2011 Air Quality Progress Report for:

EAST AYRSHIRE COUNCIL

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

July 2011

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Report Reference number	EA/01/2011
Date	July 2011

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 2011 Progress Report (PR) of the fourth round of the Review and Assessment process and includes the latest available data up to the end of 2010. 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 2009 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

As a result of high levels of nitrogen dioxide found in John Finnie Street in 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 first set of the results (part year monitoring 2010) from automatic monitoring within John Finnie Street show an annual mean nitrogen dioxide level of **43** µg/m^3 (Table 2.3a) which is above the Air Quality Objective of 40 µg/m^3. Annual mean Air Quality Objectives for nitrogen dioxide are only applicable to locations where members of the public might be regularly exposed such as building facades of residential properties, schools, hospitals, care homes etc. Referring to table 2.4b levels at the boundary wall (42.6 µg/m^3) would also exceed the annual mean objective. Although the actual 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. 1-hour mean levels apply to all locations where the

annual mean apply as well as gardens of residential properties kerbside sites (for example, pavements of busy shopping streets), hotels, in essence all locations where members of the public might reasonably be expected to spend one hour or more. The number of exceedences of the 1-hour mean (200 µg/m^3) at Kilmarnock was 16 (table 2.3b). 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 only eleven months of monitoring was carried out at Kilmarnock in 2011 data capture was below 90% , therefore the 99.8th percentile should be included. The site at Kilmarnock gave a 99.8th percentile of 197 µg/m^3 which is just below the allowable 200 µg/m^3 limit. Diffusion tube monitoring has also indicated annual levels of nitrogen dioxide above the Air Quality Objective within John Finnie Street in 2010.

Nitrogen dioxide levels have risen throughout Scotland in 2010 (Air Pollution in Scotland 2010 Reference 13). Further monitoring is therefore required to ascertain whether the raised 2010 levels of nitrogen dioxide are likely to be repeated in future years or whether 2010 was an exception due to the unusually extended periods of cold, still weather. It should also be noted that ongoing town centre regeneration works in the town centre are also adding to these levels. Nitrogen dioxide levels were predicted to fall steadily from 2008 (Detailed Report Reference 5). This is now known not to be the case, due partly to problems associated with more modern vehicles which although predicted to emit less nitrogen dioxide are in reality emitting similar levels. The actual trend is more likely to, at best, allow levels of nitrogen dioxide to remain static until introduction of Euro VI European Vehicle Emissions Standards. It remains to be seen whether the promised emission levels of Euro V and 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. To this end East Ayrshire Council Environmental Health are moving the NO_x analyser from New Cumnock and commissioning an additional PM_{10} monitor to St Marnock Street, Kilmarnock. This second automatic monitoring site within the heavily trafficked Kilmarnock one way system will give additional robust monitoring data before a decision is taken on whether to proceed to a detailed assessment. It will also allow more accurate modelling, if this is required, due to possible continued levels of nitrogen dioxide and/or PM_{10} levels in exceedence of the relevant Air Quality Objectives.

Diffusion tube monitoring of nitrogen dioxide (Table 2.4b) at Loudoun Road, Newmilns and Earl Grey Street, Mauchline also gave raised levels of nitrogen dioxide at areas of relevant public exposure at 38.9 µg/m^3 and 37.6 µg/m^3 respectively. Monitoring in both towns will therefore be continued and expanded if further monitoring shows continued raised levels.

All other monitoring locations within East Ayrshire gave annual mean levels of nitrogen dioxide well below the annual mean objective. Since all sites gave an annual mean level well below 60 µg/m^3 we can conclude that no exceedences of the one hour mean are likely to occur within East Ayrshire (Section 2).

PM_{10}

PM_{10} monitoring commenced in New Cumnock in 2009. This location was chosen due to the extensive open cast coal works in the surrounding area and the associated potentially raised background PM_{10} levels. Results for 2009 gave levels of PM10 at 12 µg/m^3 and 2010 gave levels at 9 µg/m^3 , well below the Annual Air Quality Objective (Table 2.5a). Similarly no exceedences of the 24 hour mean occurred.

PM_{10} monitoring commenced in John Finnie Street, Kilmarnock in February 2010. The annual mean level recorded in 2010 was 21 µg/m^3 which is significantly above the Annual Air Quality Objective of 18 µg/m^3. PM_{10} levels (similarly to NO_2) have risen in 2010 throughout

Scotland. John Finnie Street is also subject to the aforementioned town centre regeneration works which add to PM levels.

It has therefore been concluded that a Detailed Assessment is not required for East Ayrshire Council at this time.

An Updating and Screening Assessment will be submitted to the Scottish Government by the end of April 2012 and a decision will be taken based on the results of further monitoring whether to proceed to detailed assessments for NO_2 and PM_{10}.

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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. 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 the port of Stranraer 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 440,000.

Maps of the area are included in Figure 1.

1.2 Purpose of Progress Report

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, $\mu g/m^3$ (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 Local Air Quality Management in Scotland.

Pollutant	Concentration	Measured as	Date to be achieved by
Benzene	16.25 $\mu g/m^3$	Running annual mean	31.12.2003
	3.25 $\mu g/m^3$	Running annual mean	31.12.2010
1,3-Butadiene	2.25 $\mu g/m^3$	Running annual mean	31.12.2003
Carbon monoxide	10.0 mg/m^3	Running 8-hour mean	31.12.2003
Lead	0.5 $\mu g/m^3$	Annual mean	31.12.2004
	0.25 $\mu g/m^3$	Annual mean	31.12.2008
Nitrogen dioxide	200 $\mu g/m^3$ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 $\mu g/m^3$	Annual mean	31.12.2005
Particles (PM_{10}) (gravimetric)	50 $\mu g/m^3$, not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	50 $\mu g/m^3$, not to be exceeded more than 7 times a year	24-hour mean	31.12.2010
	40 $\mu g/m^3$	Annual mean	31.12.2004
	18 $\mu g/m^3$	Annual mean	31.12.2010
Sulphur dioxide	350 $\mu g/m^3$, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 $\mu g/m^3$, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 $\mu g/m^3$, 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 levels were found or predicted.
Updating and Screening Assessment	2006	No exceedences of the air quality levels 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.

2 New Monitoring Data

2.1 Summary of Monitoring Undertaken

East Ayrshire Council carried out automatic monitoring for NO_2 and PM_{10} and non-automatic monitoring for NO_2 during 2010.

2.1.1 Automatic Monitoring Sites

Automatic Monitoring for NO_2 was carried out at two locations, and for PM_{10} at three locations within East Ayrshire during 2010, using two API Chemiluminescent $NO/NO_2/NO_x$ Analysers, two Met One Instruments BETA Attenuation Mass Monitor (BAM 1020) and one E-Sampler (light scatter measurement of airborne particulate). All monitors are fitted with web logger functionality.

One station is located next to the Sports Hall, Castle, New Cumnock and is representative of residential areas within the town (Figure 3). New Cumnock was chosen for PM_{10} monitoring since it lies in an area of widespread open cast coal mining (Figure 2), with associated potentially raised background levels of PM_{10}.
Automatic monitoring commenced for NO_2 and PM_{10} in John Finnie Street, Kilmarnock (Figure 4) in February 2010. 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 2.4a) 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 is sensible.

Short term monitoring (April to November) of PM_{10} was carried out at the Council Offices in Lugar (Figure 6) using an E-sampler which uses the light scatter measurement of airborne particles. This measurement technique is a useful, relatively low cost screening technique and can be used to assess whether further monitoring is required. Lugar was chosen because it lies in an area of widespread opencast coal mining similar to the New Cumnock site (Figure 2). It must be noted that the E-sampler uses a non gravimetric equivalent measurement and any results should be treated with extreme caution. It is our intention to carry out a before and after weighing of the filter system provided with the sampler to check the accuracy of the measurement.

Further details of all three monitoring stations are provided in Table 2.1. The location of the New Cumnock, Lugar and Kilmarnock sites are shown in Figure 3, Figure 4 and Figure 6 respectively.

Table 2.1 Details of Automatic Monitoring Sites

Site Name	**Site Type**	**OS Grid Ref**		**Pollutants Monitored**	**Monitoring Technique**	**In AQMA?**	**Relevant Exposure?** (Y/N with distance (m) to relevant exposure)	**Distance to kerb of nearest road** (N/A if not applicable)	**Does this location represent worst-case exposure?**
New Cumnock	Urban Background	X 2618812	Y 613503	NO2	Chemiluminescent	N	Y(<1m)	45m	N
				PM10	BAM1020	N	Y(<1m)	45m	N
Kilmarnock	Roadside	X 242691	Y 638095	NO2	Chemiluminescent	N	Y(<1m)	2.850m	Y
				PM10	BAM1020	N	Y(<1m)	2.620m	Y
Lugar	Urban Background	X 258957	Y 621494	PM10	Light Scatter	N	Y(<1m)	80m	N

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. Similarly the E-Sampler is serviced twice yearly by Air Monitors. The E-Sampler automatically zeros on a programmed basis. Both the 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.

AEA undertake quality control of the automatic data for both the New Cumnock and 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 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 represent 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 24 separate locations in East Ayrshire during 2010 (Figures 4 and 5a-5l). 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. These tubes are located at a height of 1.70m which is the height of the NO_x inlet for the automatic analyser.

Table 2.2 Details of Non- Automatic Monitoring Sites

Site Name	Site Type	OS Grid Ref		Pollutants Monitored	In AQMA?	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Worst-case Location?
1. Fowlds Street/King Street Junction, Kilmarnock	Kerbside	X 242805	Y 637620	NO_2	N	N (35m)*	< 1m	Y
2. 28 John Finnie Street, Kilmarnock	Roadside	X 242701	Y 638083	NO_2	N	Y (3 – 4m)	2-3m	Y
3. 19 Lainshaw Street, Stewarton	Kerbside	X 241907	Y 645820	NO_2	N	Y (2 – 3m)	< 1m	Y
4. 40 Main Street, Newmilns	Roadside	X 253601	Y 637310	NO_2	N	Y (< 1m)	2-3m	Y
5. The Cross, Hurlford	Roadside	X 245524	Y 636914	NO_2	N	N (9 – 10m)*	2-3m	Y
6. 8A Kilmarnock Road, Mauchline	Roadside	X 249826	Y 627335	NO_2	N	Y (2 – 3m)	2-3m	Y
7. Junction at Main Street & A70 Ochiltree	Roadside	X 250712	Y 621166	NO_2	N	N (15m)*	1-2m	Y
8. Junction at A76 Roundabout, Auchinleck	Roadside	X 254450	Y 622454	NO_2	N	N (18m)*	2-3m	Y
9.Townhead/Glaisnock Street Junction, Cumnock	Roadside	X 256889	Y 620133	NO_2	N	N (9m)*	1-2m	Y
11. 96 John Finnie Street, Kilmarnock	Roadside	X 242657	Y 637883	NO_2	N	Y (3-4m)	2-3m	Y
12. 62 John Finnie Street, Kilmarnock	Roadside	X 242673	Y 637955	NO_2	N	Y(3 – 4m)	2-3m	Y

Site Name	Site Type	OS Grid Ref		Pollutants Monitored	In AQMA?	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Worst-case Location?
13. 22/24 Nursery Avenue, Kilmarnock	Roadside	X 243458	Y 637520	NO_2	N	N(5-6m)*	2-3m	Y
14. 95/97 John Finnie Street, Kilmarnock	Roadside	X 242619	Y 637773	NO_2	N	N(100m)**	3m	Y
15. 16 West George Street, Kilmarnock	Roadside	X 242766	Y 638160	NO_2	N	N(35m)*	1-2m	Y
16. Bridge Street, Galston	Kerbside	X 250117	Y 636661	NO_2	N	Y(<1m)	<1m	Y
17. 23/25 Loudoun Road, Newmilns	Roadside	X 253204	Y 637237	NO_2	N	Y(<1m)	2-3m	Y
18. 100 Main Street, Newmilns	Roadside	X 253784	Y 637336	NO_2	N	Y(3-4m)	2-3m	Y
19. 57/59 Townhead Street, Cumnock	Roadside	X 257059	Y 620157	NO_2	N	Y(<1m)	1-2m	Y
20. 66 Main Street, Muirkirk	Roadside	X 269706	Y 627355	NO_2	N	Y(5m)	2-3m	Y
21. The Jougs, Kilmaurs	Roadside	X 241043	Y 641221	NO_2	N	N(15m)*	2-3m	Y
22. The Cross, Mauchline	Roadside	X 249863	Y 627257	NO_2	N	N(5-6m)*	2-3m	Y
23. 3/5 Loudoun Street, Mauchline	Roadside	X 249867	Y 627232	NO_2	N	Y(<1m)	3-4m	Y
24. 5/7 Earl Grey Street, Mauchline	Roadside	X 249894	Y 627233	NO_2	N	Y(<1m)	2m	Y
25A. John Finnie Street, Kilmarnock	Roadside	X 242691	Y 638095	NO_2	N	Y (17m)*	2-3M	Y
25B. John Finnie Street, Kilmarnock	Roadside	X 242691	Y 638095	NO_2	N	Y (17m)*	2-3m	Y
25C. John Finnie Street, Kilmarnock	Roadside	X 242691	Y 638095	NO_2	N	Y (17m)*	2-3m	Y

*Although these sites are greater than 5m from relevant exposure, 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 relevant exposure.
** 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 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 the exposed tubes are 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 performance testing scheme, operated by the Health and Safety laboratory (HSL). GSS scored a GOOD performance in the WASP scheme for analysis of NO_2 diffusion tubes, April 2009 – April 2010. From October 2010 the performance criteria set by HSL will be based on the Rolling Performance Index (RPI) which allows long-term trends in performance to be monitored. Performance criteria in effect will be tightened. GSS also scored a GOOD performance based on these enhanced criteria.

GSS follow the procedures set out in the Harmonisation Practical Guidance.

GSS prepares the Palmes-Type diffusion tubes using the 20% Triethanolamine (TEA) in water.

During 2010 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 (Appendix F) was completed and sent to Dr Nick Martin, National Physical Laboratory. A resultant bias adjustment of 1.24 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. At the time of writing one site from East Ayrshire, four sites from Glasgow and the Marylebone Road site in London were present on the spreadsheet. Overall bias adjustment was therefore calculated from these six 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 1.12 was calculated from these six sites.

The bias adjustment factor applied to the raw annual means of the diffusion tubes was therefore **1.12** for 2010 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 6 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.

5/ The co-location data from the East Ayrshire site was of poor precision and should therefore be treated with caution.

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 2010 and where relevant, provides results from previous years to identify any trends.

2.2.1 Nitrogen Dioxide

The results of the nitrogen dioxide monitoring at the automatic station at Castle, New Cumnock and John Finnie Street, Kilmarnock together with the results from diffusion tube monitoring from sites across East Ayrshire are presented below.

Automatic Monitoring Data

The results of automatic monitoring for nitrogen dioxide carried out in 2010 at Castle, New Cumnock and John Finnie Street, Kilmarnock are displayed in Table 2.3a and 2.3b and the full report produced by AEA on behalf of the Scottish Government in Appendix C.

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

Site ID	Location	Within AQMA?	Relevant public exposure? Y/N	Data Capture for monitoring period %	Data Capture for full calendar year 2010 %	Annual mean concentrations (μg/m^3)		
						2008	2009	2010
A1	New Cumnock	N	Y		99.6		7	11
A2	Kilmarnock	N	Y	94*	89.2*			**43**

*Monitoring commenced in Kilmarnock on the 21st January 2010 for NO_x and 1st February 2010 for PM_{10}.

Table 2.3b Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with 1-hour Mean Objective

Site ID	Location	Within AQMA?	Relevant public exposure? Y/N	Data Capture for monitoring period %	Data Capture for full calendar year 2010 %	Number of Exceedences of hourly mean (200 μg/m^3) If the period of valid data is less than 90% of a full year, include the 99.8th percentile of hourly means in brackets.		
						2008	2009	2010
A1	New Cumnock	N	Y		99.6		0	0
A2	Kilmarnock	N	Y	94*	89.2*			16(197μg/m^3)

*Monitoring commenced in Kilmarnock on the 21st January 2010 for NO_x and 1st February 2010 for PM_{10}.

