2013 Air Quality Progress Report for East Ayrshire Council

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

December 2013

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Executive Summary

East Ayrshire Council has carried out a review of air quality within East Ayrshire, which fulfils the requirements of the Local Air Quality Management process as set out in part IV of the Environment Act (1995) and the Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2007. The Report follows Technical Guidance LAQM.TG(09) (Reference 1), issued by the Scottish Government to assist local authorities in their Review and Assessment of air quality.

The report forms the 2013 Progress Report (PR) of the fifth round of the Review and Assessment process and includes the latest available data up to the end of 2012. It also considers the conclusions of the previous rounds of Review and Assessment and any changes that have occurred since then which would have an effect on local air quality.

The report sets out the results of air quality monitoring carried out by East Ayrshire Council and considers the potential impacts from a range of sources such as road traffic and other transport emissions, industrial processes, commercial and domestic fuel use and fugitive emission sources which may have changed since the 2012 Updating and Screening Assessment.

The Progress Report concluded that concentrations of the Air Quality Objectives outlined in Table 1.1 are unlikely to be exceeded for the following pollutants. On the basis of this assessment, no further action is required in respect of the pollutants:

Carbon Monoxide
Benzene
1,3-Butadiene
Lead
Sulphur Dioxide

Nitrogen Dioxide and PM_{10}

Automatic annualised monitoring results of PM_{10} within Kilmarnock during 2012 indicated that PM_{10} levels (estimated) at both John Finnie Street and St. Marnock Street (Table 2.7) were below the Annual Mean Air Quality Objective (18 µg/m$^{3)}$. Unfortunately data capture was poor and therefore caution must be used when interpreting the results. We can, however, conclude that levels of PM_{10} have dropped compared with 2010 and 2011 and further monitoring is therefore necessary to ascertain whether this drop is a short term deviation or long term trend. Three exceedences of the 24-hour objective occurred at the St. Marnock site during 2012 with a 99.8th percentile of 44 µg/m^3.

All monitoring locations where both automatic and passive monitoring was carried out for NO_2 resulted in measured concentration below the Annual Mean Air Quality Objective (40 µg/m^3)(Table2.3 and 2.5). Similarly no exceedences of the 1-hour mean (Table 2.4) were recorded at John Finnie Street or St. Marnock Street.
Since PM_{10} levels exceeded the Annual Mean Air Quality Objective during 2010 and 2011 and Annual Mean Air Quality Objectives for NO_2 have been exceeded in previous years a Detailed Assessment (Reference 24) was conducted for both pollutants. This was completed in December 2013 and concluded that the NO_2 Annual Mean Air Quality Objective was being met and there was therefore no requirement for an AQMA at this time. Following adjustment the modelling predictions indicated that the PM_{10} Annual Mean Objective is being exceeded within Kilmarnock Town Centre. However, due to a significant drop in measured concentrations during 2012 (Figure 2.7), possibly partly due to a reduction in traffic from the closure of the Johnnie Walker Factory, East Ayrshire Council has decided to delay declaration of an AQMA for PM_{10} until further monitoring data (with high data capture) is obtained. This will be completed using 2013 monitoring data and reported on during 2014.

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1 Introduction

1.1 Description of Local Authority Area

East Ayrshire is one of 32 unitary authority council areas in Scotland. It borders onto North Ayrshire, East Renfrewshire, South Lanarkshire, South Ayrshire and Dumfries and Galloway. With South Ayrshire and the mainland areas of North Ayrshire, it formed the former county of Ayrshire. The area was formed in 1996, from the former Kilmarnock and Loudoun, and Cumnock and Doon Valley Districts.

East Ayrshire has an area of 1,262 Km^2 (97% rural) and a population of 119,600 (2007), giving a population density of 95/Km^2. East Ayrshire has 22 localities with populations over 500. Kilmarnock is the largest town with a population of around 43,000. There are three other towns with populations over 5,000, namely Cumnock (9,400), Stewarton (6,600) and Galston (5,000).

Agriculture is the dominant land use, with pastoral farming the main type, along with small areas of arable crops grown mainly for animal feed. 22% of the land area is covered in woodland. Significant areas of land are used for open cast coal mining, stretching north and east from Dalmellington in the south west of the district, through Cumnock and New Cumnock to Muirkirk and into South Lanarkshire.

East Ayrshire, in common with the rest of Scotland, has seen the decline of traditional heavy industry and manufacturing along with the closure of deep-mine collieries. Employment is now provided by service industries, light industry, smaller-scale manufacturing, retail and the public sector, with deep mining being replaced by open-cast mining. The Diageo Johnnie Walker whisky bottling plant, Kilmarnock's largest private employer, closed in March 2012 with the loss of over 700 jobs. A significant proportion of the population now work outside the district, with significant areas of new housing developments reflecting this. New housing on the north side of Kilmarnock is one example of this, with many of the new residents heading north towards Glasgow and beyond on the M77.

The main transportation route within East Ayrshire is the A77/M77, which runs from Stranraer and the port of Cairnryan in Dumfries and Galloway, passing through South Ayrshire and East Ayrshire, before heading north to Glasgow. Although the most heavily trafficked route by far within East Ayrshire, with daily traffic flows in excess of 40,000 vehicles (Source: Transport Scotland), the road bypasses all centres of populations and built- up areas.

East Ayrshire is also served by six railway stations, with Kilmarnock being the largest, with an annual passenger usage of 421,000.

Previous monitoring and modelling has indicated that road traffic is the major localised source of PM_{10} and NO_2 within East Ayrshire. Where traffic levels are high, combined with congestion (due to traffic lights, frequent junctions etc.) and relatively

narrow streets with tall buildings on either side of the road, has resulted in annual mean PM_{10} exceedences (2010 and 2011, Table 2.7) and annual mean NO_2 exceedences (2010, Table 2.3 and Table2.6) in Kilmarnock Town Centre. Similar combinations in Newmilns and Mauchline have led to NO_2 being close to the annual mean (diffusion tube monitoring, Table 2.6).

Kilmarnock Town Centre
John Finnie Street is part of the one way system in the centre of Kilmarnock and has three lanes of traffic with parking bays on either side of the street. Most of the street has tall buildings on both sides of the road close to the kerb. Annual average daily traffic flows, although in excess of 17,000 vehicles per day during 2006 have dropped to just below 14,000 during 2013. (Source; Traffic Section, East Ayrshire Council); there are several feeder roads and several sets of traffic lights along the street, with the resultant stationary traffic. All these factors combine to give raised levels of nitrogen dioxide and PM_{10}.

Newmilns
Daily traffic flows through Newmilns (A71) are in the region of 10-11,000 vehicles (Source; Traffic Section, East Ayrshire Council), and that combined with the relatively narrow streets and high buildings on either side of the street (canyon effect), combined with pedestrian lights has resulted in levels of nitrogen dioxide around the annual mean Air Quality Objective of 40 µg/m^3 (Table 2.6) in previous years along the A71.

Mauchline
The A76 Kilmarnock to Dumfries Trunk Road runs through Mauchline and daily traffic flows are in the region of 12-13,000 vehicles (Source Transport Scotland). This combined with relatively narrow streets and high buildings (canyon effect) with traffic lights both at the intersection of the A76 and the B743 (Mauchline/Ayr Road) in conjunction with pedestrian lights, has resulted in levels of nitrogen dioxide around the annual mean Air Quality Objective (diffusion tube monitoring, Table 2.6) in recent years along the A76.

A map of the area is included in Figure 1.

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.

The Progress Report presented in this document was carried out in accordance with the most recent technical guidance document, Local Air Quality Management Technical Guidance LAQM.TG(09) (Reference 1).

1.3 Air Quality Objectives

The air quality objectives applicable to LAQM **in Scotland** are set out in the Air Quality (Scotland) Regulations 2000 (Scottish SI 2000 No 97), the Air Quality (Scotland) (Amendment) Regulations 2002 (Scottish SI 2002 No 297), and are shown in Table 1.1. This table shows the objectives in units of microgrammes per cubic metre µg/m^3 (milligrammes per cubic metre, mg/m^3 for carbon monoxide) with the number of exceedences in each year that are permitted (where applicable).

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

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Benzene	16.25 µg/m^3	Running annual mean	31.12.2003
	3.25 µg/m^3	Running annual mean	31.12.2010
1,3-Butadiene	2.25 µg/m^3	Running annual mean	31.12.2003
Carbon monoxide	10 mg/m^3	Running 8-hour mean	31.12.2003
Lead	0.50 µg/m^3	Annual mean	31.12.2004
	0.25 µg/m^3	Annual mean	31.12.2008
Nitrogen dioxide	200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 µg/m^3	Annual mean	31.12.2005
Particulate Matter (PM_{10}) (gravimetric)	50 µg/m^3, not to be exceeded more than 7 times a year	24-hour mean	31.12.2010
	18 µg/m^3	Annual mean	31.12.2010
Sulphur dioxide	350 µg/m^3, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 µg/m^3, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 µg/m^3, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

1.4 Summary of Previous Review and Assessments

LQMA Activity	Date	Outcome
First Round of Review and Assessment	1998-2001	No exceedences of Air Quality Objectives were found or predicted.
Updating and Screening Assessment	2003	No exceedences of Air Quality Objectives were found or predicted.
Progress Report	2004	Although some exceedences of the Air Quality Objective for benzene were predicted for 2010 levels, this was as a result of problems associated with the analytical laboratory. No other exceedences were found or predicted.
Progress Report	2005	No exceedences of the Air Quality Objectives were found or predicted.
Updating and Screening Assessment	2006	No exceedences of the Air Quality Objectives were found or predicted. Although future levels of nitrogen dioxide and PM_{10} were predicted to be within future Air Quality Objective limits, the levels found suggested more detailed monitoring was required.
Progress Report	2007	No exceedences of Air Quality Objectives were found or predicted.
Progress Report	2008	No exceedences of Air Quality Objectives were found or predicted for all pollutants. However, due to nitrogen dioxide levels being close to the annual mean objective within John Finnie Street, Kilmarnock, it was decided to commission a Detailed Assessment.
Detailed Assessment	2008	An atmospheric dispersion modelling of road traffic emissions was undertaken to determine nitrogen dioxide pollutant concentrations at locations of relevant public exposure, within John Finnie Street, Kilmarnock. No exceedences of both the annual mean and the 1-hour objective for nitrogen dioxide were predicted at areas of relevant public exposure. It was therefore not necessary to declare an Air Quality Management area at this time. Extra monitoring was recommended using both diffusion tubes (underway August 2009) and automatic monitoring (nearing installation).
Updating and Screening Assessment	2009	No exceedences of Air Quality Objectives were found or predicted for all pollutants at locations of relevant public exposure. Further monitoring was deemed necessary particularly in Kilmarnock, Newmilns and Mauchline as levels of NO_2 were just below the Air

		Quality Objectives.
Progress Report	2010	No exceedences of Air Quality Objectives were found or predicted for all pollutants at locations of relevant public exposure. Further monitoring was deemed necessary particularly in Kilmarnock, Newmilns and Mauchline as levels of NO_2 were just below the Air Quality Objectives.
Progress Report	2011	Exceedences of Air Quality Objectives were found for both annual mean PM_{10} and annual mean NO_2 within Kilmarnock. Due to the exceptional weather conditions associated with 2010 further monitoring was deemed necessary and if either PM_{10} or NO_2 levels exceeded the Air Quality Objectives for a second year East Ayrshire Council would proceed to a Detailed Assessment.
Updating and Screening Assessment	2012	In 2011 exceedence of Air Quality Objective were found for the annual mean PM_{10} within John Finnie Street, Kilmarnock with no exceedence of the 24-hour mean PM_{10} Objective. No exceedences were found for NO_2 Air Quality Objectives within East Ayrshire in 2011. Due to two consecutive years with PM_{10} annual mean exceedence East Ayrshire Council has proceeded to a Detailed Assessment. NO_2 has also been included in the Detailed Assessment due to past exceedences.

2 New Monitoring Data

2.1 Summary of Monitoring Undertaken

2.1.1 Automatic Monitoring Sites

East Ayrshire Council carried out automatic monitoring for NO_2 and PM_{10} and non-automatic monitoring for NO_2 during 2012.

Automatic Monitoring for NO_2 and PM_{10} was carried out at two locations within East Ayrshire during 2012, using two API Chemiluminescent $NO/NO_2/NO_x$ Analysers and one Met One Instruments BETA Attenuation Mass Monitor (BAM 1020) and one TEOM FDMS 1405 Monitor. All monitors are fitted with web logger functionality.

Automatic monitoring commenced for NO_2 and PM_{10} in John Finnie Street, Kilmarnock (Figure 4) in February 2010 and continued through 2011 and 2012. John Finnie Street was chosen for NO_2 monitoring since previous monitoring using diffusion tubes has indicated that NO_2 levels are just below the National Air Quality Objective (Table 2.2 and 2.6) and it is a heavily trafficked town centre road, with several feeder roads, several sets of traffic lights and tall buildings on either side of the road. Although earlier modelling suggested 2010 PM_{10} levels would be under 18 $\mu g/m^3$, the fact that levels of NO_2 were close to the Air Quality Objective due to high levels of road traffic (and experience suggests PM_{10} levels would also be close to the Air Quality Objective in these circumstances), monitoring to check actual PM_{10} levels was sensible. In fact monitoring during 2010 and 2011 indicated that PM_{10} levels, at 21 and 20 $\mu g/m^3$ respectively, were in fact above the annual mean Air Quality Objective (Table 1.1 and Table 2.7). Further monitoring was therefore deemed necessary and the BAM1020 in John Finnie Street was replaced by a TEOM FDMS PM_{10} monitor in the early part of 2012 and the BAM1020 and API Chemiluminescent analyser from New Cumnock moved to St. Marnock Street, Kilmarnock (Figure 4, part of the one-way system). This was deemed sensible for two reasons, firstly, two years monitoring at New Cumnock confirmed that both NO_2 and PM_{10} are consistently well below Air Quality Objectives (Table 2.3, 2.4, 2.7 and 2.8) and as no major change is predicted the analysers were moved to St. Marnock Street, Kilmarnock which is part of the one way system. This second site within the heavily trafficked Kilmarnock one way system will give us additional robust monitoring data which will allow more accurate modelling if any detailed or further assessments are required in the future.

Further details of all two monitoring stations are provided in Table 2.1. The locations of both Kilmarnock sites are shown in Figure 4.

Table 2.1 Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Inlet Height (m)	Pollutants Monitored	In AQMA?	Monitoring Technique	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
A2	Kilmarnock, John Finnie Street	Roadside	242691	638095	1.77	NO_2	N	Chemiluminescent	Y (<1m)	2.79	Y
					2.11	PM_{10}	N	FDMS	Y (<1m)	2.73	Y
A3	Kilmarnock, St. Marnock Street	Roadside	242742	637705	1.67	NO_2	N	Chemiluminescent	Y (<1m)	3.25	Y
					1.77	PM_{10}	N	BAM 1020	Y (<1m)	3.50	Y

QA/QC of the Automatic Monitoring

The maintenance of the two monitoring sites at New Cumnock and Kilmarnock is carried out by Air Monitors. This involves routine servicing and provision for emergency callouts as required. Automatic calibration, zero and span checks are carried out daily. The automatic span check consists of a gas of known concentration being passed through the NOx analyser and the measured concentration being recorded automatically for rescaling. Both the New Cumnock and Kilmarnock sites are part of the Scottish Air Quality Network and are audited twice yearly by AEA Technology on behalf of the Scottish Government. AEA also carry out the data management for these two sites. Since the installation of web loggers, the data is checked daily by East Ayrshire Council Environmental Health staff to ensure that it is being recorded properly and there are no faults showing with any of the analysers, as well as checking the zero and span recordings. AEA and Air Monitors also check the data at regular intervals and e-mail or telephone Environmental Health if any problems occur. An officer from Environmental Health will attend the site to rectify any problems found, often in consultation with an engineer from Air Monitors. If the problem cannot be rectified by Environmental Health staff, Air Monitors attend the site and rectify the faults found. An officer from Environmental Health also carries out any routine filter changes, inlet cleaning etc. as recommended in the equipment instruction manual. At the request of AEA Technology East Ayrshire Council is now carrying out manual calibration checks due to some technical issues with automatic calibrations. Regular visits to the monitoring sites is also good practice as any other faults which may arise from time to time can be picked up and quickly rectified.

