



# REPORT TO EXECUTIVE

## PORTFOLIO AREA: ENVIRONMENT, HOUSING INFRASTRUCTURE AND TRANSPORT

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Date of Meeting: 4th July 2005

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Public

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Key Decision: Yes

Recorded in Forward Plan: Yes

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Inside Policy Framework

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**Title:** LOCAL AIR QUALITY MANAGEMENT:- PROGRESS REPORT  
**Report of:** ACTING HEAD OF ENVIRONMENTAL PROTECTION SERVICES  
**Report reference:** EPS 21/05

### Summary:

The Air Quality Progress Report has been compiled for submission to the Secretary of State for assessment as required under the National Air Quality Strategy.

The report contains updated information on the review and assessment of local air quality and incorporates the results of air quality disposal modelling carried out by scientific consultants who were commissioned by the Council to provide this service.

The Progress Report also makes recommendation on the extent of the zone proposed for declaration as an Air Quality Management Area.

### Recommendations:

Members are asked to consider the Air Quality Progress Report and agree that it be forwarded to full Council for approval.

**Contact Officer:** David Ingham

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Environmental Quality Manager

Note: in compliance with section 100d of the Local Government (Access to Information) Act 1985 the report has been prepared in part from the following papers: None

## **1. BACKGROUND INFORMATION AND OPTIONS**

- 1.1 This is a Progress Report undertaken by the Council as part of its Local Air Quality Management duties and has been compiled for submission to the Secretary of State for assessment under the National Air Quality Strategy.

The Progress Report is the next stage following on from the Council's Local Air Quality Updating and Screening Report of 2003 and Detailed Assessment Report of 2004.

- 1.2 The Detailed Assessment report recommended that an Air Quality Management Area was required along the A7 in Carlisle and this has been endorsed by Council. However further work was deemed necessary to identify the boundary of the zone to be declared and consultants were commissioned to carry out air quality dispersion modelling of the area to assist in this process.

As the Detailed Assessment Report had also examined air quality concerns in the Caldewgate area the consultants were additionally directed to carry out dispersion modelling at that location.

The work carried out by the consultants and the results of the dispersion modelling are referred to in the Progress Report.

- 1.3 The Progress Report makes proposals regarding the extent of the area to be declared as an Air Quality Management Area.

It is recommended that this should form an area along the A7 in Carlisle stretching between the Hardwick Circus roundabout and the M6 junction 44 roundabout and include those properties directly adjacent to and along both sides of the road and also properties adjacent to the junction of Brampton Road and Stanwix Bank.

Once the Air Quality Management Area has been formally declared by the Council an Action Plan must be drawn up specifying measures to reduce NO<sub>2</sub> levels in that area. This must be produced within 18 months of the date of declaration and preliminary discussions have already taken place with the County Council (Highways Authority) and with colleagues in the Planning Department. Details will be included in a future report to executive.

- 1.4 The Progress report identifies that further detailed assessments, including monitoring and dispersion modelling, should be carried out at several identified locations, particularly at busy road junctions in Carlisle where relevant locations exist (i.e. roadside residential properties).

## **2. CONSULTATION**

- 2.1 The Council is obliged to consult with the Department for Environment, Food and Rural Affairs (DEFRA) on the Progress Report and a copy has been sent for their assessment and comment.
- 2.2 The consultation proposed in relation to the declaration of the Air Quality Management Area will be in accordance with the statutory provisions of the Environment Act 1995 Schedule II and will involve consultation with the following.
- The Secretary of State
  - The Environment Agency
  - The Highways Authority
  - Neighbouring Local Authorities
  - The County Council
  - Bodies representing local business interests and other organisations as appropriate
- 2.3 Consultation will also take place regarding the Progress Report with Corporate Management Team and Joint Management Team.
- 2.4 The Progress Report was considered by members of Community Overview and scrutiny Committee on 9<sup>th</sup> June 2005. The committee resolutions are contained in the appended minute excerpt.

## **3. RECOMMENDATIONS**

- 3.1 That Members consider the Progress Report and note its contents.
- 3.2 That members agree with the proposals of the report regarding the extent of the area to be declared as an Air Quality Management Area along the A7 in Carlisle.
- 3.3 That members agree that an Action Plan be compiled in respect of the Air Quality Management Area and this be the subject of a future report to Executive.

- 3.4 That members agree to forward the Progress Report to Council for approval.

#### **4. REASONS FOR RECOMMENDATIONS**

- 4.1 To ensure compliance with Council constitution and with Government requirements regarding local air quality management.

#### **5. IMPLICATIONS**

- Staffing/Resources – The introduction of Local Air Quality Management Area and the identified potential for further areas of exceedance of the Governments air quality objectives within Carlisle has raised the priority level of the Council's air quality assessment work and has involved a significant increase in officer time being spent on this subject.

There are likely to be ongoing staff implications which are currently being assessed and quantified and may be subject of a further report.

- Financial – Funding within existing budgets will continue to be required for air quality monitoring. There will also be a need to fund further work by consultants to carry out air quality dispersion modelling at the other locations identified as being subject to potential air quality objective exceedances. In the short term this is being funded within existing budgets.
- Legal – The Council is under legal obligation to carry out Local Air Quality Assessment and Management.
- Corporate – The Council is required to carry out a Progress Report and act appropriately on its findings and conclusions.
- Risk Management – Failing to meet the Government requirements would be a reputation risk to the Council.
- Equality Issues – Nil.
- Environmental – The assessment and management of local air quality is an important part of the Council's objectives to maintain a safe and healthy environment.
- Crime and Disorder – Nil.
- Impact on Customers – Nil.



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**EXCERPT FROM THE MINUTES OF THE  
COMMUNITY OVERVIEW AND SCRUTINY COMMITTEE  
HELD ON 9 JUNE 2005**

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**COS.77/05 LOCAL AIR QUALITY MANAGEMENT PROGRESS REPORT**

The Environmental Quality Manager presented report EPS.20/05 containing the Local Air Quality Management Progress report which had been compiled for submission to the Secretary of State at DEFRA for assessment as required under the National Air Quality Strategy.

The report contained updated information on the Review and Assessment of Local Air Quality and included the report and recommendations of Consultant's who are commissioned to carry out the Air Quality modelling for the Council. The progress report also made recommendations on the extent of the zone proposed for declaration as an Air Quality Management area.

The Environmental Quality Manager tabled colour copies of maps contained within the report which clarified the proposed zone for the Air Quality Management Area (AQMA) for the A7. The recommendation was that the zone for the Air Quality Management area be along the A7 between Junction 44 of the M6 and Hardwicke Circus, extending only to the properties located directly adjacent to the roadside and also properties adjacent to the junctions of Brampton Road and Stanwix Bank.

The report also outlined new developments which had taken place or are planned which may have an impact on Air Quality and will be considered during future review and assessment work. Since both the need to declare an AQMA along the A7 and the need for further detailed assessment work to be carried out elsewhere in the city has arisen out of vehicle emissions, traffic based management measures and techniques will need to be employed. This will require a collaborative effort amongst land use planners and transport planners alike including the City and County Council.

The Environmental Quality Manager asked Members to consider the report and make any comments for onward submission to the Executive on 4 July 2005.

In considering the report Members commented as follows:

- (a) In response to a question about Air Pollution around roadworks, Mr Ingham responded that in areas where there are roadworks which may alter the behaviour of traffic, these will be particularly targeted.
- (b) A Member queried what actions need to be undertaken to ensure that the Air Quality Management area does not become worse. He questioned whether the Council could realistically stop it from getting worse with the increase in the amount of traffic on the road and he queried the role of the Local Transport Plan.

Mr Ingham responded that the Council has a role in monitoring Air Quality, taking a lead to identify an area and declare it as an Air Quality Management area and within eighteen months must draw up an Action Plan to improve the Air Quality. This will mean that the Council has to act with partners including the County Council, Planners, Housing Developers to work towards improving Air Quality. The City Council has the lead role but it will have to ensure that the other partners take the necessary actions.

The Head of Commercial and Technical Services advised that Infrastructure Overview and Scrutiny Committee had looked at the implications of Air Quality and had emphasised the importance of its inclusion within the Local Transport Plan. County colleagues developing Local Transport Plan are taking notice of this and meetings have been held with them regarding the development of an action plan and the inclusion of these issues in the Local Transport Plan 2.

- (c) In relation response to a question about the Local Plan process, Mr Battersby advised that this matter had been raised with Planning and he commented that any development generating traffic in the Air Quality Management Area may have a problem.

The Environmental Quality Manager added that it would mean looking at new sites which were proposed for development and looking at blocks in traffic and standing traffic.

The declaration of an Air Quality Management area should be a starting point to improve things.

- (d) A comment was made about the substantial increase in NO<sub>2</sub> concentrations during 1998, but there was no explanation for this increase. The Environmental Quality Manager commented that NO<sub>2</sub> emissions should decrease as Car Manufacturers take account of Directives on fuel emissions. However, there is an increase in

traffic on the road and standing traffic, which contributes to a reduction in Air Quality.

- (e) The importance of the Committee finding mechanisms to monitor the production of an Action Plan and the Council's role in improving the Air Quality in the AQMA was emphasised. In this regard it was stated that it will be necessary to have regular updates to this Committee on the progress in taking forward what is necessary to improve Air Quality in the identified areas.

Mr Ingham advised that he was happy to report back on progress, including the co-operation which has been received from other Agencies.

RESOLVED – (1) That the progress report be noted.

- (2) That the Executive be advised that this Committee will continue to receive regular updates on progress in taking forward the actions necessary to improve Air Quality, including the co-operation which has been received from other Agencies.

**CARLISLE**  
**CITY COUNCIL**



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# **AIR QUALITY**

# **PROGRESS**

# **REPORT**

**Local Air Quality Management**

**Environment Act 1995**

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## Executive Summary

The production of an annual air quality report is now a statutory duty for all local authorities. The report will help to keep air quality issues high on the agenda, further raising the public's awareness and local member's awareness of its importance.

As part of the National Air Quality Strategy (NAQS) local authorities are required to undertake assessments of air quality within their borough. All potential sources of pollution (primarily industry and traffic related sources) must be taken into consideration and seven major pollutants are considered; carbon monoxide, benzene, 1, 3 butadiene, lead, nitrogen dioxide, sulphur dioxide and PM<sub>10</sub>. The concentration of these pollutants in the air are compared to air quality objectives, which are based on current medical evidence for the health effects of the particular pollutant and provide a framework for determining the extent to which authorities should aim to improve air quality.

Two rounds of review and assessment have taken place since the National Air Quality Strategy was first published in 1996.

The first round took place between 1997 – 2000 and the second round between 2003 – 2004.

During the last round of review and assessment it was identified that an exceedance of the annual mean NO<sub>2</sub> objective was likely to occur along sections of the A7 between Stanwix Bank and Kingstown and that an Air Quality Management Area (AQMA) would have to be declared for this area. This was subsequently approved by Executive, Council and DEFRA.

Further monitoring and detailed air dispersion modelling undertaken by Westlakes Scientific Consulting Ltd has since been carried out to assist Carlisle City Council in defining the boundaries of the AQMA. The results of this work are included in this Progress Report.

The Progress Report recommends that an AQMA be designated along the A7 between junction 44 of the M6 and Hardwick Circus extending only to properties located directly adjacent to the roadside and also properties adjacent to the junction of Brampton Road and Stanwix Bank.

Following the declaration of the AQMA Carlisle City Council will have a duty to draw up an Action Plan within 18 months specifying the measures it intends to take in pursuit of reducing nitrogen dioxide concentrations within the AQMA.

This Progress Report also provides an update of new monitoring data for NO<sub>2</sub> at long term sites, locations considered during the last detailed assessment and new monitoring locations.

The Progress Report identifies that further detailed assessment work is required for several roadside locations within the City where exceedences of the annual mean NO<sub>2</sub> objective may occur. It is proposed that the detailed assessment will be based on both monitoring data and detailed air dispersion modelling.

Results for the PM<sub>10</sub> real time analyser located in Caldewgate has not identified an exceedence of the PM<sub>10</sub> objective in 2004.

Results of the PM<sub>10</sub> monitoring has however identified that there may be a risk of the provisional PM<sub>10</sub> objectives being exceeded in 2010 alongside several busy roads and junctions due to road traffic emissions and also in an area where significant domestic solid fuel burning takes place. The provisional PM<sub>10</sub> objectives have not yet been included in the Air Quality Regulations and there is no requirement for Local Authorities to undertake a detailed review and assessment for the objectives at the present time. The situation will however be kept under review.

This report also outlines new developments, which have taken place or are planned, which may have an impact on air quality and will be considered during future review and assessment work.

Since both the need to declare an AQMA along the A7 and the need for further detailed assessment work to be carried out elsewhere in the City has arisen out of vehicle emissions, traffic based management measures and techniques will need to be employed. This will require a collaborative effort amongst land use planners and transport planners alike.

Policy areas of economic development, environmental protection and sustainability all need to be considered in the context of developing the air quality action plan as will the wider involvement of the community and other stakeholders.

Preliminary discussions have already taken place with colleagues in the Planning Department and Cumbria County Council Highways Department.

As a separate issue it is also hoped that, in the near future, real time NO<sub>2</sub> and PM<sub>10</sub> data will be made available on the Councils Website from the Councils automatic air quality monitoring station.



Should you wish to discuss any matters relating to this Progress Report please contact:

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## **1.0 INTRODUCTION**

### **1.1 Background to Air Quality Review and Assessment**

This is a Progress Report undertaken by the Environmental Protection Department as part of its local air quality management duties.

The Environment Act 1995 requires every local authority to periodically review and assess air quality within their geographical areas against the standards and objectives set out in the Air Quality Regulations 2000 and (Amendment) Regulations 2002.

Carlisle City Council in line with other local authorities completed the second round of review and assessment in 2004. This was undertaken in two stages. Initially an updating and screening assessment was carried out and completed in May 2003 for all pollutants identified in the Air Quality Regulations.

