



# 2013 Air Quality Progress Report for Carlisle City Council

In fulfillment of Part IV of the  
Environment Act 1995  
Local Air Quality Management

April 2013



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## Executive Summary

The Government published the revised Air Quality Strategy for England, Scotland, Wales and Northern Ireland in July 2007. At the centre of this Air Quality Strategy are the use of air quality standards, which enable air quality to be measured and assessed. These standards also provide the means to set air quality objectives and timescales. The air quality objectives had to be achieved between 2003 and 2010.

Local Authorities are required to review and assess the air quality in their areas to determine whether the air quality objectives are likely to be met. Where the likelihood of exceedences of the air quality objectives are identified, in areas of significant public exposure, a detailed assessment of that area will be required. Depending upon the findings, an Air Quality Management Area (AQMA) may need to be declared, followed by a further assessment and the formulation of an Action Plan to help reduce these exceedences.

This report represents the second stage of the fifth round of review and assessment of local air quality in Carlisle and the surrounding district. Carlisle City Council has previously undertaken 4 rounds of review and assessment and this has concluded that overall air quality within the district is good. There are, however, small pockets within the city where the annual mean objective level for nitrogen dioxide is being exceeded due to road traffic sources. As a consequence 6 Air Quality Management Areas have been declared between 2005 and 2008. One of these AQMA's (AQMA 3) was subsequently extended in 2010.

The three principal pollutants that are currently monitored by Carlisle City Council include; nitrogen dioxide, particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>) and benzene. For comparison purposes this report presents both the historical and the most recent results for 2012. The latest results for PM<sub>10</sub>, PM<sub>2.5</sub> and Benzene show that levels remain consistently below the objective and all have shown year on year reductions since 2010.

New monitoring data for nitrogen dioxide indicates that the annual mean NO<sub>2</sub> concentrations have decreased at many of the monitoring locations across the district, compared to 2011. There are still locations within all 6 of our AQMA's which remain above, or borderline of, the annual mean objective level. This Progress Report has also identified one exceedence of the NO<sub>2</sub> annual mean objective outside of our existing AQMA's. There are strong indications that this exceedence was due to prolonged traffic disruption associated with a new city centre supermarket development and nearby Shaddongate Resource Centre. These major developments resulted in increased congestion from March to October 2012 at this particular location. The work is now complete and it is expected that NO<sub>2</sub> annual mean concentrations will stabilise. The new monitoring data has not identified the need to proceed to a Detailed Assessment for any pollutant.

This report identifies the new developments which have been proposed for the district, since the last round of review and assessment, which may have air quality implications. It also details any large developments currently being considered by the planning department. In most cases the prospective developers have been asked to demonstrate the likely impacts and mitigation measures by submitting an Air Quality Impact Assessment (AQIA). Depending on the conclusions of these and in the event of a



granted application, it can be necessary to proceed to a detailed assessment. This report concludes that there are no new or proposed developments that have predicted impacts which are sufficient to warrant further detailed investigation.

The most significant development in the district since the previous round of review and assessment has been the completion of the Carlisle Northern Development Route (CNDR) in February 2012. The Further Assessment (2007) indicated that the opening of the CNDR will have a major impact on nitrogen dioxide levels along A7 (AQMA 1) bringing levels to below the objective level. A Further Assessment undertaken in 2009 also indicated that the CNDR will have a significant positive impact on air quality along the A595 (AQMA's 3 and 4).

At this stage it is not feasible to draw firm conclusions as to the full effects of the CNDR on air quality monitoring data. Early indications from traffic counts and local observation suggested that the bypass was having a significant effect on congestion and traffic volume in some of the key arterial routes through the city. One month after the opening of the bypass two major new developments resulted in significant traffic disruption in the city centre for around 8 months. During 2012 reductions in NO<sub>2</sub> annual means were observed in AQMAS 1, 3 and 4 however it is expected that this traffic disruption will have had a negative impact on NO<sub>2</sub> concentrations in several areas. It is hoped that 2013 will provide the first full year of representative data since the opening of the CNDR. This will be reported upon in Progress Report 2014 and any trends in the traffic count data will also be examined.

In order to enable accurate 'before and after' comparisons to be drawn as to the long term impact of the CNDR at key locations it is anticipated that much of the monitoring network will remain unchanged during 2013.

Some minor changes were made to the diffusion tube monitoring network in 2012 to allow for the new major developments on Castle Way and to begin monitoring NO<sub>2</sub> at residential properties along the route of the CNDR. Initial investigation has shown that so far there are no exceedences of the objective at any of the newly identified receptors along the CNDR route. This is likely to be due to the distance of these properties to the road, the open rural environment and the free flowing nature of the traffic. Previous Air Quality Impact Assessment work carried out in the planning stages of the development also supports this conclusion.

This report summarises the current policies adopted by the council which relate to air quality including the Local Transport Plan 3, Air Quality Planning Policies and Climate Change Strategies. It also includes a summary of the measures detailed in the newly revised Air Quality Action Plan which are expected to have a positive effect on air quality in the city. It provides an update on the progress made in implementing these measures and the timescales in which they are likely to run.

The revised Air Quality Action Plan 2012 is now available to view on the City Council website at:

[http://www.carlisle.gov.uk/environment\\_and\\_waste/environmental\\_health/air\\_quality/air\\_quality\\_documents.aspx](http://www.carlisle.gov.uk/environment_and_waste/environmental_health/air_quality/air_quality_documents.aspx)

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# **1 Introduction**

## **1.1 Description of Local Authority Area**

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

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

Carlisle is remote from other centres of population being 300 miles from London, more than 120 miles from Manchester, more than 90 miles from Glasgow and Edinburgh, and 60 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 manufactures and engineering. The dominant sectors are branch operation in warehousing, retailing, manufacturing, public administration and health services.

Carlisle is also a significant transport hub for rail services and the national road transport network.

## **1.2 Purpose of Progress Report**

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

Progress Reports are required in the intervening years between the three-yearly Updating and Screening Assessment reports. Their purpose is to maintain continuity in the Local Air Quality Management process. They are not intended to be as detailed as Updating and Screening Assessment Reports, or to require as much effort. However, if the Progress Report identifies the risk of exceedence of an Air Quality Objective, the Local Authority (LA) should undertake a Detailed Assessment immediately, and not wait until the next round of Review and Assessment.

### 1.3 Air Quality Objectives

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

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

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Benzene	16.25 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2003
	5.00 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2010
1,3-Butadiene	2.25 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2003
Carbon monoxide	10 $\text{mg}/\text{m}^3$	Running 8-hour mean	31.12.2003
Lead	0.50 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2004
	0.25 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2008
Nitrogen dioxide	200 $\mu\text{g}/\text{m}^3$ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2005
Particulate Matter (PM <sub>10</sub> ) (gravimetric)	50 $\mu\text{g}/\text{m}^3$ , not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2004
Sulphur dioxide	350 $\mu\text{g}/\text{m}^3$ , not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 $\mu\text{g}/\text{m}^3$ , not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 $\mu\text{g}/\text{m}^3$ , not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

## 1.4 Summary of Previous Review and Assessments

Since 1996 Carlisle City Council has been monitoring pollution levels in Carlisle and comparing them with the national air quality objectives, as part of a process known as review and assessment.

Our review and assessment work has concluded that air quality within our local authority is generally very good. For the majority of pollutants the concentrations found in Carlisle are well below the governments health based objectives and are not of any concern. However there are small pockets within the city where the annual mean objective for nitrogen dioxide is not being met due to road traffic emissions. The local authority has subsequently declared six Air Quality Management Areas within the city.

**Stage 1 Report 1996** - concluded that a stage 2 assessment would be required for nitrogen dioxide and particulates

**Stage 2 Report 1998** - concluded that a detailed stage 3 assessment would be required in respect to nitrogen dioxide and particulates.

**Stage 3 Report 2000** - concluded that it was unlikely that an air quality objective would be exceeded.

**Updating and Screening Assessment 2003** – concluded that a detailed assessment would be required for nitrogen dioxide and particulates.

**Detailed Assessment 2004** – concluded that it was likely that the annual mean objective for nitrogen dioxide would be exceeded at locations alongside the A7. As a consequence Air Quality Management Area No.1 was declared in 2005

**Progress Report 2005** – concluded that it was likely that the annual mean objective for nitrogen dioxide would be exceeded at locations alongside Currock Street. As a consequence Air Quality Management Area No.2 was declared in Dec 2006

**Updating and Screening Assessment 2006** - concluded that a detailed assessment would be required in respect to the annual mean nitrogen dioxide at 4 locations within the City i.e. Wigton Rd, Bridge St, London Rd and Dalston Rd.

**Progress Report 2007** – update on air quality issues.

**Detailed Assessment 2007** – concluded that it was likely that the annual mean objective for nitrogen dioxide would be exceeded at locations alongside Wigton Rd, Bridge St, London Rd and Dalston Rd. As a consequence Air Quality Management Areas No's. 3, 4, 5 and 6 were declared in 2008.

**Further Assessment Report 2007** – confirmed that AQMA boundaries for AQMA No's 1 and 2 were correct.

**Progress Report 2008** – update on air quality issues

**Further Assessment Report 2009** – confirmed that the boundaries AQMA's No's. 4-6 are correct. It recommends that the boundary of AQMA No.3 be extended to the bottom of Caldewgate roundabout.



**Updating and Screening Assessment 2009** - concludes that the existing boundary of AQMA No.3 on Wigton Rd will need to be extended to the Caldewgate roundabout and include properties on Caldcotes.

**Progress Report 2010** – update on Air Quality issues. Confirmed that the recent extension of AQMA No.3 had taken place and gave an update on progress with action plan measures.

**Progress Report 2011** – update on Air Quality issues. Confirmed no further changes required to AQMA's and gave an update on progress with action plan measures.

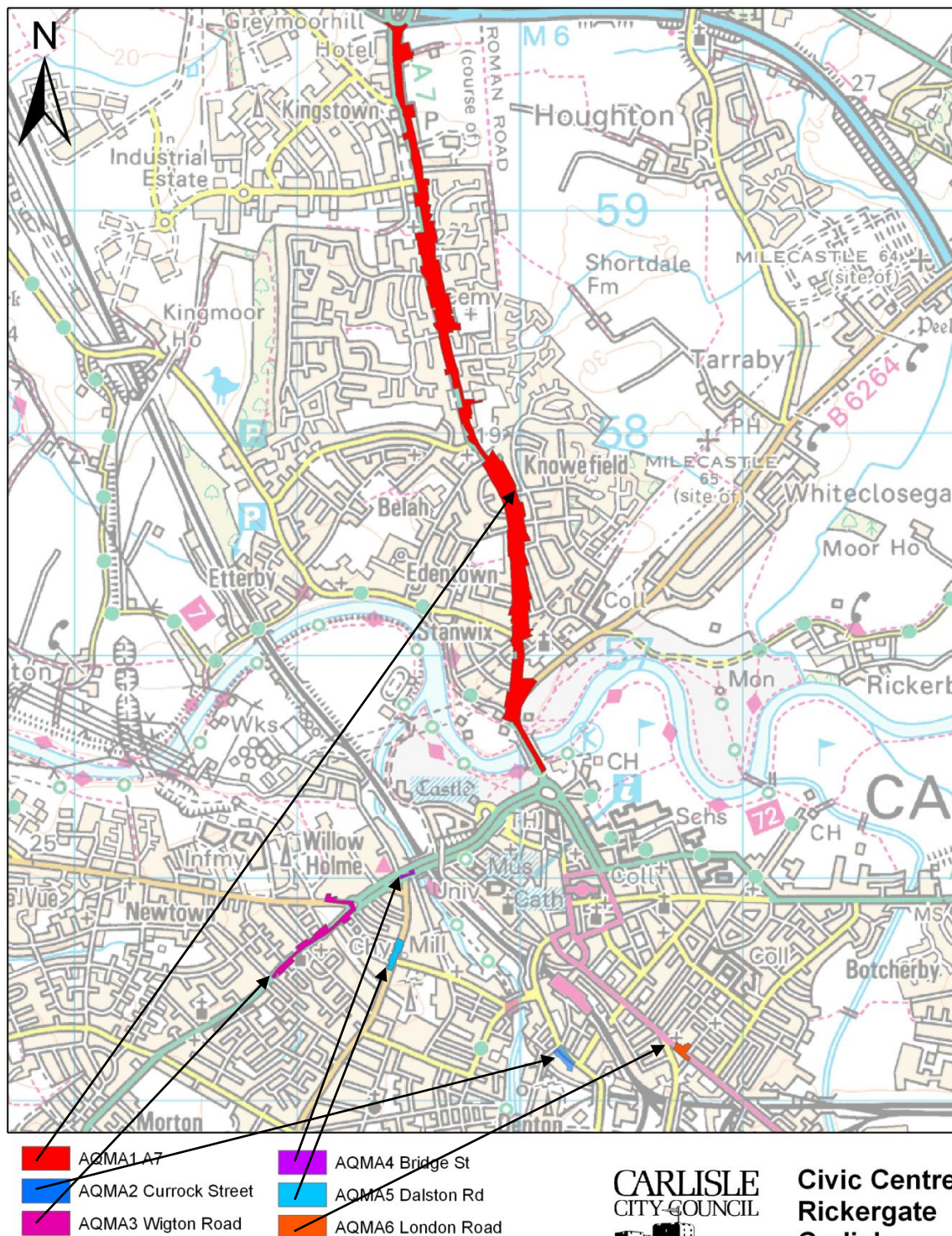
**Updating and Screening Assessment 2012** - Concludes that no further amendments to AQMA's are required. Overall improvement seen in every AQMA compared to previous year. Some minor changes were introduced to monitoring network to include new receptors on newly built Carlisle Northern Development Route (CNDR).

**Action Plan 2012** – Introduced a revised concise set of measures to be implemented over the following 5 years the major improvement being the opening of the new Carlisle bypass (CNDR).

The following maps show all six of the AQMA's that have been declared in the district. All of the AQMA's have been declared due to exceedences of the nitrogen dioxide annual mean objective. Figure 1.1 shows all of the AQMA's on one large map and the subsequent figures show the individual AQMA's in more detail.

**Figure 1.1 Map of all AQMA Boundaries**

**Location of Carlisle AQMAs.**



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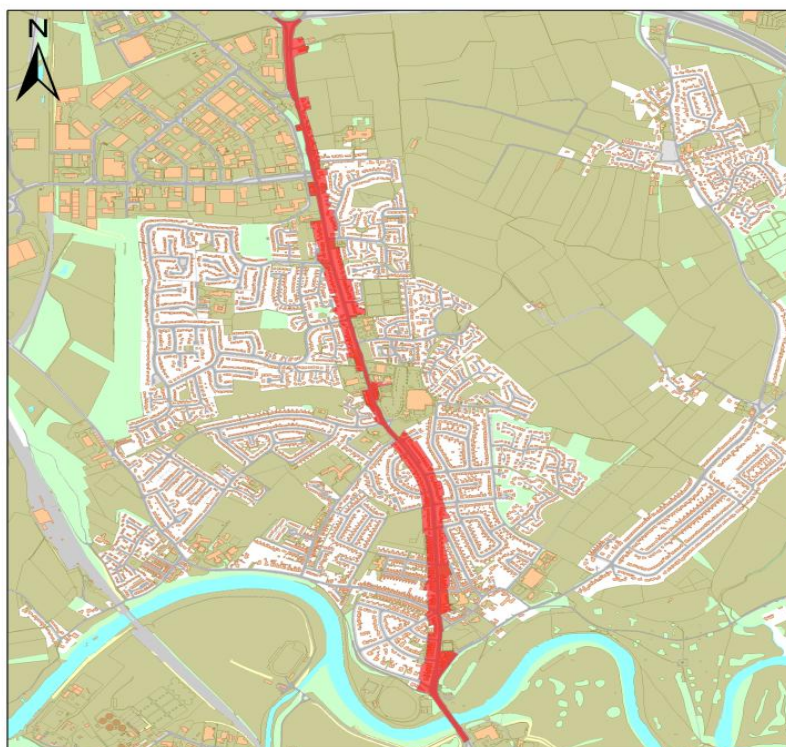
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**Figure 1.2 Maps of individual AQMA Boundaries**

**Air Quality Management Area 1 - A7**

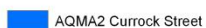


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**Air Quality Management Area 2 - Currock Street.**



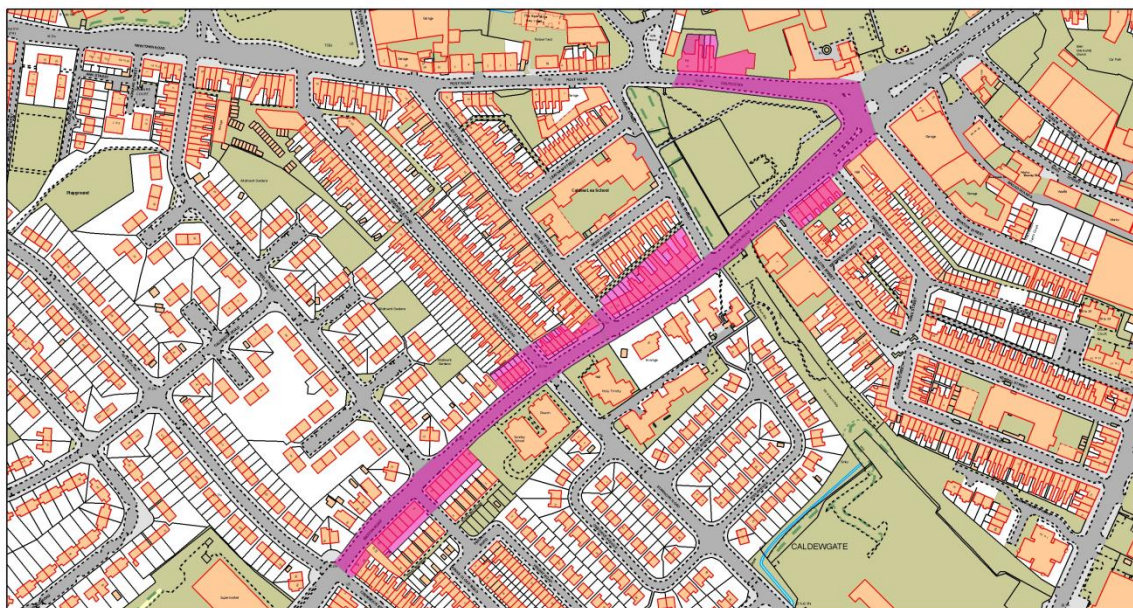
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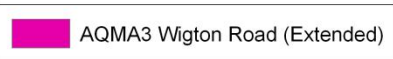
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### AQMA3 Wigton Road (Extended)

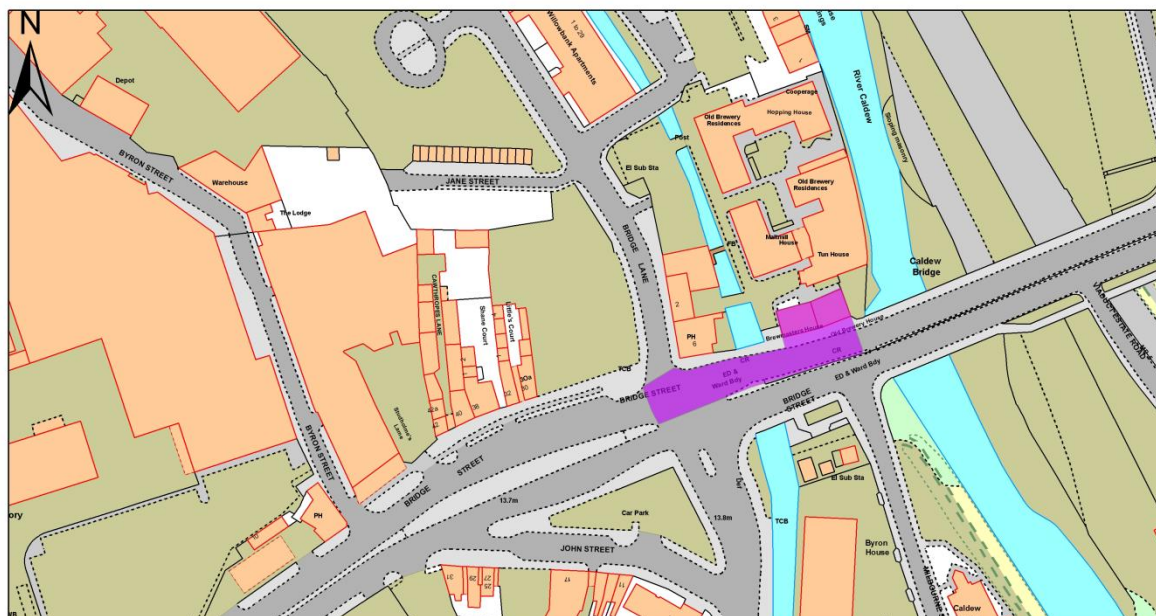


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### Air Quality Management Area 4 - Bridge Street.



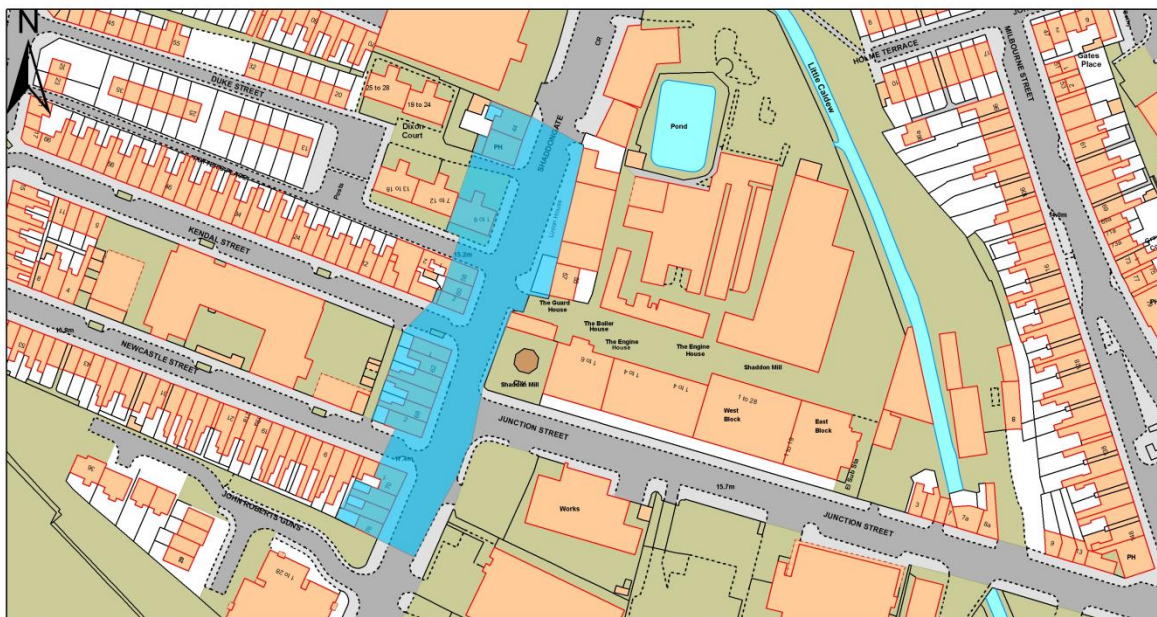
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**Air Quality Management Area 5 - Dalston Road.**



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**Air Quality Management Area 6 - London Road.**



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## 2 New Monitoring Data

### 2.1 Summary of Monitoring Undertaken

Air quality monitoring in Carlisle City Council is driven by the local air quality management process and in particular the review and assessment of air quality. Carlisle City Council currently monitors for 3 pollutants; **nitrogen dioxide**, **particulates** and **benzene** and employs two principle methods of monitoring; diffusion tubes and continuous monitoring.

**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 principle source of nitrogen dioxide within the district is road transport.

**Particulates** are the fraction of suspended airborne particles, these small particles can be breathed into the lungs carrying with them a range of both natural and man made substances.

Particulate Matter 10 or PM<sub>10</sub> is the fraction of particulate matter less than 10µm (Ten micrometres) in aerodynamic diameter. This comes from a wide range of sources known as *primary* i.e. combustion processes such as vehicle exhaust emissions, *secondary* i.e. formed in the atmosphere and *course* i.e. from suspended soils, dust and construction etc. In Carlisle the dominating sources are likely to be:

- Local traffic
- Resuspension of road dust
- Agriculture
- Background PM10 carried from other parts of the UK and continental Europe.

The PM2.5 fraction of particulate matter differs from PM10 only in respect of the size of the particles, these particles are much smaller, less than 2.5µm (2.5 micrometres) in aerodynamic diameter. Carlisle City Council began measuring PM 2.5 at the Paddy's Market monitoring station in March 2009.

**Benzene** is a recognised genotoxic human carcinogen. The main sources of benzene in the UK are petrol engine vehicles, petrol refining and the distribution and uncontrolled emissions from petrol station forecourts without vapour recovery systems.

Whilst the local authority does not have any sources within the area which are likely to exceed the objective levels Carlisle has been monitoring benzene since April 2008. Benzene monitoring is undertaken at the Paddy's Market station using a pumped tube sampler with sorbent tubes containing Carbopack X, as part of the Non Automatic Hydrocarbon Network (NAHN).

## 2.1.1 Automatic Monitoring Sites

There are two continuous monitoring stations in Carlisle. These are located at Paddy's Market and Stanwix Bank.

**Paddy's Market** in Caldewgate has been used as a roadside monitoring site since 2005. As well as benzene, the pollutants measured include oxides of nitrogen using a Chemiluminescent Analyser and particulate matter (PM<sub>10</sub>) using a Tapered Element Oscillating Microbalance (TEOM). In March 2009 an additional TEOM to measure smaller sized particles (PM<sub>2.5</sub>) was installed in Paddy's Market monitoring station by Defra. Both TEOM's have been upgraded to include a Filter Dynamics Measurement System (FDMS) to allow better equivalence to the objective level. The site is now partly funded by Defra.

Since February 2008 the site has been affiliated to the Automatic Urban and Rural Network (AURN) and the network quality assurance and control procedures are implemented. The benzene monitoring forms part of the Non Automatic Hydrocarbons Network (NAHN).

**Stanwix Bank** is a site that has been in operation since the beginning of 2007 and measures nitrogen dioxide with a chemiluminescent analyser. During 2012 the data collected at the site was managed by Casella Monitor on behalf of Carlisle City Council. The data management contract was passed over to Supporting U in April 2013, which is where it remains. Both Cassella and Supporting U have defined quality assurance and quality control systems in place.

The service and maintenance contracts for both NO<sub>x</sub> analysers were passed from Casella to Enviro Technology Services PLC in April 2012, as part of a novation agreement. The contracts for both Stanwix bank and Paddys Market monitoring sites have subsequently ended and were moved to Supporting U in April 2013.

Daily data from both monitoring stations is available to the public on Carlisle City Councils website.

Appendix A contains further details on our automatic monitoring including information on co-location study, quality control and quality assurance measures.

Table 2.1 gives further details of the sites and the following maps show the locations of the automatic monitoring stations.