AEA undertake quality control of the automatic data for both the Kilmarnock sites. The QA/QC procedures follow the requirements of the Local Air Quality Management Technical Guidance LAQM.TG(09) (Reference 1) and are equivalent to those used at UK National Network (AURN) monitoring sites. This gives a high degree of confidence in the data obtained for reliable concentrations at the automatic sites. Once the calibration factors have been applied AEA carry out monthly Data Validation. In essence the data is screened by visual examination to determine if it contains spurious and unusual measurements. Any suspicious data, such as large spikes or high concentrations are “flagged” or marked to be investigated more fully. At six monthly intervals (quarterly from 2013) AEA carry out Data Ratification. This involves thorough checking of the data to ensure it is reliable and consistent. Essentially the data ratification procedure involves a critical review of all information relating to a particular data set, in order to verify, amend or reject the data. When the data has been ratified, AEA present the final data set to be used in Review and Assessment Process. BAM PM_{10} data was corrected for slope using a factor of 0.83333 to give an Indicative Gravimetric Equivalent (Reference 9). The Air Pollution Reports produced by AEA on behalf of the Scottish Government can be found in Appendix C.

2.1.2 Non-Automatic Monitoring Sites

Non-automatic monitoring of nitrogen dioxide using passive diffusion tubes was undertaken at 27 separate locations in East Ayrshire during 2012 (Figures 5a-5h). (Reference 22 Air Quality Progress Reports East Ayrshire Council and Table 2.2, 2.3 and 2.6). Monitoring commenced at six new sites in January 2011 including four new sites in Kilmarnock, one site in Newmilns and one new site in Mauchline (Table 2.2 and Figures 5a – 5h).

The diffusion tube locations are described in Table 2.2. All diffusion tubes except for the co-location tubes are located at a height of 2.95m. A lower height would be preferred but a compromise of 2.95m was necessary to minimise vandalism but still be representative of the air people breathe at street level. Three nitrogen dioxide diffusion tubes were also located at the automatic monitoring station in John Finnie Street Kilmarnock to allow a local bias adjustment to be calculated and to add to the National Diffusion Tube Bias Adjustment Factor Spreadsheet for Glasgow Scientific Services. These tubes are located at a height of 1.77m which is the height of the NO_x inlet for the automatic analyser.

Table 2.2 Details of Non- Automatic Monitoring Sites

Site ID / Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
1. Fowlds Street/King Street Junction, Kilmarnock	Kerbside	242805	637620	2.95	NO_2	N	N	Y(35m)*	< 1m	Y
2. 28 John Finnie Street, Kilmarnock	Roadside	242701	638083	2.95	NO_2	N	N	Y(3 – 4m)	2-3m	Y
3. 19 Lainshaw Street, Stewarton	Kerbside	241907	645820	2.95	NO_2	N	N	Y(2 – 3m)	< 1m	Y
4. 40 Main Street, Newmilns	Roadside	253601	637310	2.95	NO_2	N	N	Y(< 1m)	2-3m	Y
6. 8A Kilmarnock Road, Mauchline	Roadside	249826	627335	2.95	NO_2	N	N	Y(2 – 3m)	2-3m	Y
7. Junction at Main Street & A70 Ochiltree	Roadside	250712	621166	2.95	NO_2	N	N	Y(15m)*	1-2m	Y
9.Townhead/Glaisnock Street Junction, Cumnock	Roadside	256889	620133	2.95	NO_2	N	N	Y 9m)*	1-2m	Y
11. 96 John Finnie Street, Kilmarnock	Roadside	242657	637883	2.95	NO_2	N	N	Y(3-4m)	2-3m	Y
12. 62 John Finnie Street, Kilmarnock	Roadside	242673	637955	2.95	NO_2	N	N	Y(3 – 4m)	2-3m	Y

Site ID / Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
14. 95/97 John Finnie Street, Kilmarnock	Roadside	242619	637773	2.95	NO_2	N	N	Y(100m)**	3m	Y
15. 16 West George Street, Kilmarnock	Roadside	242766	638160	2.95	NO_2	N	N	Y(35m)*	1-2m	Y
17. 23/25 Loudoun Road, Newmilns	Roadside	253204	637237	2.95	NO_2	N	N	Y(<1m)	2-3m	Y
18. 100 Main Street, Newmilns	Roadside	253784	637336	2.95	NO_2	N	N	Y(3-4m)	2-3m	Y
19. 57/59 Townhead Street, Cumnock	Roadside	257059	620157	2.95	NO_2	N	N	Y(<1m)	1-2m	Y
20. 66 Main Street, Muirkirk	Roadside	269706	627355	2.95	NO_2	N	N	Y(5m)	2-3m	Y
22. The Cross, Mauchline	Roadside	249863	627257	2.95	NO_2	N	N	Y(5-6m)*	2-3m	Y
23. 3/5 Loudoun Street, Mauchline	Roadside	249867	627232	2.95	NO_2	N	N	Y(<1m)	3-4m	Y
24. 5/7 Earl Grey Street, Mauchline	Roadside	249894	627233	2.95	NO_2	N	N	Y(<1m)	2m	Y
25A. John Finnie Street, Kilmarnock	Roadside***	242691	638095	2.95	NO_2	N	Y	Y(17m)*	2-3m	Y
25B. John Finnie Street, Kilmarnock	Roadside***	242691	638095	2.95	NO_2	N	Y	Y(17m)*	2-3m	Y

Site ID / Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
25C. John Finnie Street, Kilmarnock	Roadside***	242691	638095	2.95	NO_2	N	Y	Y(17m)*	2-3m	Y
26 76 Loudoun Road, Newmilns	Roadside	253015	637232	2.95	NO_2	N	N	Y(9-10m)*	1-2m	Y
27 Junction King Street/St. Marnock Street, Kilmarnock	Kerbside	242771	637714	2.95	NO_2	N	N	Y(44m)*	<1m	Y
28 2A Welbeck Street, Kilmarnock	Roadside	243212	637338	2.95	NO_2	N	N	Y(29m)*	2-3m	Y
29 Junction McLelland Drive/Dundonald Road, Kilmarnock	Roadside	242192	637249	2.95	NO_2	N	N	Y(5m)	2-3m	Y
30 16 Cumnock Road, Mauchline.	Roadside	249943	627024	2.95	NO_2	N	N	Y(7m)*	1-2m	Y
31 Wellington Street, Kilmarnock	Kerbside	242965	638555	2.95	NO_2	N	N	Y(8m)*	<1m	Y

*Although these sites are greater than 5m from relevant exposure (annual mean), they are representative of such exposure. These locations were chosen because of the suitability of mounting the NO_2 diffusion tubes at equivalent representative points to annual mean relevant exposure. Although diffusion tubes can only be used to measure annual mean levels of NO_2 they do give an indication of whether the hourly mean objective is likely to be breached (Reference 6). It is therefore reasonable to conclude that all of the above sites have relevant exposure as members of the public might reasonably be expected to spend one hour or longer at these locations.
** On the recommendation of BMT Cordah, Air Quality Consultants, an extra NO_2 diffusion tube was located to provide a better spread of NO_2 levels along John Finnie Street to allow better model verification if any future detailed assessments are required (Section 2.2.1 Kilmarnock).
***Diffusion Tubes 25A, 25B and 25C are co-located with a continuous analyser

Nitrogen Dioxide Diffusion Tube Monitoring Procedure

The nitrogen dioxide diffusion tubes are placed at each location by East Ayrshire Council to give 12 periods within the calendar year. On a monthly basis the exposed tubes are replaced and sent to the laboratory for analysis. All exposure times and dates are recorded and sent to the laboratory with the exposed tubes. East Ayrshire Council also sends one unexposed tube with each batch to check that there has been no contamination while in transit or storage. Selection of diffusion tube sites and instructions for exposing diffusing tubes were carried out using the latest guidance issued by AEA from the work completed by the Working Group on Harmonisation of Diffusion Tubes (Reference 3). The supply of the tubes and analysis is undertaken by Glasgow Scientific Services (GSS) – part of Glasgow City Council. The laboratory is UKAS accredited for the analysis and also participates in two centralised QA/QC schemes; the Workplace Analysis Scheme for Proficiency (WASP scheme)(Reference 4) and a monthly field inter-comparison exercise managed by Bureau Veritas, in which diffusion tubes are co-located with an automatic analyser. The WASP scheme is an independent analytical proficiency- testing scheme (PT), operated by the Health and Safety laboratory (HSL). For the 5 quarters from October 2011 to December 2012 GSS obtained 4 rounds at 100% and one round with a score of 50%, giving a combined score of 90% which were subsequently determined to be satisfactory based on the z-score system (Reference 4). Over a rolling five round WASP window one would expect that 95% of laboratory results should be within the criteria set within the scheme. If this percentage is substantially lower than 95% for a particular laboratory, within this 5 round window, then one can conclude that the laboratory in question may have significant systemic sources of bias in their assay. A score of 90% by GSS is not substantially lower than the 95% standard and can therefore be deemed acceptable.

GSS follow the procedures set out in the Harmonisation Practical Guidance and prepares the Palmes-Type diffusion tubes using the 20% Triethanolamine (TEA) in water.

During 2012 East Ayrshire Council carried out a local co-location study involving co-locating diffusion tubes in triplicate with the chemiluminescent analyser located in John Finnie Street, Kilmarnock. The tubes were placed within 1m of the analyser inlet and

10cm apart. The co-located tubes were prepared, handled and analysed in exactly the same way as those from the other (non co-located) monitoring sites in the survey. A co-location data questionnaire was completed and sent to the National Physical Laboratory, Teddington, London. A resultant bias adjustment of 0.96 was computed. A combined bias adjustment was determined utilising the spreadsheet from the Review and Assessment Helpdesk Website (Appendix A) (Reference 20) GSS undertakes analysis of diffusion tubes from several sites which runs co-location studies. GSS also participate in the Bureau Veritas Marylebone laboratory inter-comparison study (Reference 23). At the time of writing 11 sites, including one site from East Ayrshire, three sites from Glasgow, two sites from West Dunbartonshire, 4 sites from East Dumbartonshire and the Marylebone Road site in London were present on the spreadsheet. Overall bias adjustment was therefore calculated from these eleven sites using orthogonal regression to allow for the uncertainty in both the automatic monitor and the diffusion tubes. The uncertainty of the diffusion tube has been assumed to be double that of the automatic monitor. An overall bias adjustment of 0.96 was calculated from these eleven sites.

The bias adjustment factor applied to the raw annual means of the diffusion tubes was therefore **0.96** for 2012 data. Precision and Bias Adjustment Data (Reference 20) are shown in Appendix A.

The combined bias adjustment figure was used rather than the local bias adjustment figure for the following reasons:-

1/ The survey consists of tubes exposed over a range of settings which differ from the co-location site.

2/ The data capture from the automatic analyser was less than 90%.

3/ The overall bias adjustment figure was based on 11 sites rather than one single site decreasing the error from using a single survey.

4/ The co-location survey was carried out over a period of 11 months whereas the overall survey was carried out over a period of 12 months.

2.2 Comparison of Monitoring Results with Air Quality Objectives

This section sets out the results of all monitoring carried out by East Ayrshire Council in 2012 and where relevant, provides results from previous years to identify any trends.

2.2.1 Nitrogen Dioxide (NO_2)

Automatic Monitoring Data

The results of automatic monitoring for nitrogen dioxide carried out in 2012 at St. Marnock Street and John Finnie Street, Kilmarnock are displayed in Table 2.3 and 2.4 and the full report produced by Ricardo-AEA on behalf of the Scottish Government in Appendix C.

Table 2.3 Results of Automatic Monitoring for NO_2: Comparison with Annual Mean Objective

Site ID	Site Type	Within AQMA?	Valid Data Capture for Monitoring Period %	Valid Data Capture 2012 % [b]	Annual Mean Concentration (µg/m^3)				
					2008	2009	2010	2011	2012
A2/John Finnie Street, Kilmarnock	Roadside	N	-	85.3			**43**	35	30
A3/St. Marnock Street, Kilmarnock	Roadside	N	95.6	45.5					29(36 annualised)

Annual Mean Air Quality Objective (included in Regulations for the purpose of LAQM in Scotland) for Nitrogen Dioxide - 40 µg/m^3.

In bold, exceedence of the NO_2 annual mean AQS objective of 40µg/m^3

Monitoring in John Finnie Street, Kilmarnock was carried out from 18th February until 31st December 2012 for NO_x. Monitoring for PM_{10} was started in March but due to technical problems with the newly introduced FDMS1405 model, valid data was only obtained for the final three months of 2012. Monitoring at St. Marnock Street, Kilmarnock was carried out for NO_x between 18th February until 18th July 2012 and for a short period in December. PM_{10} monitoring was carried out between 13th March and 18th July 2012 and for a short period in December. Monitoring was interrupted at the St. Marnock Street site due to major sewer replacement works being carried out by Scottish Water.

Short-term to Long-term Data adjustment

Where only short-term periods of monitoring data are available, the results may be adjusted to estimate an annual mean concentration using the approach set out in Technical Guidance LAQM.TG(09) Box 3.2 (Reference 1).

Adjustment to estimate annual mean (Appendix D)

The adjustment is based on the fact that patterns in pollutant concentrations usually affect a wide region. Thus if a six month average is above average at one place it will almost certainly be above average at other locations in the region. The adjustment procedure is as follows:-

1. Four nearby, urban background, long term, continuous monitoring sites within 50 miles were identified: Glasgow Anderston, Glagow Waulkmillglen, North Lanarkshire Whifflet and North Lanarkshire Cumbernauld.
2. The results of the annual mean, **Am,** for these sites in 2012 were obtained.
3. The period means, **Pm,** for 2012 were obtained for the months of the short term monitoring in East Ayrshire).
4. The Ratio, **R,** of the annual mean/period mean (**Am/Pm)** for each of the sites was then calculated.
5. The average of these ratios, $\mathbf{R_a}$**,** was then calculated to give an adjustment factor.
6. The measured period mean **M** was multiplied by the adjustment factor $\mathbf{R_a}$ to give the estimate of the annual mean for 2012 (Table 2.3 and 2.7)

Table 2.4 Results of Automatic Monitoring for NO_2: Comparison with 1-hour Mean Objective

Site ID	Site Type	Within AQMA?	Valid Data Capture for Monitoring Period %	Valid Data Capture 2012 %	Number of Hourly Means > 200µg/m^3				
					2008	2009	2010	2011	2012
A2/John Finnie Street, Kilmarnock	Roadside	N		85.3			16(197 µg/m^3)	1(159 µg/ m^3)	0(109µg/m^3)
A3/St. Marnock Street, Kilmarnock	Roadside	N	95.6	45.5					0(122 µg/m^3)

Annual 1-hour mean Air Quality Objective (included in Regulations for the purpose of LAQM in Scotland) for Nitrogen Dioxide - 200 µg/m^3, not to be exceeded more than 18 times a year.

In bold, exceedence of the NO_2 hourly mean AQS objective (200µg/m^3-not to be exceeded more than 18 times per year).Where the period of valid data was less than 90% of the full year, the 99.8th percentile of hourly means are included in brackets.

Kilmarnock

As a result of high levels of nitrogen dioxide found in John Finnie Street during 2007 a Detailed Assessment was carried out by BMT Cordah in 2008 (Reference 5). The modelling study concluded that although the annual mean NO_2 objective would be exceeded along the centre of the road, no exceedences of the annual mean were predicted at locations of relevant public exposure. Furthermore, no exceedences of the 1-hour mean objective were predicted at areas of relevant public exposure. It was therefore not considered necessary to declare an Air Quality Management Area at this time. The report also recommended that the location of the diffusion tube monitoring sites be reviewed and an additional location on the south west of John Finnie Street be considered. This has been carried out (Figure 5c), along with one tube sited on West George Street (Figure 5c). The report also recommended that an automatic monitoring unit, with triplicate diffusion tubes co-located, be installed on John Finnie Street, to provide a local bias adjustment factor for the diffusion tubes and allow full verification of any future modelling studies. This commenced in John Finnie Street in February 2010 (Figure 4).