The purpose of the updating and screening assessment was to identify any matters that had changed since the first round of review and assessment completed by this authority in March 2000, which might lead to a risk of an air quality objective being exceeded.

The Updating and Screening Assessment Report identified that there might be a risk of both the NO<sub>2</sub> annual mean objective and PM<sub>10</sub> objectives being exceeded at relevant locations along the A595 running through Caldewgate, and the NO<sub>2</sub> annual mean objective being exceeded at relevant locations alongside the A7.

Where a significant risk of exceeding one or more of the air quality objectives is identified local authorities are required to proceed to the second stage and carry out a detailed assessment. Carlisle City Council consequently undertook a detailed assessment in 2004 at these two localities. The purpose of the detailed assessment was to determine with reasonable certainty whether these objectives were likely to be exceeded at relevant locations.

The detailed assessment concluded that :-

- The current and forward predicted exceedences of the relevant air quality objectives for NO<sub>2</sub> and PM<sub>10</sub> had not been identified for Caldewgate but that monitoring would continue in the locality.

- Current and forward predicted exceedences of the annual mean NO<sub>2</sub> objective had been identified for the A7.

As a result of the detailed assessment it was recommended that an air quality management area (AQMA) be declared for the A7. Progress in the declaration of the AQMA is discussed in Chapter 3.

## **1.2 Purpose of the Progress Report**

Following consultation on the LAQM process the Government concluded that it was too 'stop-start', and that gaps of several years might occur between air quality reviews.

A new timetable for the submission of reviews and assessments was subsequently set in 2003 and is shown in Appendix 1.

Updating and screening assessments are required every three years, 2003, 2006 and 2009.

Progress reports are only required in the intervening years when the local authority is not carrying out either an updating and screening assessment or a detailed assessment and therefore ensures continuity in the Local Air Quality Management (LAQM) process as they fill in the gaps between the 3 yearly requirement to carry out a full review and assessment of air quality.

It is intended that this Progress Report will assist the local authority in several ways:-

- Helping retain a profile for LAQM within the authority.
- Providing a means of communicating air quality information to members and the public.
- Maximising the usefulness and interpretation of the monitoring effort being carried out by the local authority.
- Helping the local authority to respond to requests for up to date information on air quality.



- Providing information to assist in other policy areas such as transport and land use planning.
- By providing a timely indication of the need for further measures to improve air quality rather than delaying until the next round of review and assessment.

Progress Reports are not designed to represent a further updating and screening assessment although authorities are required, if at any time they identify a risk of an air quality exceedance, to proceed to a detailed assessment and not delay until the next round of review and assessment

A Progress Report Guidance document, LAQM PRG (03), has been issued by the Government to assist local authorities in the preparation of air quality progress reports. This document supplements the two documents LAQM PG (03) and LAQM TG(03) issued in February 2003 by Defra, which provide policy guidance and technical guidance for local authorities carrying out their LAQM duties.

The progress report guidance states that the overall aim of the Progress Report should be to :-

- report progress on implementing local air quality management, and
- report progress in achieving concentrations below the national air quality standards and objectives.

It suggests that these aims can be best achieved by addressing two matters:-

- new monitoring results and
- identifying and listing new local developments that might affect local air quality. The progress report should log these changes so that they can be considered more thoroughly during the next full round of review and assessment.

Carlisle City Council has taken account of this guidance when carrying out this Progress Report.

### **1.3 National Air Quality Standards and Objective**

The air quality objectives set by the Air Quality Regulations are shown in table 1 below. These objectives are to be achieved between 2003 and 2010.

**Table 1: Objectives included in the Air Quality Regulations 2000 and (Amendment) Regulations 2002<sup>a</sup> for the purpose of Local Air Quality Management**

Pollutant	Air Quality Objective		Deadline
	Concentration	Measured as	
<b>Benzene</b>			
All authorities	16.25 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2003
Authorities in England and Wales only	5.00 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2010
<b>1,3 Butadiene</b>	2.25 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2003
<b>Carbon Monoxide</b>	10.0 $\text{mg}/\text{m}^3$	Maximum daily 8-hour mean	31.12.2003
<b>Lead</b>	0.5 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2004
	0.25 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2008
<b>Nitrogen dioxide</b>	200 $\mu\text{g}/\text{m}^3$ not to be exceeded more than 18 times a year	1 hour mean	31.12.2005
	40 $\mu\text{g}/\text{m}^3$	annual mean	31.12.2005
<b>Particles (PM<sub>10</sub>) (gravimetric)*</b>	50 $\mu\text{g}/\text{m}^3$ not to be exceeded more than 35 times a year	24 hour mean	31.12.2004
	40 $\mu\text{g}/\text{m}^3$	annual mean	31.12.2004
<b>Sulphur Dioxide</b>	350 $\mu\text{g}/\text{m}^3$ not to be exceeded more than 24 times a year	1 hour mean	31.12.2004
	125 $\mu\text{g}/\text{m}^3$ not to be exceeded more than 3 times a year	24 hour mean	31.12.2004
	266 $\mu\text{g}/\text{m}^3$ not to be exceeded more than 35 times a year	15 minute mean	31.12.2005

\* The EU has also set indicative limit values for PM<sub>10</sub> which are to be achieved by 1<sup>st</sup> January 2010. These limit values are considerably more stringent and are 20  $\mu\text{g}/\text{m}^3$  as the annual mean and 50  $\mu\text{g}/\text{m}^3$  as the 24 hour mean to be exceeded on no more than 7 days per year.

These provisional objectives for PM<sub>10</sub> are not currently included in the Regulations for the purposes of LAQM. Local authorities are under no obligation to review and assess against these objectives. However the government recommends it might be helpful to do so for long term planning and the assessment of development proposals within the local authority area. Assessment against these provisional objectives is provided in this progress report.



## 2.0 A BRIEF DESCRIPTION OF THE CARLISLE CITY COUNCIL AREA

Carlisle City Council is the most northerly of the 6 Cumbrian District Council's and covers more than 400 square miles.



The City of Carlisle supports the highest population concentration in Cumbria with 70,000 people living within the urban area. The rural towns of Brampton and Longtown support the next two highest population concentrations, 4000 and 2000 respectively.

Carlisle is remote from other main centres of population being 300 miles from London, more than 120 miles from Manchester, more than 90 miles from Glasgow and

Edinburgh and more than 50 miles from Newcastle Upon Tyne. Consequently Carlisle is the regional commercial, administrative and retail centre serving a catchment population of around 450,000 who live within an hours travelling time of the city.

Today's economy is characterised by food processing, agricultural support, automotive component manufacturers and engineering. The dominant sectors being branch operation in wholesaling and retailing, manufacturing, public administration and health services.

It is a significant transport hub for rail services and the national road transport network. It's regional role has been greatly enhanced in recent years by The Lanes Shopping Centre, The Sands Leisure Centre, Tullie House and the Art Gallery and the City is well placed to advance as a regional centre.

The Government Regional Planning Guidance for the North West identifies Carlisle as one of the North Wests key town and cities where development should be concentrated.

As part of its role as community leader the City Council has, in partnership with local key public, private and volunteering sector organisations, developed a Corporate Plan for promoting the long term economic, social and environmental well being of the local area.

The Corporate Plan sets out the Council's priorities for 2004-2007. Although the Council priorities are categorised into five different promises they are all integrated and positive progress within one promise is likely to have a positive knock on effect. Together the promises aim to meet the Council's overall mission:

'To ensure a high quality of life for all in both our urban and rural communities'

Clean air is an essential ingredient of a good quality of life. The main reasons for managing air quality are the links between air quality and the quality of life, and the need to minimise the risk of poor air quality to human health. In the wider context managing air quality is central to the strategy for sustainable development.

As well as fulfilling a statutory duty, managing local air quality therefore significantly contributes towards the achievement of Councils priorities set out in the Corporate Plan, namely;

To develop a sustainable economy

To manage our environment responsibly

To improve local housing, health and well being

To ensure Carlisle is a safe and attractive place



### 3.0 NEW MONITORING DATA - NITROGEN DIOXIDE

#### 3.1 Introduction

Nitrogen Dioxide (NO<sub>2</sub>) and nitric oxide (NO) are both oxides of nitrogen and are collectively referred to as nitrogen oxides (NO<sub>x</sub>). All combustion processes produce NO<sub>x</sub> emissions, largely in the form of NO, which is then converted to NO<sub>2</sub>, mainly as a result of reaction with ozone in the atmosphere.

The principal source of nitrogen dioxide (NO<sub>2</sub>) within the district of Carlisle City Council is road transport. A map of Carlisle City's main roads is shown in Appendix 4 along with the most up to date information on current annual average daily traffic flows (AADT). This information is supplied by Cumbria County Council

The Council has been monitoring nitrogen dioxide at sites around the District using diffusion tubes for many years. Four of the sites in Carlisle contribute information to the United Kingdom Nitrogen Dioxide Survey.

This section identifies the diffusion tube sites used for collecting data in the Carlisle area. For the purposes of this report new monitoring results are reported for the following:

i Long term monitoring sites

Reason: to provide evidence of any trends over recent years

ii Locations considered during the last detailed assessment

Reason: To provide updates on monitoring sites alongside the A7 and Caldewgate/Castleway A595.

iii New monitoring sites

Reason: to establish whether they reveal any new information about air quality.

The sites are subject to regular review and where sufficient data has been gathered, some of the diffusion tubes are relocated to new locations of interest. Occasionally problems occur such as tubes are stolen or interfered with on a regular basis leading to the sites becoming unsuitable. As a result some diffusion tubes have been relocated to other similar sites close by.

Analysis for all NO<sub>2</sub> diffusion tubes used by Carlisle Council is undertaken by Casella Cre Air. Their method of tube preparation is 10% TEA (triethanolamine) in water. Quality assurance/quality control methods for the tubes are explained in the Detailed Assessment Report published in 2004.

### **Bias adjustment of Diffusion Tube Data**

As a result of the considerable difference in the performance of tubes prepared by different labs, technical guidance LAQM TG (03) recommends that a bias adjustment factor is determined and applied to the data.

LAQM TG 03 gives a method for this which involves the collocation of these tubes with a chemiluminescent Nox analyser. The minimum period for which this must be carried out is 9 months.

Guidance issued recommends that authorities report the adjustment factor from both their own collocation study (where available), and the 'national' bias adjustment factor determined by Air Quality Consultants (AQC) who, on behalf of Defra, collate and assess data from NO<sub>2</sub> collocation studies across the UK. As a result of the AQC work new annual mean national correction factors are now available for the specific Casella Cre Air 10% TEA in water diffusion tubes used by Carlisle City Council.

The national bias adjustment factor for Casella Cre Air in 2004 is 0.85

Carlisle City Council did operate a NO<sub>x</sub> chemiluminescent analyser but unfortunately results from August 2004 onwards could not be quality assured due to repeated significant span gas drift between calibrations. The analyser and data logger was completely destroyed in January 2005 during major flooding in the City. New data from the chemiluminescent analyser is therefore not included in this Progress Report.

A bias adjustment factor of 0.9 was however calculated from a 6 month collocation study undertaken between January – June 2004. When added to the adjustment factors provided by Defra the bias adjustment factor remains at 0.85.

The national bias adjustment factor of 0.85 has subsequently been applied to data sets of 9 months or more for 2004. It is important to note that data reported for monitoring surveys less than 9 months can not be bias adjusted and subsequently it has not been possible to adjust the data to predict annual mean concentrations and allow easy comparison with the annual mean objective. Raw data must be treat with caution.



