



2014 Air Quality Progress Report for Glasgow City Council

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

August 2014

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Executive Summary

Local Authorities are required to regularly review and assess the air quality within their area of responsibility. This Review and Assessment process is the basis of local air quality management and is intended to compare current and future concentrations of key air pollutants against the objectives detailed in the regulations as part of the National Air Quality Strategy. This report comprises Glasgow City Council's Progress Report as part of Round 5 of review and Assessment. This Progress Report has looked in detail at the new monitoring data available since the last round of review and assessment as well as considering the impact from various potential sources of pollution.

Previous rounds of review and assessment have shown the potential for exceedences of the Objectives included in the Air Quality Regulations at a number of locations outwith the existing Air Quality Management Areas.

During 2013, Glasgow City Council has measured concentrations of nitrogen dioxide above the Annual Mean Objective at several automatic monitoring stations within existing AQMA's and at one location, by diffusion tube, outwith an existing declared AQMA. The Hourly Mean Objective was exceeded at one of the automatic monitoring stations within the city centre AQMA

The Annual Mean Objective for PM₁₀ has been exceeded at two of the automatic monitoring stations; there were no exceedences of the Daily Mean Objective.

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1.0 Introduction

1.1 Description of Local Authority Area

Glasgow City Council, serving a population of around 590,000, is Scotland's largest local authority. As the largest city in Scotland, Glasgow is a centre for business, manufacturing and retail. As such, the city attracts a large daily influx of people and traffic from the surrounding areas.

The city of Glasgow lies at the western end of the Clyde Valley which takes its name from the river which runs through the city. The Glasgow area is bounded both north and south by low hill ranges which can adversely affect air quality.

Glasgow in many ways typifies the modern developed city where road traffic tends to be the major air quality concern, superseding a long industrial heritage. The Glasgow area contains an extensive motorway network with traffic travelling to and through the area on the M8, M74, M77 and M80 motorways.

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, 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	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Benzene (C ₃ H ₆)	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
1,3-Butadiene	2.25 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2003
Carbon monoxide (CO)	10.0 mg/m^3	Running 8-hour mean	31.12.2003
Lead (Pb)	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
Nitrogen dioxide (NO ₂)	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
Particles (PM ₁₀) (gravimetric)	50 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 7 times a year	24-hour mean	31.12.2010
	18 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2010
Sulphur dioxide (SO ₂)	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

Glasgow's first AQMA was declared in 2002 for NO₂ within the City Centre area. Since that time further assessments have concluded that the boundary of the original AQMA required to be increased and that new AQMAs were required for Parkhead Cross and the Byres Road / Dumbarton Road areas, both declared 2007. At this time the City Centre AQMA was also amended to include the annual mean PM₁₀ objective. In March 2012 further extensions were made to the City Centre and Byres Road / Dumbarton Road AQMAs, additionally the City Centre area was declared in respect of the hourly mean NO₂ objective. At this time the whole of the Glasgow area was also declared an AQMA in respect of the daily and annual mean PM₁₀ objectives.

Table 1.2 shows a summary of the previous rounds of review and assessment and a brief description of the outcomes from each.

Table 1.2 Summary of Previous Rounds of Review and Assessment

Report	Date Produced	Outcome
Stage I	1998	Proceeded to Stage II for CO. Proceed to Stage III for NO ₂ and PM ₁₀
Stage II	2000	Concluded that levels of CO and SO ₂ will meet Objectives
Stage III	2001	Recommended an AQMA be declared for the city centre for NO ₂
Updating and Screening Assessment	2003	Proceeded to Detailed Assessment for NO ₂ , SO ₂ and PM ₁₀
Stage IV	2004	Confirmed city centre AQMA declared for NO ₂
Detailed Assessment	2005	Recommended AQMA's be declared for NO ₂ at Parkhead Cross and Dumbarton Rd / Byres Rd. Extension of city centre AQMA to Royston Rd and recommended declaration of the city centre as an AQMA for PM ₁₀

Table 1.2 Summary of Previous Rounds of Review and Assessment (Cont.)

Report	Date Produced	Outcome
Progress Report	2005	Reported on continuing monitoring and recommended new monitoring at various locations
Updating and Screening Assessment	2006	Proceeded to Detailed Assessment for NO ₂ in a variety of areas. Recommended new monitoring of PM ₁₀ at various locations
Detailed Assessment	2007	Recommended additional NO ₂ monitoring at locations of concern
Further Assessment	2008	Confirmed ongoing exceedences of the objectives in the declared AQMA's
Progress Report	2008	Confirmed ongoing exceedences of the objectives in the declared AQMA's and predicted likely exceedences of PM ₁₀ objectives for 2010
Updating and Screening Assessment	2009	Proceeded to Detailed Assessment for NO ₂ at a variety of locations and for PM ₁₀ citywide
Progress Report	2010	Highlighted exceedences of NO ₂ hourly objective at Glasgow Kerbside
Detailed Assessment	2010	Recommended extension of city centre AQMA to Bridge Street for NO ₂ . Recommended further monitoring city wide for PM ₁₀ and Queen Margaret Drive for NO ₂
Progress Report	2011	Confirmed exceedences at Bridge St and QMD for NO ₂ and citywide for PM ₁₀ . Recommended new AQMA's be declared.
Updating and Screening Assessment	2012	Proceeded to Detailed Assessment for NO ₂ in the Crow Road and Great Western Road areas.
Further Assessment	2013	Recommended not to proceed to an action plan in regard to the AQMA's declared in 2011 until monitoring data for 2013 becomes available.

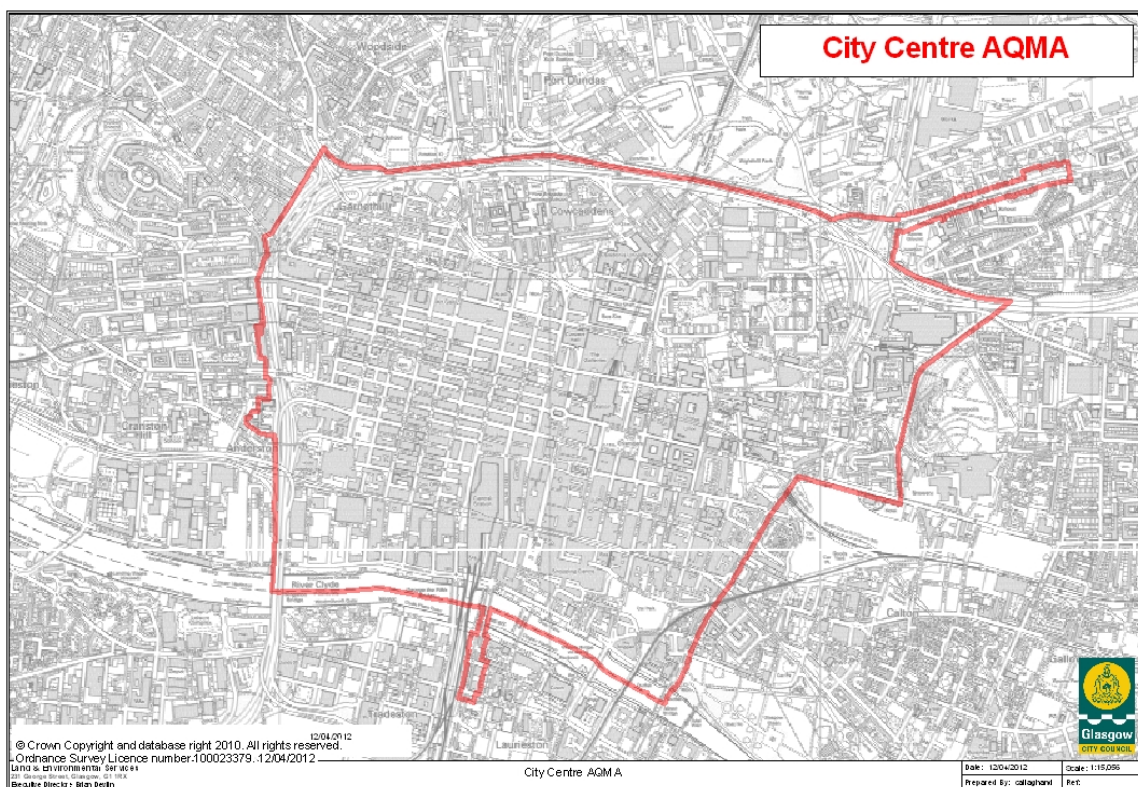
Table 1.2 Summary of Previous Rounds of Review and Assessment (Cont.)