Annual mean levels of nitrogen dioxide in John Finnie Street, Kilmarnock during 2012 dropped 5 µg/m^3 from the previous year (Table 2.3) and was, at 30 µg/m^3, well under the annual mean Air Quality Objective. 2010 levels, at 43 µg/m^3, were raised due to long periods of cold still weather and were higher than any year since monitoring started. 2011 levels also recorded a substantial drop from 2010 at around 35 µg/m^3. Levels at locations where members of the public might be regularly exposed such as building facades of residential property, schools, hospitals, care homes etc. would be less than the levels found at the roadside as NO_2 levels drop off with distance from the roadside. Although the site of the automatic monitoring station has no actual relevant exposure as regards the annual mean it can be regarded as representative of an area of relevant exposure as it is located at a similar distance from the road as other properties along the length of the road. As it is located near a busy shopping area relevant exposure is applicable to the 1-hour mean. 1-hour mean levels apply to all locations where the annual mean applies, as well as gardens of residential properties, kerbside sites (for example, pavements of busy shopping streets), hotels etc., in essence all locations where members of the public might reasonably be expected to spend one hour or more. There were no exceedences of the 1-hour mean (200 µg/m^3) recorded in John Finnie St., Kilmarnock during 2012. The Air Quality Regulations state that 1-hour mean of 200 µg/m^3 nitrogen dioxide levels should not be exceeded more than 18 times per year. Since less than 12 months of monitoring was carried out at Kilmarnock in 2012 and the data capture was therefore below 90%, the 99.8th percentile should be included. The site at Kilmarnock gave a 99.8th percentile of 109 µg/m^3 (table 2.4) which is significantly below the objective 200 µg/m^3 limit (Table 1.1)

Monitoring of nitrogen oxides commenced at St. Marnock St., Kilmarnock during February 2012. Unfortunately monitoring was only carried out for less than 6 months due to major sewerage works being undertaken around the site. Annualised estimated annual mean levels at 36 µg/m^3 (annualised) were under the 40 µg/m^3 Air Quality Objective. The St. Marnock St. site gave a 99.8th percentile of 122 µg/m^3 (table 2.4) which is significantly below the objective 200 µg/m^3 limit (Table 1.1)

Nitrogen dioxide levels were predicted to fall steadily within Kilmarnock from 2008 (Detailed Report Reference 5) to follow predicated national trends. Although the

sharp rise in 2010 may be due to the exceptionally long cold weather in that year, the accepted evidence of a levelling-off in the reduction in concentrations in recent years (AQEG 2007, Reference 21) may be due to:

1/ An increase in the proportion of the total NO_x emitted directly to the atmosphere as NO_2 . This in turn is due to the increased penetration of diesel cars and the retrofitting of pollution control devices, such as catalytically regenerative traps to buses.

2/ Increasing background concentrations of O_3 , which promotes the oxidation of emitted NO to NO_2.

3/ Recent research has also indicated that actual emissions from vehicles are higher in real driving conditions than when the vehicles were tested under European Emissions Standards using a test completed under a standardised test cycle. The expected reductions in emissions from more modern vehicles have been much more limited than predicted.

The actual trend is more likely to, at best, allow levels of nitrogen dioxide from road transport to remain static until introduction of Euro 6 (VI) legislation. It remains to be seen whether the actual promised emission levels of Euro 5(V) and 6(VI) vehicles live up to expectation.

Further automatic monitoring in Kilmarnock is therefore essential to verify actual levels of nitrogen dioxide and likely future trends.

Nitrogen Dioxide Diffusion Tube Monitoring Data

The diffusion tube method is open to a degree of uncertainty inherent in the method and as such the results of the survey should be treated with caution and used as indicators of nitrogen dioxide levels only. That said it is a useful screening method which can be used to cover multiple sites at low cost. They are also easily located, where it may not be practical to site bulky automatic monitoring equipment.

The diffusion tube monitoring data for nitrogen dioxide is presented below in Table 2.5 and the full monthly dataset is displayed in Appendix B. Diffusion tube locations are shown in Fig. 5a-5h.

Table 2.5 Results of NO_2 Diffusion Tubes 2012

Site ID	Location	Site Type	Within AQMA?	Triplicate or Co-located Tube	Full Calendar Year Data Capture 2012 (Number of Months)[a]	2012 Annual Mean Concentration (µg/m^3) - Bias Adjustment factor = 0.96
1	Fowlds Street/King Street Junction, Kilmarnock	Kerbside	N	N	12	27.4
2	28 John Finnie Street, Kilmarnock	Roadside	N	N	9	26.4
3	19 Lainshaw Street, Stewarton	Kerbside	N	N	12	28.7
4	40 Main Street, Newmilns	Roadside	N	N	12	26.5
6	8A Kilmarnock Road, Mauchline	Roadside	N	N	12	23.5
7	Junction at Main Street & A70 Ochiltree	Roadside	N	N	12	20.3
9	Townhead/Glaisnock Street Junction, Cumnock	Roadside	N	N	12	13.8
11	96 John Finnie Street, Kilmarnock	Roadside	N	N	12	28.4
12	62 John Finnie Street, Kilmarnock	Roadside	N	N	12	31.1
14	95/97 John Finnie Street, Kilmarnock	Roadside	N	N	12	33.7
15	16 West George Street, Kilmarnock	Roadside	N	N	12	34.8
17	23/25 Loudoun Road, Newmilns	Roadside	N	N	12	31.8

Site ID	Location	Site Type	Within AQMA?	Triplicate or Co-located Tube	Full Calendar Year Data Capture 2012 (Number of Months)[a]	2012 Annual Mean Concentration (µg/m^3) - Bias Adjustment factor = 0.96
18	100 Main Street, Newmilns	Roadside	N	N	12	19.9
19	57/59 Townhead Street, Cumnock	Roadside	N	N	11	17.5
20	66 Main Street, Muirkirk	Roadside	N	N	12	12.9
22	The Cross, Mauchline	Roadside	N	N	11	24.7
23	3/5 Loudoun Street, Mauchline	Roadside	N	N	11	26.0
24	5/7 Earl Grey Street, Mauchline	Roadside	N	N	12	33.5
25A	John Finnie Street, Kilmarnock	Roadside***	N	Triplicate and Co-located	11	28.9
25B	John Finnie Street, Kilmarnock	Roadside***	N	Triplicate and Co-located	11	29.5
25C	John Finnie Street, Kilmarnock	Roadside***	N	Triplicate and Co-located	11	28.9
26	76 Loudoun Road, Newmilns	Roadside	N	N	12	18.8
27	Junction King Street/St. Marnock Street, Kilmarnock	Kerbside	N	N	12	29.9
28	2A Welbeck Street, Kilmarnock	Roadside	N	N	11	24.9
29	Junction McLelland Drive/Dundonald Road, Kilmarnock	Roadside	N	N	12	25.2
30	16 Cumnock Road, Mauchline.	Roadside	N	N	12	20.0

Site ID	Location	Site Type	Within AQMA?	Triplicate or Co-located Tube	Full Calendar Year Data Capture 2012 (Number of Months)[a]	2012 Annual Mean Concentration (µg/m^3) - Bias Adjustment factor = 0.96
31	Wellington Street, Kilmarnock	Kerbside	N	N	11	26.2

Annual mean Air Quality Objective (included in Regulations for the purpose of LAQM in Scotland) for Nitrogen Dioxide - 40 µg/m^3.

In bold, exceedence of the NO_2 annual mean AQS objective of 40µg/m^3

Table 2.6 Results of NO_2 Diffusion Tubes (2008 to 2012)

Site ID	Location	Site Type	Within AQMA?	Annual mean concentration (adjusted for bias) μg/m^3					
				2007 (Bias Adjustment Factor = 1.05)	2008 (Bias Adjustment Factor = 0.97)	2009 (Bias Adjustment Factor = 1.23)	2010 (Bias Adjustment Factor = 1.12)	2011 (Bias Adjustment Factor = 0.94)	2012 (Bias Adjustment Factor = 0.96)
1.	Fowlds Street/King Street Junction, Kilmarnock	Kerbside	N	38	35	32.3	39.1	25.0	27.4
2.	28 John Finnie Street, Kilmarnock	Roadside	N	39	39	32.8	**40.2**	32.1	26.4
3.	19 Lainshaw Street, Stewarton	Kerbside	N	33	32	31.2	35.8	27.0	28.7
4.	40 Main Street, Newmilns	Roadside	N	38	38	29.9	33.0	25.9	26.5
6.	8A Kilmarnock Road, Mauchline	Roadside	N	34	32	30.7	31.6	27.9	23.5
7.	Junction at Main Street & A70 Ochiltree	Roadside	N	26	26	23.2	26.2	19.9	20.3
9.	Townhead/Glaisnock Street Junction, Cumnock	Roadside	N	16	16	18.5	17.4	15.6	13.8
11.	96 John Finnie Street, Kilmarnock	Roadside	N		31	33.3	34.8	27.9	28.4
12.	62 John Finnie Street, Kilmarnock	Roadside	N		38	38.3	**40.0**	33.3	31.1
14.	95/97 John Finnie Street, Kilmarnock	Roadside	N			**43.7***	**43.8**	34.2	33.7
15.	16 West George Street, Kilmarnock	Roadside	N			39.9*	**43.2**	35.8	34.8

Site ID	Location	Site Type	Within AQMA?	Annual mean concentration (adjusted for bias) μg/m^3					
				2007 (Bias Adjustment Factor = 1.05)	2008 (Bias Adjustment Factor = 0.97)	2009 (Bias Adjustment Factor = 1.23)	2010 (Bias Adjustment Factor = 1.12)	2011 (Bias Adjustment Factor = 0.94)	2012 (Bias Adjustment Factor = 0.96)
17.	23/25 Loudoun Road, Newmilns	Roadside	N			39.8*	**40.6**	30.4	31.8
18.	100 Main Street, Newmilns	Roadside	N			24.4*	26.4	22.1	19.9
19.	57/59 Townhead Street, Cumnock	Roadside	N			19.6*	22.6	19.0	17.5
20.	66 Main Street, Muirkirk	Roadside	N			15.1*	17.8	14.2	12.9
22.	The Cross, Mauchline	Roadside	N			28.7*	29.5	29.6	24.7
23.	3/5 Loudoun Street, Mauchline	Roadside	N			31.2*	31.4	28.4	26.0
24.	5/7 Earl Grey Street, Mauchline	Roadside	N			**41.3***	39.5	34.2	33.5
25A.	John Finnie Street, Kilmarnock	Roadside***	N				35.2	28.2	28.9
25B.	John Finnie Street, Kilmarnock	Roadside***	N				39.8	28.0	29.5
25C	John Finnie Street, Kilmarnock	Roadside***	N				37.8	30.6	28.9
Mean 25A-25C	John Finnie Street, Kilmarnock	Roadside***	N				37.7	29.0	29.1
26	76 Loudoun Road, Newmilns	Roadside	N					21.4	18.8
27	Junction King Street/St. Marnock Street, Kilmarnock	Kerbside	N					30.8	29.9

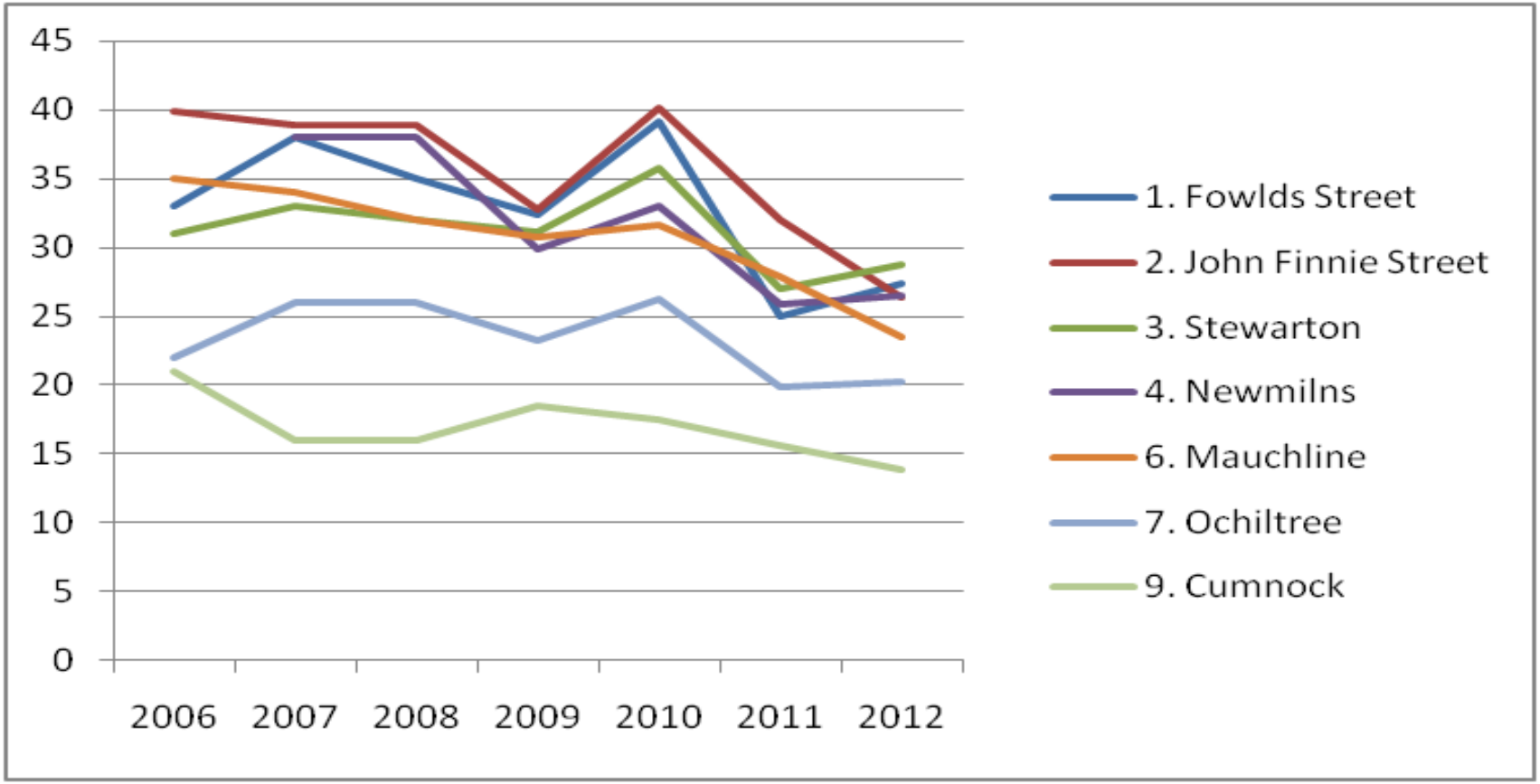
Site ID	Location	Site Type	Within AQMA?	Annual mean concentration (adjusted for bias) µg/m^3					
				2007 (Bias Adjustment Factor = 1.05)	2008 (Bias Adjustment Factor = 0.97)	2009 (Bias Adjustment Factor = 1.23)	2010 (Bias Adjustment Factor = 1.12)	2011 (Bias Adjustment Factor = 0.94)	2012 (Bias Adjustment Factor = 0.96)
28	2A Welbeck Street, Kilmarnock	Roadside	N					25.6	24.9
29	Junction McLelland Drive/Dundonald Road, Kilmarnock	Roadside	N					25.2	25.2
30	16 Cumnock Road, Mauchline.	Roadside	N					19.1	20.0
31	Wellington Street, Kilmarnock	Kerbside	N					21.8	26.2

Annual mean Air Quality Objective (included in Regulations for the purpose of LAQM in Scotland) for Nitrogen Dioxide - 40 µg/m^3.

*2009 Short term data annualised (2010 Air Quality Progress Report East Ayrshire Council, Reference 22).

In bold, exceedence of the NO_2 annual mean AQS objective of 40µg/m^3

Figure 2.4 Trends in Annual Mean Nitrogen Dioxide Concentrations Measured at Diffusion Tube Monitoring Sites



Annual mean nitrogen dioxide levels in µg/m^3 (y-axis) were plotted against the year of measurement 2006-20012 (x-axis) for the long term diffusion tube monitoring sites. From the data available the overall trend from seven long term monitoring sites within East Ayrshire over the last 6 years would appear to be marginally downwards from years 2006 -2009 with a sharp rise in 2010, with a significant fall in 2011 and a levelling off in 2012.The sharp rise in 2010 was almost certainly due to the prevailing period of very cold weather experienced during that year. The overall trend would appear to be generally downwards.

2012

All locations where nitrogen dioxide tubes were located within East Ayrshire displayed levels of nitrogen dioxide below the 40 µg/m^3 annual mean Air Quality Objective (Table 2.5 and 2.6). All sites showed a substantial decrease on 2010 levels (Table 2.6).

Kilmarnock

Four new locations were added in Kilmarnock (Table 4 and Figures 5h) in January 2011 to provide an indication of NO_2 levels out with the one way system and will provide robust data if any future modelling is required and the likely impact if any changes of traffic flow are carried out in the future.

During 2012 all sites were below the annual mean Air Quality Objective (Table 2.5). Similar to 2011 showing a substantial fall on 2010 where prolonged very cold weather patterns were experienced which lead to raised levels of NO_2 (Table 2.6).