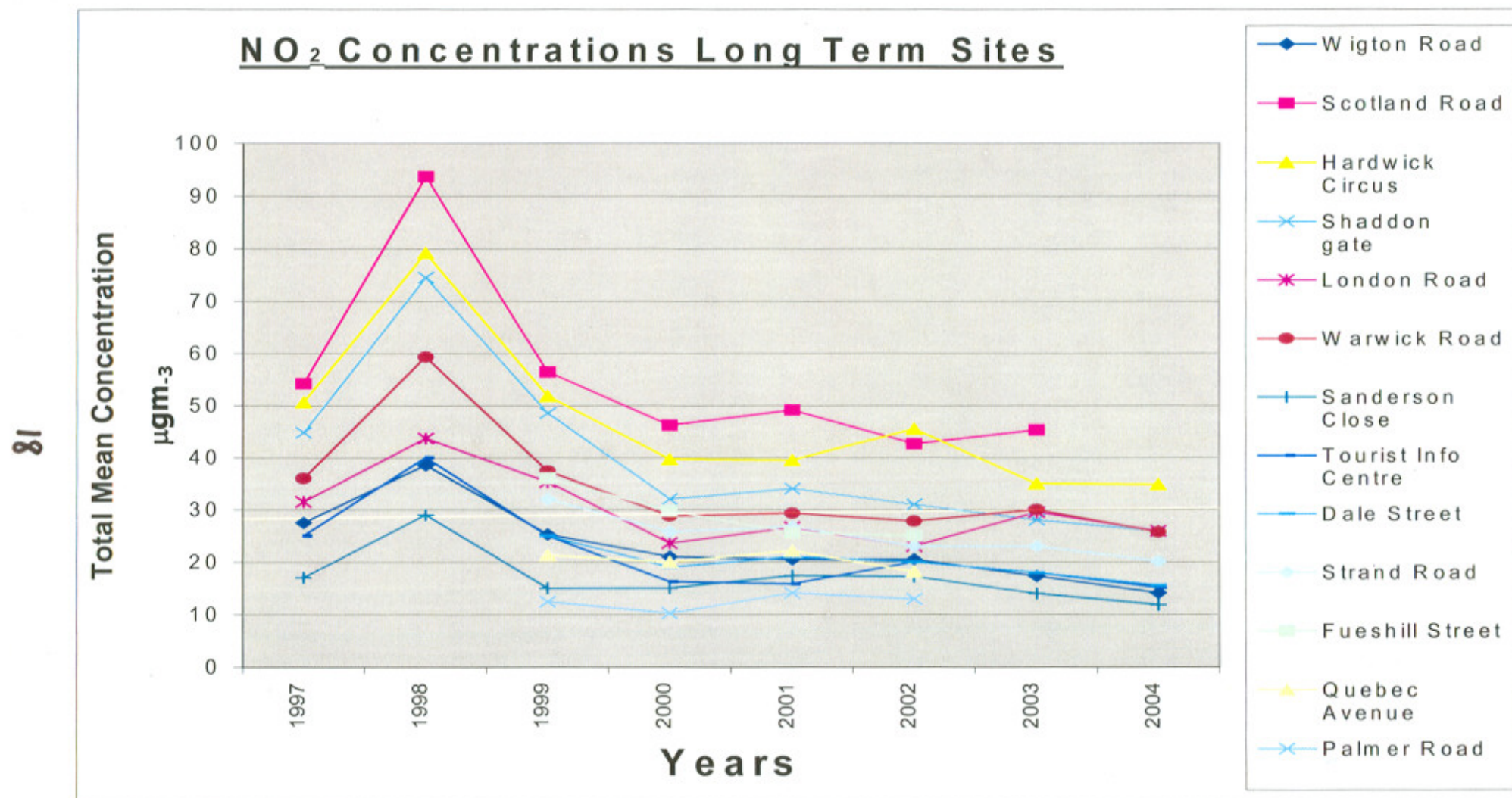
### 3.2. Long Term Monitoring Sites

Table 2

#### Long Term NO<sub>2</sub> Monitoring Sites – Carlisle City

Location	Type of Site	Grid Reference	Annual NO <sub>2</sub> Concentrations $\mu\text{gm}^3$							
			1997 R	1998 R	1999 R	2000 R	2001 R	2002 R	2003 V	2004 V
Wigton Road	Roadside	337926 554558	27.50	38.50	25.30	21.00	20.50	20.50	17.30	14.1
Scotland Road	Roadside	339992 557187	54.20	93.70	56.40	46.20	49.10	42.60	45.30	
Hardwick Circus	Roadside	340143 556347	50.60	79.20	51.80	39.70	39.50	45.50	35.00	34.8
Shaddon gate	Roadside	339483 555892	44.80	74.50	48.50	32.00	34.00	31.00	28.00	25.9
London Road	Roadside	341912 553972	31.50	43.70	35.30	23.60	26.60	23.00	29.50	25.9
Warwick Road	Roadside	341310 555918	36.00	59.30	37.40	28.80	29.30	27.80	30.00	25.7
Sanderson Close	Suburban	339461 558489	17.00	29.00	15.00	15.00	17.40	17.20	14.00	11.8
Tourist Info Centre	Urban Centre	340070 555955	25.00	40.00	25.00	16.20	15.80	20.00	18.00	15.1
Dale Street	Urban Background	339615 554863			25.00	19.00	21.00	20.00	18.00	15.5
Strand Road	Urban Background	340550 556174			32.00	25.80	26.70	23.00	23.00	20.1
Fueshill Street	Urban Background	340780 555600			36.00	29.80	25.60	25.00		
Quebec Avenue	Suburban	340408 554143			21.30	20.00	22.10	18.10		
Palmer Road	Suburban	337171 556340			12.40	10.20	14.10	12.90		

Figure 1



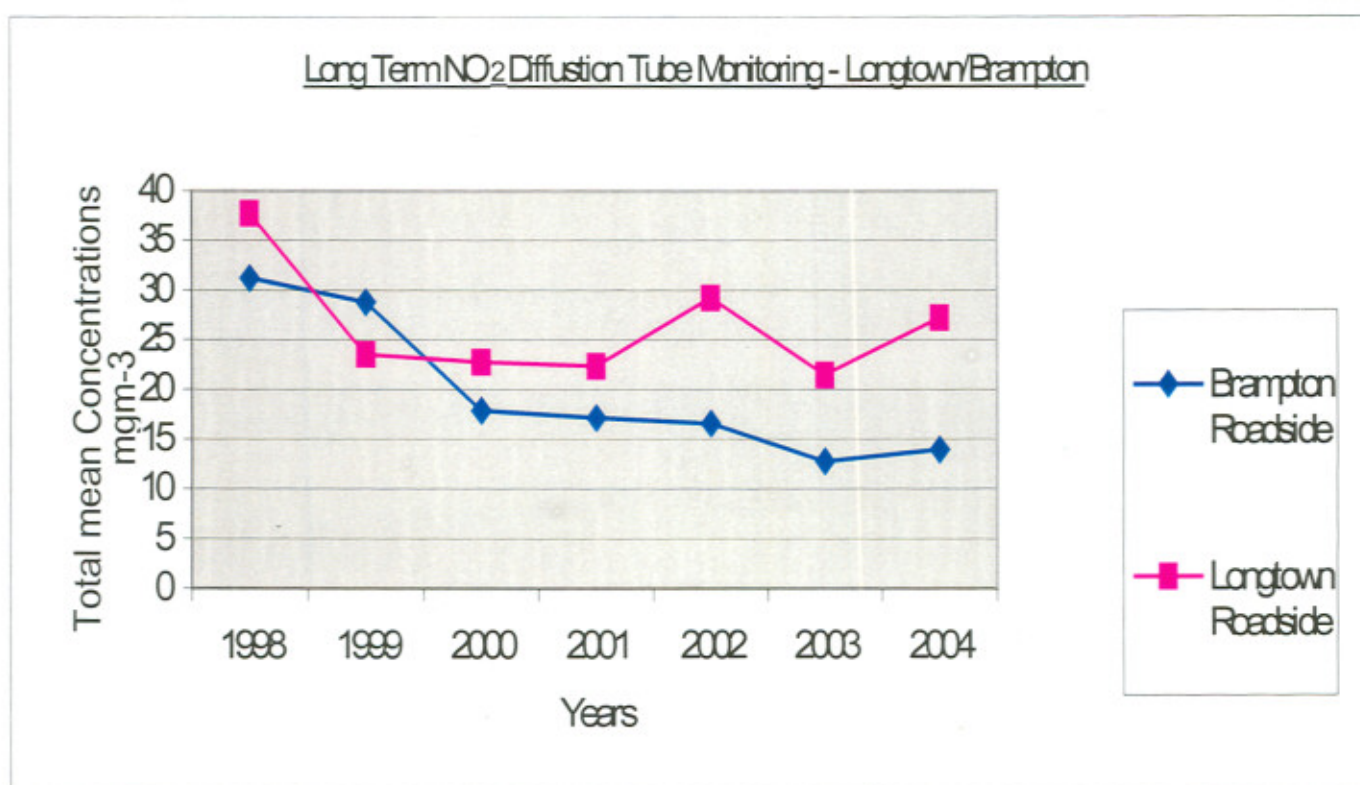
**Table 3**

**Long Term NO<sub>2</sub> Diffusion Tube Monitoring – Longtown/Brampton**

Location	Type of Site	Annual NO <sub>2</sub> Concentrations $\mu\text{gm}^3$						
		1998	1999	2000	2001	2002	2003	2004
Brampton	Roadside	31.2	28.8	17.9	17.2	16.6	12.8	14
Longtown	Roadside	37.7	23.5	22.7	22.3	29.2	21.4 *	27.2

- 2003 – Tube relocated

**Figure 2**





The long-term sites cover a range of different types of monitoring locations including roadside, urban centre, urban background and suburban sites.

Results indicate that nitrogen dioxide concentrations are reducing at these long term sites and indicate that the contribution from road traffic to nitrogen dioxide concentrations have significantly declined in recent years as a direct result of national and international policies to improve emissions from vehicles.

As stated previously technical guidance indicates that exceedances of the NO<sub>2</sub> objective are still likely to occur but only along side busy and congested roads. This is discussed in more detail in the following section.

### **3.3 New Data For Locations Considered During The Last Detailed Assessment (Undertaken In 2004)**

Relevant locations alongside two of the most heavily used road traffic routes in Carlisle were considered during the last detailed assessment; the A7 and the A595.

#### **3.3.1 A7 Stanwix Bank / Scotland Road / Kingstown Road**

The Detailed Assessment undertaken in 2004 concluded that current and forward predicted exceedences of the annual mean NO<sub>2</sub> objections had been identified for relevant locations alongside the A7 and that an Air Quality Management Area (AQMA) would be required.

The report however also concluded that further monitoring would be necessary to assess the likely area of exceedence and establish the boundaries of the AQMA. Results at the time indicated that exceedences of the objective levels would not occur along the entire length of the A7 but in pockets where relevant locations are closet to the roadside.

The Detailed Assessment Report and its recommendation to declare an AQMA was endorsed by Council in January 2005.

Further monitoring has since taken place and air quality consultants have been commissioned to carry out complex air dispersion modelling for the City of Carlisle and specifically alongside the A7 to assist in defining the AQMA. Results of both monitoring and modelling are discussed below.

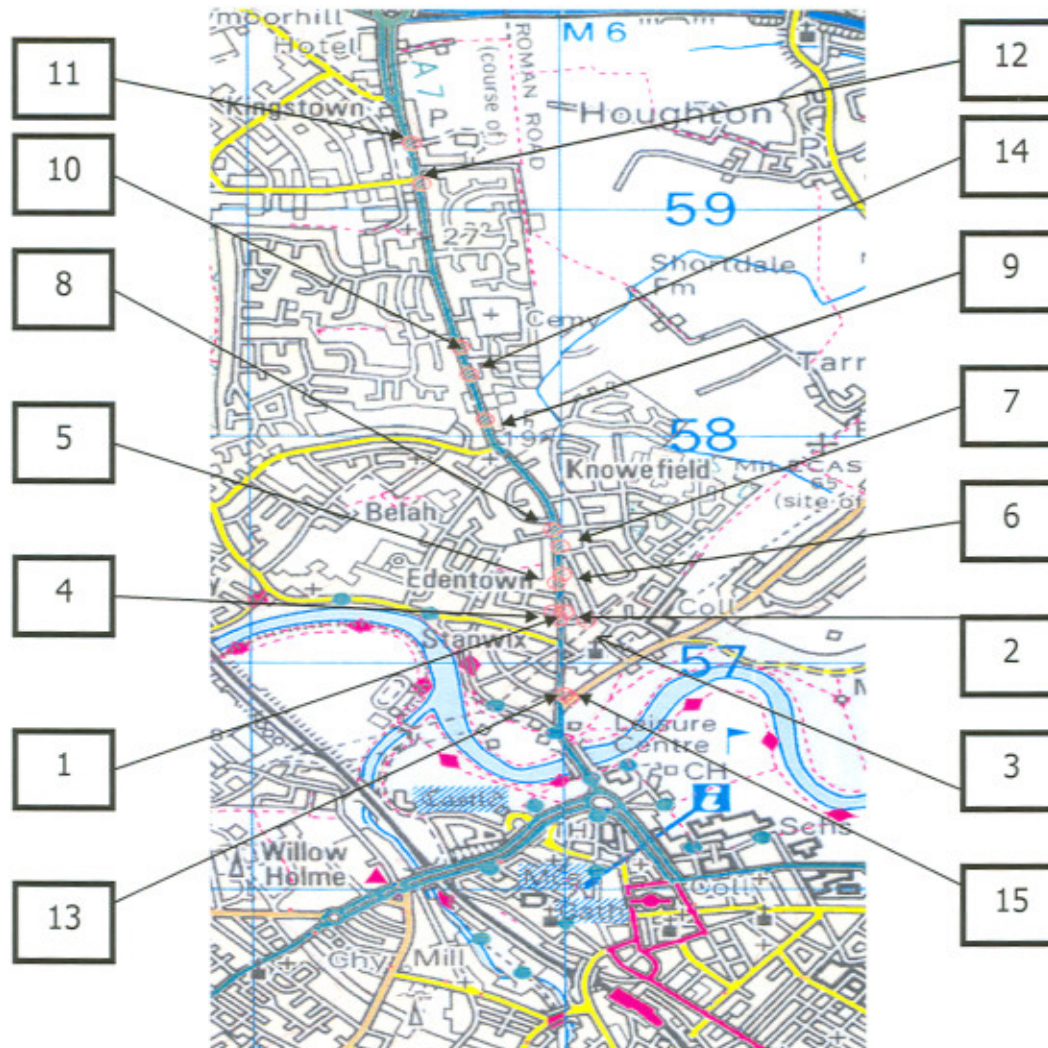
**Table 4 – NO<sub>2</sub> Diffusion Tube Results 2004**

**A7 Stanwix Bank/Scotland Road/Kingstown Road**

		Monthly NO <sub>2</sub> Concentration (µgm <sup>-3</sup> ) 2004															
Area Location	Grid Reference	J	F	M	A	M	J	J	A	S	O	N	D	Length of survey (Months)	Raw	Bias Adjusted (0.85)	Projected 2005
1	339991 557187	46	48	A	50	A	32	49	50	49				7	46.3		
2	340013 557218	40	45	42	45	30	20	31	36	Stopped				8	36.1		
3	340082 557178	24	34	18	26	19	19	Stopped						6	23.3		
4	339972 557218	24	26	29	23	21	14	Stopped						6	22.8		
5	339985 557346				48	41	42	45	37	37	42	41	47	9	42.2	34.18	
6	340004 557382				29	20	13	A	21	Stopped				5	20.7		
7	339999 557506				33	21	17	22	21	Stopped				5	22.8		
8	339973 557580				25	27	13	19	30	18	35	49	30	9	27.3	22.11	
9	339758 558065				55	44	49	52	51	48	50	48	51	9	49.8	42.3	41.2
10	339678 558386				43	33	24	29	38	25	36	46	39	9	34.7	29.5	
11	339528 559284				32	38	39	36	35	31	45	40	54	9	38.9	33.1	
12	339558 559107				38	33	34	35	34	A	44	61	37	9	39.5	33.6	
13	340009 556852				A	52	49	57	35	45	73	67	50	8	53.5		
14	339707 558266									32	57	49	42	4	45		
15	340028 556835									46	51	63	51	4	52.7		