Report	Date Produced	Outcome
Progress Report	2013	Reported on continuing monitoring, no recommendation of changes to existing AQMA's or need for progression to Detailed Assessment.
Detailed Assessment	2013	Dispersion modelling of locations highlighted by monitoring and USA 2012 as potentially exceeding NO ₂ annual mean Objective showed that exceedences were unlikely. Confirmed that monitoring should continue at these locations.

1.5.1 City Centre Air Quality Management Area

The city centre area has been extensively developed with a large number of multi-storey properties for both commercial and residential use. The city centre AQMA is loosely bound by the M8 motorway to the west and north (with slight protrusions at North Street and Royston Road), by High Street and Saltmarket to the east and by the river Clyde to the south. This area was declared an AQMA in 2004 in respect of the annual mean NO₂ objective. In 2007 the area covered by this AQMA was extended and declared in respect of the annual mean PM₁₀ objective. In 2012 a further extension of the AQMA was declared and the order amended in respect of the NO₂ hourly mean objective. The area is shown in Figure 1.2

Figure 1.2 City Centre Air Quality Management Area

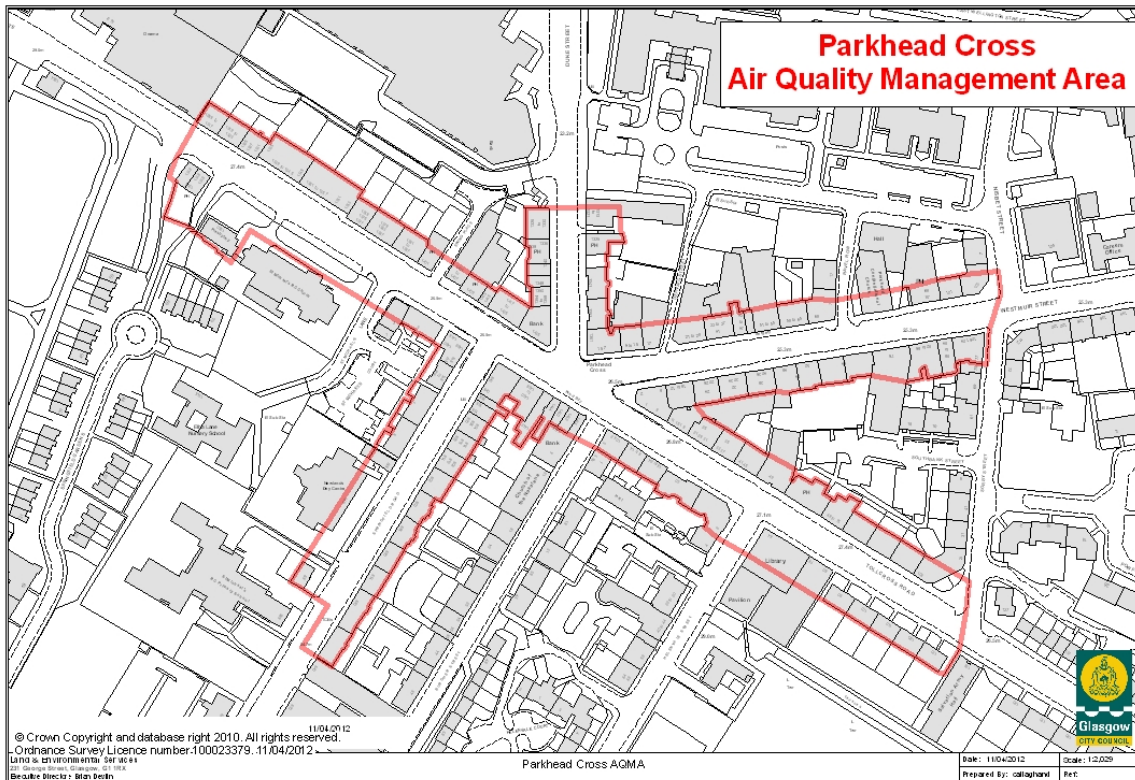


The detailed street listing for this AQMA can be found in the 1st March 2012 order.

1.5.2 Parkhead Cross Air Quality Management Area

Parkhead Cross is formed by the convergence of five roads in Glasgow’s east end. The roads are Westmuir Street, Tollcross road, Springfield Road, Duke Street and Gallowgate. The area is a mixture of commercial and residential properties within mostly tenement properties. This area was declared in respect of the annual mean NO₂ objective. The area is shown in Figure 1.3.

Figure 1.3 Parkhead Cross Air Quality Management Area

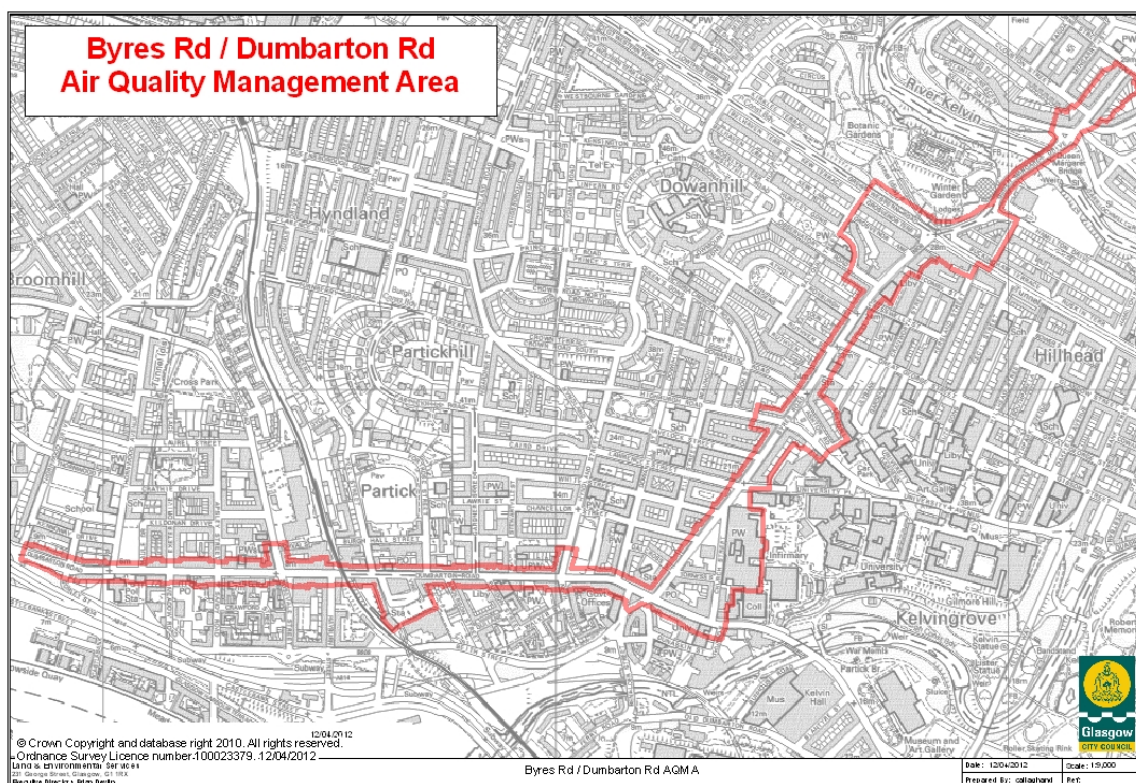


The detailed street listing for this AQMA can be found in the 1st July 2007 order.