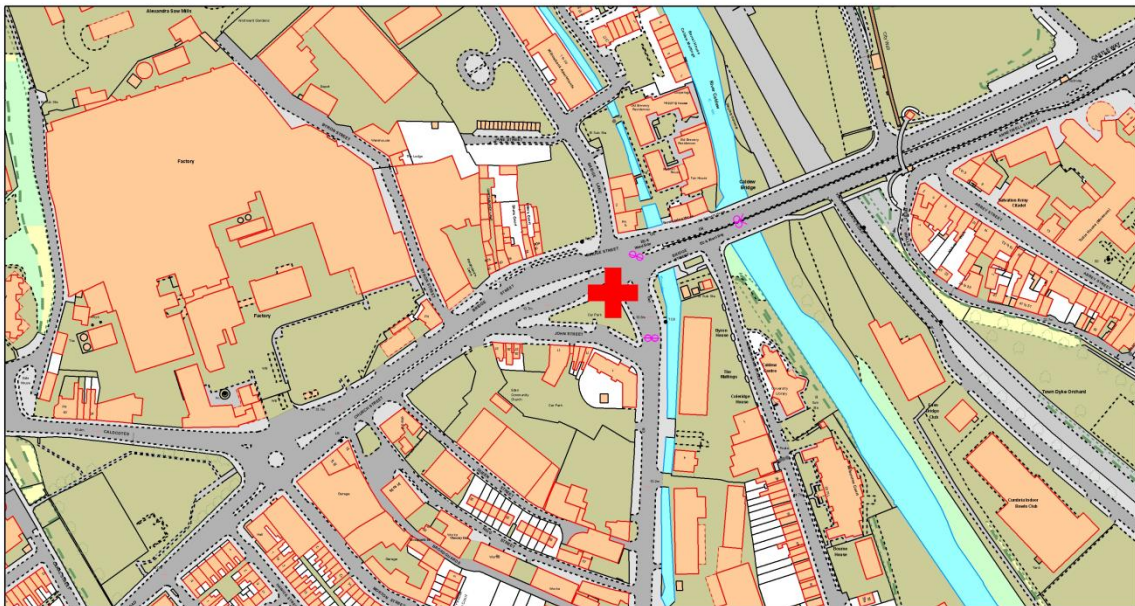
**Table 2.1 Details of Automatic Monitoring Sites**

Site ID	Site Name	Site Type	OS Grid Ref		Inlet Height (m)	Pollutants Monitored	Monitoring Technique	In AQMA ?	Relevant Exposure ?	Distance to kerb of nearest road	Does this location represent worst-case exposure?
			X	Y							
PM 1	Paddy's Market	Road side	339467	555974	3	NO <sub>x</sub> ,	Chemiluminescent analyser,	N	N 42m to relevant exposure	4m	Y
					2.9	PM <sub>10</sub> ,	TEOM FDMS				
					3	PM <sub>2.5</sub>	TEOM FDMS				
SB 1	Stanwix Bank	Road side	340018	557044	2.2	NO <sub>x</sub>	Chemiluminescent analyser.	Y	N 15m to relevant exposure	3m	Y



**Figure 2.1 Maps of Automatic Monitoring Sites**

**Paddys Market Automatic Monitoring Station**



**Scale:** 1:2,500

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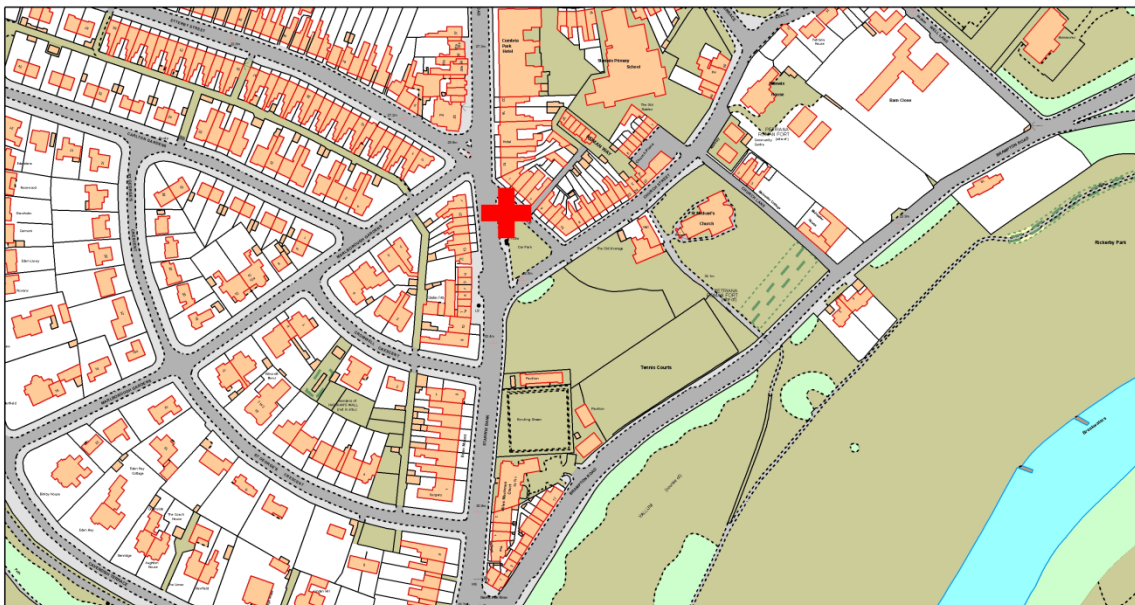


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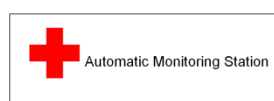
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**Stanwix Bank Automatic Monitoring Station**



**Scale:** 1:2,500

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## **2.1.2 Non-Automatic Monitoring Sites**

### **Benzene**

The council operates a pumped tube benzene sampler as part of the UK Non-Automatic Hydrocarbon Network. The benzene station is located within the Paddy's Market Unit and has been in operation since April 2008. It is entirely funded by Defra.

### **Nitrogen Dioxide**

Carlisle City Council operates an extensive network of Nitrogen Dioxide diffusion tubes across the district. Since February 2009 the council has utilised tubes prepared with 20% Triethanolamine (TEA) in water, prepared and analysed by Gradko Environmental Ltd.

Throughout 2012 the council has obtained a full twelve months of monitoring data from most of the diffusion tube monitoring locations. Some locations have slightly fewer monthly results due to problems with individual tubes such as laboratory issues and dislodging or unauthorised removal of a tube from its mounting.

Monitoring at four new locations on the newly opened Carlisle Northern Development Route began in May 2012. This data required further adjustment in order to estimate the mean pollutant concentration for the whole calendar year as the collected data covered less than 75% of 2012. The methodology and calculations carried out for this data adjustment can be found in appendix A.

Appendix A contains further details on the NO<sub>2</sub> diffusion tube analysis including bias adjustment and Quality control measures.

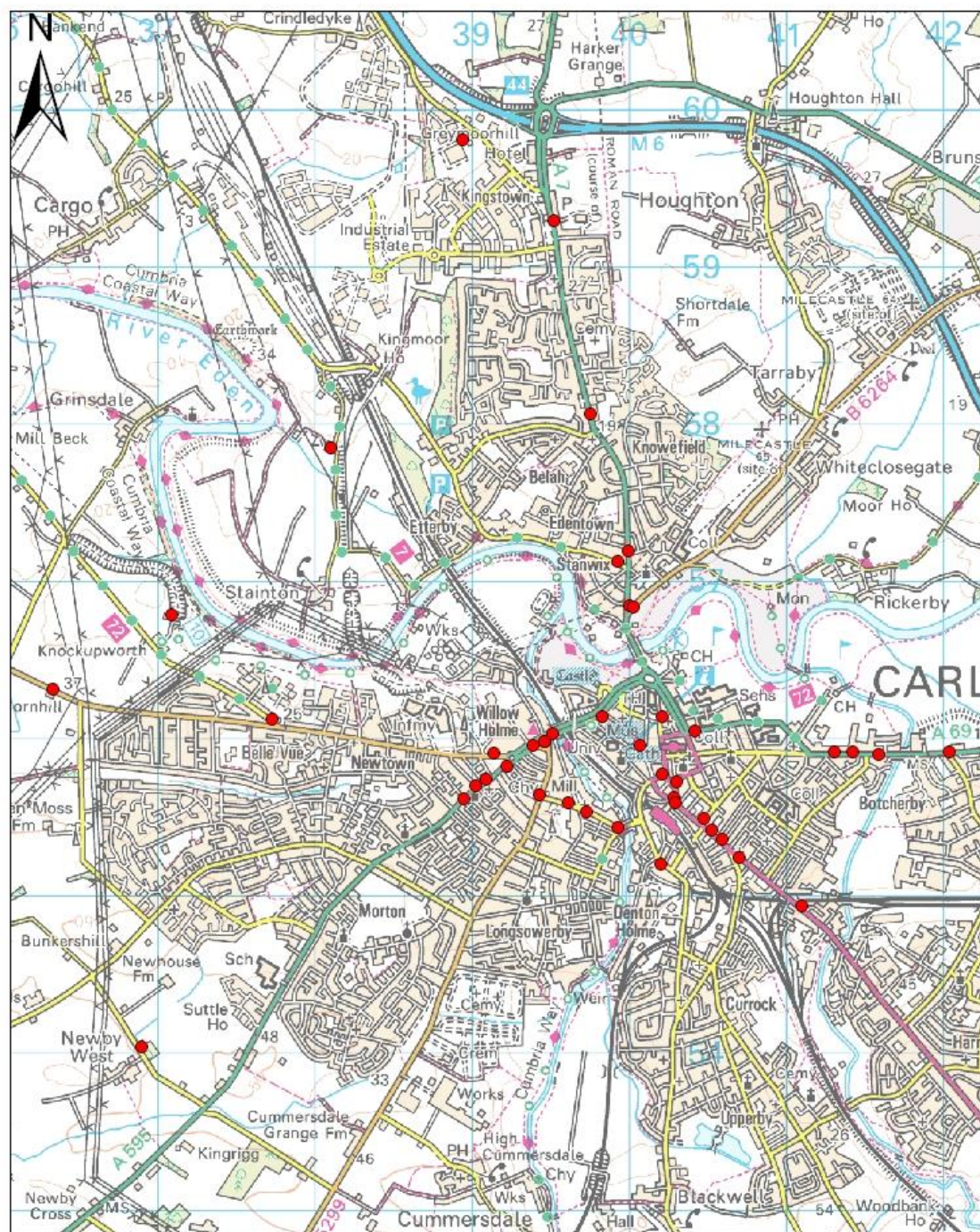
All of the monthly diffusion tube results for 2012 can be found in appendix B. The bias adjusted annual mean data and other calculated results can be found in appendix C.

Further detail relating to each specific monitoring location is provided in Table 2.2.

The majority of the diffusion tube monitoring locations are shown on the following map (Figure 2.2). Accurate close up maps showing more detail of each location within each monitoring area are provided later in this chapter.

**Figure 2.2 Map of Non-Automatic Monitoring Sites**

**NO2 Diffusion Tube Location Map**



● NO2 Diffusion Tube



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**Table 2.2 Details of Non- Automatic Monitoring Sites**

Site ID	Site Name	Site Type	OS Grid Ref		Site Height (m)	Pollutants Monitored	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road	Does this location represent worst-case exposure?
			X	Y							
A1	45 SCOTLAND RD	Roadside	339995	557188	3.05	NO <sub>2</sub>	Y	N	N (4.5)	1.5	Y
A10	STANWIX BANK	Roadside	340008	556842	2.95	NO <sub>2</sub>	Y	N	N (1.5)	1.5	Y
A12	14 ETTERBY ST	Roadside	339935	557125	2.8	NO <sub>2</sub>	N	N	Y	3	Y
A5	37 KINGSTOWN RD	Roadside	339758	558059	2.8	NO <sub>2</sub>	Y	N	Y	4	Y
A7	282 KINGSTOWN RD	Roadside	339526	559285	2.7	NO <sub>2</sub>	Y	N	N (7.5)	4	Y
A9	BRAMPTON RD	Roadside	340028	556833	2.75	NO <sub>2</sub>	Y	N	Y	1.5	Y
B12	DENTON ST	Kerbside	339921	555406	2.65	NO <sub>2</sub>	N	N	N (10)	0.5	Y
B4	DALSTON RD	Roadside	339434	555638	2.8	NO <sub>2</sub>	Y	N	Y	3.5	Y
B5	8 JUNCTION ST	Roadside	339613	555587	2.7	NO <sub>2</sub>	N	N	Y	2.5	Y
B6	41 CHARLOTTE ST	Roadside	339731	555526	2.75	NO <sub>2</sub>	N	N	Y	2.5	Y
B7	12 CURROCK ST	Roadside	340205	555198	3.05	NO <sub>2</sub>	Y	N	Y	3	Y
C1	LOWTHER ST	Roadside	340216	556131	2.85	NO <sub>2</sub>	N	N	Y	3	Y
C2	TOURIST INFO	Urban Centre	340069	555955	2.7	NO <sub>2</sub>	N	N	N	N/A	N
C3	DEVONSHIRE ST	Roadside	340218	555768	2.85	NO <sub>2</sub>	N	N	Y	3	Y
C4	BAR SOLO	Roadside	340286	555622	2.7	NO <sub>2</sub>	N	N	Y	9	Y
C5	GRIFFEN	Roadside	340298	555589	3	NO <sub>2</sub>	N	N	Y	3	Y
D10	368 WARWICK RD	Roadside	342044	555907	2.75	NO <sub>2</sub>	N	N	Y	5	Y
D11	CARTREF	Roadside	340426	556040	2.7	NO <sub>2</sub>	N	N	Y	4.5	Y
D12	POST OFFICE	Kerbside	340307	555718	2.95	NO <sub>2</sub>	N	N	N	5	Y
D5	215 WARWICK RD	Roadside	341310	555914	2.4	NO <sub>2</sub>	N	N	Y	9	Y
D7	282 WARWICK RD	Roadside	341593	555893	2.8	NO <sub>2</sub>	N	N	Y	7	Y
D9	251 WARWICK RD	Roadside	341426	555910	2.7	NO <sub>2</sub>	N	N	Y	8.5	Y

Site ID	Site Name	Site Type	OS Grid Ref		Site Height (m)	Pollutants Monitored	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road	Does this location represent worst-case exposure?
			X	Y							
E22	FINKLE ST	Roadside	339834	556137	2.8	NO <sub>2</sub>	N	N	Y	12	Y
E12	3 WIGTON RD	Roadside	339225	555821	2.95	NO <sub>2</sub>	Y	N	N (2)	2.5	Y
E15	22 WIGTON RD	Roadside	339091	555736	3.9	NO <sub>2</sub>	Y	N	Y	4.5	Y
E16	JOVIAL SAILOR	Roadside	339141	555900	2.7	NO <sub>2</sub>	Y	N	Y	2.5	Y
E19	49 WIGTON RD	Roadside	338953	555610	3.1	NO <sub>2</sub>	Y	N	Y	2.5	Y
E20	44 WIGTON RD	Roadside	339023	555692	2.5	NO <sub>2</sub>	Y	N	Y	5.5	Y
E4	JOHN ST	Roadside	339396	555947	2.75	NO <sub>2</sub>	N	N	N(3)	3	Y
E6	PADDYS MARKET 1	Roadside	339467	555974	3	NO <sub>2</sub>	N	Y	N(42)	9	Y
E6	PADDYS MARKET 2	Roadside	339467	555974	3	NO <sub>2</sub>	N	Y	N(42)	9	Y
E6	PADDYS MARKET 3	Roadside	339467	555974	3	NO <sub>2</sub>	N	Y	N(42)	9	Y
E8	BRIDGE ST	Roadside	339516	556024	3.05	NO <sub>2</sub>	Y	N	Y	4	Y
E21	BURGH RD	Roadside	337730	556118	2.9	NO <sub>2</sub>	N	N	N (8)	3	Y
F1	3 TAIT ST	Roadside	340482	555489	2.7	NO <sub>2</sub>	N	N	Y	3.5	Y
F10	155 BOTCHERGATE	Roadside	349597	555351	2.7	NO <sub>2</sub>	N	N	Y	3	Y
F5	STANLEY HALL	Roadside	340534	555409	2.7	NO <sub>2</sub>	N	N	Y	3	Y
F7	24 LONDON RD	Roadside	340708	555240	2.7	NO <sub>2</sub>	Y	N	Y	4.5	Y
F9	129 LONDON RD	Kerbside	341099	554931	2.95	NO <sub>2</sub>	N	N	Y	0.5	Y
G1	SPA HOUSE	Rural	338109	557841	2.8	NO <sub>2</sub>	N	N	Y	85	Y
G2	KNOCKUPWORTH COTTAGE	Rural	337093	556785	2.9	NO <sub>2</sub>	N	N	Y	22	Y
G3	CORNHILL FARM	Roadside	336338	556311	2.9	NO <sub>2</sub>	N	N	Y	3	Y
G4	THE HOBBIT	Rural	336905	554036	2.85	NO <sub>2</sub>	N	N	Y	19	Y
H1	BRAMPTON	Roadside	352824	561039	2.75	NO <sub>2</sub>	N	N	N (0.5)	2.5	Y
H3	LONGTOWN	Roadside	338052	568478	2.8	NO <sub>2</sub>	N	N	N (0.5)	2.5	Y
H4	WARWICK BRIDGE	Roadside	347411	556881	2.6	NO <sub>2</sub>	N	N	N (0.5)	2.5	Y
H5	WIGTON RD	Roadside	337643	554100	2.4	NO <sub>2</sub>	N	N	Y	1.5	Y
H6	PETER LANE	Roadside	337962	553220	2.4	NO <sub>2</sub>	N	N	Y	4	Y
H7	DALSTON RD	Roadside	338282	553396	2.4	NO <sub>2</sub>	N	N	Y	6.5	Y
H8	AIRPORT	Other	347874	561254	2.4	NO <sub>2</sub>	N	N	Y	2	Y



## 2.2 Comparison of Monitoring Results with Air Quality Objectives

### 2.2.1 Nitrogen Dioxide (NO<sub>2</sub>)

#### Automatic Monitoring Data

All 2012 nitrogen dioxide monitoring data has been ratified by RICARDO-AEA (Paddys Market) and Casella Monitor (Stanwix Bank). Monitoring data was collected throughout 2012 therefore the data capture for the monitoring period is given as the data capture for 2012.

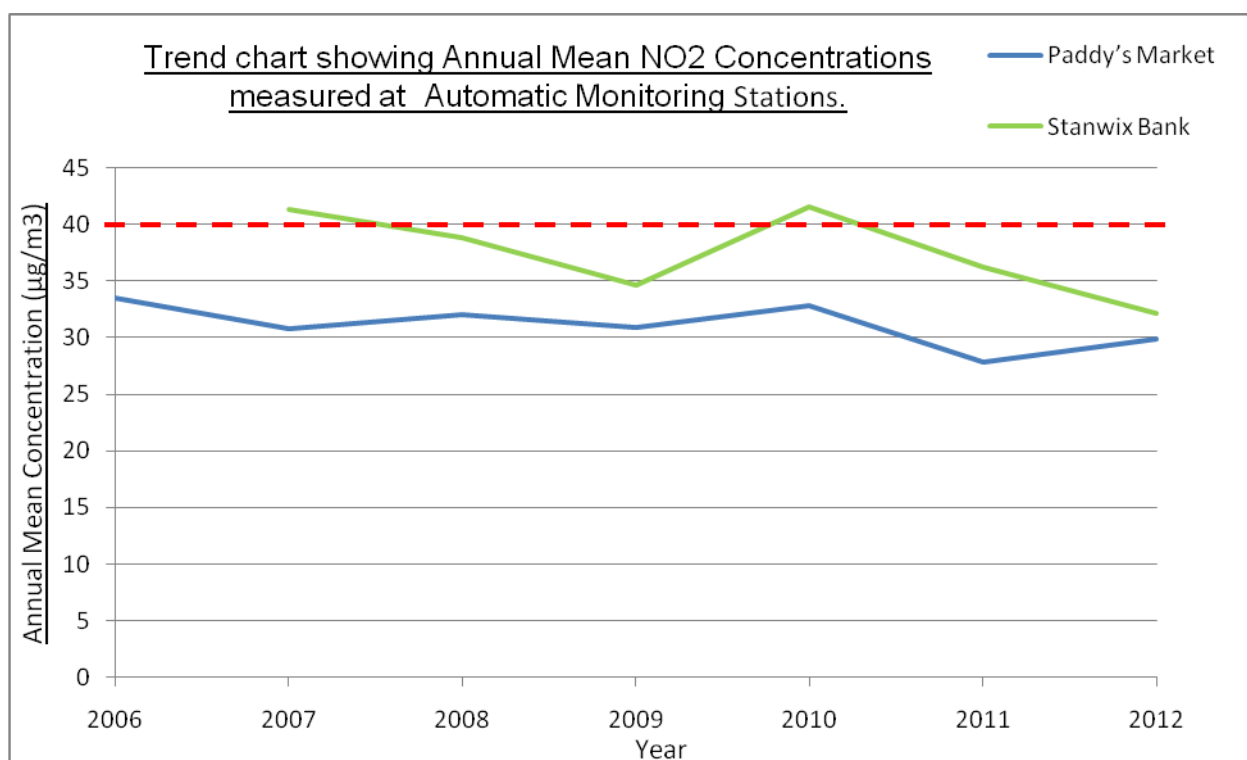
**Table 2.3 Results of Automatic Monitoring of Nitrogen Dioxide: Comparison with Annual Mean Objective**

Data in red indicates results that exceed the annual mean objective of 40 µg/m<sup>3</sup>

Site ID	Site Name	Site Type	Within AQMA?	Valid Data Capture 2012 (%)	Annual Mean Concentration µg/m <sup>3</sup>						
					2006	2007	2008	2009	2010	2011	2012
PM1	Paddy's Market	Road side	N	82	33.5	30.8	32.0	30.85	32.79	27.78	29.9
SB1	Stanwix Bank	Road side	Y	98	-	41.3	38.8	34.6	41.6	36.2	32.2

**Figure 2.3 Trends in Annual Mean Nitrogen Dioxide Concentrations measured at Automatic Monitoring Sites**

..... The dashed red line on the following flow charts is used to indicate the annual mean objective of 40 µg/m<sup>3</sup> or 1 hour mean objective of 200 µg/m<sup>3</sup>



The above trend chart indicates that nitrogen dioxide levels at the Paddys Market roadside unit have remained relatively constant since 2006. During 2012 there has been a slight increase in the annual mean compared to 2011 however it is still marginally less than all other previous years of monitoring.

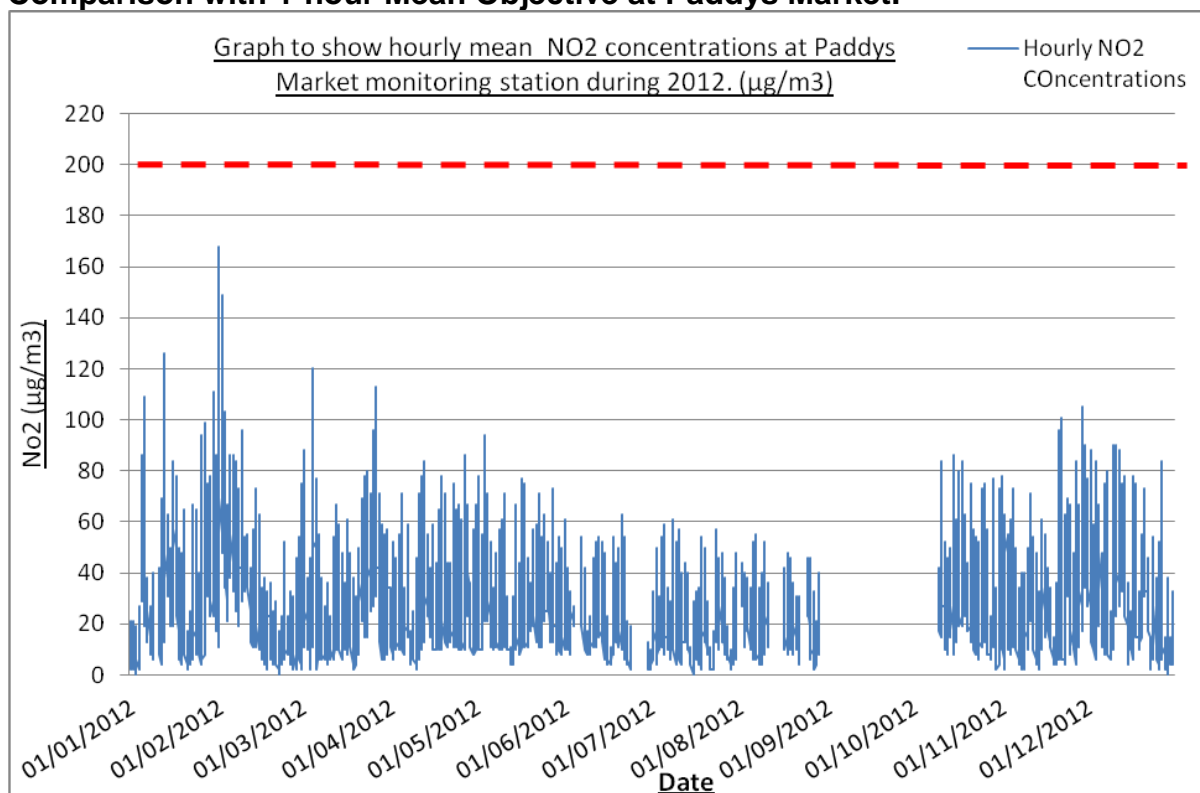
The Stanwix Bank unit has shown a gradual reduction in nitrogen dioxide levels between 2007 and 2009. In 2010 there was a sharp increase which is believed to be due to meteorological conditions. Since 2010 the annual mean has reduced year on year and is now at the lowest since monitoring began.

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

Site ID	Site Name	Site Type	Within AQMA?	Valid Data Capture 2012 (%)	Number of Exceedences of Hourly Mean (200 $\mu\text{g}/\text{m}^3$ )						
					2006	2007	2008	2009	2010	2011	2012
PM1	Paddy's Market	Road side	N	82	0	0	0	0	0	0	0
SB1	Stanwix Bank	Road side	Y	98	0	0	0	0	0	0	0

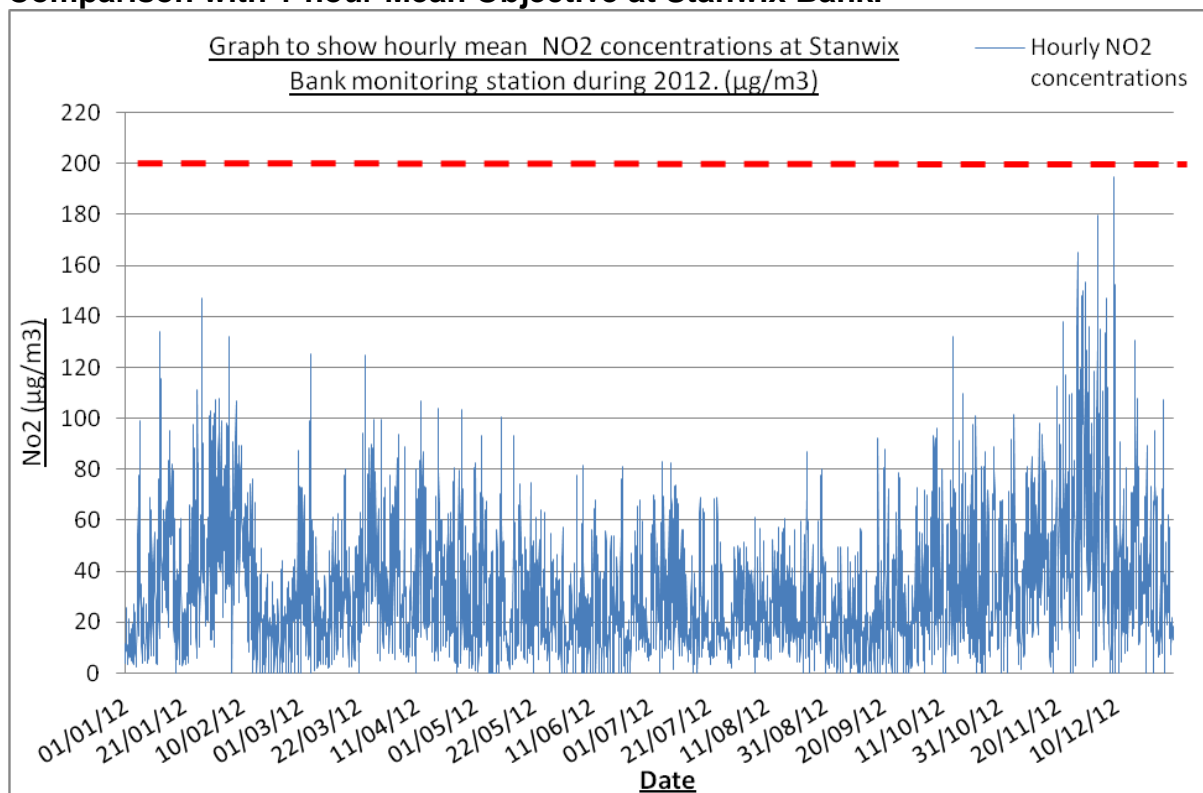
It is clear from the table above that the  $\text{NO}_2$  data capture for Paddys Market was less than 90% during 2012, for this reason it was necessary to calculate the 99.8<sup>th</sup> percentile using the data archive on the Defra (UK Air) website. The 99.8<sup>th</sup> percentile of the hourly measured  $\text{NO}_2$  concentrations was found to be **109 $\mu\text{g}/\text{m}^3$** . A result of over 200 $\mu\text{g}/\text{m}^3$  would indicate that there could potentially be an exceedence of the objective level. This shows that concentrations at Paddys Market are still significantly below the objective levels.

**Figure 2.4 Results of Hourly Automatic Monitoring for Nitrogen Dioxide: Comparison with 1-hour Mean Objective at Paddys Market.**



The graph above shows that there were no recorded exceedences of the 1 hour mean objective for Nitrogen Dioxide during 2012. The highest reading at the Paddys Market site was  $168\mu\text{g}/\text{m}^3$ . This was recorded during a short period of unusually high concentrations on the 1st February 2012.

**Figure 2.5 Results of Hourly Automatic Monitoring for Nitrogen Dioxide: Comparison with 1-hour Mean Objective at Stanwix Bank.**



The data above shows that there were no recorded exceedences of the 1 hour mean objective for Nitrogen Dioxide during 2012. The highest reading at the Stanwix Bank site was  $195\mu\text{g}/\text{m}^3$ . This was recorded on the 10th December 2012 toward the end of a period of high concentrations.

The  $200\mu\text{g}/\text{m}^3$  1 hour mean objective for Nitrogen Dioxide should not be exceeded more than 18 times per year, neither of our continuous monitoring sites showed any exceedence of this objective.

## Diffusion Tube Monitoring Data

The monitoring period for the majority of diffusion tube locations was 12 months. All of these diffusion tube locations obtained more than 9 months of valid data during 2012. The annual mean for each of these monitoring locations has been adjusted using the national bias adjustment factor of 0.97. (See appendix A for details).

The four diffusion tubes located on the new CNDR had a monitoring period of 8 months from May to December. This data required adjustment in order to estimate the mean pollutant concentration for the whole calendar year because the data capture for 2012 was less than 75%. The mean for the monitoring period has been annualised using the methodology given in Box 3.2 of LAQM.TG(09). Further information on the method and calculations carried out for this data adjustment can be found in appendix A.

In some cases it is not possible to carry out monitoring directly at a point of public exposure such as the facade of a house or office, in these cases monitoring was undertaken at the nearest feasible location such as nearby lamp post. In these cases it has been necessary to distance correct the data in order to predict the NO<sub>2</sub> concentration at the nearest receptor using the methodology given in Box 2.3 of LAQM.TG(09). The locations where this calculation has been applied are identified below in table 2.5.

**Table 2.5 Results of Nitrogen Dioxide Diffusion Tubes in 2012**

In the table below data shown in **BLUE** has been annualised.

Data shown in **RED** indicates a result which has exceeded the annual mean objective of 40µg/m<sup>3</sup>.

