contributor (cars).

Figure 3: Source of NO_X emissions at sensitive receptors in the town centre AQMA, where the annual mean NO_2 objective is exceeded

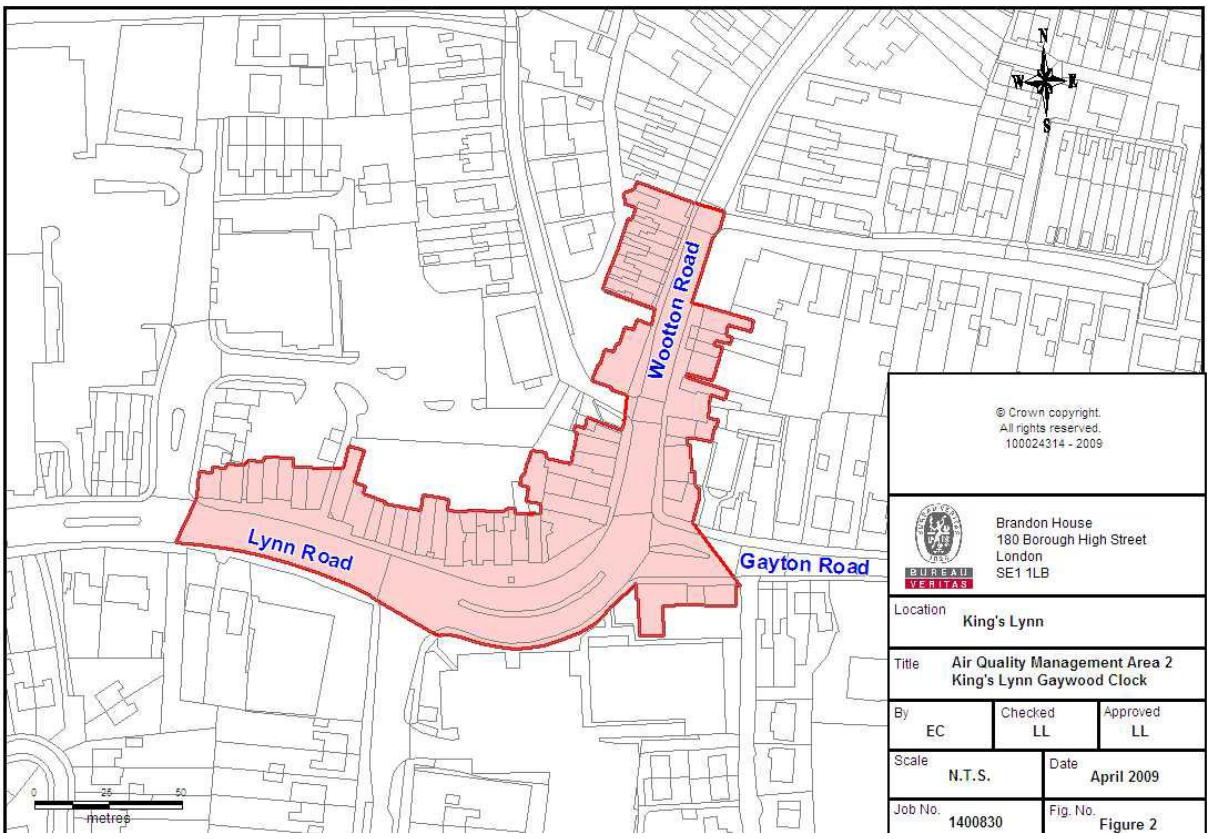


3.2.1 Gaywood Clock AQMA

A Detailed Assessment of air quality was undertaken in 2008 for the Gaywood Clock area of King's Lynn, following recorded exceedences of the AQS nitrogen dioxide annual mean objective. The detailed dispersion modelling study concluded that a new AQMA was required, as both updated monitoring data and predicted NO_2 concentrations confirmed that the AQS objectives were likely to be exceeded.

The Gaywood Clock AQMA was declared in April 2009, for an area encompassing properties at the junction of Wootton Road, Gayton Road and Lynn Road, due east of the town centre AQMA shown in Figure 2.

Figure 2: Gaywood Air Quality Management Area



3.2.2 Monitoring Data

The Borough Council installed a continuous automatic monitoring station at Gaywood Clock which has been collecting data since January 2012.

Data from the Gaywood clock monitoring station from January to December 2012 indicates a maximum hourly mean of 147µg/m^3 NO_2 and an average concentration of 33 µg/m^3. No exceedences of the hourly or annual mean were recorded in 2012.

Eight roadside diffusion tube sites are also used to monitor NO_2 within or near the Gaywood Clock AQMA. A bias adjustment factor has been applied to the data. Adjustment factors are derived by using national bias adjustment factors, or in years of sufficient data capture, from the triplicate diffusion tube results co-located with the continuous monitoring site in King's Lynn Southgates.

Data capture was good at all sites, with a minimum of 10-month worth of data; therefore it was not necessary to annualise the results. Bias adjusted monitoring results for the past 5 years for the sites located within or near the Gaywood Clock AQMA are provided in Table 4

Only one diffusion tube (site 41 Wootton Road 2) has regularly recorded annual mean concentrations which exceed the 40µg/m³ objective. This tube is located within the AQMA on Wootton Road. Two other sites within the AQMA (sites 40: The Swan, Gayton Road, and 44: Lynn Road 2) have been close to the objective (within 38 - 39µg/m^3).

The annual mean at site Lynn Road 3 was also close to the objective in 2009 (37µg/m^3). This site is located 30m further west of the AQMA. Results at site 45 on Lynn Road, Gaywood, and 51 on Wootton Road, both outside the AQMA, are regularly well below the AQS objective, which confirms that NO_2 levels drop off away from the A148 / A1076 junction.

With regard to the NO_2 short term objective; there is a potential risk of exceedence where the annual mean concentration is greater than 60µg/m³. There are no monitoring locations which recorded such concentrations and therefore it is expected that the short-term objective of 200µg/m³ is being met. This is supported by the provisional monitoring data from the continuous monitoring station.

During 2012 an additional tube has been installed and some tubes have been moved to an elevated position to better reflect exposure, particularly where residential accommodation is at first floor height.

Table 4 - NO_2 Monitoring Results near Gaywood Clock AQMA – 2007- 2012

Site ID	Name	Within AQMA ?	Annual mean µg/m^3 2007	Annual mean µg/m^3 2008	Annual mean µg/m^3 2009	Annual mean µg/m^3 2010	Annual mean µg/m^3 2011	Annual mean µg/m^3 2012
40	Swan, Gayton Rd	Y	36.9	36.6	39.0	33.7	35.7	33
41	Wootton Rd 2	Y	**45.1**	**40.4**	**45.1**	**42.4**	38.8	33
42	Wootton Rd 1	Y	35.2	31.6	35.4	31.2	30.6	31
43	Lynn Rd 1	Y	34.6	30.0	32.7	32.0	29.4	30
44	Lynn Rd 2	Y	39.8	34.1	38.6	35.8	35.5	33
45	Gaywood 3	N	34.0	30.8	33.3	34.4	31.5	29
51	Wootton Rd 3	N	22.3	21.4	23.6	20.5	20.7	19
52	Lynn Rd 3	N	33.2	30.7	37.0	32.1	29.6	29
bias			0.89	0.88	0.97	0.88	0.89	0.86

Site ID	Name	OS NGR
40	Swan, Gayton Rd	563480 320470
41	Wootton Rd 2	563478 320515
42	Wootton Rd 1	563480 320582
43	Lynn Rd 1	563412 320477
44	Lynn Rd 2	563377 320484
45	Gaywood 3	563202 320488
51	Wootton Rd 3	563515 320628
52	Lynn Rd 3	563288 320499
bias		

3.2.3 Source Apportionment

A source apportionment study was undertaken as part of the 2010 Further Assessment in order to identify the dominant sources of NO_2 at the sensitive receptors. The breakdown of vehicle classification was taken into account in the model set-up. This allows the calculation of NOx source apportionment at specific (worst case) receptors, where exceedences were predicted. The source apportionment was carried out for the following vehicle classes:

- cars,
- light goods vehicles (LGVs),
- buses/coaches,
- heavy goods vehicles (HGVs), and
- motorcycles.