## NO<sub>2</sub> Diffusion Tube Monitoring Locations – A7



**Table 5****NO<sub>2</sub> Diffusion Tube Results 2005****A7 Stanwix Bank / Scotland Road / Kingstown Road - 2005**

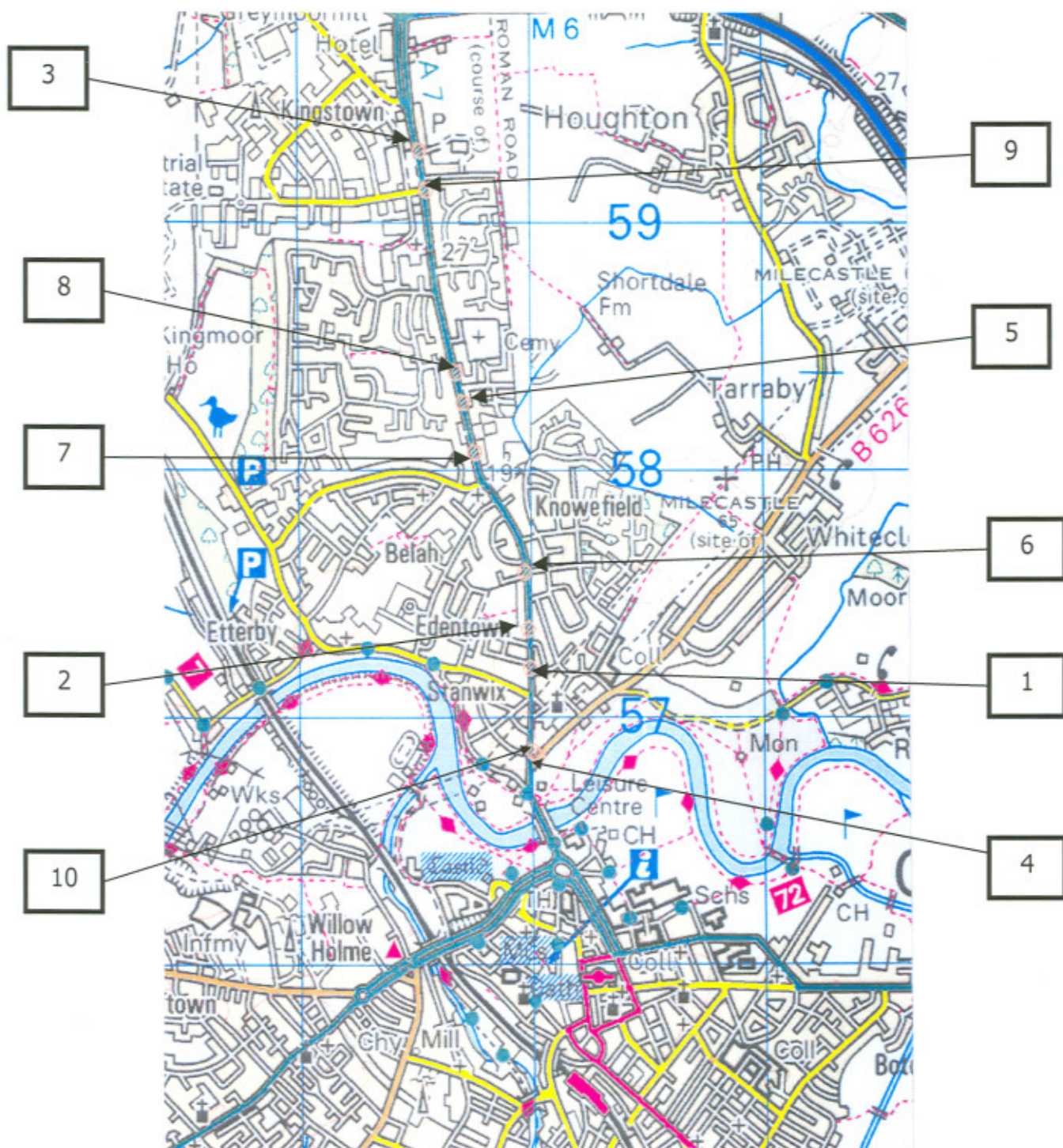
Location	Grid Reference	Raw Monthly Mean NO <sub>2</sub> Concentration $\mu\text{gm}^{-3}$			Length of Survey (months)	Av
		J	F	M		
1 *	339995 557191	71	50	50	3	57
2 *	339988 557348	42	58	51	3	50.3
3 *	339527 559285	70	59	-	2	64.5
4	340028 556835	57	62	49	3	56
5	309709 558266	46	42	42	3	43.3
6	339973 557580	28	37	34	3	33
7 *	339759 558065	61	70	59	3	63.3
8 *	339678 558386	35	36	40	3	37
9	339555 559123	A	56	44	3	50
10	340009 556852	52	69	66	3	62.3

\* = Diffusion tubes relocated to lampposts closer to roadside where NO<sub>2</sub> concentrations are higher. These new monitoring points are not at relevant locations but will assist in the validation of future air dispersion modelling.



**Figure 4**

**NO<sub>2</sub> Diffusion Tube Monitoring Locations – A7**





Bias adjusted diffusion tube results measured during 2004 when projected to 2005 (using a correction factor of 0.975) confirms that an exceedence of the 2005 NO<sub>2</sub> annual mean objective has been identified for relevant locations alongside Kingstown Road.

Bias adjusted diffusion tube results measured during April 2004 – March 2005 at relevant locations alongside Stanwix Bank are shown in the table below. When projected to 2005 (using a correction factor of 0.975) the results confirm that an exceedence of the 2005 annual mean NO<sub>2</sub> objective is likely to occur.

Only 7 months of raw data has been collected over the monitoring period September 2004 – March 2005 for locations near to the Brampton Road/Stanwix Bank Junction, shown in the table below. These results (as there is less than 9 months data) cannot be bias adjusted, however it is considered that an exceedence of the 2005 NO<sub>2</sub> annual mean objective is likely to occur at these localities.

<u>Location</u>	Monthly Mean NO <sub>2</sub> Concentration $\mu\text{gm}^{-3}$											Raw Average	Bias Adjusted (0.85)	Projected 2005
	M	J	J	A	S	O	N	D	J	F	M			
Stanwix Bank	52	49	57	35	45	73	67	50	52	69	66	55.9	47.5	46.3
Brampton Road					46	51	63	51	57	62	49	54.1		

### 3.3.2 Dispersion Modelling For NO<sub>2</sub> Along The A7

Air quality consultants, Westlakes Scientific Consulting Ltd were commissioned to assist Carlisle City Council with the designation of an air quality management Area (AQMA) to the north of Carlisle City along the A7 road link between Stanwix and Kingstown.

Westlakes Scientific Consulting have developed an emissions database (EDB) of NO<sub>x</sub> in and around the City. The creation of an EDB along with statistical meteorological data for the years 2000 to 2004, topographical data and physiological data for the area allowed NO<sub>2</sub> concentrations to be modelled over the City and specifically along the A7 using the airviro air quality management system.

Two air dispersion models have been used:-

- Gauss model
- Canyon Model

The Gaussian model is used to predict air concentrations of NO<sub>2</sub> over the entire City including the A7 during 2004. The model was configured so that all sources within the Council EDB were included (road, point and grid sources).

The canyon model is designed for use on individual streets where tall buildings are present either side of the road link and takes account of the effects of buildings.

The following input data was used in the modelling system:

- Emission of pollutants from grid, road and point sources.
- Topography data on surface roughness and percentage of urban area / open area and forest in each grid cell
- Meteorological data (wind speed, wind direction, temperature and temperature difference with respect to height) for the years 2000 to 2004 obtained from the Met Office. Temperature difference values were calculated from data supplied from Eskdalemuir (the nearest site with boundary layer data) whilst the remainder were determined from Carlisle Airport.

The modelling studies were conducted in three stages:

1. Annual average concentrations of NO<sub>x</sub> and NO<sub>2</sub> arising from background emissions were calculated using the Gauss model on a coarse grid resolution (1 x 1 km) across the map area using meteorological data for 2004, a year for which Carlisle City Council has comprehensive NO<sub>2</sub> monitoring data. Similar studies were also undertaken to determine NO<sub>x</sub> and NO<sub>2</sub> concentrations from road link sources surrounding the A7 between Stanwix and Kingstown on a medium (250 x 250m) and fine (25 x 25m) scale resolution. The Gauss model is particularly suited to local-dispersion studies and was, therefore, considered appropriate for use in the Carlisle EDB map area.
2. Specific modelling studies were conducted using the Canyon model to predict annual NO<sub>x</sub> and NO<sub>2</sub> concentrations at the Scotland Road, Kingstown Road and Stanwix Bank sections of the A7, where the designation of an AQMA is proposed. The Canyon model is designed for use on individual streets where tall buildings are present either side of the road link.



3. Validation studies for NO<sub>2</sub> were carried out by comparing modelled concentrations of the pollutant with those monitored by Carlisle City Council in 2004.

An outline of how the modelling studies were conducted are given in Appendix 2 along with the validation of the dispersion model.

### 3.3.3 Results of Gauss Model Studies for the A7

The annual mean concentration of NO<sub>2</sub> along the A7, using the Gauss model for the meteorological period 2000 to 2004 is shown below:

**Figure 5**  
**Contour Plot Showing Predicted Annual Mean Concentration of NO<sub>2</sub> (µgm<sup>-3</sup>) Along The A7 For The Years 2000 – 2004**

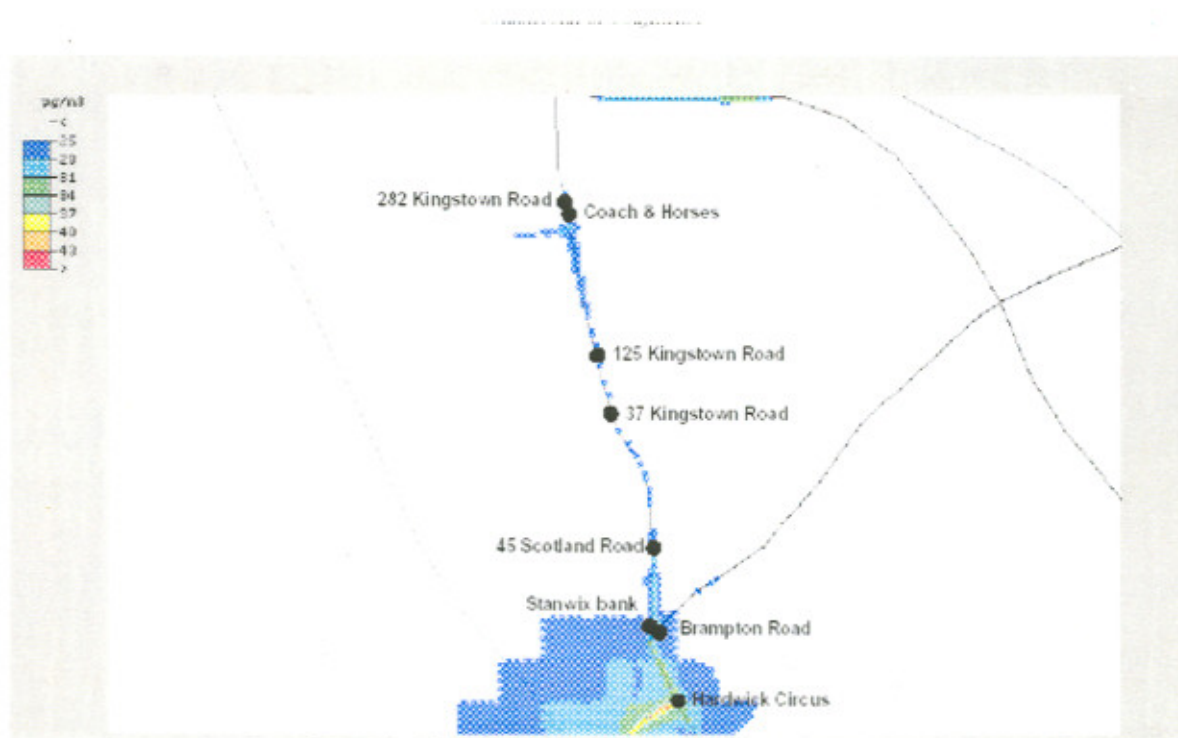


Figure 7: Contour plot showing predicted annual mean concentration of NO<sub>2</sub> (µg m<sup>-3</sup>) along the A7 for the years 2000 – 2004. Location of diffusion tubes indicated by black circles.

Using the Gauss model it is shown that NO<sub>2</sub> concentrations between Stanwix and Kingstown do not exceed the annual mean NO<sub>2</sub> objective of 40µgm<sup>-3</sup>.