1.5.3 Byres Road and Dumbarton Road Air Quality Management Area

Byres Road and Dumbarton Road are at the heart of Glasgow's west end and comprise a mixture of residential and commercial properties within mostly tenement type buildings. The Area covers from the junction of Byres Road and Great Western Road south to Dumbarton Road and west along Dumbarton Road as far as Thornwood Drive roundabout. This area was declared an AQMA in 2007 in respect of the annual mean NO₂ objective. In 2012 the area covered by this AQMA was extended northwards along Queen Margaret Drive to the junction with Oban Drive. The area is shown in Figure 1.4

Figure 1.4 Byres Road and Dumbarton Road Air Quality Management Area

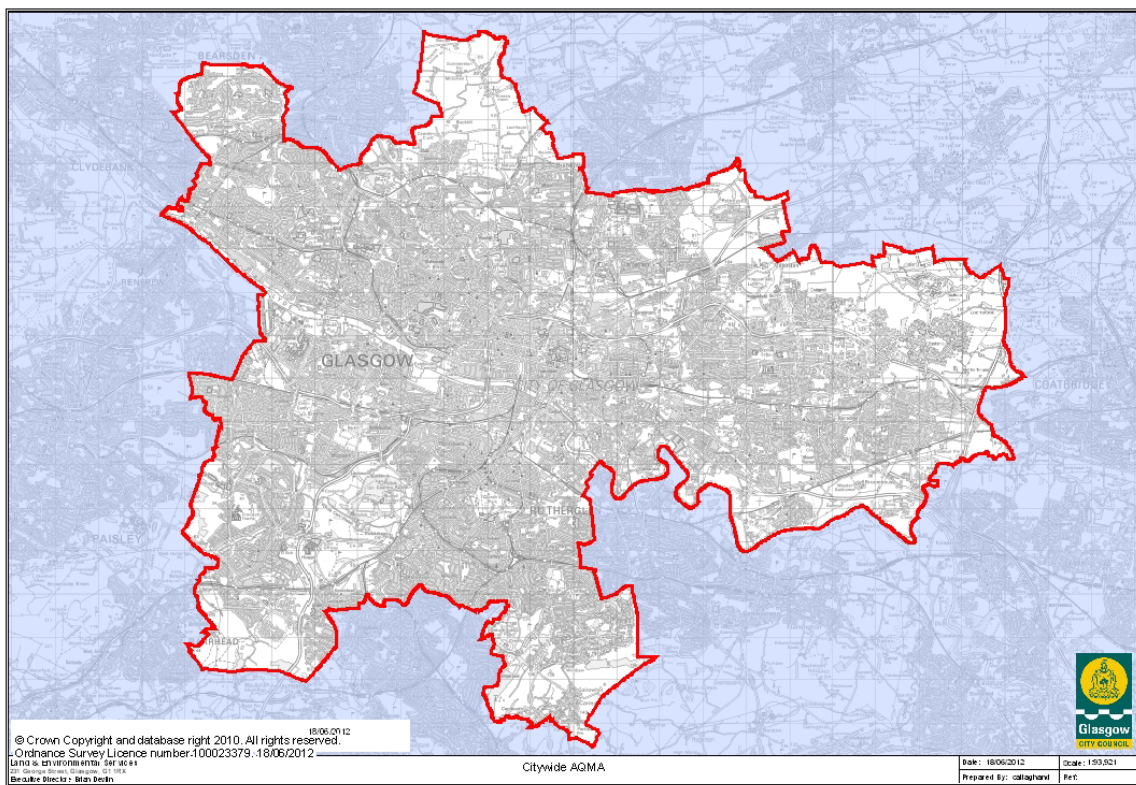


The detailed street listing for this AQMA can be found in the 1st March 2012 order.

1.5.4 Citywide Air Quality Management Area

The Citywide AQMA was declared in 2012 as a result of monitoring results showing exceedences of both the annual mean PM₁₀ objective and the daily mean PM₁₀ objective. Since these exceedences occurred at multiple locations across the city it was decided that the most effective strategy would be to declare the entirety of the city as an AQMA in respect of these Objectives.

Figure 1.5 Citywide Air Quality Management Area



The detailed street listing for this AQMA can be found in the 1st March 2012 order.

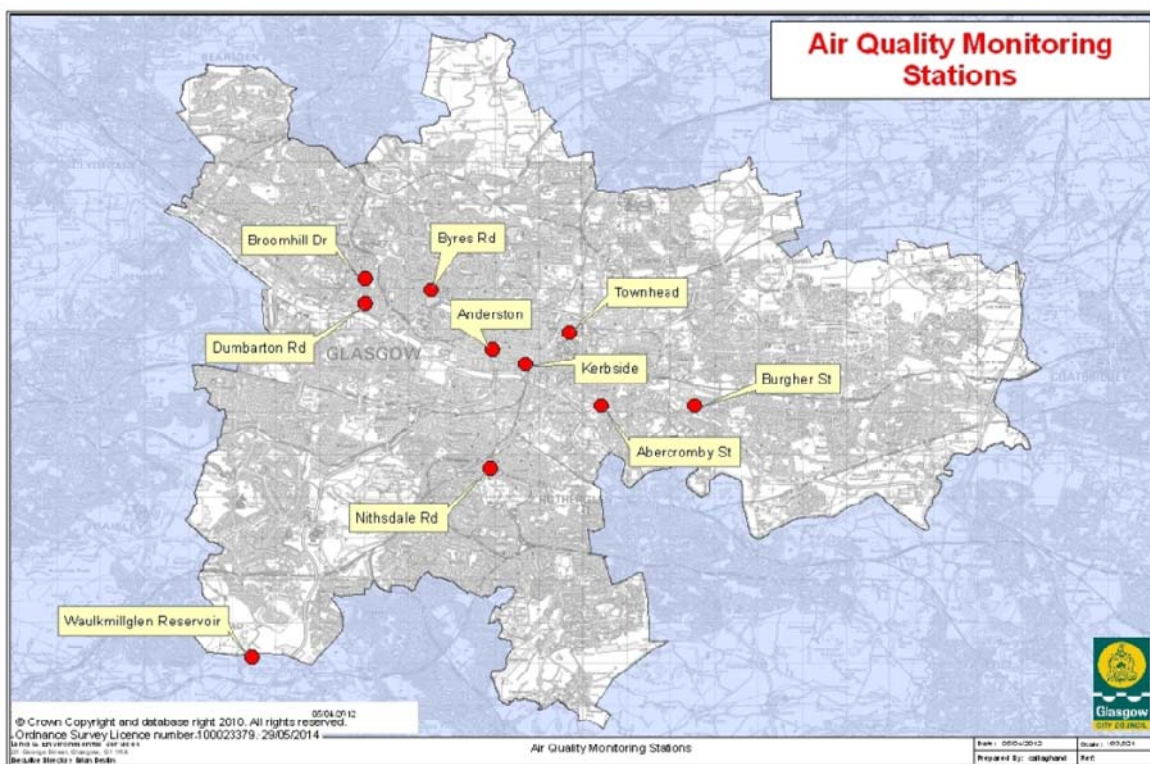
2.0 Monitoring Data

2.1 Summary of Monitoring Undertaken

2.1.1 Automatic Monitoring Sites

Glasgow City Council operates an extensive monitoring network across the city to measure ambient levels of air pollutants. During 2013, automated monitoring equipment was located at ten sites. Two of which, Glasgow Kerbside and Townhead form part of the Department for Environment, Food and Rural Affairs (DEFRA) Automated Urban and Rural Network (AURN). The monitoring station at Townhead was previously located at Glasgow Centre where monitoring was discontinued during 2012. Monitoring commenced at Townhead during October 2013.