The break down of NOx background concentrations by source as provided in the national background maps, combined with the actual background NOx used for the assessment have been used to estimate the contribution of each background component to the total background NOx in the assessment area. The 1 x 1km grid square relevant to the assessment is x= 563500, y= 320500.
Table 5 summarises the results at the worst case receptor representing public exposure in the exceedence area. The source apportionment indicates that, at the worst case receptor:

- Road traffic emissions are the main contributor to NOx, as they account for 75% of the
- total NOx concentration;
- Of the road traffic sources, cars and buses are the most significant contributors, as they account for respectively 35% and 24% of the total NOx concentration. The contribution of buses to the total NOx concentration is quite significant especially if compared to the proportion of the vehicle fleet they represent (1-2% of overall traffic);
- Light goods vehicles (LGVs) contribute around 10% to the total NOx concentration;
- Heavy-goods vehicles (HGVs) contribute around 6% to the total NOx concentration;
- Background concentrations account for nearly 25% of the total NOx concentration, including 10% due to the “regional” background concentration outside the local authority’s influence;
- Similar to NOx, the source apportionment of NO2 indicates road traffic emissions to be the most significant source, contributing 63% to overall NO2 concentration at the worst-case receptor. Of these, cars and buses are the biggest contributors, accounting for respectively about 30% and 20% of the overall NO2 concentration.

3.2.4 NOx / NO2 Required Reduction

A requirement of the Further Assessment is to determine the amount of NO_2 reduction required at the worst-case receptors within the exceedence areas. This approach highlights the maximum reduction in NO_2 required (as NOx, in µg/m3) to comply with the AQS objective, and assumes that other receptors will require less of a reduction. For the current assessment, the approach to estimate the required NO_2 reduction was to determine the levels of NOx for the highest concentrations predicted at sensitive receptors relevant of public exposure. The results are shown in Table 6.

In order to determine the required reduction in NOx, the NO_2 annual mean AQS objective of 40µg/m3 was calculated to be equivalent to 84.7µg/m3 NOx concentration (based on local background NOx and the NOx/NO_2 conversion calculator).

The maximum predicted NOx reduction required within the Gaywood Clock AQMA to comply with the NO2 AQS objective is 29.5µg/m3 (equivalent to 26% decrease in NOx). This equates to an 8.2µg/m3 reduction in NO2 (equivalent to a 17% decrease in NO_2). This is at the worst-case location in the AQMA at the junction of Wootton Road/Lynn Road and Gayton Road. Consequently, the formulation of the Action Plan should aim to reduce the levels of NOx/NO_2 in the AQMA by these amounts.

Table 5 - Source Apportionment of NO_2 Concentrations at Worst-Case Receptor

Receptor (Maximum Modelled Concentration) (µg/m3)	**WoottonRd1**
Total NO_2 2009 (Total Background + Local Road Source)	48.2
NO_2 Total Background (Local + Regional)	17.9
▪ NO_2 Local Background	10.3
▪ NO_2 Regional Background	7.6
Local Road Source Contributions (LDV + HDV)	30.3
▪ NO_2 CAR	14.0
▪ NO_2 LGV	4.2
▪ NO_2 HGV	2.5
▪ NO_2 BUS	9.5
▪ NO_2 MOTORCYCLE	0.1
Contribution as Percentage of Total NO_2 Concentration	
% Total Background (Local + Regional)	37.1%
% Local background	21.4%
% Regional background	15.7%
% Road traffic	62.9%
▪ % due to CAR traffic	29.0%
▪ % due to LGV traffic	8.7%
▪ % due to HGV traffic	5.3%
▪ % due to BUS traffic	19.7%
▪ % due to MOTORCYCLE traffic	0.2%
▪ % CAR contribution of total road traffic	46.1%
▪ % LGV contribution of total road traffic	13.8%
▪ % HGV contribution of total road traffic	8.4%
▪ % BUS contribution of total road traffic	31.3%
▪ % MOTORCYCLE contribution of total road traffic	0.3%

Table 6 - Required NO_x and NO_2 Reduction to Comply with AQS Objective

Receptor ID	**Modelled NOx 2009 (mg/m3)**	**Equivalent NOx Objective (µg/m3)**	**NOx Reduction Required (µg/m3)**	**NOx % Reduction Required**	**Modelled NO2 (µg/m3)**	**NO2 AQS objective (µg/m3)**	**NO2 Reduction Required (µg/m3)**	**NO2 % Reduction Required**
Wootton Rd1	114.2	84.7	29.5	25.8%	48.2	40	8.2	17.0%

3.3 Summary of actions taken to improve air quality

The King's Lynn & West Norfolk Borough Council has already started to take measures to address exceedences of the Air Quality Strategy annual mean NO_2 objective in the AQMA. These include:

1. Adoption of a Green Travel Plan with the following objectives:
    - Reduce the need for single occupancy private car travel for commuting and council business;
    - Increase the travel choices available for staff, members and visitors to the council offices with the help of Norfolk County Council;
    - Promote and encourage the use of greener, sustainable and healthy travel choices to staff, members, visitors and local businesses;
    - Minimise the environmental impact of the Borough Council's staff commuting and business travel;
2. Modification of the Borough Council's Car Lease Scheme to preclude large engine sizes and high CO_2 emissions, including a 'Green Fleet Review';
3. Policy of hiring more efficient cars for journeys over 150 miles;
4. Adoption of an Environmental Statement, including support for monitoring and improvement of air quality across the Borough;
5. Material consideration of air quality when dealing with planning applications within the AQMA or where the AQMA may be affected from outside;
6. Recommendation of air quality improvement measures for inclusion within the Community Infrastructure Fund bid successfully mounted by the County Council;
7. Consultation and liaising with the County Council with regard to the King's Lynn Area Transport Strategy (KLATS);
8. Setting up a corporate air quality steering group to follow on from KLATS work;
9. Inclusion of air quality issues within the County Council Local Transport Plan;
10. Drafting of a Development Management Policy for inclusion in the Local Development Framework.

3.4 Conclusions

Past rounds of the LAQM Review and Assessment process have identified two areas in the Borough of King's Lynn & West Norfolk where the AQS annual mean NO_2 objective has been exceeded (King's Lynn Town Centre and Gaywood Clock areas), and have subsequently been declared AQMAs. This AQAP outlines measures to be taken with regard to both AQMAs.

Assessment of monitoring data and modelled concentrations in the 2008 Detailed Assessment of Air Quality has indicated that exceedences of the annual mean NO_2 objective of 40µg/m^3 are predicted at locations where members of the public spend a considerable amount of time, and are hence considered to be 'sensitive' e.g. façades of residential properties. Data from diffusion tube monitoring sites indicate that exceedences of the annual mean NO_2 objective are still being measured within the AQMAs. Using results from a source apportionment study, emissions from road traffic, in particular cars have been identified as the dominant contributor to these exceedences. The contribution of buses is significant given their low proportion within the overall vehicle fleet.

The Borough Council has already started to undertake measures to combat poor air quality in the Borough, including the requirement to consider the impact upon air quality of developments within the AQMA, and the adoption of a Green Travel Plan.

The greatest exceedence of the NO_2 annual mean objective in the Town Centre AQMA and Gaywood clock AQMA is estimated to by around 6µg/m^3 and 8 µg/m^3 respectively. Hence this AQAP aims to identify measures which will contribute to the reduction of ambient concentrations by these amounts in their respective AQMAs. It should be noted that background concentrations of NO_2 are also a significant contributor to the NO_2 annual mean in the Borough. Therefore, measures taken on a wider scale to reduce emissions of NO_X are also likely to have an impact upon the exceedences of the annual mean concentrations.

4 Air Quality Action Plan options and their assessment

4.1 Introduction

The Air Quality Action Plan must include:

- Quantification of the source contributions to the predicted exceedences of the objectives, allowing the Action Plan measures to be effectively targeted;
- Evidence that all available options have been considered on the grounds of cost-effectiveness and feasibility;
- How the local authority will use its powers and also work in conjunction with other organisations in pursuit of the air quality objectives;
- Clear timescales in which the Borough Council and other organisations and agencies propose to implement the measures within the plan;
- Quantification of the expected impacts of the proposed measures and where possible an indication as to whether the measures will be sufficient to meet the air quality objectives; and
- How the local authority intends to fund, monitor and evaluate the effectiveness of the plan.

4.2 Air Quality Action Plan Steering Group

The King's Lynn Area Transport Strategy Group (KLATS) was set up in order to investigate and promote methods of dealing with road traffic congestion within the King's Lynn urban area.

This was deemed to be necessary as there were large scale regeneration projects due to be instigated including. the Nar Ouse Regeneration Area (NORA) - a large area to be redeveloped for housing and commercial uses on a former fertilizer works site; a new marina comprising of domestic and commercial properties; the provision of 12,000 new homes in the Borough following a successful Growth Point status bid; town centre redevelopment etc. It was evident that there were existing traffic congestion problems within King's Lynn and that the proposed new developments could aggravate these. Furthermore prospective new businesses could themselves be adversely affected by transport difficulties.

As the breach of the Air Quality Objective for Nitrogen Dioxide was linked to traffic congestion it was considered that KLATS would be the ideal forum for bringing about the necessary improvements in air quality. In effect KLATS became the Steering Group comprising of representatives from the Borough Council's Environmental Health and Housing, Planning and Regeneration Departments, Norfolk County Council's Planning and Transportation Department together with their consultants Mott McDonald, a local bus operator and the Highways Agency.