Site ID	Location	Site Type	Within AQMA (Y/N)	Triplicate / Co-located Tube	Data Capture for 2012 (%)	Has data been distance corrected (Y/N)	Annual mean concentration 2012 (µg/m <sup>3</sup> ) (Bias Adjustment factor = 0.97)
A1	45 SCOTLAND RD	Roadside	✓	N	100	Y	31.8
A10	STANWIX BANK	Roadside	✓	N	100	Y	41.5
A12	14 ETTERBY ST	Roadside	x	N	100	N	22.33
A5	37 KINGSTOWN RD	Roadside	✓	N	100	N	34.81
A7	282 KINGSTOWN RD	Roadside	✓	N	92	Y	23.4
A9	BRAMPTON RD	Roadside	✓	N	100	N	42.89
B12	DENTON ST	Kerbside	x	N	92	Y	31.3
B4	DALSTON RD	Roadside	✓	N	100	N	53.73
B5	8 JUNCTION ST	Roadside	x	N	92	N	31.51
B6	41 CHARLOTTE ST	Roadside	x	N	92	N	34.90
B7	12 CURROCK ST	Roadside	✓	N	92	N	39.78
C1	LOWTHER ST	Roadside	x	N	100	N	42.55
C2	TOURIST INFO	Urban Centre	x	N	100	N	18.53
C3	DEVONSHIRE ST	Roadside	x	N	100	N	39.03
C4	BAR SOLO	Roadside	x	N	100	N	36.20
C5	GRIFFIN	Roadside	x	N	100	N	39.72



Site ID	Location	Site Type	Within AQMA (Y/N)	Triplicate / Co-located Tube	Data Capture for 2012 (%)	Has data been distance corrected (Y/N)	Annual mean concentration 2012 ( $\mu\text{g}/\text{m}^3$ ) (Bias Adjustment factor = 0.97)
D10	368 WARWICK RD	Roadside	x	N	100	N	32.84
D11	CARTREF	Roadside	x	N	100	N	34.44
D12	POST OFFICE	Kerbside	x	N	92	N	41.56
D5	215 WARWICK RD	Roadside	x	N	100	N	25.48
D7	282 WARWICK RD	Roadside	x	N	100	N	36.83
D9	251 WARWICK RD	Roadside	x	N	100	N	29.82
E22	FINKLE ST	Roadside	x	N	100	N	36.40
E12	3 WIGTON RD	Roadside	✓	N	100	Y	39.6
E15	22 WIGTON RD	Roadside	✓	N	100	N	35.75
E16	JOVIAL SAILOR	Roadside	✓	N	92	N	37.62
E19	49 WIGTON RD	Roadside	✓	N	92	N	42.47
E20	44 WIGTON RD	Roadside	✓	N	92	N	36.33
E4	JOHN ST	Roadside	x	N	92	Y	35.7
E6	PADDYS MARKET 1	Roadside	x	Triplicate & Co-located	100	N	30.60
E6	PADDYS MARKET 2	Roadside	x	Triplicate & Co-located	100	N	29.66
E6	PADDYS MARKET 3	Roadside	x	Triplicate & Co-located	100	N	30.61
E8	BRIDGE ST	Roadside	✓	N	100	N	47.02
E21	BURGH RD	Roadside	x	N	100	Y	16.7
F1	3 TAIT ST	Roadside	x	N	92	N	33.77
F10	155 BOTCHERGATE	Roadside	x	N	100	N	35.98
F5	STANLEY HALL	Roadside	x	N	83	N	34.49
F7	24 LONDON RD	Roadside	✓	N	100	N	42.28
F9	129 LONDON RD	Kerbside	x	N	100	N	35.09
G1	SPA HOUSE	Rural	x	N	67	N	13.2
G2	KNOCKUPWORTH COTTAGE	Rural	x	N	58	N	12.0
G3	CORNHILL FARM	Roadside	x	N	67	N	11.2
G4	THE HOBBIT	Rural	x	N	67	N	15.2
H1	BRAMPTON	Roadside	x	N	100	Y	19.3
H3	LONGTOWN	Roadside	x	N	100	Y	23.2
H4	WARWICK BRIDGE	Roadside	x	N	100	Y	32.0
H5	WIGTON RD	Roadside	x	N	100	N	20.54
H6	PETER LANE	Roadside	x	N	100	N	12.58
H7	DALSTON RD	Roadside	x	N	100	N	17.81
H8	AIRPORT	Other	x	N	83	N	9.72

The table above shows that some of the annual mean concentrations for nitrogen dioxide have exceeded the  $40\mu\text{g}/\text{m}^3$  objective level for 2012, these results will be discussed later in this section. The data shows that none of the annual means exceeded  $60\mu\text{g}/\text{m}^3$ . An annual mean level of  $60\mu\text{g}/\text{m}^3$  is the equivalent indicator level for the likelihood of exceedence of the hourly mean objective of  $200\mu\text{g}/\text{m}^3$ . All of the results are below  $60\mu\text{g}/\text{m}^3$  so it can therefore be concluded that there has been no indication of any exceedence of the hourly mean objective at any location.

## Trends in Annual Mean Nitrogen Dioxide Concentration Measured at Diffusion Tube Monitoring Sites.

The diffusion tube locations are divided into geographical areas of the city, including areas A, B, C, D, E, F, G and H. The following section looks at each of these areas individually. For each area there is a map showing each monitoring location, a table showing all previous annual mean NO<sub>2</sub> concentrations and a trend chart displaying this data. Results in (brackets) indicate the distance corrected annual mean for the 10 locations that are not relevant to public exposure. In these cases the associated trend charts show the bias adjusted annual mean results from the actual location, not the nearest receptor, as this is a more conservative figure.

### Area A – A7 Stanwix Bank, Scotland Rd and Kingstown Rd (AQMA No1)

Figure 2.6 Map of diffusion tube locations in area A.

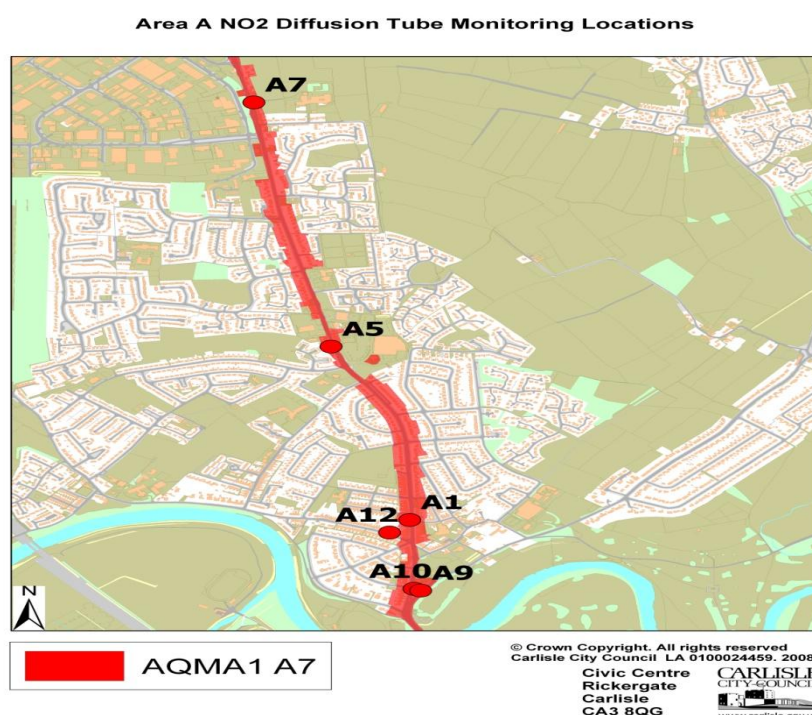
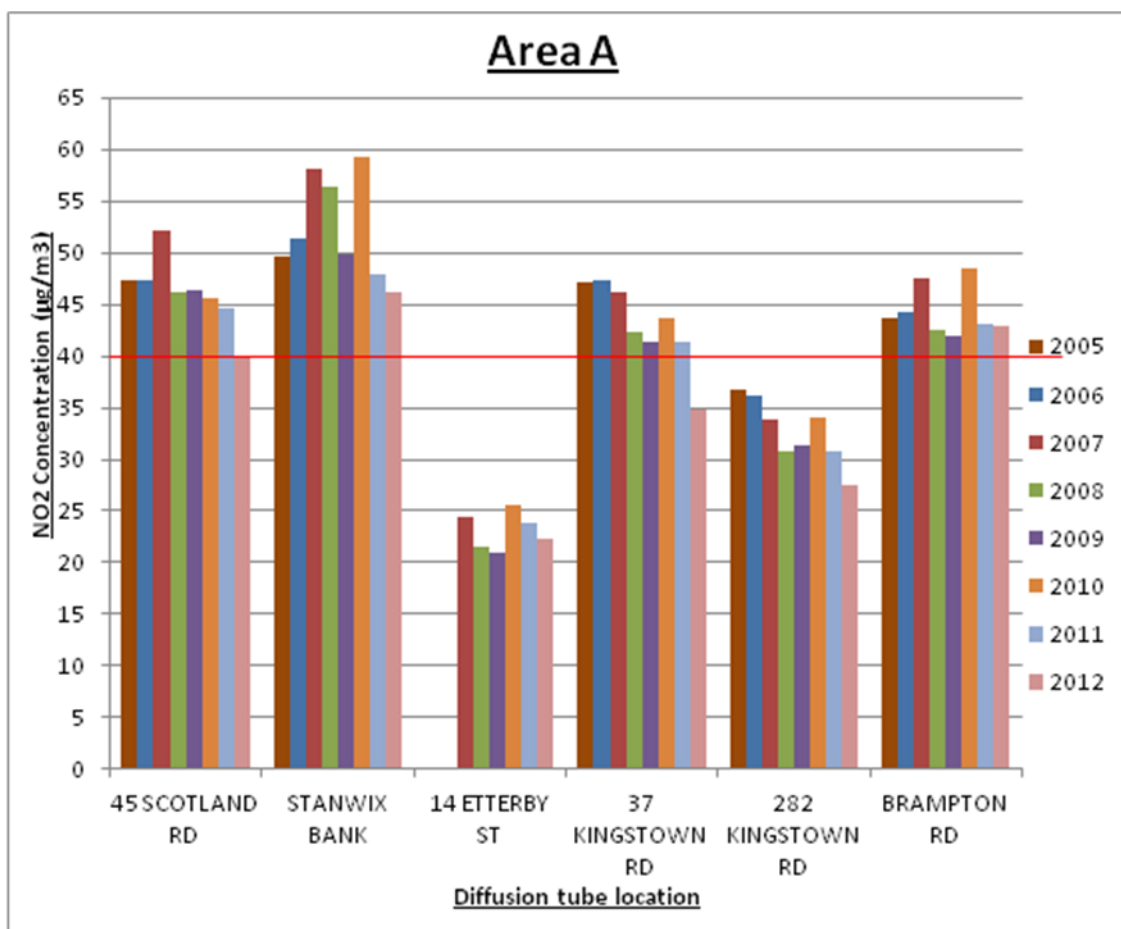


Table 2.5a NO<sub>2</sub> diffusion tube results at monitoring locations in area A.

SITE ID	LOCATION	Site Type	WITHIN AQMA?	ANNUAL MEAN CONCENTRATIONS ADJUSTED FOR BIAS (µg/m <sup>3</sup> )							
				2005 (0.81)	2006 (0.87)	2007 (0.89)	2008 (0.82)	2009 (0.86)	2010 (0.92)	2011 (0.89)	2012 (0.97)
A1	45 SCOTLAND RD	Road side	✓	47.4	47.3	52.1	46.1 (43.4)	46.3 (35.8)	45.7 (35.6)	44.6 (34.6)	39.8 (31.8)
A10	STANWIX BANK	Road side	✓	49.7	51.4	58.1	56.4	49.9 (44.8)	59.2 (52.5)	48 (42.9)	46.1 (41.5)
A12	14 ETTERBY ST	Road side	x	-	-	24.5	21.6	21.0	25.5	23.8	22.3
A5	37 KINGSTOWN RD	Road side	✓	47.2	47.3	46.1	42.4	41.4	43.6	41.3	34.8
A7	282 KINGSTOWN RD	Road side	✓	36.7	36.2	33.8	30.7 (28.3)	31.4 (26.4)	34.1 (27.1)	30.7 (25.4)	27.5 (23.4)
A9	BRAMPTON RD	Road side	✓	43.7	44.2	47.5	42.6	41.9	48.5	43.0	42.9

**Figure 2.7 Chart showing NO<sub>2</sub> diffusion tube trends at monitoring locations in area A**



Results indicate that there are two locations within AQMA (No1) that remain above the NO<sub>2</sub> annual mean objective level. Location A1 has dropped just below the objective level for the first time since monitoring began and has become a borderline result. For these reasons there is no proposal to amend AQMA 1 at this stage.

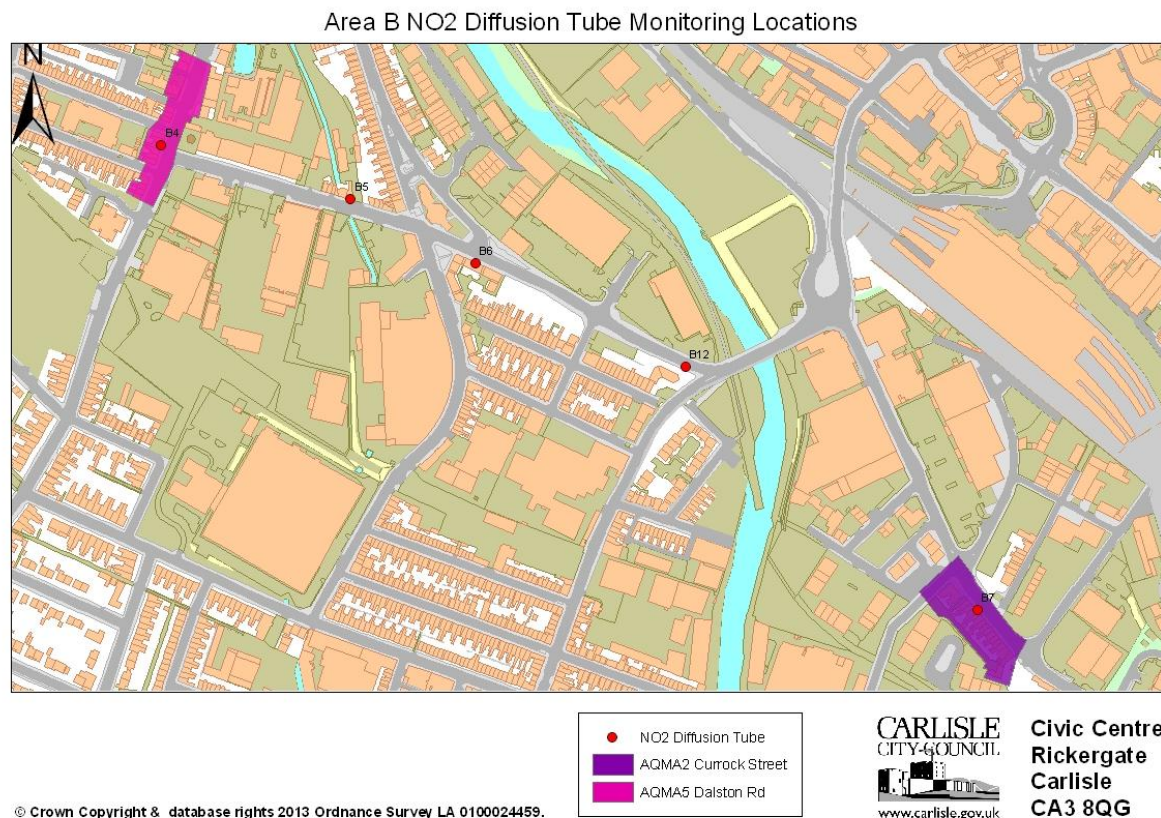
Results from the diffusion tubes show that the annual mean concentrations have decreased year on year at every location over the last three years since 2010. Results from the continuous analyser on Stanwix Bank support this overall decrease in NO<sub>2</sub> annual mean concentrations during 2012.

The opening of the CNDR in February 2012 was expected to bring a sustained reduction in traffic flows along this particular main route. It would appear that over the first year traffic volumes have reduced and there is a significant reduction in the NO<sub>2</sub> annual mean at a number of locations in this area. The traffic data will continue to be monitored and reported upon in the next Progress Report in April 2014.

Results indicate that there are no locations within this area that are likely to have exceeded the 1 hour mean objective level for nitrogen dioxide. This is also supported by results from the automatic monitoring site in this area.

**Area B – Currock St, Victoria Viaduct, Charlotte St, Junction St and Dalston Rd**  
**(Includes AQMA No.2 and No.5)**

**Figure 2.8 Map of diffusion tube locations in area B**

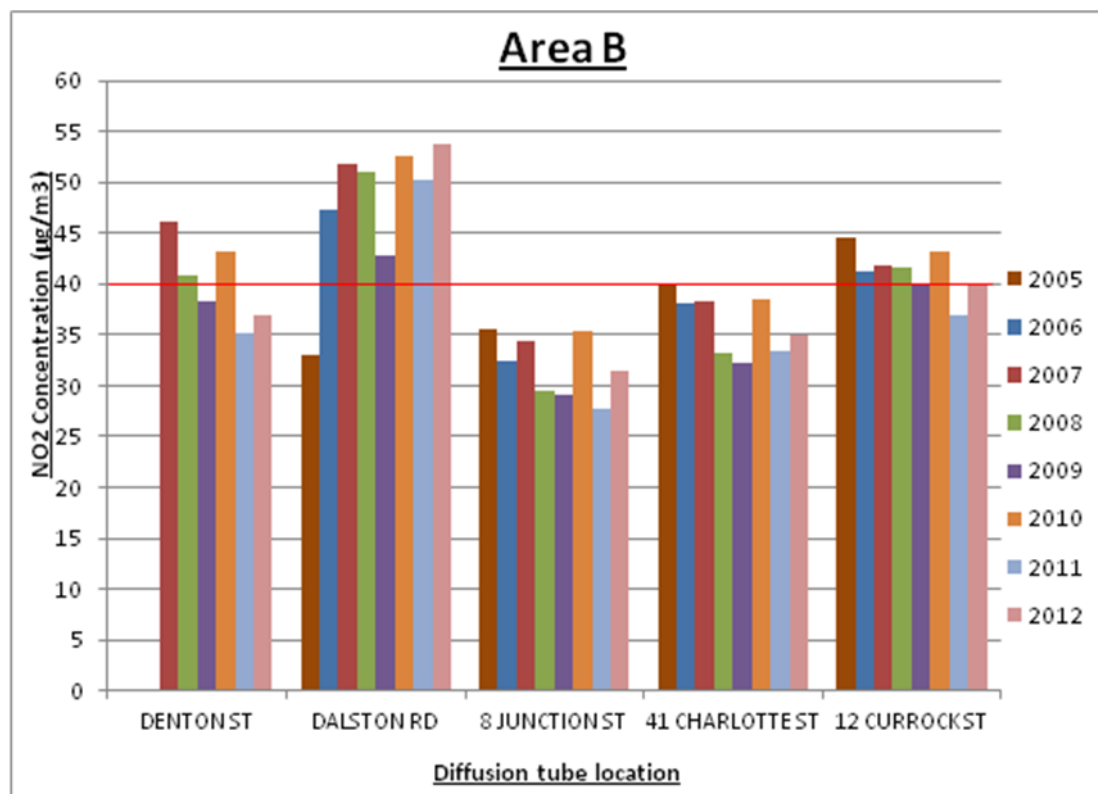


**Table 2.5b NO<sub>2</sub> diffusion tube results at monitoring locations in area B.**

SITE ID	LOCATION	Site Type	WITHIN AQMA?	ANNUAL MEAN CONCENTRATIONS ADJUSTED FOR BIAS (µg/m <sup>3</sup> )							
				2005 (0.81)	2006 (0.87)	2007 (0.89)	2008 (0.82)	2009 (0.86)	2010 (0.92)	2011 (0.89)	2012 (0.97)
B12	DENTON ST	Kerb Side	x	-	-	46.1	40.9 (25.9)	38.3 (35.0)	43.2 (33.6)	35.2 (29.5)	36.9 (31.3)
B4	DALSTON RD	Road side	✓	33.0	47.2	51.7	51	42.8	52.6	50.2	53.7
B5	8 JUNCTION ST	Road side	x	35.6	32.5	34.3	29.4	29.1	35.4	27.6	31.5
B6	41 CHARLOTTE ST	Road side	x	39.8	38.1	38.3	33.2	32.3	38.6	33.5	34.9
B7	12 CURROCK ST	Road side	✓	44.6	41.2	41.9	41.6	39.8	43.3	36.9	39.8



**Figure 2.9 Chart showing NO<sub>2</sub> diffusion tube trends at monitoring locations in area B**

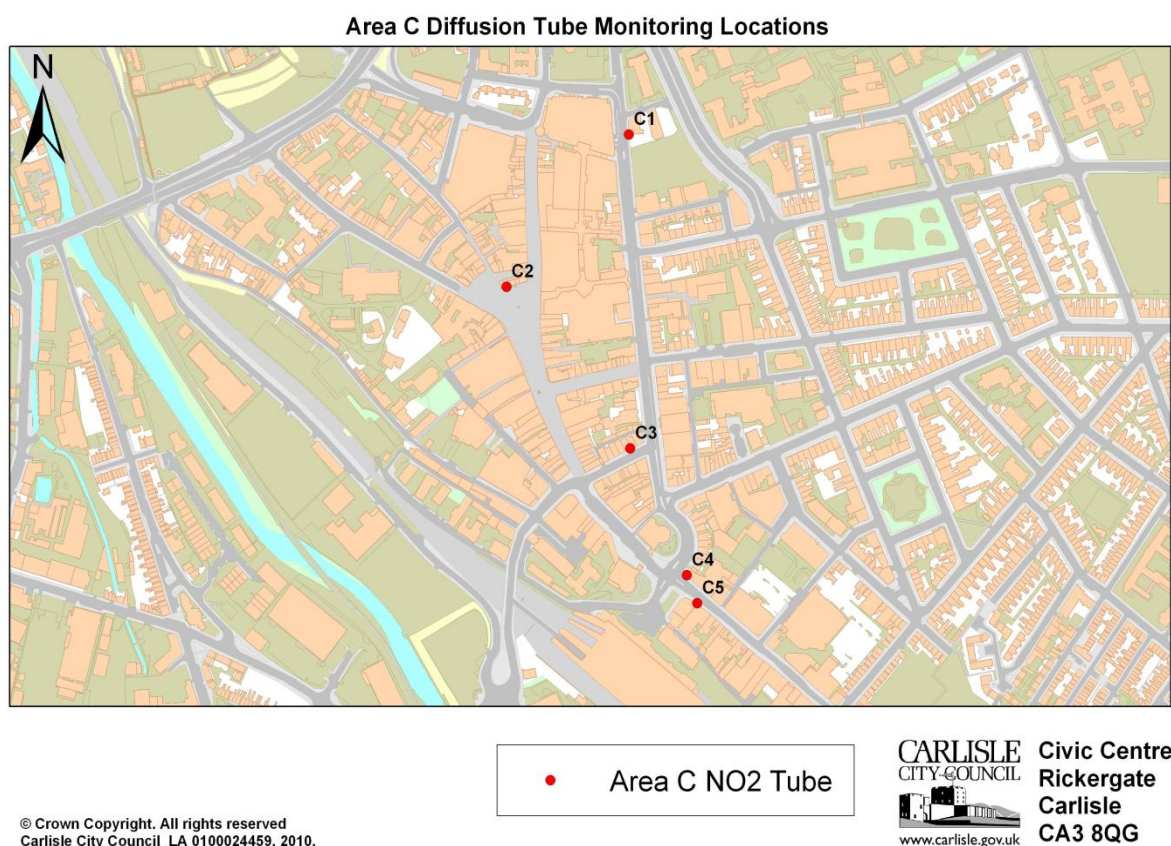


Results from these diffusion tubes show that NO<sub>2</sub> concentrations at all locations along this main traffic route have increased from the previous year however the majority of locations remain below the objective level.

Location B4 (Dalston Road) remains above the objective and is located within AQMA 5. It is likely that this overall increase across the area was due to major road improvement works associated with the nearby Sainsbury's development and the newly built Shaddongate Resource Centre. Construction work led to major traffic disruption and increased HGV movements between March and October 2012.

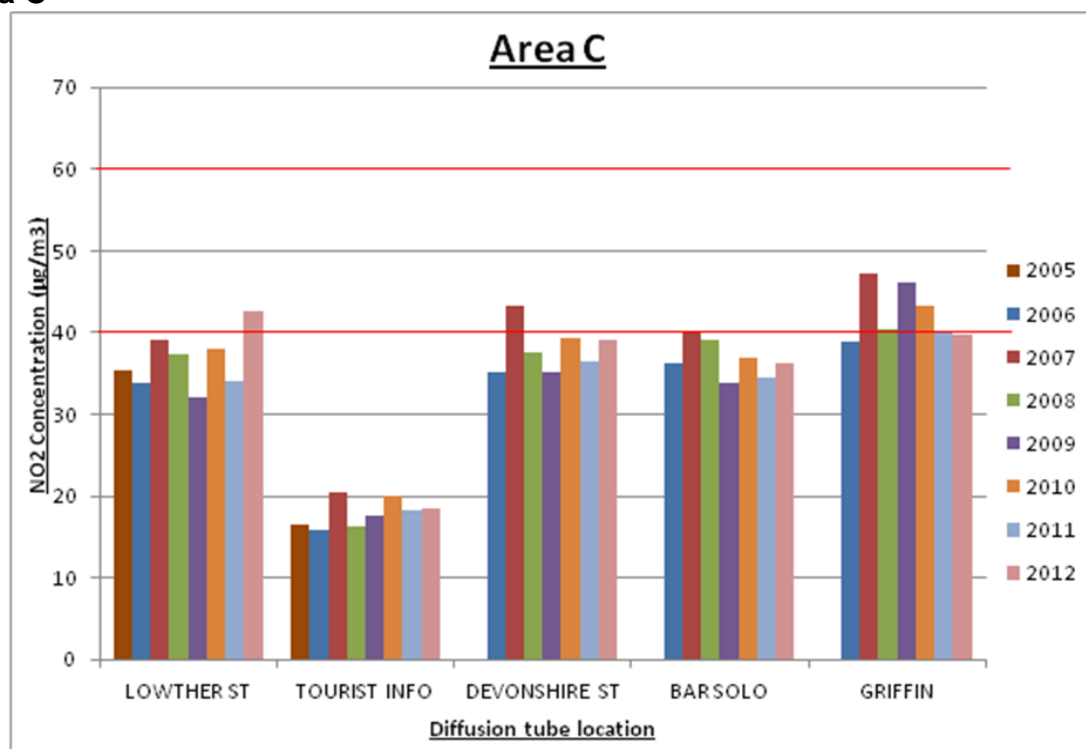
Location B7 (Currock St) (AQMA No.2) dropped below the objective level in 2011 for the second time, this has increased slightly in 2012 to a borderline result. Carlisle City Council has worked with Cumbria County Council to develop a new revised Action Plan. This aims to reduce nitrogen dioxide levels along Dalston Rd (AQMA No5) and Currock Street (AQMA No.2). The final Action Plan was approved by Carlisle City Council's Executive Committee in July 2012.

Results indicate that there are no locations within this area that are likely to have exceeded the 1 hour mean objective level for nitrogen dioxide.

**Area C – City Centre Locations****Figure 2.10 Map of diffusion tube locations in area C****Table 2.5c NO<sub>2</sub> diffusion tube results at monitoring locations in area C.**

SITE ID	LOCATION	Site Type	WITHIN AQMA?	ANNUAL MEAN CONCENTRATIONS ADJUSTED FOR BIAS (µg/m <sup>3</sup> )							
				2005 (0.81)	2006 (0.87)	2007 (0.89)	2008 (0.82)	2009 (0.86)	2010 (0.92)	2011 (0.89)	2012 (0.97)
C1	LOWTHER ST	Road side	x	35.3	33.9	39.1	37.3	32.1	38.1	34.1	42.6
C2	TOURIST INFO	Urban Centre	x	16.5	15.9	20.5	16.2	17.6	19.9	18.2	18.5
C3	DEVONSHIRE ST	Road side	x	-	35.1	43.2	37.6	35.2	39.4	36.5	39.0
C4	BAR SOLO	Road side	x	-	36.2	40.2	39.1	33.8	37.0	34.6	36.2
C5	GRIFFEN	Road side	x	-	39	47.3	40.5	46.2	43.3	40.0	39.7

**Figure 2.11 Chart showing NO<sub>2</sub> diffusion tube trends at monitoring locations in area C**

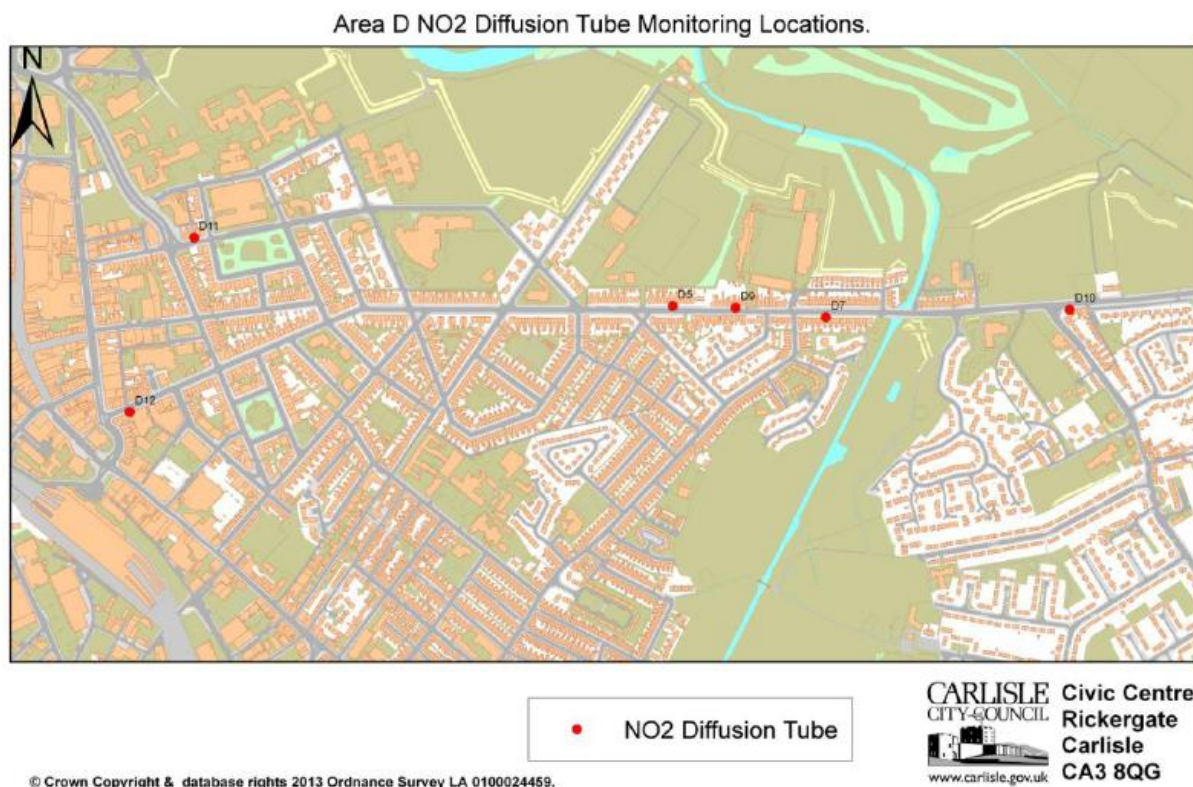


Results from these diffusion tubes show that, despite a slight overall increase in NO<sub>2</sub> concentrations at the majority of these main city centre locations, most still remain below the objective level.

