



**NORTH AYRSHIRE**  
COUNCIL



# **2010 Air Quality Progress Report for North Ayrshire Council**

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

**Date (April 2010)**

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Cover Photo: Largs overlooking Isle of Cumbrae (Isle of Arran in background right)

## Executive Summary

The Environment Act 1995 makes a requirement for Local Authorities to review and assess air quality in their areas. The Air Quality Regulations 1997 provided National Air Quality objectives for 7 key pollutants, local authorities must assess whether these objectives are liable to be met. Any Local Authority, which identifies any areas where objectives are not met, must declare an Air Quality Management Area.

This report was prepared in accordance with the Local Air Quality Management, Technical Guidance LAQM, TG(09) and sets out the air quality monitoring carried out in North Ayrshire, with results and conclusions.

With regard to nitrogen dioxide (NO<sub>2</sub>), it was predicted that a localised area of High Street, Irvine would continue to be subject to elevated levels bordering or exceeding the guideline limit for the annual mean (40µg/m<sup>3</sup>) national air quality standard. There has been increased focus and sampling in this area with additional diffusion tube monitoring sites established to better define the special extent of any possible exceedence. Of the total 37 diffusion tubes in North Ayrshire Council, 17 are located in High Street, Irvine within a 50m stretch of road.

This year there have been no annual mean exceedences for High Street, Irvine, however this area will continue to be intensely monitored until long term trends are established.

Previous NO<sub>2</sub> monitoring results (2007 & 2008) for Townhead Street, Dalry and New Street, Dalry showed consistent exceedences for the 40 µg/m<sup>3</sup> level limit. A detailed assessment was carried out however a new traffic management scheme was put in place changing the characteristics of the traffic flow (speed). Early monitoring results showed a significant reduction in monthly nitrogen dioxide levels. In view of this it was considered inappropriate to proceed to declaration of an AQMA and to collect a full calendar year of data for 2009.

The 2009 annual mean for NO<sub>2</sub> diffusion tube locations in Dalry are all below the 40 µg/m<sup>3</sup> level limit, indicating the traffic management has been successful. These locations will be continued to be closely monitored until long term trends are established and significant confidence the levels will remain below the objective limits.



## Table of contents

<b>1</b>	<b>Introduction</b>	<b>6</b>
1.1	Description of Local Authority Area	6
1.2	Purpose of Progress Report	6
1.3	Air Quality Objectives	7
1.4	Summary of Previous Review and Assessments	8
<b>2</b>	<b>New Monitoring Data</b>	<b>12</b>
2.1	Summary of Monitoring Undertaken	12
2.2	Comparison of Monitoring Results with Air Quality Objectives	16
<b>3</b>	<b>New Local Developments</b>	<b>25</b>
3.1	Road Traffic Sources	25
3.2	Other Transport Sources	25
3.3	Industrial Sources	25
3.4	Commercial and Domestic Sources	25
3.5	New Developments with Fugitive or Uncontrolled Sources	25
<b>4</b>	<b>Conclusions and Proposed Actions</b>	<b>26</b>
4.1	Conclusions from New Monitoring Data	26
4.2	Conclusions relating to New Local Developments	26
4.3	Proposed Actions	26
<b>5</b>	<b>References</b>	<b>27</b>



## Appendices

Appendix 1	QA:QC Data
Appendix 2	AEA Air Pollution Report
Appendix 3	Bias Factor Spreadsheet GSS
Appendix 4	Bias Factor Spreadsheet National Results
Appendix 5	Diffusion Tube Accuracy NAC
Appendix 6	Map of Locality & Surrounding Area
Appendix 7:	Map of NO <sub>2</sub> Diffusion Tube Locations
Appendix 8:	Irvine Town Centre
Appendix 9:	Irvine, High St (2007) NO <sub>2</sub> µg/m <sup>3</sup>
Appendix 10:	Irvine, High St (2008) NO <sub>2</sub> µg/m <sup>3</sup>
Appendix 11:	Irvine, High St (2009) NO <sub>2</sub> µg/m <sup>3</sup>
Appendix 12:	Irvine, High St – Hot Spot
Appendix 13:	Dalry (Ordnance Survey)
Appendix 14:	Dalry - Town Centre
Appendix 15:	Dalry - New Traffic Management (2008)
Appendix 16:	Dalry - Traffic Congestion (2008)
Appendix 17:	Dalry – Townhead St/New St (2008) NO <sub>2</sub> µg/m <sup>3</sup>
Appendix 18:	Dalry – Townhead St/New St (2009) NO <sub>2</sub> µg/m <sup>3</sup>
Appendix 19:	Historical No2 Results (1998-2009)
Appendix 20:	Radiation Food and Environmental Programme

## List of Tables

Table 2.1	Details of Automatic Monitoring Sites
Table 2.2	Details of Non- Automatic Monitoring Sites
Table 2.3a	Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with Annual Mean Objective
Table 2.3b	Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with 1-hour Mean Objective
Table 2.4	Results of Nitrogen Dioxide Diffusion Tubes

## List of Figures

Figure 2.4	Trends in Annual Mean Nitrogen Dioxide Concentration
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# **1 Introduction**

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

North Ayrshire can be divided roughly into four main regional character classifications based on landscape and topography. Isle of Arran represents a distinctive landscape from the mainland, whilst at the same time offering a variety of landscape types which have caused it to be referred to as 'Scotland in Miniature'. The Inner Firth of Clyde is another distinctive character area which includes the northern coastal fringe and the Cumbrae Islands. Inland from this, the topography is dominated by the Renfrew heights, which cover the northern part of North Ayrshire. These hills narrow towards a point near Ardrossan and are largely unsettled. The final area comprises the northern part of the Ayr Basin which is heavily populated in comparison with the neighbouring areas, with a dense network of roads and settlements.

The major trunk road network within North Ayrshire consists of the A78 coastal route running from Irvine, to Largs and the A737 Garnock Valley link to the M8 and Glasgow conurbation. Other major routes are the A736 to Barrhead; and the A71 to Kilmarnock road. North Ayrshire is also well served by the rail network and there are stations on the main Glasgow Central to Ayr line at Dalry, Glengarnock, Kilwinning and Irvine; served by a frequent passenger service. In addition the Largs line continues on from Kilwinning and serves the towns of Stevenston, Saltcoats, Ardrossan, West Kilbride, Fairlie and Largs.

North Ayrshire has commercial ports at Ardrossan and Hunterston; which has a deep sea terminal, and leisure facilities are also available at Largs, Irvine, Saltcoats and Millport. Ferry services connect Ardrossan to Brodick (Arran), Largs to Millport (Cumbrae), and Lochranza to Claonaig in Argyll.

Main sources of pollutants affecting areas relevant exposures are caused by road traffic vehicles. Areas particularly affected are High Street, Irvine and Townhead Street/New Street, Dalry. Key focus of this and previous reports has been on these areas.

## **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.



### 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,  $\mu\text{g}/\text{m}^3$  (milligrammes per cubic metre,  $\text{mg}/\text{m}^3$  for carbon monoxide) with the number of exceedences in each year that are permitted (where applicable).

**Table 1.1 Air Quality Objectives included in Regulations for the purpose of Local Air Quality Management in Scotland.**

Pollutant	Concentration	Measured as	Date to be achieved by
<b>Benzene</b>	16.25 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2003
	3.25 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2010
<b>1,3-Butadiene</b>	2.25 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2003
<b>Carbon monoxide</b>	10.0 $\text{mg}/\text{m}^3$	Running 8-hour mean	31.12.2003
<b>Lead</b>	0.5 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2004
	0.25 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2008
<b>Nitrogen dioxide</b>	200 $\mu\text{g}/\text{m}^3$ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2005
<b>Particles (PM<sub>10</sub>) (gravimetric)</b>	50 $\mu\text{g}/\text{m}^3$ , not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	50 $\mu\text{g}/\text{m}^3$ , not to be exceeded more than 7 times a year	24-hour mean	31.12.2010
	40 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2004
	18 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2010
<b>Sulphur dioxide</b>	350 $\mu\text{g}/\text{m}^3$ , not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 $\mu\text{g}/\text{m}^3$ , not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 $\mu\text{g}/\text{m}^3$ , not to be exceeded more than 35 times a year	15-minute mean	31.12.2005



## 1.4 Summary of Previous Review and Assessments

Report	Summary
<p>Stage 1 Review and Assessment (1998)</p>	<p>It is recommended that a second stage review and assessment be undertaken for nitrogen dioxide.</p> <p>It is recommended that the current air quality monitoring work in North Ayrshire be continued. This will provide data to indicate compliance with the objectives and will be useful in the next review and assessment to be undertaken before 2005.</p>
<p>Stage 2 Review and Assessment (2000)</p>	<p>The air quality objective for nitrogen dioxide are likely to be met by the end of 2005, it will, therefore not be necessary to proceed to a stage three review and assessment.</p> <p>It would be prudent to undertake a limited programme of diffusion tube monitoring adjacent to the A78 at Auchengate sawmill to confirm the level of nitrogen dioxide at that location.</p>
<p><b>2003</b> Updating and Screening Assessment</p>	<p>DMRB screening shows that there are no areas within North Ayrshire, which are likely to fail the objective due to Road Traffic. The annual mean nitrogen dioxide levels over a short length of High Street, Irvine, however, are marginally in excess of the annual mean objective in 2002. When the "year correction factors" are applied, as allowed in the guidance, all Annual Mean levels for 2005 should meet the Air Quality Objective. It is believed also that the traffic management scheme, already proposed by North Ayrshire Council will minimise the risk of any further increase.</p> <p>Passive monitoring for nitrogen dioxide should continue in High Street, Irvine to assess the effect of the proposed traffic management scheme.</p> <p>There are no significant industrial sources of nitrogen dioxide within North Ayrshire.</p> <p>There is no requirement to proceed to a detailed assessment for nitrogen dioxide.</p>

Report	Summary
<b>2004</b> Progress Report	<p>With the exception of nitrogen dioxide all guideline limits for the National Air Quality Standards shall be met for 2004.</p> <p>With regard to nitrogen dioxide, it is predicted that a highly localised area of High Street, Irvine shall continue to be subject to concentration levels in excess of the guideline limit for the annual mean (<math>40\mu\text{g}/\text{m}^3</math>) national air quality standard at the end of 2005.</p> <p>With regard to <math>\text{PM}_{10}</math>, whilst the predicted estimated annual mean concentration for 2004 (<math>21.39\mu\text{g}/\text{m}^3</math>) shall be well below the U.K. Air Quality Objective, for 2010 it is predicted to be <math>19.75\mu\text{g}/\text{m}^3</math>, marginally exceeding the much reduced Scottish Air Quality Objective of <math>18\mu\text{g}/\text{m}^3</math>.</p> <p>Passive sampling shall continue in the area to monitor ambient levels of nitrogen dioxide. Additionally, the TEOM particulate monitor is due to be re-sited in the area from May 2005 for twelve months. At the end of that period the effects of the traffic management scheme can be further assessed.</p>
<b>2005</b> Progress Report	<p>With the exception of nitrogen dioxide all guideline limits for the National Air Quality Standards shall be met for 2004.</p> <p>With regard to nitrogen dioxide, a highly localised area of High Street, Irvine continues to be subject to concentration levels in excess of the guideline limit for the annual mean (<math>40\mu\text{g}/\text{m}^3</math>) national air quality standard at the end of 2005. However, this is not an area of relevant public exposure. Consequently, a detailed assessment for nitrogen dioxide remains unnecessary.</p> <p>There is no need to proceed to a detailed assessment for any of the seven air pollutants.</p>
<b>2006</b> Updating and Screening Assessment Report	<p>The Annual Mean Objective for nitrogen dioxide is now being complied with throughout North Ayrshire as demonstrated by passive monitoring. However, monitoring should continue, especially in High Street, Irvine, to ensure the improvement in air quality is maintained.</p> <p>DMRB screening shows that there are no areas within North Ayrshire, which are likely to fail the objective due to road traffic.</p> <p>There are no significant industrial sources of nitrogen dioxide within, either North Ayrshire or neighbouring areas that would adversely affect local air quality in North Ayrshire.</p> <p>There continues to be no need to proceed to a detailed assessment for nitrogen dioxide.</p>



Report	Summary
<b>2007</b> Progress Report	<p>All guideline limits for the National Air Quality Standards should be met for 2010.</p> <p>With regard to nitrogen dioxide, it is predicted that a highly localised area of High Street, Irvine <b>may</b> have concentrations levels in excess of the guideline limit for the annual mean (<math>40\mu\text{g}/\text{m}^3</math>) national air quality standard. However it is expected that a new updated traffic management scheme will see these figures fall. On the advice of the Scottish Government and the Scottish Environment Protection Agency, a detailed assessment for nitrogen dioxide will be carried out for this area.</p> <p>With the exception of Nitrogen Dioxide there is no need to proceed to a detailed assessment for any of the air pollutants.</p>
<b>2008</b> Progress Report & Detailed Assessment	<p>NO<sub>2</sub> monitoring results for <b>Townhead Street, Dalry and New Street, Dalry</b> show consistent exceedences for the <b>40 <math>\mu\text{g}/\text{m}^3</math></b> level limit. Previous modelling of this area suggested there would be no breaches, however the modelling did not fully account for stationary traffic on an incline at traffic lights.</p> <p>A highly localised area at the façade of <b>75 High Street, Irvine</b> may continue to be subject to concentration levels in excess of the guideline limit for the annual mean (<math>40\mu\text{g}/\text{m}^3</math>) national air quality standard.</p> <p>Further diffusion tubes will be sited in the area to assess the lateral extent of the exceedence area. There is now an NO<sub>x</sub> analyser and PM<sub>10</sub> monitor at a site approximately 25 metres from the "hot spot". This shall provide data on the concentration of these pollutants in the immediate environment. As hoped, this equipment was commissioned for the start of 2009.</p> <p>With regard to PM<sub>10</sub>, whilst the predicted estimated annual mean concentration for 2004 (<math>21.39\mu\text{g}/\text{m}^3</math>) shall be well below the U.K. Air Quality Objective, for 2010 it is predicted to be <math>19.75\mu\text{g}/\text{m}^3</math>, marginally exceeding the much reduced Scottish Air Quality Objective of <math>18\mu\text{g}/\text{m}^3</math>.</p> <p>With the exception of Nitrogen Dioxide there was no need to proceed to a detailed assessment for any of the air pollutants.</p> <p>With regards to Townhead Street/New Street, Dalry North Ayrshire Council shall progress to a detailed assessment of NO<sub>2</sub> once a full calendar year of data is available. However the narrowness of the street and the level of traffic flow will limit the options for carrying out more detailed monitoring in the area.</p>



Report	Summary
2009 Air Quality Updating and Screening Assessment	<p>High Street, Irvine continues to have erratic results bordering on the <math>40 \mu\text{g}/\text{m}^3</math> limit. The results do not warrant declaration of an AQMA. However all sampling locations, old and new, will remain within the monitoring programme to establish a more accurate picture of nitrogen dioxide levels in this locality.</p> <p>High Street, Irvine will continue to be closely monitored using nitrogen dioxide diffusion tubes and the automatic monitoring site (ROMON) located in High Street, Irvine which will also be operational for 2009. The ROMON contains a BAM and NO<sub>2</sub> analyser and will allow better analysis of NO<sub>2</sub> daily trends to identify keys sources affecting the higher readings at tubes in this location.</p> <p>The ROMON will also be the site used in 2009 for a co-location study for nitrogen dioxide diffusion tubes.</p> <p>Nitrogen dioxide levels in Townhead Street/New Street, Dalry continue to exceed <math>40 \mu\text{g}/\text{m}^3</math> at two relevant locations and are consistent in suggesting a strong correlation with previous traffic congestion in the area. Since 2009 monitoring has shown a reduction in levels as a result of the new traffic management system put in place.</p> <p>Based on the 2008 results for Townhead Street/New Steet, Dalry North Ayrshire Council had expected to declare this an AQMA. However the new traffic management scheme has been in operation since February 2009 and results so far have shown a reduction in levels. On this basis, it is proposed to delay declaring an AQMA until a full calendar year of data is available based on the new traffic management.</p>

## **2 New Monitoring Data**

### **2.1 Summary of Monitoring Undertaken**

#### **2.1.1 Automatic Monitoring Sites**

The Groundhog mobile monitoring unit has been replaced by a fixed ROMON unit containing NO<sub>2</sub> analyser and Beta Attenuation Monitor for PM<sub>10</sub>. This monitoring station has been operational since early 2009 and is the site being used for the co-location tubes. The unit is permanently located here and is not part of a shared scheme, which will allow for full calendar year data to be collected.