KLATS initially considered a full range of relevant options to change traffic flow in the town centre AQMA in order to improve air quality in the area. The process was one of narrowing down a range of potential options to those that are specifically focussed on the problem, feasible and also cost-effective compared with others.

Following production of the KLATS report[5] the Borough Council has agreed to set up an Air Quality Steering Group (AQSG) to finalise options and implement this action plan.

[5] King's Lynn Area Transportation and Land Use Study Stage 1 Final Report, March 2009, Norfolk County Council

4.3 Assessment of options

Measures put forward for consideration can be considered to come under certain 'types' of measure, including:

- Strategic actions;
- Movement of receptors away from the AQMA;
- Movement of sources away from the AQMA;
- Optimisation of emissions source movement through the AQMA;
- Reduction of emissions from sources by technical means; and
- Reduction of emissions from sources through reduction in demand for travel, or achieving better travel choices.

KLATS considered selected options in further detail against Local Transport Plan Service Output Objectives; Service Output Objective Number 1 being the need to improve air quality in declared areas. Although some of the options may not relate to measures to be taken within the AQMA they were considered to have possible benefits to traffic flows within it.

KLATS provided an initial assessment of the feasibility and applicability of the types of options. A decision was reached for each option; either to eliminate it from further consideration, or to consider the option in greater detail. The decisions were made with reference to:

1. Conclusions drawn from the Detailed Assessment of air quality in the Railway Road AQMA (see Chapter 3);
2. Comments received from the KLATS group; and
3. Additional comments from King's Lynn & West Norfolk Borough Council's consultant, based upon experience of previous assessments.

The methodology used to assess options is set out in Appendix 2. A wide range of options to reduce emissions from road transport was put forward for consideration. These options are listed in Appendix 3. It should be noted that the Borough and County Councils do not necessarily have the power to implement all options directly. However the Councils may potentially have a role in attempting to influence those bodies or individuals that could implement them. Therefore, it was considered appropriate to initially consider all options.

4.4 Transport Strategy Options

The Detailed Assessment of air quality in the town centre AQMA, undertaken in 2008 and summarised in Chapter 3, identified road transport as the dominant contributor to the high annual mean concentrations of NO_2 recorded within the AQMA.

A feasibility study of the possible measures for reducing NO_2 levels within the King's Lynn town centre AQMA has been carried out, as outlined in Section 4.3. As mentioned above, the possible measures were specifically targeted at emissions of NO_X from road transport, since this source was found to be the dominant contributor to exceedences of the annual mean NO_2 objective of 40µg/m^3.

A summary of the available transport strategy options and their feasibility for mitigating NO_X emissions from road transport in the King's Lynn town centre AQMA is presented below. A more detailed description and discussion of the strategy options is presented in Appendix 3 and Appendix 4.

4.4.1 Partnership between the Council and the Local Transport Authority

Norfolk County Council is responsible for overall transport strategy in Norfolk. As the Town Centre AQMA is dominated by emissions from road transport, a partnership arrangement between the Borough and County Councils for the development of the AQAP is advisable.

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

The most recent LTP issued by Norfolk County Council (LTP3) "Connecting Norfolk 2011-2026" aims to reduce the negative impacts of road traffic and reduce delays in the County, especially where they affect public transport or result in poor air quality. The LTP recognises that the King's Lynn Town Centre AQMA stems from the one-way system that is in place, which requires general traffic and bus services to circulate the town centre. The County Council has, and is currently working with the Borough Council in the development of the Action Plan to improve air quality within the AQMA. This is also linked with the Community Infrastructure Fund work that the County Council is developing for King's Lynn. Once the plan has been developed, a proxy transport indicator will be adopted in the LTP. It is expected that the implementation of the LTP will contribute towards improvement in air quality by reducing background concentrations of pollutants as emissions will be reduced on a regional scale.

4.4.2 Borough Council Partnerships

The planning system plays a key role in protecting and improving the environment. Land use planning and development control can become an effective tool to improve air quality by first locating developments in such a way as to reduce emissions overall, and secondly reducing the direct impacts of those developments. Although the presence of an AQMA makes consideration of the air quality impacts of a proposed development more important, there is still a need to regard air quality as a material factor in determining planning applications in any location. This is particularly important where the proposed development is not physically within the AQMA, but could have adverse impacts on air quality within it, or where air quality in that given area is close to exceeding guideline objectives itself.

The National Planning Policy Framework states that 'Planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan.'

The National Air Quality Strategy reiterates that the government strongly believes that air quality issues should be dealt with in a holistic and multi-disciplinary way. In developing an Air Quality Action Plan, Environmental Health will engage with Borough Council Development Services and County Planning and Transportation to ensure the actions are supported by all parts of the administration.

Environmental Health are consulted on applications within the AQMA or on major applications in the King's Lynn urban area. The weekly planning application list is reviewed to take account of any development in or nearby the AQMA. Pre-application discussions may highlight the need for an application for planning consent to be accompanied by an air quality impact assessment. Small scale developments may require mitigation measures.

4.4.3 Community Infrastructure Fund

A new public transport route running from Wisbech Road in the south to Boal Street in the north has been built using Community Infrastructure Fund monies. The route is linked to the existing highway network with a new junction at each end of its length. Air Quality Assessment has concluded that due to the resultant reduction of vehicles travelling along London Road, which is within the AQMA, annual average NO2 levels in that part of the AQMA will improve by up to 2.5ug/m^3. Provision for bus only lanes in Millfleet and Littleport Street has also been made.

4.4.4 Urban Traffic Control

Urban Traffic Control (UTC) is typically used to co-ordinate traffic signals to get traffic flowing through junctions as swiftly as possible. This action will be used to improve the timing of traffic signals in a systematic way to improve traffic flows and reduce idling, both of which contribute significantly to poor air quality in this area.

4.4.5 Road Layout Changes

Work is currently being undertaken to identify possible road layout changes in the town centre that would lead to improvements in air quality as part of the King's Lynn Area Transport Strategy Group (KLATS). A change in the way traffic flows around the one way system area could improve traffic flows and reduce congestion, which could then lead to substantial reductions in emissions from transport in this area or provision of new roads could help reduce congestion.

4.4.6 Low Emission Zone

A Low Emission Zone (LEZ) on Railway Road would restrict certain types of vehicle entering the zone, and would require that those vehicles would comply with set emissions standards or fuel type. LEZs are typically based around Euro IV emissions standards, which can reduce NO_x emissions by 15-50%.

4.4.7 Quality Bus Partnerships and Contracts

Contracts can be drawn up between Norfolk County Council and local bus operators stipulating the standards required for buses operating within the Council's remit. Quality Bus Partnerships can be used to set emissions standards on bus fleets for local operators in order to assist in compliance with a future LEZ.

4.4.8 Car Parking Strategy

Car parking provision and charging can help to create a modal shift from car usage to public transport or park & ride schemes. The number, type and location of car parks needs to be assessed and consolidated as required. A car parking strategy could examine options such as variable message signs, on street vending, electric vehicle charging points and variable car parking rates. The feasibility of a park and ride scheme for King's Lynn and associated car parking policy has yet to be implemented. Such a measure may have benefits in reducing emissions within the AQMA.

4.4.9 Low Emissions Strategy

Individual council and Joint Transport Emissions groups have either adopted Low Emission Strategies (LES) or are investigating their application. A LES provides a package of measures to help mitigate the transport impacts of development. The primary aim is to accelerate the uptake of low emission fuels and technologies.

Low emission strategies complement other design and mitigation options, such as travel planning and the provision of public transport infrastructure.

Strategies are often secured through a combination of planning conditions and legal obligations. They may incorporate policy measures and/or require financial investments in and contributions to the delivery of low emission transport projects and plans, including strategic monitoring and assessment activities.

A LES can include measures such as:

- Low emission planning agreements, such as securing EV charging points
- Public Transport fleet improvements
- Fleet reviews
- Taxi emission standards

- Specification for public charging in car parks or parking allocation for low emission vehicles
- EV recharging points for Hotels, Superstores and Industrial Estates
- Low emission vehicle demonstration days.
- Low emission procurement strategies
- Creation of low emission zones

4.4.10 Smarter Choices

Smarter choices promote education and awareness in an attempt to induce modal shift. The following measures will be used to this end:

- Signage - to raise awareness that people are entering an AQMA;
- Travelwise - an initiative which seeks to make people aware of the travel choices that are available to them and encourages people to use more sustainable modes of transport such as walking, cycling, and buses where it is reasonable and practicable to do so;
- Travel Plans - a package of practical measures for the workplace or schools to encourage those people travelling to such organisations to choose alternatives to single-occupancy car-use; and
- Carsharing - when two or more people share a car and travel together. It allows people to benefit from the convenience of the car, whilst alleviating the associated problems of congestion and pollution.