Location C1 is a hostel on Lowther Street with residential bedsits on the first and second floors, it is the only residential location in this area. For this reason it is the only result that should be compared to the annual mean objective of 40 µg/m<sup>3</sup>. The data shows that this location has exceeded this objective for the first time. It seems certain that the increase is due to the previously discussed major road works associated with the nearby Sainsbury's on Bridge Street. Road narrowing and restrictions led to a greatly increased volume of traffic being diverted onto Lowther Street from March to October 2012. The development and road improvements are now complete and as a result there has been a noticeable reduction in traffic volume and standing traffic at location C1. For this reason it is not proposed to proceed to a detailed assessment at this location due to the temporary nature of the increase. That said, 2013 monitoring data will be closely examined and any sustained results above the objective will require further investigation and a possible implementation of a new AQMA. The outcome will be discussed in detail in Progress Report 2014.

Results from locations C2 – C5 should only be compared to the 1 hour mean objective level for nitrogen dioxide which is equivalent to an annual mean of 60 µg/m<sup>3</sup>. This is due to the likelihood of people spending longer periods of time in these areas, for example, shopping, drinking and dining outdoors. This covers the main shopping and outdoor cafe areas within the centre of Carlisle which are located near busy roads. All are considerably below the hourly objective level therefore there is no need to proceed to a 'Detailed Assessment'.

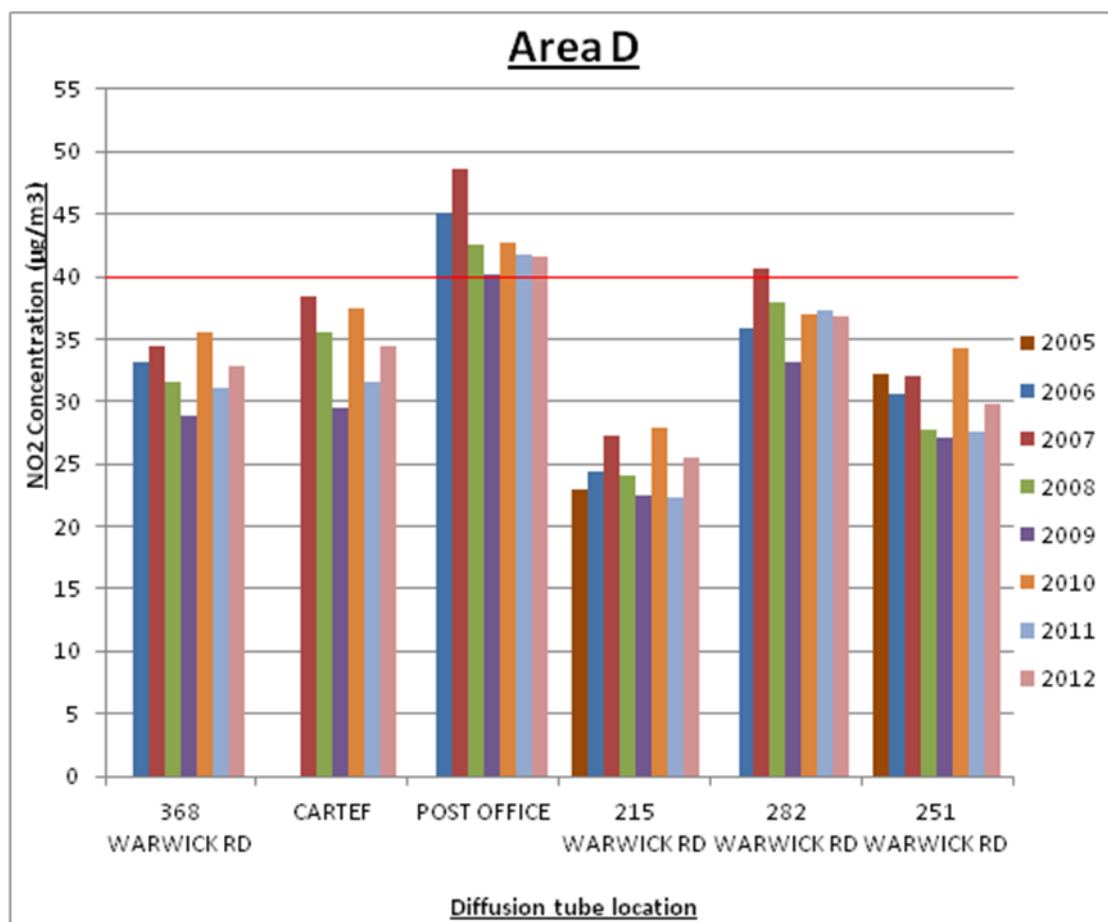
Tube C2 is located in a pedestrian precinct in the heart of the city centre. The area is a pedestrianised shopping precinct and represents an urban centre location. It has consistently shown no indication of exceeding the hourly objective.

**Area D A69 – Warwick Rd****Figure 2.12 Map of diffusion tube locations in area D.****Table 2.5d NO<sub>2</sub> diffusion tube results at monitoring locations in area D.**

SITE ID	LOCATION	Site Type	WITHIN AQMA?	ANNUAL MEAN CONCENTRATIONS ADJUSTED FOR BIAS (µg/m <sup>3</sup> )							
				2005 (0.81)	2006 (0.87)	2007 (0.89)	2008 (0.82)	2009 (0.86)	2010 (0.92)	2011 (0.89)	2012 (0.97)
D10	368 WARWICK RD	Road side	x	-	33.2	34.5	31.6	28.9	35.5	31.1	32.8
D11	CARTEF	Road side	x	-	-	38.4	35.6	29.4	37.4	31.5	34.4
D12	POST OFFICE	Kerb Side	x	-	45.1	48.7	42.6	40.1	42.8	41.7	41.6
D5	215 WARWICK RD	Road side	x	23.0	24.4	27.2	24.1	22.5	28.0	22.3	25.5
D7	282 WARWICK RD	Road side	x	-	35.8	40.7	37.9	33.1	37.1	37.3	36.8
D9	251 WARWICK RD	Road side	x	32.2	30.6	32.1	27.7	27.1	34.4	27.6	29.8



**Figure 2.13 Chart showing NO<sub>2</sub> diffusion tube trends at monitoring locations in area D**



The nitrogen dioxide levels in this area have slightly increased at some locations compared to 2011 but all locations are quite consistent when compared to previous years of data.

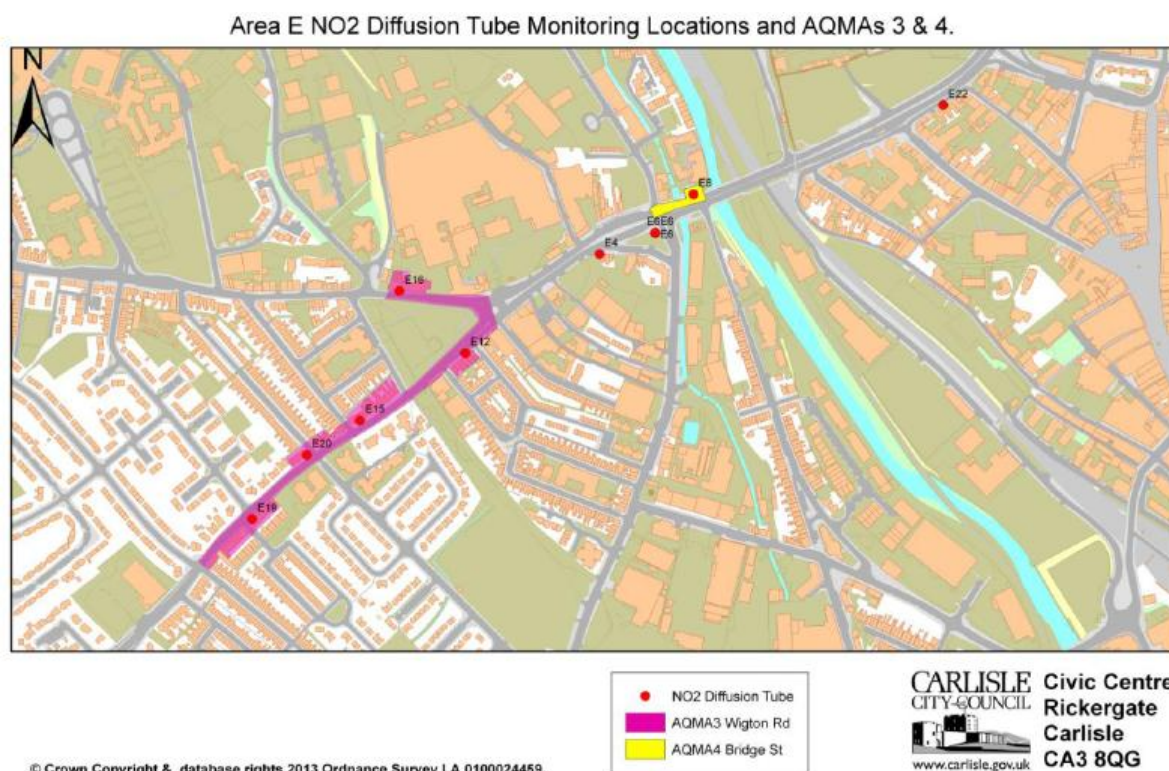
Most locations in this area still show annual mean concentrations that are considerably below the objective level. The location with the highest annual mean is D12 (Post Office). This is not a 'relevant location' in that it is not located on or near a residential property, although it is a location where people may spend an hour or more outdoors. For this reason, it should only be compared to the 1 hour mean objective level for nitrogen dioxide ( $60\mu\text{g}/\text{m}^3$ ). This location has consistently shown no indication of exceeding the hourly objective.

Tube D7 is located in a residential area and despite showing a slight decrease on the 2011 annual mean this is still considered to be a borderline result. This location will continue to be monitored and reported upon in Progress Report 2014.

Results indicate that there are no locations within this area that are at risk of exceeding the objective levels for nitrogen dioxide and there is therefore no need to proceed to a 'Detailed Assessment'.

**Area E - A595 Caldewgate, Wigton Rd and Newtown Rd ( includes AQMA No3 and AQMA No4)**

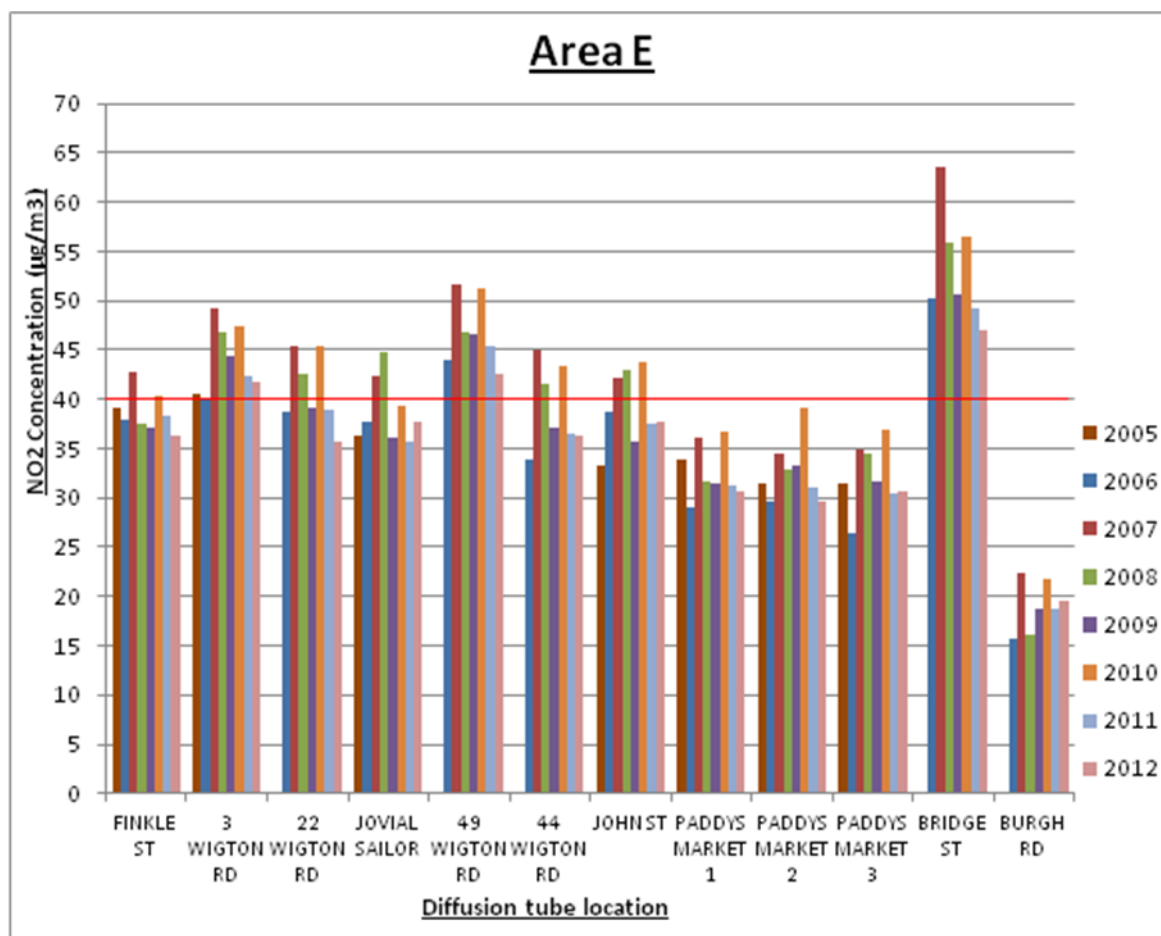
**Figure 2.14 Map of diffusion tube locations in area E.**



**Table 2.5e NO<sub>2</sub> diffusion tube results at monitoring locations in area E.**

SITE ID	LOCATION	Site Type	WITHIN AQMA?	ANNUAL MEAN CONCENTRATIONS ADJUSTED FOR BIAS (µg/m <sup>3</sup> )							
				2005 (0.81)	2006 (0.87)	2007 (0.89)	2008 (0.82)	2009 (0.86)	2010 (0.92)	2011 (0.89)	2012 (0.97)
E22	FINKLE ST	Road side	x	39.1	37.9	42.7	37.6	37.1	40.4	38.4	36.4
E12	3 WIGTON RD	Road side	✓	40.5	40.1	49.3	46.9 (41.5)	44.4 (41.8)	47.4 (44.2)	42.4 (39.9)	41.8 (39.6)
E15	22 WIGTON RD	Road side	✓	-	38.8	45.3	42.5	39.1	45.5	38.9	35.8
E16	JOVIAL SAILOR	Road side	✓	36.3	37.8	42.3	44.7	36.0	39.3	35.7	37.6
E19	49 WIGTON RD	Road side	✓	-	43.9	51.7	46.9	46.7	51.2	45.4	42.5
E20	44 WIGTON RD	Road side	✓	-	33.8	44.9	41.6	37.1	43.4	36.5	36.3
E4	JOHN ST	Road side	x	33.3	38.8	42.2	42.9 (37.8)	35.7 (34.1)	43.7 (40.4)	37.5 (35.2)	37.7 (35.7)
E6	PADDYS MARKET 1	Road side	x	33.9	29	36.1	31.6	31.5	36.8	31.2	30.6
E6	PADDYS MARKET 2	Road side	x	31.4	29.6	34.4	32.8	33.3	39.2	31.1	29.7
E6	PADDYS MARKET 3	Road side	x	31.4	26.5	34.8	34.5	31.6	36.9	30.5	30.6
E8	BRIDGE ST	Road side	✓	-	50.3	63.6	55.8	50.6	56.6	49.2	47.0
E21	BURGH RD	Road side	x	-	15.7	22.4	16.2 (15.5)	18.7 (16.1)	21.8 (17.9)	18.7 (15.7)	19.5 (16.7)

**Figure 2.15 Chart showing NO<sub>2</sub> diffusion tube trends at monitoring locations in area E.**

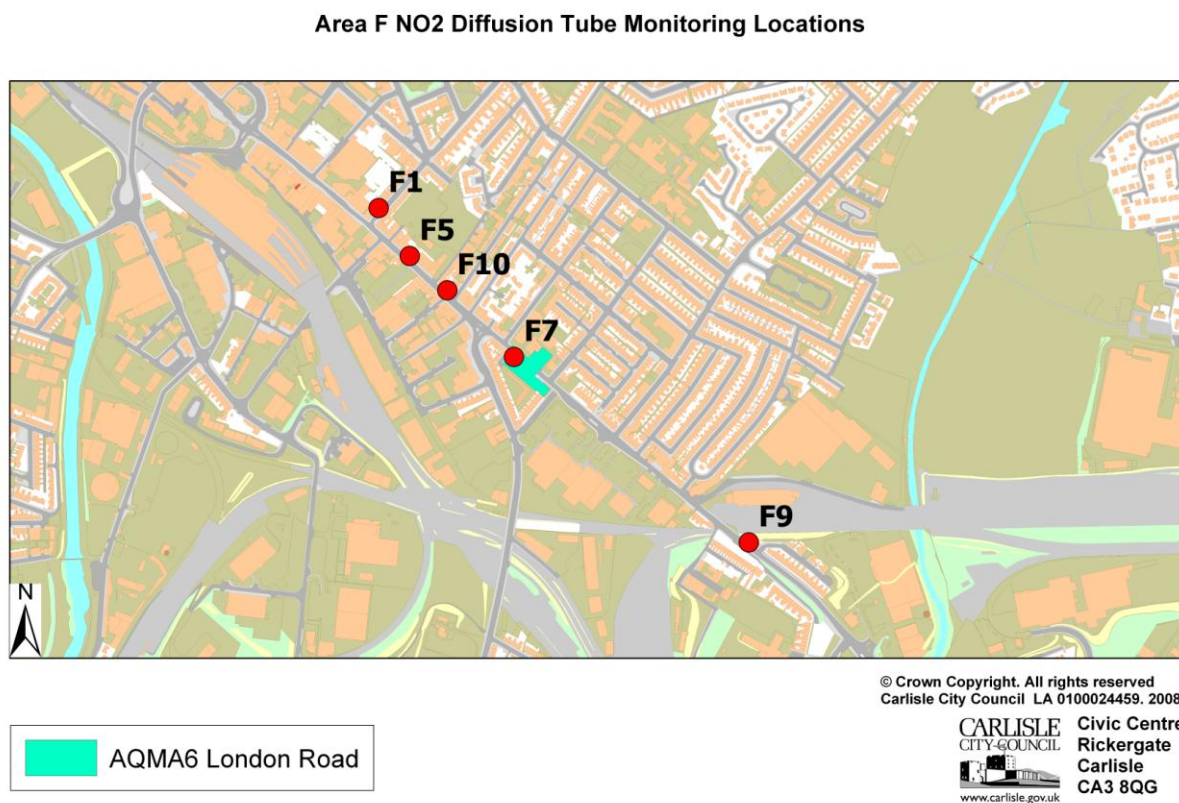


These diffusion tube results show that during 2012 NO<sub>2</sub> concentrations at most locations along this main traffic route have decreased from 2011. Several have also continued a trend of reduction from previous years.

Three locations still have an annual mean above the objective level, two of these locations are within AQMA 3 and one is within AQMA 4. All three locations have continued to show significant year on year improvement since 2010: Location E12 has shown the lowest annual mean concentration since 2007 and locations E19 and E8 are now at their lowest since monitoring began in 2006. E22 is the only location outside of an AQMA that can be considered border line. The remaining locations all show an annual mean which was below the objective level during 2012.

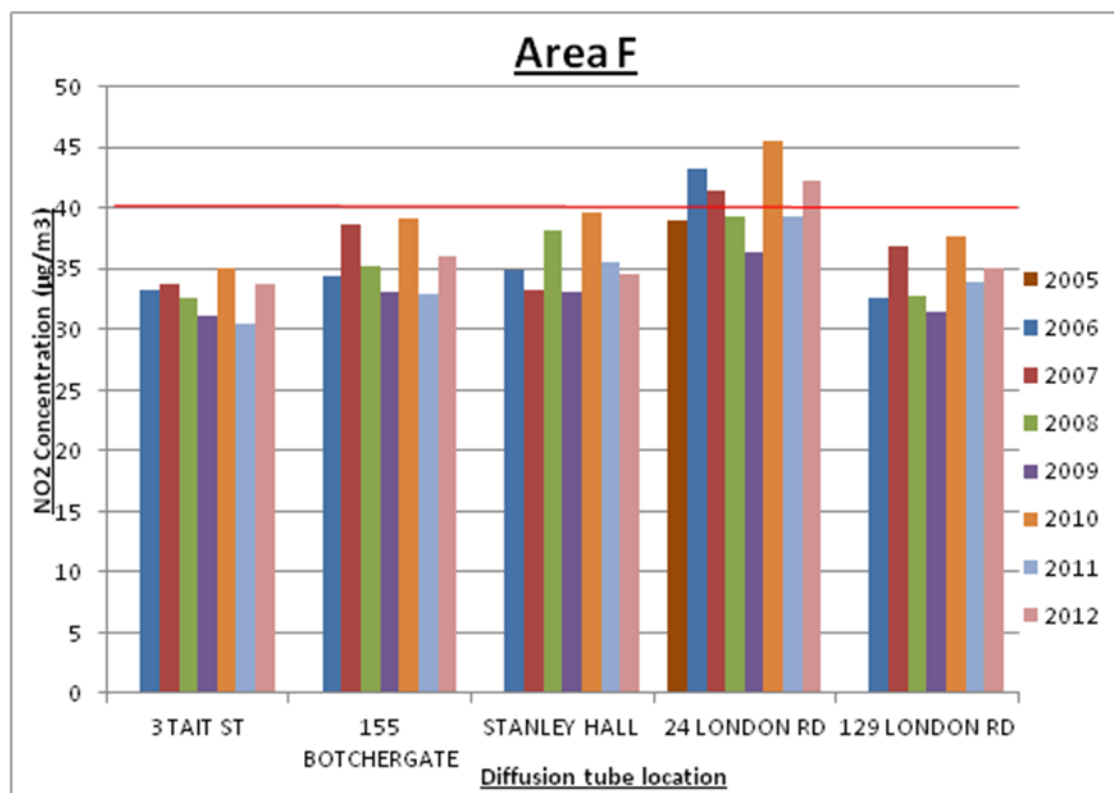
It was anticipated that both of these AQMA's would benefit from a substantial reduction in traffic flows due to the introduction of the CNDR in February 2012. Following the opening of the route it appeared that traffic volumes had reduced significantly in this area. This improvement was then interrupted by 7-8 months of major road works due to the Sainsbury's development, which is now located between the two AQMA's. The overall impact of these factors will continue to be monitored and reported upon in the Progress Report in April 2014.

Results indicate that there are no locations within area E that are at risk of exceeding the 1 hour mean objective level for nitrogen dioxide, this is also supported by results from the automatic monitoring site within this area.

**Area F – A6 London Road / Botchergate (AQMA No6)****Figure 2.16 Map of diffusion tube locations in area F.****Table 2.5f NO<sub>2</sub> diffusion tube results at monitoring locations in area F.**

SITE ID	LOCATION	Site Type	WITHIN AQMA?	ANNUAL MEAN CONCENTRATIONS ADJUSTED FOR BIAS (µg/m <sup>3</sup> )							
				2005 (0.81)	2006 (0.87)	2007 (0.89)	2008 (0.82)	2009 (0.86)	2010 (0.92)	2011 (0.89)	2012 (0.97)
F1	3 TAIT ST	Road side	x	-	33.2	33.8	32.6	31.2	35.1	30.5	33.8
F10	155 BOTCHERGATE	Road side	x	-	34.4	38.7	35.2	33.0	39.1	33.0	36.0
F5	STANLEY HALL	Road side	x	-	34.9	33.2	38.1	33.0	39.7	35.5	34.5
F7	24 LONDON RD	Road side	✓	39.0	43.3	41.4	39.4	36.3	45.5	39.3	42.3
F9	129 LONDON RD	Kerb Side	x	-	32.6	36.8	32.7	31.5	37.7	33.9	35.1

**Figure 2.17 Chart showing NO<sub>2</sub> diffusion tube trends at monitoring locations in area F.**



Results show that the nitrogen dioxide annual mean concentrations have slightly increased at most locations in this area compared to 2011.

All locations in this area have remained below the objective level apart from F7 (London Road) which is located within AQMA No 6. The nitrogen dioxide levels have once again increased slightly above the objective level at this location.

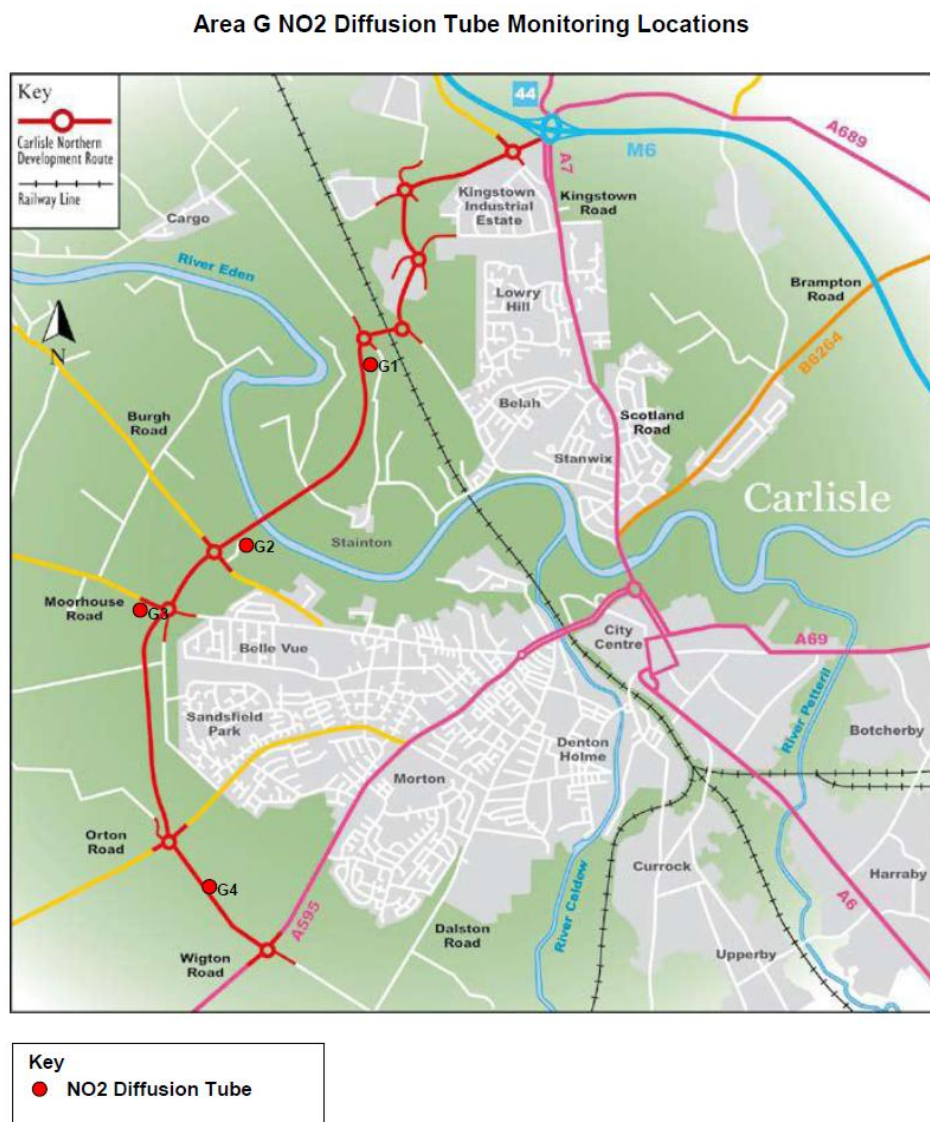
Work on a new ASDA supermarket development and associated road and junction improvement work began in this area in January 2013 and is expected to be complete in May 2013. This has disrupted traffic flow in this area but has not affected the above 2012 data. It is hoped that the completion of the road and junction improvements, combined with the potential knock on effects of the Carlisle Northern Development Route, will provide some improvement in the long term. The impact of the ASDA development will also influence traffic volumes within this area. The combined impacts of these factors will continue to be monitored and reported upon in the Progress report in April 2014.