Calibration checks are conducted every 2 weeks on site by LA Officers and collected data is forwarded to AEA Technologies who validate and ratify the data. The unit is calibrated by AEA Technologies every 6 months. Certificates are included in Appendix 2.

The unit was installed on site in January 2009 and has been collecting data since it was commissioned at the start of February 2009. The fortnightly calibration checks by LA officers have only been consistently carried out since June 2009. Hence the AEA report only shows ratified data from this point onwards.

The collected data is available on the Scottish Air Quality website [www.scottishairquality.co.uk](http://www.scottishairquality.co.uk).

#### **Map(s) of Automatic Monitoring Sites**

The location of the ROMON is detailed in the Irvine High Street maps in appendices 10 – 14 at the rear of the report.

**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?
Example 1	Urban background.	X111222	Y222111	PM <sub>10</sub>	FDMS	Y	Y (1m)	3m	Y
GroundHog	Kerbside	X232188	Y638861	NO <sub>2</sub> , PM <sub>10</sub> , CO	Replaced by ROMON				
ROMON	Kerbside	X232188	Y638861	NO <sub>2</sub> , PM <sub>10</sub>	NOx & BAM	No	20m	2.5m	y



### 2.1.2 Non-Automatic Monitoring

Monitoring of nitrogen dioxide was undertaken at 37 sites using passive diffusion tubes. Tubes were relocated from long term sites where there were significantly low levels of nitrogen dioxide to more important positions within Detailed Assessment areas (High Street, Irvine and Townhead/New Street, Dalry).

Maps of Non-Automatic Monitoring Sites and surrounding areas are included in Appendices 9 to 20.

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

Site ID		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?
			EAST INGS	NORTH INGS					
1	Cunninghame House, Irvine	UB	231627	638718	NO <sub>2</sub>	N	N	N/A	N
2	35 East Road Irvine	K	232323	638892	NO <sub>2</sub>	N	N	5m	N
3	Irvine Police Station	UB	232255	638910	NO <sub>2</sub>	N	N	5m	N
4	70 High Street Irvine	K	232172	638894	NO <sub>2</sub>	N	N	1.5m	Y
5	18 Bank St, Irvine	K	232202	638952	NO <sub>2</sub>	N	Y (1m)	3m	Y
6	19 Bank St Irvine	K	232210	638976	NO <sub>2</sub>	N	Y (1m)	3m	Y
7	147 High Street, Irvine	K	232077	638990	NO <sub>2</sub>	N	Y	3m	Y
8	3 Bridgegate,	K	232122	638908	NO <sub>2</sub>	N	N	3m	Y
9	97 High St, Irvine LOW	K	232135	638907	NO <sub>2</sub>	N	Y (3m)	3m	Y
10	97 High St, Irvine HIGH	K	232142	638897	NO <sub>2</sub>	N	Y (1m)	3m	Y
11	91 High St, Irvine LOW	K	232147	638892	NO <sub>2</sub>	N	Y (1m)	3m	Y
12	85 High St, Irvine	K	232158	638882	NO <sub>2</sub>	N	Y (1m)	3m	Y
13	79 High St, Irvine	K	232169	638878	NO <sub>2</sub>	N	N	3m	Y
14	75 High St, Irvine LOW	K	232170	638871	NO <sub>2</sub>	N	Y (3m)	3m	Y
15	75 High St, Irvine HIGH	K	232170	638871	NO <sub>2</sub>	N	Y (1m)	3m	Y

**Table 2.2 Details of Non- Automatic Monitoring Sites (cont)**

Site ID		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?
			EAST INGS	NORTH INGS					
16	71 High St, Irvine	K	232174	638868	NO <sub>2</sub>	N	Y (1m)	1m	Y
17	65a High Street, Irvine, (ROMON)	K	232188	638861	NO <sub>2</sub>	N	N	2.5m	Y
18	65 High Street, Irvine, (ROMON)	K	232188	638861	NO <sub>2</sub>	N	N	2.5m	Y
19	63 High Street, Irvine, (ROMON)	K	232188	638861	NO <sub>2</sub>	N	N	2.5m	Y
20	34 Kirkgate Irvine	UB	232085	638774	NO <sub>2</sub>	N	N	N/A	N
21	Eglinton Street Irvine	K	231997	639252	NO <sub>2</sub>	N	N	N/A	N
22	25 Main Rd, Springside	K	236813	638659	NO <sub>2</sub>	N	N	N/A	N
23	Main St, Drybridge	SP	235946	636597	NO <sub>2</sub>	N	N	N/A	N
24	Auchengate (Bridge)	SP	233332	635558	NO <sub>2</sub>	N	N	N/A	N
25	Dalry Rd , Kilwinning	K	229928	643400	NO <sub>2</sub>	N	N	N/A	N
26	Byrehill , Kilwinning	K	229520	642319	NO <sub>2</sub>	N	N	N/A	N
27	12 Garnock St, Dalry	UB	229326	649250	NO <sub>2</sub>	N	Y (1m)	1.5	N
28	69 New St Dalry	K	229360	649330	NO <sub>2</sub>	N	Y (2m)	2.5	Y
29	67 New St, Dalry	K	229338	649337	NO <sub>2</sub>	N	Y (1m)	2m	Y
30	45 New St Dalry	K	229286	649365	NO <sub>2</sub>	N	Y (1m)	1.5m	Y
31	60 New St Dalry	K	229311	649363	NO <sub>2</sub>	N	Y (1m)	1.5m	Y
32	44 New St Dalry	K	229280	649380	NO <sub>2</sub>	N	Y (1m)	1.5m	Y
33	3 Townhead St, Dalry	K	229222	649344	NO <sub>2</sub>	N	N	2m	Y
34	2 Townhead St, Dalry	K	229230	649338	NO <sub>2</sub>	N	Y (1m)	2m	Y
35	Highfield Hamlet , Dalry	K	230943	650280	NO <sub>2</sub>	N	N	N/A	N
36	85 Main Street , Largs	K	220333	659322	NO <sub>2</sub>	N	N	N/A	N
37	Hunterston Road	SP	219582	650020	NO <sub>2</sub>	N	N	N/A	N

 Locations subject to previous Detailed Assessments



## 2.2 Comparison of Monitoring Results with Air Quality Objectives

### 2.2.1 Nitrogen Dioxide

North Ayrshire Council have previously used a Groundhog for automatic monitoring of NO<sub>2</sub> and PM<sub>10</sub> which was shared with Inverclyde Council as a joint venture. The unit was transferred between authorities every 12 months. North Ayrshire Council now have a ROMON which will be permanently located at the previous Groundhog, High Street, Irvine site.

North Ayrshire Council also have 37 NO<sub>2</sub> diffusion tubes located throughout the district which record monthly levels of nitrogen dioxide. 25 of these tubes are located with two areas of particular concern, High Street, Irvine and Townhead Street/New Street, Dalry. These areas have had exceedences in previous reports and have been subject to detailed assessments. Results for 2007, 2008 and 2009 are listed in the following tables and show a general downwards trend for the last 3 years.

### Automatic Monitoring Data

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

Site ID	Location	Within AQMA?	Data Capture for monitoring period %	Data Capture for full calendar year 2009 %	Annual mean concentrations (µg/m <sup>3</sup> )		
					2007	2008	2009
A1	1 Example Site	N	95	95	30.1	25.1	26.2
ROMON	High St, Irvine	N	98	51.1			26

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

Site ID	Location	Within AQMA?	Data Capture for monitoring period %	Data Capture for full calendar year 2009 %	Number of Exceedences of hourly mean (200 µg/m <sup>3</sup> )		
					2007 <sup>c</sup>	2008 <sup>c</sup>	2009
A1	1 Example Site	N	95	95	0	3	15
ROMON	High St, Irvine	N	98	51.1			0



## Diffusion Tube Monitoring Data

New sites were introduced in July 2008. Data was collected Jul-Dec and figures in green are 6 month averages. A table containing all historical NO<sub>2</sub> diffusion tube monitoring annual mean results is included in Appendix 21.

North Ayrshire Council had a co-location study for 2009 located at the ROMON site, High Street, Irvine. Three NO<sub>2</sub> diffusion tubes were located ~20cm away from the ROMON sampling inlet. Corresponding data was entered in the "Checking Precision and Accuracy of Triplicate Tubes" spreadsheet provided by AEA Energy & Environment. The resulting Bias Correction Factor is 0.96.

**Table 2.4 Results of Nitrogen Dioxide Diffusion Tubes**

Site ID	Location	Within AQMA?	Data Capture for monitoring period %	Data Capture for full calendar year 2009 %	Annual mean concentrations (µg/m <sup>3</sup> )		
					2007	2008	2009
A1	1 Example Site	N	95	95	30.1	25.1	26.2
1	Cunninghame House, Irvine	N	100	100	12	10	12
2	35 East Road Irvine	N	100	100	26	24	25
3	Irvine Police Station	N	100	100	12	12	13
4	70 High Street Irvine	N	100	100	29	26	25
5	18 Bank St, Irvine	N	100	100		32.5 100% Jul-Dec	26
6	19 Bank St Irvine	N	100	100	24	26	23
7	147 High Street, Irvine	N	100	100	29	34	29
8	3 Bridgegate, CCTV Camera	N	100	100		23.9 100% Jul-Dec	22

Site ID	Location	Within AQMA?	Data Capture for monitoring period %	Data Capture for full calendar year 2009 %	Annual mean concentrations ( $\mu\text{g}/\text{m}^3$ )		
					2007	2008	2009
A1	1 Example Site	N	95	95	30.1	25.1	26.2
9	97 High St, Irvine LOW	N	100	100	32	28	28
10	97 High St, Irvine HIGH	N	100	100		29.4 100% Jul-Dec	29
11	91 High St, Irvine LOW	N	100	100		34.1 100% Jul-Dec	32
12	85 High St, Irvine	N	100	100		34.1 100% Jul-Dec	27
13	79 High St, Irvine	N	100	100	44	39	37
14	75 High St, Irvine LOW	N	100	100	48	37	35
15	75 High St, Irvine HIGH	N	100	100		44.6 100% Jul-Dec	37
16	71 High St, Irvine	N	100	100		34.8 100% Jul-Dec	29
17	65a High Street, Irvine, (ROMON)	N	100	100	35	31	29
18	65 High Street, Irvine, (ROMON)	N	100	100	N/A	30	29
19	63 High Street, Irvine, (ROMON)	N	100	100	N/A	29	30
20	34 Kirkgate Irvine	N	100	100	11	8	16

Site ID	Location	Within AQMA?	Data Capture for monitoring period %	Data Capture for full calendar year 2009 %	Annual mean concentrations ( $\mu\text{g}/\text{m}^3$ )		
					2007	2008	2009
A1	1 Example Site	N	95	95	30.1	25.1	26.2
21	Eglinton Street Irvine	N	100	100	22	27	26
22	25 Main Rd, Springside	N	100	100	17	16	17
23	Main St, Drybridge	N	100	100	9	6	12
24	Auchengate (Bridge)	N	100	100	14	12	15
25	Dalry Rd , Kilwinning	N	100	100	25	19	21
26	Byrehill , Kilwinning	N	100	100	10	8	13
27	12 Garnock St, Dalry	N	100	100	9	11	15
28	69 New St Dalry	N	100	100	28	29	26
29	67 New St, Dalry	N	100	100		34.1 100% Jul-Dec	34
30	45 New St Dalry	N	100	100	48	45	39
31	60 New St Dalry	N	100	100		36.1 100% Jul-Dec	33
32	44 New St Dalry	N	100	100	47	51	39

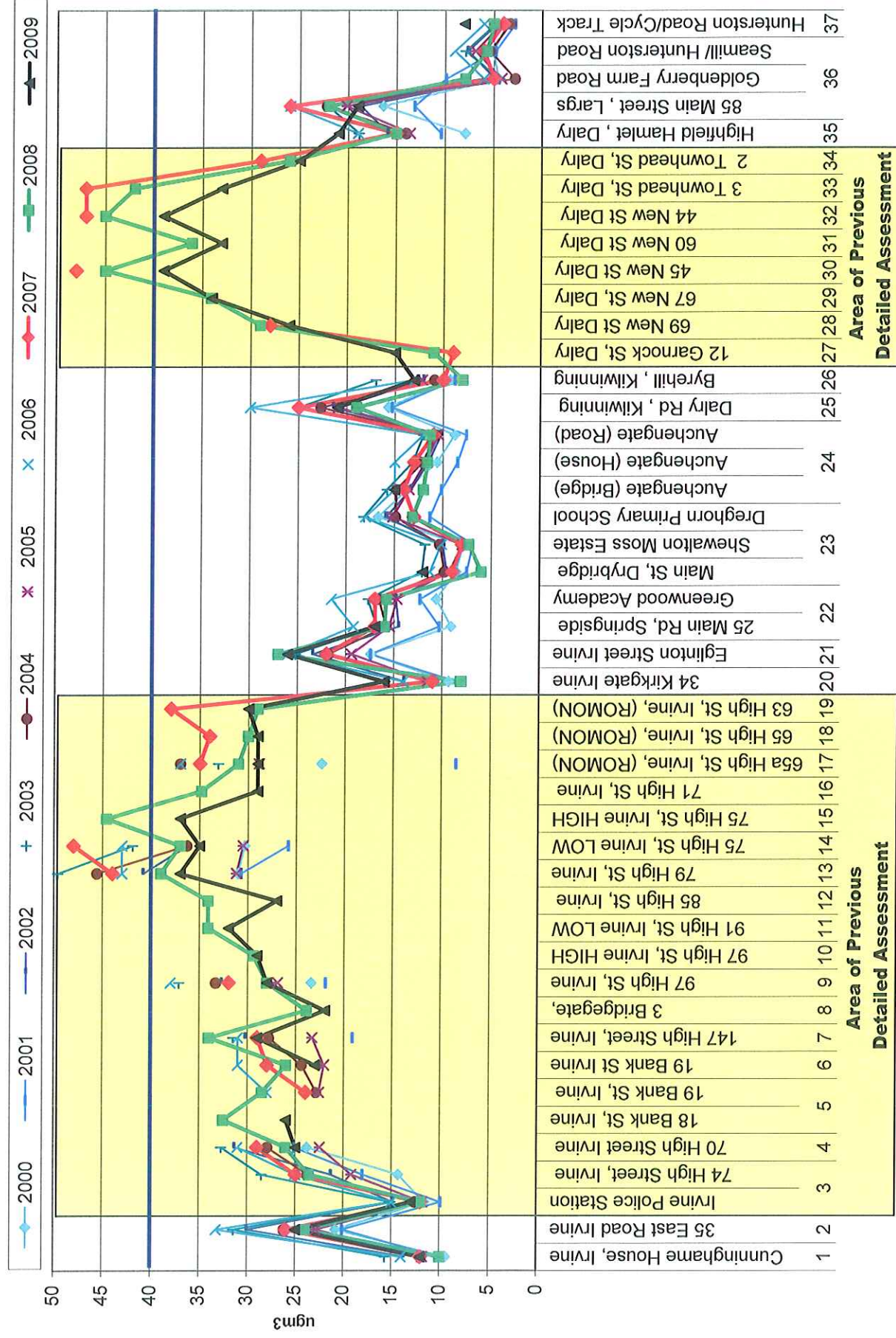


Site ID	Location	Within AQMA?	Data Capture for monitoring period %	Data Capture for full calendar year 2009 %	Annual mean concentrations ( $\mu\text{g}/\text{m}^3$ )		
					2007	2008	2009
A1	1 Example Site	N	95	95	30.1	25.1	26.2
<b>33</b>	3 Townhead St, Dalry	N	100	100	47	42	33
<b>34</b>	2 Townhead St, Dalry	N	100	100	29	26	25
<b>35</b>	Highfield Hamlet, Dalry	N	100	100	15	15	21
<b>36</b>	85 Main Street, Largs	N	100	100	26	22	19
<b>37</b>	Hunterston Road	N	100	100	4	5	8

Appendices 10, 11 and 12 illustrate tube locations and concentrations in High Street, Irvine for 2007, 2008 and 2009 respectively.