4.4.11 Alternative Fuels

To support and encourage the uptake of alternative fuel vehicles the Borough Council will disseminate information about grants available for converting existing vehicles or purchasing alternative fuel vehicles.

4.4.12 Leading by Example

The Borough Council will lead by example by undertaking the following actions:
- Examining the use of Low Sulphur Diesel in its fleet of diesel powered vehicles;
- Continuing to encourage employees to join the Carsharing scheme;
- Use of hire cars on journeys more than 150 miles;
- Adoption and implementation of Green Travel Plan;
- Continuing to limit the engine size and CO_2 emissions of leased cars made available to council employees;
- Public space vehicles have had a telematic tracking system installed which enables the fleet to be monitored and deploy vehicles more efficiently;
- Eco-driving training and best practice is being rolled out to drivers within the public spaces team.
- An Environmental Statement has been produced and adopted, including support for monitoring and improvement of air quality across the Borough

4.5 Assessment methods

In accordance with the principle that air quality issues should be dealt with in a holistic and multi-disciplinary way the options outlined in 4.3 were initially assessed against 10 key objectives; these were that they should :

1 Improve air quality in declared areas;
2 Design public transport and car parking strategies to deliver regeneration and growth;
3 Reduce the need to travel and promote low carbon options through better planning;
4 Reduce short inter- urban journeys;
5 Target capacity improvements where growth impacts on existing network;
6 Improve access to strategic transport network;
7 Provide infrastructure for growth adaptable to climate change and minimise environmental impact;
8 Ensure that growth supports road safety;
9 Enhance access to jobs, leisure and social activities;
10 Develop a safe, secure public realm.

Each of the options was given a score which defined the extent to which the above 10 objectives would be affected.

Options were assessed taking into account:

- Potential air quality impact
- Cost effectiveness
- Potential co-environmental benefits
- Potential risk factors
- Potential social impacts
- Potential economic impacts
- Feasibility based on cost and air quality impact

Appendix 2 provides more detail on the assessment methods and cost-effectiveness scoring.

Appendix 3 sets out the assessment of specific options. Some options were discounted due to prohibitive cost implications and/or unfeasibility. The most cost-effective options were selected for inclusion in the action plan measures.

4.6 Consultation

Consultation on the Air Quality Action Plan took place with a wide range of stakeholders including:

- Secretary of State (DEFRA)
- King's Lynn Area Consultative Committee
- King's Lynn Chamber of Commerce
- Elected Members
- Environment Agency
- Norfolk County Council including Highways
- Bus operating companies
- Neighbouring district local authorities
- Members of the public
- Interest groups (Bicycle Users Group, Community and Voluntary Action groups, Health Watch, Clinical Commissioning Group, Community transport)

Drop in sessions were held at Gaywood and King's Lynn libraries during August and September. A leaflet drop was carried out to properties within the air quality management areas to let them know about the consultation.

An Air Quality Action Plan webpage was set up on the Borough Council's web site with a link to an electronic survey and an email address for specific comments. Stakeholders and interest groups were contacted by email and directed to the website for more information. Taxi and Private Hire operators were contacted by letter for comments. Items also appeared in the local press to inform the local community that the consultation was taking place.

A separate report is available on the AQAP webpage setting out the results of the consultation. The general consensus of opinion was that the measures in the AQAP were supported.

5.1 Measures

Following consideration of all the options in section 4, twenty measures have been selected to be carried forward in this Action Plan. The plan is summarised in Table A at the front of this report.

5.2 Implementation and Monitoring

The Borough Council of King's Lynn and West Norfolk will jointly work on the Action Plan measures with relevant partners and stakeholders. To secure the necessary air quality improvements there must be involvement by all local stakeholders to achieve the Action Plan's goals.

The implementation and effectiveness of this Action Plan will be carefully monitored through monitoring of NO_2 at relevant receptors within the AQMA. In addition traffic flow changes on key routes will be assessed through the review and assessment process.

There will be regular review and assessment of the Action Plan proposals to evaluate progress and this will be reported annually as part of the LAQM Action Plan Progress Report.

5.3 Future Actions

The AQAP includes the measures that the Air Quality Action Plan Steering Group considers to be the most appropriate to make progress towards the air quality objectives in the Town Centre and Gaywood AQMAs at this time.

The final action plan has been approved by the Borough Council of King's Lynn & West Norfolk Cabinet and by DEFRA before becoming a fully adopted policy. Now adopted and integrated into the Norfolk Local Transport Plan, the Borough and County Councils will collaborate to implement the measures in the AQAP and in monitor their progress. This information will be reported annually to the Secretary of State in a statutory progress report.

Appendices

Appendix 1: UK National Air Quality Standards and Objectives

Appendix 2: Assessment Methods

Appendix 3: Air Quality Action Plan Assessment of Options

Appendix 1: UK National Air Quality Standards and Objectives

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

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
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
Authorities in open areas and coastal areas should be cleaner as air changes more frequently and Northern Ireland only	3.25 μg/m^3	Running annual mean	31.12.2010
1,3-Butadiene	2.25 μg/m^3	running annual mean	31.12.2003
Carbon monoxide Authorities in England, Wales and Northern Ireland only	10.0 mg/m^3	maximum daily running 8-hour mean	31.12.2003
Authorities in Scotland only	10.0 mg/m^3	running 8-hour mean	31.12.2003
Lead	0.5 μg/m^3 0.25 μg/m^3	annual mean annual mean	31.12.2004 31.12.2008
Nitrogen dioxide[b]	200 μg/m^3 not to be exceeded more than 18 times a year 40 μg/m^3	1 hour mean Annual mean	31.12.2005 31.12.2005
Particles (PM_{10}) (gravimetric)[c] All authorities	50 μg/m^3 not to be exceeded more than 35 times a year 40 μg/m^3	24 hour mean Annual mean	31.12.2004 31.12.2004
Authorities in Scotland only[d]	50 μg/m^3 not to be exceeded more than 7 times a year 18 μg/m^3	24 hour mean Annual mean	31.12.2010 31.12.2010
Sulphur dioxide	350 μg/m^3 not to be exceeded more than 24 times a year 125 μg/m^3 not to be exceeded more than 3 times a year 266 μg/m^3 not to be exceeded more than 35 times a year	1 hour mean 24 hour mean 15 minute mean	31.12.2004 31.12.2004 31.12.2005

b. The objectives for nitrogen dioxide are provisional.
c. Measured using the European gravimetric transfer standard sampler or equivalent.
d. These 2010 Air Quality Objectives for PM10 apply in Scotland only, as set out in the Air Quality (Scotland) Amendment Regulations 2002.

Additional national particles objectives for England, Wales and Greater London (see table below) are not currently included in Regulations for the purpose of LAQM. The Government and the Welsh Assembly Government however intends that the new particles objectives will be included in Regulations as soon as practicable after the review of the EU's first air quality daughter directive. Whilst authorities have no obligation to review and assess against them, they may find it helpful to do so, in order to assist with longer-term planning, and the assessment of development proposals in their local areas.

Proposed new particles objectives for England, Wales and Greater London (not included in Regulations)

Region	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
London	50 μg/m^3 not to be exceeded more than 10 times a year	24 hour mean	31.12.2010
London	23 μg/m^3	annual mean	31.12.2010
London	20 μg/m^3	annual mean	31.12.2015
Rest of England and Wales	50 μg/m^3 not to be exceeded more than 7 times a year	24 hour mean	31.12.2010
Rest of England and Wales	20 μg/m^3	annual mean	31.12.2010

Efforts to achieve these objectives should be focussed on locations where members of the public are likely to be exposed over the averaging period of the objective. The table below summarises the locations where these objectives should and should not apply.

Typical locations where the objectives should and should not apply			
Averaging Period	**Pollutants**	**Objectives *should* apply at …**	**Objectives should *not* generally apply at …**
Annual mean	1,3 Butadiene Benzene Lead Nitrogen dioxide PM_{10}	All background locations where members of the public might be regularly exposed.	Building facades of offices or other places of work where members of the public do not have regular access.
		Building facades of residential properties, schools, hospitals, libraries etc.	Gardens of residential properties. Kerbside sites (as opposed to locations at the building facade), or any other location where public exposure is expected to be short term
24 hour mean and 8-hour mean	Carbon monoxide PM_{10} Sulphur dioxide	All locations where the annual mean objective would apply. Gardens of residential properties.	Kerbside sites (as opposed to locations at the building facade), or any other location where public exposure is expected to be short term.
1 hour mean	Nitrogen dioxide Sulphur dioxide	All locations where the annual mean and 24 and 8-hour mean objectives apply. Kerbside sites (e.g. pavements of busy shopping streets). Those parts of car parks and railway stations etc. which are not fully enclosed. Any outdoor locations to which the public might reasonably be expected to have access.	Kerbside sites where the public would not be expected to have regular access.
15 minute mean	Sulphur dioxide	All locations where members of the public might reasonably be exposed for a period of 15 minutes or longer.	