### 3.3.4 Results of Canyon Model Studies for the A7

The mean annual concentrations of NO<sub>2</sub> at Scotland Road, Kingstown Road and Stanwix Bank, predicted for the meteorological periods 2004 and 2000-2004 in the canyon model studies are presented below:

**Figure 6**  
**Predicted Annual Concentration of NO<sub>2</sub> (µgm<sup>-3</sup>)**  
**Along the A7 in 2004 using Canyon Model**

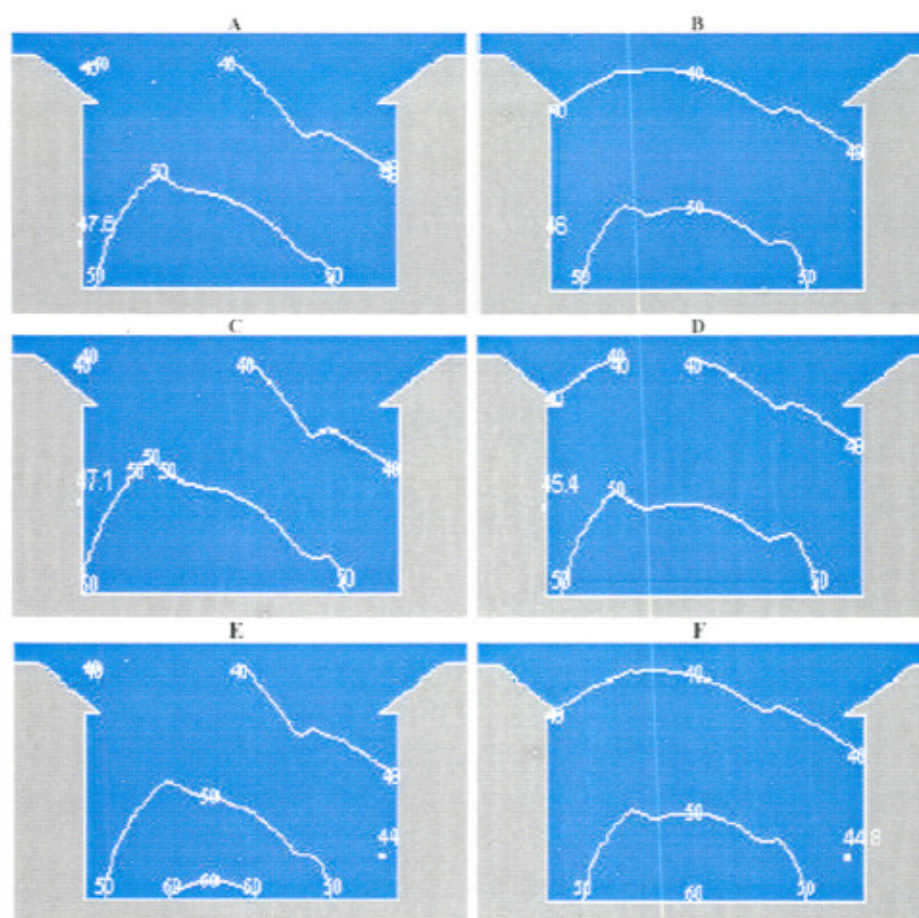


Figure 9: Predicted annual concentration of  $\text{NO}_2$  ( $\mu\text{g m}^{-3}$ ) along Scotland Road in 2004 (A) and 2000-2004 (B), Kingstown Road in 2004 (C) and 2000-2004 (D) and Stanwix Bank in 2004 (E) and 2000-2004 (F).

It can be seen that for all canyon studies undertaken,  $\text{NO}_2$  concentration at a height of between 2 and 3 m exceed the annual LAQM standard, ranging between 44 and 47  $\mu\text{gm}^{-3}$ . Such concentrations are considerably higher than those predicted for these locations using the Gauss model, and



demonstrate the effect of pollutant circulation created as a result of buildings effects on air movements. Although above the objective of  $40\mu\text{gm}^{-3}$  the  $\text{NO}_2$  concentrations predicted using the Canyon Model suggest that the AQMA need not extend beyond on the width of the street canyon.

Results from both monitoring and modelling undertaken shows that there is a close relationship between the annual mean  $\text{NO}_2$  concentrations predicted by the Canyon Model studies and actual monitored concentrations:-

Location	Annual Mean $\text{NO}_2$ Concentrations $\mu\text{gm}^{-3}$	
	Modelled	Monitored
Scotland Road	47.6	45.3 *
Kingstown Road	47.1	42.3
Stanwix Bank	44	45.5 <sup>A</sup>

\* = 2003  $\text{NO}_2$  Concentration

<sup>A</sup> = Based on 2004 average

### 3.3.5 Recommended Boundary of the Air Quality Management Area

Given the results of the canyon model studies and diffusion tube monitoring it is recommended that an AQMA be designated along the A7 between Junction 44 of the M6 and Hardwicke Circus, extending only to properties located directly adjacent to the roadside and also properties adjacent to the junction of Brampton Road and Stanwix Bank.

A map with the proposed AQMA boundary is shown in Appendix 3 A and 3 B.

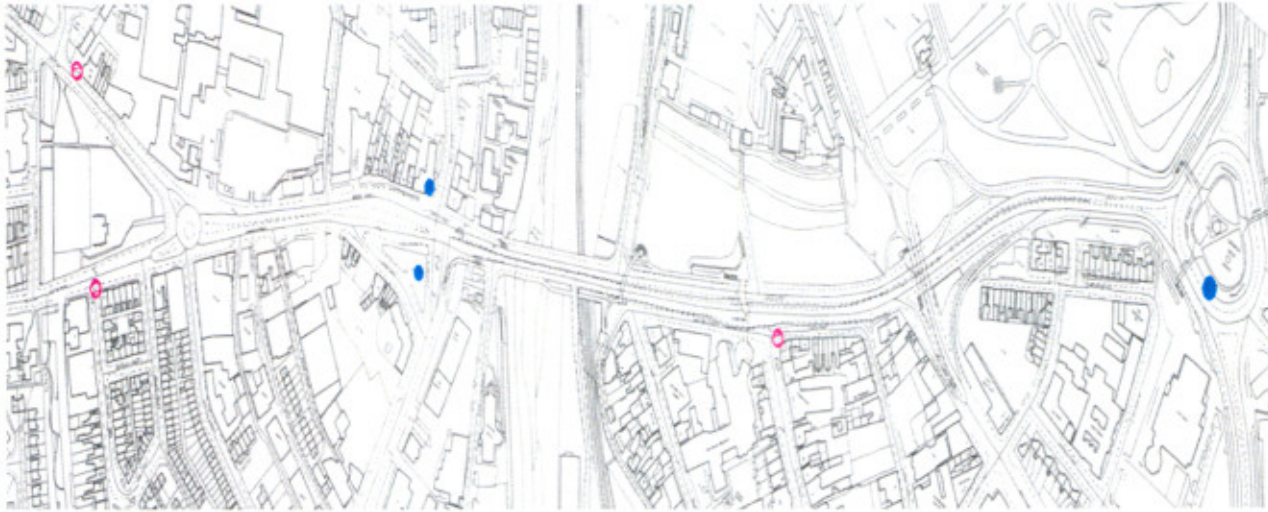
### 3.3.6 A595 Caldewgate

A detailed assessment was undertaken at this locality because results from a DMRB model used in the Updating and Screening assessment indicated that there was a risk that both the  $\text{NO}_2$  and  $\text{PM}_{10}$  objectives keeping exceeded at relevant locations along this route.

The detailed assessment concluded in 2004 that exceedences of the air quality objectives for nitrogen dioxide and particulates ( $\text{PM}_{10}$ ) at relevant locations had not been identified but that monitoring would continue. Monitoring has been extended to include residential properties alongside Castleway and the base of Wigton Road and Newtown Road and covers the A595 from the Hardwicke Circus to the Caldewgate roundabout. A location map with the previous and new  $\text{NO}_2$  monitoring locations is shown below and the most up to date results are given in table 6.



**Figure 7**  
**Monitoring Locations – Hardwick Circus – Wigton Road/Newtown Road Area**



**Table 6****A595 Caldewgate/Castleway – 2004**

Area	Grid Reference	Monthly Mean NO <sub>2</sub> Concentrations (µgm <sup>-3</sup> ) 2004												Length of survey (Months)	Raw	Bias Adjusted (0.85)	Projected 2005 Annual Mean Concentration
		J	F	M	A	M	J	J	A	S	O	N	D				2005 (0.975)
Bridge Street	339452 556014	42	43	35	35	41	37	37	41	41	46	46	47	12	40.9	34.8	33.8
Paddys Market 1.	339465 555973	39	50		45	45	42	41	45	36	49	49	38	11	43.5	36.9	36
Paddys Market 2.	339465 555973	39	43		43	51	43	45	42	39	50	54	40	11	44.4	37.7	36.8
Paddys Market 3.	339465 555973	33	42		34	43	38	41	52	40	48	50	36	11	41.5	35.3	34.4
Wigton Road	339202 555801									57	50	43	40	4	47.5		
Finkle Street	339784 556110					41	40	36	44	43	52	49	43	8	43.5		
Newtown Road																	

**Table 7****A595 Caldewgate / Castleway – 2005**

Area	Grid Reference	Monthly Mean NO <sub>2</sub> Concentration (µgm <sup>-3</sup> ) 2005												Length of survey (Months)	Raw	Bias Adjusted
		J	F	M	A	M	J	J	A	S	O	N	D			
Bridge Street	339452 556014	44	35	29										3	36	
Paddys Market 1.	339465 555973	48	58	46										3	50.7	
Paddys Market 2.	339465 555973	42	55	42										3	46.3	
Paddys Market 3.	339465 555973	46	41	42										3	43	
Wigton Road	339202 555801	55	44	A										2	49.5	
Finkle Street	339784 556110	63	54	A										2	58.5	
Newtown Road																

### 3.3.7 Gauss Modelling Data – A595 Caldewgate / Castleway

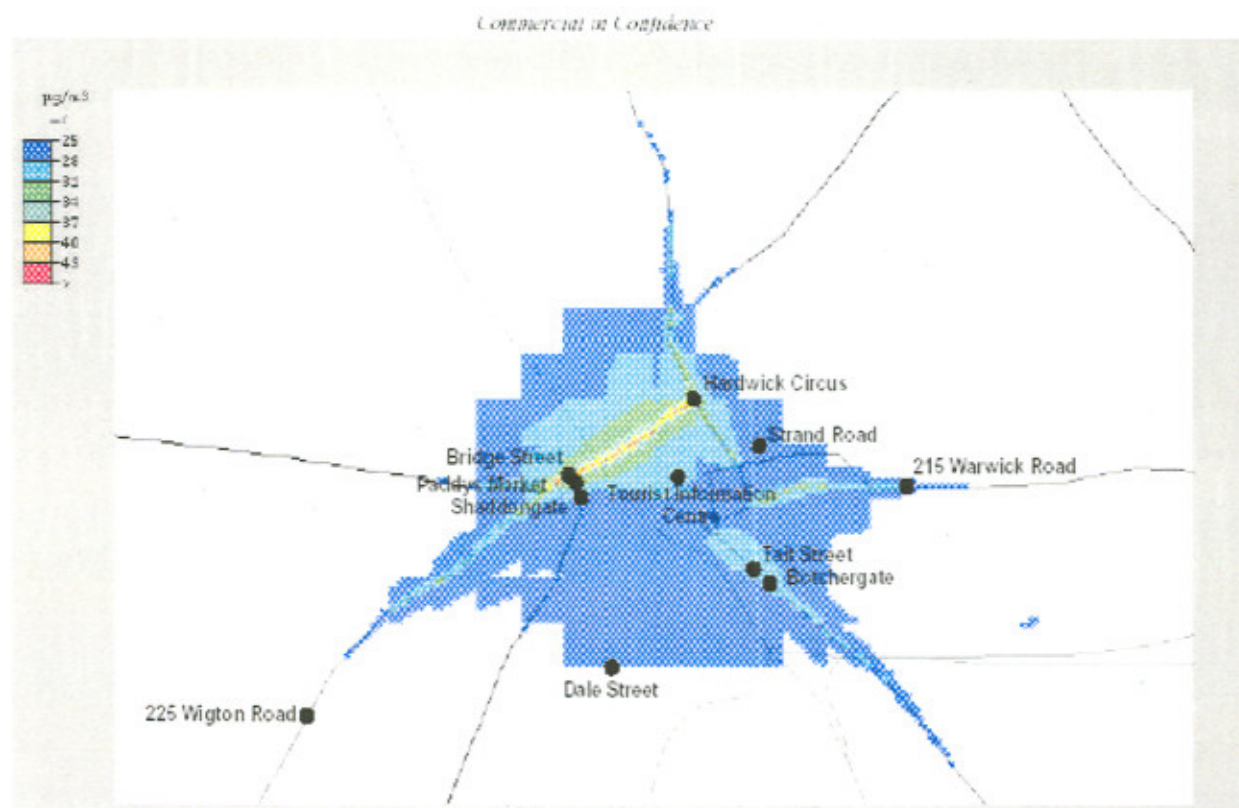
As discussed previously annual average concentration of  $\text{NO}_x$  and  $\text{NO}_2$  were calculated using a Gauss model on a coarse grid resolution (1km/1km) across the City of Carlisle.

The model was configured so that all sources within the Carlisle emissions database were included (road, point and grid sources)

The model does not take account of very localised air dispersion (e.g. effects of buildings, localised traffic movement) but provides a general picture of  $\text{NO}_2$  dispersion.

**Figure 8**

**Contour Plot Showing Predicted Annual Mean Concentration of  $\text{NO}_2$  Over The Centre Of Carlisle City For The Years 2000 – 2004**



Gaussian plume modelling of  $\text{NO}_2$  over Carlisle City Centre revealed that annual air concentrations of the pollutants were predicted to be above the  $\text{NO}_2$  2005 annual mean objectives along many sections of Caldewgate and Castle Way, ranging between 30.5 and 47.9  $\mu\text{g}/\text{m}^3$  when accounting for model



uncertainty. However diffusion tube monitoring undertaken in 2004 at Bridge Street, and Paddys Market thought to be two hot spot locations has not to date shown any exceedence.

Comparisons between NO<sub>2</sub> concentrations in 2004 predicted by airviro and those actually measured using NOx diffusion tubes at Paddys Market and Bridge Street (See Appendix 2) are in close agreement. Both studies indicate that the NO<sub>2</sub> concentrations at these two localities will be below the annual mean NO<sub>2</sub> objective in 2005.

More recent diffusion tube results in 2005 at these sites have however indicated higher concentrations for the first 3 months of this year. It is likely that this has occurred due to road works at Junction Street, Victoria Viaduct, Spencer Street and possibly from the conversion of Hardwicke Circus from being controlled by traffic lights to normal roundabout conditions. The situation is to be kept under review.

Eight months of raw data collected over the monitoring period September 2004 – March 2005 collected from a new site located at the bottom of Wigton Road indicates that there may be an exceedence at this locality.

It is therefore considered necessary that a further detailed assessment is carried out for the A595.

Both NO<sub>2</sub> diffusion tubes and the newly purchased NOx chemiluniniscent analyser (once delivered and installed) will continue to monitor NO<sub>2</sub> concentrations at this locality and it is proposed that more detailed dispersion modelling will also be undertaken along this traffic route.

Given the results of the Gauss Model a Nitrogen Dioxide tube is to be relocated to the lower end of John Street and positioned closer to the junction with Church Street and it has also proposed to undertake diffusion tube monitoring near to the Graham and Bowness garage where residential development has been approved.