Appendices 19 and 20 illustrate tube locations and concentrations in Townhead Street/New Street, Dalry for 2008 and 2009 respectively.

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



### 2.2.2 PM<sub>10</sub>

The newly installed ROMON houses a Met-One Beta Attenuation Monitor (BAM) which has been monitoring PM<sub>10</sub> since February 2009. The monitor is checked for error messages every 2 weeks during calibration checks for the NO<sub>2</sub> monitor and the filter tape is replaced every 8 weeks. This installation is a permanent unit and will allow data collection for each full year.

**Table 2.5a Results of PM<sub>10</sub> Automatic Monitoring: Comparison with Annual Mean Objective**

Site ID	Location	Within AQMA?	Data Capture for monitoring period <sup>a</sup> %	Data Capture for full calendar year 2009 <sup>b</sup> %	Annual mean concentrations (µg/m <sup>3</sup> )		
					2007 <sup>c, d</sup>	2008 <sup>c, d</sup>	2009 <sup>c</sup>
A1	1 Example Site	N	98	98	45	41	44
ROMON	High St , Irvine	N	>90	83.8			18

**Table 2.5b Results of PM<sub>10</sub> Automatic Monitoring: Comparison with 24-hour Mean Objective**

Site ID	Location	Within AQMA?	Data Capture for monitoring period %	Data Capture 2009 %	Number of Exceedences of daily mean objective (50 µg/m <sup>3</sup> ) 98 <sup>th</sup> percentile of daily means in brackets.		
					2007 <sup>c</sup>	2008 <sup>c</sup>	2009 <sup>c</sup>
A	1 Example Site	N	98	95	0	3	2
ROMON	High St , Irvine	N	>90	83.8			1 (37µg/m <sup>3</sup> )



### **2.2.3 Sulphur Dioxide**

Monitoring for sulphur dioxide and smoke has been discontinued in North Ayrshire since 2004. Historical monitoring data is available for nearly every town in the area and there is no indication from these results that the air quality standard is likely to be breached even around local industrial sources.

Previous reviews concluded that:

1. The extensive smoke control programme undertaken by Cunninghame District Council has improved sulphur dioxide levels in the area due to the shift to natural gas and electricity.
2. The extensive historical monitoring programmes for sulphur dioxide in North Ayrshire has covered every urban area and results indicate the air quality standard continues to be met.
3. There is no need to progress to a detailed assessment for sulphur dioxide.
4. The rail link serving North Ayrshire is electrified therefore there are very few diesel-powered passenger trains each day. Goods trains on the network are diesel-powered. There are no major stockyards apart from those serving Hunterston coal terminal. These, however, are not within 15 metres of a relevant location. Neither are there any stations or signal junctions where diesel locomotives are likely to be stationary for 15 minutes or more within 15 metres of a relevant exposure.

There has been no evidence of any change to sulphur dioxide production or release in North Ayrshire. Similarly, there has been no development likely to result in any increase in sulphur dioxide levels at locations where there could be relevant public exposure.

### **2.2.4 Benzene**

No recent monitoring of benzene has been undertaken. However, previous reviews have concluded that:

1. There was no significant industrial source of benzene located either within North Ayrshire or neighbouring areas which is likely to adversely affect air quality within North Ayrshire.
2. There was no need to proceed to a detailed assessment for benzene.

Since the last report there has been no evidence of any change to benzene production or release in North Ayrshire. Similarly, there has been no development likely to result in any increase in benzene levels at locations where there could be relevant public exposure.

### **2.2.5 Other pollutants monitored**

#### **Radiation Monitoring**

North Ayrshire Council Radiation – Food and Environment Programme which involves collecting monthly samples of foods, soils, seawater, etc for analysis by Glasgow Scientific Services. Sampling programme for 2009/2010 is included in Appendix 22

Additional environmental monitoring is conducted by officers on a monthly basis using a portable Mini 680 monitor to measure background levels of radiation at 7 sites located throughout the district.

#### **Dust Deposition**

3 dust deposit gauges are located in Fairlie specifically to monitor dust from the coal stockyard at Clydeport Hunterston. The dust deposit gauges are checked every month in conjunction with the NO<sub>2</sub> diffusion tubes being changed. The samples are sent to Glasgow Scientific Services and analysed for total rainfall, pH, Total Dissolved Solids (TDS), Total Dried Undissolved Matter (TDUM), Combustible Matter and ash. Reports will include breakdown of additional parameters (metals etc) if detected at significant levels.

There are no British Standards with which to compare results. Assessment is based on any significant changes in the amount of particulate, etc which is present in the samples.

### **2.2.6 Summary of Compliance with AQS Objectives**

North Ayrshire Council has examined the results from monitoring in North Ayrshire. Concentrations are all below the objectives, therefore there is no need to proceed to a Detailed Assessment.

### **3 New Local Developments**

#### **3.1 Road Traffic Sources**

#### **3.2 Other Transport Sources**

#### **3.3 Industrial Sources**

#### **3.4 Commercial and Domestic Sources**

#### **3.5 New Developments with Fugitive or Uncontrolled Sources**

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



## **4 Conclusions and Proposed Actions**

### **4.1 Conclusions from New Monitoring Data**

Monitoring data for 2009 has shown all diffusion tubes and automatic monitoring sites comply with the  $40 \mu\text{g}/\text{m}^3$  NO<sub>2</sub> limit set out in the directive. There have been significant reductions in the annual mean concentration of in NO<sub>2</sub> Townhead Street/New Street, Dalry which was previously subject of a Detailed Assessment. The decision whether or not to declare an Air Quality Management Area for this site was delayed until more data was available to reflect potential changes due to the new traffic management scheme.

It was previously speculated that queuing traffic appeared to have increased as a result of the additional set of traffic lights and this may lead to a subsequent increase in NO<sub>2</sub> levels. However, monitoring data for the area has shown a decrease in annual mean concentration.

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

There are no implications from New Local Developments.

### **4.3 Proposed Actions**

NO<sub>2</sub> levels in the Detailed Assessment areas have continued to decline over the last 3 years. Some of the results are still borderline with annual means close to the  $40 \mu\text{g}/\text{m}^3$  limit, as such North Ayrshire Council will continue with the current monitoring regime and will not reduce the number of NO<sub>2</sub> diffusion tubes until long term trends are established, particularly in areas which have been subject to Detailed Assessments in the past.

Future reports will have the benefit of continuing the co-location study with a complete year of ratified and validated results which will afford increased confidence in final results.

North Ayrshire Council will continue to work closely with Strathclyde Partnership for Transport (SPT) in monitoring the public transport activities in High Street, Irvine to ensure best practices are adopted by operators.

Next course of action will be to submit the 2011 Air Quality Progress Report.

## **5       References**

1. Local Air Quality Management, Technical Guidance LAQM.TG (09), February 2009.
2. Spreadsheet of Bias Adjustment Factors, version 03/10, accessed at [www.uwe.ac.uk/aqm](http://www.uwe.ac.uk/aqm), March 2010. (Appendix 4)

# Appendices



## Appendix 1: QA:QC Data

### Diffusion Tube Bias Adjustment Factors

Tubes supplied and analysed by

Glasgow Scientific Services Glasgow City Council		
<b>Address:</b> Glasgow Scientific Services 64 Everard Drive Glasgow United Kingdom G211XG	<b>Contact:</b> Mr T Platt <b>Tel:</b> +44(0)141-276 0619 <b>Fax:</b> +44(0)141-276 0669	
Testing performed at permanent laboratory		

Diffusion Tube Bias Adjustment Factor for tubes provided by Glasgow Scientific Services is listed in Appendix 5. The resultant bias for Glasgow Scientific Services is **1.23** based on 4 studies with 2 poor precision and 2 good precision.

The bias factors for all national laboratories are listed in Appendix 6. It should be noted that the average bias factor is **0.90** and all factors greater than **1.00** have 50%-100% poor Tube Precision or are only based on a single study.

#### Factor from Local Co-location Studies

The automatic monitoring station (ROMON) has been operational since early 2009 and is the site being used for 3 co-location tubes. The unit is permanently located here and is not part of a shared scheme, which will now allow for full "calendar year" data to be collected.

The ROMON was commissioned in February 2009 but fortnightly QA/QC calibration checks were not in place until June. For this reason, AEA have only fully validated and ratified data from this point onwards.

Calibration checks were conducted by AEA in May and December. These correction factors were used to adjust the data from February to June. In the absence of the fortnightly rescaling checks being conducted, the correction factor was selected to give the highest results to reflect a worst case scenario.

Corresponding data was entered in the "Checking Precision and Accuracy of Triplicate Tubes" spreadsheet provided by AEA Energy & Environment (Appendix 7). The resulting Bias factor is **0.96**.

#### Discussion of Choice of Factor to Use

Local Air Quality Management Technical Guidance LAQM TG (09) explains that where the Review and Assessment Helpdesk spreadsheet contains data from fewer than 5 other studies using the same laboratory, then the co-location study is preferred. It should also be noted that 50% of the studies listed for Glasgow Scientific Services have poor precision, further undermining the confidence in the 1.23 correction factor.

The co-location study for North Ayrshire Council has “good” precision and high quality results from the ROMON, supporting the case for the use of the locally obtained bias adjustment factor which is shown to be more representative.

Figure 4.2 charts the trends of NO<sub>2</sub> since 2000 and contains a number of long term monitoring sites. This chart clearly illustrates that applying the 0.96 bias correction factor places the majority of the long term background sites at elevated levels of NO<sub>2</sub> than previous years and the significant reductions are only observed in the areas of previous detailed assessments. This gives increased confidence that the reductions of NO<sub>2</sub> levels are genuine and not an artificial blanket reduction of all NO<sub>2</sub> results from the selection of a lower bias factor.

The 0.96 bias correction factor has been selected because data and trends observed when using this factor show the most representative picture of NO<sub>2</sub> levels within the area North Ayrshire Council.

### **PM Monitoring Adjustment**

PM10 data handled and ratified by AEA. Air Pollution Report for North Ayrshire, Irvine High Street for 1<sup>st</sup> January 2009 to 31<sup>st</sup> December 2009 is included in Appendix 2

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

The automatic monitoring station (ROMON) is calibrated and data rescaled every 2 weeks. All checks are carried out in accordance with procedures laid out by AEA Technologies and calibration check sheets are forwarded to them after each visit. The site is visited by AEA engineers every 6 months to carry out calibration tests (certificate included in Appendix 2).

As detailed above, there were initial teething problems with the automatic monitoring unit in the first few weeks after commissioning. Data has been collected since February 2009, however, the fortnightly checks were only consistently conducted since June 2009, and hence only the last 6 months of collected data has been ratified by AEA.



## Appendix 2: AEA Air Pollution Report

# Air Pollution Report

Produced by AEA on behalf of the Scottish Government

### NORTH AYRSHIRE IRVINE HIGH ST 1<sup>st</sup> January to 31<sup>st</sup> December 2009

These data have been fully ratified by AEA

POLLUTANT	PM <sub>10</sub> <sup>*,+</sup>	NO <sub>2</sub>	NO <sub>x</sub>
Number Very High	0	0	-
Number High	0	0	-
Number Moderate	0	0	-
Number Low	7187	4473	-
Maximum 15-minute mean	130 µg m <sup>-3</sup>	340 µg m <sup>-3</sup>	1083 µg m <sup>-3</sup>
Maximum hourly mean	130 µg m <sup>-3</sup>	126 µg m <sup>-3</sup>	838 µg m <sup>-3</sup>
Maximum running 8-hour mean	76 µg m <sup>-3</sup>	106 µg m <sup>-3</sup>	521 µg m <sup>-3</sup>
Maximum running 24-hour mean	57 µg m <sup>-3</sup>	83 µg m <sup>-3</sup>	357 µg m <sup>-3</sup>
Maximum daily mean	53 µg m <sup>-3</sup>	73 µg m <sup>-3</sup>	286 µg m <sup>-3</sup>
Average	18 µg m <sup>-3</sup>	26 µg m <sup>-3</sup>	88 µg m <sup>-3</sup>
Data capture	83.8 %	51.1 %	51.1 %

\* PM<sub>10</sub> Indicative Gravimetric Equivalent µg m<sup>-3</sup>

+ PM<sub>10</sub> instruments:

BAM using a gravimetric factor of 0.83333 for Indicative Gravimetric Equivalent from 12<sup>th</sup> February 2009

All mass units are at 20°C and 1013mb

NO<sub>x</sub> mass units are NO<sub>x</sub> as NO<sub>2</sub> µg m<sup>-3</sup>

Pollutant	Air Quality Regulations (2000) and Air Quality (Scotland) Amendment Regulations 2002	Exceedences	Days
PM <sub>10</sub> Particulate Matter (Gravimetric)	Daily mean > 50 µg m <sup>-3</sup>	1	1
PM <sub>10</sub> Particulate Matter (Gravimetric)	Annual mean > 18 µg m <sup>-3</sup>	0	-
Nitrogen Dioxide	Annual mean > 40 µg m <sup>-3</sup>	0	-
Nitrogen Dioxide	Hourly mean > 200 µg m <sup>-3</sup>	0	0

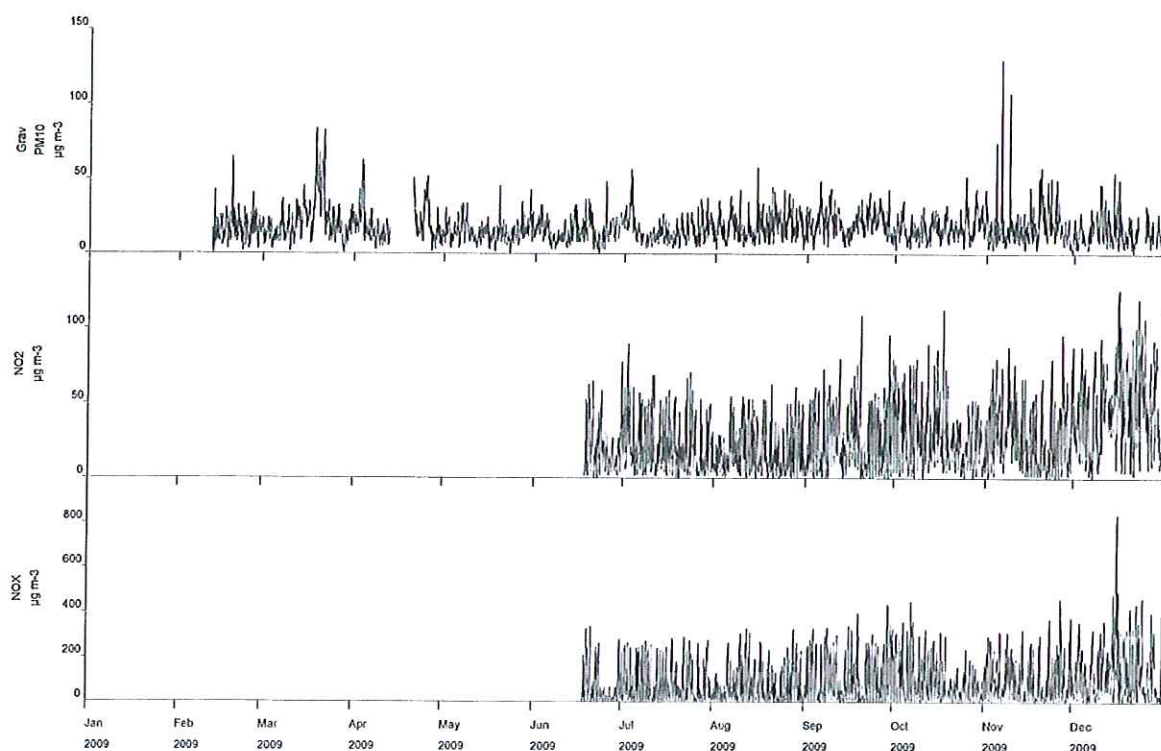


## Appendix 2: AEA Air Pollution Report (cont)

# Air Pollution Report

Produced by AEA on behalf of the Scottish Government

**North Ayrshire Irvine High St Air Monitoring**  
**Hourly Mean Data for 1<sup>st</sup> January to 31<sup>st</sup> December 2009**



Stephen Stratton  
Ambient Air Quality Monitoring  
AEA  
Glengarnock Technology Centre  
Caledonian Road  
Lochshore Business Park  
Glengarnock  
Ayrshire  
KA14 3DD

Email: [Stephen.Stratton@aeat.co.uk](mailto:Stephen.Stratton@aeat.co.uk)  
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Fax: 0870 190 5151



## Appendix 2: AEA Air Pollution Report (cont)



### CERTIFICATE OF CALIBRATION

Glengarnock Technology Centre, Caledonian Road, Lochshore Business Park, Glengarnock,  
Ayrshire, KA14 3DD. Telephone 0870 1905269 Fax 0870 1905151



Approved Signatories:

K. Stevenson

S. Stratton ✓

Signed:

Date: 23<sup>rd</sup> March 2010

Date of issue:

23<sup>rd</sup> March 2010

Cert No: 2250

Page 1 of 3

Customer Name and Address:

Scottish Government  
Water, Air, Soils and Flooding Division  
Environmental Quality Directorate  
Scottish Government  
Victoria Quay  
Edinburgh  
EH6 6QQ

Description:

Calibration factors for North Ayrshire Council's Irvine High  
Street air monitoring station.