Figure 2.1 Locations of Automatic Monitoring Sites



2.1.1 Automatic Monitoring Sites (Cont.)

Table 2.1 Details of Automatic Monitoring Sites

Site Name	Site Type	OS Grid Ref	Pollutants Monitored	In AQMA?	Relevant Exposure?	Distance to kerb of nearest road	Worst-case Location?
Glasgow Kerbside	Kerbside	258708 665200	NO ₂ PM ₁₀ PM _{2.5}	City Centre	Yes	1m	Yes
Glasgow Townhead	Urban Background	259675 665900	NO ₂ PM ₁₀ PM _{2.5} O ₃	City Centre	Yes	120m	No
Glasgow Anderston	Urban Background	257925 665487	NO ₂ PM ₁₀ CO SO ₂	City Centre	Yes	N/A	No
Glasgow Byres Road	Roadside	256526 666933	NO ₂ PM ₁₀ CO	Byres Dumbarton	Yes	3m	Yes
Glasgow Dumbarton Road	Roadside	255030 666608	NO ₂ PM ₁₀	Byres Dumbarton	Yes	3m	Yes
Glasgow Burgher Street	Roadside	262550 664164	NO ₂ PM ₁₀	Parkhead	Yes	3m	Yes
Glasgow Abercromby Street	Roadside	260420 664175	PM ₁₀	Citywide	Yes	3m	Yes
Glasgow Broomhill	Roadside	255030 667195	PM ₁₀	Citywide	Yes	3m	Yes
Glasgow Nithsdale Road	Roadside	257883 662673	PM ₁₀	Citywide	Yes	3m	Yes
Glasgow Waulkmillglen Reservoir	Rural	252520 658095	NO ₂ PM ₁₀ O ₃	No	No	N/A	No

2.1.1 Automatic Monitoring Sites (Cont.)

Equipment located at the sites measure a variety of air pollutants including NO₂, CO, SO₂ and Particulates. Instruments at these sites are calibrated by the Local Site Operators according to the specific site guidelines, audits are carried out every six months by AEA Technology. All of the automatic air quality data gathered is independently ratified by AEA Technology and made available for viewing by the public at the Scottish Government funded air quality website at: <http://www.scottishairquality.co.uk>

The automatic monitoring sites at Waulkmillglen and Dumbarton Road measure PM₁₀ by standard TEOM, and the results expressed using the Volatile Correction Model adjustment, the other sites measure PM10 using FDMS TEOMs

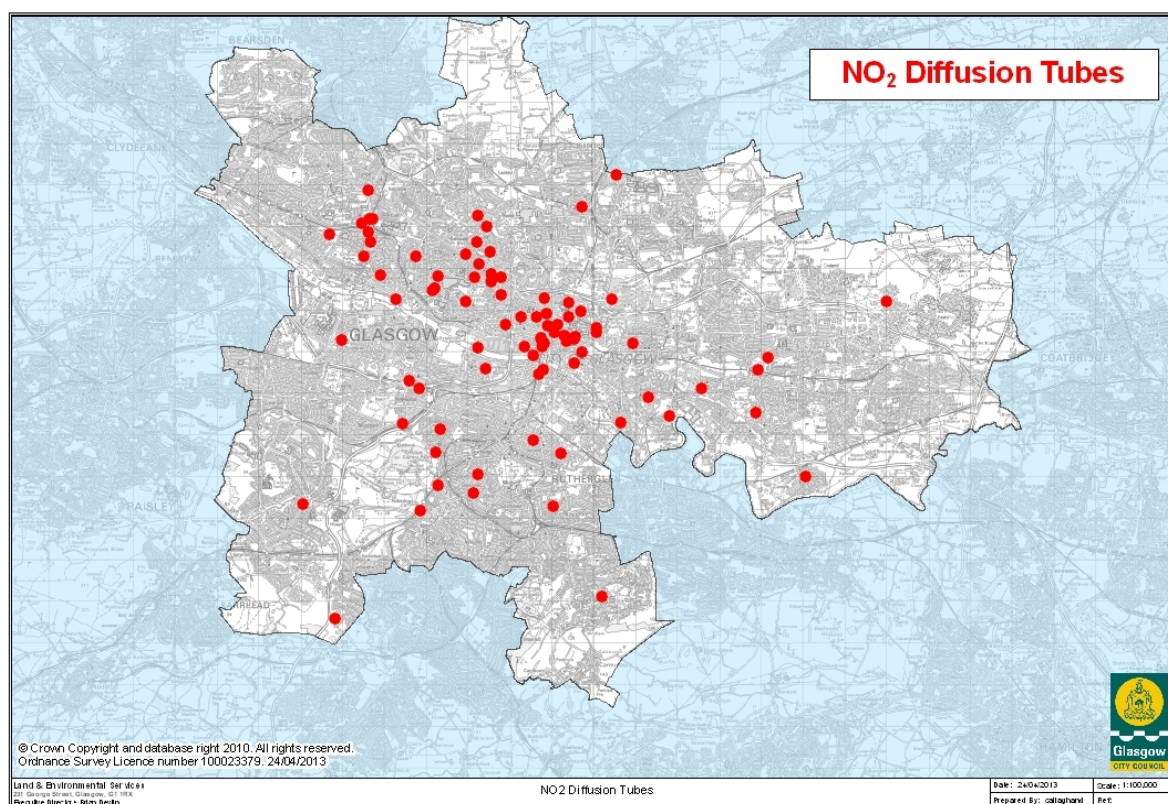
Glasgow City Council has also introduced several Osiris particulate monitors into the monitoring network to measure particulate levels at areas of interest. Monitors were located at three locations during 2013. These locations had been highlighted in the 2010 Detailed Assessment as potentially exceeding the Annual Mean Objective. Monitoring at Sauchiehall Street was discontinued in September 2013, Commissioning of the Paisley Road West installation was completed in late 2013, no data has been included from this location.

Table 2.2 Details of Osiris Particulate Monitoring Sites

Site Name	Site Type	OS Grid Ref	In AQMA?	Relevant Exposure	Distance to kerb of nearest road	Worst-case Location?
Sauchiehall Street	Roadside	257605 666020	Citywide	Yes	3m	No
Maryhill Road	Urban Background	257522 667756	Citywide	Yes	>10m	No
Paisley Road West	Roadside	253349 663843	Citywide	Yes	3m	Yes

2.1.2 Non-Automatic Monitoring Sites

Figure 2.2 Locations of Nitrogen Dioxide Diffusion Tubes



Glasgow City Council operates an extensive network of diffusion tubes measuring NO₂ levels at almost 100 sites around the city. NO₂ diffusion tubes represent a simple, effective and low cost method of monitoring ambient concentrations of NO₂ in a large number of locations.

However, NO₂ concentration data provided by diffusion tubes is limited to fairly long-term exposure. Tubes are generally exposed for periods of a month, annual mean concentrations determined and compared with the annual mean objective. Furthermore, the accuracy of diffusion tubes can vary depending on the preparation methodology, handling procedures and the identity of the analysing laboratory. To correct for this possible bias in tube data, results are corrected using information gained from co-location studies. Diffusion tubes utilised by Glasgow City Council are prepared and analysed by Glasgow City Council's Scientific Services (GSS). Triplicate tubes were co-located with automatic NO₂ analysers in Glasgow and both East and West Dunbartonshire. Concentrations obtained by both methods were compared over the same sampling period and a national factor for GSS determined. For 2013 a bias correction factor of 0.96 was calculated. This laboratory participates in both the WASP scheme and the field intercomparison exercise managed by AEA. The laboratory also follows the procedures set out in the Harmonisation Practical Guidance.

For the purposes of this progress report it is not considered necessary to annualize results from individual sites to allow for missing data. During 2013 a power failure at GSS resulted in an entire months (August) data being lost.

2.1.2 Non-Automatic Monitoring Sites (cont.)**Table 2.3 Details of Non - Automatic Nitrogen Dioxide Monitoring Sites**

Site Name	Site Type	OS Grid Ref	In AQMA?	Relevant Exposure	Distance to kerb of nearest road	Worst-case Location?
George Square	Urban Background	259296 665389	Yes	No (30m)	30m	No
Union Street	Roadside	258828 665204	Yes	Yes	3m	Yes
Bath Street	Roadside	258262 665851	Yes	No (3m)	3m	Yes
Glassford Street	Roadside	259361 665252	Yes	Yes	3m	Yes
Buchanan Street	Roadside	259055 665468	Yes	Yes	3m	No
Castle Street	Roadside	260068 665589	Yes	Yes	3m	No
Hope Street 3	Kerbside	258856 665940	Yes	No (5m)	1m	No
Montrose Street	Roadside	259536 665313	Yes	Yes	3m	Yes
Cochrane Street	Roadside	259430 665316	Yes	Yes	3m	Yes
Renfield Street	Roadside	258896 665637	Yes	Yes	3m	Yes
George Street	Kerbside	259551 665380	Yes	No (3m)	1m	Yes
North Street	Roadside	257906 665672	Yes	No (15m)	3m	No
Hope Street 1	Roadside	258730 665322	Yes	Yes	3m	Yes
Gordon Street	Roadside	258756 665346	Yes	No (5m)	3m	No
Heilanmans Umbrella North	Roadside	258770 665120	Yes	Yes	3m	Yes
Saltmarket	Roadside	259545 664739	Yes	Yes	3m	Yes
High Street	Roadside	259732 664991	Yes	Yes	3m	Yes