New Cumnock

New Cumnock was chosen as an automatic monitoring site as it lies in an area of extensive open cast coal mining. Concern has been raised about the level of PM_{10} emanating from coal extraction. Castle was chosen as an area which represents a typical residential area within the town. As can be seen from Table 2.3a and Table 2.3b annual mean levels of nitrogen dioxide are very low at 11 μg/m^3 and well within the annual air quality objective. No exceedences of the hourly mean air quality objective were found. With these low recorded levels it can be predicted that no exceedences of the 2010 NO_2 Air Quality Objectives are predicted in any area within New Cumnock. It is worth noting that although the annual mean was only 11 μg/m^3, this was a rise of 4 μg/m^3 over 2009, which follows a similar trend to the majority of sites throughout East Ayrshire and an overall rise shown nationally. (Air Pollution in Scotland 2010, Reference 13).

Kilmarnock

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 are in excess of 17,000 vehicles per day (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 the high levels of nitrogen dioxide.

As a result of high levels of nitrogen dioxide found in John Finnie Street in 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).

The first set of the results from John Finnie Street show an annual mean nitrogen dioxide level of **43** µg/m^3 (Table 2.3a) which is above the Air Quality Objective of 40 µg/m^3. Annual mean Air Quality Objectives for nitrogen dioxide are only applicable to locations where members of the public might be regularly exposed such as building facades of residential properties, schools, hospitals, care homes etc. Referring to table 2.4b levels at the boundary wall (42.6 µg/m^3) would also exceed the annual mean objective. Although the actual 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. 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. The number of exceedences of the 1-hour mean (200 µg/m^3) at Kilmarnock was 16 (table 2.3b). 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 only eleven months of monitoring was carried out at Kilmarnock in 2011 and the data capture was below 90%, the 99.8th percentile should be included. The site at Kilmarnock gave a 99.8th percentile of 197 µg/m^3 which is just below the objective 200 µg/m^3 limit.

As mentioned earlier nitrogen dioxide levels have risen throughout Scotland in 2010 (Air Pollution in Scotland 2010 Reference 13). Further monitoring is therefore required to ascertain whether the raised 2010 levels of nitrogen dioxide are likely to be repeated in future years or whether 2010 was an exception due to the unusually extended periods of cold, still weather. 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 has 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 actual expectation.

Further automatic monitoring in Kilmarnock is therefore essential to verify actual levels of nitrogen dioxide and likely future trends. To this end East Ayrshire Council Environmental Health are moving the NO_x analyser from New Cumnock and commissioning an additional PM_{10} monitor to St Marnock Street, Kilmarnock. This second automatic monitoring site within the heavily trafficked Kilmarnock one way system will give us additional robust monitoring data which will allow more accurate modelling, if this is required, due to possible continued levels of nitrogen dioxide and/or PM_{10} levels in exceedence of the relevant Air Quality Objectives.

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 2.4a.and the full monthly dataset is displayed in Appendix B. Diffusion tube locations are shown in Fig. 5a-5l.

Table 2.4a Results of Nitrogen Dioxide Diffusion Tubes

Site ID	Location	Within AQMA?	Data Capture for monitoring period %	Data Capture for full calendar year 2010 %	Annual mean concentrations (μg/m^3)				
					2006	2007	2008	2009	2010
1	Fowlds Street/King Street Junction, Kilmarnock	N		100	33	38	35	32.3	**39.1**
2	28 John Finnie Street, Kilmarnock	N		100	40	39	39	32.8	**40.2**
3	19 Lainshaw Street, Stewarton	N		100	31	33	32	31.2	**35.8**
4	40 Main Street, Newmilns	N		100	23	38	38	29.9	**33.0**
5	The Cross, Hurlford	N		100	29	28	28	24.6	**26.0**
6	8A Kilmarnock Road, Mauchline	N		100	35	34	32	30.7	**31.6**
7	Junction at Main Street & A70 Ochiltree	N		100	22	26	26	23.2	**26.2**

8	Junction at A76 Roundabout, Auchinleck	N		100	18	17	15	18.6	**18.4**
9	Townhead/Glaisnock Street Junction, Cumnock	N		100	21	16	16	18.5	**17.4**
10	Air Quality Monitoring Station, Western Road, Kilmarnock	N		N/A	16	16	14		
11	96 John Finnie Street, Kilmarnock	N		91.7			31	33.3	**34.8**
12	62 John Finnie Street, Kilmarnock	N		100			38	38.3	**40.0**
13	22/24 Nursery Avenue, Kilmarnock	N		91.7				23.7	**26.9**
14	95/97 John Finnie Street, Kilmarnock	N		100				43.7*	**43.8**
15	16 West George Street, Kilmarnock	N		75				39.9*	**43.2**
16	18 Bridge Street, Galston	N		100				24.4*	**27.1**
17	22/25 Loudoun Road, Newmilns	N		91.7				39.8*	**40.6**
18	100 Main Street, Newmilns	N		91.7				24.4*	**26.4**
19	57/59 Townhead Street, Cumnock	N		100				19.6*	**22.6**
20	66 Main Street, Muirkirk	N		100				15.1*	**17.8**
21	The Jougs, Kilmaurs	N		91.7				21.1*	**25.5**
22	The Cross, Mauchline	N		91.7				28.7*	**29.5**
23	3/5 Loudoun Street, Mauchline	N		100				31.2*	**31.4**
24	5/7 Earl Grey Street, Mauchline	N		91.7				41.3*	**39.5**
25A	John Finnie Street, Kilmarnock	N	100	91.7					**35.2**
25B	John Finnie Street, Kilmarnock	N	100	91.7					**39.8**
25C	John Finnie Street, Kilmarnock	N	100	91.7					**37.8**
Mean 25A-C	John Finnie Street, Kilmarnock	N	100	91.7					**37.7**

Bias adjustment factor of 1.12 was applied to all 2010 diffusion tube measurements (Appendix A).
*Short term data was annualised (Appendix D)

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).

2009 - 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. Three nearby, urban background, long term, continuous monitoring sites within 50 miles were identified: Glasgow Anderston, Glasgow City Chambers and Coatbridge Whifflet.
2. The results of the annual mean, **Am,** for these sites in 2009 were obtained.
3. The period means, **Pm,** for 2009 were obtained for August to December (the months of the short term monitoring in East Ayrshire).
4. The Ratio, **R,** of the annual 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 2009 (Table 2.4a).

2010
There were four sites (Figures 5a-l) which displayed exceedences of the annual mean (diffusion tube monitoring Table 2.4a) within East Ayrshire in 2010. Three sites were within the one way system in Kilmarnock, namely 95/97 John Finnie Street (43.8 µg/m^3), 28 John Finnie Street (40.2 µg/m3) and16 West George Street (43.2 µg/m^3) and one site located in Loudoun Road Newmilns (40.6 µg/m^3). One site also displayed levels at the annual mean (40 µg/m^3), 62 John Finnie Street, Kilmarnock which is also located within the one way system.

Kilmarnock
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 are in excess of 17,000 vehicles per day (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 the high levels of nitrogen dioxide.

As a result of high levels of nitrogen dioxide in John Finnie Street in 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).

Three locations (diffusion tubes Table 2.4a) in Kilmarnock exceeded the annual mean. All three sites were located within the one way system, 28 John Finnie Street (40.2 $\mu g/m^3$), 95/97 john Finnie Street (43.8 $\mu g/m^3$) and 16 West George Street (43.2 $\mu g/m^3$). 62 John Finnie Street gave an annual mean at the Air Quality Objective of 40 $\mu g/m^3$. It should be noted that 95/97 John Finnie Street has no relevant exposure within 100m of the diffusion tube location and West George Street has no relevant exposure within 35m of the diffusion tube location. Although the latter two diffusion tube locations have no relevant exposure in the immediate vicinity they may be regarded as representative of areas of relevant exposure and therefore give a more complete picture of NO_2 levels along John Finnie Street.

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 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.

In summary the diffusion tube results for the one way system in Kilmarnock follow the national trend for 2010 and indicate a rise of nitrogen dioxide levels and are now at levels which exceed or are close to the annual mean objective along a stretch of the one way system from Fowlds Street to West George Street. Further monitoring is therefore required and if this trend continues East Ayrshire will proceed to a further detailed assessment for the one way system in Kilmarnock

Newmilns

The monitoring location (diffusion tube) in Loudoun Road, Newmilns (Figure 5e) gave an annual mean for nitrogen dioxide in 2010 of 40.6 $\mu g/m^3$ which is marginally above

the 40 µg/m^3 Air Quality Objective, although when extrapolated to the location of relevant public exposure this falls to 38.9 µg/m^3. Daily traffic flows through Newmilns are in the region of 10-11,000 (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 close to the annual mean in previous years at 40 Main Street (Table 2.4a). In consequence two additional diffusion tubes have been added in 2009, one additional tube in Main Street, Newmilns and one in Loudoun Road (Figure 5e), to ascertain the spread of nitrogen dioxide levels along the A71 running through Newmilns. Although levels of NO_2 had actually dropped at 40 Main Street (due to improved off road parking and traffic flow), levels at Loudoun Road were close to the 40 µg/m^3 annual mean in 2009 (short term monitoring) and marginally exceeded the annual mean in 2010 at the roadside location. Further monitoring is therefore required to ascertain whether the exceedence is a one off due to unusual weather patterns in 2010 or, a long term trend where further action will be required.

Mauchline

The A76 Kilmarnock to Dumfries Trunk Road runs through Mauchline and daily traffic flows are in the region of 12-13,000 (Source Transport Scotland). This combined with relatively narrow streets and high buildings (canyon effect), and traffic lights both at the intersection of the A76 and the B743 (Mauchline/Ayr Road) and pedestrian lights has resulted in levels of nitrogen dioxide in the Kilmarnock Road monitoring site up to 35 µg/m^3 in recent years (Table 2.4a). The potential for higher levels of nitrogen dioxide was therefore a possibility and it was therefore decided to place additional tubes around Mauchline Cross (Figure 5h) covering the A76 North, A76 South (Earl Grey Street) and B743 Loudoun Street (Mauchline/Ayr Road). The trend in nitrogen dioxide levels over the four years from 2006 to 2009 (Figure 2.4a) was downwards at the long term monitoring site in Kilmarnock Road, Mauchline to levels in the low 30's (30.7 µg/m^3 in 2009). The 2010 levels show a slight rise to 31.6 µg/m3. The new monitoring site in Loudoun Street and The Cross gave slightly lower levels at 31.4 and 29.5 µg/m^3 respectively, but the site in Earl Grey Street gave levels just under the 2005 annual mean Air Quality Objective at 39.5 µg/m^3. It should be noted the 2010 annual mean NO_2 levels at the nearest relevant public exposure was 37.6 µg/m^3 comfortably below the annual mean objective (Table 2.2 and Table 2.4b). It should also be noted that complete resurfacing of the A76 which runs through Mauchline took place over a period of 14 weeks during the summer of 2010 causing significant traffic disruption.

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

Relevant Exposure

Table 2.4b (below) illustrates NO_2 levels at locations of 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. Table 2.4b illustrates the extrapolated NO_2 levels from the kerbside and roadside data 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.

All annual mean extrapolated results at areas of relevant exposure were found to be below the annual objective of 40µg/m^3. 95/97 John Finnie Street, Kilmarnock exceeded the annual mean with a result of 42.6 µg/m^3 at the boundary wall of the nearest business. This site has no relevant exposure (for annual mean) within100m however it can be regarded as representative of location of relevant exposure. The location at West George Street also gave an extrapolated result (42.2 µg/m^3) which would exceed the annual mean at the boundary of the property. Again this location has no relevant exposure within 35m but both locations will be continued to be monitored as they provide a more complete picture of nitrogen dioxide levels within the one way system and provide a likelihood to whether or not the 1-hour mean (which is relevant for pavements of busy shopping streets etc.) could be exceeded.

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 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 and we can therefore conclude no exceedences of the one hour mean 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.)

Table 2.4b Results of Nitrogen Dioxide Diffusion Tubes – Relevant Exposure

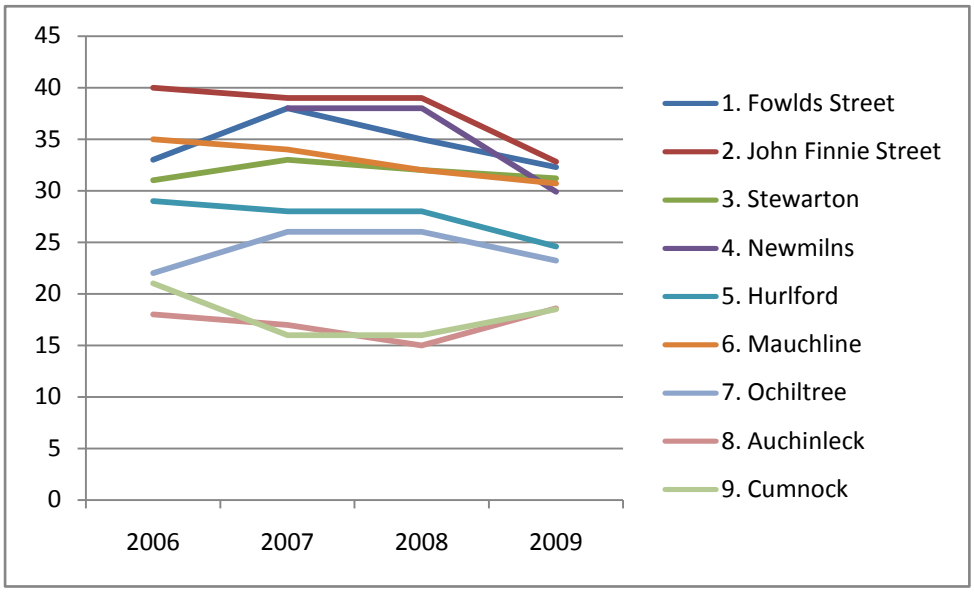
Site ID	Location	Annual mean concentrations (μg/m^3)				
		2010 Kerbside/ Roadside	2010 Background	2010 Building Facade	2010 Relevant Exposure	
1	Fowlds Street/King Street Junction, Kilmarnock	39.1	16.4	31.6	**N/A****	
2	28 John Finnie Street, Kilmarnock	40.2	26.8	37.6	**37.6**	
3	19 Lainshaw Street, Stewarton	35.8	7.7	28.0	**28.0**	
4	40 Main Street, Newmilns	33.0	11.1	32.3	**32.3**	
6	8A Kilmarnock Road, Mauchline	31.6	9.1	27.9	**27.9**	
11	96 John Finnie Street, Kilmarnock	34.8	16.4	31.5	**31.5**	
12	62 John Finnie Street, Kilmarnock	40.0	16.4	35.3	**35.3**	
14	95/97 John Finnie Street, Kilmarnock	43.8	16.4	42.6	**N/A****	
15	16 West George Street, Kilmarnock	43.2*	26.8	42.2	**N/A****	
17	22/25 Loudoun Road, Newmilns	40.6	11.1	38.9	**38.9**	
23	3/5 Loudoun Street, Mauchline	31.4	9.1	30.5	**30.5**	
24	5/7 Earl Grey Street, Mauchline	39.5	9.1	37.6	**37.6**	

25	Monitoring Site, John Finnie Street, Kilmarnock	37.6	26.8	37.4	**N/A****	

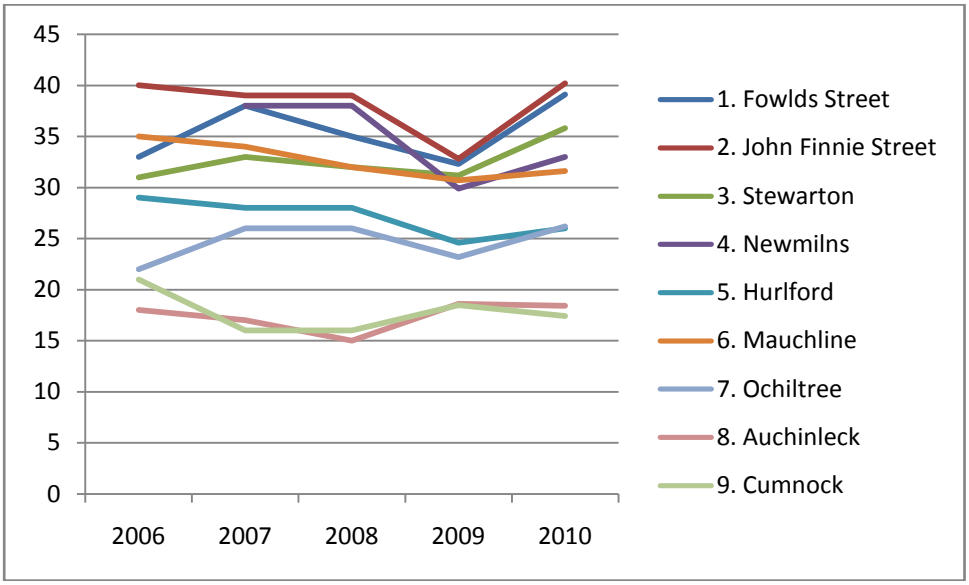
** No calculation was carried out for these sites since any relevant exposure is more than 35m from the monitor (Table 2.2) and the calculation would be meaningless (Reference 8).