AEA Identification Number:

43060/NAYR/A1A2

Site / Date Test Carried Out	Species	Analyser Serial No.	Zero Response <sup>1</sup>	Uncertainty (ppb)	Calibration Factor <sup>2</sup>	Uncertainty %	Converter eff. (%) <sup>3</sup>
Irvine High Street 19 <sup>th</sup> May 2009	NOx	29818873	1.0	5.3	0.9913	5.0	100.4
	NO	29818873	-0.7	5.0	0.9963	5.0	N/A
Irvine High Street 15 <sup>th</sup> Dec 2009	NOx	29818873	1.0	5.0	1.0483	5.0	96.5
	NO	29818873	-1.0	5.0	1.0394	5.0	N/A

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.  
This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to recognised national standards, and to units of measurement realised at the National Physical Laboratory or other recognised national standards Laboratories. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

## Appendix 2: AEA Air Pollution Report (cont)

Date of issue:

23<sup>rd</sup> March 2010

Cert No: 2250

Page 2 of 3

AEA Identification Number:

43060/NAYR/A1A2

Site / Date Test Carried Out	Species	Analyser Serial No.	Parameter	Specified Value	Measured Value	Deviation %
Irvine High Street 19 <sup>th</sup> May 2009	BAM PM <sub>10</sub>	H3190	Main Flow	16.67	15.82	-5.1
Irvine High Street 15 <sup>th</sup> Dec 2009	BAM PM <sub>10</sub>	H3190	Main Flow	16.67	13.12	-20.3

### Uncertainties:

TEOM PM<sub>10</sub>

Main Flow

±2.2%

Total Flow

±2.2%

Aux Flow

±2.2%

k<sub>0</sub>

±1.0%



## Appendix 3: Bias Factor Spreadsheet GSS

Spreadsheet Version Number: 03/10											
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											
This spreadsheet will be updated every few months: the factors may therefore be subject to change. This should not discourage their immediate use.											
Published by Air Quality Consultants Ltd on behalf of Defra, the Welsh Assembly Government, the Scottish Government and the Department of the Environment Northern Ireland											
R&A website											
This spreadsheet will be updated in late September 2010 on the											
<b>Step 1:</b>											
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.											
<b>Step 2:</b>											
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.											
<b>Step 3:</b>											
Select a Year from the Drop-Down List											
If a year is not shown, we have no data											
<b>Step 4:</b>											
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 <sup>3</sup> shown in blue at the foot of the final column.											
If you have your own co-location study then see footnote <sup>4</sup> . If uncertain what to do then contact the Review and Assessment Helpdesk 0117 328 3668 adm-review@uwe.ac.uk.											
Analysed By <sup>1</sup>	Method	Year <sup>5</sup>	Site Type	Local Authority	Length of Study (months)	Diffusion Tube Mean Conc. (µg/m3)	Monitor Mean Conc. (Cm)	Bias (B)	Tube Precision <sup>6</sup>	Bias Adjustment Factor (A) (Cm/Dm)	
Glasgow Scientific Services	20% TEA in Water	2009	R	East Dunbartonshire Council	12	28	33	-17.7%	P	1.21	
Glasgow Scientific Services	20% TEA in Water	2009	R	East Dunbartonshire Council	12	35	40	-12.3%	G	1.14	
Glasgow Scientific Services	20% TEA in Water	2009	R	East Dunbartonshire Council	11	30	43	-29.2%	P	1.41	
Glasgow Scientific Services	20% TEA in Water	2009	K	AEA Tech Intercomparison	11	92	108	-14.5%	G	1.17	
Glasgow Scientific Services	20% TEA in Water	2009									
Overall Factor <sup>3</sup> (4 studies)										Use	1.23



## Appendix 4: Bias Factor Spreadsheet National Results

Spreadsheet Version Number: 03/10									
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									
This spreadsheet will be updated every few months: the factors may therefore be subject to change. This should not discourage their immediate use.									
Published by Air Quality Consultants Ltd on behalf of Defra, the Welsh Assembly Government, the Scottish Government and the Department of the Environment Northern Ireland									
R&A website									
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									
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 <sup>3</sup> shown in blue at the foot of the final column.									
If you have your own co-location study then see footnote <sup>4</sup> . If uncertain what to do then contact the Review and Assessment Helpdesk 0117 328 3668 aqm-review@uwe.ac.uk									
Analysed By	Method	Year <sup>5</sup>	Local Authority	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) (µg/m <sup>3</sup> )	Monitor Mean Conc. (Cm)	Bias (B)	Tube Precision <sup>6</sup>	Bias Adjustment Factor (A) (Cm/Dm)
Tayside SS	20% TEA in Water	2009	Overall Factor <sup>3</sup> (3 studies)				Use		0.77
Cardiff Scientific Services	50% TEA in Acetone	2009	Overall Factor <sup>3</sup> (5 studies)				Use		0.84
Edinburgh Scientific Services	50% TEA in Acetone	2008	Overall Factor <sup>3</sup> (2 studies)				Use		0.95
Glasgow Scientific Services	20% TEA in Water	2009	Overall Factor <sup>3</sup> (4 studies)				Use		1.23
Gradko	20% TEA in Water	2009	Overall Factor <sup>3</sup> (33 studies)				Use		0.90
Gradko	50% TEA in Acetone	2009	Overall Factor <sup>3</sup> (15 studies)				Use		0.99
Harwell Scientific Services	50% TEA in Acetone	2009	Overall Factor <sup>3</sup> (19 studies)				Use		0.81
Northampton BC	20% TEA in Water	2009	Overall Factor <sup>3</sup> (3 studies)				Use		0.72
South Yorkshire Labs	50% TEA in Acetone	2009	Overall Factor <sup>3</sup> (8 studies)				Use		0.91
Staffordshire Scientific Services	20% TEA in Water	2009	Overall Factor <sup>3</sup> (9 studies)				Use		0.81
West Yorkshire Analytical Services	50% TEA in Acetone	2009	Overall Factor <sup>3</sup> (12 studies)				Use		0.86
Aberdeen CC	20% TEA in Water	2008	Overall Factor <sup>3</sup> (5 studies)				Use		0.93
Bristol Scientific Services	20% TEA in Water	2009	Overall Factor <sup>3</sup> (2 studies)				Use		0.84
Edinburgh Scientific Services	50% TEA in Acetone	2009	Overall Factor <sup>3</sup> (2 studies)				Use		0.95
Environmental Scientific Groups	20% TEA in Water	2009	Overall Factor <sup>3</sup> (8 studies)				Use		0.81
Lambeth Scientific Services	50% TEA in Acetone	2009	Overall Factor <sup>3</sup> (2 studies)				Use		1.03
Milton Keynes Council	20% TEA in Water	2009	Overall Factor <sup>3</sup> (3 studies)				Use		0.79
Walsall MBC	50% TEA in Acetone	2009	Overall Factor <sup>3</sup> (6 studies)				Use		1.17

5/5 good  
2/2 good  
2/4 poor  
25/33 good  
12/15 good  
15/19 good  
3/3 good  
8/8 good  
9/9 good  
7/12 good  
1/1 good  
1/2 poor  
2/2 good  
7/8 good  
1/1 good  
3/3 good  
5/5 poor



## Appendix 5: Diffusion Tube Accuracy NAC

## Checking Precision and Accuracy of Triplicate Tubes



Period	Diffusion Tubes Measurements								
	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 μgm <sup>-3</sup>	Tube 2 μgm <sup>-3</sup>	Tube 3 μgm <sup>-3</sup>	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean
1	08.01.09	06.02.09	25.3	28.6	33.5	29	4.1	14	10.2
2	06.02.09	03.03.09	39.8	30.4	41.3	37	5.9	16	14.7
3	03.03.09	31.03.09	35.3	37.1	39.5	37	2.1	6	5.2
4	31.03.09	30.04.09	30.4	32.7	32.9	32	1.4	4	3.5
5	30.04.09	04.06.09	22.8	29.3	22.2	25	3.9	16	9.8
6	04.06.09	01.07.09	19.9	21.9	23.3	22	1.7	8	4.2
7	01.07.09	29.07.09	27.4	28.1	30.0	29	1.3	5	3.3
8	29.07.09	02.09.09	19.0	16.9	19.1	18	1.2	7	3.1
9	02.09.09	29.09.09		37.5	31.2	34	4.5	13	40.0
10	29.09.09	04.11.09	32.0	32.1	31.1	32	0.6	2	1.4
11	04.11.09	02.12.09	32.4	23.2	25.3	27	4.8	18	12.0
12	02.12.09	06.01.10	48.6	48.7	44.0	47	2.7	6	6.7
13									

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

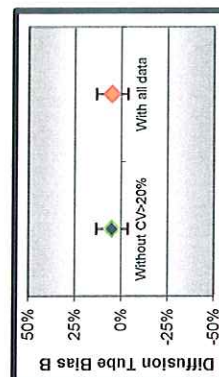
Site Name/ ID:	Automatic Monitoring Site
Accuracy	(with 95% confidence interval)
without periods with CV larger than 20%	
Bias calculated using 11 periods of data	
Bias factor A	0.96 (0.89 - 1.04)
Bias B	4% (-4% - 13%)
Diffusion Tubes Mean:	31 $\mu\text{m}^3$
Mean CV (Precision):	9
Automatic Mean:	30 $\mu\text{m}^3$
Data Capture for periods used:	95%
Adjusted Tubes Mean:	30 (28 - 32) $\mu\text{m}^3$

Precision	12 out of 12 periods have a CV smaller than 10%
Accuracy	(with 95% confidence interval)
WITH ALL DATA	
Bias calculated using 11 periods of data	
Bias factor A	0.96 (0.89 - 1.04)
Bias B	4% (-4% - 13%)
Diffusion Tubes Mean:	31 $\mu\text{g m}^{-3}$
Mean CV (Precision):	9
Automatic Mean:	30 $\mu\text{g m}^{-3}$
Data Capture for periods used:	95%
Adjusted Tubes Mean:	30 (28 - 32) $\mu\text{g m}^{-3}$

**Overall survival**  
**smaller than 20%**

Automatic Method			Data Quality Check		
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data		
70	4.3	Good	Good	Good	
36	82.1	Good	Good	Good	
36	97.5	Good	Good	Good	
30	97	Good	Good	Good	
26	96.8	Good	Good	Good	
24	96.8	Good	Good	Good	
22	95.9	Good	Good	Good	
18	95.8	Good	Good	Good	
28	93.5	Good	Good	Good	
28	95.9	Good	Good	Good	
30	97.1	Good	Good	Good	
48	97.1	Good	Good	Good	

Good precision	Poor Overall DC
(Check average CV & DC from Accuracy calculations)	



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Version 03 - November 2006



## Appendix 5: Diffusion Tube Accuracy NAC (cont)

Diffusion Tube Measurements														
Site Name/ID	Periods													Valid periods
	1	2	3	4	5	6	7	8	9	10	11	12	13	
1. Cunninghame House	15.9	12.8	13.6	12.9	7.9	5.2	7.6	7.3	9.7	14.1	18.1	28.9		12
2. East Road, Irvine	25.2	23.7	29.7	27	21.1	19.1	18.8	15.9	21.3	25.9	29.3	55		12
3. Irvine Police Station	16.3	14.5	12.5	15.3	11	7.8	7.7	7	6.1	15.1	16.1	30.8		12
4. 70 High St Irvine	23	24.5	29	28.5	20.5	19.7	19.1	11.9	19.5	28.3	27.9	63.8		12
5. 18 Bank St, Irvine	3.6	27.9	35.2	37.0	23.8	16.8	19.4	20.5	23.4	25.7	32.3	54.7		12
6. 19 Bank St Irvine	26.5	25.6	24.9	30.2	19.5	15.6	20.8	17	22.5	24.1	23.3	40.3		12
7. 147 High Street, Irvine	32.4	31.4	30.8	32.5	16.7	15.2	20.8	21.8	29.2	29.8	34.8	71.7		12
8. 3 Bridgegate, CCTV Camera	16.8	29.1	23.6	25.9	17	17.1	13.8		15.2	23.9	21.5	45.9		11
9. 97 High St, Irvine LOW	28.3	30.3	39.5	33.8	25.8	20.4	23.3	19.1	25.3	30.1	31.2	44.1		12
10. 97 High St, Irvine HIGH	26.0	31.8	39.6	43.4	22.1	18.6	24.7	22.2	25.3	28.7	31.2	52.5		12
11. 91 High St, Irvine LOW	38.4	36.5	34.2	36.1	25.7	23.1	32.1	25.2	28.2	30.7	31.8	55.7		12
12. 85 High St, Irvine	26.8	30.1	37.6	32.2	25.5	19.4	28.8	25.8	28.6	29.4	25.2	32.5		12
13. 79 High St, Irvine	34.6	49.1	50.1	34.5	32.7	26	28.7	43	46.7	43.6	37.7	37.2		12
14. 75 High St, Irvine LOW	48.8	43.3	47.8	35	32.6	22.4	41	13.4	46.9	30.8		39.1		11
15. 75 High St, Irvine HIGH	36.3	39.2	34.3	38.4	28	29.2	38.9	29	35.8	41.1	53.5	62		12
16. 71 High St, Irvine	22.0	26.8	35.4	30	27.3	24.7		20.1	31.3	34.2	29.3	47.8		11
17. 65a High Street, Irvine	25.3	39.8	35.3	30.4	22.8	19.9	27.4	19	9.7	32	32.4	48.6		12
18. 65 High Street, Irvine	28.6	30.4	37.1	32.7	29.3	21.9	28.1	16.9	37.5	32.1	23.2	48.7		12
19. 63 High Street, Irvine	33.5	41.3	39.5	32.9	22.2	23.3	30	19.1	31.2	31.1	25.3	44		12
20. 34 Kirkgate Irvine	16.7	13.8	13.1	11.2	6.9		29.1	5.5	31.8	11.8	14.6	33.5		11
21. Eglinton Street Irvine	25.2	26.7	24.1	34.1	21.5	18.5	5.1	24.7	27.2	30	27.9	58.8		12
22. 25 Main Rd, Springside	18.4	21.1	19.7	12.1	11.2	9.5	23.5	9.6	11.6	19.1	16.2	39.3		12
23. Main St, Drybridge	15	12	15.4	17.6	8.5	8.3	9.8	5.7	9.5	12.5	13.8	25.4		12
24. Auchengate (Bridge)	19.3	21.7	17.7	26.2	9.2	9.4	6.5	10.2	12	15.3	15.2	22.8		12
25. Dairy Rd , Kilwinning	23.5	26.7	30.4	13.7	6.3	16.2	10	16.3	21.4	32	24.6	44.2		12

The bias adjustment factor used in these calculations include all the data and no screening of data due to poor precision has been applied.