2.1.2 Non-Automatic Monitoring Sites (cont.)**Table 2.3 Details of Non - Automatic Nitrogen Dioxide Monitoring Sites (Cont.)**

Site Name	Site Type	OS Grid Ref	In AQMA?	Relevant Exposure	Distance to kerb of nearest road	Worst-case Location?
Dobbies Loan	Urban Background	259415 666194	Yes	Yes	3m	No
Cathedral Bridge	Roadside	259136 665661	Yes	No (10m)	3m	No
Dundasvale Street	Urban Background	258820 666306	Yes	Yes	15m	No
Royston Road	Roadside	260429 666264	Yes	No (5m)	3m	No
St Mungo Avenue	Urban Background	259392 665866	Yes	Yes	5m	Yes
Brown Street	Roadside	258336 665122	Yes	Yes	3m	No
Broomielaw	Roadside	258562 664933	Yes	No (5m)	3m	No
McLeod Street	Urban Background	260077 665481	Yes	Yes	8m	No
Sauchiehall Street	Urban Background	258639 665852	Yes	No (10m)	N/A	No
Kennedy Path	Urban Background	259701 665983	Yes	Yes	10m	No
Dumbarton Road	Roadside	256209 666525	Yes	No (3m)	3m	Yes
Lawrence Street	Roadside	256295 666816	Yes	No (5m)	2m	No
Cooperswell Street	Roadside	256154 666478	Yes	Yes	4m	Yes
Westmuir Street	Roadside	262589 664139	Yes	Yes	3m	Yes
Mossie Road	Roadside	257235 662064	No	No (3m)	3m	Yes
Bridge Street	Roadside	258702 664480	Yes	No (3m)	3m	Yes
Finnieston Street	Roadside	257235 665108	No	No (5m)	3m	Yes

2.1.2 Non-Automatic Monitoring Sites (cont.)**Table 2.3 Details of Non - Automatic Nitrogen Dioxide Monitoring Sites (Cont.)**

Site Name	Site Type	OS Grid Ref	In AQMA?	Relevant Exposure	Distance to kerb of nearest road	Worst-case Location?
Hillcrest Road	Roadside	265075 662001	No	No (5m)	3m	No
St Andrews Drive	Urban Background	256229 662587	No	Yes	N/A	No
Haggs Road	Roadside	256295 661792	No	Yes	3m	Yes
Pollokshaws Road	Roadside	255864 661180	No	Yes	5m	No
Queen Margaret Drive	Roadside	257435 668015	No	No (20m)	3m	Yes
Napiershall Street	Roadside	257790 666791	No	Yes	4m	Yes
Queen Margaret Drive 2	Roadside	257216 667639	Yes	Yes	3m	Yes
Queen Margaret Drive 3	Roadside	257012 667433	Yes	Yes	3m	No
Oxford Street	Roadside	258798 664570	No	Yes	3m	No
Anniesland Cross	Roadside	254613 668886	No	Yes	15m	No
Balshagray Avenue	Roadside	254498 667291	No	Yes	10m	No
Dougrie Road	Roadside	260203 659128	No	No (20m)	3m	Yes
Main Street (Bridgeton)	Roadside	260650 663319	No	Yes	5m	Yes
Aikenhead Road	Roadside	259225 662579	No	Yes	6m	Yes
Langside Primary School	Roadside	257138 661617	No	No (5m)	3m	No
Thornwood Drive	Roadside	254903 666855	No	Yes	3m	No
Springburn Road	Roadside	260541 669268	No	Yes	6m	Yes

2.1.2 Non-Automatic Monitoring Sites (cont.)**Table 2.3 Details of Non - Automatic Nitrogen Dioxide Monitoring Sites (Cont.)**

Site Name	Site Type	OS Grid Ref	In AQMA?	Relevant Exposure	Distance to kerb of nearest road	Worst-case Location?
Paisley Road West	Roadside	255599 664313	No	Yes	3m	Yes
Sutherland Avenue	Urban Background	256343 663153	No	No (10m)	5m	No
Belmont Street	Roadside	257533 667418	No	No (5m)	3m	Yes
Mallaig Place	Urban background	253989 665298	No	No (20m)	6m	No
Govanhill Street	Roadside	258678 662901	No	No (3m)	3m	No
Westercraigs	Urban Background	260942 665226	No	Yes	15m	No
Inveresk Lane	Urban Background	264163 664856	No	Yes	20m	No
Kippen Street	Urban Background	259731 668488	No	No (5m)	3m	No
Sacone SW	Urban background	263920 664569	No	Yes	20m	No
Invergarrie Road	Urban Background	253821 658590	No	No (5m)	3m	No
Easterhouse	Roadside	267005 666217	No	Yes	5m	No
Dunn Street	Urban Background	261305 663928	No	Yes	5m	No
Glasgow Harbour	Urban Background	255287 666276	No	Yes	30m	No
Mosspark Boulevard	Urban Background	255436 663274	No	Yes	15m	No
Crow Road	Roadside	254640 254730	No	Yes	3m	Yes
Silverburn	Roadside	253047 661349	No	Yes	5m	No
Hyndland Road	Roadside	255764 667297	No	Yes	4m	No

2.1.2 Non-Automatic Monitoring Sites (cont.)**Table 2.3 Details of Non - Automatic Nitrogen Dioxide Monitoring Sites (Cont.)**

Site Name	Site Type	OS Grid Ref	In AQMA?	Relevant Exposure	Distance to kerb of nearest road	Worst-case Location?
Urrdale Road	Urban Background	255826 664118	No	Yes	N/A	No
Park Road	Roadside	257555 666896	No	Yes	3m	Yes
Springfield Road	Roadside	261823 663468	No	Yes	3m	No
Paisley Rd West 2	Roadside	257415 664616	No	Yes	3m	Yes
Crow Road 2	Roadside	254606 667894	No	Yes	3m	Yes
Maryhill Road	Roadside	257243 668285	No	Yes	3m	Yes
Scotstoun	Urban Background	253592 667771	No	Yes	>10m	No
Hampden	Urban Background	259038 661285	No	Yes	3m	No
Kelvingrove Park	Roadside	256950 666229	No	No	3m	No
Tollcross Park	Roadside	263864 663544	No	Yes	3m	No
Milner Road	Roadside	254456 668108	No	No	3m	No
Gibson Street	Roadside	257166 666787	No	Yes	3m	Yes
Woodlands Road	Roadside	257550 666697	No	Yes	3m	Yes
Arlington Street	Roadside	257796 666378	No	Yes	3m	No
Poplar Avenue	Roadside	254662 667636	No	Yes	3m	Yes
Great Western Road	Roadside	257255 667112	No	No	3m	Yes
1031 Maryhill Road	Roadside	257352 668122	No	Yes	5m	Yes
MHR Shawpark Street	Roadside	257075 668502	No	Yes	5m	Yes
1428 Maryhill Road	Roadside	257243 668285	No	No	3m	Yes

2.1.2 Non-Automatic Monitoring Sites (cont.)

In addition to monitoring NO₂ levels, Glasgow City Council also monitor benzene by diffusion tube at four sites across the city. This analysis is also conducted by the GSS laboratory.

Table 2.4 Details of Non - Automatic Benzene Monitoring Sites

Site Name	Site Type	OS Grid Ref	In AQMA?	Relevant Exposure	Distance to kerb of nearest road	Worst-case Location?
Heilanmans Umbrella North	Roadside	258770 665121	Yes	Yes	3m	Yes
Hope Street	Kerbside	258738 665167	Yes	No (3m)	<1m	Yes
Ochiltree Avenue	Roadside	254839 669295	No	No (3m)	5m	Yes
Pollokshaws Road	Roadside	255869 661185	No	No (3m)	3m	Yes

2.2 Comparison of Monitoring Results with Air Quality Objectives

2.2.1 Nitrogen Dioxide

2.2.1.1 Automatic Monitoring Data

Nitrogen dioxide is monitored using automatic analysers at seven locations; the Kerbside and Townhead AURN sites, Anderson, Byres Road, Dumbarton Road, Burgher Street and Waulkmillglen reservoir. Objectives have been set for both the Annual Mean and an Hourly Mean. Table 2.5 shows the measured annual mean at these locations over the last five years. Townhead was commissioned during October 2013; no data has been included from this location.