It should be noted that Kilmarnock Town Centre Regeneration works are ongoing and are expected to continue for a considerable period of time. The works are producing particulates from building and ground works as well as the use of generators and traffic disruption which are producing increased NO_x emissions. The main detrimental effect on air quality from the town centre works is likely to result from disruption to traffic flow. This was evidenced from October through to December 2010 and during periods in 2011 where one lane was closed off at the northern end of John Finnie Street and West George Street resulting in a build up of slow-moving traffic and the associated increase of accelerations, decelerations and braking. Major sewer replacement works were also being carried out during 2012 and 2013 in the centre of Kilmarnock resulting in, as previously mentioned, disruption to monitoring at St. Marnock Street. Similar to the regeneration works being carried out the replacement sewer works increased the pollutant levels within the town centre, particularly PM_{10} levels as the temporary materials handling yard lay in the vicinity of the St. Marnock St. automatic monitor.

In summary the diffusion tube results for the one way system in Kilmarnock followed the national trend for 2011/2012(Reference 13, Air Pollution in Scotland 2011/12) with a significant decrease in nitrogen dioxide levels from the raised levels experienced in 2010. Further monitoring will be carried out to establish whether levels of NO_2 will remain consistently below the annual mean Air Quality Objective (Table 2.6).

Newmilns

All sites were below the annual mean Air Quality Objective during 2012 (Table 2.5). This showed a substantial fall on 2010 where prolonged very cold weather patterns were experienced which lead to raised levels of NO_2 (Table 2.6). One additional diffusion tube was added in Newmilns, in January 2011, at the western end of Loudoun Road (Figure 5c) to ascertain the spread of NO_2 levels along the A71 running through Newmilns. This tube site was discontinued in January 2013 as levels at 21 µg/m^3 in 2011 and19 µg/m^3 in 2012 (Table 2.6) were well below the annual mean Air Quality Objective (40 µg/m^3). The tube site at the western end of Newmilns, 100 Main Street, was also discontinued since measured 19 µg/m^3 levels had dropped below 20 µg/m^3 during 2012.

Since levels in previous years have been around the of 40 µg/m^3 annual mean objective at 22 Loudoun Road (Table 2.6) further monitoring is necessary to establish if levels will remain consistently below the annual mean Air Quality Objective.

Mauchline

All sites were below the annual mean Air Quality Objective during 2012 (Table 2.5). This showed a fall on 2010 where prolonged spells of very cold weather were experienced which lead to raised levels of NO_2 (Table 2.6). One additional diffusion tube was added in Mauchline, in January 2011, at the southern end of the town to ascertain the spread of NO_2 levels along the A76 running through Mauchline (Figure 5d). This tube site, 16 Cumnock Road, was discontinued in January 2012 as levels at 19 µg/m^3 during 2011 and 20 µg/m^3 during 2012 (Table 2.6) were well below the annual mean Air Quality Objective (40 µg/m^3).

Since levels in previous years have been around the of 40 µg/m^3 annual mean objective in Earl Grey Street (Table 2.6), further monitoring is necessary to establish if levels will remain consistently below the annual mean Air Quality Objective.

Cumnock

The NO_2 diffusion tube monitoring site at 57/59 Townhead Street was discontinued in January 2013 since measured levels of NO_2 have dropped below 20 µg/m^3 since 2011.

Muirkirk

The NO_2 diffusion tube monitoring site at 66 Main Street was discontinued in January 2013 since measured levels of NO_2 have been consistently below 20 µg/m^3 since 2009.

Summary

In summary diffusion tube monitoring is open to a degree of uncertainty and although levels of nitrogen dioxide in Kilmarnock, Newmilns and Mauchline are below the annual mean Air Quality Objective, the raised levels indicate the need to carry out further monitoring.

Relevant Exposure

Diffusion tube monitoring can only give an annual mean level of NO_2, therefore objectives should only apply at locations where members of the public might be regularly exposed such as building facades of residential properties, schools, hospitals, care homes etc. Tube locations are often limited by practical implications such as a suitable mounting point (e.g. lamp post etc.) and often they are nearer the kerb than would be ideal. In the past where levels have exceeded the annual Air Quality Objectives the extrapolated NO_2 levels from the kerbside and roadside data were computed using The NO_2 With Distance From Roads Calculator (Reference 8):-

Cz = ((Cy - Cb) / (-0.5476 x Ln(Dy) + 2.7171)) x (-0.5476*Ln(Dz) + 2.7171) + Cb

Where:

Cz is the total predicted concentration (µg/m^3)at distance Dz;
Cy is the total measured concentration (µg/m^3) at distance Dy;
Cb is the background concentration (µg/m^3);
Dy is the distance from the kerb at which concentrations were measured; and
Dz is the distance from the kerb at which concentrations are to be predicted.
Ln(D) is the natural log of the number D.

Since all monitoring locations during 2012 recorded levels below the annual mean objective this calculation has not been necessary for this report.

1-Hour Mean

Diffusion tubes can only be used to measure the annual mean NO_2 level. Previous research carried out on behalf of DEFRA and the Devolved Administration (Reference 6, Laxen D and Marener B (2003)) identified a relationship between the annual mean and the 1-hour objective, such that exceedences of the latter were considered unlikely where the annual mean was below 60 µg/m^3. An updated analysis (Reference 7, Cook A (2008)) has been carried out taking into account new monitoring data collected over the period 2003-2007. This new analysis has identified a number of exceedences of the 1-hour mean objective where annual mean were below 60 µg/m^3. The majority of these occurrences were recorded at kerbside and roadside sites, and were at sites within South-East England (and in particular within Greater London), but not exclusively so. A large number of these exceedences were associated with a regional pollution event that occurred over several days in December 2007. If these latter exceedences are excluded the number of exceedences of the 1-hour mean where annual mean are below 60 µg/m^3, is extremely limited. On the basis of this new evidence, the guidance remains unchanged and authorities may assume that exceedences of the 1-hour mean objective are only likely to occur at locations where annual mean concentrations are 60 µg/m^3 and above. Annual mean levels of NO_2 are well below 60 µg/m^3 throughout

all monitoring sites within East Ayrshire (Table 2.5 and 2.6) and we can therefore conclude no exceedences of the one hour mean objective are likely at locations of relevant public exposure (any outdoor location where members of the public might reasonably be expected to spend one hour or more e.g. pavements of busy shopping streets etc.)

2.2.2 Particulate Matter (PM_{10})

The results of the automatic monitoring carried out at both Kilmarnock are set out in Table 2.7 and Table 2.8 and the full monthly dataset in Appendix C. The BAM 1020 data was corrected using a gravimetric factor of 0.83333 for Indicative Gravimetric Equivalent (Appendix C) (Reference 9).

PM Monitoring Adjustment

The UK objectives for particulate matter (and the EU limit values) are based upon measurement carried out using the European reference sampler; this is a gravimetric device, where the particle mass is collected onto a filter and subsequently weighed. This type of sampler has significant disadvantages, in that only 24-hour mean concentrations are recorded, the data cannot be disseminated to the public in real time, and the operation is labour intensive. East Ayrshire Council therefore used two Beta Attenuation Monitor (with unheated inlets) (BAM 1020) continuous analysers during 2009 – 2011 and one BAM 1020 and one TEOM FDMS 1405 during 2012. Unheated BAMs tend to over-read PM_{10} with respect to the gravimetric method since they can also read moisture as particulate matter. In 2006, the UK Government and the Devolved Administrations published a report on the outcome of detailed equivalence tests for various PM_{10} samplers when compared with the European reference sampler. The tests carried out were based on the Guidance for the Demonstration of Equivalence of Ambient Air Monitoring Methods issued by an EC Working Group. In simple terms, the guidance sets out an approach whereby it is possible to test whether an instrument is able to comply with the Data Quality Objective for overall uncertainty as defined within the relevant Air Quality Directive – in the case of PM_{10} this is 25%. The tests were conducted at four sites within the UK, over both summer and winter seasons. The full report can be downloaded from the web (Harrison D (2006) Reference 9).

The Met-One BAM (with unheated inlet) meets the equivalence criteria for PM10 monitoring provided the results are corrected for slope. A correction for slope of 0.83333 was therefore used (Appendix C) (Reference 9).

Table 2.7 Results of Automatic Monitoring for PM_{10}: Comparison with Annual Mean Objective

Site ID	Site Type	Within AQMA?	Valid Data Capture for Monitoring Period %	Valid Data Capture 2012 %	Confirm Gravimetric Equivalent (Y or N/A)	Annual Mean Concentration (µg/m^3)				
						2008	2009	2010	2011	2012
A2 Kilmarnock, John Finnie Street	Roadside	N	98.2	24.7	Y			**21**	**20**	13(12 annualised)
A3 Kilmarnock, Saint Marnock Street	Roadside	N	91.4	37.1	Y					**19**(17 annualised)

Annual mean Air Quality Objective (included in Regulations for the purpose of LAQM in Scotland) for PM_{10} - 18 µg/m^3.

In bold, exceedence of the PM_{10} annual mean AQS objective of 18µg/m^3

Means were "annualised" as in Box 3.2 of TG(09) (http://laqm.defra.gov.uk/technical-guidance/index.html?d=page=38) (Appendices)

Table 2.8 Results of Automatic Monitoring for PM_{10}: Comparison with 24-hour Mean Objective

Site ID	Site Type	Within AQMA?	Valid Data Capture for Monitoring Period %	Valid Data Capture 2012 %	Confirm Gravimetric Equivalent (Y or N/A)	Number of Daily Means > 50µg/m^3				
						2008	2009	2010	2011	2012
A2 Kilmarnock, John Finnie Street	Roadside	N	98.2	24.7	Y			0(40µg /m^3)	1(38µg /m^3	0(21µg /m^3)
A3 Kilmarnock, Saint Marnock Street	Roadside	N	91.4	37.1	Y					3(44µg /m^3)

24- hour mean Air Quality Objective (included in Regulations for the purpose of LAQM in Scotland) for PM_{10} - 50 µg/m^3, not to be exceeded more than 7 times a year.

In bold, exceedence of the PM_{10} daily mean AQS objective (50µg/m^3 – not to be exceeded more than 7 times per year)

Kilmarnock John Finnie Street and St. Marnock Street (Table 2.7 and 2.8)

An estimated annualised annual mean of 12 µg/m^3 was computed for John Finnie Street (Appendix E). This is significantly lower than the annual mean objective of 18 µg/m$^{3.}$ No exceedences of the 24-hour objective occurred during 2012 within John Finnie Street. The 99.8th percentile of daily means was 21 µg/m^3 (included since data capture was below 90%).

An estimated annualised annual mean of 17 µg/m^3 was computed for St. Marnock Street (Appendix E). This is lower than the annual mean objective of 18 µg/m$^{3.}$ 3 exceedences of the 24-hour objective occurred during 2012 within St. Marnock Street. The 99.8th percentile of daily means was 44 µg/m^3 (included since data capture was below 90%).

As in the previous discussion regarding NO_2 the main source of localised PM_{10} in John Finnie Street is due to road traffic. As previously discussed Town Centre Regeneration construction works are directly increasing PM_{10} levels, and indirectly through associated traffic flow changes.

PM_{10} Summary

Although estimated annualised PM_{10} levels within the town centre were below the 18 µg/m^3 Annual Mean Objective, data capture was very poor at both monitoring locations during 2012, therefore caution should be used when interpreting the results. What we can say is that there has been a drop in PM_{10} levels, but further monitoring is necessary to conclude whether this trend is a pattern rather than a short term anomaly. The most surprising issue arising from the results is the fact that there is a large difference (5 µg/m^3) between both sites. The drop in levels may be partly related to the recent closure (March 2012) of the Johnnie Walker whisky bottling plant. This does not explain the substantial level of reduction of 8 µg/m^3. We suspect that part of the reduction may be due to the monitor being changed from an unheated BAM1020 to an FDMS PM_{10} monitor. To ascertain whether this is the case East Ayrshire Council has been awarded additional funding for one year to co-locate an FDMS monitor with the BAM1020 monitor at St. Marnock Street. When this trial is completed conclusions will be presented in a short report, hopefully allowing a conclusion to be drawn as to whether the drop in PM_{10} levels is partly due to the change of monitor type or fully due to an actual reduction in levels. Further monitoring is therefore required to ascertain whether the drop in PM_{10} level is likely to continue.

2.2.3 Sulphur Dioxide (SO_2)

No Sulphur Dioxide monitoring was carried out in East Ayrshire in 2012. Monitoring was discontinued in 2005 due to the very low levels recorded.

Previous monitoring of sulphur dioxide showed no exceedences of Air Quality Objectives were found or predicted.

Previous assessment of sources of sulphur dioxide concluded that no exceedences of Air Quality Objectives were likely due to the reduction in domestic coal usage and industrial sources.

2.2.4 Benzene

No benzene monitoring was carried out in East Ayrshire in 2012. Monitoring of Benzene was discontinued in January 2008 due to the very low levels of benzene recorded.

Previous monitoring of benzene showed no exceedences of Air Quality Objectives were found or predicted.

Previous assessment of sources of Benzene concluded that no exceedences of Air Quality Objectives were predicted.

2.2.5 Other Pollutants Monitored

No other pollutants, included in the Regulations for the purpose of Local Air Quality Management in Scotland, were monitored by East Ayrshire Council in 2012.

2.2.6 Summary of Compliance with AQS Objectives

East Ayrshire Council has examined the results from the 2012 monitoring stations within East Ayrshire. Concentrations are all below the objectives, therefore there is no need to proceed to a further Detailed Assessment at this time.

3 New Local Developments

3.1 Road Traffic Sources

In order to provide an assessment of road traffic sources for this report, the most up to date information on traffic flows on several roads within East Ayrshire was obtained from the Traffic Section, East Ayrshire Council and Transport Scotland.

The following sources were considered:-

- Narrow congested streets with residential properties close to the kerb.
- Busy streets where people may spend one hour or more close to traffic.
- Roads with a high flow of buses and/or HGVs.
- Junctions.
- New roads constructed or proposed since the last Updating and Screening Assessment.
- Roads with significantly changed traffic flows.
- Bus or coach stations.

East Ayrshire Council confirms that there are no new or newly identified **Road Traffic Sources** which may have an impact on air quality within the Local Authority area.

3.2 Other Transport Source

The following transport sources were considered:-

- Airports.
- Locations where diesel or steam trains are regularly stationary for periods of 15 minutes or more, with potential for relevant exposure within 15m.
- Locations with a large number of movements of diesel locomotives, and potential long-term relevant exposure within 30m.
- Ports for shipping.

East Ayrshire Council confirms that there are no new or newly identified **Other Transport Sources** which may have an impact on air quality within the Local Authority area.

3.3 Industrial Sources

East Ayrshire Council considered the following industrial sources which are new since the last Updating and Screening Assessment.

- **Industrial installations:** new or proposed installations for which an air quality assessment has been carried out.
- **Industrial installations:** existing installations where emissions have increased substantially or new relevant exposure has been introduced.
- **Industrial installations:** new or significantly changed installations with no previous air quality assessment.
- Major fuel storage depots storing petrol.
- Petrol stations.
- Poultry farms.

East Ayrshire Council confirms that there are no new industrial installations or existing installations with substantially increased emissions or new relevant exposure in their vicinity within its area or nearby in a neighbouring authority.

3.4 Commercial and Domestic Sources

East Ayrshire Council considered the following commercial and industrial sources which are new since the last Updating and Screening Assessment.

- Biomass combustion plant – individual installations.
- Areas where the combined impact of several biomass combustion sources may be relevant.
- Areas where domestic solid fuel burning may be relevant.

East Ayrshire Council confirms that there are no new or newly identified biomass combustion plants or areas where domestic solid fuel burning which may have an impact on air quality within the Local Authority area.

3.5 New Developments with Fugitive or Uncontrolled Sources

East Ayrshire Council considered the following new developments with fugitive or uncontrolled sources which are new since the last Updating and Screening Assessment.

- Landfill sites.
- Open cast coal sites
- Quarries.
- Unmade haulage roads on industrial sites.
- Waste transfer stations, etc.
- Other potential sources of fugitive particulate matter emissions.

East Ayrshire Council confirms that there are no new or newly identified fugitive or uncontrolled sources which may have an impact on air quality within the Local Authority area.

In summary, East Ayrshire 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.

East Ayrshire 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 Air Quality Planning Policies

The local plan currently in force within the East Ayrshire unitary authority is the **East Ayrshire Council Local Plan (2010)** (Reference 14). It contains the following policy which is used to assess planning applications:-

Policy ENV25

The Council will require all developers to ensure that their proposals have minimal adverse impact on air quality and will require air quality assessments to be undertaken in respect of any proposed developments which it considers may significantly impact on air quality. The Council will also ensure that any new development will have minimum adverse effects on the physical environment and the amenity of an area as a result of light and noise pollution. Appropriate conditions and Section 75 Agreements will be attached to individual planning consents to ensure that environmental impacts caused by air, light and noise pollution are minimised wherever possible.