Adjusted measurement confidence interval) with all the data		(95%)
11 periods used in this calculations		
Bias Factor A 0.96 (0.89 - 1.04)		
Bias B 4% (-4% - 13%)		
Tube Precision: 9 Automatic DC: 95%		
Adjusted with 95% CI	12	(11 - 13)
Adjusted with 95% CI	25	(23 - 27)
Adjusted with 95% CI	13	(12 - 14)
Adjusted with 95% CI	25	(23 - 27)
Adjusted with 95% CI	26	(24 - 28)
Adjusted with 95% CI	23	(22 - 25)
Adjusted with 95% CI	29	(27 - 32)
Adjusted with 95% CI	22	(20 - 24)
Adjusted with 95% CI	28	(26 - 30)
Adjusted with 95% CI	29	(27 - 32)
Adjusted with 95% CI	32	(29 - 34)
Adjusted with 95% CI	27	(25 - 30)
Adjusted with 95% CI	37	(34 - 40)
Adjusted with 95% CI	35	(32 - 38)
Adjusted with 95% CI	37	(35 - 40)
Adjusted with 95% CI	29	(27 - 31)
Adjusted with 95% CI	27	(25 - 30)
Adjusted with 95% CI	29	(27 - 32)
Adjusted with 95% CI	30	(28 - 32)
Adjusted with 95% CI	16	(15 - 18)
Adjusted with 95% CI	26	(24 - 28)
Adjusted with 95% CI	17	(16 - 18)
Adjusted with 95% CI	12	(11 - 13)
Adjusted with 95% CI	15	(14 - 16)
Adjusted with 95% CI	21	(20 - 23)

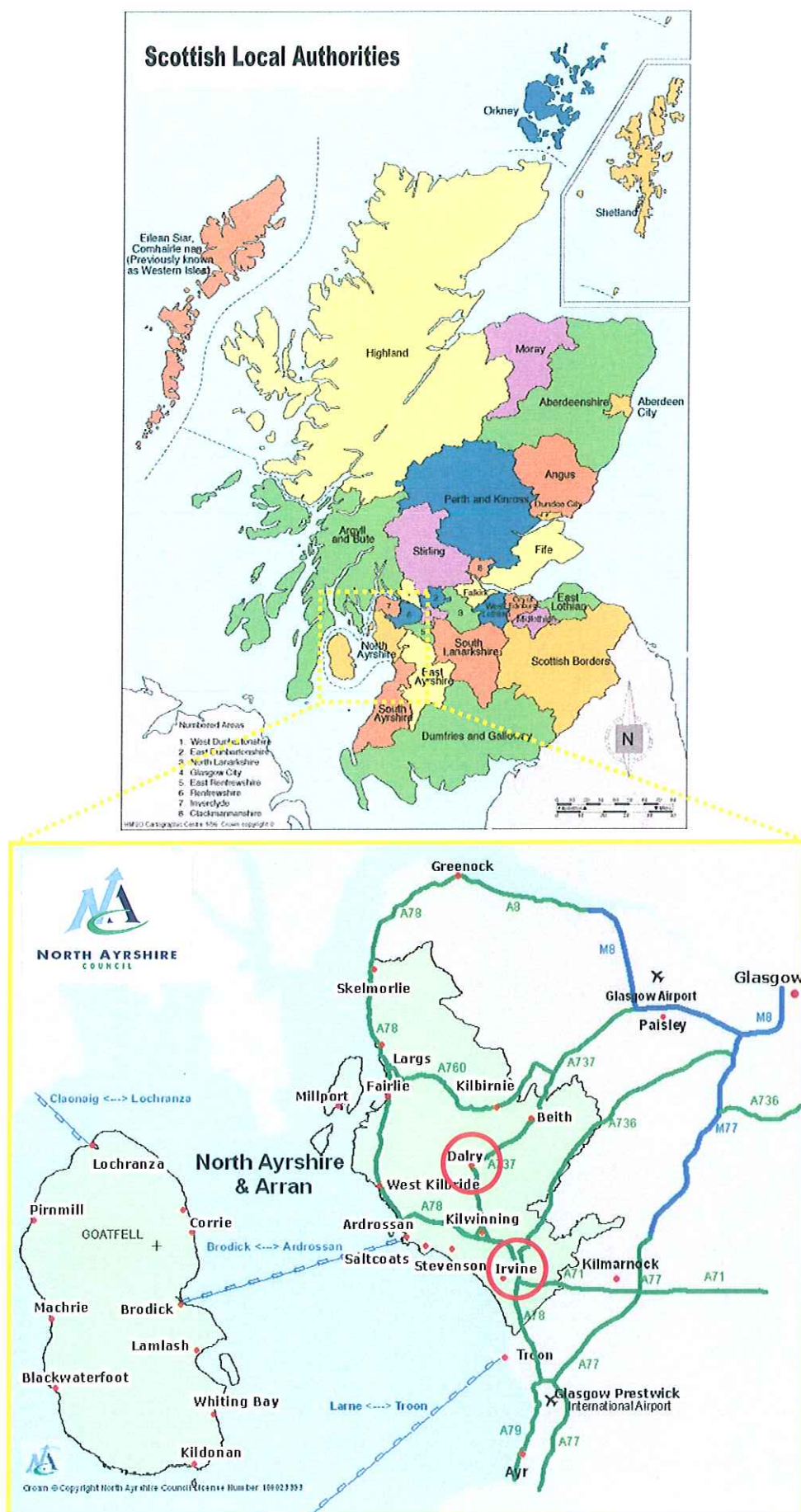


## Appendix 5: Diffusion Tube Accuracy NAC (cont)

## Adjustment of SINGLE Tubes

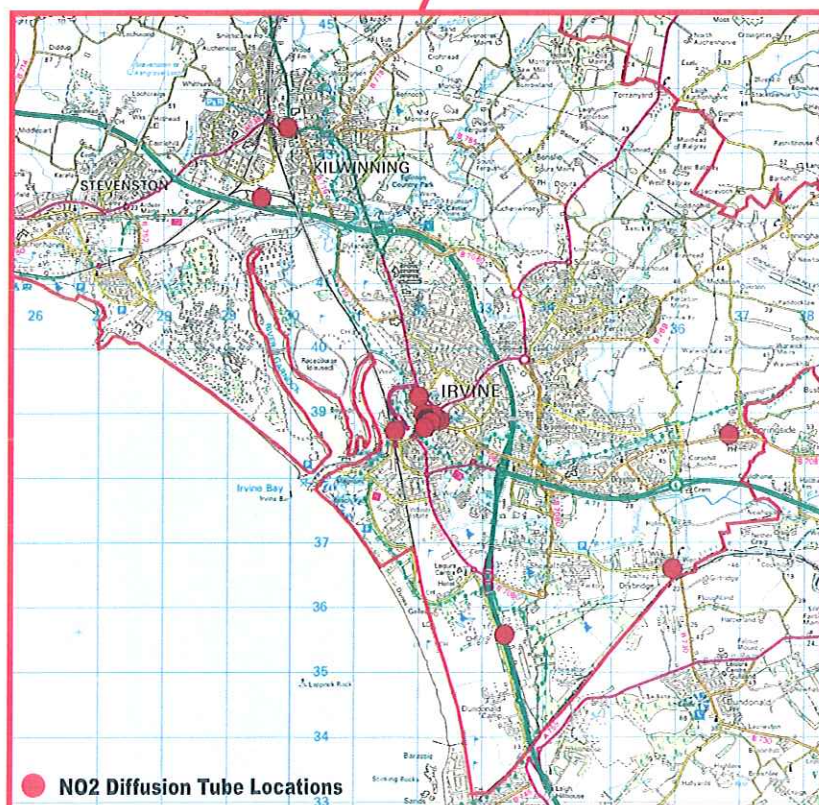
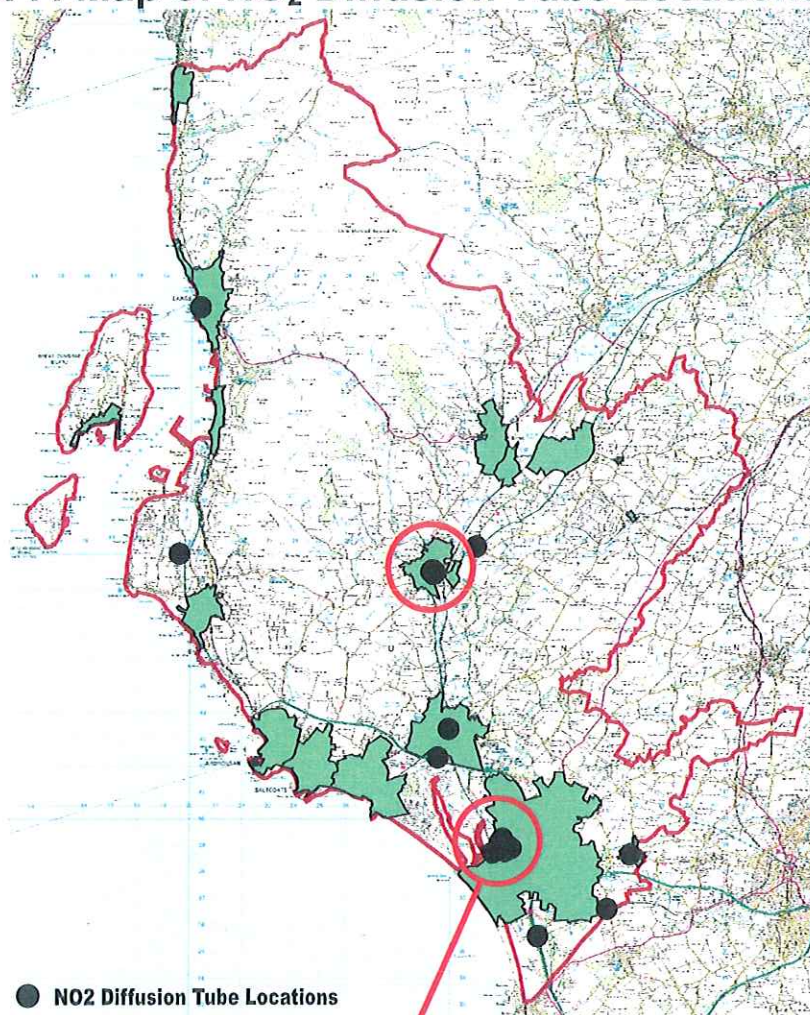
[illegible]