Table 2.5 Results of Automatic Monitoring for Nitrogen Dioxide Comparison with Annual Mean Objective (40µg/m³)

Site Name	Within AQMA?	Relevant Public Exposure	Valid Data Capture 2013 %	Annual Mean Concentration µg/m ³				
				2009	2010	2011	2012	2013
Glasgow Kerbside	City Centre	Yes	97	78	84	72	72	65
Glasgow Anderston	City Centre	Yes	96	36	38	36	33	28
Glasgow Byres Road	Byres / Dumbarton	Yes	84	40	47	42	39	44
Glasgow Dumbarton Road	Byres / Dumbarton	Yes	79	-	-	-	-	46
Glasgow Burgher Street	Parkhead	Yes	98	-	-	35	34	28
Glasgow Waulkmillglen Reservoir	No	No	99	12	16	11	12	11

During 2013 the Annual Mean Objective was exceeded at Glasgow Kerbside, Byres Road and Dumbarton Road. Figure 2.3 following, displays the five year trend at these locations. Glasgow Kerbside whilst showing a gradual improvement has continually exceeded the Annual Mean Objective, Byres Road appears as a static trend approx 2 µg/m³ above the Objective. Data capture rates during 2013 at both Byres Rd (air conditioning failure) and Dumbarton Rd (instrument) were below the 90% target.

2.2.1.1 Automatic Monitoring Data (Cont.)

Figure 2.3 Trends in Annual Mean Nitrogen Dioxide Concentration Measured at Automatic Monitoring Sites.

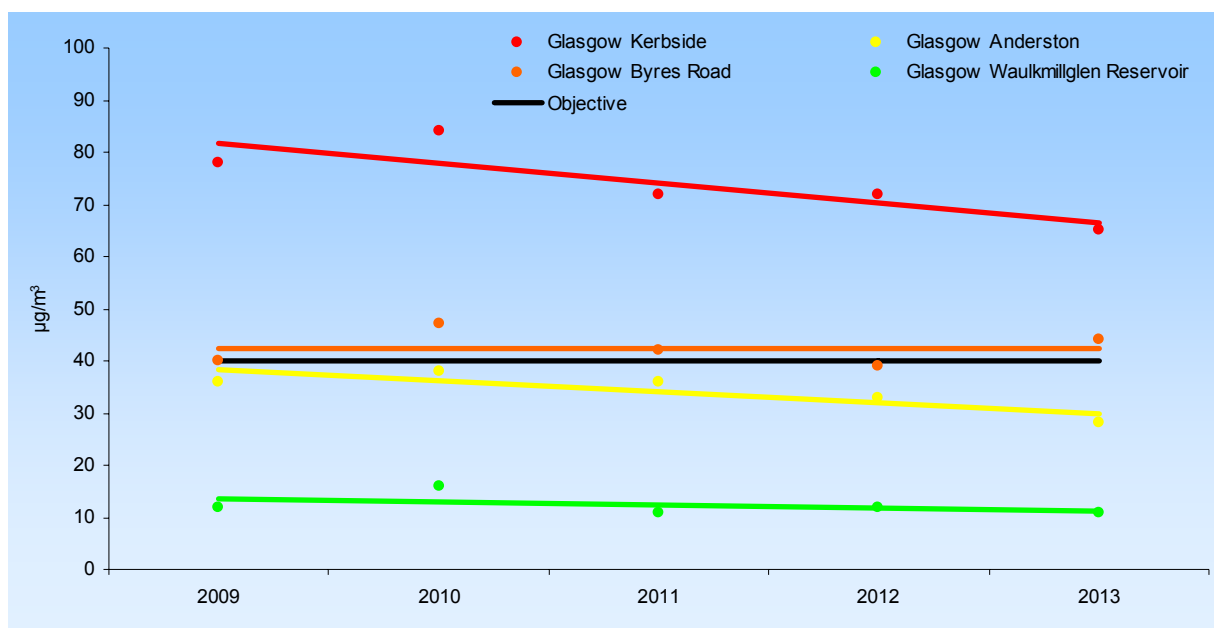


Table 2.6 shows the number of exceedences of the $200\mu\text{g}/\text{m}^3$ hourly objective over the last five years. During 2013, the permitted number of exceedences (18) of the Objective was exceeded at Anderston, where the Objective was exceeded on 42 occasions.

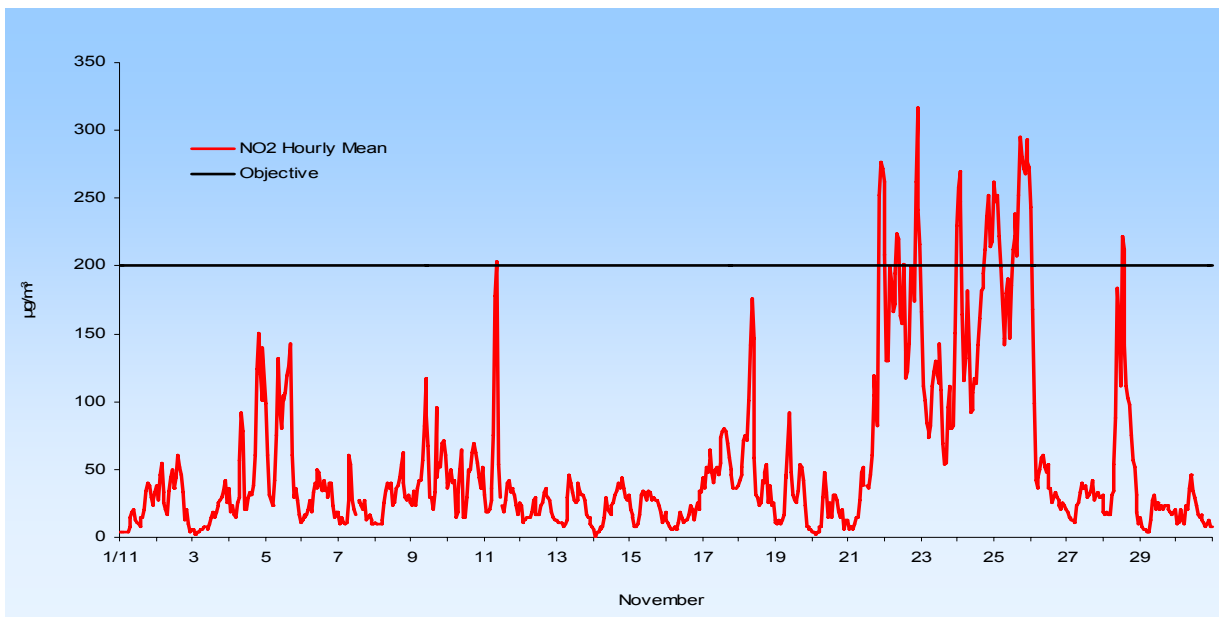
Table 2.6 Results of Automatic Monitoring for Nitrogen Dioxide Comparison with Hourly Mean Objective

Site Name	Within AQMA?	Relevant Public Exposure	% Valid Data Capture 2013	Number of Exceedences of Hourly Mean Objective ($200\mu\text{g}/\text{m}^3$) (99.8 th Percentile of Hourly Means) if % Valid Data Capture < 90%				
				2009	2010	2011	2012	2013
Glasgow Kerbside	City Centre	Yes	97	57	97	31	17	12
Glasgow Anderston	City Centre	Yes	96	4	16(204)	4	4	42
Glasgow Byres Road	Byres / Dumbarton	Yes	84	0	14	0(145)	7 (168)	4 (164)
Glasgow Dumbarton Road	Byres / Dumbarton	Yes	79	-	-	-	-	0 (141)
Glasgow Burgher Street	Parkhead	Yes	98	-	-	52(338)	0 (153)	1
Glasgow Waulkmillglen Reservoir	No	No	99	0	0	0	0 (109)	0

2.2.1.1 Automatic Monitoring Data (Cont.)

The majority of the 42 hourly exceedences recorded at Anderston (38) occurred during the period Thursday 21st (21:00) – Tuesday 26th (01:00) November, 28 of which occurred overnight. This would normally indicate an external cause such as roadwork's or construction on this occasion however no definitive cause was identified. Whilst these exceedences were accepted as valid during ratification it is noted that the 4 exceedences measured out with the dates above is similar to previous years at this location. Figure 2.4 following shows the hourly values obtained at this location during November 2013.