Results indicate that there are no locations within this area that are at risk of exceeding the 1 hour mean objective level for nitrogen dioxide.



### Area G – Bypass

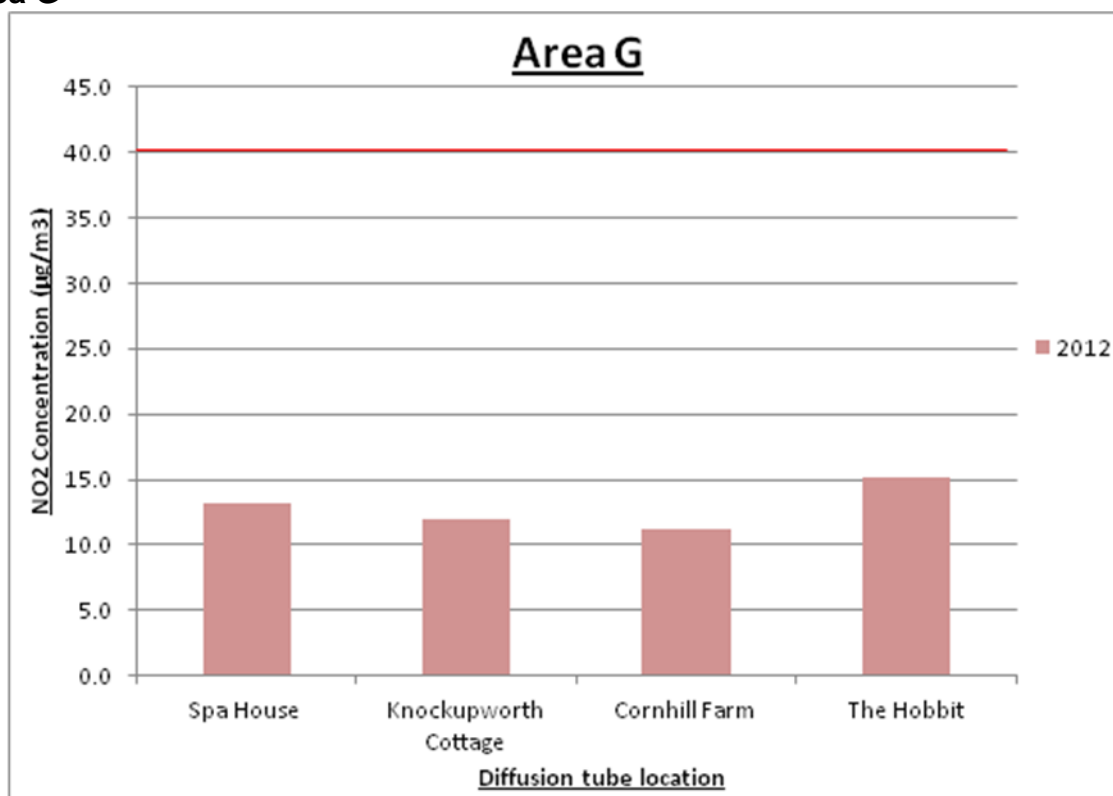
**Figure 2.18 Map of diffusion tube locations in area G.**



**Table 2.5g NO<sub>2</sub> diffusion tube results at monitoring locations in area G.**

[illegible]

**Figure 2.19 Chart showing NO<sub>2</sub> diffusion tube trends at monitoring locations in area G**



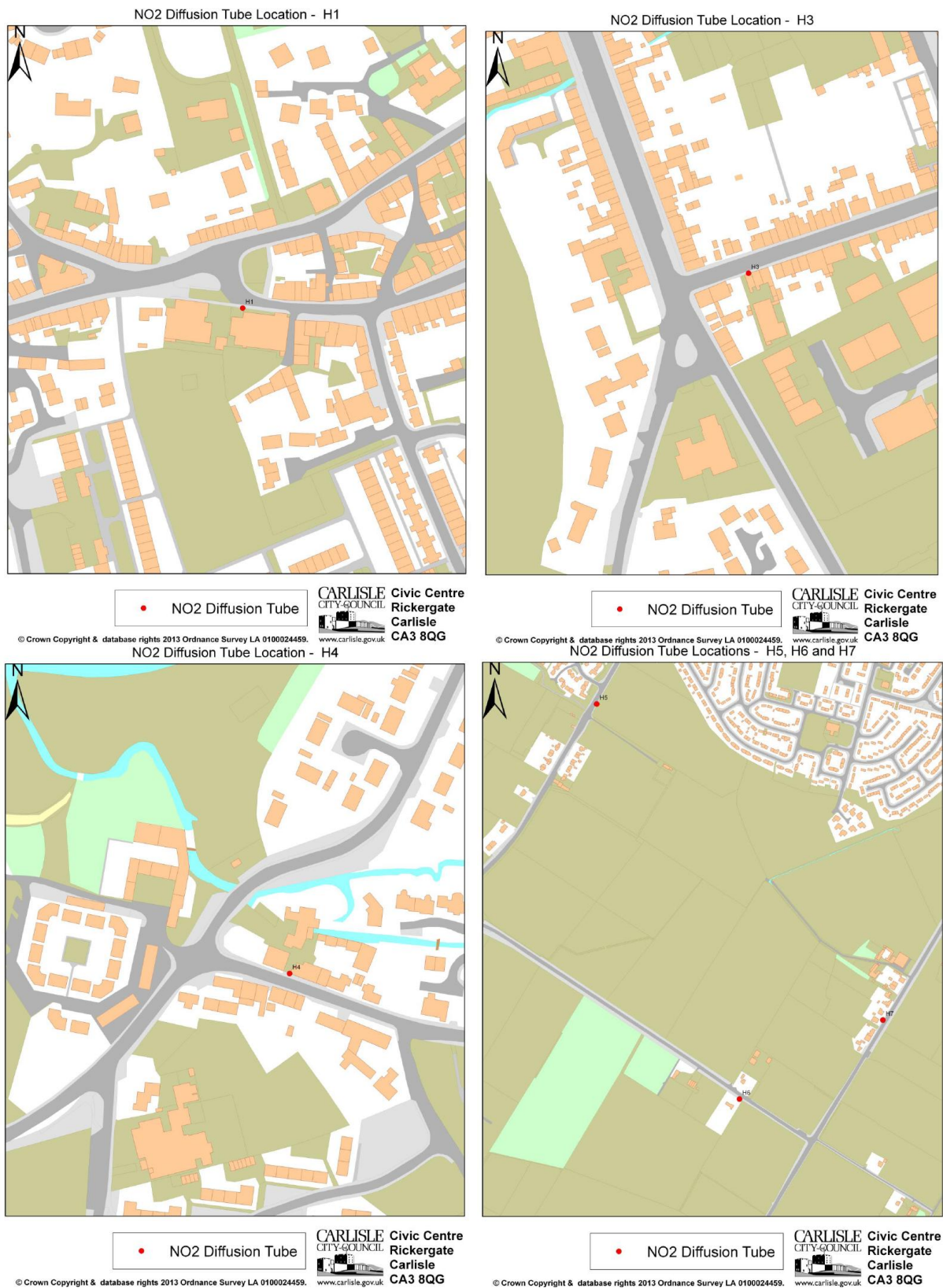
The four new diffusion tube locations shown above are detached residential dwellings located on the newly opened CNDR, they had a monitoring period of 8 months from May to December 2012 although G2 also had one month of lost data. This data required adjustment in order to estimate the mean pollutant concentration for the whole calendar year as the data capture for 2012 was less than 75%. Further information on the method and calculations carried out for this data adjustment can be found in appendix A. Since this is the first period of monitoring it is not possible to draw comparisons with any previous data.

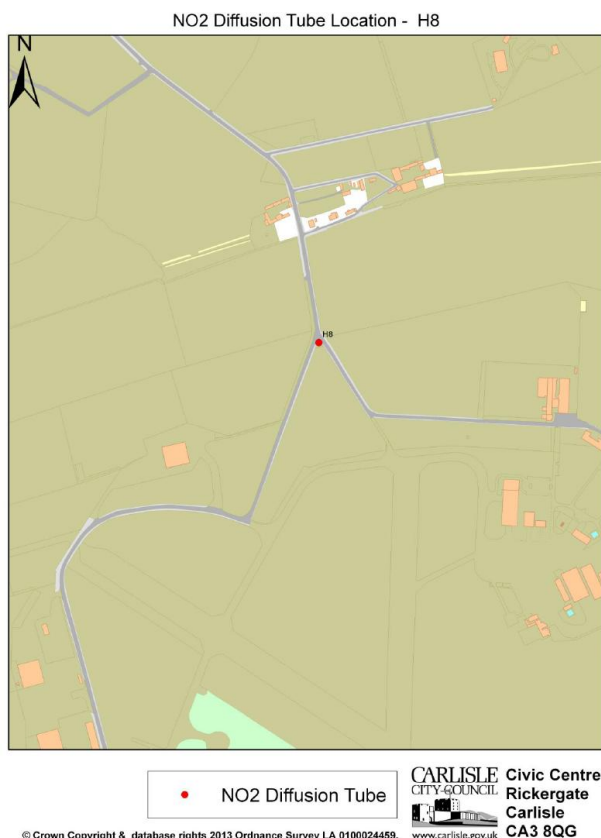
This initial data indicates that there is unlikely to be any exceedence of the annual mean or hourly mean objective levels at any relevant location along the bypass. It is possible that future commercial investment and development attracted by the bypass, particularly in the north and south west of the City, may increase traffic flow along this route. Given the very low estimated annual mean concentrations shown above, it seems unlikely that any traffic increase will result in an exceedence of the air quality objectives in the near future.

Monitoring will continue at these locations throughout 2013 and the first full year of monitored data will be reported upon in the April 2014 Progress Report.

**Area H – Outskirts of City, Townships and Airport**

**Figure 2.20 Maps of diffusion tube locations in area H.**

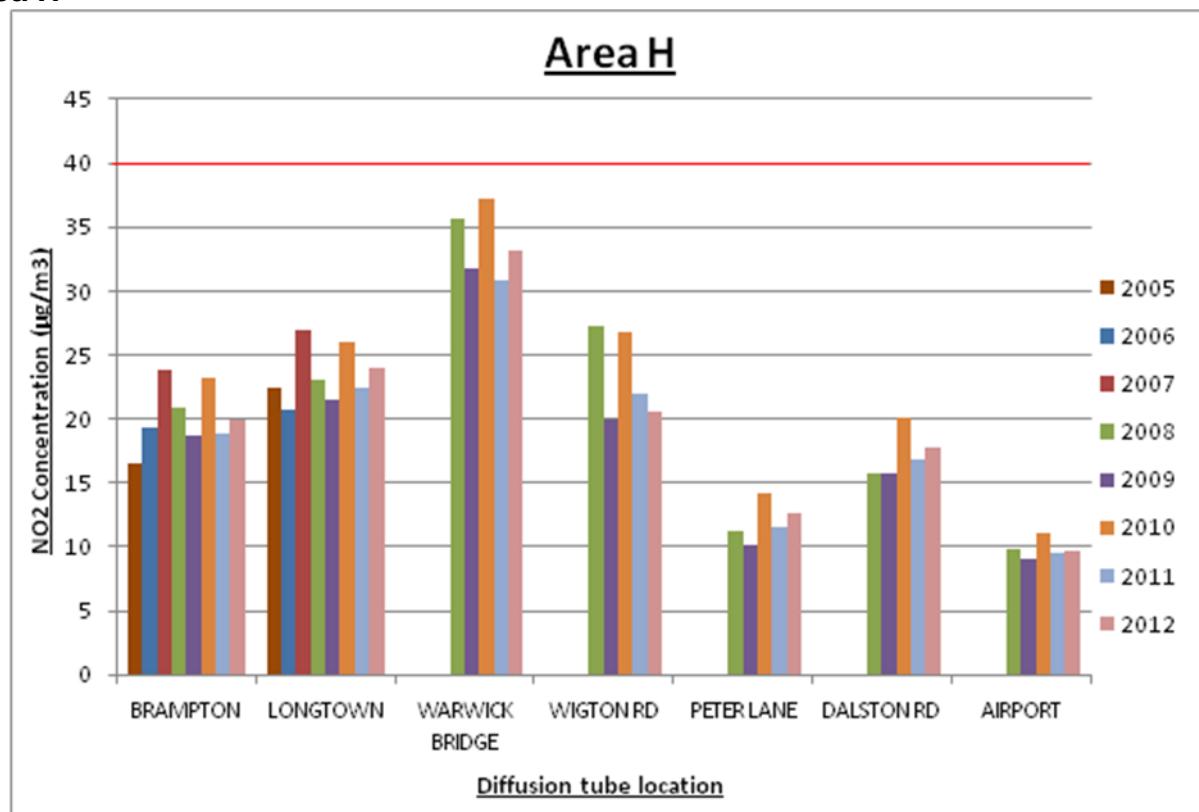




**Table 2.5h NO<sub>2</sub> diffusion tube results at monitoring locations in area H.**

SITE ID	LOCATION	Site Type	WITHIN AQMA?	ANNUAL MEAN CONCENTRATIONS ADJUSTED FOR BIAS (µg/m <sup>3</sup> )							
				2005 (0.81)	2006 (0.87)	2007 (0.89)	2008 (0.82)	2009 (0.86)	2010 (0.92)	2011 (0.89)	2012 (0.97)
H1	BRAMPTON	Road side	x	16.5	19.3	23.9	20.9 (20.3)	18.7 (18.2)	23.2 (22.4)	18.8 (18.3)	19.9 (19.3)
H3	LONGTOWN	Road side	x	22.5	20.7	26.9	23.1 (22.4)	21.5 (20.8)	26.0 (24.9)	22.4 (21.7)	24.0 (23.2)
H4	WARWICK BRIDGE	Road side	x	-	-	-	35.7 (34.5)	31.8 (30.8)	37.2 (35.9)	30.9 (29.8)	33.2 (32)
H5	WIGTON RD	Road side	x	-	-	-	27.3	20.0	26.8	22.0	20.5
H6	PETER LANE	Road side	x	-	-	-	11.3	10.2	14.2	11.5	12.6
H7	DALSTON RD	Road side	x	-	-	-	15.8	15.7	20.0	16.9	17.8
H8	AIRPORT	Other	x	-	-	-	9.84	9.1	11.0	9.5	9.7

**Figure 2.21 Chart showing NO<sub>2</sub> diffusion tube trends at monitoring locations in area H**



In 2012 there was a slight increase at most of the above monitoring locations however all have consistently showed NO<sub>2</sub> annual mean concentrations that are well below the objective level.

Locations H1 & H3 are located in the two largest centres of population outside the city of Carlisle. Locations H5 – H8 are located on the outskirts of the city on key roads leading into the city itself. Location H4 (Warwick bridge) showed the highest annual mean, this location showed a small increase compared to 2011 however this has remained consistent with previous years.

Results from all of these sites indicate that there is no risk of exceeding the 1 hour mean objective level for nitrogen dioxide. We will continue to monitor these areas in future rounds of review and assessment.



## 2.2.2 Particulate Matter (PM<sub>10</sub>)

The TEOM analysers at Paddys Market were upgraded using a Filter Dynamics Measurement System (FDMS) on 18<sup>th</sup> March 2009. The FDMS records gravimetric equivalent particulate data and therefore allows equivalence to the objective level. (More information on this change can be found in Appendix A.) The location of the monitoring unit is not representative of relevant public exposure.

Monitoring data was collected throughout 2012 therefore the data capture for the monitoring period is given as the data capture for 2012.

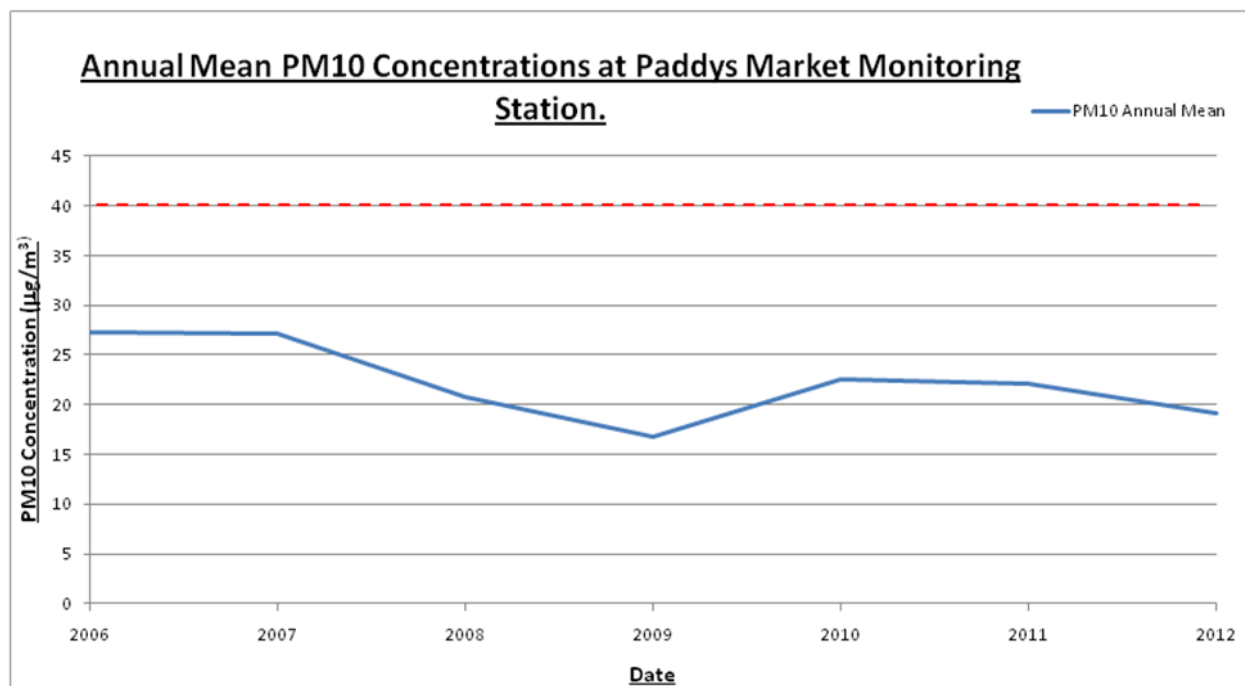
All PM<sub>10</sub> data has been collected by Bureau Veritas as part of the AURN and ratified by Ricardo-AEA.

The PM<sub>10</sub> objective for England is an annual mean of 40µg/m<sup>3</sup>. There is also a 50µg/m<sup>3</sup> 24 hour mean not to be exceeded more than 35 times per year.

**Table 2.6 Results of Automatic Monitoring of PM<sub>10</sub> Comparison with Annual Mean Objective**

Site ID	Location	Site Type	Within AQMA?	Data Capture for 2012 (%)	Gravimetric Equivalent	Annual mean concentrations (µg/m <sup>3</sup> )						
						2006	2007	2008	2009	2010	2011	2012
PM1	Paddy's Market	Road Side	N	83	Y	27.3	27.2	20.8	16.8	22.5	22.1	19.2

**Figure 2.22 Trends in Annual Mean PM<sub>10</sub> Concentrations.**

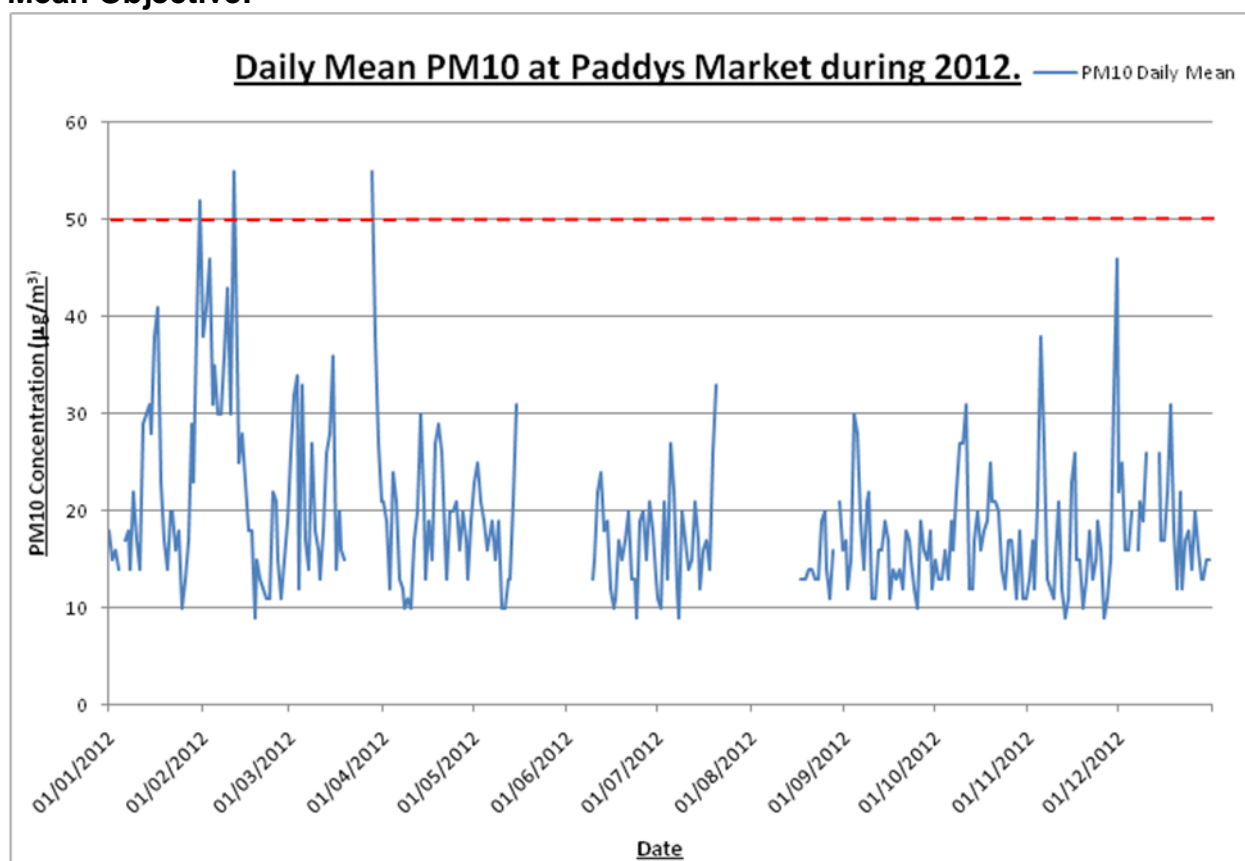


The data above shows that the PM<sub>10</sub> annual mean for 2012 remains significantly below the objective level of 40µg/m<sup>3</sup>. The result for 2012 is consistent with previously recorded data and the above trend chart shows that there appears to be a gradual downward trend over the seven years of monitoring at this site.

**Table 2.7 Results of Automatic Monitoring for PM<sub>10</sub>: Comparison with 24-hour mean Objective**

Site ID	Location	Site Type	Within AQMA?	Data Capture for 2012 (%)	Gravimetric Equivalent	Number of Exceedences of daily mean objective (50 µg/m <sup>3</sup> )						
						2006	2007	2008	2009	2010	2011	2012
PM1	Paddy's Market	Road Side	N	83	Y	16	11	0	7	18	11	3

It is clear from the table above that the PM<sub>10</sub> data capture for 2012 was less than 90%, for this reason it was necessary to calculate the 90<sup>th</sup> percentile using the data archive on the Defra (UK Air) website. The 90<sup>th</sup> percentile of the daily mean taken from the hourly measured PM<sub>10</sub> is 30µg/m<sup>3</sup>. An exceedence of 50µg/m<sup>3</sup> would indicate that there may be an exceedence of the objective level, however the results show clearly that concentrations are significantly below both objective levels.

**Figure 2.23 Results of PM<sub>10</sub> Automatic Monitoring: Comparison with 24-hour Mean Objective:**

This data shows that during 2012 there were only 3 recorded exceedences of the 50µg/m<sup>3</sup> 24 hour mean. This is significantly less than the objective level of 35 exceedences per year. There is therefore no exceedence of the overall 24 hour mean objective for PM<sub>10</sub>.

### 2.2.3 Benzene

Carlisle has been monitoring benzene since April 2008 as part of the Non Automatic Hydrocarbon Network. The site is located on the roadside, 42 metres away from the nearest relevant public exposure.

The objective level for benzene is an annual mean of  $5\mu\text{g}/\text{m}^3$  to be achieved by December 2010. There is also a running annual mean objective of  $16.25\mu\text{g}/\text{m}^3$  to be achieved by December 2003.

The benzene data shown has been ratified by Ricardo-AEA who manage the Non Automatic Hydrocarbons Network (NAHN)

Monitoring data was collected throughout 2012 therefore the data capture for the monitoring period is given as the data capture for 2012.

**Table 2.8 Results of Benzene Monitoring: Comparison with Running Annual Mean Objective**

Site ID	Location	Within AQMA?	Data Capture for 2012 (%)	Annual mean concentrations ( $\mu\text{g}/\text{m}^3$ )				
				2008	2009	2010	2011	2012
PM1	Paddy's Market	N	89	0.81	0.92	1.1	0.78	0.74

The data above shows that the 2012 annual mean concentration for benzene remains consistently below the objective level. The result is lower than any previous year of monitoring at this location. There are, therefore, no concerns of exceeding the national objectives for benzene.

## 2.2.4 PM<sub>2.5</sub>

Carlisle City Council began monitoring PM<sub>2.5</sub> at the Paddy's Market site in March 2009. This is the fourth time that the council has reported the measurements in its review and assessment work.

The PM<sub>2.5</sub> objective for England is an annual mean of 25µg/m<sup>3</sup>, to be achieved by 2020. There is also an exposure reduction target of 15% (measured as a 3-year mean) between 2010 and 2020, applicable at urban background locations. The objectives for this pollutant are not included in the air quality regulations for the purpose of local air quality management.

Monitoring data was collected throughout 2012 therefore the data capture for the monitoring period is given as the data capture for 2012.

All PM<sub>2.5</sub> data has been collected by Bureau Veritas as part of the AURN and ratified by Ricardo-AEA.

**Table 2.9 Results of PM<sub>2.5</sub> Automatic Monitoring: Comparison with Annual Mean Objective**

Site ID	Location	Within AQMA?	Data Capture for 2012 (%)	Annual mean concentrations (µg/m <sup>3</sup> )			
				2009	2010	2011	2012
PM1	Paddy's Market	N	87	11.8	15.54	12.21	11.04

The 2012 annual mean for PM<sub>2.5</sub> remains significantly below the objective level. The annual mean concentration has reduced year on year since 2010 and the result for 2012 is the lowest since monitoring began. We will continue to monitor PM<sub>2.5</sub> at this location, as more data is collected clearer trends should become apparent.

## 2.2.5 Summary of Compliance with AQS Objectives

Carlisle City Council has examined the results from monitoring in the district.

Concentrations within all 6 of the AQMA's still exceed, or are borderline, of the objective for Nitrogen Dioxide, therefore the AQMA's should remain.

Concentrations outside of the AQMA's are below the objectives at all relevant locations apart from one diffusion tube location that has been temporarily effected by localised traffic disruption and building work. The NO<sub>2</sub> data collected during 2013 is expected to show significant improvement, there is therefore no need to proceed to a Detailed Assessment at this stage.



## 3 New Local Developments

DEFRA guidance requires that details of new local developments, that might affect local air quality, are included in the Progress Report. New developments which were covered in previous rounds of review and assessment have, in some cases, been included. Any update on progress with these developments is given, where appropriate. These new developments are considered under the following categories:

### 3.1 Road Traffic Sources

There have been a number of minor changes to roads in the district, in particular changes to junctions to allow increased traffic flows associated with new developments or to reduce the volume of standing traffic. The following summarises the changes since Updating and Screening Assessment 2012.

- There are no new narrow congested streets with residential properties close to the kerb.
- There are no new busy streets where people may spend one hour or more close to traffic.
- There are no new roads with a high flow of buses and/or HGVs.
- There are no new bus or coach stations.
- There have been two significant new developments to road junctions within the city, these include:
  - The junction changes to allow access to the new Sainsbury's supermarket and petrol filling station on Bridge Street. This development was completed in October 2012 after around 8 months of work. The road is now wider with additional lanes and improved traffic signals. Traffic disruption has now ended and overall congestion in this area appears to have improved. The impact of this change on nearby AQMA's 3 and 4 will continue to be monitored.
  - Works on the new ASDA development and associated junction on London Road will continue throughout May 2013. Works include removal of the existing traffic signals on the junction with Grey Street and the introduction of new signals at the entrance to the retail park. The new signalling system will incorporate a pedestrian crossing and the road layout will provide additional lanes. This change is expected to impact AQMA 6 in that it will potentially increase the number of vehicles using this road but the new layout will hopefully ease congestion. Removal of the old traffic signals adjacent to AQMA 6 should significantly reduce the number of standing vehicles in this location.
- There has been one major new road development; the CNDR. This has been the most significant recent change in the road network and it was completed in February 2012. The road development was considered in detail in the Updating and Screening Assessment 2012 and continues to be monitored as part of the diffusion tube network.