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

2006 - 2009



2006 -2010



Annual mean nitrogen dioxide levels in µg/m^3 (y-axis) were plotted against the year of measurement 2006-20010 (x-axis) for the long term diffusion tube monitoring sites. Since valid data is only available for 5 years any trend analysis should be treated with caution. From the limited data available the overall trend from nine long term monitoring sites within East Ayrshire over the last 5 years would appear to be marginally downwards from years 2006 -2009 with a sharp rise in 2010. To emphasise the sharp

rise in nitrogen dioxide levels in 2010 both the 2006 – 2009 graph and the 2006 – 2010 graph are shown. Further monitoring will determine whether the rise in 2010 is due to the unusual weather conditions of 2010 or a sustained long term trend.

2.2.2 PM_{10}

The results of the automatic monitoring carried out at New Cumnock, Kilmarnock and Lugar are set out in table 2.5a and table 2.5b and the full monthly dataset for New Cumnock and Kilmarnock in Appendix C. The BAM 1020 data was corrected using a gravimetric factor of 0.83333 for Indicative Gravimetric Equivalent from 17th January 2009 (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 uses Beta Attenuation Monitor (with unheated inlets) (BAM 1020) continuous analysers. 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 2.5a Results of PM_{10} Automatic Monitoring: Comparison with Annual Mean Objective

Site ID	Location	Within AQMA?	Data Capture for monitoring period %	Data Capture for full calendar year 2010 %	Annual mean concentrations (μg/m^3)		
					2008	2009	2010
A1	New Cumnock	N		99.6		12	9
A2	Kilmarnock	N	95	87.3			21
A3	Lugar	N	99.5	58.1			2

Table 2.5b Results of PM_{10} Automatic Monitoring: Comparison with 24-hour Mean Objective

Site ID	Location	Within AQMA?	Data Capture for monitoring period %	Data Capture 2010 %	Number of Exceedences of daily mean objective (50 μg/m^3) If data capture < 90%, include the 98th percentile (in Scotland) of daily means in brackets.		
					2008	2009	2010
A1	New Cumnock	N		99.6		0	0
A2	Kilmarnock	N	95	87.3			0 (40 μg/m^3)
A3	Lugar	N	99.5	58.1			0

New Cumnock

New Cumnock was chosen as an automatic monitoring site as it lies in an area of extensive open cast coal mining. Concern has been raised about the level of PM_{10} emanating from coal extraction. Castle was chosen as an area which represents a typical residential area within the town. As can be seen from Table 2.5a and Table 2.5b the measured annual mean concentration of PM_{10} complied with the 2010 Air Quality Objective and that no exceedences of the 2010 24 hour Air Quality Objective occurred at this site. The annual mean level recorded for Castle, New Cumnock was at 12 μg/m^3 in 2009 and 9 μg/m^3 in 2010, well below the 18 μg/m^3 2010 annual mean Air Quality Objective. With these low recorded levels it can be predicted that no exceedences of the 2010 PM_{10} Air Quality Objectives are predicted in any area within New Cumnock.

Kilmarnock

PM_{10} monitoring commenced in John Finnie Street, Kilmarnock in February 2010. This site was chosen as previous monitoring has shown NO_2 levels close to the 2005 Air Quality Objective due mainly to road traffic. Where high levels of NO_2 are due to road traffic it follows that PM_{10} levels are also likely to be high and monitoring would be recommended.

Monitoring for John Finnie Street was not carried out for the full year and therefore any interpretation of results must be treated with caution. An annual mean of 21 μg/m^3 was measured at John Finnie Street during 2010. This is significantly higher than the annual mean objective of 18 μg/m^3. No exceedences of the 50 μg/m^3 were measured during the 11 month monitoring period. The 99.8th percentile of daily means was 40 μg/m^3 (included since data capture was below 90%). As in the previous discussion regarding NO_2 the main source of PM_{10} in John Finnie Street is due to road traffic. 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 are in excess of 17,000 vehicles per day (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 the high PM_{10} levels. As previously discussed Town Centre Regeneration construction works are directly and indirectly increasing PM_{10} through associated traffic flow changes. There was also a national rise in PM_{10} at roadside sites during 2010.

In summary, automatic monitoring of PM_{10} indicate annual mean levels of PM_{10}, at 21 $\mu g/m^3$ within John Finnie Street in 2010, are above the Air Quality Objective of 18 $\mu g/m^3$. Further monitoring is therefore required and if these levels are confirmed in future years East Ayrshire will proceed to a detailed assessment for the one way system in Kilmarnock. Further automatic monitoring in Kilmarnock is therefore essential to verify actual levels of PM_{10} and likely future trends. To this end, East Ayrshire Council Environmental Health applied for funding from the Scottish Government for an additional PM_{10} automatic monitor to be located within the one way system at St Marnock Street, Kilmarnock. Part funding from the Scottish Government was awarded in June this year and a new TEOM FDMS PM_{10} monitor will be commissioned in the next few months along with the relocated NO_x analyser from New Cumnock. This second site within the heavily trafficked Kilmarnock one way system will give us additional robust monitoring data which will allow more accurate modelling as part of a Detailed Assessment if required, due to possible continued levels of nitrogen dioxide and/or PM_{10} levels in exceedence of the relevant Air Quality Objectives.

Lugar

As previously mentioned, short term PM_{10} monitoring was carried out at Lugar using an E-sampler. Although the results have to be treated with caution, the annual mean is very low at 2 $\mu g/m^3$. Comparison checks will be carried out by comparing the results with a weighed filter to provide a calibration factor (gravimetric comparison) to provide greater accuracy for future monitoring.

2.2.3 Sulphur Dioxide

No Sulphur Dioxide monitoring was carried out in East Ayrshire in 2010. 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 2010. 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 2010.

2.2.6 Summary of Compliance with AQS Objective

East Ayrshire Council has examined the results from monitoring within East Ayrshire. **Part year** monitoring for 2010 has shown concentrations of PM_{10} within John Finnie Street exceeding the annual mean. Similarly **part year** automatic monitoring and diffusion tube monitoring has shown concentrations of nitrogen dioxide exceeding the annual mean. Previous modelling, diffusion tube monitoring and a detailed assessment of nitrogen dioxide had shown levels of all relevant pollutants would be below all the objectives at relevant locations. With this in mind and the exceptional weather conditions during 2010 it has been concluded that further monitoring is necessary to provide robust data before a decision is taken to proceed to a further detailed assessment.

3 New Local Developments
(including planning applications)

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.

3.1.1 Narrow Congested Streets with Residential Properties Close to the Kerb

Narrow congested streets were identified in previous rounds of Review and Assessment, including streets within Kilmarnock, Cumnock, Stewarton, the A71 which runs through Newmilns and the A76 which runs through Mauchline. These are at present subject to nitrogen dioxide monitoring. Exceedences of the Air Quality Objectives have been found for both NO_2 and for PM_{10} within Kilmarnock in 2010 (refer to Section 2).

East Ayrshire Council confirms that there are no new/newly identified congested streets with a flow above 5,000 vehicles per day and residential properties close to the kerb, that have not been adequately considered in previous rounds of Review and Assessment.

3.1.2 Busy Streets Where People May Spend 1-hour or More Close to Traffic

Busy streets within East Ayrshire with significant numbers of shops were previously assessed in previous rounds of Review and Assessment.

East Ayrshire Council confirms that there are no new/newly identified busy streets where people may spend 1 hour or more close to traffic.

3.1.3 Roads with a High Flow of Buses and/or HGVs.

Roads with potentially a high flow of buses and/or HGVs were assessed in previous rounds of Review and Assessment.

East Ayrshire Council confirms that there are no new/newly identified roads with high flows of buses/HGVs.

3.1.4 Junctions and Busy Roads

Busy roads and junctions (greater than 10,000 vehicles per day), with relevant exposure, were assessed in previous round of Review and Assessment. Where necessary, these junctions and busy roads are subject to further air quality monitoring. (Table 2.3a, Table 2.3b, 2.4a, 2.4b, 2.5a and 2.5b)

East Ayrshire Council confirms that there are no new/newly identified busy junctions/busy roads.

3.1.5 New Roads Constructed or Proposed Since the Last Round of Review and Assessment

No new roads have been built within East Ayrshire since the last round of Review and Assessment, with either, traffic flow of greater than 10,000 vehicles a day, or, which have increased traffic flow significantly on existing roads having a NO_2 annual mean greater than 36µg/m^3.

East Ayrshire Council confirms that there are no new/proposed roads.

3.1.6 Roads with Significantly Changed Traffic Flows

There are no roads within East Ayrshire, with traffic flows of greater than 10,000 which have experienced “large” increases (>25%) in traffic.

East Ayrshire Council confirms that there are no new/newly identified roads with significantly changed traffic flows.

3.1.7 Bus and Coach Stations

East Ayrshire Council has two bus stations, one in Kilmarnock and one in Cumnock. Kilmarnock Bus Station has 850 bus movements per day and Cumnock has 420 bus movements per day. These numbers of movements are well below the criteria, of 2500 movements per day, required for an assessment of NO_2 and PM_{10} to be carried out.

East Ayrshire Council confirms that there are no relevant bus stations in the Local Authority area.

3.2 Other Transport Sources

3.2.1 Airports

East Ayrshire Council confirms that there are no airports in the Local Authority area.

3.2.2 Railways (Diesel and Steam Trains)

Information on rail transport was obtained from ScotRail and Network Rail.

Stationary Trains (potential SO_2 exposure)

East Ayrshire has 6 railway stations in the towns of Kilmarnock, Kilmaurs, Stewarton, Dunlop, New Cumnock and Auchinleck, with Kilmarnock being the largest with 72 movements per day, and, an annual passenger usage of 438,000 (2006/2007). Kilmarnock is the only station with the potential for trains to be stationary for over the 15 minute criteria for further assessment. Information from ScotRail indicates that diesel locomotives have their engines shut off before being stationary for 15 minutes, and in any case, have an automatic cut-off fitted to the engine which activates on a timer after the engine is stationary for 15 minutes. There are also no more than two trains in the station at any one time, and the station has no catering facilities. There is also no residential housing or shops within 15 m of the station. It is therefore unlikely that members of the public will be exposed to 15 minute levels of SO_2 above 266 µg/m^3.

East Ayrshire has several rail sidings for loading and movement of coal, including Killoch, Chalmerston and New Cumnock. There is also a railway carriage refurbishment works, Brush Barclay, located at the Caledonia Works, Kilmarnock. These utilise diesel shunters, which although may be stationary for more than 15 minutes, are located more than 15m from people with relevant exposure.

East Ayrshire Council confirms that there are no locations where diesel or steam trains are regularly stationary for periods of 15 minutes or more, with potential for relevant exposure within 15m.

Moving Trains (potential NO_2 exposure)

East Ayrshire has no railway lines with a high usage of diesel locomotives. No further assessment for NO_2 levels is therefore required.

East Ayrshire Council confirms that there are no locations with a large number of movements of diesel locomotives, and potential long-term relevant exposure within 30m.

3.2.3 Ports (Shipping)

East Ayrshire Council confirms that there are no ports or shipping within the Local Authority area.

3.3 Industrial Sources

Information on installations regulated under the Pollution Prevention and Control (Scotland) Regulations 2000 as either Part A or Part B processes was obtained from SEPA. The list of authorised processes is set out in Appendix E.

3.3.1 Industrial Installations

New or Proposed Installations for which an Air Quality Assessment has been Carried Out

Information on any new or proposed installations for which an air quality assessment has been carried out was obtained from SEPA. Since the last Updating and Screening Assessment, there are two new industrial installations for which planning approval has been granted. The two premises which may have an impact on air quality are:-

Barr Ltd., Moorfield Plant have received planning consent for a roadstone coating plant at Moorfield Industrial Estate, Kilmarnock, and the Egger Barony recycling plant at Auchinleck. Both installations were covered in the 2010 Progress Report.

Existing Installations where Emissions have Increased Substantially or New Relevant Exposure has been Introduced

Information obtained from SEPA indicates that there are no existing installations where emissions have substantially increased.

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

New or Significantly Changed Installations with No Previous Air Quality Assessment

Information obtained from SEPA indicates that there are no new or significantly changed installations where no previous air quality assessment was carried out.

East Ayrshire Council confirms that there are no new or proposed industrial installations for which planning approval has been granted within its area or nearby in a neighbouring authority.

3.3.2 Major Fuel (Petrol) Storage Depots

Information obtained by SEPA and from Appendix E of LAQM TG(09), confirms that there are no major fuel storage depots within East Ayrshire.

There are no major fuel (petrol) storage depots within the East Ayrshire Council area.

3.3.3 Petrol Stations

East Ayrshire Council has only one petrol station which has both an annual throughput of petrol greater than 2,000 m^3 and is situated adjacent to a busy road with more than 30,000 vehicles per day. Pace Petrol Station at the Bellfield Interchange, Kilmarnock sits adjacent to the intersection of the A77, A71, A76 and the A735. However, the nearest relevant exposure, a care home, is well in excess of 10m, at 180m distant, and therefore, no Detailed Assessment for benzene is required.

East Ayrshire Council confirms that there are no petrol stations meeting the specified criteria**.**

3.3.4 Poultry Farms

East Ayrshire Council has five poultry farms (Source; Scottish Government Rural Affairs Department) within its boundaries, two in the Mauchline area, two in the Stewarton area and one in the Muirkirk area. All five have fewer than 40,000 birds, and therefore their numbers are well under the specified criteria, for which a Detailed Assessment for PM_{10} would be required.

East Ayrshire Council confirms that there are no poultry farms meeting the specified criteria.

3.4 Commercial and Domestic Sources

3.4.1 Biomass Combustion – Individual Installations

Information available at the time of writing indicates that there are no plants burning biomass within the specified criteria of between 50KW and 20MW units within the East Ayrshire Council Boundary. A biomass boiler has been installed at Dumfries House, Cumnock to control humidity and temperature. At present Environmental Health does not have details of the technical specifications. We have requested this information from the architects involved in the project and at the time of writing have not received this information. The biomass burner will be covered in more detailed in the 2012 Updating and Screening Assessment. If further details are required before this time I can be contacted directly (contact details on page 2) and I will provide any updated information which has been made available to me at that time.

3.4.2 Biomass Combustion – Combined Impacts

An assessment of domestic solid fuel burning was carried out in previous LAQM assessments (see 3.4.3 below). The assessments indicated that due to the low density of domestic solid fuel burning no exceedences were likely. As there are no new biomass installations within areas of East Ayrshire where PM_{10} are of concern, there is no necessity to carry out an assessment of the combined impacts of biomass combustion (on PM_{10} levels) at this time.

East Ayrshire Council confirms that there are no biomass combustion plants in the Local Authority area.

3.4.3 Domestic Solid-Fuel Burning

As previously mentioned an assessment of domestic solid fuel burning was carried out in previous LAQM assessments. Some physical checks were undertaken in some of the former traditional mining areas to check whether any significant coal burning was still taking place (using the checklist procedure contained in LAQM.TG(03). The results were much less than anticipated, and were substantially less than half of the suggested trigger of 100 houses per 500 by 500 metre grid squares burning solid fuel. Since this research was carried out, the number of houses burning coal has declined significantly and therefore, East Ayrshire Council confirms there are no issues with regards to sulphur dioxide due to domestic solid fuel burning. Past monitoring also confirms low levels of sulphur dioxide throughout the council area. Therefore no detailed assessment for domestic properties burning solid fuel (SO_2 concentrations) is required.

East Ayrshire Council confirms that there are no areas of significant domestic fuel use in the Local Authority area.