## Appendix 6: Map of Locality & Surrounding Area





## Appendix 7: Map of NO<sub>2</sub> Diffusion Tube Locations

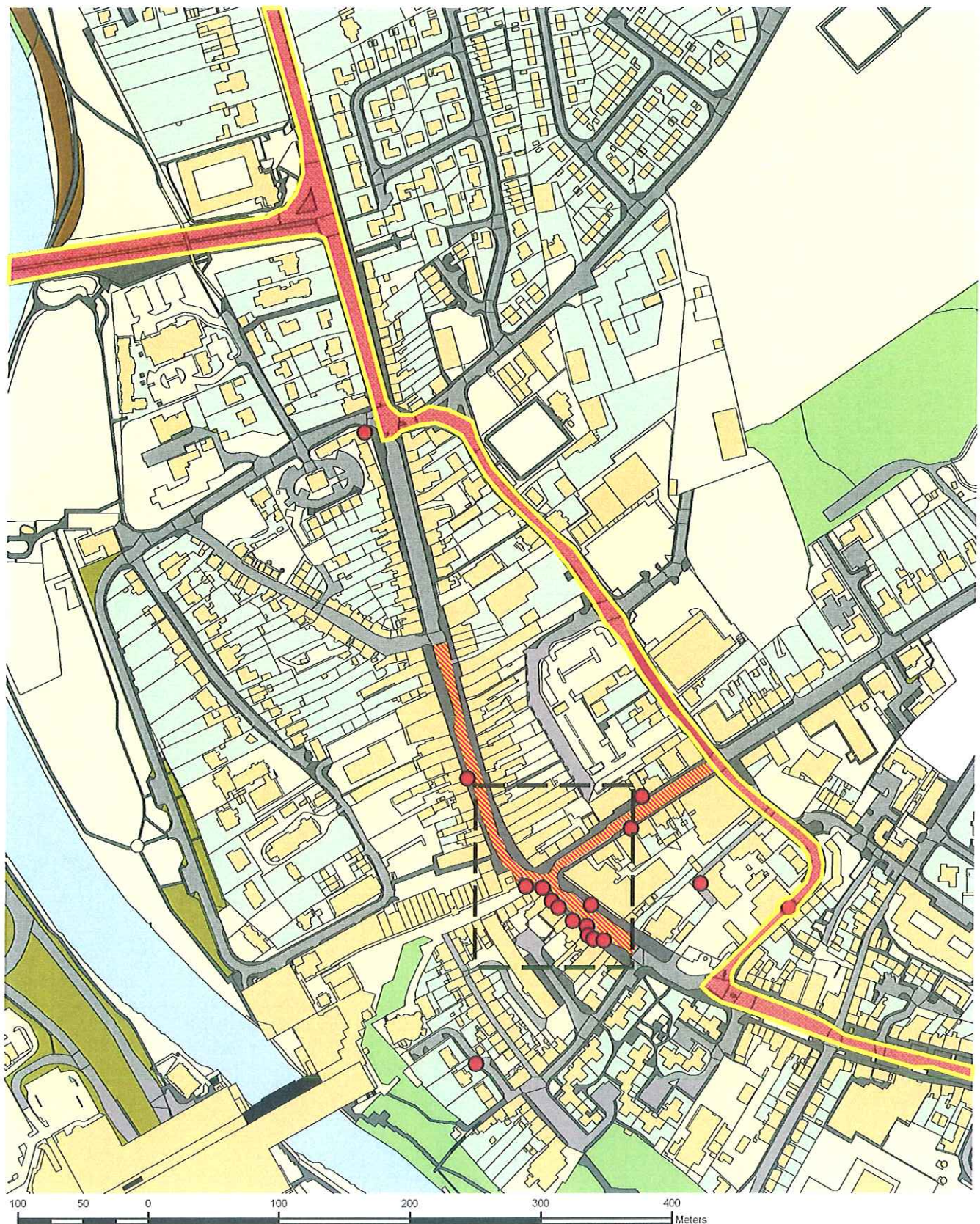


# **Irvine Area**

## **Appendices 8 to 12**



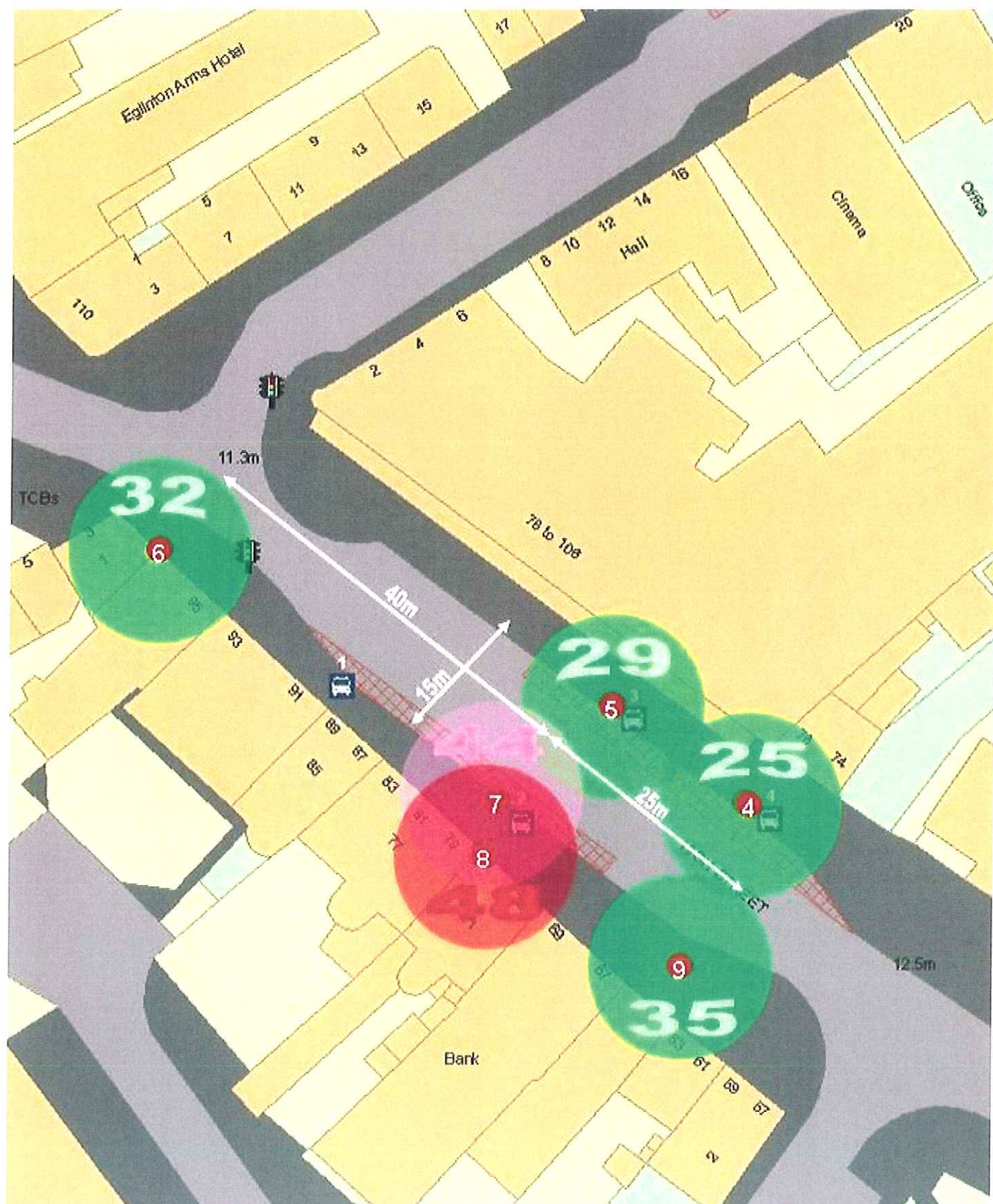
## Appendix 8 Irvine Town Centre



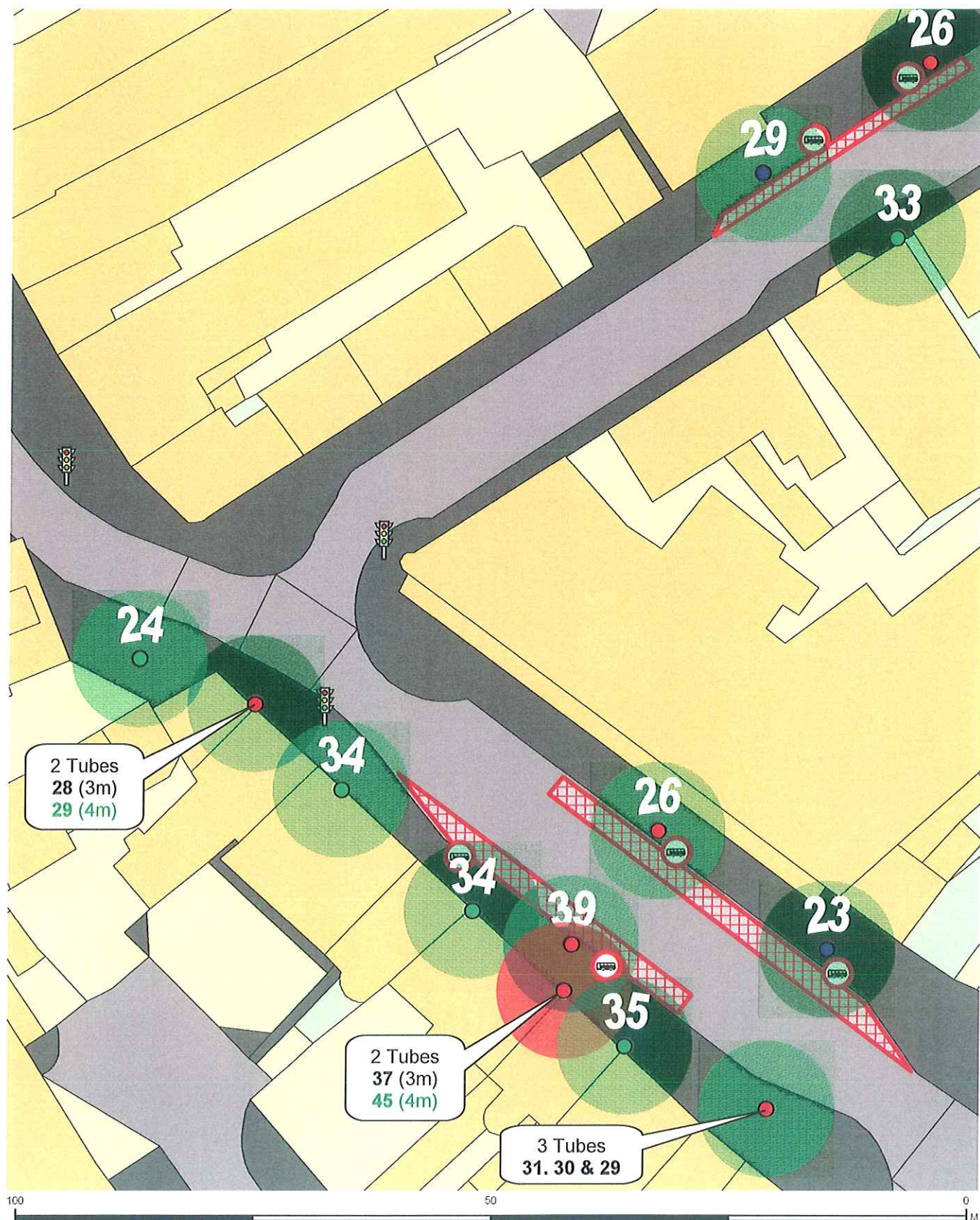
- Main traffic route**
- Restricted Area (buses, taxis & loading only)**
- NO2 diffusion tubes**



# Appendix 9: Irvine, High St (2007) NO<sub>2</sub> µg/m<sup>3</sup>

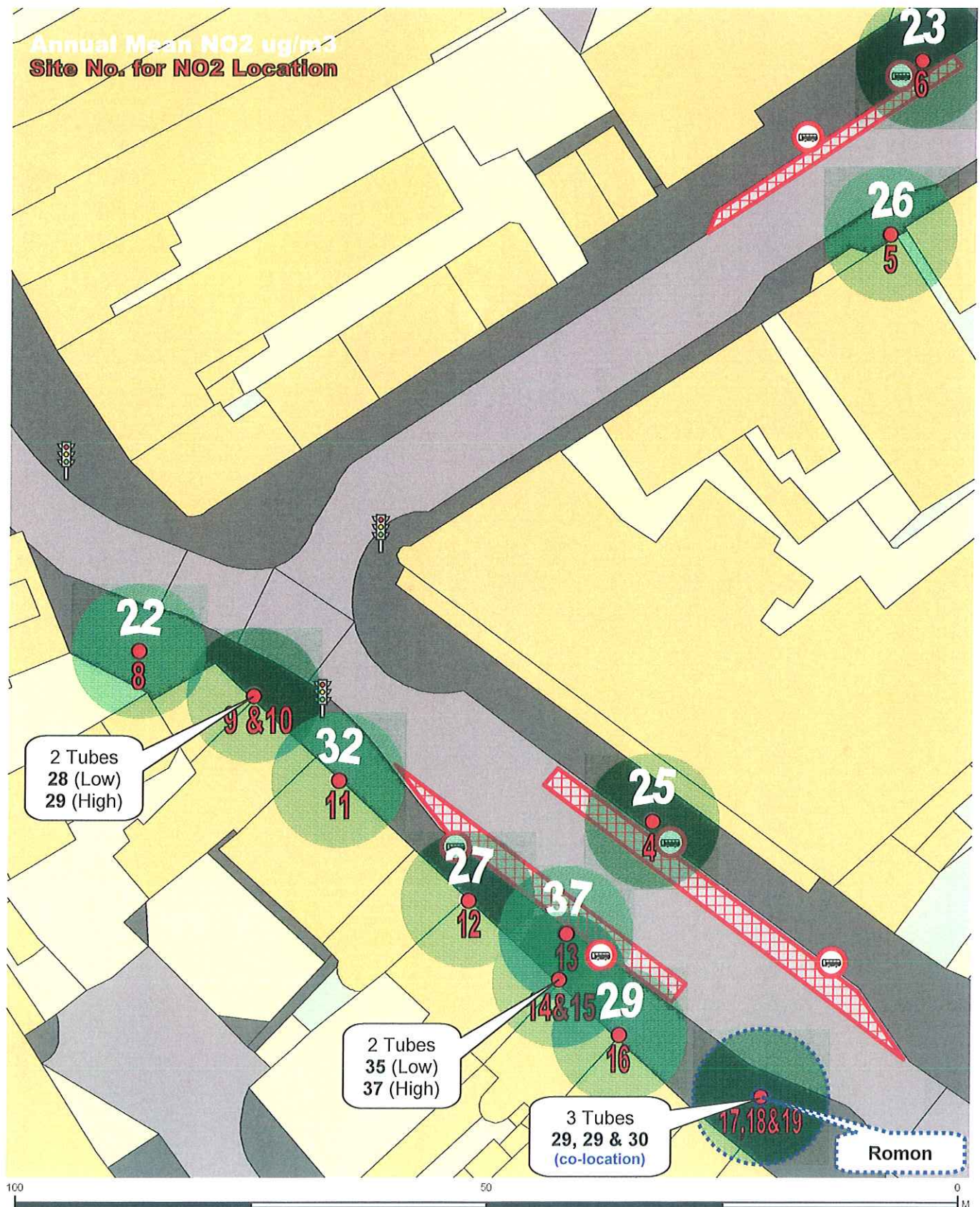




**Appendix 10: Irvine, High St (2008)  $\text{NO}_2$   $\mu\text{g}/\text{m}^3$** 

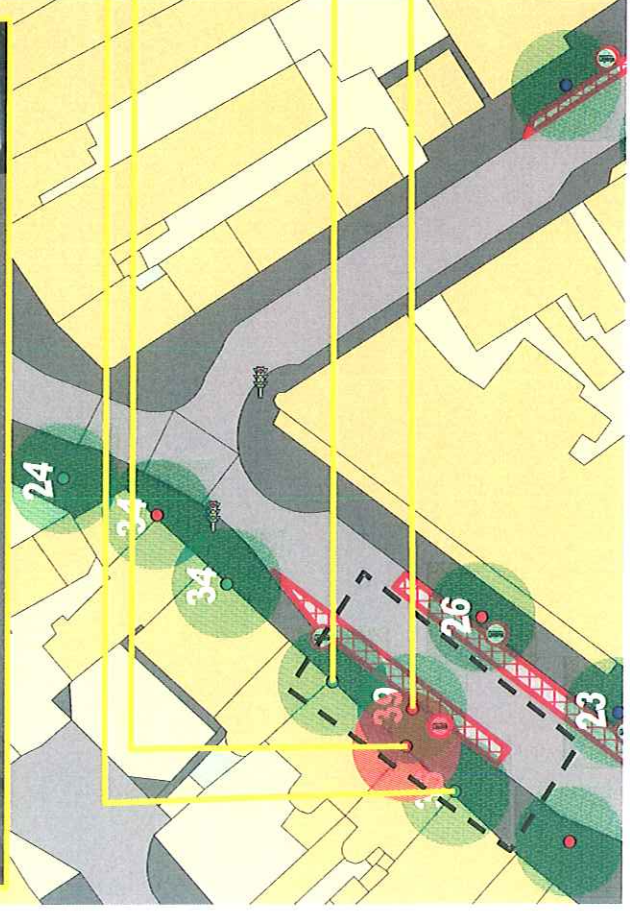
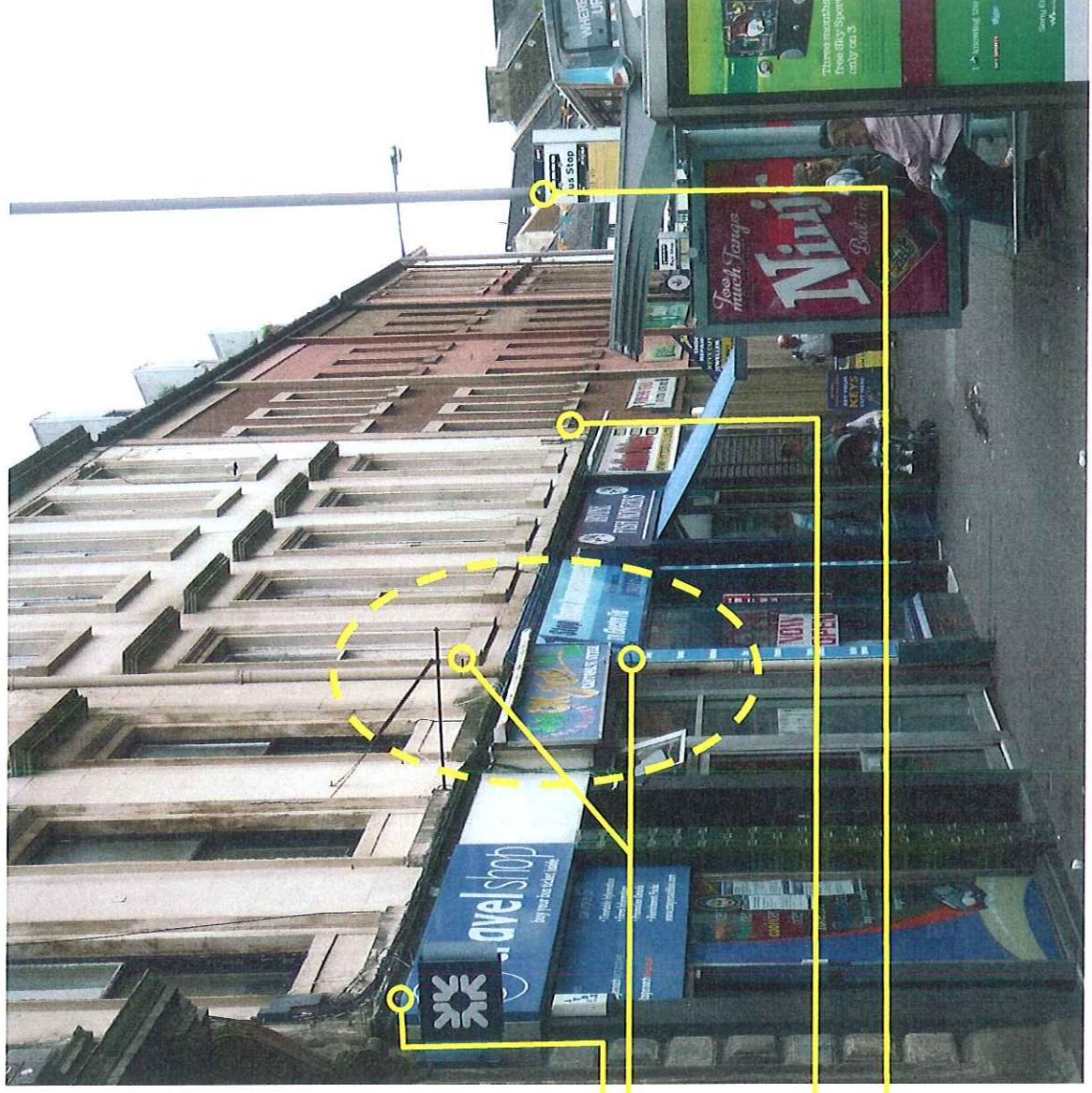
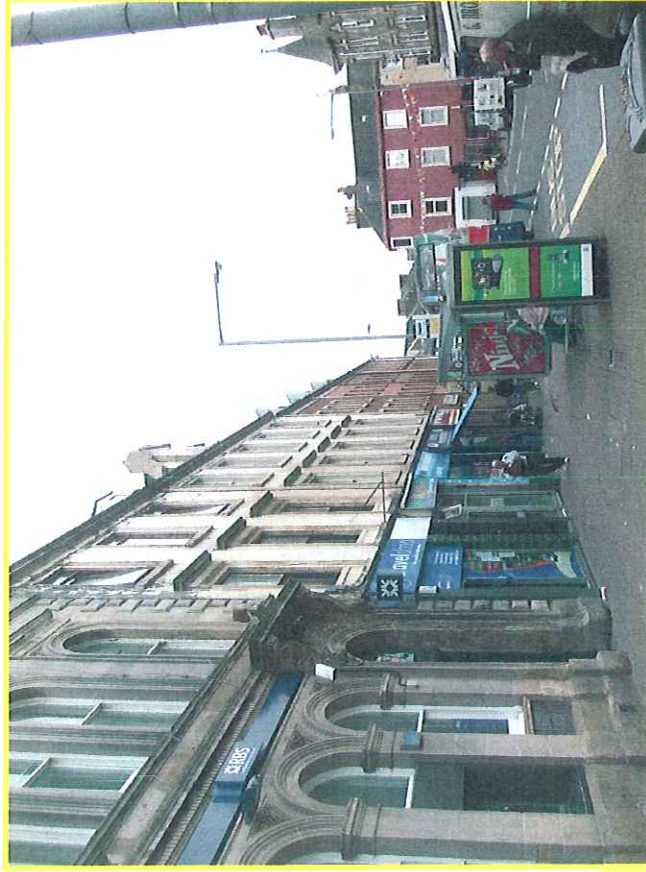