Appendix 2: Assessment Methods

The KLATS/ Air Quality Action Plan Steering Group have identified a wide range of options during the initial assessment. These have been assessed in more detail against a range of criteria in order to determine which ones to include within the Action Plan. The following paragraphs outline how the assessment has been made.

What is the option?

The KLATS/ AQAPSG have listed the potential options and made comments on the potential effects, pros and cons associated with the option. The information given here along with the source apportionment information in chapter 3 is the basis of the assessment.

What is being proposed?

The options are defined in specific terms where possible. For the detailed assessment each option has been defined in sufficient detail to understand the change, from the current situation, that is being proposed.

Typically the proposal is either to change the traffic in the AQMAs or traffic more generally across King's Lynn. The effects on traffic in these locations are defined as 'fewer vehicles' or 'fewer vehicles queuing' or 'lower emitting vehicles'. In other cases the focus is considered to be 'strategic' i.e. developing those options may not have direct impacts on the problem but improve the Borough Councils' capacity to make the correct decision on managing air quality in the AQMA and across King's Lynn.

Potential air quality impact

This is a key assessment in that the Air Quality Action Plan must focus on prioritising options that improve air quality most effectively. The assessment is complex in that the detailed assessment of any given option could normally be subject to a study of its own requiring significant resources.

Ideally, a traffic model for King's Lynn town centre and Gaywood would be developed to a stage where it would be possible to quantitatively assess the potential air quality impacts of any given options. However, this is not currently the case. Therefore, a semi-quantitative assessment relying on a level of judgement has been adopted. The method used is described below:

1 What proportion of emissions would be affected by the option?
The option description, comments, focus of the option and source apportionment have been used to define how much of the contribution to the air quality issue in King's Lynn town centre and Gaywood that this option potentially addresses.

2 Realistically how much of the traffic would change due to the option?
Beyond the potential influence there must be consideration of the realistic impact of the proposed option. Road closure would obviously remove all traffic emissions and hence realistically remove 100% of all local road transport emissions. However, this may only be acceptable in very few cases. Options listed for King's Lynn are more modest in ambition. Non-regulatory interventions are likely to have limited impact since the junction-users will still be left to decide whether to use the junction or not.

The level of realistic change has been defined as being:

- Neutral – basically changing no traffic
- Very small – changing around 1-2% of traffic
- Small – changing 2-5% of traffic
- Moderate – changing 5-10% of traffic
- Large – changing more than 10% of traffic

3 Therefore what level of reduction in emissions might result from the option?
The proportion of emissions potentially affected by the option and the view on how far they could be changed by the option (steps 1 and 2 above) are combined to express an overall assessment of the amount of local transport emissions in King's Lynn town centre and Gaywood that may realistically be reduced by the option.

4 How significant might the air quality improvement be as a result?
The source apportionment and review and assessment information presented in this report indicates that a 6µg/m^3 (13%) reduction in NO_2 concentrations in the King's Lynn town centre AQMA is required based upon 2007 modelling, to achieve the air quality standard. An 8 µg/m^3 (17%) reduction is required at Gaywood.

For the purpose of the air quality assessment the result of the realistic intervention has been assessed as having a potentially:

- Neutral local air quality benefit if the realistic intervention is 0% or worse
- Low local air quality benefit if the realistic intervention is 1%
- Medium local air quality benefit if the realistic intervention is 2-5%
- Large local air quality benefit if the realistic intervention is >5%

The result of the assessment is to define the potential air quality benefit of an option (in terms of making progress towards the air quality standard in the AQMA) as ranging from neutral to relatively large.

Cost-effectiveness assessment

Implementation costs
The potential implementation costs of each option are assessed as follows:

- Cost neutral;
- Low costs (up to £20k annually e.g. for small surveys or campaigns or other options using current resources)
- Medium costs (up to £200k annually e.g. for small traffic management schemes)
- High costs (above £200k annually e.g. for new infrastructure)

The assessed costs attempt to include the costs to vehicle operators as well as to the Councils.

The effectiveness of each measure in improving air quality is compared to the implementation costs in the matrix provided in Table a below.

In this matrix the assessed implementation costs and potential air quality impacts have been given a weighted score. The product of the weighted scores for each option is calculated. The results can be interpreted as follows:

- If the product is high (8 or more) then the measure is more cost-effective (significant impacts for the cost involved) and perhaps favourably cost-effective;
- If the product is medium (between 3-7) then the measure is in the medium range of cost-effectiveness; and
- If the product is low (2 or less) then the measure is less cost-effective (small impacts for the cost involved) and perhaps unacceptably poor in cost-effectiveness terms.

The final cost-effectiveness value is sensitive to changes in the assumptions of how effective a measure might be in reducing emissions and how costly it is.

Note that a score of 4 for one option and a score of 8 for another does not necessarily mean that the former option is exactly two times more cost-effective. This method only estimates the *relative* cost-effectiveness of options rather than their *absolute* values. The method is useful during discussions of the relative priority of different options.

Table a: Level and magnitude of cost and air quality impact indicators

AQ benefit / Cost	Rating	Neutral	Low	Medium	High
Rating		0	1	2	3
Neutral	4	0	4	8	12
Low	3	0	3	6	9
Medium	2	0	2	4	6
High	1	0	1	2	3

Within Table 7 located in Appendix 3, indicators for cost and air quality impact are given to enable the comparison between options and their potential feasibility. Approximate values have been assigned for the indicators, as shown in Table b. The measure of cost is given in pounds sterling (£), whilst the measure of air quality impact is given in the predicted change in NO_2 concentration, $\mu g/m^3$. The definition of such indicators also allows for the assessment of the effectiveness of the measure/option, should it be put in place.

Table b: Level and magnitude of cost and air quality impact indicators*

Indicator	Level	Magnitude
Cost	Low	< £20,000
	Medium	£10,000 - £200,000
	High	>£200,000
AQ Impact	Negative	< 0$\mu g/m^3$
	Low	0 - 1$\mu g/m^3$
	Medium	1- 3$\mu g/m^3$
	High	> 3$\mu g/m^3$

*Costs already allocated or spent are not included in this assessment and would therefore be described as 'neutral'.

Potential co-environmental benefits

In this assessment other environmental benefits are highlighted.

- Other pollutants: The likely effect on local PM_{10} concentration is assessed as being an overall reduction or a local reduction perhaps with emissions being relocated elsewhere;
- Greenhouse gases: The likely effect on greenhouse gas emissions is assessed as being an overall reduction or a local reduction perhaps with emissions being relocated elsewhere in the District.

Without detailed information on the true impacts of the options these assessments rely on judgement and therefore any issues have been raised within the `comments' column in the assessment results in Table 7.

Potential risk factors

In this assessment risk factors are highlighted. These may be looked at more closely within a Strategic Environmental Assessment of any option implemented. At this stage it is simply highlighted whether it is likely that the option:

- may relocate emissions and hence lead to worsening air quality elsewhere
- may require a change in land use
- may place limits on pace of development or their costs

Without detailed information on the true impacts of the options these assessments rely on judgement and therefore any issues have been raised within the `comments' column in the assessment results in Table 7.

Potential social impacts

Potential social impacts are highlighted. These may need to be examined more closely when developing the options further. At this stage it is simply highlighted whether it is likely that the option would potentially:

- Provide health benefits in terms of lower exposure to pollutants or increased mobility
- Increase road safety
- Improve accessibility

Without detailed information on the true impacts of the options these assessments rely on judgement and therefore any issues have been raised within the `comments' column in the assessment results in Table 7.

Potential economic impacts

Potential economic impacts are highlighted. These may need to be examined more closely when developing the options further. At this stage it is simply highlighted whether it is likely that the option would potentially:

- Provide environmental improvements to property
- Make the town more appealing to live or work
- Attract more visitors or shoppers to the town centre
- Improve sustainable development or accessibility in King's Lynn
- Reduce or increase overall travel time
- Impact on deliveries to King's Lynn
- Impact on operator costs and potentially pass these through to passengers or clients
- Require significant re-adjustment to the scheme

Without detailed information on the true impacts of the options these assessments rely on judgement and therefore any issues have been raised within the `comments' column in the assessment results in Table 7.

Who is the appropriate authority for implementing an option?

A single authority would be responsible for leading on developing and implementing Action Plan measures or in attempting to influence other agencies to take such action. Each option has been identified as being within the responsibility of the following authorities:

1. King's Lynn & West Norfolk Borough Council; and
2. Norfolk County Council.

How feasible or acceptable is it to implement the option?

Comments on feasibility and acceptability are included where appropriate in Appendix 3.