3.5 New Developments with Fugitive or Uncontrolled Sources :-

Landfill Sites
Quarries
Unmade haulage roads on industrial sites
Waste transfer stations etc
Other potential sources of fugitive particulate emissions

Opencast Coal Extraction

At the time of writing the 2011 Progress Report (July 2011) the following potential sources of fugitive or uncontrolled particulate matter which are new since the last Updating and Screening assessment have been identified :-

1/ ATH Resources, Duncanziemere, Cumnock – opencast coal extension – permission granted (details covered in 2010 PG)
2/ Scottish Coal, Ponesk Muirkirk – opencast coal extension – operational.
3/ Scottish Coal, Dalfad, Cronberry, Cumnock – opencast coal extension – permission granted.
4/ Viridor Waste Management, Darnconner - landfill restoration – current application.
5/ ATH Resources, Netherton, Cumnock – opencast coal extension – permission granted.
6/ Scottish Coal, Burnston Extension, New Cumnock – opencast coal extension – current application.
7/ Kier Mining, Greenburn South, New Cumnock – opencast coal extension - current application.
8/ Scottish Coal, Lanehead, House of Water, New Cumnock – opencast coal extension – permission granted.
9/ Keir Mining, Braehead Farm, New Cumnock – opencast coal extension – permission granted.

Please note that all applications for open cast coal extraction are extensions of previous mines and as such PM levels from operations are likely to be similar to the levels presently produced, but obviously different properties may be affected and as such have to be assessed.

Duncanziemere opencast coal extension was covered in the 2010 Progress Report and the summary text is repeated below. All opencast extensions have to produce an Environmental Statement as part of the planning application. An Environmental Statement (ES) is a detailed report which contains the findings of an assessment of the potential impacts of the proposed development upon the environment, referred to as an Environmental Impact Assessment (EIA). EIAs are undertaken in accordance with the Environmental Impact Assessment (Scotland) Regulations 1999. As part of the Environmental Statement an Environmental Impact Assessment is undertaken of all impacts that coal extraction will have on the environment. Part of the Environmental Assessment includes an Air Quality Assessment. They are all similar in nature to the details given below at Duncanziemere. The potential rise in PM is assessed from coal extraction, handling and transport. Coal handling processes at the mines are subject to control under Section 3.4 Part B of Schedule 1 of the Pollution Prevention and Control (Scotland) Regulations 2000. Mine support area and coal handling operations are subject to "Part B" regulation by SEPA and authorisation is required to be varied when any of the extensions to currently operating surface mines are approved. All applications have submitted an Environmental Impact Assessment incorporating an Air Quality Assessment as part of the planning application. Proposed dust mitigation measures are also submitted as part of the application. With these mitigation measures in place, the majority of dust will be controlled at source. East Ayrshire Council have a transportation of coal by road protocol which addresses issues such as dust suppression measures in terms of the use of wheel and body washing, sweeping of public roads and the dampening of internal haul roads during dry and windy weather conditions.

The recently revised technical guidance for local air quality management requires that detailed assessments should be conducted where there is any potential exposure within 200m of any source, irrespective of background. Detailed assessment of PM_{10} exposure for receptors more than 400m from mines and quarries is unlikely to be required provided the annual mean background is <16 $\mu g/m^3$, implying that the contribution from fugitive dust operations is unlikely to exceed 2 $\mu g/m^3$ within 400m. The guidance also suggests that the level of complaints and dust at the site access to the public road should be taken into account. There has been one recorded complaint about dust or from surface mines (complaint received from the New Cumnock area) since the last Updating and Screening Assessment. To date this complaint has been unsubstantiated as the dust problem has now ceased. Since the background PM_{10} is relatively low where open cast mining is taking place in East Ayrshire at less than 9 $\mu g/m^3$, (excluding industry contribution),a worst case scenario of a process contribution of 5 $\mu g/m^3$ close to the operational areas would still produce PM_{10} well below the 18 $\mu g/m^3$ annual Air Quality Objective. Actual monitoring at New Cumnock during 2010 gave actual annual mean levels within the town at 9 $\mu g/m^3$, well below the annual Air Quality Objective. At these levels only one exceedence of the 24-hour mean of 50 $\mu g/m^3$ was predicted at any of the sites, well within the Air Quality Objective of a maximum of 7 exceedences per year. New Cumnock Air Quality Monitoring site experienced no exceedences of the 24-hour mean during 2009 or 2010. Similarly a worst case scenario for $PM_{2.5}$ of a process contribution of 2.5 $\mu g/m^3$ would produce $Pm_{2.5}$ levels well below the proposed $PM_{2.5}$ levels of 12 $\mu g/m^3$ since background levels (excluding industry contribution) in areas subject to open cast are at or below 6 $\mu g/m^3$. Actual levels at receptors are significantly lower than the worst case scenario, as PM levels drop off with distance from the working area, and are therefore likely to be well within the Air Quality Objectives.

To summarise, the impacts at receptors within the vicinity of coal extraction and preparation are likely to be of minor adverse significance, with proper mitigation as outlined in the Air Quality Assessments.

Proposed mitigation for effective dust management requires integrated action on three aspects of control, design and engineering control, adequate process supervision and effective monitoring and review. The measures proposed are outlined in the Dust Management Plans submitted as part of the Environmental Statements.

Duncanziemere – text copied from 2010 PG

At the time of writing ATH Resources had submitted a planning application for a new opencast coal site at Duncanziemere, which lies to the north east of Cumnock. This new site lies to the north of, and adjacent to, the existing site at Laigh Glenmuir, and the application boundary proposed, incorporates the existing site to allow for retention of the existing overburden mound and coal preparation plant throughout the proposed operations. Coal handling processes at the mine will be subject to control under Section 3.4 Part B of Schedule 1 of the Pollution Prevention and Control (Scotland) Regulations 2000. The existing mine support area and coal handling operations are subject to "Part B" regulation by SEPA and this authorisation will require to be varied should the Duncanziemere surface mine be approved. ATH have submitted an Environmental Impact Assessment incorporating an air quality assessment (Reference 11) as part of the planning application.

The recently revised technical guidance for local air quality management requires that detailed assessments should be conducted where there is any potential exposure within 200m of any source, irrespective of background. Detailed assessment of PM_{10} exposure for receptors more than 400m from mines and quarries is unlikely to be required provided the annual mean background is <16 $\mu g/m^3$, implying that the contribution from fugitive dust operations is unlikely to exceed 2 $\mu g/m^3$ within 400m. The guidance also suggests that the level of complaints and dust at the site access to the public road should be taken into account. There have been no recorded complaints about dust or air pollution from the current operations at Laigh Glenmuir.

The nearest receptor, High Glenmuir, is 260m from the coal preparation area. The estimated background PM_{10} for 2010 (Reference 12) is 9.8 $\mu g/m^3$ and $PM_{2.5}$ of 6 $\mu g/m^3$. The process contribution at this distance was assessed at PM_{10} 2-4 $\mu g/m^3$ and $PM_{2.5}$ $\mu g/m^3$ 1-2 $\mu g/m^3$. When added to the respective baseline gives a combined process plus background PM_{10} of <14 $\mu g/m^3$ (well below the air quality objective of 18 $\mu g/m^3$) and $PM_{2.5}$ of <8 $\mu g/m^3$. The assessment for the other receptors in the vicinity of the mine workings also gave estimates of PM_{10} at a maximum <14 $\mu g/m^3$ and $PM_{2.5}$ at a maximum of <8 $\mu g/m^3$. As with the existing Laigh Glenmuir surface mine, monitoring at sensitive receptors will be carried out if SEPA or East Ayrshire Council considers there is a dust issue at nearby receptors. To date there have been no complaints about dust from local residents.

To summarise the impacts at receptors within the vicinity of coal extraction and preparation are likely to be of minor adverse significance with proper mitigation as outlined in the Air Quality Assessment (Reference 11). There are no dwellings within 1 km of the proposed development that are equally close to another surface mine site, and therefore significant adverse impacts from concurrent mining operations are therefore highly unlikely to occur.

Proposed mitigation for effective dust management requires integrated action on three aspects of control, design and engineering control, adequate process supervision and effective monitoring and review. The measures proposed are outlined in the Dust Management Plan submitted as part of the Environmental Statement (Reference 11).

The report concluded that a simple semi-quantitative assessment indicates that the worst case PM_{10} annual mean is unlikely to exceed 14 µg/m^3 at the nearest receptor with ambient $PM_{2.5}$ less than 8 µg/m^3. These are well within Scottish Air Quality Objectives. A monitoring programme should be conducted when excavation operations are within 400m of any sensitive receptor. Cumulative impacts from other activities are likely to be insignificant.

Further information and viewing of relevant documents, including Environmental Statements, can be obtained from:-

East Ayrshire Council
Planning and Economic Development Services
Department of Neighbourhood Services
The Johnnie Walker Bond
15 Strand Street
Kilmarnock
KA1 1HU

Other Fugitive Sources

There are no other new fugitive sources within East Ayrshire which are likely to have a detrimental impact on air quality.

There was one potential dust complaint from open cast coal sites (previously covered). There were no dust complaints from existing quarries or existing landfill sites (or other fugitive sources) during 2010.

There are no other new fugitive sources within East Ayrshire which are likely to have a detrimental impact on air quality.

East Ayrshire Council has identified the following new or previously unidentified local developments which may impact on air quality in the Local Authority area.

1/ ATH Resources, Duncanziemere, Cumnock – opencast coal extension – permission granted (details covered in 2010 PG)
2/ Scottish Coal, Ponesk Muirkirk – opencast coal extension – operational.
3/ Scottish Coal, Dalfad, Cronberry, Cumnock – opencast coal extension – permission granted.
4/ Viridor Waste Management, Darnconner - landfill restoration – current application.
5/ ATH Resources, Netherton, Cumnock – opencast coal extension – permission granted.
6/ Scottish Coal, Burnston Extension, New Cumnock – opencast coal extension – current application.
7/ Kier Mining, Greenburn South, New Cumnock – opencast coal extension - current application.
8/ Scottish Coal, Lanehead, House of Water, New Cumnock – opencast coal extension – permission granted.
9/ Keir Mining, Braehead Farm, New Cumnock – opencast coal extension – permission granted.

These will be taken into consideration in the next Updating and Screening Assessment, scheduled for 2012.

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:-

www.east-ayrshire.gov.uk.

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 baseline position in 2004-2005 has been used for the calculation of the council's carbon emissions. This has been calculated as 19119 tonnes of CO_2, including an allowance for 50% of the Council's electricity supply being from renewable resources. It was estimated that the Council's energy related carbon emissions could increase by 21.6% between 2004-2005 and 2009-10. However the Council's target is to reduce its combined energy related costs by 10% by 2010.

The Carbon Management Programme will be taken forward as an integral part of the Council's broader Sustainability Strategy (Reference 18), under development at the time of this report.

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 (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 and the original three year programme has been extended to five years, concluding in 2010. This will correspond to the target to reduce carbon emissions by 10% over this period. 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

Part-year automatic monitoring carried out during 2010 has shown exceedences of the annual mean Air Quality Objectives for both NO_2 and PM_{10} within John Finnie Street, Kilmarnock (Tables 2.3a and 2.5a). Previous assessments including a detailed assessment carried out by BMT Cordah in 2008 (Reference 5) concluded that no exceedences of the annual mean NO_2 were predicted at locations of relevant public exposure. Furthermore post-2008 levels of NO_2 were predicted to fall off in future years. This has not happened and in fact 2010 levels have shown a sharp rise over the previous four years (Figure 2.4.). 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 reduction in emissions from more modern vehicles has been much more limited than predicted.

Conclusions
Although it should be noted that no location of relevant public exposure exceeded the Air Quality Objective for NO_2 and PM_{10} during 2010, the locations which have exceeded are likely to be representative of locations of relevant public exposure. Further long term monitoring is therefore required particularly within John Finnie Street, Kilmarnock, A71 through Newmilns and A76 through Mauchline. No exceedences of the PM_{10} 24 – hour mean occurred at any of the three monitoring sites within East Ayrshire and it can be concluded that since no exceedence occurred in the centre of Kilmarnock, no exceedences of the PM_{10} 24 – hour mean Air Quality Objective are likely within East Ayrshire.

Trends (Figure 2.4) from NO_2 diffusion tube monitoring from 2006 to 2009 suggested decreasing levels of NO_2, but 2010 results indicate a sharp rise in this year reflecting a general increase across Scotland. Further monitoring will ascertain whether the rise in 2010 is due to the exceptional length of cold weather or a longer term trend. (It should be noted that trends of less than five years should be treated with caution).

Previous modelling, diffusion tube monitoring and a detailed assessment of nitrogen dioxide had shown levels of all relevant pollutants would be below all the objectives at relevant locations. With this in mind and the exceptional weather conditions during 2010 it has been concluded that further monitoring is necessary to provide robust data before a decision is taken to proceed to a detailed assessment.

7.2 Conclusions relating to New Local Developments

All new local developments (or proposed developments) which may have a significant effect on air quality have been covered in Section 3. The two developments which may impact on air quality, the roadstone coating plant at Moorfield, Kilmarnock (not yet operational), extensions to opencast coal mines and reinstatement sites have all been subject to air quality assessments which concluded that although all sources would have a localised impact on air quality, all pollutants included in the Regulations for the purpose of Local Air quality Management in Scotland would be well within the Air Quality Objectives.

7.3 Other Conclusions

Local Transport Plan

Objective 3 and Objective 5 (Reference 15) 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. In conclusion these specific measures will result in a reduction in NO_2 and PM_{10}.

Updates of Planning Policy that relate to Air Quality

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.

In conclusion this updated policy will ensure that developers will have to minimise the impact on air quality of any new development and if necessary enter into a legal agreement with East Ayrshire Council to ensure this is the case

7.4 Proposed Actions

Part year automatic monitoring carried out during 2010 has shown exceedences of the annual mean Air Quality Objectives for both NO_2 and PM_{10} within John Finnie Street, Kilmarnock (Tables 2.3a and 2.5a). Previous assessments including a detailed assessment carried out by BMT Cordah in 2008 (Reference 5) concluded that no exceedences of the annual mean NO_2 were predicted at locations of relevant public exposure. Furthermore post 2008 levels of NO_2 were predicted to fall off in future years. This has not happened and in fact 2010 levels have shown a sharp rise over the previous four years (Figure 2.4).

NO_2

Previous assessments have identified John Finnie Street, Kilmarnock, due to high levels of nitrogen dioxide (Tables 2.4a and 2.4b) as an area requiring further monitoring. In this regard, extra NO_2 diffusion tubes have been placed both within John Finnie Street and on the adjoining street (West George Street) (Figure 5c) during 2009 and an additional tube on the adjoining St. Marnock Street in 2011. Automatic Monitoring equipment was also commissioned at the northern end of John Finnie Street (Figure 4) during 2010, to monitor for both nitrogen dioxide and PM_{10}. Three NO_2 diffusion tubes have also been co-located with the automatic monitoring equipment to give a local bias adjustment factor. An additional PM_{10} monitor and an additional Chemiluminescent NO_x analyser will also be commissioned in the autumn of 2011 which will provide more robust data within the one way system through Kilmarnock. 2010 monitoring data presented in the 2011 Progress report has reinforced the conclusion that this extra monitoring is necessary.

Nitrogen dioxide concentrations on the A71 through Newmilns (Table 2.4a) are also at levels approaching the air quality objectives and in consequence, two extra NO_2 diffusion tubes were located in 2009 (Figure 5e) and a further diffusion tube located in Loudoun Road in 2011 to determine the extent of the problem. NO_2 monitoring has been extended in Mauchline (Figure 5h) due to the high levels of traffic and narrow streets (canyon effect).Three other NO_2 diffusion tubes were located, as previously covered in 2009 USA and 2010 PG, in Kilmaurs, Galston ,Muirkirk and Cumnock (Figures 5b, 5i and 5l respectively), to give a better spread of monitoring throughout the East Ayrshire Council area. The Kilmaurs and Galston, locations were discontinued at the end of 2010 due to recorded levels of NO_2 being well below the annual mean Air Quality Objective (Table 1.1 and Table 2.4a). Similarly the diffusion tube sites at Hurlford, Nursery Avenue, Kilmarnock and Auchinleck have been discounted. All levels of NO_2 at the discontinued sites were below 30 $\mu g/m^3$, well below the Air Quality Objective. NO_2 diffusion tubes will be located in the future in any area where air quality issues are likely to occur, such as where there are substantial changes in traffic volume and flow and also located in areas which are likely to have raised levels of NO_2 due to traffic flow, and, which have never been subject to actual monitoring.

PM_{10}

PM_{10} monitoring has continued in New Cumnock, as previously covered, due to concerns about the potential high levels of this pollutant associated with open cast coal mines. Although levels recorded were low with an annual mean off 12 $\mu g/m^3$ in 2010, further monitoring was carried out in 2010 due to continuing concerns from dust from open cast coal mines and associated works, although the levels found were again well below the PM_{10} annual Air Quality Objective at 9 $\mu g/m^3$. Nitrogen dioxide will also be monitored at this location.