5 Local Transport Plans and Strategies

During 2010 East Ayrshire Council published its second Local Transport Strategy (LTS) which sets out the Council's vision for transportation in the area. It replaced the first LTS published in 2000 and builds upon the progress to date, and outlines a vision to carry transport forward over the period 2009 to 2014, and beyond. The key issues to be addressed by the LTS include:

1. Access to education, employment and health care;
2. Access for users of all abilities;
3. Transport and access to job market areas;
4. Managing traffic levels;
5. Road safety measures; and
6. Protecting the environment.

The principle of climate change is now generally accepted. To begin to address this issue, the Scottish Government has set a target to reduce "greenhouse" gas emissions by 50% by 2030. It is therefore an underlying principle of the LTS to pursue policies and actions to enhance the environment and contribute to a reduction in emissions.

LTS Objectives

The LTS is a holistic document and includes measures to reduce emissions to the air by reducing car dependency. The LTS has established five strategic objectives to address stress points in the transport network, promote integrated and sustainable transport and remove barriers to social inclusion. These objectives are intended to be consistent with the Governments national objectives for transport, SPT's Regional Transport Strategy, and support East Ayrshire's Community Plan.

Objective 1 Economic Growth
Objective 2 Accessibility and Social Inclusion
Objective 3 Environment: to improve, conserve and enhance the natural, historic and built environment, and contribute to a healthier lifestyle by facilitating the provision and use of sustainable modes of transport and reduce emissions to air by reducing car dependency, particularly in urban areas.
Objective 4 Safety and Personal Security
Objective 5 Sustainability and Integration: to encourage the integration of transport modes and promote greater use of public transport and other sustainable modes of transport.

Objective 3 and Objective 5 contain measures to improve air quality by facilitating the provision and use of sustainable modes of transport and reduce emissions to air by reducing car dependency, particularly in urban areas. East Ayrshire Council is committed to promoting sustainable transport including cycling, walking, use of public transport and car sharing to minimise emissions of carbon dioxide and pollutants and therefore reduce detrimental economic, social and environmental effects. Similarly sustainable freight transport is encouraged by maximising the use of rail.

Key Action Area for Objective 3 and objective 5 include:-

Bus and rail network and service improvements
Parking management
Walking and cycling networks and facilities
Travel plans
East Ayrshire Core Paths Plan
Landscape Maintenance
Quality Bus Corridors
Use of new technology
Sustainable freight transport
Travel awareness
Interchanges
Park and Ride
Timetabling, ticketing and information

Linkage between the LTS Objectives, National and Regional Transport Objectives, Community Plan (Reference 17), and National Outcomes are summarised in Table E.1 of the LTS document (Reference 15).

The East Ayrshire Local Transport Strategy 2009-2014 can be found on the East Ayrshire Council Website:-

6 Climate Change Strategies

East Ayrshire Council has policies and strategies in place which promotes sustainable development and carbon reduction.

The principle of climate change is now generally accepted. To begin to address this issue, the Scottish Government has set a target to reduce "greenhouse" gas emissions by 50% by 2030. It is an underlying principle of the LTS to pursue policies and actions to enhance the environment and contribute to a reduction in emissions (summarised in section 6).

East Ayrshire Council also has carbon management programme in place. East Ayrshire Carbon Management Programme, **Strategy and Implementation Plan (SIP), October 2007** (Reference 16)**.**

Improving the environment is a key priority theme within the **East Ayrshire Community Plan.** Protecting the environment now and for future generations is a strategic priority. Climate change is of international, national, regional and individual concern and responsibility. As a community leader and provider, East Ayrshire Council is committed to, act, lead by example and support the increasing challenge of reducing greenhouse gases.

Participation in the Carbon Trust Local Authority Carbon Management Programme (Reference 19) has enabled the council to quantify its carbon emissions and develop a clear plan of action. The plan outlines the Council focus on four themes:

1. Reducing the environmental impact of the council's energy consumption.
2. Reducing the environmental impact of the council's vehicle fleet.
3. Reducing the environmental impact of landfill by reducing and recycling of the council's waste.
4. Reducing the environmental impact of street lighting.

An action plan has been developed ranging from short term, low cost measures to projects requiring significant investment and implementation time.

The Carbon Management Programme will be taken forward as an integral part of the Council's broader Sustainability Strategy (Reference 18).

The Carbon Management Programme Strategy and Implementation Plan (SIP) will raise issues that when carried out will result in benefit to the Council and could be used as a springboard to influence change in the wider community. The Council recognises the need to be visionary and proactive with regard to carbon reduction.

"A commitment to lasting development will help us make the right decisions, with the knowledge that we have taken full account of the social, economic and environmental consequences."
East Ayrshire Community Plan – Improving the Environment

East Ayrshire Council

East Ayrshire Council (EAC) objectives in pursuing the Local Authority Carbon Management (LACM) programme are:

To quantify the carbon emissions associated with running the council.
To identify and implement schemes to reduce carbon emission, by reducing energy consumption, minimising waste and lowering environmental impact of transport.
To progress towards the integration of sustainable energy generation.

The purpose of the implementation plan is

1. To establish a baseline of the Council's carbon emissions by looking at the main energy consumers including (but not exclusively) buildings, transport, street lighting, and waste management.
2. To calculate the value of the real challenges that the Council faces and the implications if no action is taken to reduce our carbon emissions.
3. To highlight the financial and environmental benefit which can arise from resourceful ideas and the implementation of carbon reduction measures.

The implementation of the energy savings programme has been ongoing since September 2005.The plan encompasses actions ranging from simple short term work to longer-term projects and renewable initiatives. One of the outcomes has been confirmation that the works carried out since 2005 have resulted in significant reduction in carbon emissions. This demonstrates that if continued the Council is in a realistic position to achieve the reduction target of 10% and that investment in projects that reduce energy consumption have the additional positive effect on reducing carbon emissions.

Table 6 within the Carbon Management implementation Plan lists nominated actions and emissions reduction opportunities and Table 7 includes an implementation summary plan (Reference 16)

7 Conclusions and Proposed Actions

7.1 Conclusions from New Monitoring Data

Both automatic and passive monitoring for NO_2 carried out during 2012 resulted in no exceedences of both the Annual Mean and the Hourly Mean Air Quality Objectives at all monitoring locations within East Ayrshire (Figures 2.3, 2.4, 2.5 and 2.6).
Automatic monitoring of PM_{10} at both the John Finnie Street and the St. Marnock Street monitoring sites produced estimated (part year measurements annualised) annual mean levels below the Air Quality Objective (18 µg/m^3) (Figures 2.7).Three exceedences of the 24-hour objective occurred at the St. Marnock Street site during 2012 with a 99.8th percentile of 44 µg/m^3 (Figure 2.8). No exceedences of the 24-hour objective occurred at the John Finnie Street site during 2012 with a 99.8th percentile of 21 µg/m^3 (Figure 2.8). Therefore both locations met the 24-hour Mean Objective, 50 µg/m^3 not to be exceeded more than 18 times per year. Both PM_{10} and NO_2 levels recorded at John Finnie Street have shown a reduction in level over both 2010 and 2011 (Figures 2.3, 2.4, 2.7 and 2.8)

Since data capture was poor and since PM_{10} and NO_2 annual mean levels have exceeded the objective level in past years, further monitoring is necessary to determine whether the downward trend is consistent and air quality objectives are being met.

7.2 Conclusions relating to New Local Developments

There are no new or newly identified local developments (since the submission of the 2012 USA) which may have a significant impact on air quality within the Local Authority area.

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.**

7.3 Other Conclusions

Large reductions were recorded for PM_{10} within John Finnie Street during 2012. The estimated 2012 annual mean PM_{10} at 12 µg/m^3 indicated an 8 µg/m^3 drop on 2011. This is a substantial drop and seems surprisingly large. It must be noted that the unheated BAM1020 monitor was replaced by a FDMS monitor in early 2012. The difference between the two sites was around 5 µg/m^3, again unusually high given the proximity of the two sites, both adjacent to the main one way system through Kilmarnock Town Centre. To this end East Ayrshire have applied successfully for funding from the Scottish Government to run two monitors side by side (BAM1020 and FDMS) at the St. Marnock Street monitoring station. This should enable us to determine whether part of the substantial fall is due to the difference in the level recorded by the different types of monitors used in different years and also hopefully determine if any of the reduction is actually due to a real reduction in PM_{10} within Kilmarnock Town Centre. The initial results will be commented on within the 2014 Progress Report and also within a short report once the trial ends.

7.4 Proposed Actions

Further automatic monitoring for both PM_{10} and NO_2 will be carried out at the two monitoring sites within Kilmarnock Town Centre to ascertain whether the downward trend in PM_{10} and NO_2 is for the long term and air quality objectives continue to be met. Diffusion tube monitoring for NO_2 will also continue throughout East Ayrshire where it is deemed likely that levels are sufficiently high to warrant this (Table 2.5 and 2.6). In this respect monitoring is likely to be concentrated within Kilmarnock Town Centre, Loudoun Road Newmilns, Mauchline Cross and possibly Stewarton. Other sites are likely to be de-commissioned as several years monitoring has indicated levels of NO_2 are well below air quality objectives. As mentioned above a comparative trial will be carried out for 12 months with the co-location of a BAM1020 and a FDMS PM_{10} monitor.

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Appendices

Appendix A:

QA/QC Data: Defra and The Devolved Administrations, Spreadsheet of Bias Adjustment Factors, Version Number 09/13. Accessed at www.uwe.ac.uk/agm/review/index.html

National Diffusion Tube Bias Adjustment Factor Spreadsheet

Spreadsheet Version Number: 09/13

Follow the steps below **in the correct order** to show the results of **relevant** co-location studies

Data only apply to tubes exposed monthly and are not suitable for correcting individual short-term monitoring periods

Whenever presenting adjusted data, you should state the adjustment factor used and the version of the spreadsheet

This spreadhseet will be updated every few months: the factors may therefore be subject to change. This should not discourage their immediate use.

This spreadsheet will be updated at the end of March 2014

LAQM Helpdesk Website

The LAQM Helpdesk is operated on behalf of Defra and the Devolved Administrations by Bureau Veritas, in conjunction with contract partners AECOM and the National Physical Laboratory.

Spreadsheet maintained by the National Physical Laboratory. Original compiled by Air Quality Consultants Ltd.

Step 1:	Step 2:	Step 3:	Step 4:
Select the Laboratory that Analyses Your Tubes from the Drop-Down List	Select a Preparation Method from the Drop-Down List	Select a Year from the Drop-Down List	Where there is only one study for a chosen combination, you should use the adjustment factor shown with caution. Where there is more than one study, use the overall factor[3] shown in blue at the foot of the final column.
If a laboratory is not shown, we have no data for this laboratory.	If a preparation method is not shown, we have no data for this method at this laboratory.	If a year is not shown, we have no data[2]	If you have your own co-location study then see footnote[4]. If uncertain what to do then contact the Local Air Quality Management Helpdesk at LAQMHelpdesk@uk.bureauveritas.com or 0800 0327953

Analysed By[1]	Method (To undo your selection, choose (All) from the pop-up list)	Year[5] (To undo your selection, choose (All))	Site Type	Local Authority	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) (µg/m^3)	Automatic Monitor Mean Conc. (Cm) (µg/m^3)	Bias (B)	Tube Precision[6]	Bias Adjustment Factor (A) (Cm/Dm)
Glasgow Scientific Services	20% TEA in water	2012	UB	Glasgow City Council	11	29	34	-12.4%	P	1.14
Glasgow Scientific Services	20% TEA in water	2012	R	Glasgow City Council	10	45	39	15.2%	P	0.87
Glasgow Scientific Services	20% TEA in water	2012	KS	Glasgow City Council	11	70	71	-1.5%	P	1.02
Glasgow Scientific Services	20% TEA in water	2012	R	East Dunbartonshire Council	11	30	30	1.8%	G	0.98
Glasgow Scientific Services	20% TEA in water	2012	R	East Dunbartonshire Council	12	41	42	-1.5%	P	1.01
Glasgow Scientific Services	20% TEA in water	2012	R	East Dunbartonshire Council	12	40	34	18.8%	P	0.84
Glasgow Scientific Services	20% TEA in water	2012	R	East Dunbartonshire Council	12	27	25	7.4%	P	0.93
Glasgow Scientific services	20% TEA in Water	2012	KS	Marylebone Road Intercomparison	12	107	95	12.7%	G	0.89
Glasgow Scientific Services	20% TEA in water	2012	R	West Dunbartonshire Council	12	27	24	9.1%	P	0.92
Glasgow Scientific Services	20% TEA in water	2012	R	West Dunbartonshire Council	12	22	21	4.7%	P	0.95
Glasgow Scientific Services	20% TEA in Water	2012	R	East Ayrshire Council	10	29	30	-2.6%	G	1.03
Glasgow Scientific Services	20% TEA in water	2012		Overall Factor[3] (11 studies)				Use		0.96

Appendix B: Monthly NO_2 Diffusion Tube Data

East Ayrshire Monthly NO_2 Diffusion Tube Data 2012 ($\mu g/m^3$)

Site Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Raw Mean	Corrected Mean (Bias Factor 0.96)
1. Fowlds Street/King Street Junction, Kilmarnock	33.8	28.3	18.4	28.1	21.3	30.5	21.4	23.0	32.1	38.1	34.5	32.8	28.52	27.4
2. 28 John Finnie Street, Kilmarnock	26.8	34.2	23.1	25.5	22.7	30.7	23.0	29.1	32.6				27.52	26.4
3. 19 Lainshaw Street, Stewarton	29.2	30.4	19.0	27.2	27.7	30.2	23.0	25.5	33.9	41.0	30.5	41.6	29.93	28.7
4. 40 Main Street, Newmilns	30.2	37.9	15.8	23.3	18.7	27.6	22.7	24.4	31.5	35.7	32.2	30.7	27.56	26.5
6. 8A Kilmarnock Road, Mauchline	24.8	23.8	14.0	17.5	17.2	34.0	21.6	20.7	27.5	34.6	27.7	30.2	24.47	23.5
7. Junction at Main Street &A70, Ochiltree	30.1	24.3	14.8	20.0	16.9	19.9	15.9	16.6	23.0	25.1	23.1	24.1	21.15	20.3
9. Townhead/ Glaisnock Street Junction, Cumnock	20.7	21.1	9.2	11.2	10.4	12.0	6.6	10.5	14.3	15.5	20.0	20.5	14.33	13.8
11. 96 John Finnie Street, Kilmarnock	36.9	30.0	33.9	25.2	23.2	19.0	23.1	23.6	30.7	35.7	32.0	41.6	29.58	28.4
12. 62 John Finnie Street Kilmarnock	34.9	35.3	29.2	32.9	22.2	29.5	25.1	30.7	29.9	41.7	39.3	37.5	32.35	31.1
14. 95/97 John Finnie Street, Kilmarnock	41.5	40.6	24.1	39.9	24.6	38.5	29.5	24.2	38.8	38.0	36.5	44.5	35.06	33.7
15. 16 West George Street, Kilmarnock	38.1	37.6	33.6	35.3	24.0	33.1	27.3	39.2	42.7	36.8	41.4	45.8	36.24	34.8
17. 22/25 Loudoun Road, Newmilns	38.7	56.4	24.5	45.9	21.3	34.3	17.6	20.0	27.7	35.2	35.5	40.7	33.15	31.8
18. 100 Main Street, Newmilns	23.4	13.4	19.0	28.1	16.5	14.6	15.4	14.9	24.2	23.8	29.2	26.5	20.75	19.9
19. 57/59 Townhead Street, Cumnock	22.6	22.8	11.6	20.5	14.4	13.8	13.0	15.3	22.1	1.7	23.3	20.6	18.18	17.5
20. 66 Main Street, Muirkirk	18.5	20.5	6.9	14.8	10.6	9.3	8.1	7.3	15.9	16.0	16.6	16.6	13.43	12.9
22. The Cross, Mauchline	27.1	39.9	15.3	23.5	13.9	26.0	18.2		34.1	25.9	29.3	29.9	25.74	24.7
23. 3/5 Loudoun Street, Mauchline		44.1	24.8	19.7	14.1	22.6	18.4	25.5	30.8	18.0	44.3	35.1	27.04	26.0
24. 5/7 Earl Gray Street, Mauchline	42.7	44.4	19.1	36.0	27.3	41.9	27.1	32.6	34.0	38.0	27.2	48.8	34.93	33.5
25A. John Finnie Street Monitor		46.5	20.3	28.2	21.4	31.9	22.6	28.8	33.9	33.7	33.1	31.2	30.15	28.9
25B. John Finnie Street Monitor		43.9	21.3	27.0	22.9	35.1	23.9	28.8	37.1	34.5	31.7	32.1	30.75	29.5
25C. John Finnie Street Monitor		39.5	23.5	30.9	23.5	25.8	28.2	28.0	35.2	30.9	31.9	33.3	30.06	28.9
26. 76 Loudoun Road, Newmilns	21.2	25.9	18.2	18.9	14.2	21.1	14.5	11.6	22.6	21.4	16.1	29.9	19.63	18.8
27. Junction King St./St. Marnock St., Kilmarnock	27.6	38.3	16.4	38.3	27.5	26.7	24.2	28.3	32.5	39.3	38.2	36.3	31.13	29.9