- There are no other new roads constructed or proposed since the Updating and Screening Assessment in 2012 other than minor roads associated with new residential developments.

### **3.2 Other Transport Sources**

As well as road vehicles, public exposure to emissions from planes, buses, trains, ships etc must also be considered. The following summarises the changes since the last Updating and Screening Assessment in 2012:

- There are no new locations where diesel or steam trains are regularly stationary for periods of 15 minutes or more, with potential for relevant exposure within 15m.
- There are no new locations with a large number of movements of diesel locomotives, and potential long-term relevant exposure within 30m.
- Carlisle City Council has no ports for shipping.
- Carlisle City Council does have an airport in the district. As discussed in previous rounds of review and assessment there have been various applications made to develop the airport and negotiations have been ongoing over recent years. The current plans relate to development of the airport, including the improvement of runways and buildings to include warehousing, hangars and improvements to the passenger terminal. The plans have now been approved by Carlisle City Council and have gone to a judicial review due to opposition from residents of a nearby village. Essentially the airport itself remains unchanged and it still operates as a small runway for light passenger/pleasure aircraft. Any further changes to the airport will be re-examined in the next round of review and assessment.

### **3.3 Industrial Sources**

For the purpose of this section of the report it is necessary to look at new or changed industrial sources of air pollution. The following summarises the changes since the last updating and screening assessment in 2009:

- There are no new or proposed installations for which an air quality assessment has been carried out.
- There are no existing installations where emissions have increased substantially or new relevant exposure has been introduced.
- There are no new or significantly changed installations without a previous air quality assessment.
- There are no new major fuel storage depots storing petrol.
- There is one new petrol station which opened in the district in October 2012. The petrol station was introduced as part of the new Sainsbury's development on Bridge Street. This part B permitted process is expected to have an annual throughput of 1000 – 3499m<sup>3</sup> of petrol and incorporates both stage 1 and 2 vapour recovery. It is located between AQMA's 3 and 4 directly opposite the Paddy's Market automatic analyser on Castle Way.
- There are no newly permitted poultry farms since April 2012.

### 3.4 Commercial and Domestic Sources

For the purpose of this section of the report it is necessary to look at new or changed commercial & domestic sources of air pollution. The following summarises the changes since the last updating and screening assessment in 2012:

- There are no new significant individual biomass combustion plants. Guidance suggests that consideration needs to be given to biomass combustion installations in the range of 50KW-20MW. There are no new installations of this size in the district.
- There are no new areas where the combined impact of several biomass combustion sources may be relevant.
- There are no new areas where domestic solid fuel burning may be relevant, however the council is in receipt of an increased number of enquiries regarding the installation of wood burning and multi fuel stoves. This also includes the installation of exempt appliances in smoke control areas and the use of exempt smokeless fuel. This is a trend that appears to cover the whole of the city and it is difficult therefore to quantify the combined effects on air quality from such sources.

### 3.5 New Developments with Fugitive or Uncontrolled Sources

For the purpose of this section of the report it is necessary to look at new developments with uncontrolled or fugitive sources of air pollution. The following summarises the changes since the last updating and screening assessment in 2012:

- There are no new landfill sites.
- There are no new quarries.
- There are no new unmade haulage roads on industrial sites.
- There are no new waste transfer stations established in the district.
- There are no other new potential sources of fugitive particulate emissions.

Carlisle City Council confirms that there are no new or newly identified local developments which may have an impact on air quality within the Local Authority area.

Carlisle City Council confirms that all the following have been considered:

- **Road traffic sources**
- **Other transport sources**
- **Industrial sources**
- **Commercial and domestic sources**
- **New developments with fugitive or uncontrolled sources.**

## 4 Planning Applications

Since 1<sup>st</sup> April 2012 Carlisle City Council has received applications for a whole range of new developments, most of which are small and insignificant in terms of air quality impacts. There are also a number of major new developments that have been granted permission or are currently being considered by the planning department. Some of the developments below were included in previous rounds of review and assessment and in these cases details of any application decisions or amended proposals are given:

### **Morton Development**

The original application made in May 2009 was for the proposed development of land for a maximum of 825 residential dwellings, 40000 m<sup>2</sup> of floor space used for employment, such as offices and warehousing, as well as public open spaces.

The proposed location is open agricultural land at Morton bounded by Peter Lane, Wigton Road and Dalston Road, the North-Eastern boundary backs onto existing suburban residential properties. It would be located right on the edge of the city, to the West, in an area which is predominantly residential. (See appendix D for map). The outline application has been granted, at committee, subject to legal agreement.

Since the original application subsequent applications have been submitted for adjacent locations in this area of the city:

- In October 2010 an application was received for further development, on adjoining land to the North of the original proposal, adjacent to Wigton Road and South of Ellesmere Way. This comprises a retail food store, petrol filling station, crèche, restaurant/cafe and take-away, with associated car parking and landscaping. A decision was made by committee to grant the outline application in 2010. It has now been announced that Tesco will be opening on the site and the final detail of the application or reserved matters are expected to be received by the planning department at the end of May 2013. (See appendix D for map).
- A further outline application was received in April 2011 for a residential development consisting of 103 new homes. The proposal is located toward the South East corner of the original development site, on land adjacent to Peter Lane and bounded by Dalston Road, Peter Lane and Newby West. The outline application was granted and a decision is currently being made as to the reserved matters which were received in October 2012. (See appendix D for map).
- A final application has been received in November 2010 and relates to the Garden Village area of Morton. The application comprises the erection of 253 dwellings, associated access, parking, engineering works and landscaping. This is located to the West of the original site on the opposite side of Wigton Road. The application was granted and construction work has now started. (See appendix D for map).

An Air Quality Impact Assessment (EIA) has been submitted as part of each of the first two applications detailed above (original 825 residential properties and the Ellesmere Way supermarket project). Consideration was made as to the combined impact of the above proposals as they are all in close proximity to one another,



together they combine to make the Morton master plan. For this reason the latter two smaller residential proposals were called in by the Secretary of State who determined that neither was sufficient to warrant an EIA as part of the planning process.

Tube H5 was placed on the roadside at the proposed entrance to the original site in 2008 when the application was first rumoured. Since then the annual mean for NO<sub>2</sub> at this location has remained significantly below the objective. Other tubes that have been positioned adjacent to the site include H6 and H7 both of which are also consistently well below the objective level.

The air quality impacts of these developments are uncertain. Traffic flow along Wigton Road (AQMA 3) could increase due to the increased density of the population in the area. At the same time the supermarket would have a large catchment in the west and rural areas reducing the need for journeys into the city centre for shopping purposes. The site entrance is planned to be right next to a junction onto the CNDR which is likely to direct much of the traffic flow around the city bypass.

### **Carlisle Lake District Airport**

As discussed in previous rounds of review and assessment there have been various applications made to develop the airport and negotiations have been ongoing over recent years. The current plans include the development of a distribution centre inclusive of air freight and road haulage, integrated chillers, workshops, offices, a gatehouse, new access, auxiliary fire station and a raised re-profiled runway. A new expanded Environmental Impact Assessment containing an Air Quality Impact Assessment was submitted as part of the proposal. The plans have now been approved by Carlisle City Council in February 2013 but have now gone to a judicial review due to opposition from residents. (See appendix D for map).

Tube H8 was placed on the roadside near to the existing site entrance in 2008 when it became clear that expansion was a possibility. Since then the annual mean for NO<sub>2</sub> at this location has been consistently below the objective and this year showed a 9.7µg/m<sup>3</sup> annual mean.

### **Crindledyke Development**

This application was submitted in July 2009 for the proposed development of a maximum of 950 residential properties, ancillary local community facilities; including a school, a community building and open public space. The total area of the site is 29.08 hectares. This development is proposed for open land at Crindledyke bounded by the North West mainline, the M6 and Kingmoor industrial estate. It would be located in an area which is semi rural farmland to the North West of the city. (See appendix D for map).

An Air Quality Impact Assessment as been submitted as part of an Environmental Impact assessment. The EIA was considered unsatisfactory as it did not take into consideration the combined impacts of other new local developments. An amended assessment was submitted. The application has now been granted subject to legal agreement and work has started on phase 1 of construction.

### **Hammonds Pond Development**

This application was submitted in September 2012 for the proposed development of 318 residential properties and associated open space and infrastructure. The development is proposed for land bounded by Hammonds Pond, Oaklands Drive and

Durdar Road, which is on the southern fringe of the city. The application is in consultation phase and will be discussed in the development control committee meeting in July 2013. (See appendix D for map).

#### **Dalston Development**

This application was submitted in October 2012 for the proposed erection of 125 dwellings, associated open space and infrastructure. The site is located on land between Townhead Road and Station Road in the village of Dalston, 5 miles outside Carlisle. The area currently has no air quality concerns. The application is in consultation phase and will be discussed in the development control committee meeting in June 2013. (See appendix D for map).

#### **Smithfield Poultry Breeding Unit**

This application was submitted in May 2012 for the proposed erection of a 5990m<sup>3</sup> poultry breeding unit for egg and hatchling production, with a maximum of 22880 birds. It also includes the siting of an agricultural worker's mobile home, engineering works and landscaping. The development is proposed for land between A6071 and U1084 in the village of Smithfield, 8 miles outside Carlisle. This application has been granted. (See appendix D for map).

#### **Biomass Boilers**

New applications relating to biomass boilers have been received from two rural schools in the last year. Stone Raise Primary School (109KW) has been approved and is expected to be installed during the summer holidays of 2013. Another application from Lanercost Primary School (45KW) has been received, however a decision has not yet been reached. In both cases stack heights have been considered by Environmental Health and discussed with planners at the County Council using Technical Guidance (09) Box 5.8.

## 5 Air Quality Planning Policies

Land use planning has a significant role to play in improving and protecting air quality within the city. Planning decisions can have a significant, long term impact on travel behaviour and traffic levels. The City Council through its function as a planning authority, can influence new development to ensure that it is designed and located so as to reduce the need to travel. It may also influence a range of travel options encouraging alternatives to car use in accordance with national policy. The integration of land use, transport and highways is key to the Council facilitating delivery of sustainability. Carlisle's main planning policies are set out in the adopted Carlisle District Local Plan, 2001 – 2016, (the Local Plan) as discussed in chapter 6.

### Development Management

Air quality as a material consideration has now been incorporated into the local planning process. As part of the Council's planning application validation process, developers are required to submit an air quality impact assessment (AQIA), as follows:

#### When is it required?

Where the development is proposed inside, or adjacent to, an AQMA; where the development could in itself result in the designation of an AQMA; or where the grant of planning permission would conflict with, or render unworkable, elements of the local authority's Air Quality Action Plan.

#### What is required?

Any report should be detailed enough to enable the planning authority to determine, with a reasonable degree of certainty, the significance of any air quality impacts, and thereby the priority to be given to air quality concerns when deciding an application. The scope of an air quality assessment will depend on the nature of the proposed development and the likely impact.

#### Why is it required?

In compliance with Policy CP13 of the adopted Carlisle District Local Plan 2001 – 2016.

Specific guidance '*Air Quality Land Use Planning*, has been produced by Environmental Health and is routinely provided to both planners and developers to assist them with this requirement. It indicates the trigger criteria where a development has the potential for significant emissions of pollutants. In these circumstances an AQIA would be expected. The following are three examples of these trigger criteria:

- Residential development in excess of 100 units; or
- Employment uses in excess of 5,000 m<sup>2</sup> gross floor space; or
- Any developments that either generates in excess of 100 heavy goods vehicles per day or 100 vehicles movements in any hour.

Once submitted, the Environmental Health Department carry out an appraisal of the AQIA, and issue comments or recommendations to planners and developers as required.

The planning guidance will be revised as necessary to incorporate a checklist of mitigating measures which could be included in Section 106 agreements based on emerging best practice. Examples of actions taken nationally to minimise adverse transport impacts on air quality include the requirements for travel plans and possible developer contributions for public transport infrastructure.

PPS23 outlines national policy on planning and pollution control, including the basis for applying a combination of planning conditions and legal obligations to address the environmental impacts of proposed developments. In particular, it notes that '*Section 106 Agreements can be used to improve air quality, make other environmental improvements [...] or offset the subsequent environmental impact of a proposed development.*'

It is important to note that the Community Infrastructure Levy (CIL) exists separately from 106 agreements. The CIL is a new charge in which local authorities are empowered, but not required, to charge on most types of new development in their area. CIL charges will be based on simple formulae which relate the size of the charge to the size and character of the development paying it. The proceeds of the levy will be spent on local and sub-regional infrastructure to support the development of the area. As yet Carlisle has not drawn up a CIL.

Despite the need to enter into the above legal agreements where appropriate, conditions may also be imposed on any planning consent to achieve the following examples:

- Secure the submission of a full emissions inventory;
- Secure the submission of a scheme for monitoring air quality in areas affected by the development;
- To secure the submission of a Green Travel Plan and Transport Assessment;
- Encourage the use of clean fuels, secure bicycle parking and changing facilities;
- Promote the use of, and the securing of improvements to public transport, walking and cycling;
- Set targets for trips made by public transport;
- Encourage the implementation and use of Green Travel Plans, Environmental Management Plans and Air Quality Strategies;
- Require industrial processes to monitor and model their emissions;
- Require developers to monitor air quality before and after development.

More details of how the planning system has been and can be used to promote and improve air quality can be found in '*Low Emissions Strategies, using the planning system to reduce transport emissions, Good Practice Guidance*', (DEFRA January 2010).



## 6 Local Transport Plans and Strategies

The Local Transport Plan 3 (LTP3) (2011 - 2026) is the statutory planning document that sets out the County Council's vision, strategy and policies for transport. It also describes the approaches and measures that will be taken to implement these policies in each Cumbrian Authority. The plan provides the framework to co-ordinate the local delivery of integrated transport and seeks improvements to our transport systems. One of the aims of the LTP is a high quality natural and built environment.

The current plan LTP(3) identifies that Carlisle suffers from traffic congestion at peak times and air quality problems on roads around the city centre. It goes on to state that:

*'2012 will see the completion of the Carlisle Northern Development Route. This will provide the opportunity to improve **air quality** as well as improving access to development sites.'*

For rural areas of the district the plan sets a priority to:

*'The priority for rural Carlisle is to improve resident's ability to access jobs, services and healthcare. This will be based around developing demand responsive services and developing opportunities within local communities.'*

The LTP(3) states that there will be a further document which, among other things, will address parking issues within the city centre of Carlisle:

*'The Carlisle City Centre Transport Overview and Joint Parking Policy Statement which is being developed between the county and city council and local businesses will help to identify the transport improvements required to support the economic priorities.'*

This document is currently in draft form and discussions are ongoing as to how best to move the policy forward. Delays have followed the decision for Carlisle City Council to hand back the highways claimed rights to the County Council. This hand over took place at the end of March 2013. Further decisions on roles and responsibilities and the future of this document are expected in due course.

The County Council has also produced the draft LTP(3) Implementation Plan (2012 – 2015). The report has not yet been presented to members and currently remains a draft internal document. This report seeks to inform members on the Carlisle section of the LTP(3) Implementation Plan. The Implementation Plan is a key part of the Cumbria Transport Plan (LTP3), setting out how the priorities of the recently approved LTP(3) Strategy will be delivered. The three year Implementation Plan 2012 -2015, which will be rolled forward and reviewed annually will incorporate a transport statement for Carlisle setting out its key transport priorities and a schedule of proposed transport improvement schemes aimed at helping to deliver them.

The outcomes and any major change as a result of these emerging documents will be reported in due course during subsequent rounds of review and assessment.

## 7 Climate Change Strategies

The council has in place three key documents relating to climate change these are summarised as follows:

- In the Nottingham Declaration the council acknowledges the occurrence of climate change and it outlines the council's commitment from the 15<sup>th</sup> January 2007 to, amongst other things, achieve a significant reduction of greenhouse gas emissions from our own authority's operations. It identifies key areas where this can be achieved including energy sourcing and use, travel and transport, waste production and disposal and the purchasing of goods and services.

The declaration shows commitment to working with central government to contribute, at a local level, to the delivery of the UK Climate Change Programme, the Kyoto Protocol and the target for carbon dioxide reduction. The document is signed by the council's Chief Executive, Leader of the Council, the Minister of State for Climate Change and the Environment (DEFRA) as well as the Parliamentary Under Secretary of State (DCLG).

- As part of Carlisle City Council's Carbon Management Programme the Carbon Management Plan (CMP) was introduced in 2008 and is due to be reviewed in 2013. The plan was developed with the Carbon Management Trust in order to meet the following objectives:
  - Lead by example in reducing carbon emissions in the Carlisle area.
  - Reduce energy and fuel consumption and expenditure on bills.
  - Meeting legislative and government requirements through the performance framework.
  - Embed fuel and energy efficiency into the Council's corporate culture and working practices.
  - Allocate roles and responsibilities for reducing carbon emissions
  - Support our partners – Carlisle Leisure Limited and Community Centres in delivering carbon reductions.
  - Establish an effective monitoring system of consumption and savings achieved.
  - Set informed carbon reduction targets to guide progress.

The key messages from the Carbon Management Plan are:

- *If we do nothing, annual utility and fuel costs to the City Council and our partners are likely to increase from £1,127,000 to £1,748,000 by 2013 and carbon emissions will rise unchecked.*
  - *If we apply the carbon management programme, we could reduce the total cumulative cost by £1,344,000 during the same period of 5 years and save 5,580 tonnes of carbon dioxide.*
- The Climate Change Strategy was developed in 2008 to be reviewed in 2013 the purpose of this was to draw together these achievements along with aims, objectives and milestones to measure success. These objectives are as follows:

**Ensure that our operations and services address the issue of climate change**

*How we will measure success:*

- Completion of a climate 'proofing' assessment of key Council policies, strategies, action plans and procedures to ensure that they are systematically lowering carbon emissions and ensuring that decisions are resilient to climate change.
- A corporate Climate Change group is established to oversee the implementation of the Climate Change Strategy.
- Staff and Members are aware of the implications of climate change, how it affects our operations and services and receiving training and support where needed.
- Carlisle is achieving targets against our performance indicators on climate change.
- The City Council's partners, businesses and the wider community have developed a Carlisle Climate Change Action Plan

**Reduce the City Council's carbon emissions associated with our operations**

*How we will measure success:*

- By April 2013 Carlisle City Council will have reduced CO2 emissions from its operations. An aspirational target of 25% on 2007-08 levels will be aimed for.
- Procurement decisions take a whole life cycle approach that includes associated carbon emissions.

**Ensure that the City Council's operations and services are adapted to climate change**

*How we will measure success*

- All directorates have undertaken a climate change impacts assessment of their operations and services
- By 2012 Carlisle City Council and our key partners will be implementing an adaptation action plan and monitoring progress.

**Establish climate change as a priority issue for the Carlisle Partnership**

*How we will measure success*

- The target of achieving a 3% reduction per annum on CO2 emissions per capita for Carlisle is being achieved.
- Carlisle Partnership members have put in place carbon reduction plans and report their action.
- Carlisle Partnership will have undertaken a local climate change impacts profile for Carlisle.
- Carlisle Partnership is playing an active role in helping local communities, businesses and partners to work towards a climate proofed Carlisle through the development and delivery of a Carlisle Climate Change Action Plan.

**Develop more environmentally friendly transport choices**

*How we will measure success*

- The City Council and Carlisle Partnership are engaging with local employers on the potential for partnership working through the development of Green Travel Plans.

**Make planning an effective tool in the pursuit of a climate proofed Carlisle**

*How we will measure success*

- Planning policies include targets and standards for addressing climate change.

**Support improvement in the energy efficiency of Carlisle's housing stock**

*How we will measure success*

- Targets are being met for the Decent Home standard and fuel poverty indicator.



## 8 Implementation of Action Plans

Carlisle City Council's revised Air Quality Action Plan (AQAP) sets out measures that the Council, along with its partners, intends to take in order to achieve a reduction in nitrogen dioxide (NO<sub>2</sub>) concentrations in Carlisle. A reduction in NO<sub>2</sub> concentrations is required in order to meet the annual average objectives for this pollutant set by the government. Particular attention has been paid to those 6 areas of the city where exceedences of the national objective level have been identified.

The Air Quality Action Plan was originally produced in 2007, it was then later revised and updated in 2012 to take into account new AQMA's and to set out new improved measures. The final version of the plan was approved by Carlisle City Councils Executive Committee in July 2012, it was subsequently submitted to and accepted by DEFRA in September 2012.

The Action Plan measures are those which are currently considered to be the most cost effective and appropriate for Carlisle. They focus on local initiatives which are realistic and achievable and are most likely to result in significant improvements. The measures seek to manage and continuously improve air quality at a local level whilst providing the level of access and development needed to maintain a vibrant, attractive and prosperous city.

This is the first year that progress with the new revised action plan has been reported upon. Progress with each measure is given under the 'progress to date' column in the following table, due to the fact that the Action Plan has been in place for less than 12 months. The progress since the Action plan was produced is limited in that some schemes are still in the early planning and design stages. It is envisaged that Progress Report 2014 will contain greater progress toward larger schemes and infrastructure improvements.

The following table contains a summary of any progress that has been made so far in the implementation of all of the revised action plan measures.

**Table8.1 Action Plan Progress**

No	Measure	Focus	Lead authority	Planning Phase	Implementation Phase	Indicator	Target Annual Emission Reduction in AQMA	Progress to Date	Estimated Completion Date	Comments Relating to Emission Reduction
1	A new major bypass, the 'Carlisle Northern Development Route,' to the west of the City will remove up to 25% of through traffic. The traffic and Air Quality impacts will be closely monitored and investigation made as to further network improvements to maximise the benefits.	Reduction of traffic volume and HGV's through the city. Reduce congestion and improve journey times	Cumbria CC & Carlisle CC	<2007	2007-2012. Further design work is ongoing to improve links with existing road network.	Reduced NO <sub>2</sub> levels at monitoring locations and within AQMA's.	Anticipate approx 25% reduction in NO <sub>2</sub> in city centre.	CNDR now opened. Additional monitoring at receptors on new road. Early indications of NO <sub>2</sub> improvements in some areas. Plans being drawn up for further improvements.	Ongoing monitoring of NO <sub>2</sub> and traffic data. Further road works expected to begin within 12 months.	Overall reduction in vehicle emissions within the city.
2	Effective traffic management measures will be implemented to improve the existing road network and incorporate new developments.	To improve traffic flows along main arterial roads and reduce congestion	Cumbria County Council	ASDA and Sainsbury's only <2012	ASDA and Sainsbury's only 2012-13	Reduced NO <sub>2</sub> levels and standing traffic within AQMA's.	Not calculated	Sainsbury's junction complete in 2012. ASDA in construction phase.	Complete ASDA in summer 2013. Other projects ongoing.	Junctions improved adjacent to 3 AQMA's should result in reduced congestion.
3	Environmental Health will continue to work with the Planning Department with regard to new developments and ensure that air quality implications are taken into consideration in the planning process.	Include air quality concern from the beginning of the planning process and influence large scale development	Carlisle City Council	Ongoing	Ongoing	Improved links between EH and Planning. AQIA's submitted as necessary. Early consultation with applicant.	Not calculated	EH is now consulted on all proposed developments which may impact on air quality at an early planning stage.	Ongoing	Potential emissions from development can be addressed at early stage.

No	Measure	Focus	Lead authority	Planning Phase	Implementation Phase	Indicator	Target Annual Emission Reduction in AQMA	Progress to Date	Estimated Completion Date	Comments Relating to Emission Reduction
4	Work will continue to upgrade the passenger transport infrastructure to make it more convenient and widely accessible across the County. Arrangements for sustainable transport systems will be integrated into major new and proposed developments	To increase patronage of all passenger transport systems.	Cumbria County Council	Ongoing	Ongoing	Improved bus service. Increased use of transport provided. Reduced NO <sub>2</sub> along main routes	Not calculated	Improved bus access with new shelters and raised kerbs. Proposed extension of real time bus info signs (PIP screens). Possibility of linking this to a new city broadband network. Plans for large new housing estates include public transport provision.	Ongoing	Reduced emissions from public transport. Use of technology to encourage the use of an improved, modern fleet.
5	Cycling and walking will be encouraged through reducing the impact of vehicle traffic in key areas of the city. New and improved pedestrian and cycle links including the Caldew and Lowry Hill Cycle ways and the River Petteril shared cycle/footway will be provided.	To provide opportunity for walking and cycling as a viable transport option across the district.	Cumbria County Council	Ongoing	Ongoing	Completion of proposed works and ongoing improvement of the cycle and pedestrian route network.	Not calculated	Plans in place to provide underpass for cycle and pedestrian access under Castle Way. Contribution made by Sainsbury's. Funding is available for new Cycle links to the CNDR including Burgh Road and Etterby Street. Planned improvement to pedestrian bridge connecting Currock to Denton Holme cycle ways.	Expected to complete all of these detailed proposals during 2013 -14.	Increased use of sustainable transport options with lower emissions.

No	Measure	Focus	Lead authority	Planning Phase	Implementation Phase	Indicator	Target Annual Emission Reduction in AQMA	Progress to Date	Estimated Completion Date	Comments Relating to Emission Reduction
6	Travel plans will be required to be implemented and monitored through S106 agreements for all new developments that meet the criteria. Existing businesses will be encouraged to implement, monitor and review travel plans.	To reduce the traffic impact of people commuting to work during peak times of the day.	Cumbria CC & Carlisle CC	Ongoing	Ongoing	Increased number of participant businesses and more widespread use of alternative transport.	Not calculated	New developments likely to result in increased highway usage must submit a travel plan for approval when making an application. All schools within the city now have travel plans.	Ongoing	Commitment from large companies may lead to reduction in business traffic emissions.
7	The City Council and the County Council will develop and implement a comprehensive Transport Overview and Joint Parking Policy'.	Improve parking arrangements and reduce congestion caused by slow moving traffic seeking spaces.	Cumbria CC & Carlisle CC	<2011	Date not yet confirmed	Approval and adoption of Transport Overview and Joint Parking Policy.	Not calculated	Mentioned as priority document in LTP(3). Ongoing discussions between authorities as to the future of the draft document.	Progress with the document and allocation of roles is ongoing	The reduction of avoidable congestion leading to reduced emissions, particularly at peak times
8	The City Council will continue to provide comprehensive control over emissions from all Part A2 and B Processes located within the local authority area.	Control industrial emissions to air in line with nationally agreed levels and encourage year on year improvement	Carlisle City Council	Ongoing	Ongoing	Risk based inspections showing that emission limits are being met and efforts are being made to improve on national objectives.	Not calculated	There are currently 68 part B and 2 A2 processes which are permitted & inspected by Carlisle CC. No enforcement action required during 2012-13 in relation to emissions.	Ongoing	Increased awareness through inspection leads to gradual improvement in process management and emissions.

No	Measure	Focus	Lead authority	Planning Phase	Implementation Phase	Indicator	Target Annual Emission Reduction in AQMA	Progress to Date	Estimated Completion Date	Comments Relating to Emission Reduction
9	The City Council will continue to investigate complaints of black smoke and smoke nuisance as well as managing smokeless zones. Enforcement action will be taken as necessary.	To control emissions from burning of trade and domestic waste. Prevent nuisance caused by smoke.	Carlisle City Council	Ongoing	Ongoing	Reduction in the number of complaints from members of the public. Reduction of repeat offenders.	Not calculated	Info on website advice and enforcement as required. N° smoke complaints responded to: 2007 – 67, 2008 – 48, 2009 – 47, 2010 – 53, 2011 – 52, 2012 – 32.	Ongoing	Reduction of emissions from burning trade and domestic waste.
10	Energy savings advice and subsidised home insulation improvements will continue to be provided to the public. Uptake will be monitored.	Improve energy efficiency. Reduce domestic emissions and fuel poverty.	Carlisle City Council (Host authority for the Cumbria Affordable Warmth Project. (CAWP)	Ongoing	Ongoing	Improved energy efficiency of residential properties.	Cumbria Warm Homes Project (CWHP) delivered a reduction of 317296 lifetime carbon tonnes	CWHP spent £4.9 million on subsidies and grants between Oct 11 – Mar 13. This included 424 cavity Wall and 1010 loft insulation projects in Carlisle	CWHP ended in March 2013. CAWP continues to seek funding as part of Green Deal for Energy	Reduction of emissions from general heating requirements of domestic properties.
11	Environmental Health will work alongside the Neighbourhoods and Green Spaces team to investigate and implement the effective use of trees and green areas to offset traffic derived emissions in existing AQMA's and in new development areas.	To investigate ways in which vegetation and trees can be used to improve air quality and raise public awareness.	Cumbria CC & Carlisle CC	Ongoing	Ongoing	Increase in trees and vegetation in visible locations. Increased public interest.	Not calculated	106 new trees planted in parks and the cemetery. 62 new trees planted on the roadsides and city centre since April 2012 by Carlisle City Council.	Highways claimed rights given back to County in March 13. Plans for tree planting are uncertain.	Use of trees to reduce air pollution and raise public awareness.



No	Measure	Focus	Lead authority	Planning Phase	Implementation Phase	Indicator	Target Annual Emission Reduction in AQMA	Progress to Date	Estimated Completion Date	Comments Relating to Emission Reduction
12	Joint working will be extended in order to include air quality improvement in all relevant City Council and County Council policies and strategies.	To generate more internal interest in air quality. Increase profile of local improvement measures.	Cumbria CC & Carlisle CC	Ongoing	Ongoing	Increased awareness of air quality issues and consideration given by more council departments.	Not calculated	Included air quality links within: Corporate Plan (2010-13) Local Transport Plan (2011-26) The Green Infrastructure Strategy (2011) The Local Plan (2001-2016)	Ongoing	Policies and strategies can lead to future decisions which favour air quality objectives.
13	The City Council will undertake regular publicity events and actively promote air quality and sustainable transport issues. Up to date air quality information and monitoring data will be provided to the public.	Increase public awareness and participation. Improve access to information and monitoring data.	Carlisle City Council	Ongoing	Ongoing	Increased public awareness and participation in improving air quality.	Not calculated	EH in partnership with other Cumbrian authorities used adverts on busses to promote alternative transport. Investigating ways to extend this campaign. Air quality info and real time monitoring data is available on the website.	Ongoing	Public can make informed choices in order to reduce emissions.