PM_{10} monitoring has commenced in John Finnie, Street, Kilmarnock in 2010 since the high level of traffic and associated high levels of NO_2 suggest the potential for raised levels of PM_{10}. The actual level found from part year monitoring, at 21 $\mu g/m^3$, is above the annual Air Quality Objective. Since only part year monitoring was carried out in 2010, exceptional

weather conditions occurred in 2010 and the additional problems with regard to Kilmarnock Town Centre Regeneration works, it has been concluded that further monitoring is required before any decision is taken to proceed to a detailed assessment. The additional PM_{10} monitor is a TEOM-FDMS system which will provide information about the nature and concentration of airborne particulate matter and will also give a comparison with the BAM 1020.

No exceedences of the PM_{10} 24 – hour mean were found at the any of the three monitoring sites.

The next course of action for East Ayrshire Council will therefore be the submission of an Updating and Screening Assessment by 30th April 2012.

8. References

1. Defra and The Devolved Administrations, Local Air Quality Management, Technical Guidance LAQM.TG(09), February 2009. Accessed at www.airquality.co.uk/laqm/tools.php

2. Part IV of the Environment Act 1995 Local Air Quality Management Policy Guidance PG(S)(09) February 2009. Accessed at http://www.airquality.co.uk/laqm/tools.php

3. Diffusion Tubes for Ambient NO_2 Monitoring: Practical Guidance for Laboratories and Users. Report to Defra and the Devolved Administrations. ED48673043 Issue 1a Feb2008. Authors Jaume Targa, Alison Lauder and The Defra Working Group on Harmonisation of Diffusion Tubes. Accessed at http://www.laqmsupport.org.uk/no2qaqc.php

4. The Workplace Analysis Scheme for Proficiency (WASP) – summary of laboratory performance in rounds 103-107. Accessed at http://www.laqmsupport.org.uk/no2qaqc.php

5. Detailed Assessment of John Finnie Street, Kilmarnock, Ayrshire. Compiled by BMT Cordah on behalf of East Ayrshire Council; Report No.: G_EAC-003/04-01-01 dated 7th October 2008.

6. Laxen D and Marner B (2003). Analysis of the relationship between 1-hour and annual mean nitrogen dioxide at UK roadside and kerbside monitoring sites. Available at www.airquality.co.uk/archive/reports/list.php

7. Cook A (2008). Analysis of the relationship between annual mean nitrogen dioxide concentration and exceedences of the 1-hour mean AQS Objective. Available at www.airquality.co.uk/archive/reports/list.php

8. Fall-off in nitrogen dioxide concentrations at different distances from roads. The calculator accessed at www.airquality.co.uk/archive/laqm/tools.php

9. Harrison D (2006) UK Equivalence Programme for Monitoring of Particulate Matter. Available at www.airquality.co.uk/archive/reports/list.php

10. Kilmarnock Roadstone Coating Plant Dispersion Modelling Assessment 23/01/09. Author: WYG Environment Planning Transport Limited.

11. Duncanziemere Surface Mine Environmental Statement/Air Quality. Author: RBS Group June 2009.

12. Background Pollutant Concentration Maps. Accessed at www.airquality.co.uk/archive/laqm/tools.php

13. Air Pollution in Scotland 2010. Produced by AEA on behalf of the Scottish Government. Available at www.scottishairquality.co.uk

14. Alteration to East Ayrshire Local Plan 2009.

15. The East Ayrshire local Transport Strategy 2009 – 2014

16. East Ayrshire Council Carbon Management Programme Strategy and implementation Plan (SIP) October 2007

17. East Ayrshire Community Plan

18. East Ayrshire Council Sustainability Strategy

19. Carbon Trust Local Authority Carbon Management Programme

20. Defra and The Devolved Administrations, Spreadsheet of Bias Adjustment factors, version 03/10. Accessed at http://www.uwe.ac.uk/aqm/review/index.html

21. www.defra.gov.uk/environment/quality/air/airquality/publications/primaryno2-trends/index.htm (accessed 25th February 2011).

Appendices

Appendix A: QA:QC Data

QA/QC Data: Defra and The Devolved Administrations, Spreadsheet of Bias Adjustment Factors, Version Number 03/10. Accessed at www.uwe.ac.uk/aqm/review/index.html

National Diffusion Tube Bias Adjustment Factor Spreadsheet — Spreadsheet Version Number: 06/11

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 spreadsheet 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 in late September 2011 on the 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: Select the Laboratory that Analyses Your Tubes from the Drop-Down List — If a laboratory is not shown, we have no data for this laboratory.

Step 2: Select a Preparation Method from the Drop-Down List — If a preparation method is not shown, we have no data for this method at this laboratory.

Step 3: Select a Year from the Drop-Down List — If a year is not shown, we have no data [2]

Step 4: **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 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 make your selection, choose [All] from the pop-up list)	Year [5] (To make your selection, choose [All])	Site Type	Local Authority	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) (µg/m³)	Automatic Monitor Mean Conc. (Cm)	Bias (B)	Tube Precision [6]	Bias Adjustment Factor (A)
Glasgow Scientific Services	20% TEA in Water	2010	K	Marylebone Road Intercomparison	12	85	93	-8.8%	G	1.10
Glasgow Scientific Services	20% TEA in Water	2010	UB	Glasgow City Council	9	35	39	-9.5%	P	1.10
Glasgow Scientific Services	20% TEA in Water	2010	R	Glasgow City Council	10	43	46	3.3%	P	0.97
Glasgow Scientific Services	20% TEA in Water	2010	UC	Glasgow City Council	12	38	43	-11.0%	P	1.12
Glasgow Scientific Services	20% TEA in Water	2010	K	Glasgow City Council	11	67	81	-16.3%	G	1.20
Glasgow Scientific Services	20% TEA in Water	2010	R	East Ayrshire Council	11	34	42	-19.6%	P	1.24
Glasgow Scientific Services	20% TEA in Water	2002		**Overall Factor [3] (3 studies)**					Use	0.92
Glasgow Scientific Services	20% TEA in Water	2004		**Overall Factor [3] (3 studies)**					Use	0.83
Glasgow Scientific Services	20% TEA in Water	2005		**Overall Factor [3] (3 studies)**					Use	0.75
Glasgow Scientific Services	20% TEA in Water	2006		**Overall Factor [3] (3 studies)**					Use	0.96
Glasgow Scientific Services	20% TEA in Water	2007		**Overall Factor [3] (4 studies)**					Use	1.05
Glasgow Scientific Services	20% TEA in Water	2008		**Overall Factor [3] (4 studies)**					Use	0.97
Glasgow Scientific Services	20% TEA in Water	2009		**Overall Factor [3] (4 studies)**					Use	1.23
Glasgow Scientific Services	20% TEA in Water	2010		**Overall Factor [3] (6 studies)**					Use	1.12

[1] For Casella Stanger/Bureau Veritas (NOT Bureau Veritas Labs) use Gradko 50% TEA in Acetone.
For Casella Seal/GMSS/Casella CRE/Bureau Veritas Labs/Eurofins use Environmental Scientific Groups.
For Staffordshire CC SS/Staffordshire County Analyst use Staffordshire Scientific Services.
For Bodycote Health Sciences and Clyde Analytical Laboratories use Exova.
For Rotherham MBC use South Yorkshire Labs.
For Dundee CC use Tayside SS.
For Leicester Scientific Services use Staffordshire Scientific Services.
For South Yorkshire Air Quality Samplers use South Yorkshire Labs. As of January 2010 sampler body changed. As of April 2010 sampler cap changed.

[2] In this situation it would be reasonable to use data from the nearest year.

[3] Overall factors have been calculated using orthogonal regression to allow for uncertainty in both the automatic monitor and diffusion tube. The uncertainty of the diffusion tube has been assumed to be double that of the automatic monitor.

[4] If you have your own co-location study, please send your data to us, so that it can be included here. If this is not possible, but you wish to combine these factors with your own, select and copy the relevant data from this spreadsheet and paste them into a new one (otherwise your calculations will include hidden data). Then add your own data and calculate the bias. To obtain a new correction factor that includes your data, average the bias (B) values, expressed as a factor, i.e. -16% is -0.16. Next add 1 to this value, e.g. -0.16 + 1.00 = 0.84 in this example, then take the inverse to give the bias adjustment factor 1/0.84 = 1.19. (This will not be exactly the same as the correction factor calculated using orthogonal regression as used in this spreadsheet, but will be reasonably close).

To add data download a questionnaire

[5] Where an annual data set falls into two years it has been ascribed to the year in which most of the data has fallen.

[6] Tube precision is determined as follows: G = Good precision - coefficient of variation (CV) of diffusion tube replicates is considered good when the CV of eight or more periods is less than 20%, and the average CV of all monitoring periods is less than 10%; P = Poor precision - CV of four or more periods >20% and/or average CV >10%; S = Single tube, therefore not applicable; na = not available.

Appendix B: Monthly NO_2 Diffusion Tube Data

East Ayrshire Monthly NO_2 Diffusion Tube Data 2010 ($\mu g/m^3$)

Site Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Raw Mean	Corrected Mean (Bias Factor)
1. Fowlds Street/King Street Junction, Kilmarnock	50.1	34.4	40.9	23.6	29.6	24.6	23.7	27.4	30.5	35.4	45.0	53.5	34.89	**39.1**
2. 28 John Finnie Street, Kilmarnock	40.6	33.7	43.9	24.2	31.7	26.4	28.4	30.1	27.7	42.2	54.8	47.4	35.93	**40.2**
3. 19 Lainshaw Street, Stewarton	30.4	31.0	38.4	20.4	27.7	35.3	22.6	25.4	27.7	27.9	43.0	53.3	31.93	**35.8**
4. 40 Main Street, Newmilns	35.9	29.5	35.4	18.3	31.6	19.7	23.3	27.7	24.8	31.8	43.2	32.1	29.44	**33.0**
5. The Cross, Hurlford	28.3	23.7	22.7	9.8	19.9	19.0	21.2	25.4	18.4	25.6	32.9	31.1	23.17	**26.0**
6. 8A Kilmarnock Road, Mauchline	40.4	23.9	36.4	17.7	27.5	19.7	19.3	20.7	12.6	30.1	48.6	41.7	28.22	**31.6**
7. Junction at Main Street &A70, Ochiltree	32.7	21.3	21.8	12.3	19.5	18.6	21.8	26.6	14.5	23.7	31.7	36.1	23.38	**26.2**
8. Junction at A76 Roundabout, Auchinleck	26.5	19.5	18.5	8.0	13.7	8.8	10.7	14.7	10.5	16.9	23.3	25.8	16.41	**18.4**
9. Townhead/ Glaisnock Street Junction, Cumnock	15.1	15.8	17.4	9.0	13.9	10.1	12.4	14.3	8.7	19.0	25.9	25.1	15.56	**17.4**
11. 96 John Finnie Street, Kilmarnock	41.6	30.2	37.4	18.2	NR	19.5	19.6	23.2	18.9	31.0	46.5	55.5	31.05	**34.8**
12. 62 John Finnie Street Kilmarnock	37.5	38.7	37.3	24.7	29.3	23.4	24.9	25.1	29.9	43.2	48.2	66.7	35.74	**40.0**
13. 22/24 Nursery Avenue, Kilmarnock	34.9	22.5	21.6	13.2	16.8	11.0	8.7	15.2	NR	36.3	38.9	44.9	24.00	**26.9**
14. 95/97 John Finnie Street, Kilmarnock	49.0	33.3	45.1	34.4	34.2	37.3	32.1	37.8	26.0	35.6	51.9	52.6	39.11	**43.8**
15. 16 West George Street, Kilmarnock	51.5	38.0	42.5	34.5	32.9	32.2	30.4	42.9	42.2	NR	NR	NR	38.57	**43.2**
16. Bridge Street, Galston	32.5	18.8	25.7	17.2	14.8	12.5	16.9	21.6	16.5	24.5	50.0	39.0	24.17	**27.1**
17. 22/25 Loudoun Road, Newmilns	44.8	43.1	42.2	27.8	NR	22.9	28.7	28.3	20.9	33.6	50.7	55.3	36.21	**40.6**
18. 100 Main Street, Newmilns	29.9	25.0	30.9	12.9	18.1	13.7	NR	19.7	15.8	8.3	45.8	38.9	23.55	**26.4**
19. 57/59 Townhead Street, Cumnock	26.6	17.9	23.5	15.0	15.2	13.5	16.2	19.2	10.8	17.3	29.6	37.8	20.22	**22.6**
20. 66 Main Street, Muirkirk	21.3	16.5	16.0	8.6	11.8	10.7	14.8	15.4	8.2	16.4	25.0	26.0	15.89	**17.8**
21. The Jougs, Kilmaurs	34.8	22.4	24.9	16.5	NR	16.5	16.7	21.6	17.5	22.2	34.1	22.9	22.74	**25.5**
22. The Cross, Mauchline	29.7	21.8	31.8	18.5	21.0	19.3	NR	24.1	12.3	30.7	38.6	41.5	26.3	**29.5**
23. 3/5 Loudoun Street, Mauchline	33.2	27.0	34.5	20.1	26.1	21.9	22.1	29.2	15.8	27.1	40.9	38.6	28.04	**31.4**

24. 5/7 Earl Gray Street, Mauchline	44.5	33.0	47.0	NR	33.6	25.4	17.1	22.4	22.5	40.8	49.5	52.6	35.31	**39.5**
25A.	-	28.6	31.0	14.9	33.5	25.4	28.3	32.1	22.8	38.4	47.4	43.7	31.46	**35.2**
25B.	-	36.4	36.4	22.7	34.8	28.6	32.3	37.3	23.5	41.3	47.8	50.3	35.58	**39.8**
25C.	-	27.7	44.9	19.4	35.2	27.4	31.8	37.6	34.1	33.5	44.1	35.7	33.76	**37.8**

Appendix C: Results of Automatic Monitoring for $N0_2$ and PM_{10}

Produced by AEA on behalf of the Scottish Government

EAST AYRSHIRE NEW CUMNOCK
1st January to 31st December 2010

These data have been fully ratified by AEA

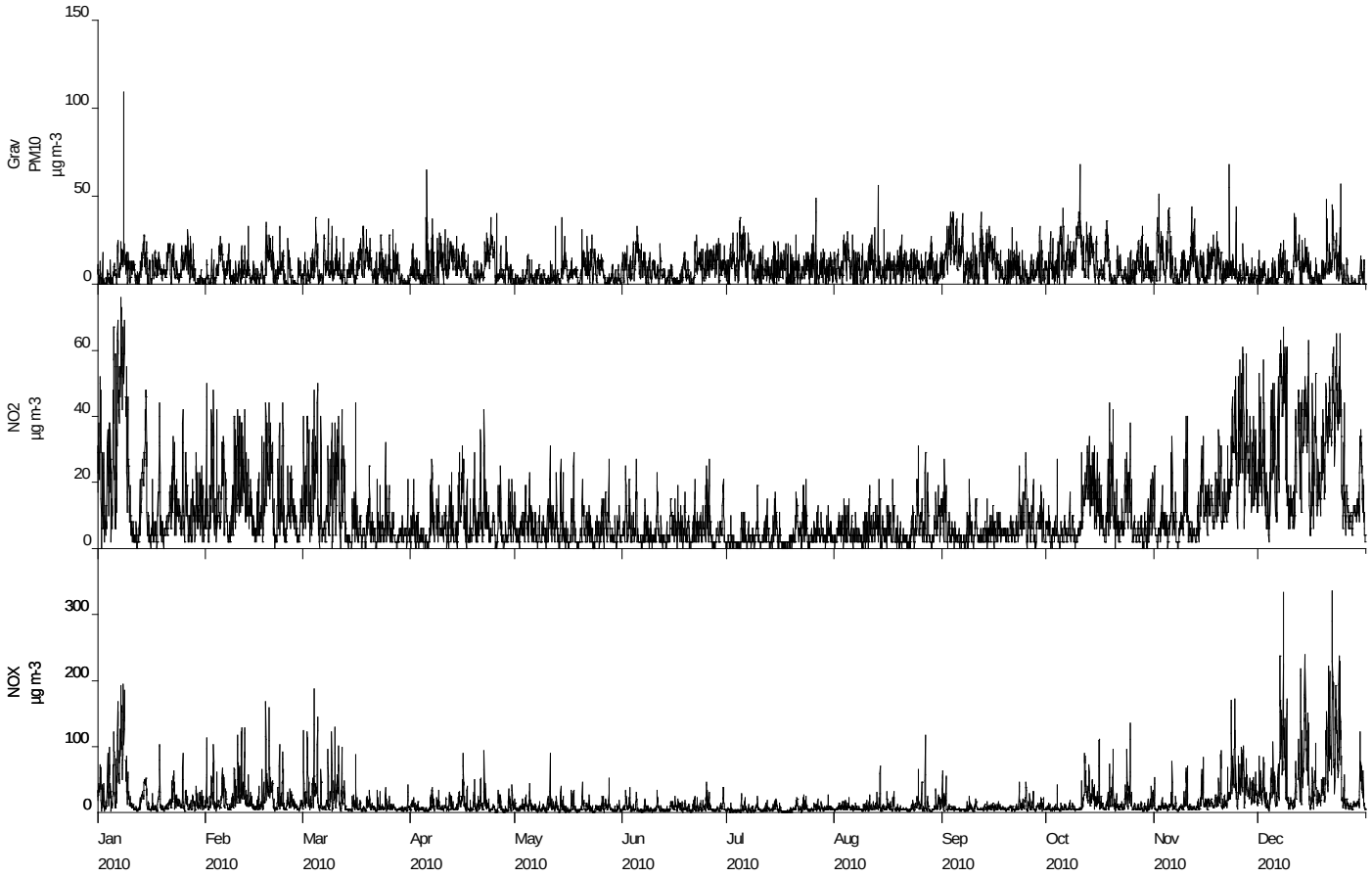
POLLUTANT	PM_{10}*+	NO_2	NO_X
Number Very High	0	0	-
Number High	0	0	-
Number Moderate	0	0	-
Number Low	8512	8721	-
Maximum 15-minute mean	109 µg m^{-3}	94 µg m^{-3}	537 µg m^{-3}
Maximum hourly mean	109 µg m^{-3}	76 µg m^{-3}	336 µg m^{-3}
Maximum running 8-hour mean	39 µg m^{-3}	67 µg m^{-3}	232 µg m^{-3}
Maximum running 24-hour mean	35 µg m^{-3}	60 µg m^{-3}	153 µg m^{-3}
Maximum daily mean	35 µg m^{-3}	57 µg m^{-3}	144 µg m^{-3}
Average	9 µg m^{-3}	11 µg m^{-3}	17 µg m^{-3}
Data capture	99.6 %	99.6 %	99.6 %