# Appendix 11: Irvine, High St (2009) NO<sub>2</sub> µg/m<sup>3</sup>





## Appendix 12: Irvine, High St – Hot Spot

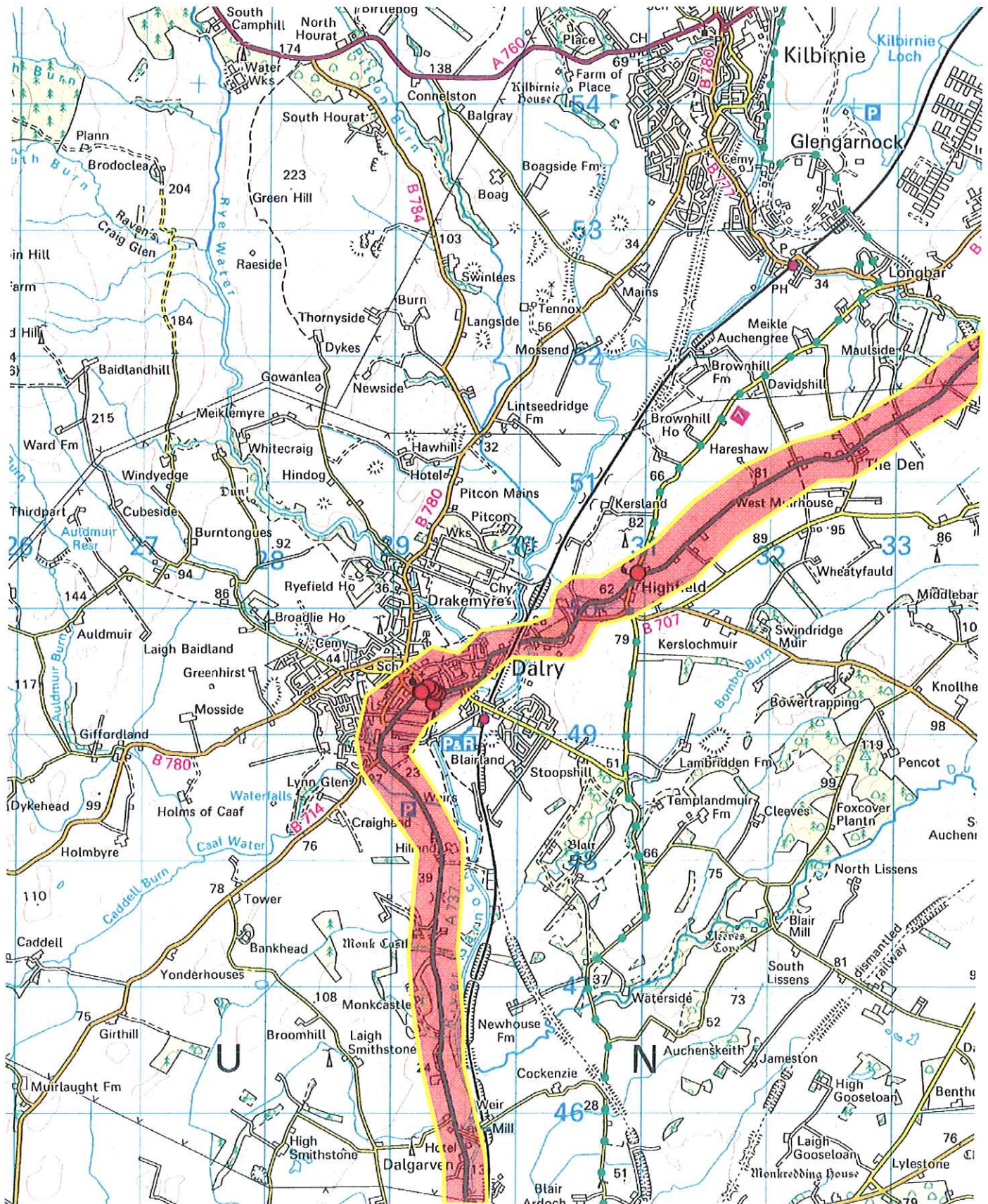


# **Dalry Area**

## **Appendices 13 to 18**



## Appendix 13: Dalry (Ordnance Survey)

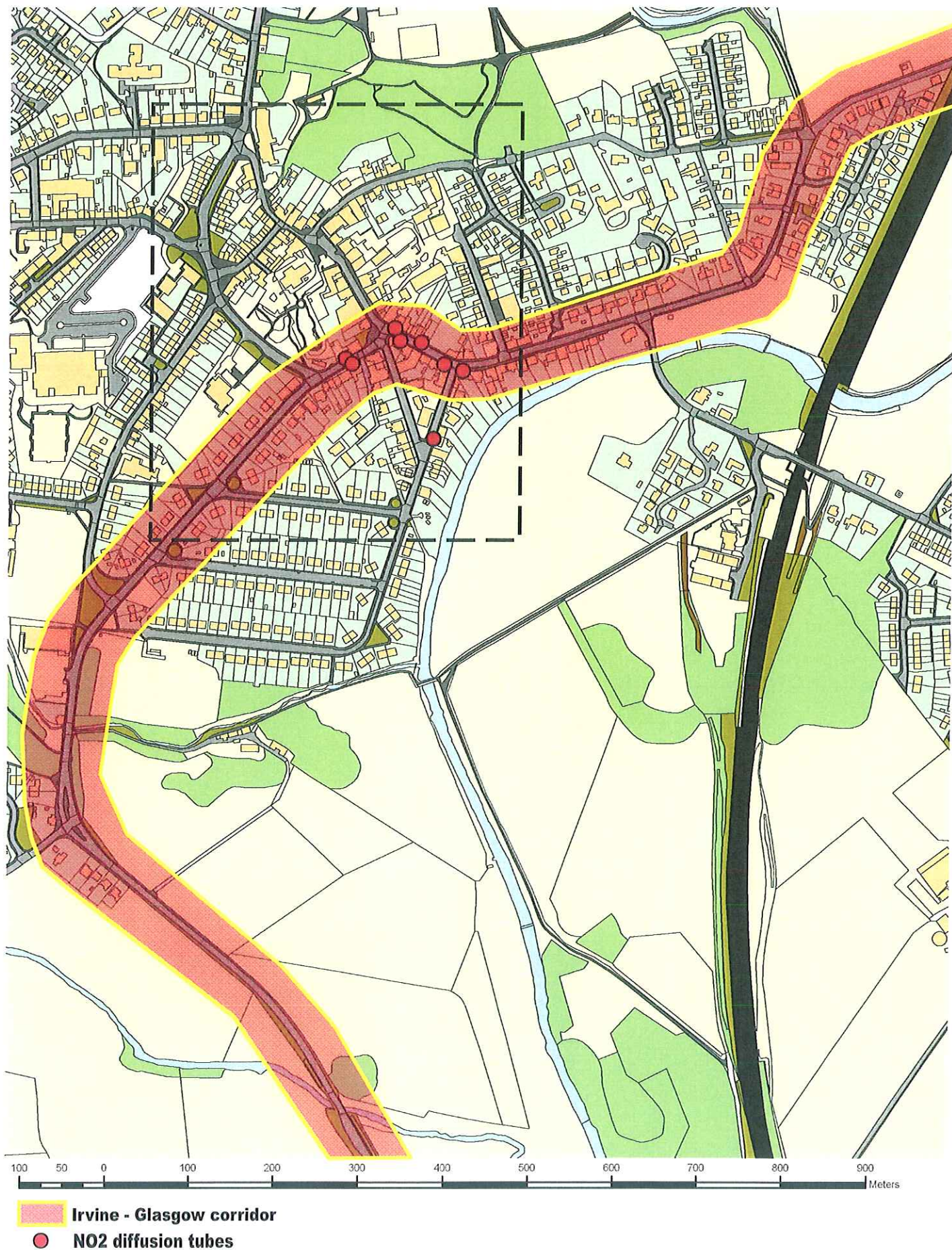


### Irvine - Glasgow corridor

- **NO<sub>2</sub> diffusion tubes**

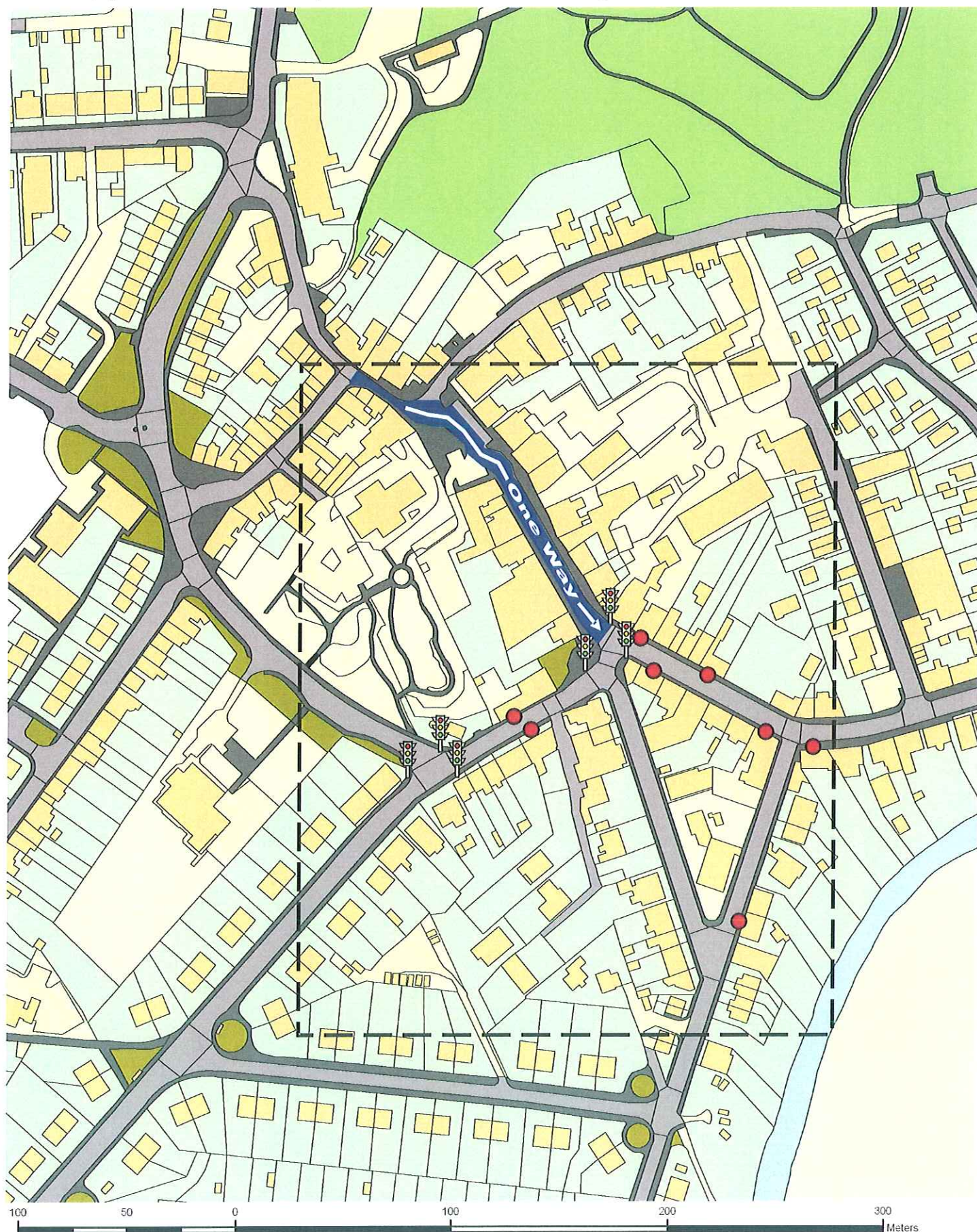


## Appendix 14: Dalry - Town Centre





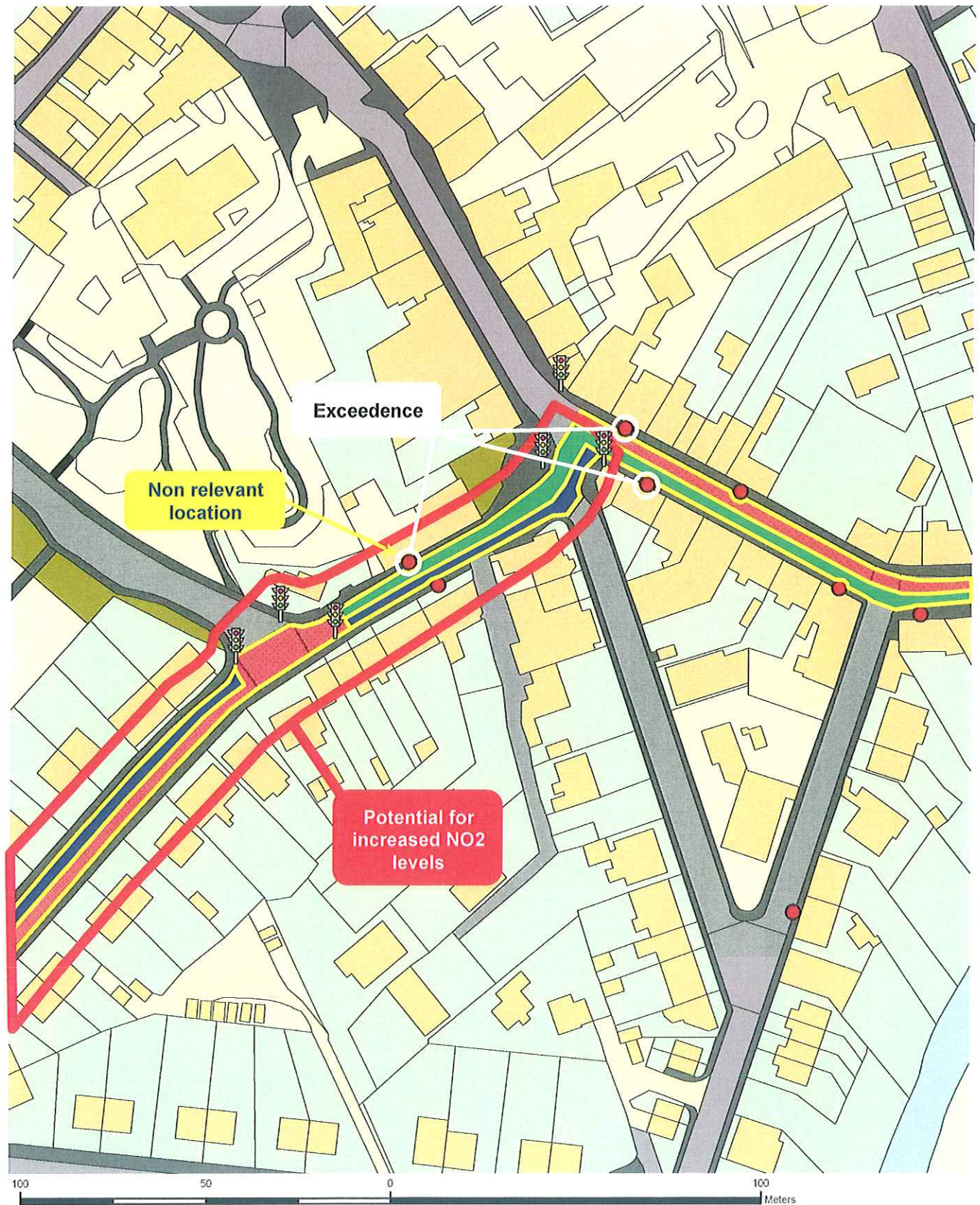
## Appendix 15: Dalry - New Traffic Management (2008)