Figure 2.4 Glasgow Anderston Hourly Mean Nitrogen Dioxide Concentration Hourly Mean Objective (200µg/m³)



2.2.1.2 Non Automatic Monitoring Data

Monitoring for NO₂ by diffusion tube is currently carried out at 28 locations within the City Centre Air Quality Management Area the results of which are shown in Table 2.7 below. Figure 2.4 following shows five year trends based on the average value from those tubes classified as urban background and roadside.

Table 2.7 Results of Diffusion Tube Monitoring for Nitrogen Dioxide Within City Centre AQMA Comparison with Annual Mean Objective (40µg/m³)

Site Name	Data Collection 2013 (%)	Annual Mean Concentration (µg/m ³) (Bias Adjustment)				
		2009 (1.09)	2010 (1.10)	2011 (0.94)	2012 (0.95)	2013 (0.96)
George Square	58	44	52	44	41	48
Union Street	58	61	72	64	63	65
Bath Street	92	53	56	51	44	53
Glassford Street	83	51	51	48	44	54
Buchanan Street	92	-	59	46	45	48
Castle Street	92	32	40	35	34	35
Hope Street 3	92	57	61	55	50	59
Montrose Street	75	42	47	42	39	47
Cochrane Street	92	44	54	42	38	38
Renfield Street	92	54	60	59	60	59
George Street	83	53	51	47	45	47
North Street	92	40	40	30	26	33
Hope Street 1	75	64	91	76	73	87

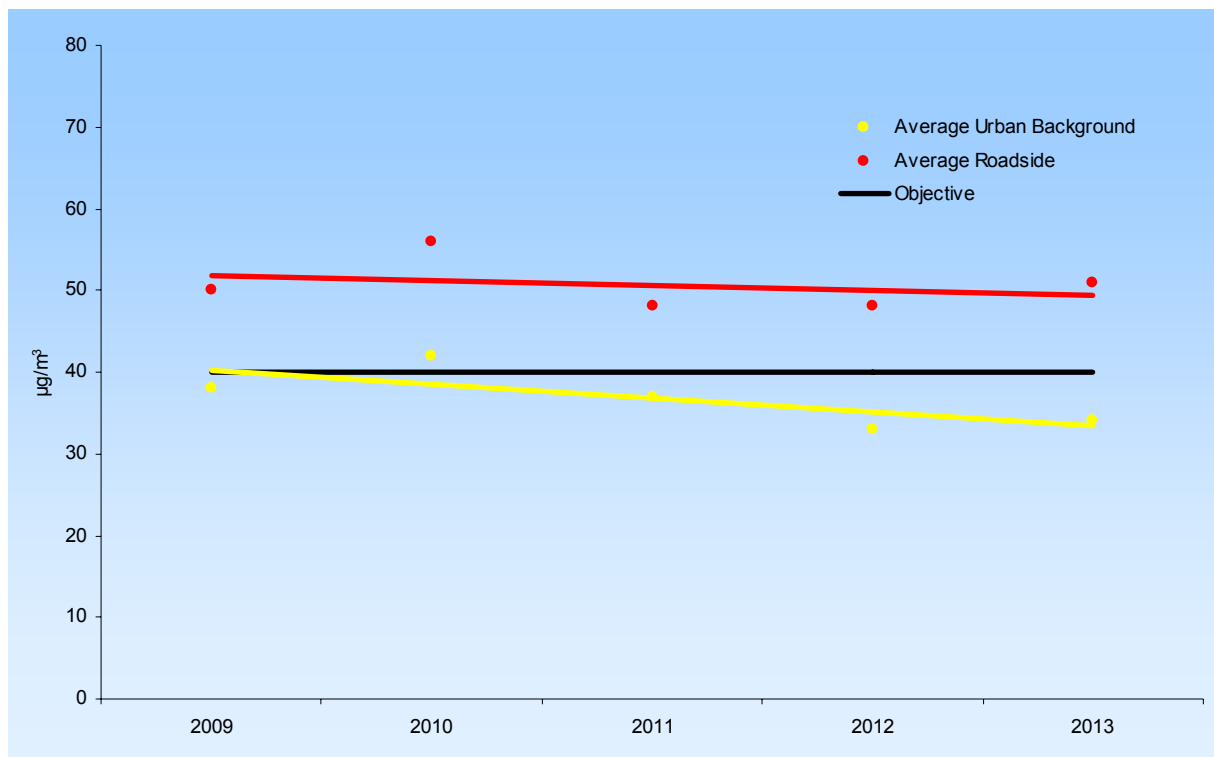
2.2.1.2 Non Automatic Monitoring Data (Cont.)

Table 2.7 Results of Diffusion Tube Monitoring for Nitrogen Dioxide Within City Centre AQMA (cont.) Comparison with Annual Mean Objective (40µg/m³)

Site Name	Data Collection 2013 (%)	Annual Mean Concentration (µg/m ³) (Bias Adjusted)				
		2009 (1.09)	2010 (1.10)	2011 (0.94)	2012 (0.95)	2013 (0.96)
Gordon Street	83	-	-	-	70	75
Heilanmans Umbrella North	83	76	84	68	59	78
Saltmarket	75	43	48	42	36	37
High Street	92	54	57	49	43	46
Dobbies Loan	92	32	33	31	28	28
Cathedral Bridge	92	60	59	53	100	57
Dundasvale Street	92	36	39	-	34	31
Royston Road	92	42	44	45	34	43
St Mungo Avenue	92	38	42	34	31	35
Brown Street	92	32	38	31	28	33
Broomielaw	75	51	51	40	33	47
McLeod Street	92	39	40	35	35	35
Sauchiehall Street	67	46	51	51	38	43
Kennedy Path	92	31	37	27	27	30
Bridge Street	92	43	43	39	35	35

2.2.1.2 Non Automatic Monitoring Data (Cont.)

Figure 2.5 Trends in Annual Mean Nitrogen Dioxide Concentration Within City Centre AQMA Comparison with Annual Mean Objective ($40\mu\text{g}/\text{m}^3$)



Monitoring for NO_2 by diffusion tube is currently carried out at 5 locations within the Byres Road / Dumbarton Road City Centre Air Quality Management Area. There were no exceedences of the Annual Mean Objective during 2013 the results of which are shown in Table 2.8.

Table 2.8 Results of Diffusion Tube Monitoring for Nitrogen Dioxide Within the Byres Road / Dumbarton Road AQMA Comparison with Annual Mean Objective ($40\mu\text{g}/\text{m}^3$)

Site Name	Data Collection 2013 (%)	Annual Mean Concentration ($\mu\text{g}/\text{m}^3$) (Bias Adjusted)				
		2009 (1.09)	2010 (1.10)	2011 (0.94)	2012 (0.95)	2013 (0.96)
Dumbarton Road	92	40	37	32	33	32
Lawrence Street	92	30	31	26	25	26
Cooperswell Street	92	27	32	27	23	28
Queen Margaret Drive 3	92	45	46	42	36	40
Queen Margaret Drive 2	83	39	41	36	31	34