Impact of proposed development particularly to the west of the city which may lead to a deterioration in NO<sub>2</sub> levels will need to be considered in future air quality assessments. New development is discussed further in Chapter 5.

The Gauss model also predicts elevated NO<sub>2</sub> concentrations along sections of Warwick Road, London Road, Botchergate, Wigton Road and Stanwix Bank, between 31 – 34  $\mu\text{gm}^{-3}$ .



Although below the NO<sub>2</sub> 2005 objective it is important to stress that modelling with the exception of the A7 is on a coarse grid resolution (1km x 1km) and does not take account of very localised air dispersion nor uses the canyon model.

Diffusion tube monitoring sites are located at each of the sections identified in the dispersion model where higher NO<sub>2</sub> concentrations are likely to occur. The results from existing sites have already been discussed in previous sections however new monitoring sites have also been established.

### **3.4 Monitoring Data - New Monitoring Sites**

Guidance issued to local authorities to assist them in carrying out their updating and screening assessment in 2003 suggested that exceedences may occur at busy junctions or where residential property is within 10 metres of a kerbside, where relatively low traffic flows of 10,000 – 20,000 vehicles per day occur, if they are in congested towns, and in particular where towns have narrow streets with residential property within 5 metres or so of the kerb.

In the absence of monitoring data during the Updating and Screening Assessment particularly in respect to busy junctions, a simple DMRB model recommended by Defra was utilised.

Results of the DMRB model indicated that there may be a risk of the 2005 annual mean objective being exceeded in Caldewgate at relevant locations adjacent to the Bridge Street Junction and consequently a detailed assessment was undertaken at this locality. (refer to section 3.3.6)

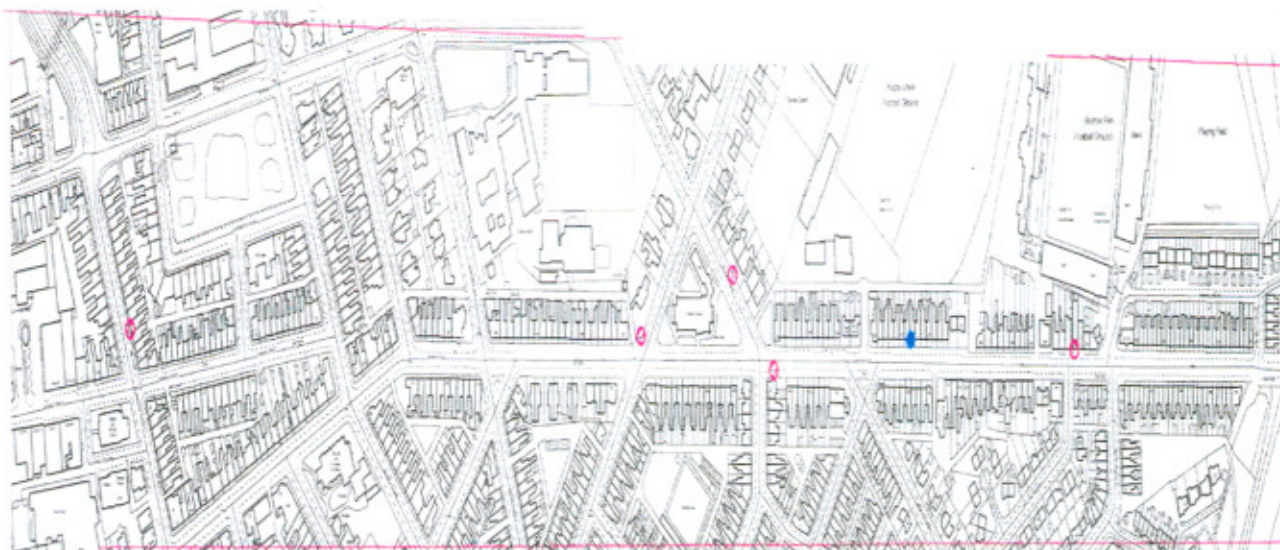
However a number of new monitoring sites have been recently established within the City located adjacent to congested roads and in particular busy junctions. These are in the following areas:

1. Warwick Road / Spencer Street / Victoria Place
2. Currock Street / Dalston Road / Junction Street / Charlotte Street / Denton Street
3. London Road / Botchergate / Tait Street

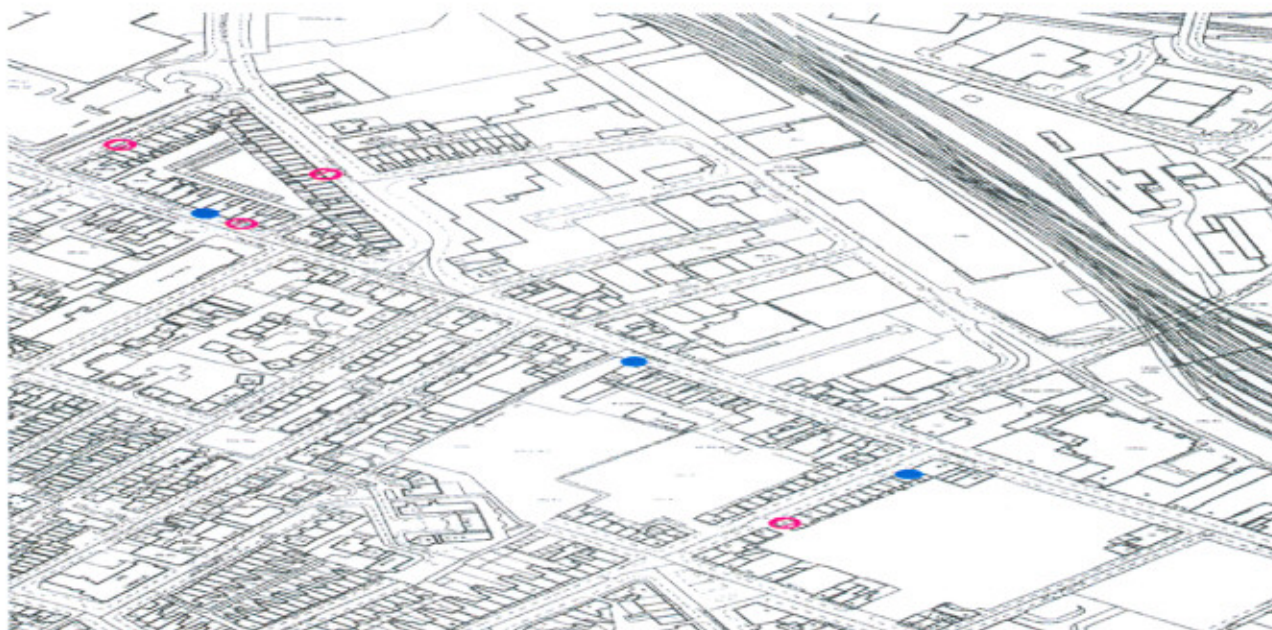
Location of monitoring sites are shown below.



**Figure 9**  
**NO<sub>2</sub> Diffusion Tube Monitoring Locations – Warwick Road Area**

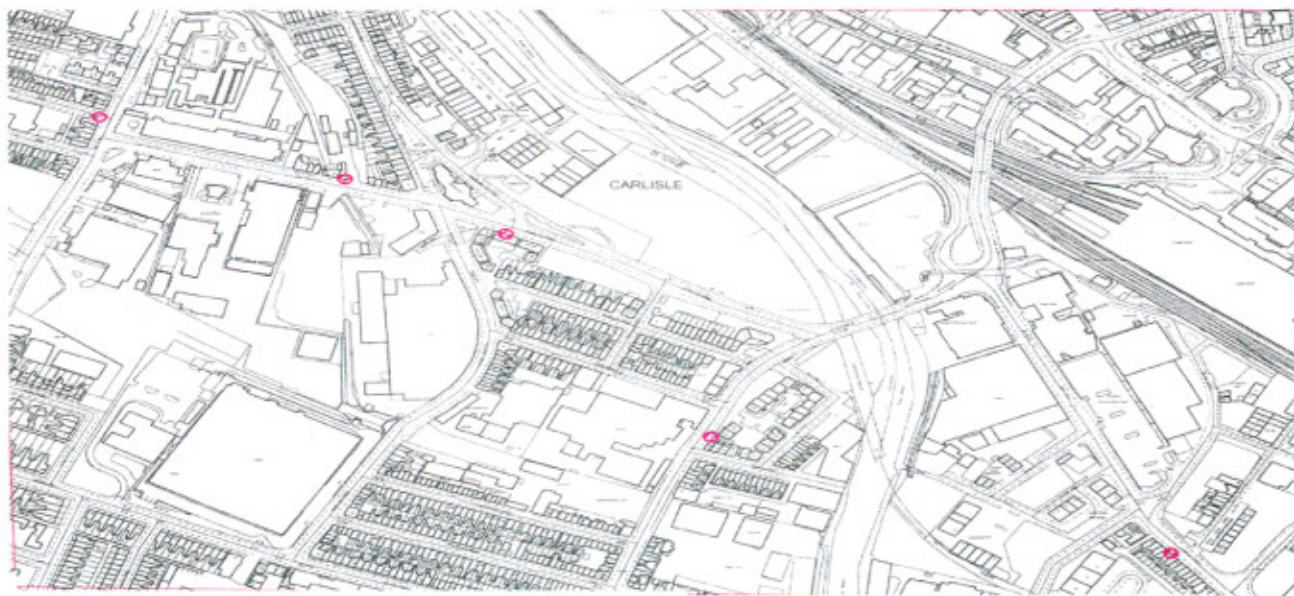


**Figure 10**  
**NO<sub>2</sub> Diffusion Tube Monitoring Locations -Botchergate / London Road Area**





**Figure 11**  
**NO<sub>2</sub> Diffusion Tubes Monitoring Locations –**  
**Currock St/Victoria Viaduct/Junction St/Shaddongate Area**



Only short term data for the majority of these sites has been collected so far and therefore it is not possible to draw any conclusions from the results to date.

As previously stated only data sets covering monitoring periods of 9 months or more can be adjusted for laboratory bias (using the correction factor 0.85) and therefore a combination of raw and bias adjusted results (where applicable) is reported in the table below.

Again because short term data cannot be bias adjusted it has not been possible to adjust the data to provide an estimate of the annual mean and therefore comparison with the annual mean objectives. Raw data must be treat with caution.

Table 8

New NO2 Monitoring Sites 2004/05

Location	Grid Reference	Site Type	Monthly Mean NO2 Concentrations (µg/m <sup>-3</sup> )															Length of Study	Raw	Bias adjusted (0.85)	Projected 2005
			J	F	M	A	M	J	J	A	S	O	N	D	J	F	M				
London Road (1)	340722 555228	R			59	54	54	50	68	63								6	58		
London Road (2)	340704 555237	R									40	61	57	49	52	53	53	7	52.1		
St. Nicholas St	340671 555200	R							31	36	21	40	29	25	48	41	37	9	34.2	29	
London Road (3) Nr Halfords	340986 555022	R							37	34	35	41	50	37	60	47	36	9	41.8	35.5	
Tait Street	340483 555488	R			43	45	45	48	41	43	41	45	55	43				10	44.9	38	37.2
Botchergate	340566 555376	R			37	46	47	39	55	52	34	52	57	42	71	70	54	13	50.5	42.9	41.8
Currock Street	340202 555199	R									45	60	61	50	74	57	56	7	57.6		
Junction St (1)	339438 555649	R									35	46	51	45	36	47	43	7	43.3		
Junction St (2)	339616 555585	R														72	45		58.5		
Charlotte St	339739 555523	R																			
Denton St	339878 555313	R															28		28		
Spencer St	340428 555920	R															30		30		
Warwick Rd	341150 555897	R														40	38		39		
Victoria Place	341104 555956	R														29	28		28.5		
Warwick Rd	341424 555911	R														68	37		52.5		



## **Results from the new monitoring locations indicate the following:**

### **3.4.1 A6 London Road / Botchergate Area**

Elevated NO<sub>2</sub> concentrations have been measured alongside Botchergate and London Road. 13 Months (2004/05) of monitoring data for Botchergate gives a bias adjusted concentration of 42.9 µgm<sup>-3</sup>. When projected forward to 2005 it is predicted that the NO<sub>2</sub> concentration will be 41.8 µgm<sup>-3</sup> in 2005 which exceeds the NO<sub>2</sub> annual mean objective level of 40µgm<sup>-3</sup>.

Where Botchergate runs into London Road 6 and 7 months of raw data results at two respective localities indicate concentrations above 50µgm<sup>-3</sup>, this may indicate levels being over the NO<sub>2</sub> annual mean objective level.

It is therefore proposed that a detailed assessment is required for the A6 particularly at relevant locations running alongside Botchergate and London Road.

Monitoring will continue along the traffic route and it is proposed that more detailed dispersion modelling will also be undertaken. e.g. to take account of the effects of buildings.

### **3.4.2 Currock Street/Junction Street/ Charlotte Street**

7 months raw data for Currock Street indicates that there may be an exceedence of the NO<sub>2</sub> annual mean objective as the uncorrected measured level exceeds 50 µgm<sup>-3</sup>.

New monitoring sites have been located alongside Junction Street, Charlotte Street and Denton Street. Insufficient data has been obtained so far to draw any conclusions.

It is however proposed that a detailed assessment for Currock Street will be required and that this will be extended to include Victoria Viaduct and Junction Street, connecting to Dalston Road and Caldewgate.

It is proposed that more detailed dispersion modelling along this route will be undertaken.

### **3.4.3 A69 Warwick Road/Victoria Place/Spencer Street**

A long term site has been located along Warwick Road for several years, which has indicated NO<sub>2</sub> levels are below the objective level for 2005.

However additional diffusion tubes have been located alongside Warwick Road and adjacent to the Victoria Place junction. Only 2 months data has been obtained so far and therefore it is not possible to draw any conclusions at the present time.

Monitoring will however continue at these locations. Rather than waiting for additional data before deciding to carry out a detailed assessment it is proposed that a detailed assessment will be carried out for relevant locations along this route. This will also include more detailed dispersion modelling along the A69.