● NO2 diffusion tubes



## Appendix 16: Dalry - Traffic Congestion (2008)

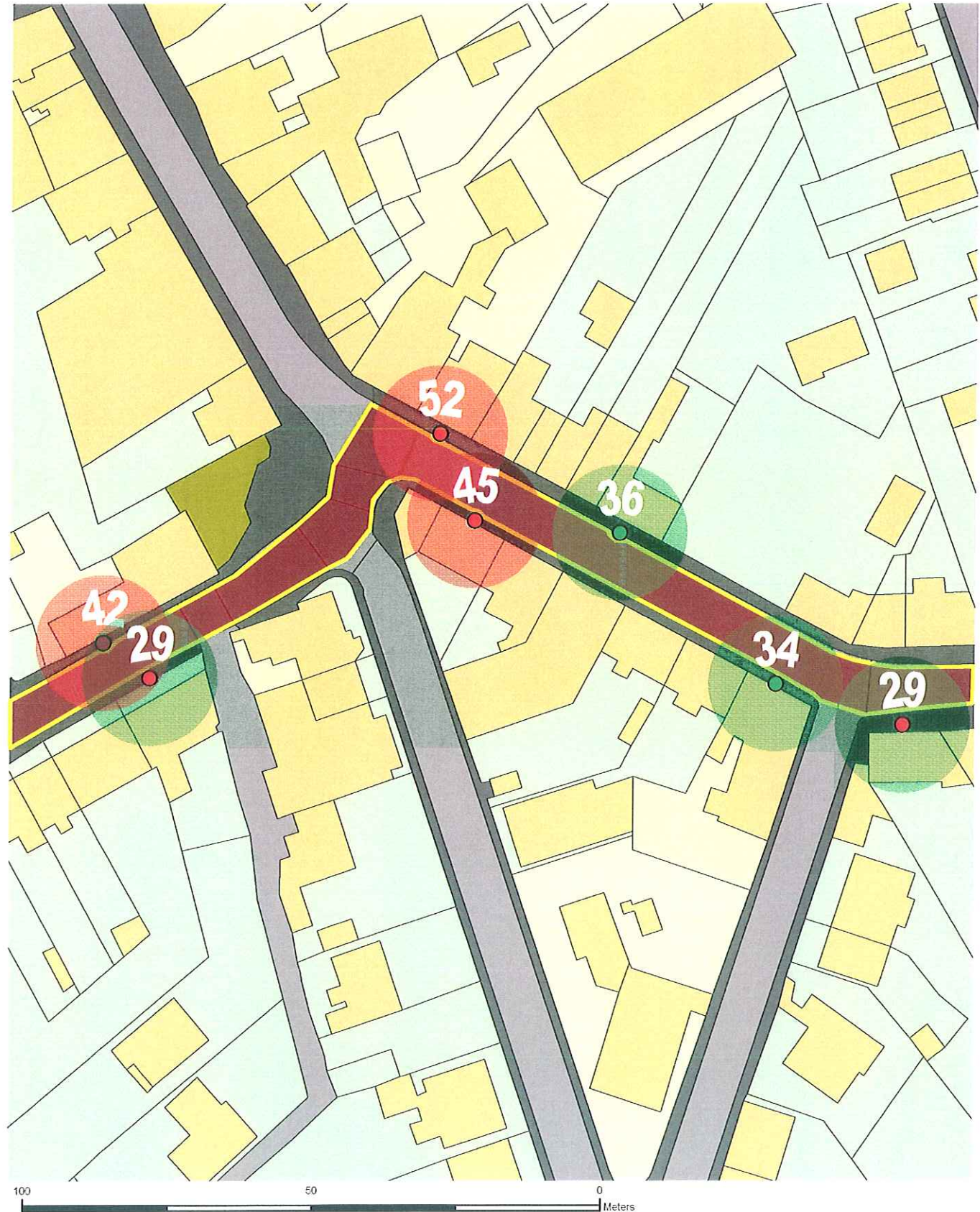


### Queuing traffic

- Only Before new traffic management
- + ■ After new traffic management
- NO2 diffusion tubes



Appendix 17: Dalry – Townhead St/New St (2008) NO<sub>2</sub> µg/m<sup>3</sup>

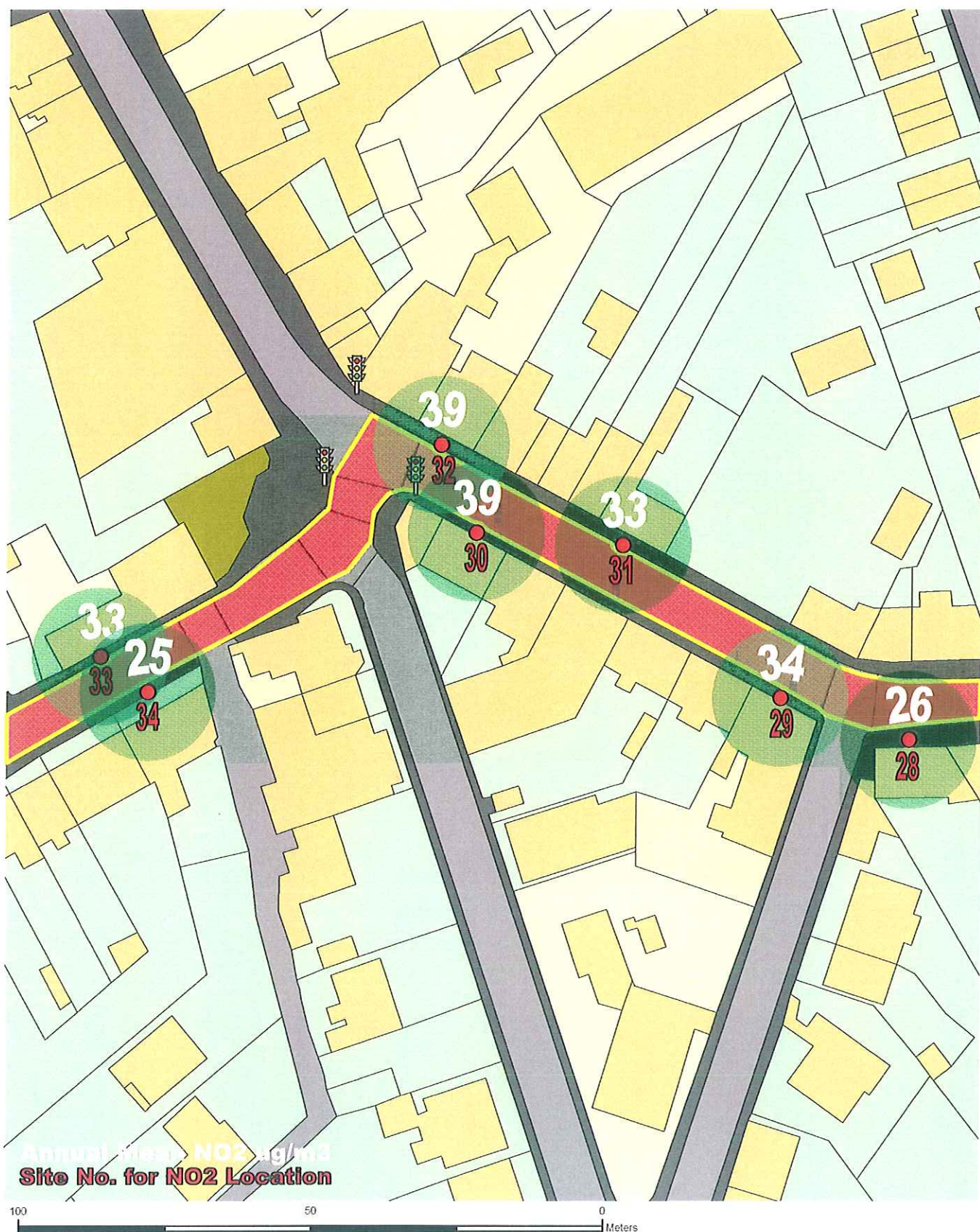


NO<sub>2</sub> diffusion tubes

- Existing
- New



# Appendix 18: Dalry – Townhead St/New St (2009) NO<sub>2</sub> µg/m<sup>3</sup>





**Appendix 19: Historical No2 Results (1998-2009)**

Site No.	RESULTS IN UG/M3
1	Cunninghame House, Irvine
2	35 East Road Irvine
3	Irvine Police Station
4	<b>74 High Street, Irvine</b>
5	70 High Street Irvine
6	<b>18 Bank St, Irvine</b>
7	<b>19 Bank St, Irvine</b>
8	19 Bank St Irvine
9	147 High Street, Irvine
10	<b>3 Bridgegate,</b>
11	97 High St, Irvine
12	<b>97 High St, Irvine HIGH</b>
13	<b>91 High St, Irvine LOW</b>
14	<b>85 High St, Irvine</b>
15	79 High St, Irvine
16	75 High St, Irvine LOW
17	<b>75 High St, Irvine HIGH</b>
18	<b>71 High St, Irvine</b>
19	65a High St, Irvine, (ROMON)
20	65 High St, Irvine, (ROMON)
	63 High St, Irvine, (ROMON)
	34 Kirkgate Irvine

1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
11	10.6	9.4	10.1	13.7	15.7	11.9	11.8	14	12	10	12
26.1	26.3	20.8	20.1	30	31.4	26.2	22.9	33.2	26	24	25
12.1	9.2	11.6	9.9	14.9	15.1	12.6	11.8	15	12	12	13
23.1	17.5	14.3	18	21.3	28.5	23.7	19.2	25	25	23.6	
30.5	29.9	23.8	25.1	31.3	32.7	27.9	22.5	31	29	26	25
										32.5	26
						22.9	22.6	28	24	28.5	
						24.4	22.1	31	28	26	23
			19.1	30.2	31.5	27.8	23.3	31	29	34	29
										23.9	22
33	28.5	23.4	21.9	32.7	37.1	33.3	26.9	38	32	28	28
										29.4	29
										34.1	32
										34.1	27
45.3	41.8	31	30.7	40.8	49.6	45.6	31.2	43	44	39	37
39.7	31.5	30.3	25.8	36.2	41.9	36.3	30.5	43	48	37	35
										44.6	37
										34.8	29
	20.5	22.4	8.5	30.9	33.1	37	28.9	37	35	31	29
										30	29
										29	30
10.7	8.5	9.3	8.5	13.9	15.9	11	11.5	14	11	8	16



## Appendix 19: Historical No2 Results (1998-2009) (cont)

Site No.	RESULTS IN UG/M3	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
21	Eglinton Street Irvine	20.2	19.6	17.4	17.4	23.4	25.2	21.8	19.4	26	22	27	26
22	25 Main Rd, Springside		7.9	9.1	10.3	14.5	16.8	15.8	15.5	19.2	17	16	17
	<b>Greenwood Academy</b>		7.6	10.6	12.3	14.8	17.71	16.6	14.7	21.5	17	15.8	
23	Main St, Drybridge		7.2	8.6	7.5	9.6	12.1	9.8	9.3	11.3	9	6	12
	<b>Shewalton Moss Estate</b>		7.1	7.9	6.9	10	11.8	10.3	8	10.1	8	7.3	
	<b>Dreghorn Primary School</b>		12.1	16.7	11.3	15.9	18.19	14.9	15.2	18	13	13.1	
24	Auchengate (Bridge)			13.7	10.1	13.3	15.8	14.8	13.5	15	14	12	15
	<b>Auchengate (House)</b>			10.6	8.5	11.5	13.1	12.1	11.8	15	13	11.6	
	<b>Auchengate (Road)</b>			8.8	7.6	10.2	12	10.7	10.5	12	11	11.3	
25	Dalry Rd , Kilwinning	19.7	23	15.7	15.3	21.4	25	22.7	20.9	30	25	19	21
26	Byrehill , Kilwinning			9.3	8.8	12	17	10.9	12.2	13	10	8	13
27	12 Garnock St, Dalry										9	11	15
28	69 New St Dalry										28	29	26
29	<b>67 New St, Dalry</b>											34.1	34
30	45 New St Dalry										48	45	39
31	<b>60 New St Dalry</b>											36.1	33
32	44 New St Dalry										47	45	39
33	3 Townhead St, Dalry										47	42	33
34	2 Townhead St, Dalry										29	26	25
35	Highfield Hamlet , Dalry		8	7.9	10.4	15.9	18.9	14	13.6	19	15	15	21
36	85 Main Street , Largs		17.1	16.4	13.1	18.7	22.1	22.2	20.2	26	26	22	19
	<b>Goldenberry Farm Road</b>			4.5	9.9	4.8	4.4	2.8	4.2	6	5	7.9	
	<b>Seamill/ Hunterston Road</b>			5.1	4.8	7.7	7.9	5.4	6.9	9	6	5.7	
37	Hunterston Road/Cycle Track			3.6	2.8	4.7	4.8	3.3	4.2	6	4	5	8

## Appendix 20: Radiation Food & Environmental Programme

### Radiation Food and Environmental Programme

2009/2010

Month	Irvine	Saltcoats	Largs	Dalry	Fencefoot Farm Fairlie
April	1 Tip Leachate (Fixed site) (Go with Andrew)	1 Private Water Supply 1Milk (Arran Dairies)	1 Fish 1 Private Water Supply	1 Private Water Supply	1 Dry Shade
May		1 Seaweed (Fixed site) 1 Sand (Fixed site) 1 Soil (Fixed site) 1 Grass (Fixed site)			1 Dry Shade
June	1 Veg 1 Seawater (Fixed site)				1 Dry Shade
July	1 Fish 1 Fruit	1Milk (Arran Dairies)	1 Seawater (Fixed site)		1 Dry Shade
August	1 Meat 1 Milk (Retail)	1 Vegetable 1 Seaweed (Fixed site) 1 Sand (Fixed site)			1 Dry Shade
September		1 Otherfood 1 Shellfish (Fixed site) 1 Seawater (Fixed site)			1 Dry Shade
October	1 Tip Leachate (Fixed site) (Go with Andrew)	1 Private Water Supply 1Milk (Arran Dairies)	1 Private Water Supply	1 Private Water	1 Dry Shade
November	1 Seaweed (Fixed site) 1 Sand (Fixed site)		2 Fruit/Veg		1 Dry Shade
December			1 Seawater (Fixed site)	1 Meat	1 Dry Shade
January	1 Other food 1 Seawater (Fixed site)	1 Fish 1Milk (Arran Dairies)			1 Dry Shade
February			1 Meat 1 Seaweed (Fixed site) 1 Sand (Fixed site)		1 Dry Shade
March	2 Fruit/veg	1 Seawater (Fixed site)	1 Shellfish (Southannan Sands)		1 Dry Shade

Airborne Radiation Monitoring Sites (Mini 6-80 Monitor)
Monthly Measurements
1. Cunnunghame House, Irvine
2. Lochshore Industrial Estate, Glen Garnock
3. Laighdykes Playing Field, Saltcoats
4. Largs Area Office
5. Hunterston A Power Station
6. Hunterston B Power Station
7. Weather Station, Hunterston Rail Loading Site
Arran shore fixed site: Markland Point
Arran inland fixed site: West Knowe Farm
Hunterston fixed site: near cooling water outfall
Irvine fixed site: Irvine beachpark
Dry Shades: Fencefoot Farm Fairlie
Fish, meat, fruit and veg: try to source locally but not always possible

Summary	Number
Seawater	6
Seaweed	4
Sand	4
Shellfish	2
Tip Leachate	2
Soil	1
Grass	1
Private Water Supply	6
Vegetable	4
Fruit	3
Fish	3
Meat	3
Milk	5
Otherfood	2
Dry Shade	12
Mini 6-80 Readings	84
<b>Total</b>	<b>142</b>



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