Appendix 3: Air Quality Action Plan Assessment of Options

Table 7: Available options and feasibility

Strategy	Measure	Description	Traffic/ AQ Impact	Ancillary Effects	Cost	Cost effectiveness (see table a above)	Comments	Action
Move receptors away from AQMA	Relocation of receptors	Remove homes and businesses from AQMA Compulsory purchase of some or all affected properties	Large. Would remove receptors from source area	Large social and environmental impact	High	3	Not feasible, due to high number of residential and commercial properties within the AQMA.	None
Move sources away from AQMA	Bypass [i.e. a new route or road to re-direct some of the traffic that traverses the AQMAs]	Possible new routes: 1) Road through Friars to Boal Quay which will take some traffic from London Road/ Railway Road. 2) Road bridge over the River Great Ouse from West Lynn which will act as a bypass to London Road/ Saddlebow Road/ Wisbech Road 3) Gaywood Link Road, to connect Gaywood Road to Hardwick Road, which will remove some traffic from Kings Lynn AQMA. 4) By pass linking North Lynn to West Lynn 5) New link road to Lynnsport	1), 2), 3) 4) & 5) Medium	Large environmental impact	1) Neutral 2), 3), 4) High 5) Potentially neutral	1) 8 2), 3), 4) 2 5) 8	1) CIF funded bus only route built to transport buses from Southgates to Boal Quay area 2) Requires NCC Highways support/input to progress. Very expensive with technical difficulties re shipping access and space requirements. 3) Requires NCC Highways support/input to progress. Very expensive with technical difficulties 4) An aspiration rather than a deliverable option 5) Could remove some traffic from Gaywood AQMA	**1) Included in Action Plan measures** 2) Not pursued, cost effectiveness low 3) Not pursued, cost effectiveness low 4) Not pursued, cost benefit low **5) Tentative funding streams**

Strategy	Measure	Description	Traffic/ AQ Impact	Ancillary Effects	Cost	Cost effectiveness (see table a above)	Comments	Action
	Control access for freight	1) 24-hour or timed ban on freight access through the AQMAs 2) Parkway, south of A47 in order to transfer incoming freight into low emission vehicles for transhipment of goods to Town Centre.	Medium	Main sources of NO2 emission are cars or buses not HGV's	High	2	Requires purchase of land Expensive and NCC funds not available at present. Possibly many likely areas have been ear-marked for other purposes already.	1) None 2) None
	Control access for cars	24-hour or timed ban on car access through the AQMAs	Large/High	Environmental improvement for residents, visitors and workers	High	3	Not feasible due to lack of alternative routes within the town centre	None
	Control access for buses	1) 24-hour or timed ban on bus access through the AQMAs: Inbound contra flow bus lane on Railway Road (AM and PM peaks) 2) Outbound bus gate on Norfolk Street (PM peak) 3) Inbound bus lane on Littleport Street (AM and PM peak) 4) Community Infrastructure Fund (CIF) bid includes proposed new bus route	1), 2), 3) & 4) Medium	Improved journey times, encouragement to use public transport	1), 2), & 3) High 4) Neutral	1), 2), & 3) 2 4) 8	Requires NCC buy in. Main sources of NO2 emission are cars. CIF funding available	1) None 2) None 3) None **4) Progress CIF bid for bus route. Include in action plan measures**

Strategy	Measure	Description	Traffic/ AQ Impact	Ancillary Effects	Cost	Cost effectiveness (see table a above)	Comments	Action
	Lobby Central Government Departments	Lobby the Highways Agency and the regional development agency for long-term policies to manage traffic volumes	Low	Improvements away from AQMA	Low	3	Trunk roads are not directly contributing towards air quality within the AQMA and therefore this measure is not considered effective.	None
Zoning Measures	20 mph zones	Residential traffic zones	Low Emissions from transport are related to fuel efficiency, and at 20 mph, fuel efficiency is lower than higher speeds, leading to increased emissions.	Reduction in noise level, potential traffic displacement, improvement in overall local environment and quality of life.	Medium	2	Only practical if sufficient enforcement is provided. AQMAs are not wholly residential. 20-mph zones would lead to an increase in emissions of NO_x from traffic. Speed limit is 30mph within AQMA	None
	Traffic free residential areas	The complete removal of traffic through access restrictions from specific residential areas, although such areas usually remain accessible to traffic from residents.	Large/ medium Would lead to a reduction in emissions from traffic within the traffic free zone, although traffic is most likely to be displaced elsewhere.	High. Would lead to a reduction in emissions from traffic within the zone, although traffic is most likely to be displaced elsewhere.	Medium	4	AQMAs are not wholly residential in nature Lack of alternative routes	None

Strategy	Measure	Description	Traffic/ AQ Impact	Ancillary Effects	Cost	Cost effectiveness (see table a above)	Comments	Action
	Low Emissions Zones (LEZ)	An LEZ is an area which seeks to reduce emissions from road vehicles by encouraging the use of cleaner fuels, more efficient vehicles, or reducing the number of vehicles overall. This is typically done by restricting access to certain areas from vehicles that do not meet the minimum set emissions standards. An LEZ can be introduced through voluntary agreements, partnerships, and licensing arrangements, such as bus quality partnerships or taxi licensing.	Medium LEZs are typically based around Euro IV standards, which reduce emissions of NOx by 15% from Euro III vehicles and 50% from Euro I vehicles.	Displacement of traffic could lead to increased congestion elsewhere. Possibility of lost trade for businesses within the LEZ.	Medium	4	An LEZ is a feasible option for buses, taxis, and delivery vehicles only. LEZ status would take this restriction one step further by setting emissions standards for those vehicles. As cars have been identified as the main pollution source on some routes, maybe feasible for certain areas where buses have greater contribution. e.g. Gaywood, Railway Road.	**Investigate within Low Emission Strategy?**
	Clear Zones	Designed to encourage solutions to traffic problems in towns and cities whilst ensuring town centres retain their accessibility, vitality, and economic viability. Usually involves the removal of traffic or access restrictions and improved pedestrian and cycling facilities within the Clear Zone.	High. The reduction of traffic within the Clear Zone would most likely have significant benefits to air quality within the immediate area.	Possible loss of trade to businesses although the improved atmosphere of Clear Zones may lead to increased trade in the longer term.	High	3	May move traffic elsewhere	None

Strategy	Measure	Description	Traffic/ AQ Impact	Ancillary Effects	Cost	Cost effectiveness (see table a above)	Comments	Action
	Vehicle Bans	The banning of certain types of vehicles from specific places or roads	Low HGVs have higher emissions but are not the main source of NO_2 in AQMA	Could displace HGV traffic to more residential areas which are less suited to accommodate HGVs. Possibility of lost trade for businesses.	Low	3	An HGV vehicle ban could lead to reduction in NO_2 concentrations and other road transport emissions, where there is a high proportion of HGV traffic on those roads.	None
Public Transport Measures	Park and Ride	Buses pick up commuters and shoppers from a car park on the outskirts of a town and take passengers directly to the town centre without stopping. 1) Situated at South Fairstead with: Bus Rapid Transit (BRT) to Central Kings Lynn using 'Sandline'; or rail connection e.g. Parry People Mover using same route. 2) Situated at a new Lynn South Parkway- rail based using existing rail line. 3) Development of Watlington Rail Station as a Parkway.	Low - Medium. Increased proportions of the population using public transport could lead to a reduction in NO_2 concentrations and other emissions from transport.	Reductions in traffic congestion. Usually only benefits car-owners and requires land. Needs to be linked to car parking strategy.	High	1-2	Needs co-operation of Network Rail, land acquisition and infrastructure built. Bus operator required. Possible increased congestion in some areas Needs buy in from Network Rail and Local train operators). Land availability for Park and Ride? Could be implemented by the Borough Council. Could reduce NOx emissions at peak hours Considered by KLATS	None

Strategy	Measure	Description	Traffic/ AQ Impact	Ancillary Effects	Cost	Cost effectiveness (see table a above)	Comments	Action
	Light rail or tram system	The introduction of a light rail or tram system will provide an alternative to the existing bus system. It is more efficient in energy terms than buses and produces substantially lower emissions.	Low - Medium. Light rail and trams, if utilised, would lead to significant reductions of emissions by transporting a larger number of people on a cleaner mode of transport than the private car or bus.	Could have detrimental environmental effects associated with construction.	High	1-2	The potential to use the 'Sand Line' freight railway line between Leziate and King's Lynn has been considered for a park & rail system operating light rail system.	None
	Subsidised Public Transport	Subsidisation of public transport fares on urban services to make the service less expensive and encourage more people to use. Fare subsidisation can be used on a temporary or longer-term basis to attract patronage and encourage a modal shift away from the private car to public transport where feasible.	Low Encouraging a modal shift away from the private car to public transport will typically lead to reductions in NO_X emissions from transport.	Modal shift to public transport from the car would help to reduce congestion.	Low - High	1-3	Funding of this could divert resources from other initiatives in local transport plan Many journeys in AQMAs are part of rural services to King's Lynn	None