28. 2A Welbeck, Street, Kilmarnock	25.6	29.0	16.2	27.9		25.3	17.2	22.2	28.0	32.2	29.1	32.9	25.96	24.9
29. JCT McLelland Drive/Dundonald Road, Kilmarnock	27.6	36.7	18.3	17.5	20.1	23.7	18.3	17.7	28.3	32.1	33.3	41.3	26.24	25.2
30. 16 Cumnock Road, Mauchline	24.6	27.3	15.6	22.6	12.3	23.5	15.1	17.4	17.9	23.7	24.3	26.1	20.87	20.0
31. Wellington Street, Kilmarnock	31.4	32.2	23.1	27.7	22.5	28.1	14.3	20.0	33.6	1.6	29.5	37.3	27.25	26.2

Appendix C: Results of Automatic Monitoring for NO_2 and PM_{10}
Produced by Ricardo-AEA on behalf of the Scottish Government

EAST AYRSHIRE KILMARNOCK JOHN FINNIE ST
1st January to 31st December 2012

These data are have been fully ratified by Ricardo-AEA

POLLUTANT	PM_{10}*	NO_2	NO_X
Maximum hourly mean	160 µg m^{-3}	136 µg m^{-3}	615 µg m^{-3}
Maximum daily mean	34 µg m^{-3}	66 µg m^{-3}	230 µg m^{-3}
99.8th percentile of hourly means	-	109 µg m^{-3}	-
98.08th percentile of daily means	21 µg m^{-3}	-	-
Average	13 µg m^{-3}	30 µg m^{-3}	71 µg m^{-3}
Data capture	24.7 %	85.3 %	85.3 %

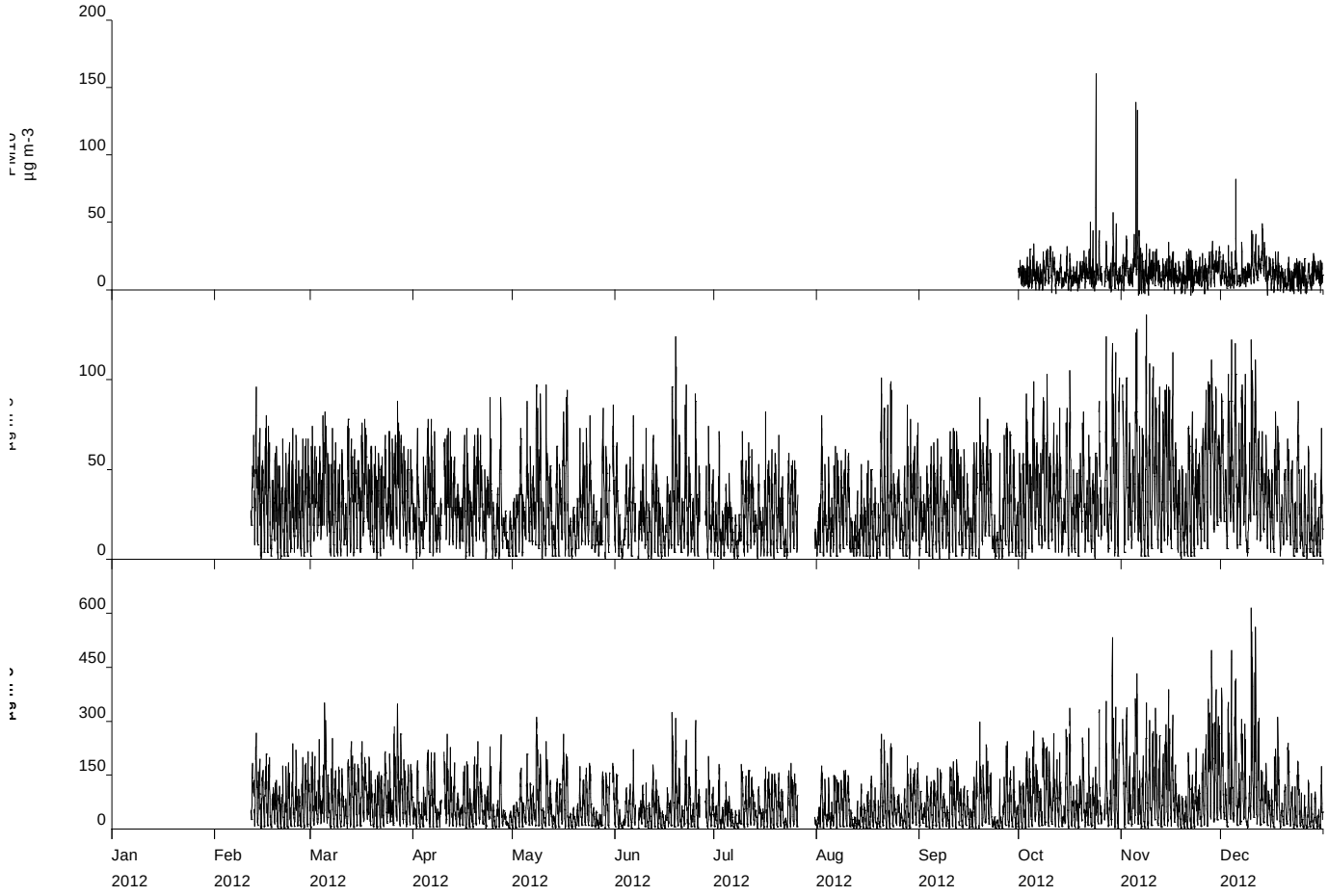
* PM_{10} instruments:
FDMS using a gravimetric factor of 1 from 22nd January 2012
BAM using a gravimetric factor of 0.83333 for Indicative Gravimetric Equivalent from 1st January 2012 to 21st January 2012
All gaseous pollutant mass units are at 20°C and 1013 mb. Particulate matter concentrations are reported at ambient temperature and pressure.
NO_X mass units are NO_X as NO_2 µg m^{-3}

Pollutant	Air Quality Regulations (2000) and Air Quality (Scotland) Amendment Regulations 2002	Exceedences	Days
PM_{10} Particulate Matter (Gravimetric)	Daily mean > 50 µg m^{-3}	0	0
PM_{10} Particulate Matter (Gravimetric)	Annual mean > 18 µg m^{-3}	0	-
Nitrogen Dioxide	Annual mean > 40 µg m^{-3}	0	-
Nitrogen Dioxide	Hourly mean > 200 µg m^{-3}	0	0

Note: For a strict comparison against the objectives there must be a data capture of >90% throughout the calendar year

Produced by Ricardo-AEA on behalf of the Scottish Government

East Ayrshire Kilmarnock John Finnie St
Hourly Mean Data for 1st January to 31st December 2012



Date Created: 20/03/2013

Produced by Ricardo-AEA on behalf of the Scottish Government

EAST AYRSHIRE KILMARNOCK ST MARNOCK ST
1st January to 31st December 2012

These data have been fully ratified by Ricardo-AEA

POLLUTANT	PM_{10}*	NO_2	NO_X
Maximum hourly mean	127 µg m^{-3}	172 µg m^{-3}	756 µg m^{-3}
Maximum daily mean	64 µg m^{-3}	55 µg m^{-3}	200 µg m^{-3}
99.8th percentile of hourly means	-	122 µg m^{-3}	-
98.08th percentile of daily means	44 µg m^{-3}	-	-
Average	19 µg m^{-3}	29 µg m^{-3}	70 µg m^{-3}
Data capture	37.1 %	45.5 %	45.5 %

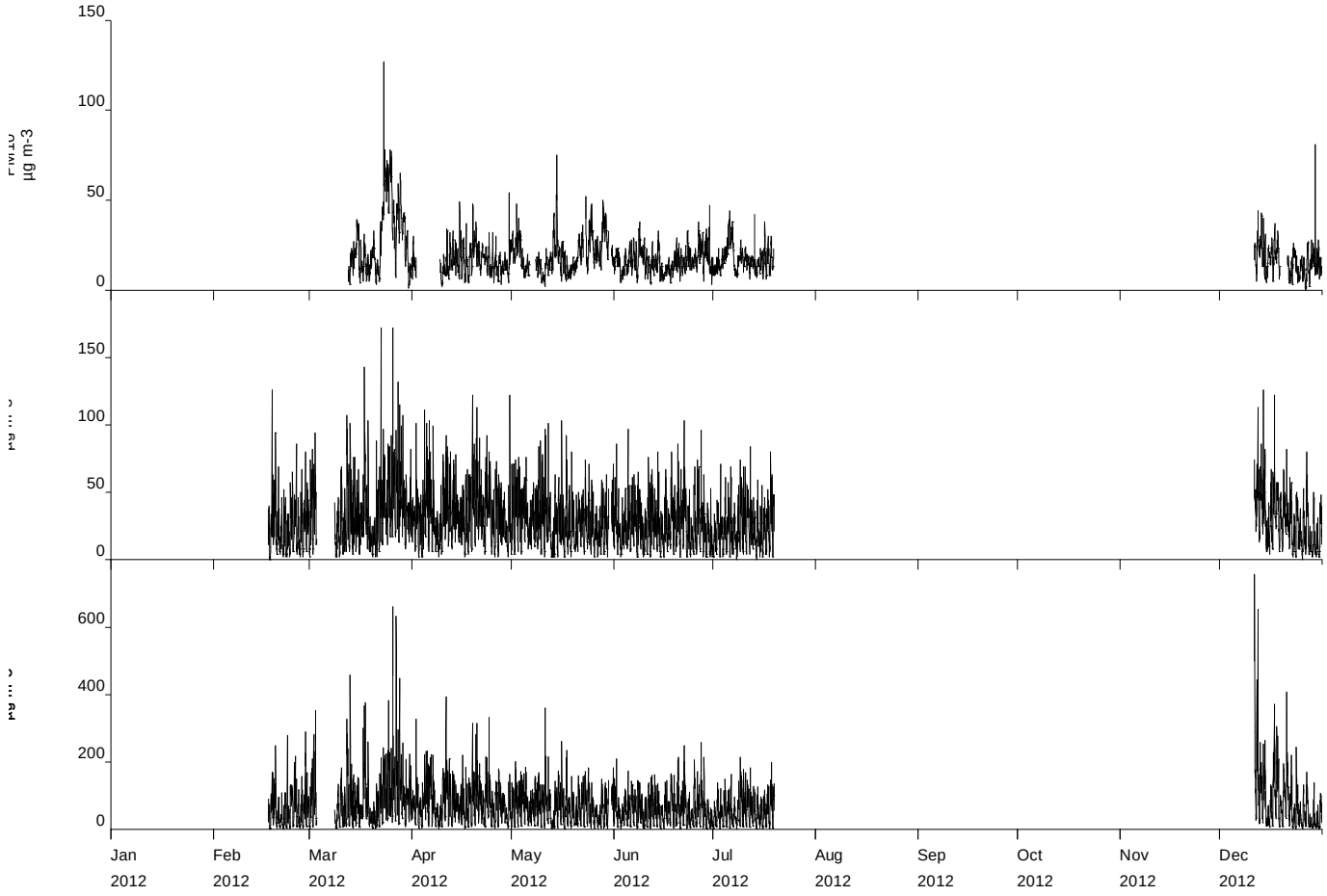
* PM_{10} instruments:
BAM using a gravimetric factor of 0.83333 for Indicative Gravimetric Equivalent from 17th February 2012
All gaseous pollutant mass units are at 20°C and 1013 mb. Particulate matter concentrations are reported at ambient temperature and pressure.
NO_X mass units are NO_X as NO_2 µg m^{-3}

Pollutant	Air Quality Regulations (2000) and Air Quality (Scotland) Amendment Regulations 2002	Exceedences	Days
PM_{10} Particulate Matter (Gravimetric)	Daily mean > 50 µg m^{-3}	3	3
PM_{10} Particulate Matter (Gravimetric)	Annual mean > 18 µg m^{-3}	1	-
Nitrogen Dioxide	Annual mean > 40 µg m^{-3}	0	-
Nitrogen Dioxide	Hourly mean > 200 µg m^{-3}	0	0

Note: For a strict comparison against the objectives there must be a data capture of >90% throughout the calendar year

Produced by Ricardo-AEA on behalf of the Scottish Government

East Ayrshire Kilmarnock St Marnock St
Hourly Mean Data for 1st January to 31st December 2012



Date Created: 20/03/2013

Appendix D: Industrial Premises Regulated by SEPA under the Pollution Prevention and Control (Scotland) Regulations 2000

Part A

PPC/W/20040	Egger	East Ayrshire
PPC/A/1079002	Auldhouse Burn Farm	East Ayrshire
PPC/A/1082048	Thomarston Poultry Farm	East Ayrshire
PPC/A/1088432	Hillhead Farm, Kilmaurs,	East Ayrshire
PPC/A/20019	Garlaff Landfill, Skares	East Ayrshire
PPC/A/1017028	Dunniflats Waste Site, Lugton	East Ayrshire
PPC/A/1038885	Billy Bowie Composting, Kilmarnock	East Ayrshire

Part B

PPC/W/30110	Ayr Road Garage, Dalmellington	East Ayrshire
PPC/W/30101	Bridgend Garage, Auchinleck	East Ayrshire
PPC/W/30111	Central Garage, Cummock	East Ayrshire
PPC/W/30112	JK Thomson, Cummock	East Ayrshire
PPC/B/1000090	AM Services, Mauchline	East Ayrshire
PPC/B/1004563	Asda Filling Station, Kilmarnock	East Ayrshire
PPC/W/30100	Blair Garage, Stewarton	East Ayrshire
PPC/W/30116	Bobbin Filling Station, Galston	East Ayrshire
PPC/B/1000092	Pace Petroleum, Galston	East Ayrshire
PPC/B/1000088	Pace Petroleum, Kilmarnock	East Ayrshire
PPC/W/30061	Morrisons, Kilmarnock	East Ayrshire
PPC/W/30114	Shell Glencairn, Kilmarnock	East Ayrshire
PPC/B/1033837	Burnpark FS, Kilmarnock	East Ayrshire
PPC/B/1004562	Western Filling Station, Kilmarnock	East Ayrshire
PPC/B/1004561	Malthurst, Kilmarnock	East Ayrshire
PPC/B/1004559	Campbell Fuel Oils, Kilmarnock	East Ayrshire
PPC/B/1000087	Grange Service Station, Kilmarnock	East Ayrshire
PPC/B/1031777	Tesco Petrol Filling Station, Kilmarnock	East Ayrshire
PPC/W/30071	Braehead Metals	East Ayrshire

PPC/W/30125	Barr Ltd (Mobile)	East Ayrshire
PPC/W/30126	BarrLtd (Mobile)	East Ayrshire
PPC/W/30141	BarrLtd (Mobile)	East Ayrshire
PPC/W/30142	Barr Ltd (Mobile) - Roadstone	East Ayrshire
PPC/W/30146	Killoch (SC) DP	East Ayrshire
PPC/W/30154	Skares OCCS	East Ayrshire
PPC/W/30158	Gasswater (SC)	East Ayrshire
PPC/B/1003136	BarrLtd (Mobile)	East Ayrshire
PPC/B/1003137	BarrLtd (Mobile)	East Ayrshire
PPC/B/1003138	BarrLtd (Mobile)	East Ayrshire
PPC/B/1003139	BarrLtd (Mobile)	East Ayrshire
PPC/B/1003189	BarrLtd (Mobile)	East Ayrshire
PPC/B/1004235	Airdsgreen (SC)	East Ayrshire
PPC/B/1004236	Chalmerston (SC)	East Ayrshire
PPC/B/1005102	BarrLtd (Mobile)	East Ayrshire
PPC/B/1009227	Lugton Limeworks, Lugton	East Ayrshire
PPC/B/1014191	Johnsons Cleaners UK Ltd	East Ayrshire
PPC/B/1015138	Eazyclean Ltd	East Ayrshire
PPC/B/1017559	Crosshouse Launderette	East Ayrshire
PPC/B/1019918	Barr Ltd (Mobile) RMC	East Ayrshire
PPC/B/1024480	Barr Limited, Moorfield Plant	East Ayrshire
PPC/B/1025233	Beez Neez, Stewarton	East Ayrshire
PPC/B/1030092	Barr Ltd (Killoch)	East Ayrshire
PPC/B/1081430	Ve-Tech, Stranhead Cement Batcher	East Ayrshire
PPC/B/1083652	ATH Resources, Netherton	East Ayrshire
PPC/B/1079817	Dunstonhill OCCS, Patna	East Ayrshire
PPC/B/1079266	Piperhill Coal Transfer, Sinclairston	East Ayrshire

Appendix E:
Short-term to Long-term Data adjustment

All concentrations are reported as μg m^{-3}

Am = Annual mean
Pm = Period mean

John Finnie St

PM10

Am = 2012 annual mean concentration
Pm = 01/10/12 - 31/12/12

	Am	Pm	Am/Pm
Glasgow Anderston	14	14	1
Glasgow Waulkmillglen	10	11	0.91
N Lan Coatbridge Whifflet	12	13	0.92
N Lan Cumbernauld	13	13	1
		Average:	0.96

	Pm (PM10)	Estimated Annual Mean
John Finnie St	**13**	**12**

St Marnock St

PM10

Am = 2012 annual mean concentration
Pm = 13/03/12 - 18/07/12

	Am	Pm	Am/Pm
Glasgow Anderston	14	15	0.93
Glasgow Waulkmillglen	10	13	0.77
N Lan Coatbridge Whifflet	12	14	0.86
N Lan Cumbernauld	13	14	0.93
		Average:	0.87

	Pm (PM10)	Estimated Annual Mean
St Marnock St	**19**	**17**

NO2

Am = 2012 annual mean concentration
Pm = 18/02/12 - 18/07/12

	Am	Pm	Am/Pm
Glasgow Anderston	31	26	1.19
Glasgow Waulkmillglen	33	28	1.18
N Lan Cumbernauld	12	9	1.33
		Average:	1.23

	Pm (NO2)	Estimated Annual Mean
St Marnock St	**29**	**36**

Figure 1: Map of East Ayrshire

Numbers Indicate Road Traffic Count Locations.