## **4.0 NEW MONITORING DATA – PARTICULATE MATTERS (PM<sub>10</sub>)**

### **4.1 Introduction**

Particulate matter (PM<sub>10</sub>'s) consists of solid matter and is categorised according to its size. PM<sub>10</sub> are particulate's, which are 10 microns or less in diameter. This very fine dust can be inhaled into the lungs.

The Government has adopted two air quality objectives for PM<sub>10</sub>. The objectives are 40 µgm<sup>-3</sup> as the annual mean and 50 µgm<sup>-3</sup> as the fixed 24 hour mean to be exceeded no more than 35 days per year to be achieved by the end of 2004.

The objectives are based upon measurements carried out using the European gravimetric transfer sampler or equivalent.

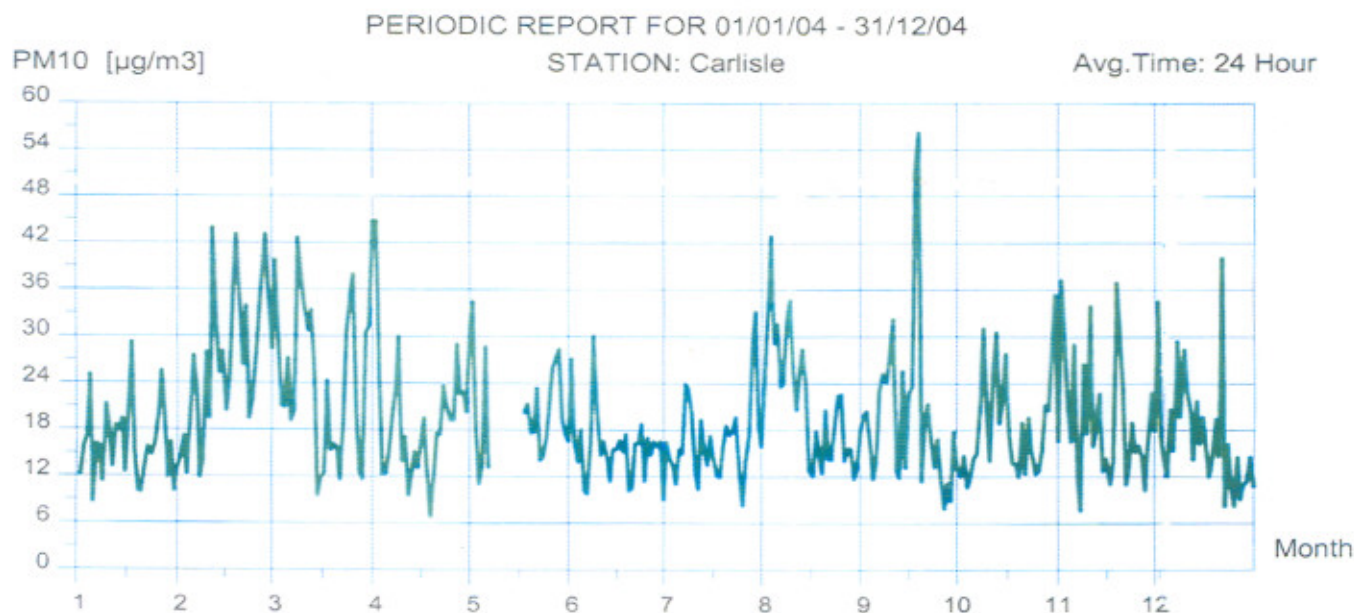
### **4.2 Results of PM<sub>10</sub> Monitoring**

Results of a DMRB screening model used during the updating and screening assessment indicated that there was a risk of 2004 PM<sub>10</sub> objectives being exceeded alongside Caldewgate. A TEOM monitor was subsequently located at Paddys Market.

A summary of the PM<sub>10</sub> concentrations monitored between January and December 2004 at Paddys Market are presented in diagram (below). Data capture during this period was 97%.



**Figure 12**



Technical guidance LAQM TG 03 advises that for data collected using a TEOM a default factor of 1.3 should be applied to estimate the gravimetric concentration, which is then compared against air quality objectives.

The annual mean for 2004 measured using the TEOM was  $19.8 \mu\text{g}/\text{m}^3$  or  $25.74 \mu\text{g}/\text{m}^3$  when converted to gravimetric. During this period there were 12 days when the TEOM monitor measured 24 hour concentrations greater than  $50 \mu\text{g}/\text{m}^3$  once the data was adjusted to give gravimetric readings. Both the annual mean and number of 24 hour exceedences were below the objective levels for 2004.

The Government has also introduced provisional  $\text{PM}_{10}$  objectives to be achieved by the end of 2010. The provisional objectives are a 24 hour mean of  $50 \mu\text{g}/\text{m}^3$  not to be exceeded more than 7 times a year and an annual mean of  $20 \mu\text{g}/\text{m}^3$  to be achieved by the end of 2010. There is no requirement at present for local authorities in England to undertake a review and assessment for 2010 objectives as they have not been included in the air quality regulations. However consideration is given to these objectives below.



Using the approach in Box 8.6 of Technical guidance LAQM TG (03), the measured concentrations can be projected to estimate the annual mean and 24 hour exceedence in 2010. All concentrations are stated as gravimetric readings.

It is estimated that the annual mean  $PM_{10}$  concentration in 2010 at Paddys Market will measure  $23.77 \mu\text{g}/\text{m}^3$  and the number of 24 hour exceedences will measure 9.64. There is therefore a risk that the provisional 2010  $PM_{10}$  objective will be exceeded alongside Caldewgate.

This compares with the results of the DMRB model run for this location during the Updating and Screening Assessment, which predicted an annual mean of  $24 \mu\text{g}/\text{m}^3$  and 10 exceedences above the 24 hour objective.

The DMRB screening model was applied to other busy junctions in Carlisle during the Updating and Screening Assessment to predict the  $PM_{10}$  concentrations in 2010. Results indicated that there may be a risk of exceeding the provisional annual mean 2010 objective at the Scotland Road/Brampton Road/Eden Bridge Junction, Junction Street/Dalston road junction and Victoria Place/Warwick Road Junction.

$PM_{10}$  monitoring has not taken place at these locations to date but will be considered in more detail in the next Updating and Screening Assessment Report.

Results of a screening assessment for domestic solid fuel burning also indicated that an area of Longtown where solid fuel is predominantly used may exceed the provisional 2010 objectives. Again no monitoring or modelling has taken place but will be considered in more detail during the next Updating and Screening Assessment.

#### **4.3 Monitoring of other Pollutants**

- Carbon Monoxide
- Benzene
- 1,3 – Butadiene
- Lead

- Sulphur Dioxide

No monitoring or modelling is carried out for these pollutants as Government Guidance indicates that it is unlikely that there is a risk of a breach of their objective levels within this local authority area.

Our position remains as summarised in the Updating and Screening Assessment undertaken in 2003.

## **5.0 NEW DEVELOPMENTS**

### **5.1 New Industrial Process**

#### **New Part A1 Processes**

There are no new Part A1 Industrial Processes in Carlisle's area, however a number of existing processes received a permit since 2003 which has now classified them as A1 industrial processes. These are Stead McAlpin a material printing process at Cummersdale, Hespin Woodland Fill Site, McVities UK food processor Caldewgate, Cavaghan and Gray, Eastern Way and Nestle UK Ltd, Dalston also food processors.

#### **New Part A2 Processes**

One A2 Industrial Process has been permitted in Carlisle since the last Updating and Screening Assessment in 2003. The process was previously authorised by the Council under part B of the Environmental Protection Act 1990. Changes to process classifications contained in the Pollution Prevention & Control (England & Wales) Regulations 2000 means the process is now classed as an A2 process, although emissions to air from the process have not altered. The process is Carnauld Metal Box which is a metal coating process based at Botcherby, Carlisle.

#### **New Part B Processes**

There have been a few new Part B industrial processes permitted in Carlisle since the last Updating and Screening Assessment in 2003. These have been small operations and do not have a significant impact on Local Air Quality. The processes included sand and cement batching and waste oil burners.

### **5.2 New Landfill/Quarrying/Mineral Development Processes**

There have been no new landfill sites established in Carlisle since 2003.

There are no new quarrying or mineral processes taking place in Carlisle since 2003.

There is a recycling site being operated at the Hespin Wood land fill site, by Cumbria Waste Management and also a stone reclamation activity run by Ken Hope Ltd is also based at the same site.



### **5.3 New Road Developments**

Consultation with Cumbria County Council has confirmed the following:

- No new roads have been constructed since the previous Updating and Screening Assessment in 2003. Work on the Carlisle Northern Development Route discussed in detail in the Updating and Screening Assessment Report 2003 has still not started.

No roads in the Carlisle area have experienced large increases (Greater than 25% or more) in traffic flow since the previous Updating and Screening Assessment. There is however an extra lane currently being added to Victoria Bridge on the outskirts of Denton Holme, which may have an impact on air quality. This will be considered during future monitoring.

### **5.4 New Commercial Development**

There are a number of new commercial developments proposed that could have an impact on air quality and will therefore be considered during future monitoring:-

- The new Tesco store at the Viaduct, Carlisle,
- The new B & Q Store on London Road, Carlisle and
- Further development at Parkhouse Business Park and Kingmoor Park for offices, retail, warehousing and small industrial use.

### **5.5 New Residential Development**

#### **Residential Development that is currently in progress**

The following developments are currently taking place:

1. Carlton Grange (495 units)
2. Garlands (302 units)
3. Wigton Road Suttlehouse (157 units)
4. Cargo – 14 MU (96 units)
5. Windsor Way (156 units)
6. Dobinson Road and Parham Drive (96 units)

These developments may have an impact on traffic flow in the future.

#### **Future Developments With Permission**

There are two proposed developments of significant size which already have planning permission. These are

1. Rome Street (199)
2. Remainder of Raffles (343)

There are also two smaller developments namely:

Shaddonmills (58) and land on Botchergate (40)

### **Land Allocated But Without Permission**

The following land has been set aside for residential use this land is on

1. West of Morton Road (8.1 hectares – 197 units)
2. East of Wigton Road (25 hectares 566 units)
3. Peter Lane, Dalston (47 hectares 101 units)

There are also a number of applications in for developments that have not currently been determined, but are below 50 dwellings/units. Quite a few of these are around the Denton Holme area, Dalston Road (Well Flat farm) and Bousteads Grassing.

Small developments by themselves are not significant but the cumulative effect may have an impact on air quality.

Any expected or predicted future developments will be taken into account in the monitoring regime.

It is also recommended that future planning policy requires air quality assessments to be submitted for the following types of development:-

- Extension of, or new proposals for industrial activities with potentially significant emissions
- Proposals that will results in an increase in vehicle trip generation in the local area, and which will result in increases in traffic volumes (AADT) of 5% or more on individual road links with more than 10,000 vehicles per day.
- Proposals that may result in increased congestion and lower vehicle speeds than is present on the existing local road network, particularly in areas of public exposure.
- Proposals that may significantly alter the composition of traffic such that adverse air quality impacts arise, particularly in areas of public exposure.

- Proposals for new developments with 300 parking spaces or more or an increase in existing parking provision of 300 spaces or more.
- Proposals for coach and lorry parks, and in areas of public exposure in particular
- Any developments likely to have an adverse impact on air quality, particularly in sensitive areas (e.g. Where predicted air pollution levels already exceed air quality objectives levels by 10% or more)



## 6.0 CONCLUSIONS AND RECOMMENDATIONS

1. A detailed assessment undertaken along the A7 in 2004 concluded that there was a risk of the nitrogen dioxide (NO<sub>2</sub>) annual mean objectives being exceeded at relevant locations between Stanwix Bank and Kingstown due to road traffic emissions and that an air quality management area was required.

It was subsequently recommended to Council that an Air Quality Management Area (AQMA) be declared for this area. This was endorsed by Council in January 2005.

2. Additional monitoring and detailed air dispersion modelling work undertaken by Westlakes Scientific Consulting Ltd has since taken place to assist in defining the boundaries of the AQMA.
3. As a result of this work it is recommended that an AQMA be formally declared along the A7 between Junction 44 of the M6 and Hardwicke Circus, extending only to properties located directly adjacent to the roadside and also properties adjacent to the junction of Brampton Road and Stanwix Bank as shown in Appendix 3.
4. Following declaration of the AQMA Carlisle City Council will have a duty to draw up an action plan within 18 months of the declaration specifying the measures it intends to take in pursuit of reducing nitrogen dioxide concentrations within the AQMA.
5. As the AQMA has been required as a result of traffic based emissions, traffic based management measures and techniques will be required to reduce NO<sub>2</sub> levels below the objective level.

This will require a collaborative effort amongst land use planners and transport planners alike.

Policy areas of economic development, wider environmental protection and sustainability all need to be considered in the context of developing the air quality action plan as will the wider involvement of the community and other stakeholders.

Preliminary discussion have already taken place with colleagues in the Planning Department and Cumbria County Council's Highways Department .

6. This Progress Report has also provided an update on new monitoring data both for existing and new locations, recent gaussian air dispersion modelling undertaken by Westlakes Scientific Consulting Ltd for the City of Carlisle and an outline of recent or proposed new development which will need to be considered during the next review and assessment.
7. Air Dispersion Modelling over the Carlisle Centre has revealed that the annual air concentration were predicted to be over the annual mean objectives along many sections of Caldewgate and Castleway. However both modelled and monitoring results have not indicated that an exceeding will occur at relevant locations to date.

It is recommended that further detailed assessment work is undertaken along the A595 to include new monitoring locations and additional air dispersion modelling.

8. This Report also highlights several other road sections within the City where there may be an exceedence of the annual mean NO<sub>2</sub> objective in 2005:-
  - Botchergate/ London Road
  - Currock Street/Victoria Viaduct/Junction Street
  - Warwick Road/Victoria Place

It is therefore considered necessary for a further detailed assessment to be undertaken at these localities which will include both monitoring and more detailed air quality dispersion modelling.