## 9 Conclusions and Proposed Actions

### 9.1 Conclusions from New Monitoring Data

#### Nitrogen Dioxide

The monitoring undertaken for the purpose of this report has identified a potential exceedence of the nitrogen dioxide annual mean at one relevant location outside our current AQMA's. The location in question is C1, Lowther St ( $42.55\mu\text{g}/\text{m}^3$ ). It seems certain that the recent increase is due to the major road works associated with the nearby Sainsbury's development on Bridge Street. Road narrowing and restrictions led to a greatly increased volume of traffic being diverted onto Lowther Street from March to October 2012. The development and road improvements are now complete and as a result there has been a noticeable reduction in traffic volume and standing traffic at location C1. For this reason it is not proposed to proceed to a detailed assessment due to the temporary nature of the traffic congestion which is likely to have caused the exceedence.

Two other locations, namely; D7 ( $36.83\mu\text{g}/\text{m}^3$ ) and E22 ( $36.4\mu\text{g}/\text{m}^3$ ) are borderline of exceeding the annual mean objective for  $\text{NO}_2$ . They are the only other locations that have an annual mean of above  $36\mu\text{g}/\text{m}^3$  and are in a relevant location. These locations have both shown a slight decrease when compared to the 2011 monitoring data.

The monitoring data indicates that there are still locations within all 6 of our AQMA's which remain above, or borderline of, the annual mean objective level, therefore there are no plans to revoke or amend any of them at this present time.

In 2012 the annual mean  $\text{NO}_2$  concentrations decreased at many of the monitoring locations across the district, compared to 2011. Some locations have also shown a further decrease on previous years particularly in AQMA 1, 3 and 4.

The vast majority of the monitoring network will continue to operate unchanged during 2013. A consistent monitoring programme will allow accurate 'before and after' comparisons to be drawn since the opening of the Carlisle Northern Development Route (CNDR) in February 2012. This Action Plan measure is expected to have a dramatic effect on inner city traffic congestion and should have a knock on improvement in  $\text{NO}_2$  concentrations in key areas.

There are now four diffusion tubes located on residential properties which are adjacent to the CNDR. The initial data based on an 8 month monitoring period indicates that the new road has had a minimal effect on those dwellings which are closest to it. These locations showed estimated annual means which are among the lowest of all of the collected data.

Monitoring from the continuous analyser at Paddys Market showed no exceedence of the 1 hour mean objective, or the annual mean objective, for nitrogen dioxide during 2012. The unit recorded an annual mean of  $29.9\mu\text{g}/\text{m}^3$ .

Monitoring from the continuous analyser unit at Stanwix Bank showed no exceedence of the nitrogen dioxide 1 hour mean objective. The unit also recorded an annual mean of  $32.2\mu\text{g}/\text{m}^3$ . It should be noted that the unit's location is not representative of public exposure and is within AQMA 1.

**Particulate Matter (PM 10)**

Monitoring from our unit at Paddys Market showed 3 exceedences of the  $50\mu\text{g}/\text{m}^3$  24 hour mean, this is below the permitted 35 exceedences given in the objective. The recorded annual mean of  $19.2\mu\text{g}/\text{m}^3$  was also significantly below the objective level of  $40\mu\text{g}/\text{m}^3$ , during 2012.

**Particulate Matter (PM 2.5)**

Monitoring from our unit at Paddys Market showed no exceedence of the  $25\mu\text{g}/\text{m}^3$  annual mean objective, for PM 2.5. The recorded annual mean of  $11.04\mu\text{g}/\text{m}^3$  was significantly below the objective level, during 2012.

**Benzene.**

Monitoring from our pumped diffusion tubes unit at Paddys Market revealed an annual mean of  $0.74\mu\text{g}/\text{m}^3$  for benzene. The result is slightly lower than any previous year of monitoring at this location. There was therefore no exceedence of the  $5\mu\text{g}/\text{m}^3$  annual mean or the running annual mean objective of  $16.25\mu\text{g}/\text{m}^3$ .

No other pollutants are of concern in the district.

## **9.2 Conclusions relating to New Local Developments**

The new local developments within the district are detailed in sections 3 and 4 of this report, the air quality impacts of these have been assessed as part of the planning process and in some cases under the Environmental Permitting Regulations 2010. There are no new major developments of any particular concern since the last round of review and assessment.

There are some large proposed developments including major residential developments and an application to develop the airport which will be closely monitored. If necessary these will be given more detailed consideration in the Updating and Screening Assessment in 2015.

No new developments currently give rise to the need for a detailed assessment.

## **9.3 Other Conclusions**

There has been some progress with initiatives set out in the Air Quality Action Plan, this is summarised in table 8.1 in section 8 of this report. The Air Quality Action Plan was originally produced in 2007, it was later revised and updated in July 2012 to take into account new AQMA's and to set out new improved measures. This is the first year that progress with the new revised action plan has been reported upon. The progress made since the Action plan was produced is limited in that some schemes are still in the early planning and design stages. It is envisaged that Progress Report 2014 will contain greater progress toward larger schemes and infrastructure improvements.

The additional monitoring of  $\text{PM}_{2.5}$  started in March 2009 and since then the monitoring results have been reported upon. The 2012 results have shown an annual mean of  $11.04\mu\text{g}/\text{m}^3$ . This is well below the target objective of  $25\mu\text{g}/\text{m}^3$  to be achieved by 2020. All monitoring undertaken to date has shown no risk of any exceedence of this pollutant.

There are a number of major planning applications which have been summarised in section 4 of this report. The only proposed developments which are likely to have any significant effect on air quality are the combined Morton developments, the Cryndledyke development and the Carlisle Airport distribution centre. In all cases an Air Quality Impact Assessment has been requested and Environmental Health has been working with the planning department and any the consultants concerned as to the scope the assessments and the potential impacts. Any outcomes or changes to these applications will be monitored and documented in Progress Report 2014.

The Local Transport Plan 3 (LTP3) (2011 - 2026) is the current statutory planning document that sets out the County Council's vision, strategy and policies for transport. It also describes the approaches and measures that will be taken to implement these policies in each Cumbrian Authority. The LTP(3) is discussed in section 6 of this report.

### **9.3.1 Proposed Actions**

The new monitoring data for 2012 has not identified the need to proceed to a Detailed Assessment for any pollutant. There are a small number of locations that are outside the existing AQMA's which are borderline or slightly above the annual mean objective for NO<sub>2</sub>. As previously discussed there are strong reasons to believe that this increase is due to temporary traffic disruption and it is expected that future levels will stabilise. If these locations continue to show an increase or significantly exceed the objective in future then it will be necessary to carry out a detailed assessment.

The new monitoring data has not identified any need for additional monitoring, or changes to the existing monitoring programme. This will remain largely the same so that comparisons can be drawn since the opening of the CNDR. It is hoped that the bypass will further improve air quality in several AQMA's and at this point it may be possible that one or more may be revoked.

The current AQMA 3 (Wigton Road) has been successfully extended and the AQMA order came into force on 1<sup>st</sup> July 2010. Monitoring will continue here in the same way during 2013. The data collected from the AQMA during 2012 is currently borderline or slightly above the NO<sub>2</sub> annual mean objective. There is currently no reason to make any further changes to the boundaries of any of the existing AQMA's.

The next report to be submitted to DEFRA will be Progress Report 2014. This will be submitted in April 2014 and will present all of the monitoring data for 2013 as well as detail any further progress with proposed or existing developments. All of the review and assessment reports will continue to be made available for public access on the City Council web site.

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## **Appendices**

**Appendix A:** Quality Assurance / Quality Control (QA/QC) Data

**Appendix B:** Monthly NO<sub>2</sub> diffusion tube results 2012(Raw Data)

**Appendix C:** NO<sub>2</sub> diffusion tube results 2012 (Calculated Data)

**Appendix D:** Maps Showing Locations of Potential New Developments.

## Appendix A: Quality Assurance / Quality Control (QA/QC) Data

### Diffusion Tube Bias Adjustment Factors

Diffusion tube precision can be described as the ability of a measurement to be consistently reproduced, i.e. how similar the results of duplicate or triplicate tubes are to each other. Accuracy represents the ability of the measurement to represent the 'true' value, which, in this case, is defined as the result from the automatic analyser. When averaged over a number of sets of results bias can be evident. This represents the overall tendency of the diffusion tubes to depart from the 'true' value, i.e. to systematically over or under-read when compared against the reference method. Once identified, bias can be adjusted for in order to improve the accuracy of diffusion tube results. This is done using bias adjustment factors, which have been found to be specific to a laboratory and tube preparation method.

As a result of the considerable difference in the performance of tubes prepared by different labs, government guidance recommends that a bias adjustment factor is determined and applied to the data. Technical guidance gives a method for this, which involves the co-location of these tubes with a chemiluminescent NO<sub>x</sub> analyser.

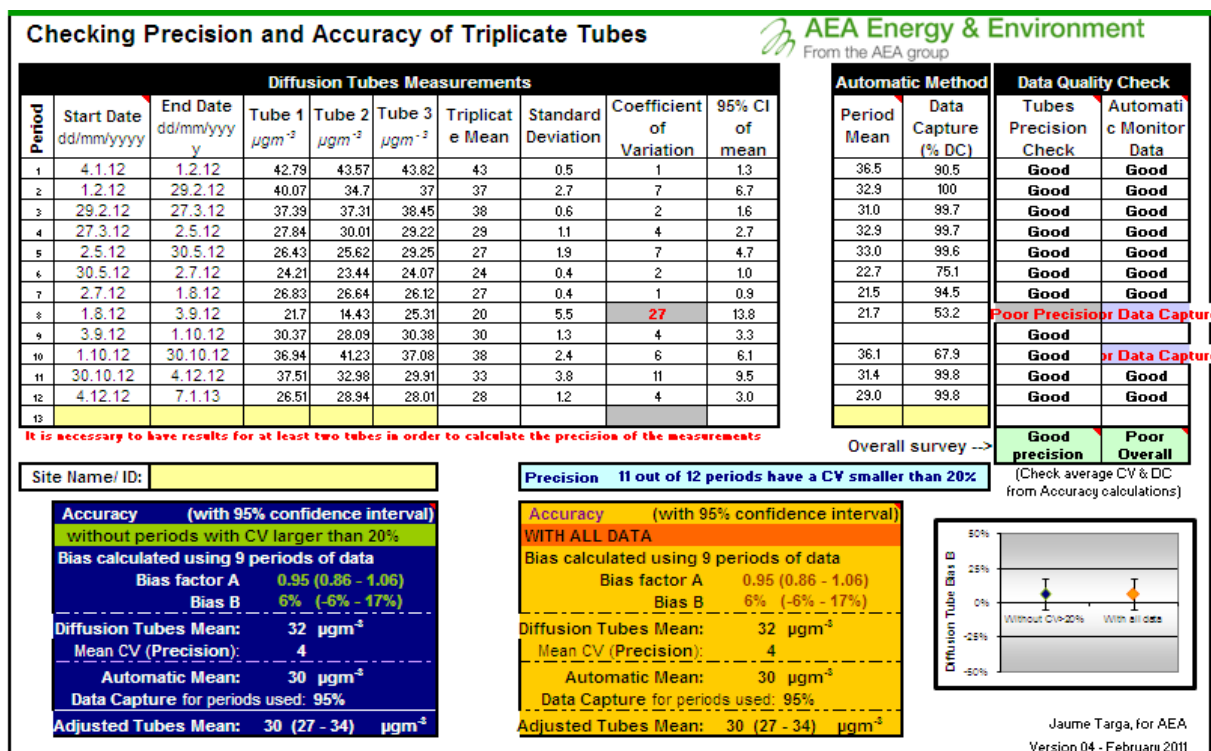
Authorities are asked to report the adjustment factor from their own co-location study, where available. The national bias adjustment factor is then determined by collating and assessing data from NO<sub>2</sub> co-location studies across the UK. Full details of both the national and local bias adjustment factors used to adjust data and details of data precision are provided below.

### Factor from Local Co-location Study

Carlisle City Council utilises NO<sub>2</sub> diffusion tubes prepared with 20% TEA in water, these are prepared and analysed by Gradko Environmental Ltd.

A local bias adjustment factor of **0.95** was derived from the diffusion tubes co-located at the Paddy's Market monitoring station. This is a roadside location, not representative of public exposure, located close to two air quality management areas.

The local bias adjustment factor was calculated using the RICARDO-AEA Spreadsheet for checking the precision and accuracy of triplicate tubes, found on the UK Air Quality Archive website. The following screen print shows the results of the data that was input into the spreadsheet:



Tube precision is separated into two categories good or poor as follows: tubes are considered to have good precision where the coefficient of variation (CV) of duplicate or triplicate diffusion tubes for eight or more periods during the year is less than 20%, and the average CV of all monitoring periods is less than 10%. Tubes are considered to have poor precision where the CV of four or more periods is greater than 20% and/or the average CV is greater than 10%.

Out of the 12 diffusion tube study periods shown above 11 had a CV of below 20% (good precision) however there was a significant loss of data from the automatic analyser during August, September and October. The local bias adjustment factor was calculated from the available 9 periods of valid data and the outcome is summarised as follows:

Diffusion tubes annual mean: **32  $\mu\text{g m}^{-3}$**   
 Automatic monitoring station mean: **30  $\mu\text{g m}^{-3}$**   
 Local bias adjustment factor: **0.95**

#### Factor from National Co-location Studies

Our local bias adjustment factor was submitted to DEFRA so that it could contribute to the overall national bias adjustment factor. Unfortunately the result of the co-location study could not be used in the determination of the national bias adjustment factor. Our study did include the minimum 9 valid sampling periods with an automatic analyser data capture of 75% or greater and valid diffusion tube results. However Gradko had a nationwide 'bad batch' of 20% TEA in water tubes in July 2012. For this reason Defra took the unilateral decision to exclude this monitoring period. As a result this has reduced the total number of valid sampling periods to 8.

A national bias adjustment factor of **0.97** was calculated using the bias adjustment spreadsheet tool on the Local Authority Air Quality Support Website spreadsheet version 03/13. This calculation is based on 27 other co-location studies nationwide. All of these studies were analysed by Gradko for the method 20% TEA in water during 2012.

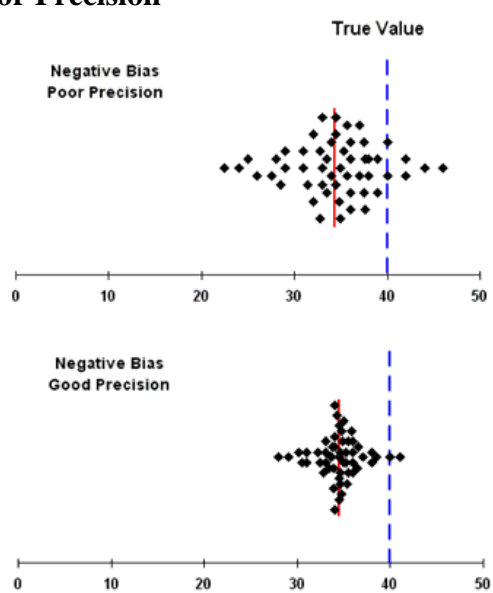
### Discussion of Choice of Factor to Use

Evidently the two bias adjustment factors are closely matched. As discussed above there were a number of data capture and technical issues with our monitoring data. It was therefore decided that the national bias adjustment factor would be the most appropriate to use. This factor is the higher of the two so it would also give the most conservative results when multiplied with the raw monitoring data. It was also considered that a correction factor derived from 27 co-location studies would incorporate variation from many different types of monitoring site. This would reflect the wide range of locations in which we expose our 50 diffusion tubes across the district, some of which differ considerably from our own co-location site. **The annual mean for each diffusion tube location has therefore been adjusted using the national bias adjustment factor of 0.97.**

### Precision

Unlike bias, poor precision cannot be adjusted for. It can only be improved by careful handling of the tubes in both the laboratory and the field. The two figures below illustrate the difference between bias and precision. Both sets of results have the same calculated negative bias, shown by the vertical red line, compared with the true value. However, those in the top part of the Figure have poor precision, whereas those in the lower part have good precision (the vertical spread is just a way of displaying the large number of individual results).

#### Good vs Poor Precision



The distinction between good and poor precision is an indicator of how well the same measurement can be reproduced. This precision will reflect the laboratories performance/consistency in preparing and analysing the tubes, as well as the subsequent handling of the tubes in the field. Any laboratory can show poor precision for a particular period/collocation study, if this is due to poor handling of the tubes in the field. Therefore, when assessing the performance of a laboratory, account should be taken of the proportion of poor precision collocation results, not just the presence or absence of poor precision co-location results.

**PM Monitoring Adjustment**

DEFRA published the results of a study investigating the equivalence of various samplers and instruments for measuring PM10 in comparison with the European reference method (a gravimetric technique).

The study found that the TEOM did not meet the equivalence criteria of the European reference method within the UK, even with the 1.3 correction factor (as advised in previous guidance). The outcome of the equivalence study means that TEOM analysers cannot strictly be used to measure PM10 concentrations for comparison with the air quality objectives.

TEOM's are however widely used in LAQM work. DEFRA & the Devolved Administrations advice to local authorities using TEOM's is that it is generally not necessary to replace the instrument immediately, but when the time does come to replace it, the selected sampler should be a reference sampler, or one that meets the equivalence criteria.

During some early rounds of review and assessment the data was corrected wherever possible using the King's College London Volatile Correction Model (VCM) for PM10 (rather than by the application of a 1.3 correction factor). This adjustment is not necessary for the purpose of more recent monitoring because the TEOM was upgraded to FDMS on 18<sup>th</sup> March 2009. For this reason the PM10 data presented here can be used to compare with the air quality objectives.

**Short-term to Long-term Data adjustment**

In order to estimate the annual mean concentration at locations where diffusion tube monitoring has been undertaken for less than 9 months of the calendar year there is a clearly defined procedure that must be followed in LAQM TG(09) section 3. The intention is to calculate an adjustment factor that can be applied to the data in order to estimate the mean pollutant concentration for the whole calendar year. This procedure applies to the new diffusion tube monitoring locations on the newly opened Carlisle Northern Development Route. Monitoring at these four locations began in May 2012.

The adjustment is based on the fact that patterns in pollution concentrations, such as seasonal variation, usually affect a wide region. Thus if a six month period is above average at one location it is also likely to be above average at other locations in the region. The first step was to identify two to four nearby continuous monitoring sites that measure nitrogen dioxide at a background location, are affiliated to the Automatic Urban and Rural Network (AURN) and have a data capture of above 90% for 2012.

The locations were selected following advice from the LAQM help desk, they match the above criteria and aim to provide a good geographical spread, however it was only possible to obtain the required data from locations which lie slightly outside of the desired 50 mile radius. Details of the locations are as follows:

- Blackpool Marton Approximately 73 miles south south west of Carlisle
- Newcastle Centre Approximately 52 miles directly east of Carlisle
- Preston Approximately 79 miles directly south of Carlisle
- Peebles Approximately 53 miles directly north of Carlisle



The monitoring data for these locations was obtained and the annual mean (Am) was calculated for each. In the same way the period means (Pm) were calculated for the period in which our diffusion tube monitoring was undertaken i.e. from May to December 2012.

The ratio of the annual mean to the period mean (Am/Pm) was then calculated for each location. An average was then taken of these four ratios to give the final adjustment factor (Ra). Below is a table showing the monitoring data that was collected and a summary of the results of the above calculations.

**Table A.1 Short-Term to Long-Term Monitoring Data Adjustment**

<b>Background Automatic Monitoring Site</b>	<b>Annual Mean 2012 (Am) (<math>\mu\text{g}/\text{m}^3</math>)</b>	<b>Period Mean May - Dec 2012 (<math>\mu\text{g}/\text{m}^3</math>) (Pm)</b>	<b>Ratio (Am/Pm)</b>
Blackpool Marton	20.21	18.39	1.099
Newcastle Centre	29.46	29.58	0.996
Preston	30.67	28.25	1.086
Peebles	7.98	7.91	1.009
Average Ratio (Ra)			1.047

The adjustment factor calculated above was then applied to the period mean for each of the four new diffusion tube monitoring locations. This was done by multiplying the measured period mean for each of the diffusion tube locations (M) with this adjustment factor. ( $M \times Ra = \text{Predicted Annual Mean}$ ) The results of these calculations can be found in appendix B & C and further discussion can be found in section 2 of this report.

#### **QA/QC of automatic monitoring**

Both of our automatic stations are subject to stringent QA/QC procedures.

Paddy's Market, which monitors  $\text{PM}_{10}$ ,  $\text{NO}_2$  and more recently  $\text{PM}_{2.5}$ , is part of the AURN and the network quality assurance and control procedures are implemented.

To ensure optimum data quality and capture, a three-tier system of calibration and analyser test procedures is employed in the AURN. The major components of this system are briefly described below.

- a) Daily automatic IZS checks - these allow instrumental drifts to be examined, and act as a daily check on instrument performance.
- b) Fortnightly manual calibrations - these are performed by the local site operators and are used by management unit to scale raw pollution data.
- c) 6 – monthly network inter calibrations – These exercises are performed by the QA/Qc Unit every 6 months to ensure that all measurements from all network stations are completely representative and intercomparable. The inter calibrations will also act as an independent audit of the system at the site.

Data ratification is undertaken at 3 monthly intervals. This involves a critical review of all information relating to the data set to verify, amend or reject the data. The ratified data represents the final data set in the review & assessment process.

The NO<sub>2</sub> data collected by the Stanwix Bank monitoring unit was managed by Casella Monitor throughout 2012. Casella Monitor has a defined quality system that forms part of their UKAS accreditation that the laboratory holds. The data management contract was passed to Supporting U in April 2013 and a decision has now been made to maintain this arrangement up to April 2014.

Re-scaling of the data relies on the Local Site Operator (Carlisle City Council) providing fortnightly calibration reports as a result of using calibration sources such as gas cylinders and zero air scrubbers. This data is used to calculate the true analyser zero and response factor and is used to scale data for the following two weeks leading up to the next scheduled calibration.

### **QA/QC of diffusion tube monitoring**

#### **Carlisle City Council QA/QC of diffusion tube monitoring**

Carlisle City Council follows the guidance set out in the 'Diffusion Tubes for Ambient NO<sub>2</sub> Monitoring: Practical Guidance for Laboratories and User' which includes advice on selection of site, the location of the samplers, instructions for exposure, and co-location with automatic analysers.

#### **Laboratory QA/QC of diffusion tube monitoring**

Gradko International has a defined quality system which forms part of the UKAS accreditation that the laboratory holds. All accredited methods are fully documented. The analytical laboratory is assessed by UKAS to establish conformance of Laboratory Quality Procedures to the requirements of ISO/IEC 17025 Standard.

UKAS assessors visit on an annual basis and review all aspects of the analysis from the sample handling to analysis and reporting. As a condition of the accreditation the laboratory is required to participate in external proficiency schemes. Gradko participates in the Workplace Analysis Scheme for Proficiency (WASP) organised by the Health and Safety Laboratory. This scheme provides a regular assessment of the labs performance in that, every quarter, the laboratory receives four diffusion tubes doped with an amount of nitrite known to HSL, but not the laboratory. At least two of the tubes are usually duplicates, which enables precision, as well as accuracy, to be assessed. Any result from such a scheme that falls outside the relevant limits is immediately investigated and steps taken to rectify the situation.

### **Calibration**

The instrument is calibrated twice daily, using a series of calibration standards to ensure a satisfactory linear response is obtained. A standard check is analysed after every fifty samples to ensure that the calibration is still valid.

### **Quality Control**

A quality control check is run after ten samples and is assessed against warning and action limits defined in the method. Quality control solutions are prepared from standards supplied by a different vendor to that of the calibration standards. Any AQC exceeding the action limit or two consecutive warning limits is internally assessed and is reported to the client as an AQC failure.

### **Travel Blank**

The travelling blank is analysed at the same time as the samples, any blank exceeding the currently prescribed maximum is investigated and reported to the client.

**Appendix B MONTHLY NO<sub>2</sub> DIFUSION TUBE RESULTS 2012 - Raw Data****AREA A - A7 STANWIX BANK, SCOTLAND ROAD AND KINGSTOWN ROAD**

Site ID	OS Grid Reference		Site Name	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	No of months
A1	339995	557188	45 SCOTLAND RD	55.64	52.73	51.37	32.58	47.1	30.18	29.23	16.79	39.28	49.42	56.24	32.24	12
A10	340008	556842	STANWIX BANK	61.26	48.66	49.14	43.89	42.4	38.33	38.08	40.75	38.76	64.7	57.84	46.93	12
A12	339935	557125	14 ETTERBY ST	29.44	26.41	24.12	17.29	19.05	17.26	14.28	31.28	16.34	29.43	27.28	24.12	12
A5	339758	558059	37 KINGSTOWN RD	48.34	50.38	43.13	31.41	26.74	28.1	29.54	33.5	39.15	17.5	50.67	32.23	12
A7	339526	559285	282 KINGSTOWN RD	34.46	35.72	29.31	19.95	19.66	21.97	22.55	25.96	26.17	a	39.56	36.35	11
A9	340028	556833	BRAMPTON RD	50.15	50.92	43.21	42.45	37.3	39	39.22	40.36	42.09	45.96	56.4	43.54	12

**AREA B - CURROCK ST-DENTON ST**

B12	339928	555428	DENTON ST	44.63	43.73	46.83	33.41	a	34.34	33.5	33.04	32.99	50.49	45.49	20.34	11
B4	339434	555638	DALSTON RD	62.61	70.27	69.85	47.46	41.85	42.26	37.7	42.69	43.1	64.35	80.8	61.74	12
B5	339613	555587	8 JUNCTION ST	40.64	34.64	36.42	29.07	26.49	22.42	22.44	24.46	a	41.26	42.95	36.49	11
B6	339731	555526	41 CHARLOTTE ST	43.86	a	43.15	25.99	30.29	30.33	26.9	32.91	30.9	48.16	48.89	34.37	11
B7	340205	555198	12 CURROCK ST	52	50.48	48.4	a	27.11	30.58	28.21	38.35	37.78	50.3	51.17	36.73	11

**AREA C - CITY CENTRE**

C1	340216	556131	LOWTHER ST	59.47	52.07	45.88	36.55	32.93	36.59	36.44	41.17	38.19	50.67	55.99	40.49	12
C2	340069	555955	TOURIST INFO	26.16	43.63	19.19	12.44	13.93	13.32	11.39	12.9	13.87	23.13	22.89	16.42	12
C3	340218	555768	DEVONSHIRE ST	42.04	37.76	44.34	43.22	39.04	32.33	36.16	33.65	40.11	46.79	50.72	36.66	12
C4	340286	555622	BAR SOLO	46.65	39.64	36.58	36.16	41.32	32.6	32.46	33.46	30.41	44.15	41.01	33.45	12
C5	340298	555589	GRIFFIN	47.84	49.37	45.23	34.45	36.48	35.72	34.97	40.19	41.16	44.58	52.8	28.54	12

**AREA D - A69 WARWICK ROAD**

D10	342044	555907	368 WARWICK RD	43.46	41.41	39.69	26.29	28.6	24.03	24.22	31.53	27.69	34.49	45.85	39.05	12
D11	340426	556040	CARTEF	43.49	41.83	42.03	35.24	23.97	29.3	29.43	29.09	31.89	45.31	42.69	31.79	12
D12	340307	555718	POST OFFICE	55.18	55.85	50.65	33.8	35.08	36.51	30.74	41.07	a	39.81	44.88	47.73	11
D5	341310	555914	215 WARWICK RD	30.01	29.7	29.89	26.66	25.86	21.37	20.58	21.93	21.98	30.65	27.07	29.5	12
D7	341593	555893	282 WARWICK RD	48.13	46.98	44.49	27.67	31.7	34.08	29.16	35.53	42.07	36.72	48.36	30.77	12
D9	341426	555910	251 WARWICK RD	35.78	33.46	39.86	27.21	30.51	24.34	24.23	27.14	28.16	31.68	35.11	31.44	12

**AREA E - CALDEWGATE-WIGTON ROAD-NEWTOWN ROAD**

E22	339834	556137	FINKLE ST	55.87	43.22	39.34	31.58	31.11	31.07	28.51	33.52	34.67	41.96	51.38	28.02	12
E12	339225	555821	3 WIGTON RD	55.8	51.38	47.27	42.59	43.19	37.41	36.48	36.03	36.14	59.34	41.31	30.35	12
E15	339091	555736	22 WIGTON RD	46.7	44.86	42.19	35.48	33.11	28.92	28.91	26.88	32.79	44.3	39.97	38.18	12
E16	339141	555900	JOVIAL SAILOR	52.37	42.04	35.58	33.41	a	38.1	32.89	33.26	30.48	60.81	24.91	42.75	11
E19	338953	555610	49 WIGTON RD	63.57	56.78	40.71	43.94	36.7	36.51	34.85	a	31	48.93	48.09	40.5	11
E20	339023	555692	44 WIGTON RD	50.77	42.4	50.22	42.84	35.03	a	26.61	27.4	31.87	42.76	28.68	33.46	11
E4	339396	555947	JOHN ST	47.06	37.94	44.03	36.5	27.9	29.07	a	31.6	34.98	52.52	48.22	37.37	11
E6	339467	555974	PADDYS MARKET 1	42.79	40.07	37.39	27.84	26.43	24.21	26.83	21.7	30.37	36.94	37.51	26.51	12
E6	339467	555974	PADDYS MARKET 2	43.57	34.7	37.31	30.01	25.62	23.44	26.64	14.43	28.09	41.23	32.98	28.94	12
E6	339467	555974	PADDYS MARKET 3	43.82	37	38.45	29.22	29.25	24.07	26.12	25.31	30.38	37.08	29.91	28.01	12
E8	339516	556024	BRIDGE ST	69.6	58.89	59.55	52.36	47.8	27.33	31.68	38.37	44.49	62.76	47.95	40.92	12
E21	337730	556118	BURGH RD	30.35	28.56	23.17	15.79	15.76	13.28	12.73	15.61	14.59	25.99	27.06	18.88	12