Figure 2: Map of Coal Extraction Sites around Cumnock and New Cumnock

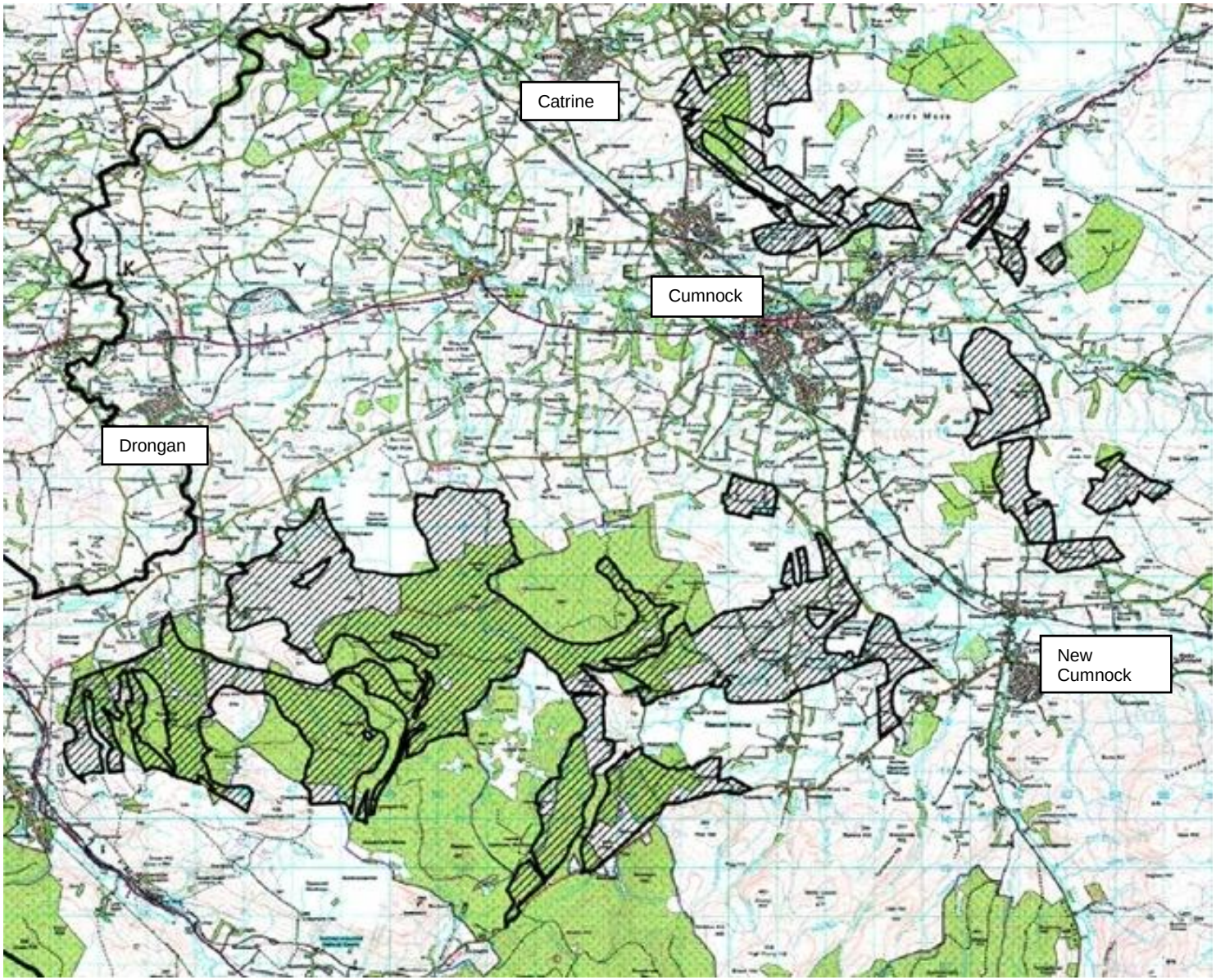


Figure 3: New Cumnock Automatic Monitoring Station

Figure 4: Kilmarnock Automatic Monitoring Stations

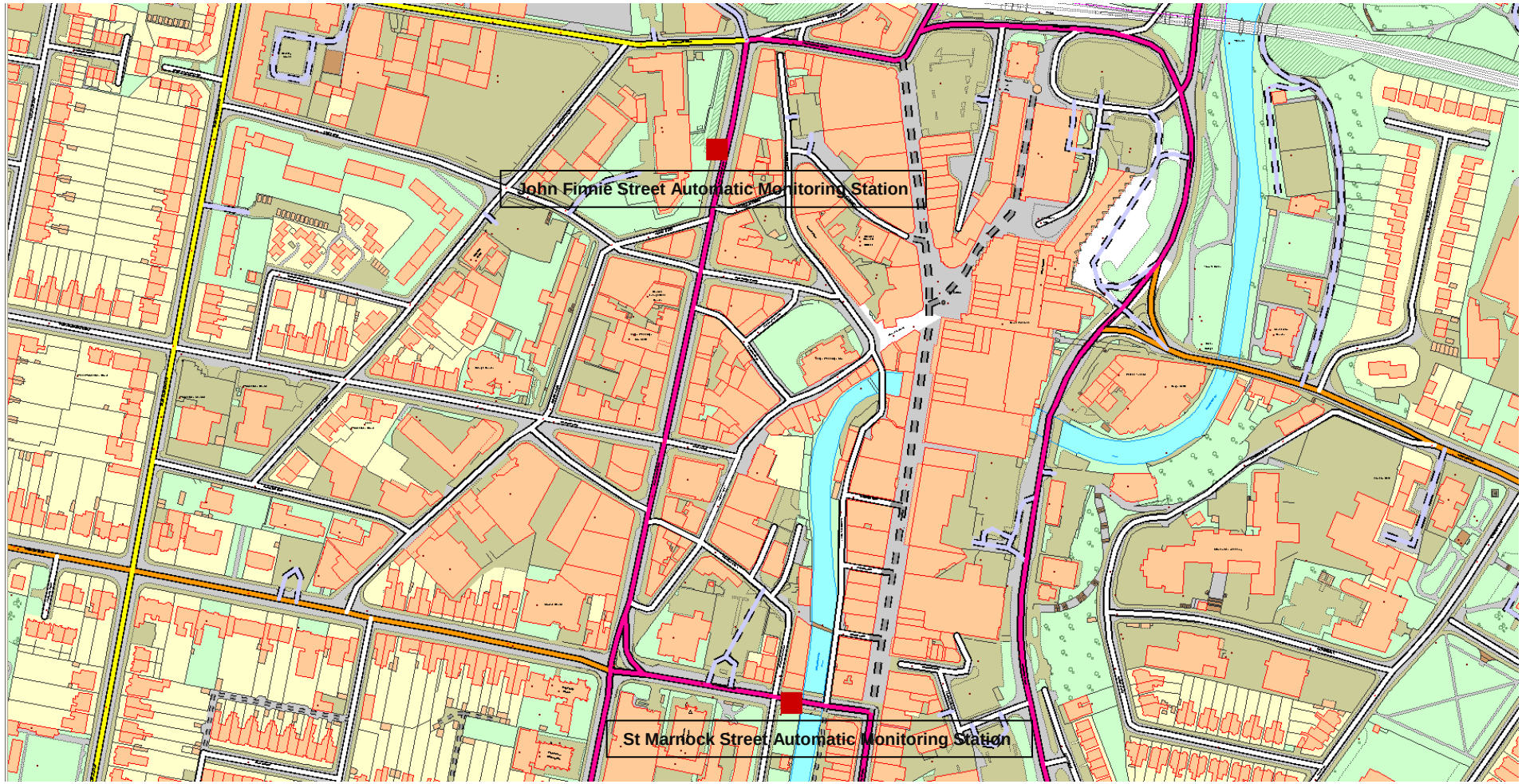


Figure 5a: Stewarton NO2 Diffusion Tube Location

Figure 5b: Kilmarnock Town Centre Air Monitoring Locations

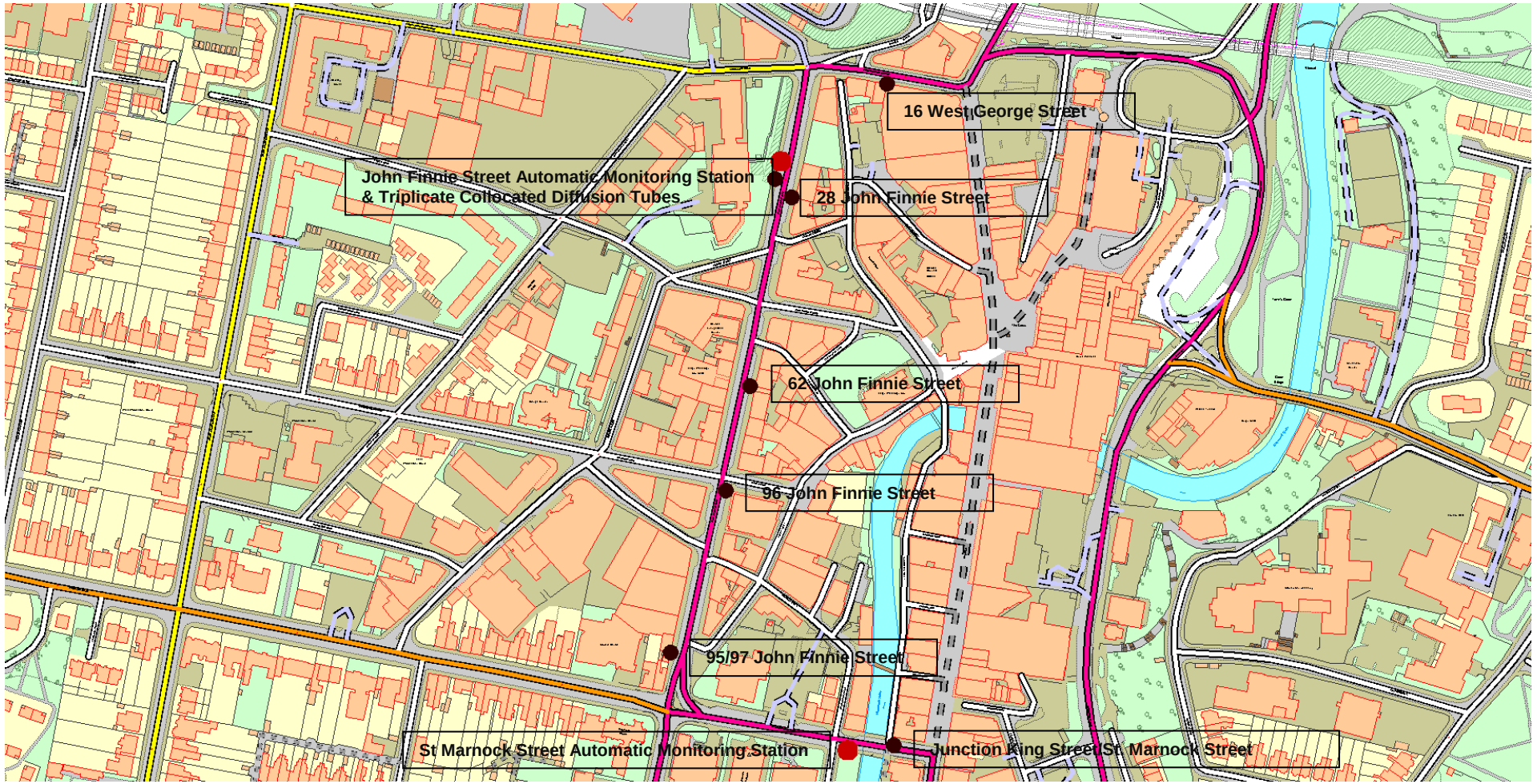


Figure 5c: Newmilns NO_2 Diffusion Tube Locations