Strategy	Measure	Description	Traffic/ AQ Impact	Ancillary Effects	Cost	Cost effectiveness (see table a above)	Comments	Action
	Quality Bus Partnerships and contracts	Contracts between the council and local bus operators that include standards for buses used in the area, such as type of bus, level of service, and standards for vehicle emissions.	High. Improved emissions standards would guarantee significant reductions in NO_X and other emissions from buses.	May encourage modal shift to public transport, as pollution produced by buses is a common complaint by bus users.	Low	9	Improve/reduce emissions from PSV fleet Incorporate emissions standards into Quality Bus Partnerships and Contracts, particularly on routes operating through AQMAs NCC/ LTP required	**Include in Action plan measures**
	On Street Ticket Vending Machines (TVM) for buses	Roadside TVMs with networked communications links to remote monitoring and revenue management systems. These systems offer the full range of tickets for travel within a zone.	Low. Encouraging a modal shift away from the private car to public transport will typically lead to reductions in NO_X emissions from transport.	Modal shift to public transport from the car would help to reduce congestion and enhance passengers travelling experience.	Medium	2	TVMs could be placed initially at Bus and Railway Stations and near key bus stop interchange points.	None
Fiscal Measures	Congestion charging/ tolls	Part III of the Transport Act 2000 provides local authorities with powers to introduce road user charging where these will help reduce road congestion and pollution. Typically, motorists are charged to enter the city by car.	Large. On 17 May, 2003 London introduced a congestion-charging scheme and results to date show that there has been a 25% reduction in overall traffic since it began.	Charging typically leads to a modal shift and a substantial overall reduction in traffic congestion.	High	2	Considered but may not be feasible in King's Lynn.	None

Strategy	Measure	Description	Traffic/ AQ Impact	Ancillary Effects	Cost	Cost effectiveness (see table a above)	Comments	Action
	Workplace Parking Levy	The workplace-parking levy is a charge for private, non-residential spaces, like those used by businesses for their workers.	Low. Workplace parking levies could potentially increase car sharing amongst employees and also encourage a modal shift towards alternative transport options.	Reduced congestion, journey time and possible reductions in other harmful atmospheric pollutants generated from transport. May displace parking onto nearby residential streets that are not currently covered under permit parking.	Low	3	Generally a less acceptable option with the public. Could considered as part of car parking strategy or LES	None,
	Parking Charges	Encourage use of car parks outside AQMA by applying reduced charges	Medium Cars parking outside AQMA will not pass through congested streets. Lower emissions	Could have beneficial effects on retail and local business if public walk from car to destination.	Low	6	Currently c20 surface car parks with large number in town centre; these could be replaced with new multi storey car parks, situated at areas accessible without necessarily passing through AQMA streets	**Examine car parking charging as part of overall car parking strategy for King's Lynn. Include in action plan measures**
	Roadside Emissions Testing	A uniformed police officer stops vehicles at the roadside and a qualified vehicle tester will test their emissions levels, and if it fails set limits, the vehicle owner may be issued with a fixed penalty notice.	Low. Although raises awareness of emissions from transport.	Raises awareness of the impact of road traffic. May increase congestion if conducted on narrow roads.	Medium	2	NCC/ Police resources needed. High cost ET Scanner and Automatic Number Plate recognition	None

Strategy	Measure	Description	Traffic/ AQ Impact	Ancillary Effects	Cost	Cost effectiveness (see table a above)	Comments	Action
	Variable Parking Rates	A system of financial incentives towards low emission vehicles. A pricing and permit structure by providing benefits to those who choose smaller, more efficient or alternative fuel vehicles.	Medium Reduces the number of highly polluting vehicles and contributes to a reduction in harmful pollutants.	Only benefits car users. May displace parking into other areas where restrictions are not found.	Low	6	Introduce a pricing and permit structure to encourage low emission vehicles. May penalise those who are less well off.	**Include in action plan measures**
	Support the use of West Lynn Ferry	Seek funding for parking improvements at West Lynn and for ferry	Low Reduction of traffic between West Lynn and AQMA	Improvement in journey time for passengers	Low - medium	2-3	Funding by NCC withdrawn	**Include in action plan measures**
	Vehicle idling regulations	Encourage the practice of switching off idling engines	Low Reduces emissions in areas of queuing and stationary traffic	Environmental benefits, reduction in noise	Low	3	Stationary traffic may not be in AQMA Requires a change of habit for drivers Could be enforced as part of enforcement of decriminalisation of parking	Pursue through NEPG sub group

Strategy	Measure	Description	Traffic/ AQ Impact	Ancillary Effects	Cost	Cost effectiveness (see table a above)	Comments	Action
Alternative Fuel Utilisation Incentives	Financial Incentives	The following incentives have been used successfully by other local authorities to encourage alternative fuels: 1) Council Tax rebates/ reductions for purchase of alternative fuel/conversion/ Euro IV standard vehicle purchase; 2) Reduction in taxi licence fee for alternative fuel use, and/ or grant assistance for conversion from Council and EST; 3) Council tax incentives for non-car owning households: travel discounts, cycle discounts, council tax rebates, etc.; 4) Priority and/or free/discounted parking in city centre for alternative fuel/ Euro IV vehicles	Low. Alternative Fuel Vehicles would have an impact on lowering emissions from transport.	None	Variable, dependent upon how far reaching incentives are.	1-4	Measures could be implemented as part of low emission strategy	**Investigate within Low Emission Strategy?**
Smarter choices; Promotion, education, awareness	Signage	Erect signage to raise awareness that people are entering an AQMA.	Low	May be seen as a visual disruption.	Low	0	May not convey a meaningful message to car-users	None

Strategy	Measure	Description	Traffic/ AQ Impact	Ancillary Effects	Cost	Cost effectiveness (see table a above)	Comments	Action
	Travelwise	To encourage the use of alternatives to the car and provide safe and attractive facilities, awareness campaigns are required to encourage a change in attitude towards travel. NCC and a number of other local authorities adopted a campaign using the trademark 'TravelWise'.	Low	Modal shift to walking and cycling could bring about health benefits.	Low	3	Norfolk County Council included a policy in the now superseded Structure Plan to develop the TravelWise campaign to raise public awareness about the problems associated with traffic growth and car reliance. Due to current financial constraints this initiative no longer has resources allocated directly	**Continue work begun with Travelwise initiative and disseminate information to the public and raising awareness about travel choice**.
	Travel Plans	A travel plan is typically a package of practical measures to encourage staff to choose alternatives to single-occupancy car use and to reduce the need to travel for work.	Low. Travel plans have the potential to reduce single-occupancy commuter car usage as well as business mileage, therefore mitigating emissions from transport.	None	Low	3	Can be partially implemented through planning system Continue to encourage and support workplace travel plans with the Norfolk County Council.	**Include in action plan measures**

Strategy	Measure	Description	Traffic/ AQ Impact	Ancillary Effects	Cost	Cost effectiveness (see table a above)	Comments	Action
	Green travel plans	For large businesses and institutions [i.e. targets for each commercial and institutional site above a given size threshold to introduce GTPs including manageable targets for the effects of the plans	Low- Medium	Can affect areas inside and outside AQMA	Low	3-6	Borough Council are currently introducing a Green Travel Plan Encourage through planning and development management policies	**Travel plans included in action plan measures**
	Car sharing	Two or more people share a car and travel together. It allows people to benefit from the convenience of the car, whilst alleviating the associated problems of congestion and pollution.	Low. Maximising occupancy in vehicles should lead to a reduced number of total trips overall, therefore reducing emissions from transport.	Reductions in traffic congestion during peak times.	Low	3	Continue to support and encourage car sharing through the role of the Travel Plan Co-ordinator and as part of the Travelwise initiative.	**Included in action plan measures**
	Car Club	The provision of a commercial car club to provide access to a car when necessary for longer journeys, while also encouraging walking, cycling and public transport for day to day travel.	Low Removes cars from the area hence reducing harmful pollutants.	A reduction in congestion. Encourages a modal shift from the car in shorter journeys.	Low	3	Locate a car club close by and in convenient location for the majority of potential occupants.	Publicise car club
	Private Hire and Hackney Carriage policy	An age limit on licensed taxis and public hire vehicles	Low Replaces older cars in the taxi fleet	Social benefit - Improvement in taxi service for customers	Low	3	New vehicles under 36 months, 45,000 miles. 10 years or younger for renewal; change vehicle after 10 years	Already in place.