9. It is recommended that air quality assessments be required for development which may have an impact on air quality and that this be reflected in the Councils planning policies.

## 7.0 REFERENCES

1. DETR (2000). The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. Department of the Environment, Transport and the Regions.
2. Carlisle City Council (2003). Updating and Screening Assessment of Air Quality in Carlisle.
3. Carlisle City Council Review and Assessment of Air Quality in Carlisle – Second and Third Stages.
4. DEFRA (2003) Local Air Quality Management LAQM.TG(03). Department for Environment, Food and Rural Affairs.
5. DEFRA (2003) Local Air Quality Management LAQM.PRG(03). Department for Environment, Food and Rural Affairs



## Appendix 1

### Recommended timescales for submission of reviews and assessments and progress reports

Appendix 1: Recommended timescales for submission of reviews and assessments and progress reports		
LAQM activity	Completion Date	Which Authorities?
Updating & Screening Assessment	End of May 2003	All authorities <sup>a</sup>
Detailed Assessment	End of April 2004	Those authorities <sup>a</sup> which have identified the need for a detailed assessment in their May 2003 updating and screening assessment
Progress Report	End of April 2004	Those authorities <sup>a</sup> which have identified no need for a detailed assessment in their May 2003 updating and screening assessment
Progress Report	End of April 2005	All authorities
Updating and screening assessment	End of April 2006	All authorities
Detailed assessment	End of April 2007	Those authorities which have identified the need for a detailed assessment in their April 2006 updating and screening assessment
Progress report	End of April 2007	Those authorities which have identified <b>no need</b> for a detailed assessment in their April 2006 updating and screening assessment
Progress report	End of April 2008	All authorities
Updating and screening assessment	End of April 2009	All authorities
Detailed assessment	End of April 2010	Those authorities which have identified the need for a detailed assessment in their April 2009 updating and screening assessment
Progress report	End of April 2010	Those authorities which have identified <b>no need</b> for a detailed assessment in their April 2009 updating and screening assessment
a)	All local authorities except those in Northern Ireland and London local authorities that have designated AQMAs. London local authorities that have designated AQMAs will be expected to submit a Updating and Screening Assessment by the end of 2003 or earlier if possible, and to complete Detailed Assessments (where required by the end of 2004.	

## **Appendix 2**

### **Air Dispersion Modelling Of NO<sub>2</sub>**

The airviro air quality management system was used to model the atmospheric dispersion of NO<sub>x</sub> emissions.

The modelling studies were conducted in three stages:

4. Annual average concentrations of NO<sub>x</sub> and NO<sub>2</sub> arising from background emissions were calculated using the Gauss model on a coarse grid resolution (1 x 1 km) across the map area using meteorological data for 2004, a year for which Carlisle City Council has comprehensive NO<sub>2</sub> monitoring data. Similar studies were also undertaken to determine NO<sub>x</sub> and NO<sub>2</sub> concentrations from road link sources surrounding the A7 between Stanwix and Kingstown on a medium (250 x 250m) and fine (25 x 25m) scale resolution. The Gauss model is particularly suited to local-dispersion studies and was, therefore, considered appropriate for use in the Carlisle EDB map area.
5. Specific modelling studies were conducted using the Canyon model to predict annual NO<sub>x</sub> and NO<sub>2</sub> concentrations at the Scotland Road, Kingstown Road and Stanwix Bank sections of the A7, where the designation of an AQMA is proposed. The Canyon model is designed for use on individual streets where tall buildings are present either side of the road link.
6. Validation studies for NO<sub>2</sub> were carried out by comparing modelled concentrations of the pollutant with those monitored by Carlisle City Council in 2004.



## Validation of the NO<sub>2</sub> Dispersion Modelling

Plotting measured NO<sub>2</sub> concentrations against those predicted by the model and fitting the data to a linear model, revealed a significant relationship between the two ( $r^2$

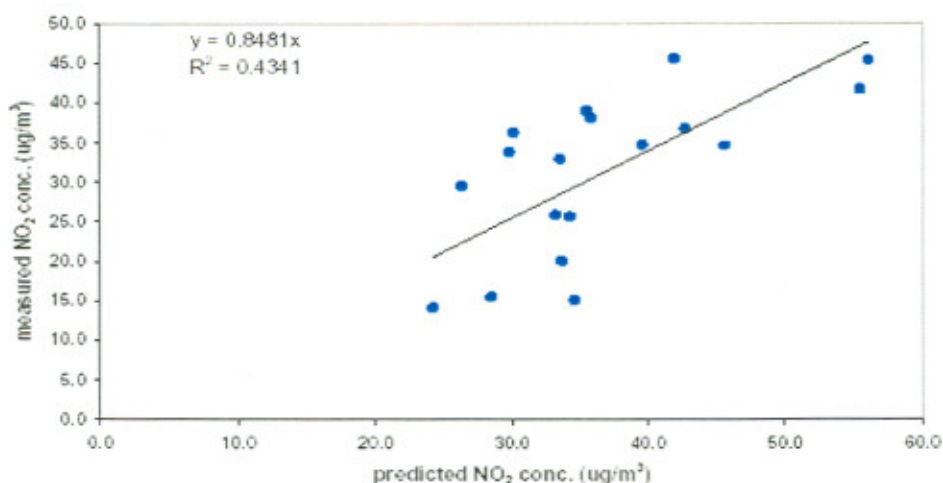


Figure 6: Relationship between predicted and measured NO<sub>2</sub> concentrations during 2004

=0.43) with a slope coefficient of 0.85 when setting the y-intercept to zero.

All NO<sub>2</sub> predicted concentrations derived using the Derwent & Middleton formula were, therefore, corrected by a factor of 0.85. Corrected concentrations predicted by the dispersion model were compared with diffusion tube estimates of air concentrations of NO<sub>2</sub> from 18 sites across the city measured in 2004. The majority of the dispersion model predictions (89%) were at or within 50% of the measured values, demonstrating that the model had performed acceptably (in-line with the TG3 (00) guidance). In cases such as the Tourist Information Centre and Dale Street, the large difference between predicted and monitored NO<sub>2</sub> concentration may be explained by the fact that a number of road links in this vicinity were not included in the EDB due to insufficient data. As such NO<sub>2</sub> predicted in this area is dependent on the use of NAEI data based on a 1km resolution.

Comparing measured and predicted concentrations of NO<sub>2</sub> at each of the 18 monitoring sites allowed determination of the Root Mean Square (RMS) of the difference between predicted and monitored NO<sub>2</sub> concentrations, providing an indication of model accuracy. RMS analysis demonstrated that prior to correction of NO<sub>2</sub> concentrations by a factor of 0.85, the uncertainty limits for the dispersion model were  $\pm 9.4 \mu\text{g m}^{-3}$ , however after correcting predicted NO<sub>2</sub> concentration, uncertainty limits were  $\pm 6.9 \mu\text{g m}^{-3}$ .



## Comparison between NO<sub>2</sub> concentrations predicted by Airviro and those monitored using NO<sub>2</sub> tubes at 18 locations throughout the City of Carlisle

Monitoring point	Monitor Location		NO <sub>x</sub> concentration (µg m <sup>-3</sup> )					NO <sub>2</sub> concentration (µg m <sup>-3</sup> )	Monitored concentration (µg m <sup>-3</sup> )	% difference
	E	N	Local concentration <sup>a</sup> (25 m grid resolution)	"Regional" background <sup>b</sup> (250 m grid resolution)	"National" background <sup>c</sup> (1km grid resolution)	Total background <sup>d</sup> (b + c)	Total predicted concentration (a+ d)			
Wigton Road	337926	554558	6.5	16.6	8.0	24.6	31.1	20.6	14.1	+ 45.8
Scotland Road	339992	557187	69.7*	25.8	8.0	33.8	103.5	47.6		+ 5.2
Hardwick Circus	340143	556347	21.7	43.0	8.0	51.0	72.7	38.8	34.6	+ 12.0
Shaddongate	339483	555892	9.5	28.6	8.0	36.6	46.1	28.2	25.8	+ 9.3
Warwick Road	341310	555918	11.5	28.5	8.0	36.5	48.0	29.1	25.6	+ 13.7
Tourist Information Centre	340070	555955	5.1	35.6	8.0	43.6	48.7	29.4	15.1	+ 95.4
Dale Street	339615	554863	1.5	28.3	8.0	36.3	37.8	24.2	15.5	+ 56.5
Strand Road	340550	556174	5.4	33.5	8.0	41.5	46.9	28.6	20.1	+ 42.6
Bridge Street	339452	556014	20.3	30.4	8.0	38.4	58.7	33.6	34.7	- 3.1
Paddys Market	339465	555973	28.5	29.2	8.0	37.2	65.7	36.3	36.7	- 1.1
Scotland Road	339985	557346	9.7	22.8	8.0	30.8	40.6	25.6	36.3	- 29.5
Kingstown Road	339527	559284	12.8	19.3	8.0	27.3	40.1	25.3	33.8	- 25.0
Kingstown Road	339758	558062	73.8*	19.7	8.0	27.7	101.5	47.1	42.3	+ 13.2
Kingstown Road	339679	558386	8.7	17.8	8.0	25.8	34.4	22.4	29.5	- 24.1
Coach & Horses	339558	559107	15.6	23.1	8.0	31.1	46.7	28.5	32.9	- 13.4
Stanwix Bank	340009	556852	50.0*	31.7	8.0	39.7	89.7	44.0	45.5	- 3.3
Tait Street	340483	555488	8.2	34.8	8.0	42.8	51.	30.4	38.1	- 20.0
Botchergate	340566	555376	7.8	34.6	8.0	42.6	50.4	30.2	39.0	- 22.6

a = NO<sub>x</sub> concentration arising from local road link and point sources at a grid resolution of 25 m.

b = "Regional background" derived by subtracting NO<sub>x</sub> concentration arising from local road link and point sources at a grid resolution of 250 m from NO<sub>x</sub> concentrations arising from all sources in the EDB (road, point and grid).

c = "National background" derived by subtracting NO<sub>x</sub> concentrations arising from sources in the EDB (road, point and grid) at a grid resolution of 1km from NO<sub>x</sub> concentration obtained from the air quality website.

d = Total background is the sum of the "Regional" and "National" background concentrations.

e = Annual averaged NO<sub>2</sub> concentrations derived from annual averaged NO<sub>x</sub> concentrations using the empirical formula developed by Derwent & Middleton (1996) and adjusted using a conversion factor of 0.85.

f = percentage difference between predicted and monitored NO<sub>2</sub> concentrations.

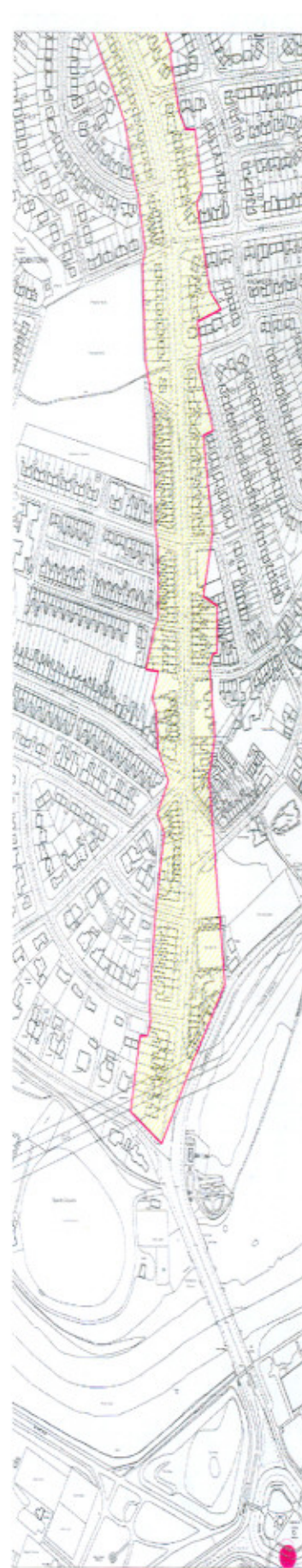
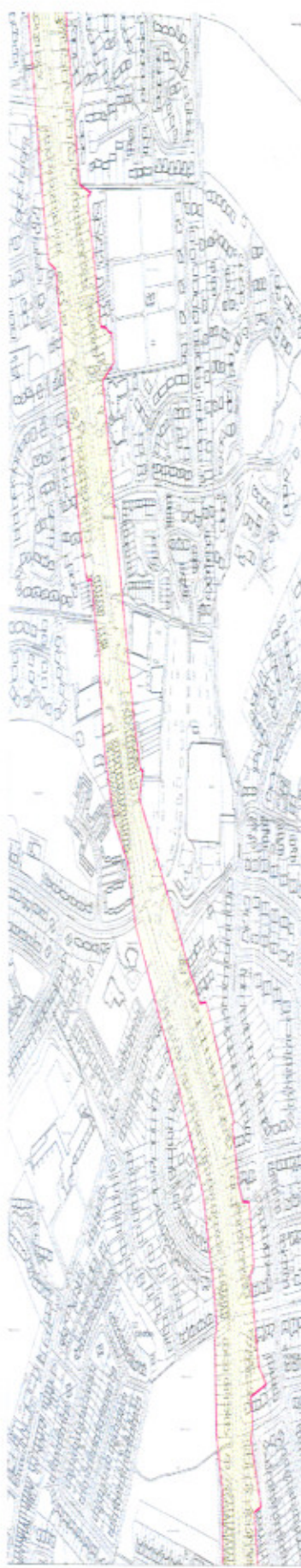
\* = figures derived from street Canyon model runs.



This is a detailed road map of Carlisle, Cumbria. The map shows the city's layout, including major roads like the M6 and A69, and the River Ure. Key locations labeled include Houghton, Brunstock, Whiteclosegate, and various districts like Kingmoor, Stainton, and Morton. The map is color-coded with yellow for major roads and blue for the river. The word 'CARLISLE' is prominently displayed in the center-right area.



**APPENDIX 3 – Recommended Air Quality Management Area (A7)**  
**(B)**





## Appendix 4 – Traffic Flows in Carlisle