* PM_{10} Indicative Gravimetric Equivalent µg m^{-3}
+ PM_{10} instruments:
BAM using a gravimetric factor of 0.83333 for Indicative Gravimetric Equivalent from 1st January 2010
All mass units are at 20°C and 1013 mb
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

Produced by AEA on behalf of the Scottish Government

East Ayrshire New Cumnock Air Monitoring
Hourly Mean Data for 1st January to 31st December 2010



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Produced by AEA on behalf of the Scottish Government

EAST AYRSHIRE KILMARNOCK JOHN FINNIE ST
1st January to 31st December 2010

These data have been fully ratified by AEA

POLLUTANT	PM_{10}*	NO_2	NO_X
Number Very High	0	0	-
Number High	0	0	-
Number Moderate	0	2	-
Number Low	7586	7815	-
Maximum 15-minute mean	253 µg m^{-3}	1299 µg m^{-3}	1664 µg m^{-3}
Maximum hourly mean	253 µg m^{-3}	372 µg m^{-3}	1358 µg m^{-3}
Maximum running 8-hour mean	87 µg m^{-3}	160 µg m^{-3}	810 µg m^{-3}
Maximum running 24-hour mean	50 µg m^{-3}	103 µg m^{-3}	494 µg m^{-3}
Maximum daily mean	49 µg m^{-3}	101 µg m^{-3}	463 µg m^{-3}
99.8th percentile of hourly means	-	197 µg m^{-3}	-
98.08th percentile of daily means	40 µg m^{-3}	-	-
Average	21 µg m^{-3}	43 µg m^{-3}	98 µg m^{-3}
Data capture	87.3 %	89.2 %	89.2 %

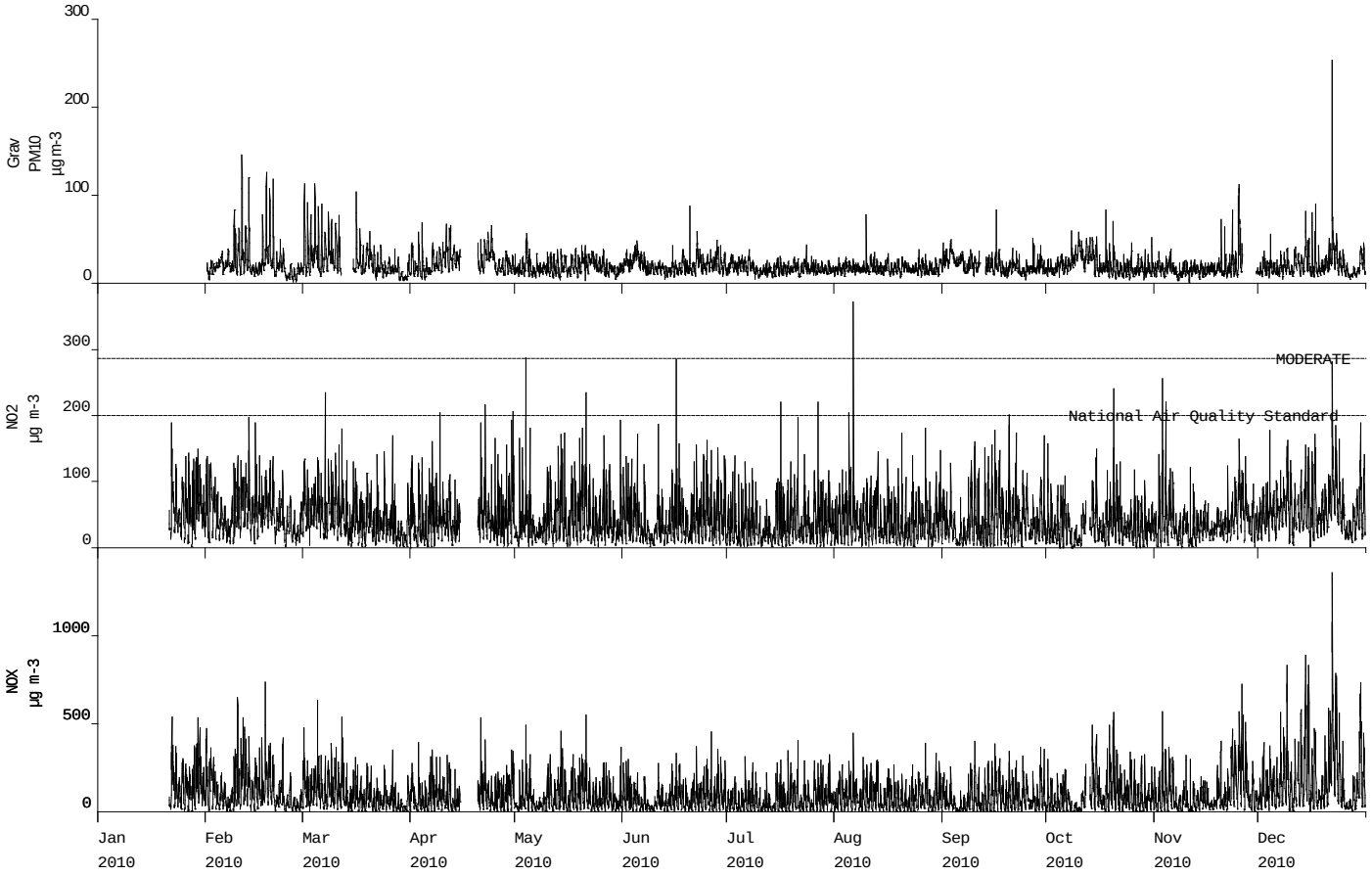
* PM_{10} instruments:
BAM using a gravimetric factor of 0.83333 for Gravimetric Equivalent
All gaseous pollutant mass units are at 20°C and 1013 mb. Particulate matter concentrations are reported at ambient temperature and pressure.
NO_X mass units are NO_X as NO_2 µg m^{-3}

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}	1	-
Nitrogen Dioxide	Annual mean > 40 µg m^{-3}	1	-
Nitrogen Dioxide	Hourly mean > 200 µg m^{-3}	16	16

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

Produced by AEA on behalf of the Scottish Government

East Ayrshire Kilmarnock John Finnie St
Hourly Mean Data for 1st January to 31st December 2010



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Appendix D: Short-term to Long-term Data Adjustment

	A	B	C	D	E	F	G
1	Average between two dates and times (GMT)						
2	Site name	Channel	End date	Average	Data capture	Units	
3	Glasgow Anderston	Nitrogen Dioxide	31/12/2009	36	92.3	µg m-3 (20'C 1013mb)	
4							
5							
6	Glasgow Anderston	Nitrogen Dioxide	31/12/2009	39	94.1	µg m-3 (20'C 1013mb)	
7							
8	Glasgow City Chambers	Nitrogen Dioxide	31/12/2009	46	97.2	µg m-3 (20'C 1013mb)	
9							
10							
11	Glasgow City Chambers	Nitrogen Dioxide	31/12/2009	48	94.5	µg m-3 (20'C 1013mb)	
12							
13	N Lanarkshire Coatbridge Whifflet	Nitrogen Dioxide	31/12/2009	24	92.9	µg m-3 (20'C 1013mb)	
14							
15							
16	N Lanarkshire Coatbridge Whifflet	Nitrogen Dioxide	31/12/2009	27	99.8	µg m-3 (20'C 1013mb)	
17							
18							
19							
20		**NO2 Concentrations (ug/m3)**		**Ratios (Am/Pm)-R**			
21		**Jan - Dec 09 (Am)**	**Aug - Dec 09 (Pm)**			**Aug - Dec 09**	
22	**Glasgow Anderston**	36	39			0.923	
23	**Glasgow City Chambers**	46	48			0.958	
24	**N Lanarkshire Coatbridge Whifflet**	24	27			0.889	
25					**Average (Ra)**	**0.923**	

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

Part A

PPC/W/20040	Egger	East Ayrshire
PPC/W/20055	Kilmarnock Abattoir	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

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/1000016	Vesuvius UK Ltd, Newmilns	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