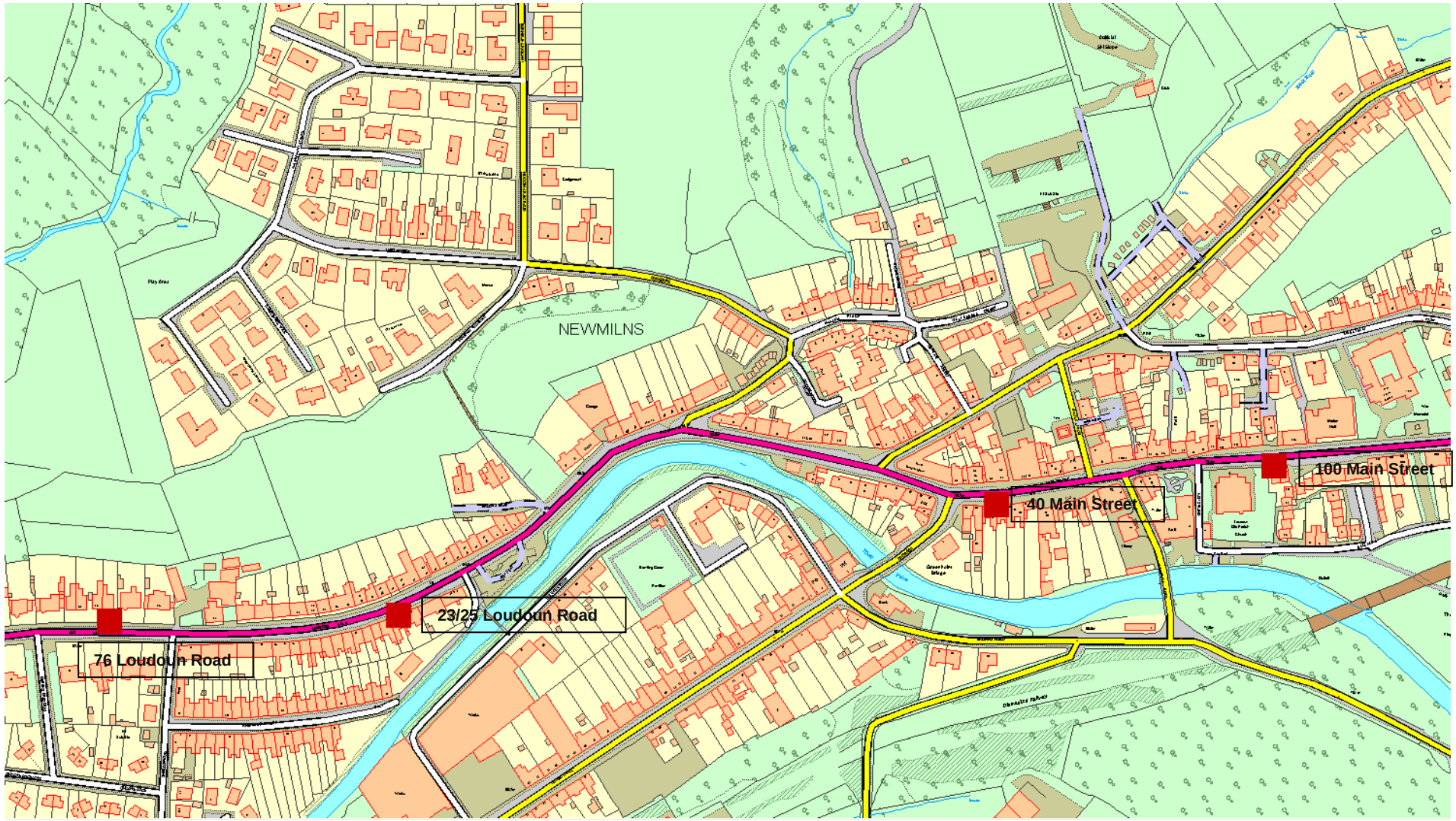


Figure 5d: Mauchline NO_2 Diffusion Tube Locations

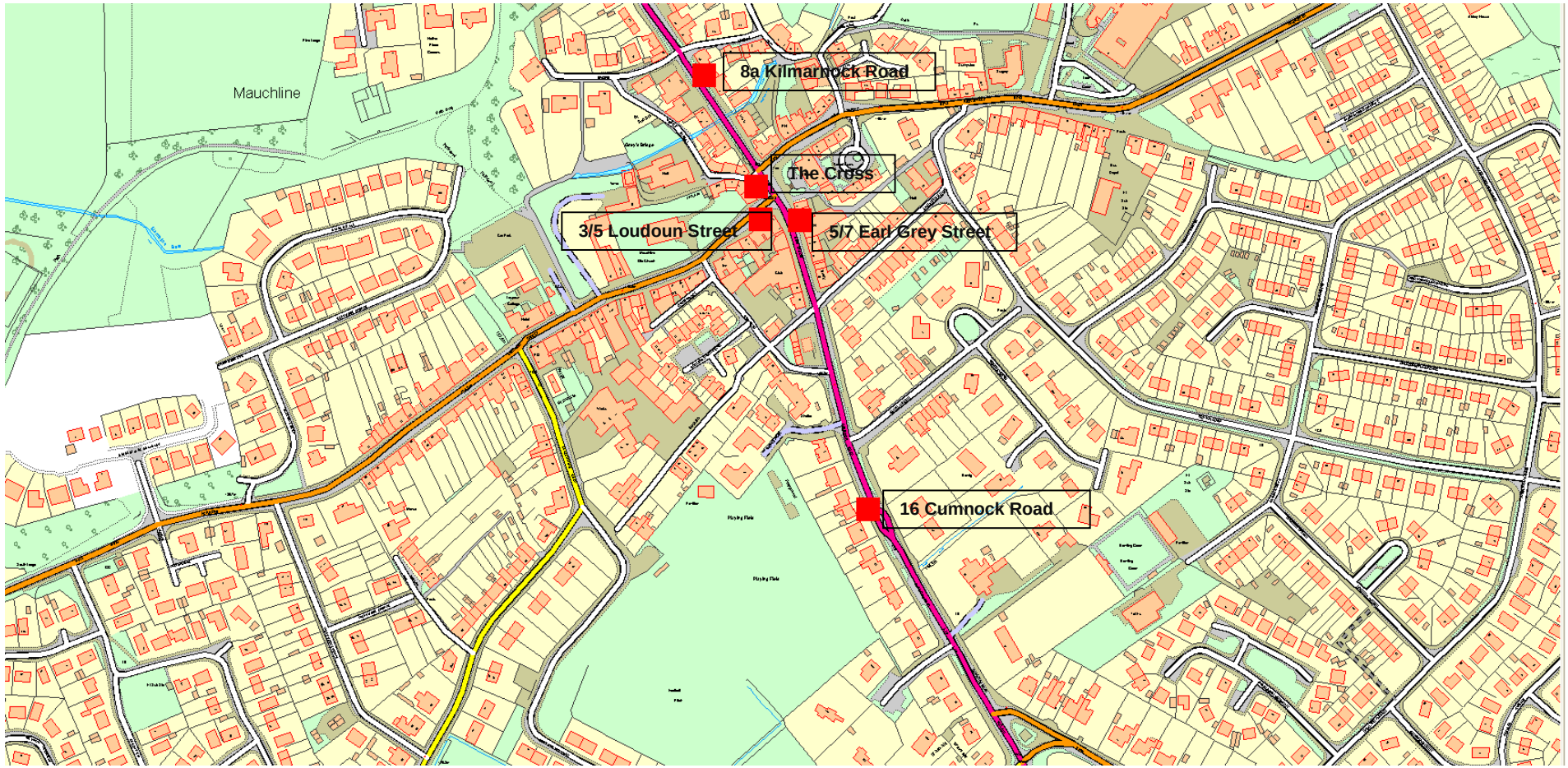


Figure 5e: Muirkirk NO_2 Diffusion Tube Location

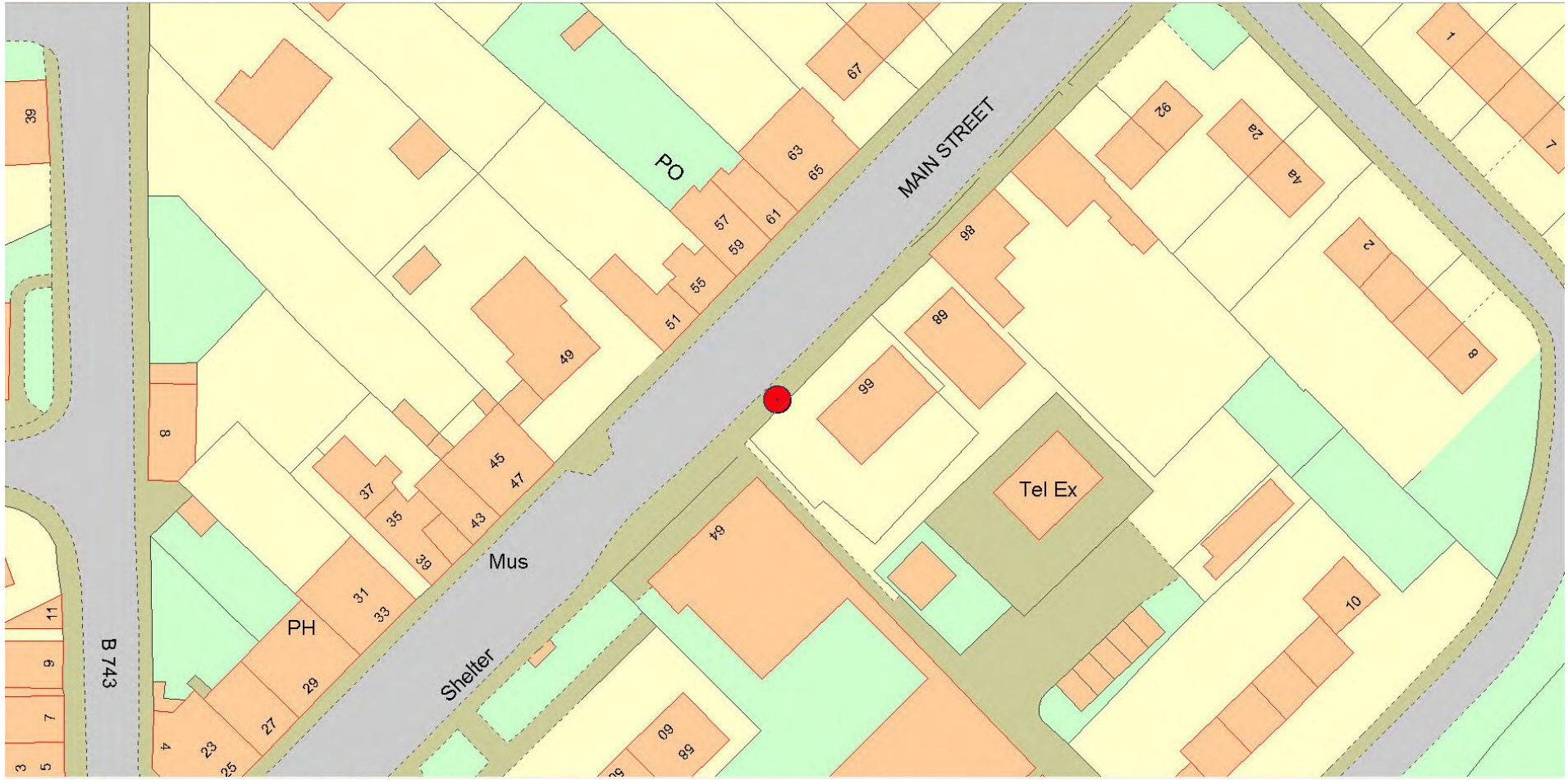


Figure 5f: Ochiltree NO_2 Diffusion Tube Location

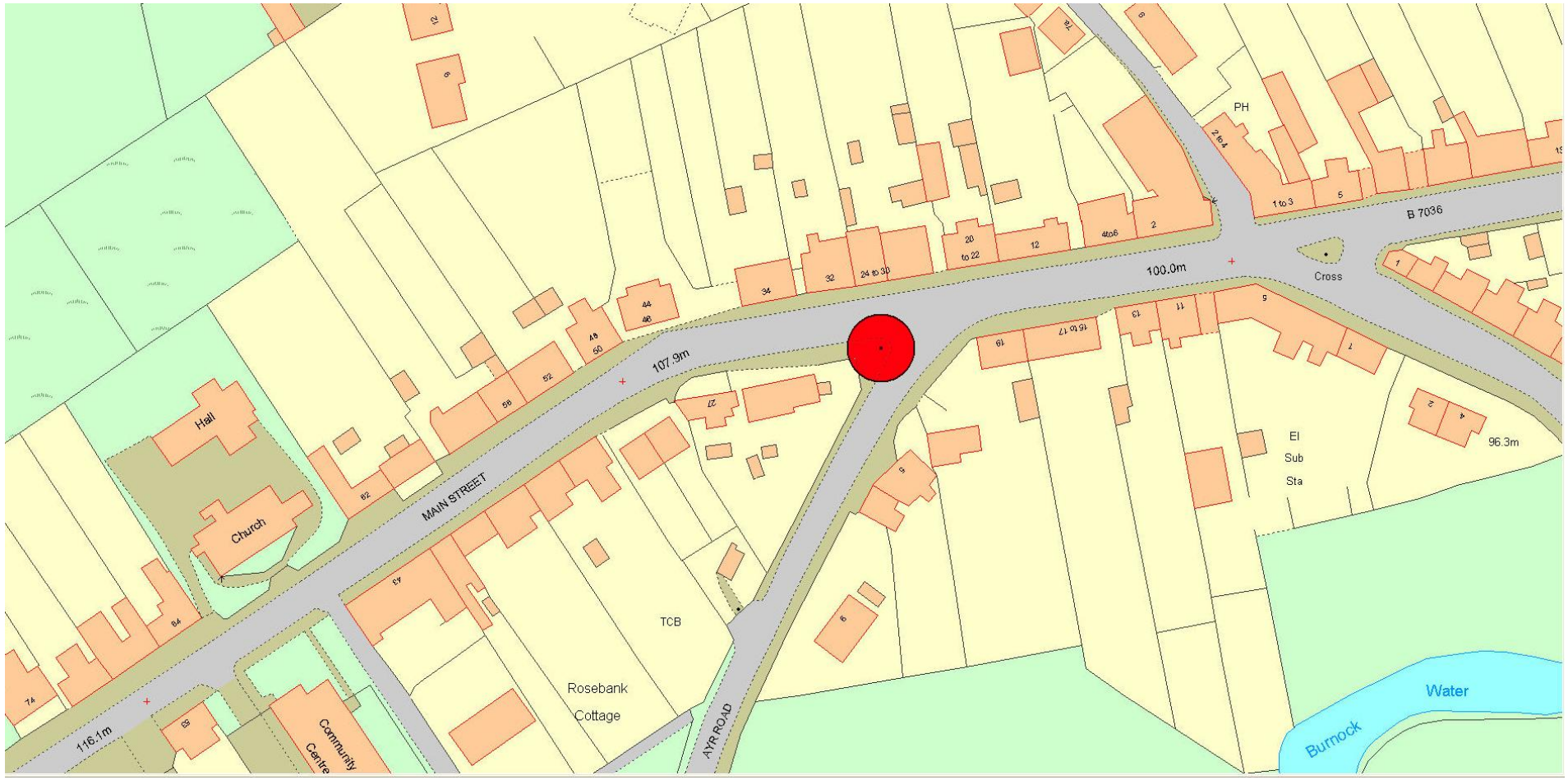


Figure 5g: Cumnock NO_2 Diffusion Tube Locations

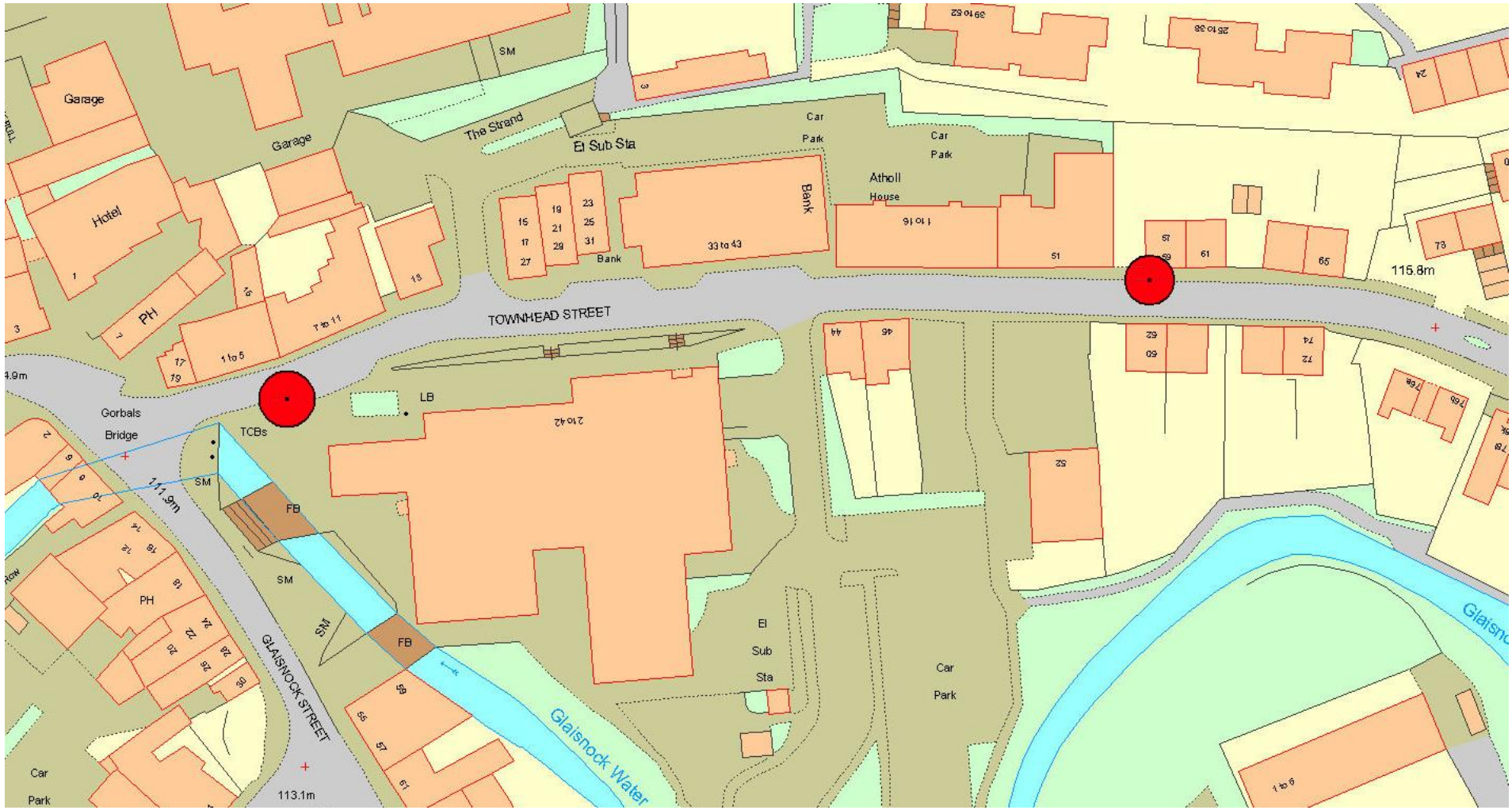


Figure 5h: Kilmarnock NO_2 Diffusion Tube Locations