**AREA F - BOTCHERGATE / LONDON ROAD**

F1	340482	555489	3 TAIT ST	41.13	37.88	43.86	29.83	29.07	27.11	29.34	28.9	a	42.2	35.7	37.99	11
F10	349597	555351	155 BOTCHERGATE	46.26	39.44	41.31	36.86	33.92	28.99	31.96	31.18	29.87	45.48	41.88	37.94	12
F5	340534	555409	STANLEY HALL	a	32.93	37.38	43.21	38.13	32.83	a	32.74	28.46	49.3	33.29	27.26	10
F7	340708	555240	24 LONDON RD	54.3	54.74	50.42	33.2	34.37	31.42	36.62	37.22	36.48	45.83	59	49.44	12
F9	341099	554931	129 LONDON RD	42.87	39.59	41.48	34.38	33.04	28.89	27.83	30.6	29.88	44.59	37.01	43.92	12

**AREA G - BYPASS**

G1	338109	557841	SPA HOUSE	a	a	a	a	8.59	10.25	9.38	11.7	10.18	17.84	17.19	15.91	8
G2	337093	556785	KNOCKUPWORTH COTTAGE	a	a	a	a	11.62	11.34	10.34	11.76	1.71	a	17.54	15.91	7
G3	336338	556311	CORNHILL FARM	a	a	a	a	7.08	7.63	7.37	9.49	8.31	15.05	16.13	14.14	8
G4	336905	554036	THE HOBBIT	a	a	a	a	13.89	12.5	10.36	12.01	9.3	19.83	17.78	20.64	8

**AREA H - OUTSKIRTS OF CITY, TOWNSHIPS AND AIRPORT**

H1	352824	561039	BRAMPTON	28.29	24	24.32	18.08	18.1	16.28	17.2	16.78	16.23	22.83	21.84	22.05	12
H3	338052	568478	LONGTOWN	31.14	29.89	23.95	21.45	21.74	21.86	20.01	21.98	20.78	27.23	26.59	29.67	12
H4	347411	556881	WARWICK BRIDGE	39.79	32.48	41.63	33.24	36.19	28.48	35.29	30.26	28.54	39.7	31.36	33.45	12
H5	337643	554100	WIGTON RD	32.56	28.72	26.55	18.35	13.14	11.5	10.61	14.34	17.81	27.35	23.79	29.37	12
H6	337962	553220	PETER LANE	17.7	14.99	13.86	11.62	11.7	10.41	9.34	9.78	6.49	19.82	10.92	19.02	12
H7	338282	553396	DALSTON RD	23.81	23.85	21.24	10.04	17.15	14.2	13.96	14.35	14.32	27.54	21.27	18.64	12
H8	347874	561254	AIRPORT	15.48	12.9	11.79	6.52	6.88	7.52	a	6.07	a	9.64	13.19	10.22	10

**Appendix C NO<sub>2</sub> DIFUSION TUBE RESULTS 2012 - Calculated Data****AREA A - A7 STANWIX BANK, SCOTLAND ROAD AND KINGSTOWN ROAD**

Site ID	Site Name	Annual Mean (µg/m <sup>3</sup> )	Local Bias Adjustment (0.95)	National Bias Adjustment (0.97)	In relevant location? (Distance of residence from tube) (m)	Distance of tube from kerb of nearest Road. (m)	NO <sub>2</sub> Background Concentration (µg/m <sup>3</sup> )	Predicted NO <sub>2</sub> Concentration at receptor (µg/m <sup>3</sup> )
A1	45 SCOTLAND RD	41.07	39.01	39.83	N (4.5)	1.5	13.316028	31.8
A10	STANWIX BANK	47.56	45.18	46.13	N (1.5)	1.5	15.79779	41.5
A12	14 ETTERBY ST	23.03	21.87	22.33	Y	3	-	-
A5	37 KINGSTOWN RD	35.89	34.10	34.81	Y	4	-	-
A7	282 KINGSTOWN RD	28.33	26.92	27.48	N (7.5)	4	13.69177	23.4
A9	BRAMPTON RD	44.22	42.01	42.89	Y	1.5	-	-

**AREA B - CURROCK ST-DENTON ST**

B12	DENTON ST	38.07	36.17	36.93	N (10)	0.5	26.546386	31.3
B4	DALSTON RD	55.39	52.62	53.73	Y	3.5	-	-
B5	8 JUNCTION ST	32.48	30.86	31.51	Y	2.5	-	-
B6	41 CHARLOTTE ST	35.98	34.18	34.90	Y	2.5	-	-
B7	12 CURROCK ST	41.01	38.96	39.78	Y	3	-	-

**AREA C - CITY CENTRE**

C1	LOWTHER ST	43.87	41.68	42.55	Y	3	-	-
C2	TOURIST INFO	19.11	18.15	18.53	N	-	-	Not residential
C3	DEVONSHIRE ST	40.24	38.22	39.03	N	3	-	Not residential
C4	BAR SOLO	37.32	35.46	36.20	N	9	-	Not residential
C5	GRIFFIN	40.94	38.90	39.72	N	3	-	Not residential

**AREA D - A69 WARWICK ROAD**

D10	368 WARWICK RD	33.86	32.17	32.84	Y	5	-	-
D11	CARTEF	35.51	33.73	34.44	Y	4.5	-	-
D12	POST OFFICE	42.85	40.70	41.56	N	5	-	Not residential
D5	215 WARWICK RD	26.27	24.95	25.48	Y	9	-	-
D7	282 WARWICK RD	37.97	36.07	36.83	Y	7	-	-
D9	251 WARWICK RD	30.74	29.21	29.82	Y	8.5	-	-



**AREA E - CALDEWEGATE-WIGTON ROAD-NEWTOWN ROAD**

E22	FINKLE ST	37.52	35.64	36.40	Y	12	-	-
E12	3 WIGTON RD	43.11	40.95	41.81	N (2)	2.5	26.546386	39.6
E15	22 WIGTON RD	36.86	35.01	35.75	Y	4.5	-	-
E16	JOVIAL SAILOR	38.78	36.84	37.62	Y	2.5	-	-
E19	49 WIGTON RD	43.78	41.59	42.47	Y	2.5	-	-
E20	44 WIGTON RD	37.46	35.59	36.33	Y	5.5	-	-
E4	JOHN ST	38.84	36.89	37.67	N (3)	3	26.546386	35.7
E6	PADDYS MARKET 1	31.55	29.97	30.60	N (42)	9	-	Not residential
E6	PADDYS MARKET 2	30.58	29.05	29.66	N (42)	9	-	Not residential
E6	PADDYS MARKET 3	31.55	29.97	30.61	N (42)	9	-	Not residential
E8	BRIDGE ST	48.48	46.05	47.02	Y	4	-	-
E21	BURGH RD	20.15	19.14	19.54	N (8)	3	11.109434	16.7

**AREA F - BOTCHERGATE / LONDON ROAD**

F1	3 TAIT ST	34.82	33.08	33.77	Y	3.5	-	-
F10	155 BOTCHERGATE	37.09	35.24	35.98	Y	3	-	-
F5	STANLEY HALL	35.55	33.78	34.49	Y	3	-	-
F7	24 LONDON RD	43.59	41.41	42.28	Y	4.5	-	-
F9	129 LONDON RD	36.17	34.36	35.09	Y	0.5	-	-

**AREA G - BYPASS**

G1	SPA HOUSE	12.63	13.22	Y	85	-	-
G2	KNOCKUPWORTH COTTAGE	11.46	12.00	Y	22	-	-
G3	CORNHILL FARM	10.65	11.15	Y	3	-	-
G4	THE HOBBIT	14.54	15.22	Y	19	-	-

**AREA H - OUTSKIRTS OF CITY, TOWNSHIPS AND AIRPORT**

H1	BRAMPTON	20.50	19.48	19.89	N (0.5)	2.5	6.239793	19.3
H3	LONGTOWN	24.69	23.46	23.95	N (0.5)	2.5	6.411215	23.2
H4	WARWICK BRIDGE	34.20	32.49	33.17	N (0.5)	2.5	7.734763	32
H5	WIGTON RD	21.17	20.12	20.54	Y	1.5	-	-
H6	PETER LANE	12.97	12.32	12.58	Y	4	-	-
H7	DALSTON RD	18.36	17.45	17.81	Y	6.5	-	-
H8	AIRPORT	10.02	9.52	9.72	Y	2	-	-

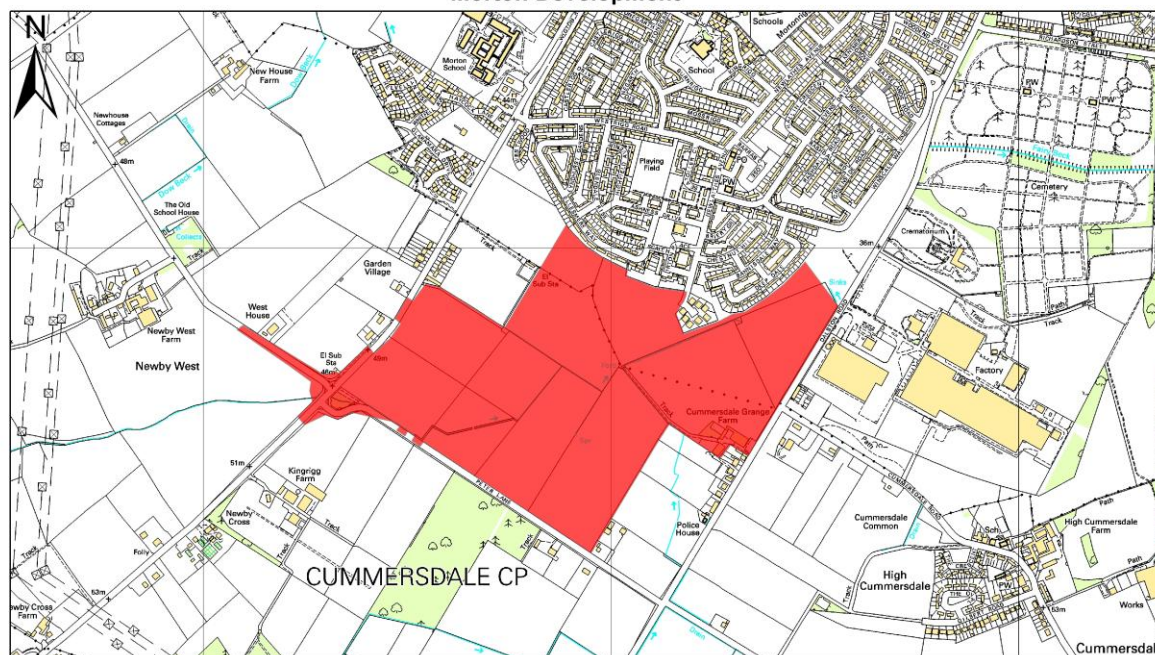
Results in red indicate an exceedence of the annual mean objective of 40µg/m3.

Results in blue are an estimation of the annual mean using short term monitoring data, using adjustment factor of 1.047. (See appendix A)

## Appendix D: Maps Showing Locations of Potential New Developments.

### Morton Development - Original application

**Morton Development**

 Morton Development

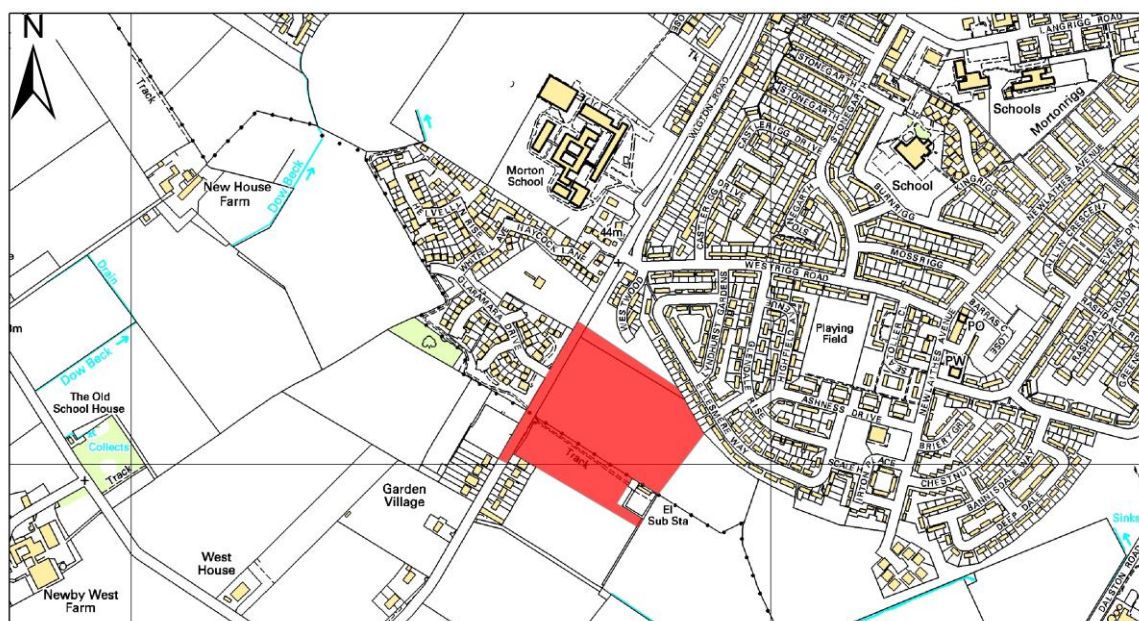
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## Morton Development - Ellesmere Way application

**Development at land south west of Ellesmere Way & adjacent to Wigton Road, Carlisle**



Ellesmere Way Development

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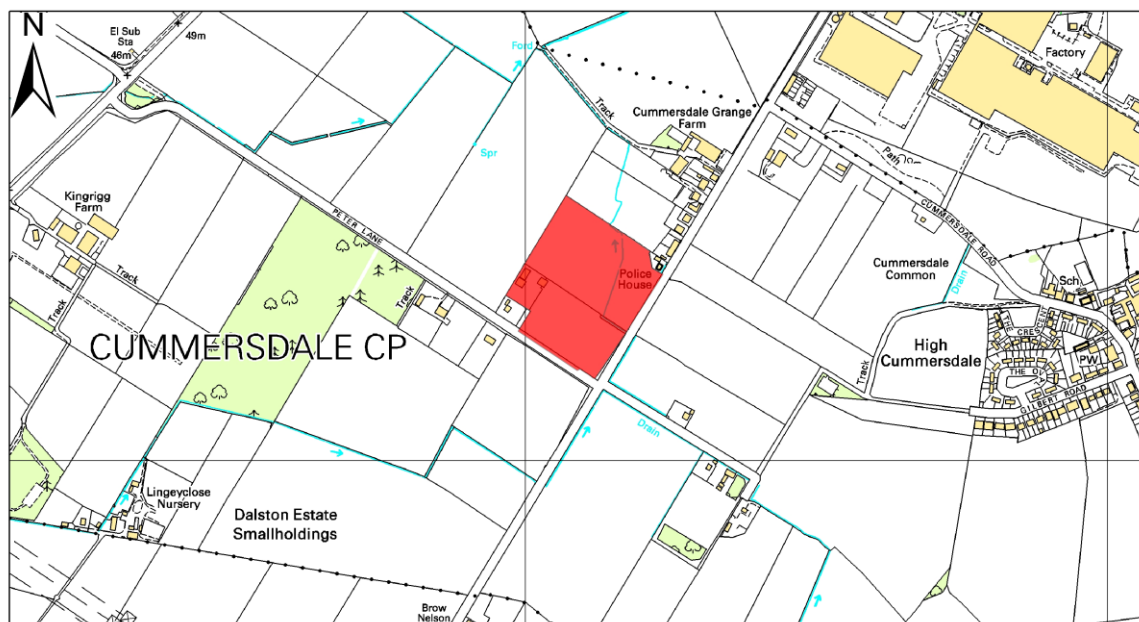
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## Morton Development - Peter Lane application

**Development at land adjacent to Peter Lane bounded by Dalston Road and Peter Lane, Carlisle**



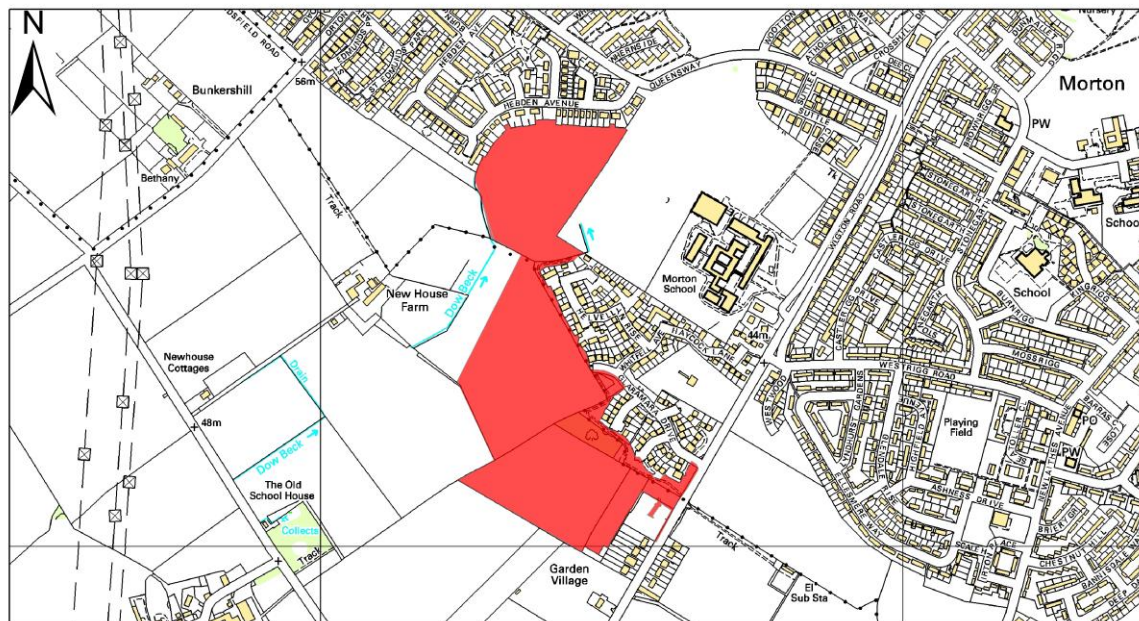
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## Morton Development - Garden Village application

## Garden Village Development



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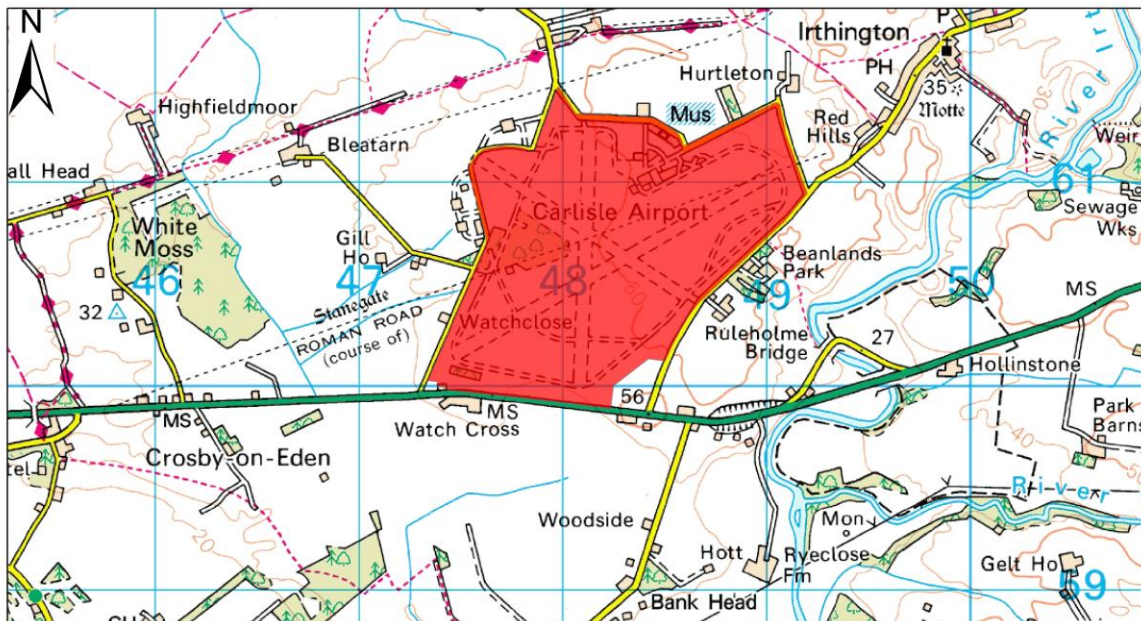


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## Carlisle & Lake District Airport

Development at Carlisle Lake District Airport, Carlisle



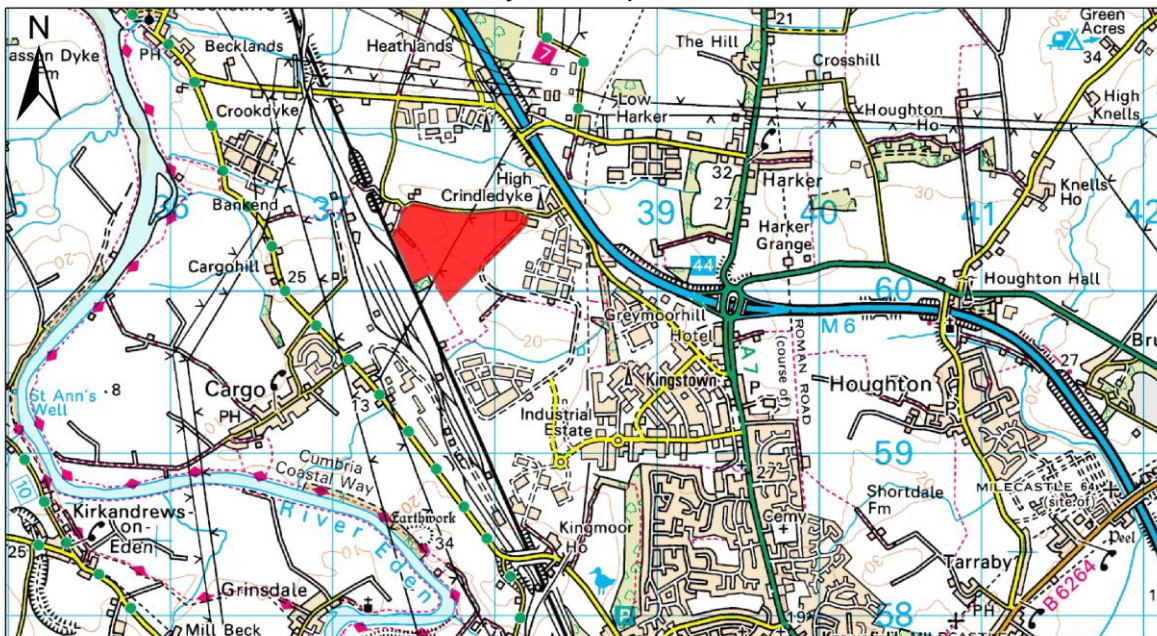
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## Crindledyke Development

Crindledyke Development Area



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## Hammonds Pond Development

Hammonds Pond Development

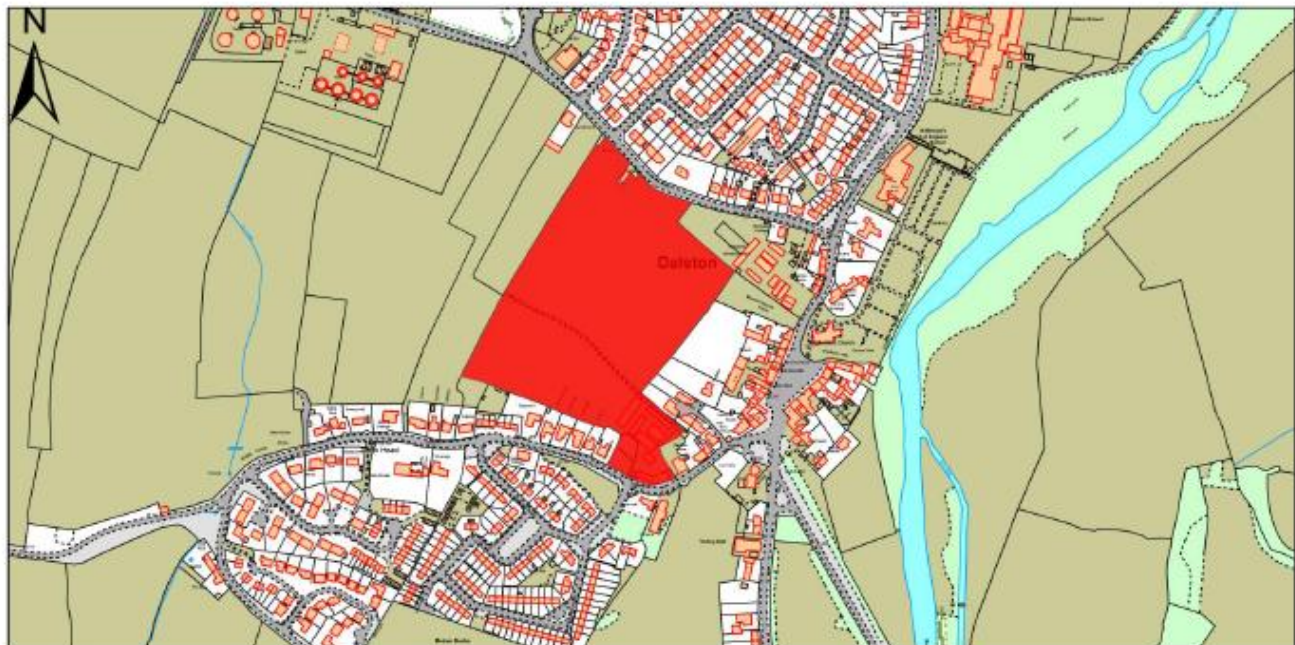


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## Dalston Development

Dalston Development

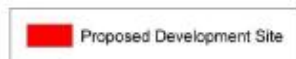
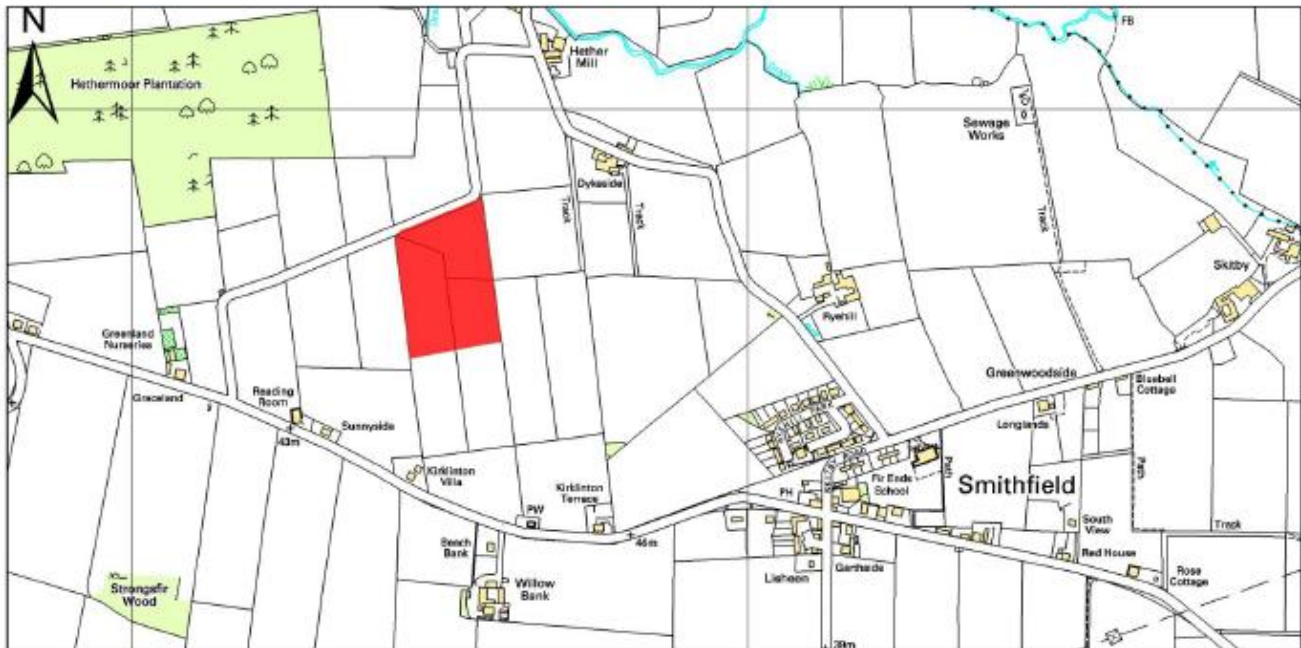


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## Smithfield Poultry Unit

### Smithfield Poultry Breeding Unit Proposed Development



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