Figure 1a: Map of East Ayrshire

Figure 1b: Map of East Ayrshire – Towns and Villages

Figure 1c: Map of East Ayrshire – Major Roads

Figure 2: Map of Opencast Coal Sites around New Cumnock

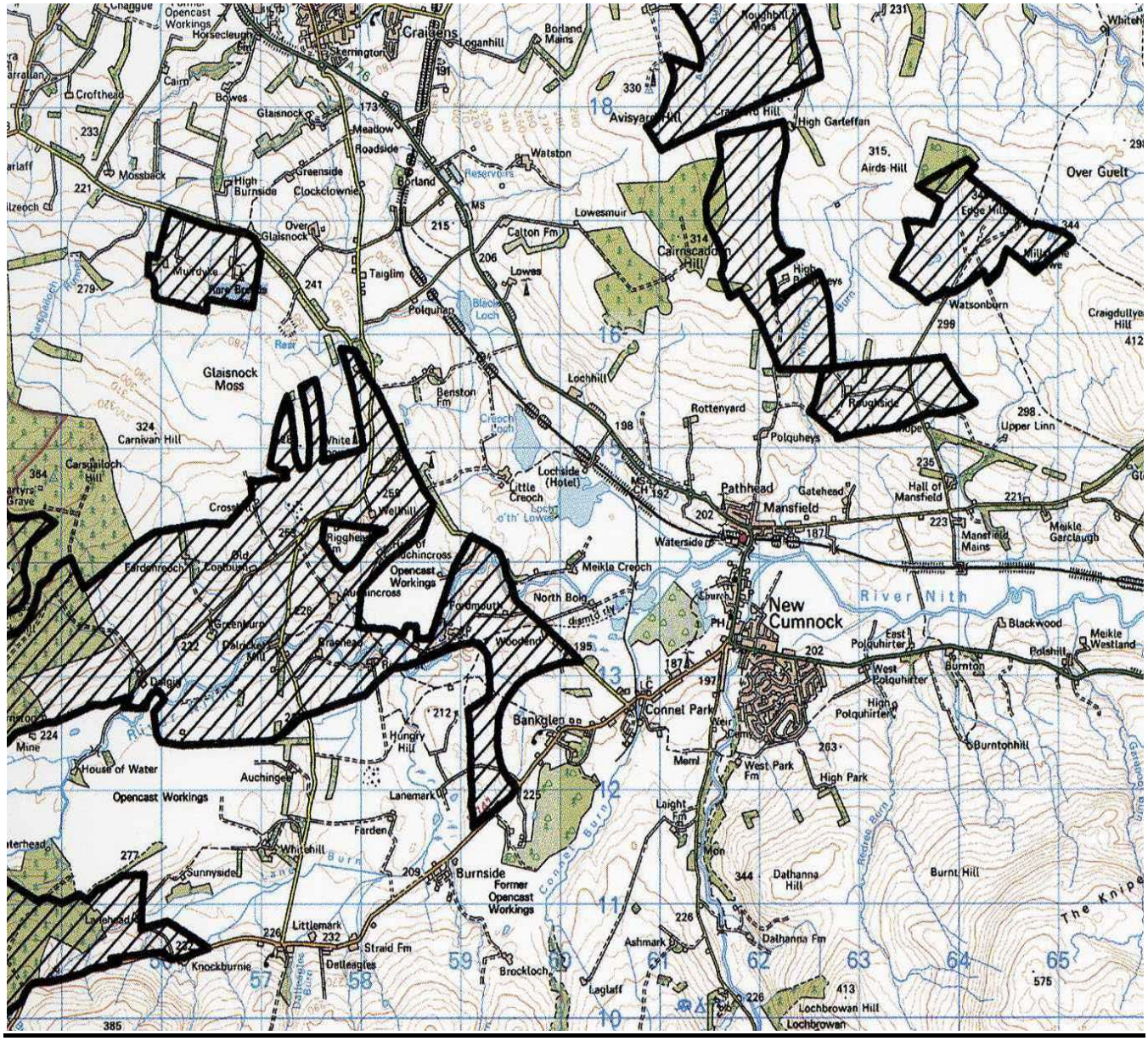


Figure 3: New Cumnock Automatic Monitoring Equipment

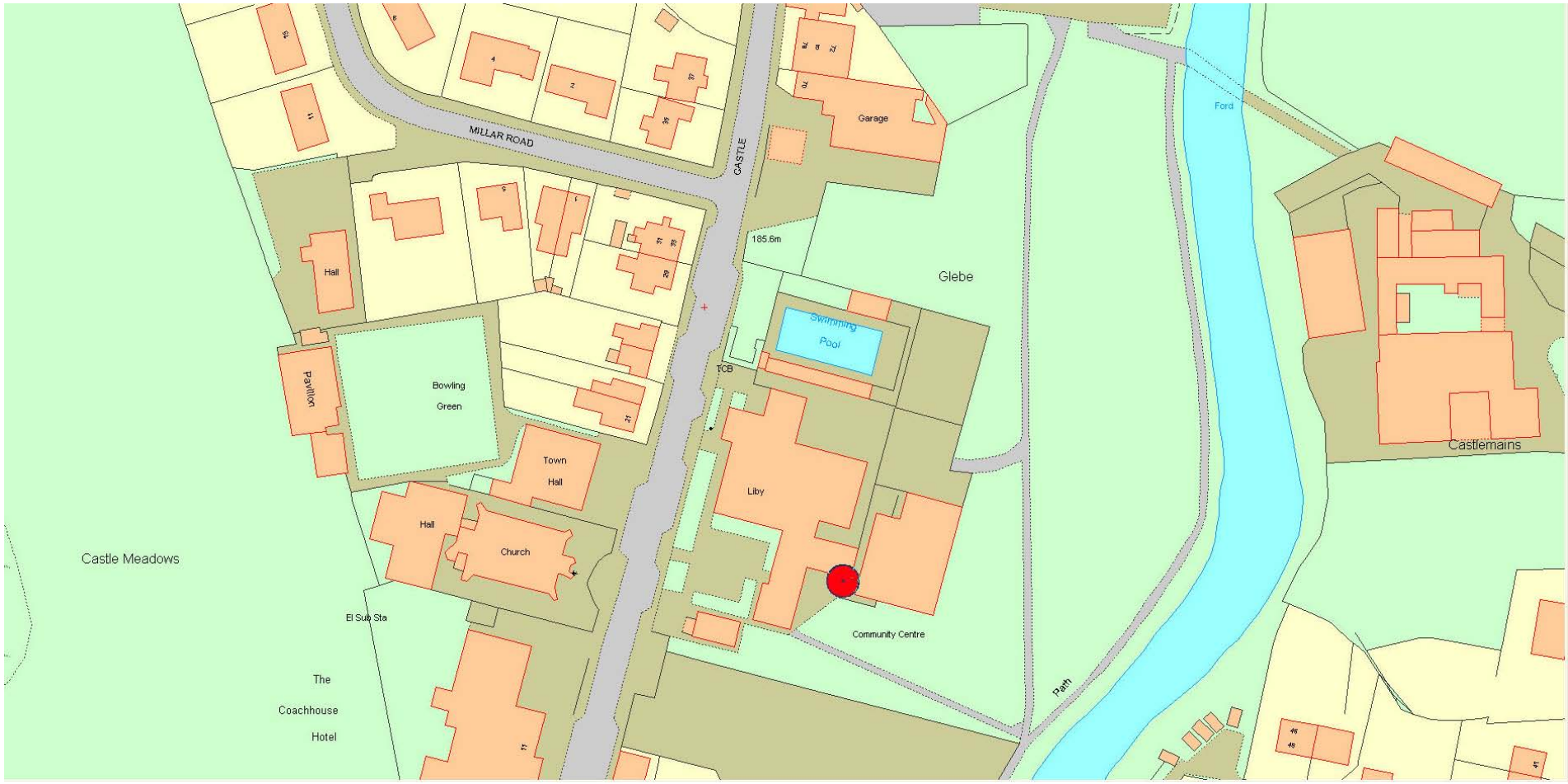


Figure 4: John Finnie Street, Kilmarnock – Automatic Monitoring Location

Figure 5a: Stewarton NO2 Diffusion Tube Location

Figure 5b: Kilmaurs NO2 Diffusion Tube Location

Figure 5c: John Finnie Street NO2 Diffusion Tube Location

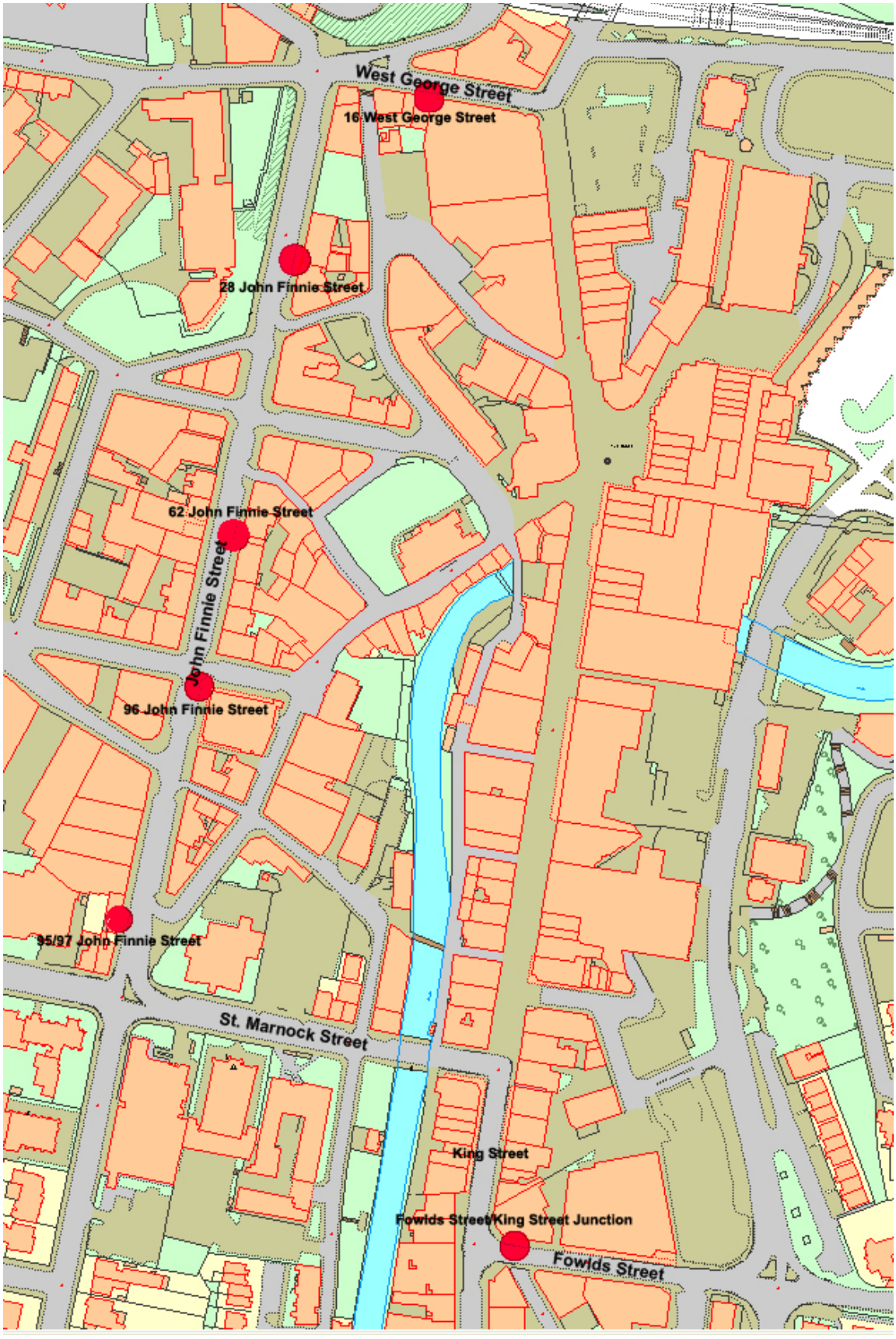
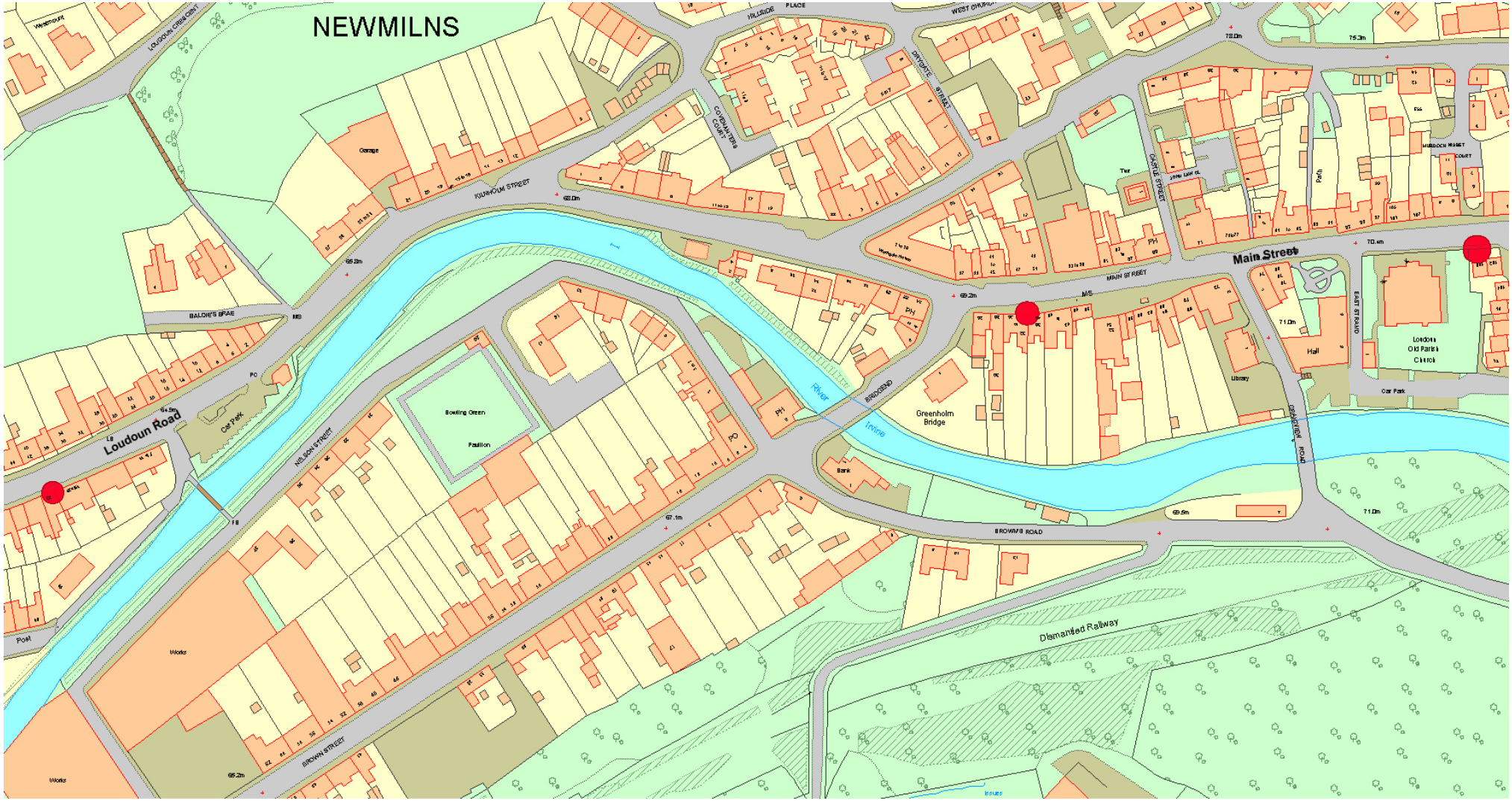
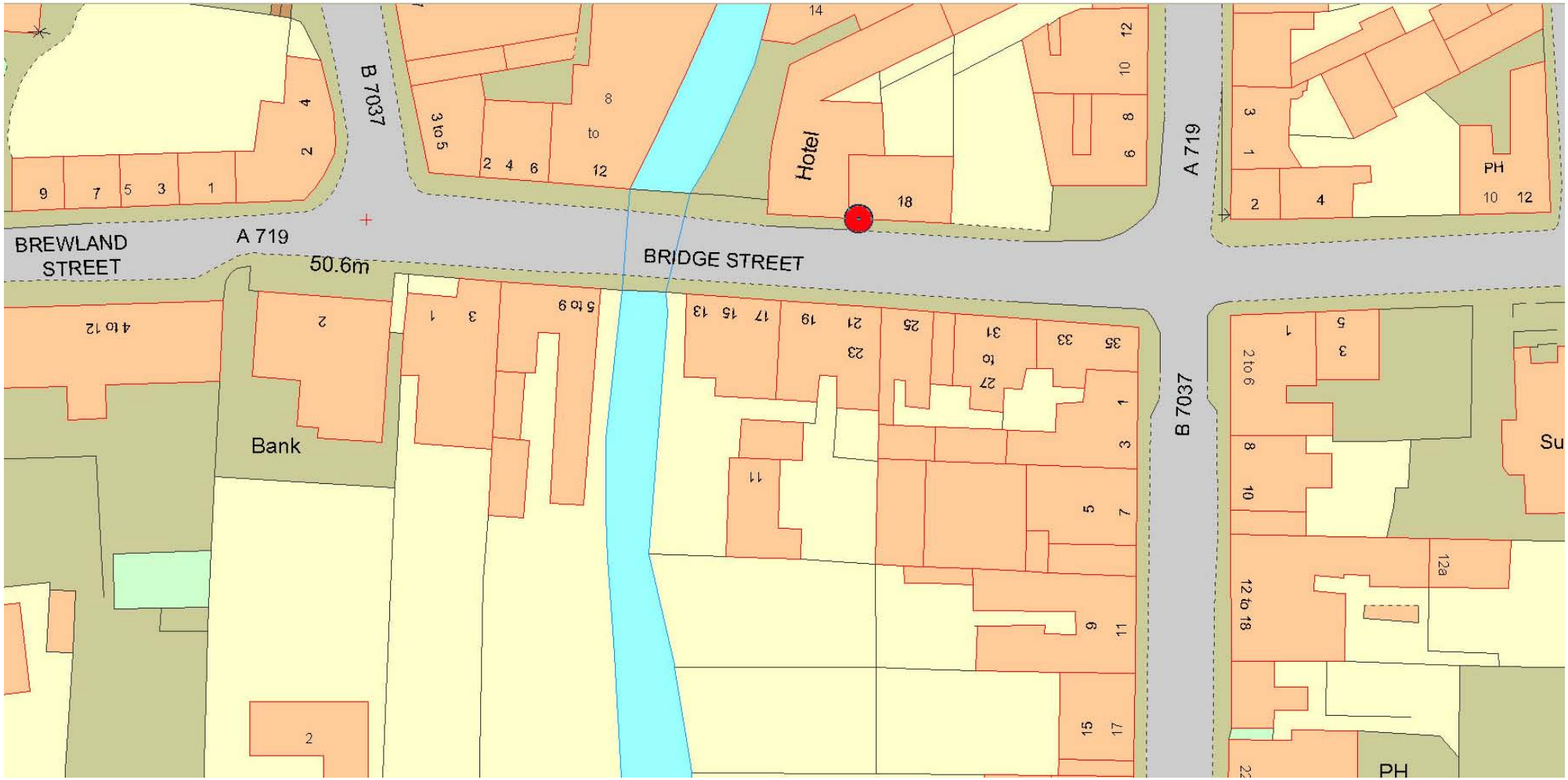


Figure 5d: Nursery Avenue NO2 Diffusion Tube Location

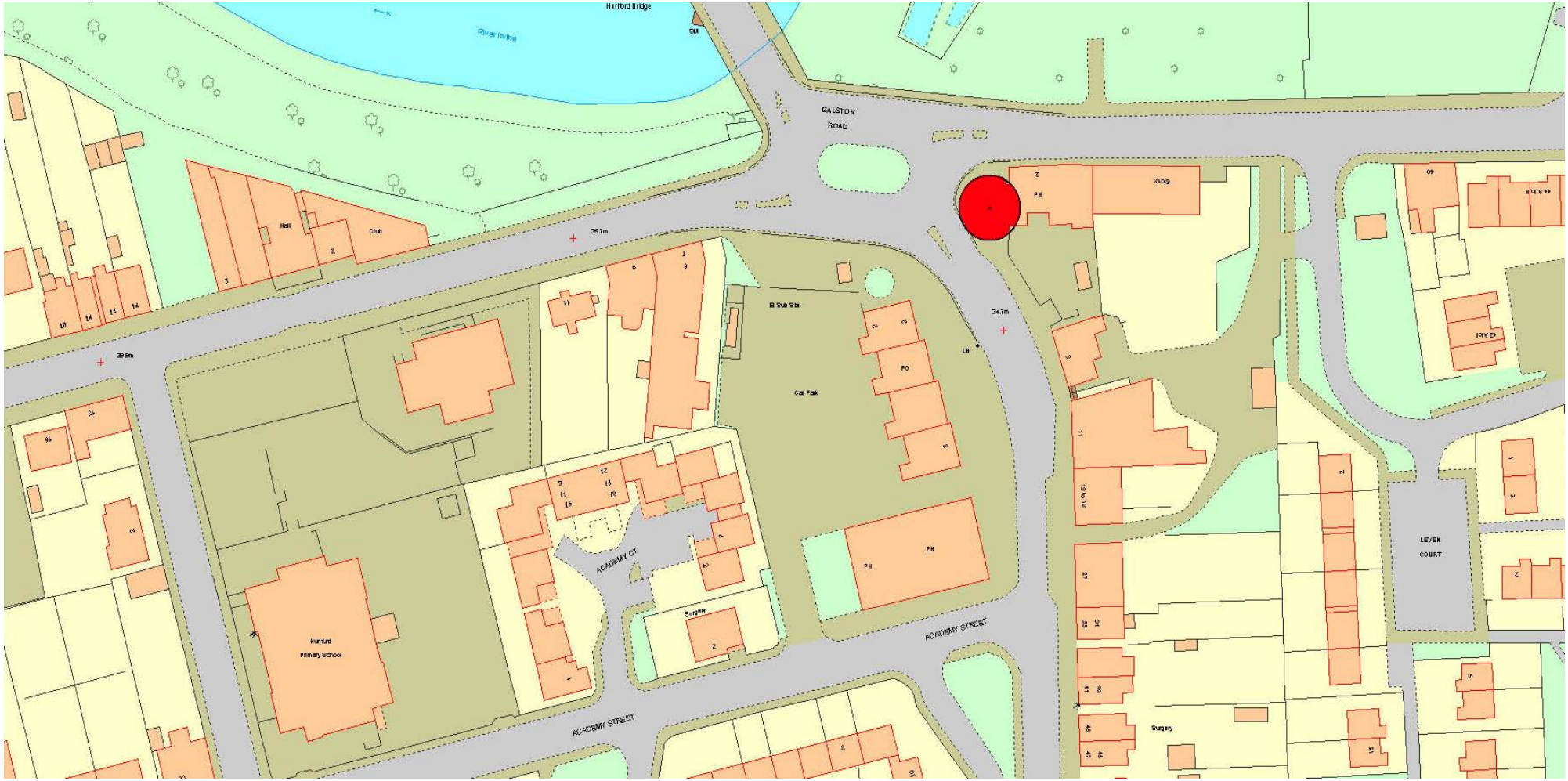
5e: Newmilns – NO2 Diffusion Tube Locations