Strategy	Measure	Description	Traffic/ AQ Impact	Ancillary Effects	Cost	Cost effectiveness (see table a above)	Comments	Action
	Freight quality partnerships	Voluntary agreements with significant local fleet managers to achieve set emission standards for delivery HDVs	Low Improve/reduce HDV emissions		Low	3	HDV ban on some roads to prevent through traffic to Docks i.e. John Kennedy Road near to 'Zoots'	None
	Infrastructure for cleaner fuels	Creation of infrastructure for the delivery, storage and sale of non-conventional fuels in order to encourage a switch towards alternative-fuelled vehicles in targeted fleets such as freight and or public transport	Low		Low	3	Need to review alternative fuel supply and use at some petrol filling stations (alternative fuels)	**Include in LES?**
	Green procurement	Improving the emissions performance of the council's own fleet, the fleets of service providers via contract conditions or voluntary agreement	Low	Lead by example	Low	3	Green Travel Plan. Procurement policy.	**Include in LES?**
	Eco-driving training	Raising awareness of the techniques through which significant fuel savings can be achieved and hence to reduce emissions	Low		Low	3	Part of Smarter choices options package. Education/ advice Pilot in Green spaces department	**Include in LES?**

Strategy	Measure	Description	Traffic/ AQ Impact	Ancillary Effects	Cost	Cost effectiveness (see table a above)	Comments	Action
Traffic Management – Optimise how sources transit the AQMA	Urban Traffic Control (UTC)	Urban Traffic Control is typically used to co-ordinate traffic signals to get traffic flowing through junctions as swiftly as possible.	Medium. Intelligent use of signal timing could improve traffic flow and reducing idling, which contributes significantly to increased emissions.	Possible reductions in congestion.	Medium	4	Requires NCC buy in Implemented in some locations	**Include in action plan measures**
	Road layout and traffic management changes	To change way traffic moves around a road network to improve traffic flows and reduce congestion.	Low - High. Better movement and flow of traffic around the road network could lead to reductions in traffic congestion which would lower emissions from transport.	Can be disruptive to implement. Improved road layout could reduce traffic congestion. Environmental improvements, noise reduction	Medium - High	1-6	Investigate and identify traffic management changes in the AQMA that could lead to improvements in air quality. Progress with NCC	**Include in action plan measures**
	Speed control / regulation	To reduce vehicle speeds through improved enforcement, lowering speed limits, or by introducing traffic calming measures.	Neutral/Negative.	May reduce ambient noise levels and improve safety on a local level.	Low	0	Reductions in speed in general will lead to increased emissions from transport due to the loss of fuel economy at lower speeds.	None.

Strategy	Measure	Description	Traffic/ AQ Impact	Ancillary Effects	Cost	Cost effectiveness (see table a above)	Comments	Action
	High Occupancy Vehicle (HOV) Lanes	HOV lanes are dedicated lanes that only allow utilisation by multiple occupancy vehicles, making it less congested and typically faster.	Low. HOV lanes would encourage car sharing which could lead to a reduction in the total number of cars travelling at any given time.	Often requires a significant amount of land.	Medium	2	HOV lanes have had considerable success in the USA at encouraging car sharing on motorways in California and Washington, D.C. The nature of the AQMAs declared is not conducive to HOV lanes.	None.
	Congestion charging/ Tolls	Installation of pay system for urban area at peak times	Medium	Can aid traffic management and improve environment for residents, visitors and workers	High	2	Has been successfully used in central London. Difficult and expensive to implement	None
	Intelligent Transport Systems (Variable Message Signs - VMS)	The introduction of variable message signs highlighting the number of available parking spaces and their location at strategic locations throughout.	High Reduce the number of unnecessary vehicle movements and as a consequence reduce emissions.	Reduced congestion and reduction in passenger journey time. Only benefits car drivers.	Medium	6	Could be implemented. May need to be situated on County Council land so would need NCC buy in. No barriers currently at car park entrances so would need to be upgraded to enable vehicle counting.	**Link to Borough Council's Car Parking Policy. Include in action plan measures**

Strategy	Measure	Description	Traffic/ AQ Impact	Ancillary Effects	Cost	Cost effectiveness (see table a above)	Comments	Action
	Transhipment Centre	Creation of a transhipment centre to consolidate freight deliveries and collections from businesses within King's Lynn. A low emission vehicle would then complete the deliveries from the depot to the shops.	High. A transhipment centre has the potential to remove a large proportion of HGVs from the centre hence reducing harmful pollutants.	A reduction in congestion and noise pollution. Will require land for construction of site.	High	3	A transhipment centre needs to be located in a strategically advantageous location on the outskirts of the town. A centre would need to be situated close to other key interchange points such as a Park and Ride site.	None
Infrastructure Improvements	Pedestrianisation	Remove traffic entirely from a road or area and allow access to pedestrians and cyclists only.	Low. Reduction in emissions generated from transport.	Economic effects in pedestrian shopping areas can be either positive or negative.	High	1	Town centre part pedestrianised. May move traffic elsewhere	None
	Improved cycling and walking provision	The improvement of provision of space for walking and cycling such as cycle lanes and pavements. Provision of lighting to footpaths and cycleways	Low. A modal shift towards cycling and walking will reduce harmful emissions from transport.	Increases in cycling and walking could lead to health improvements.	Low	3		**Include in action plan measures**
	Traffic Calming	The installation of calming measures such as speed humps, to slow traffic down.	Negative. Reduction in speed is less fuel efficiency, leading to increases in emissions.	Traffic calming may have a positive effect on local safety.	Medium	0		None

Strategy	Measure	Description	Traffic/ AQ Impact	Ancillary Effects	Cost	Cost effectiveness (see table a above)	Comments	Action
	Bypasses and road building	A bypass or additional road may help reduce traffic flow through a particular area.	Negative - Low. May lead to an overall increase in number of cars, as congestion may currently be suppressing demand, and a requisite increase in emissions.	Possible reduction in congestion in and around King's Lynn.	High	0-1		Consider schemes that may help reduce congestion around Town Centre as part of King's Lynn ATS.
	New North South route	Route joining the northern bypass with Lynnsport/Wootton Road area	Medium in Gaywood clock area	Possible reduction in congestion in and around King's Lynn.	High	2	Could move traffic to currently traffic free area	**With NCC - investigate funding/feasibility for new route**
	New North South route (partial)	Route joining the northern bypass with Lynnsport/Marsh Lane area	Medium	Possible reduction in congestion in and around King's Lynn.	High	2	Could move traffic to currently traffic free area	**With NCC - investigate funding/feasibility for new route**
Planning	Development Plans (Strategic and Local)	Through the choice of site, the development plan process can affect the amount of traffic generated by a development and the number of people who will use alternatives to the car.	Low. Better land use planning should lead to air quality improvements.	Could potentially restrict development in appropriate areas.	Low	3	Continue to assess land use based on its impact on local air quality.	**Include considerations in LES? Develop Development Management (DM) Policy Include in action plan measures**

Strategy	Measure	Description	Traffic/ AQ Impact	Ancillary Effects	Cost	Cost effectiveness (see table a above)	Comments	Action
	Supplementary planning guidance	Creation of planning guidance that a) triggers detailed air quality assessments b) considers the cumulative impacts of development and c) sets out site operation conditions with the aim of significantly mitigating the emissions impacts of larger commercial or residential developments	Low	Clearer guidance for developers	Low	3	Following publication of the National Planning Policy Framework (NPPF) DCLG are reviewing all their planning guidance, including the plan-making manual. The EP team provide comments on planning applications NEPG are developing technical guidance. A LES could perform a similar function	**Include in LES?** **Produce technical guidance** **Include in action plan measures**
	Car-free residential development	Developments with a restriction on owners or tenants owning cars. Introduce deliberate formal Planning policy designed to limit residential parking within the AQMA.	Low	None	Low	3	. Probably not main source of NO2.	none
	Residents only parking	Introduce areas where on-street parking is restricted to residents only.	Low	Improvement in environment and ease of parking for residents	Low	3	Reduce stop-start journeys by commuters looking for free parking places	**Include in action plan measures**

Strategy	Measure	Description	Traffic/ AQ Impact	Ancillary Effects	Cost	Cost effectiveness (see table a above)	Comments	Action
	Lobby to influence national policy	If KL and local partners cannot achieve the air quality objectives alone then the government to consider additional national policies such as further controls on industrial and vehicle emissions	Low	None	Low	3	To be considered as part of overall package	Pursue through NEPG sub-group
	Integrate AQAP into the LTP	Integrate the Action Plan into the Council strategy/plan with the greatest potential to influence the dominant pollution source in a beneficial way	Low-Medium		Low	3		Pursue with NCC
	Low Emission Strategy (LES)	Link LES and mitigation directly into development applications with or without AQ assessments.	Low-Medium	Can help minimise emissions from all developments.	Low	3-6	DEFRA funding available for development of Strategy. Successful examples being developed elsewhere	**Include in action plan measures if supported by steering group**
	Car Parking provision improvement strategy	Review routes and access to car parking and location of short and long-term parking. Smooth out traffic flow, reduce congestion and stop start driving.	Medium	Improve conditions for commuters. Improvement to King's Lynn 'destination' and trade for local businesses	Low	6	Consider - Decriminalisation & civil parking enforcement - Car parking capacity/balance - Town centre regeneration needs	**Include in action plan measures**