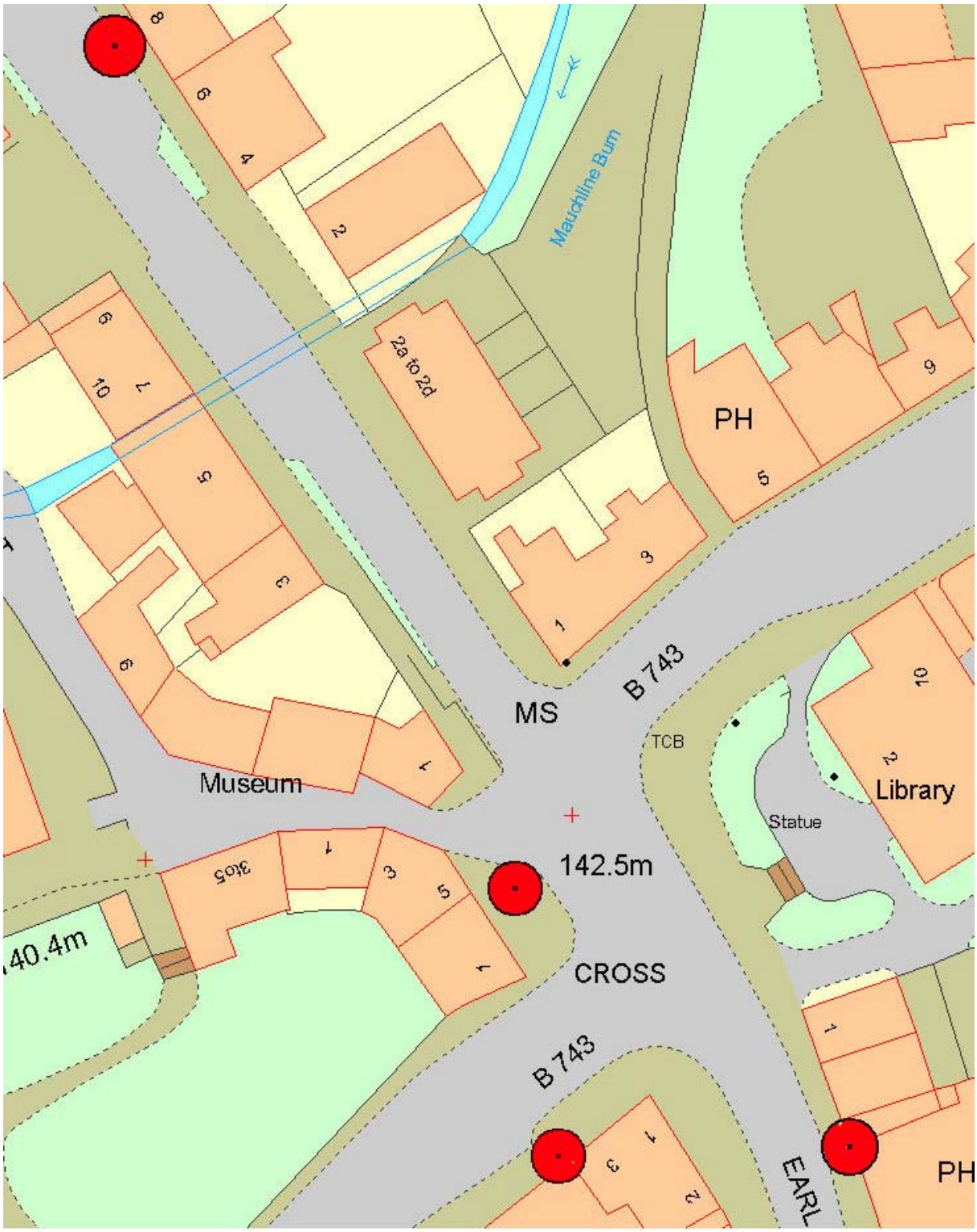
5f: Galston – NO2 Diffusion Tube Locations



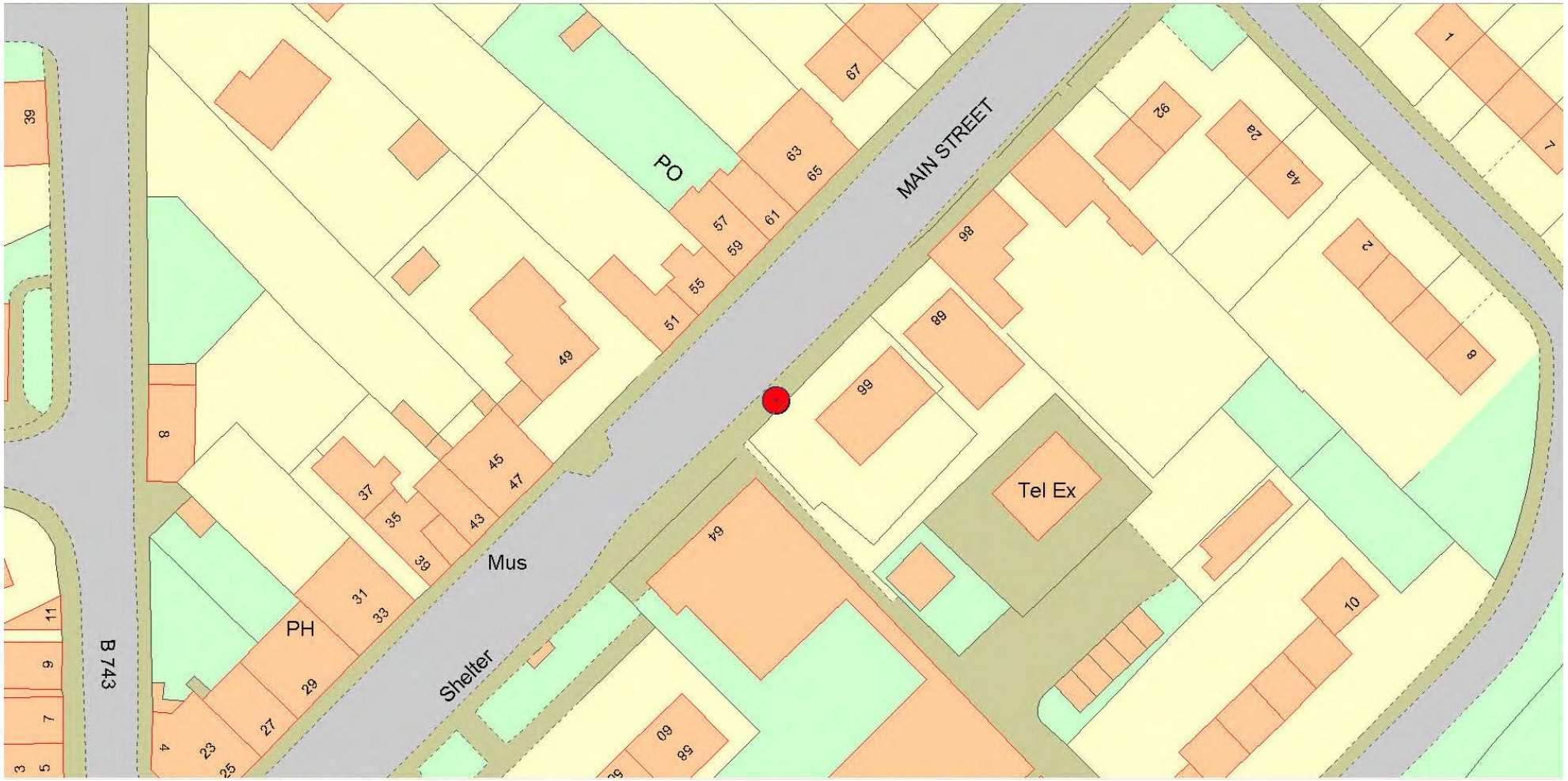
5g: Hurlford – NO2 Diffusion Tube Locations



5h: Mauchline – NO2 Diffusion Tube Locations

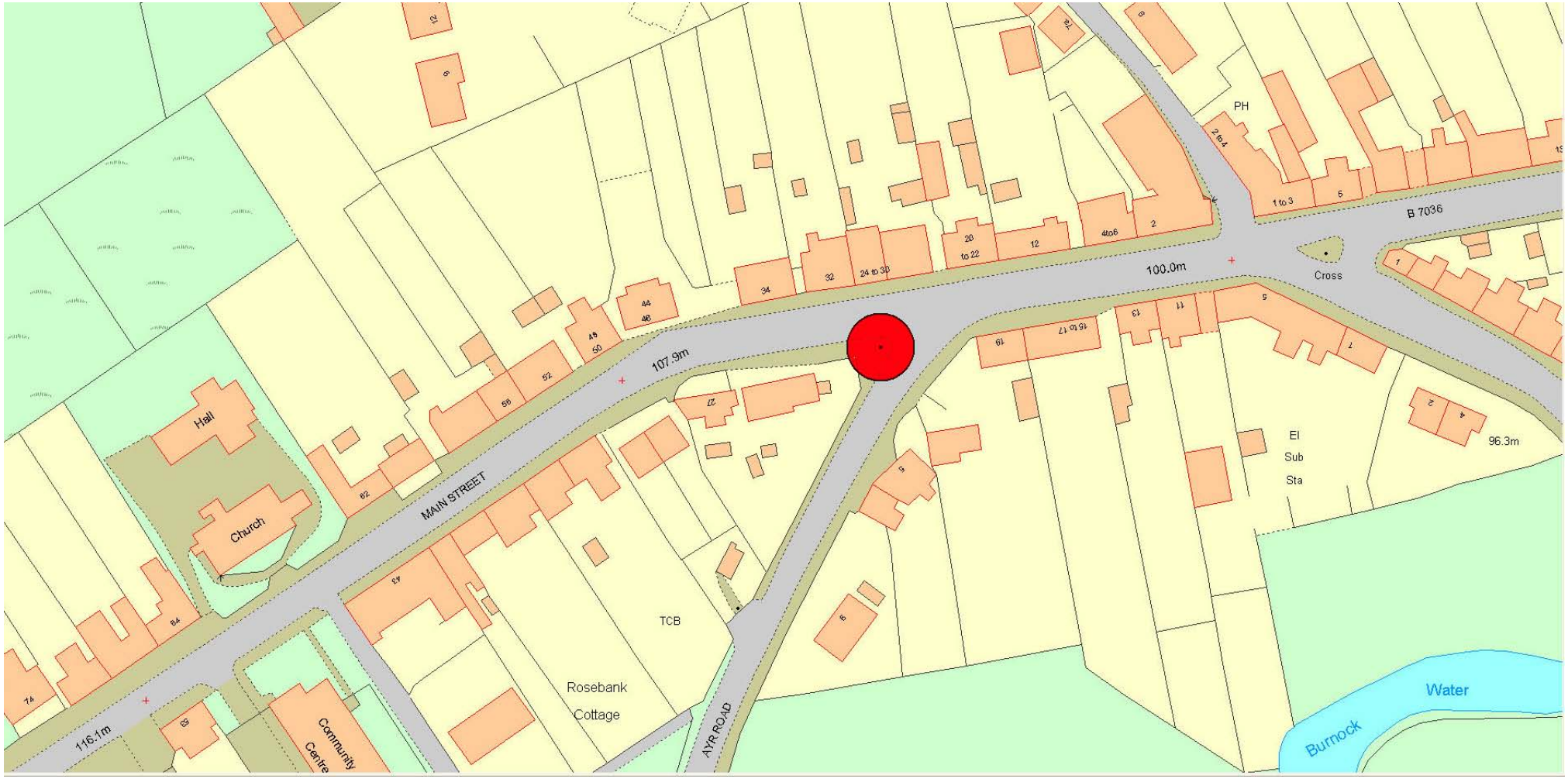


5i: Muirkirk – NO2 Diffusion Tube Locations

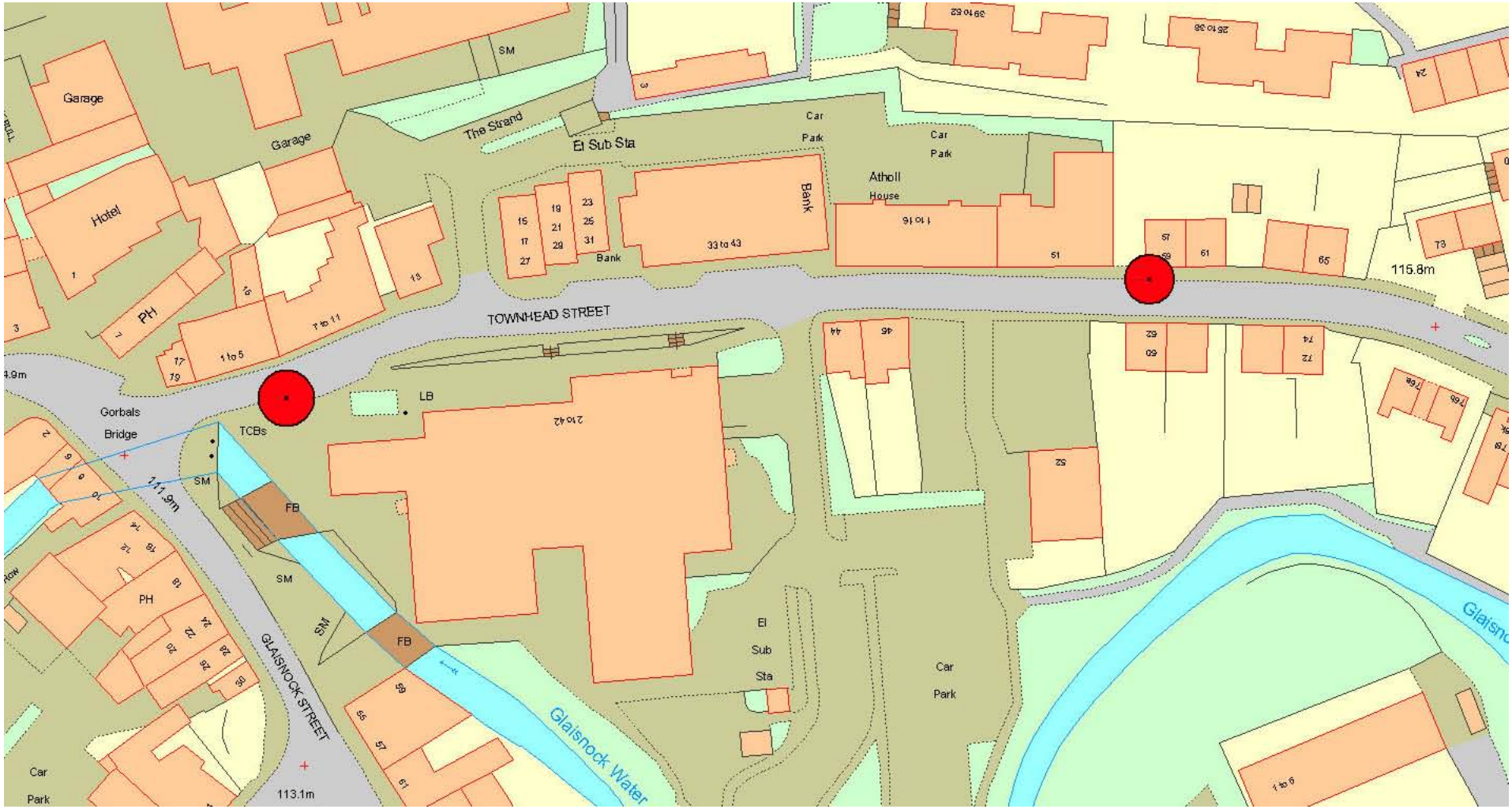


5j: Auchinleck – NO2 Diffusion Tube Locations

5k: Ochiltree – NO2 Diffusion Tube Locations



5l: Cumnock – NO2 Diffusion Tube Locations



6: Lugar – E- Sampler Location