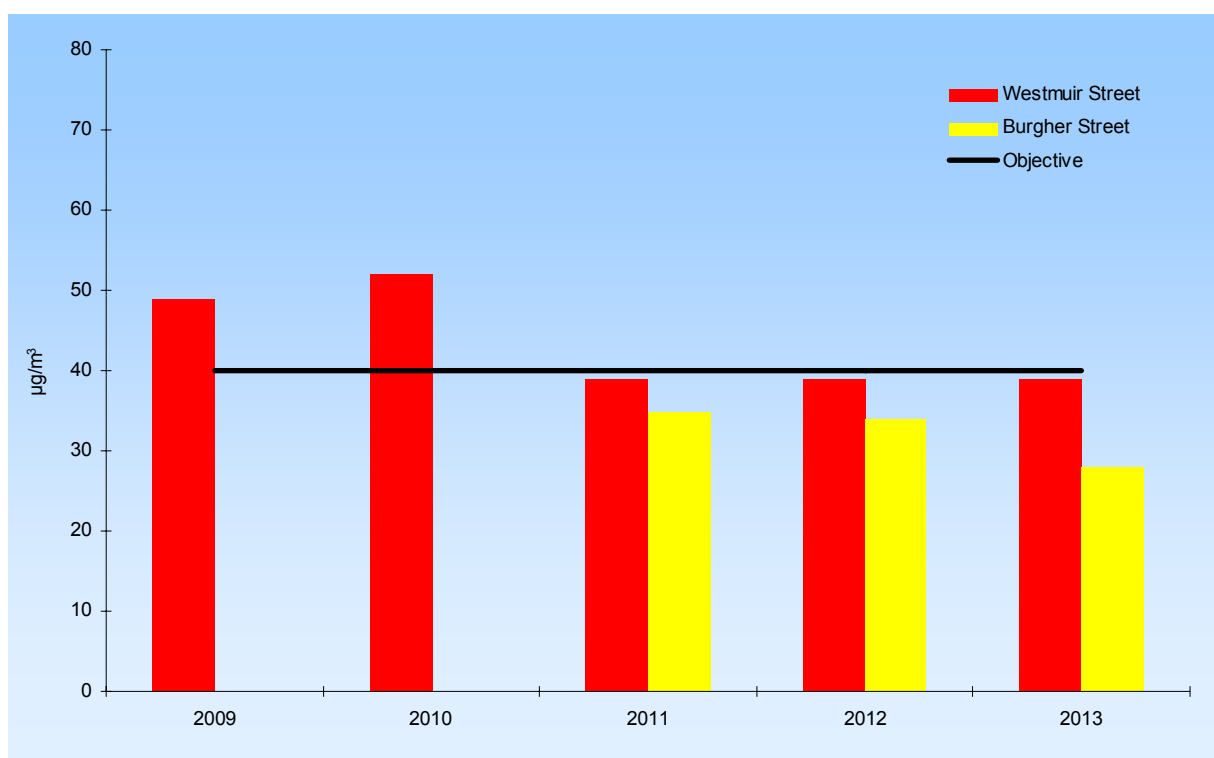
2.2.1.2 Non Automatic Monitoring Data (Cont.)

Monitoring for NO₂ by diffusion tube is currently carried out at a single location within the Parkhead Cross Air Quality Management Area. The Annual Mean Objective was not exceeded during 2013; results from this location are shown in Table 2.9. For comparison Figure 2.5 also shows the annual mean concentration from the automatic monitoring station at Burgher Street which is also located within this AQMA.

Table 2.9 Results of Diffusion Tube Monitoring for Nitrogen Dioxide Within Parkhead Cross AQMA Comparison with Annual Mean Objective (40µg/m³)

Site Name	Data Collection 2013 (%)	Annual Mean Concentration (µg/m ³) Bias Adjusted				
		2009 (1.09)	2010 (1.10)	2011 (0.94)	2012 (0.95)	2013 (0.96)
Westmuir Street	92	49	52	39	39	39

Figure 2.6 Annual Mean Nitrogen Dioxide Concentrations Within Parkhead Cross AQMA Comparison with Annual Mean Objective (40µg/m³)



2.2.1.2 Non Automatic Monitoring Data (Cont.)

Monitoring for NO₂ by diffusion tube is extensively carried out across the Glasgow Area at locations out with Air Quality Management Areas. The Annual Mean Objective was exceeded at one location, Maryhill Road during 2013. Monitoring at this location commenced in 2012, three additional tubes were installed in this area during 2013; monitoring results are shown in Table 2.10.

Table 2.10 Results of Diffusion Tube Monitoring for Nitrogen Dioxide Outwith the Existing AQMA's Comparison with Annual Mean Objective (40µg/m³)

Site Name	Data Collection 2013 (%)	Annual Mean Concentration (µg/m ³) Bias Adjusted				
		2009 (1.09)	2010 (1.10)	2011 (0.94)	2012 (0.95)	2013 (0.96)
Mossie Road	83	36	37	29	26	37
Finnieston Street	83	37	39	35	32	36
Hillcrest Road	92	26	26	19	21	24
St Andrews Drive	92	21	24	22	18	19
Haggs Road	83	36	36	36	32	30
Pollokshaws Road	92	27	29	32	20	25
Queen Margaret Drive	92	35	34	30	27	27
Napiershall Street	83	35	40	31	30	33
Oxford Street	92	38	37	34	29	31
Annie'sland Cross	92	29	35	34	26	30
Balshagray Avenue	83	32	33	26	25	29
Dougrie Road	92	23	25	20	20	19
Main Street (Bridgeton)	92	27	28	23	23	25
Aikenhead Road	92	27	31	23	27	29
Langside Primary School	83	24	25	18	22	22
Thornwood Drive	92	26	29	21	18	21
Springburn Road	92	31	37	30	22	31

2.2.1.2 Non Automatic Monitoring Data (Cont.)

**Table 2.10 Results of Diffusion Tube Monitoring for Nitrogen Dioxide
Outwith the Existing AQMA's (cont.)
Comparison with Annual Mean Objective (40µg/m³)**

Site Name	Data Collection 2013 (%)	Annual Mean Concentration (µg/m ³) Bias Adjusted				
		2009 (1.09)	2010 (1.10)	2011 (0.94)	2012 (0.95)	2013 (0.96)
Paisley Road West	83	33	42	31	33	28
Sutherland Avenue	83	20	23	16	18	18
Belmont Street	83	28	31	23	21	21
Mallaig Place	92	27	29	23	19	23
Govanhill Street	92	31	32	28	26	28
Westercraigs	75	25	26	22	24	24
Inveresk Lane	75	20	28	18	18	17
Kippen Street	92	28	27	29	22	23
Sacone SW	92	22	27	21	21	21
Invergarrie Road	92	19	23	18	17	17
Easterhouse	92	20	22	20	19	24
Dunn Street	92	23	31	20	20	23
Glasgow Harbour	92	28	34	28	25	26
Mosspark Boulevard	92	28	30	27	25	25
Crow Road	83	-	45	44	37	33
Silverburn	92	23	23	21	23	23
Hyndland Road	92	32	35	31	27	33
Urrdale Road	92	-	41	31	31	32
Park Road	92	-	-	40	31	36

2.2.1.2 Non Automatic Monitoring Data (Cont.)

**Table 2.10 Results of Diffusion Tube Monitoring for Nitrogen Dioxide
Outwith the Existing AQMA's (cont.)
Comparison with Annual Mean Objective (40µg/m³)**

Site Name	Data Collection 2013 (%)	Annual Mean Concentration (µg/m ³) Bias Adjusted				
		2009 (1.09)	2010 (1.10)	2011 (0.94)	2012 (0.95)	2013 (0.96)
Springfield Road	92	-	-	30	25	21
Paisley Road West 2	92	-	-	-	37	40
Crow Road 2	92	-	-	-	28	34
Maryhill Road	92	-	-	-	40	41
Scotstoun	92	-	-	-	19	22
Hampden	92	-	-	-	18	21
Kelvingrove Park	83	-	-	-	29	25
Tollcross Park	92	-	-	-	30	25
Milner Road	92	-	-	-	-	20
Gibson Street	92	-	-	-	-	32
Woodlands Road	75	-	-	-	-	31
Arlington Street	92	-	-	-	-	31
Poplar Avenue	92	-	-	-	-	29
Great Western Road	92	-	-	-	-	37
1031 Maryhill Road	83	-	-	-	-	37
MHR Shawpark Street	83	-	-	-	-	34
1428 Maryhill Road	83	-	-	-	-	29

2.2.2 Particulate Material at PM₁₀

Particulate Material (PM₁₀) is monitored using automatic analysers at ten locations across Glasgow, the Kerbside and Townhead AURN sites, the air quality stations at Glasgow Anderson, Byres Road, Burgher Street, Dumbarton Road and Waulkmillglen reservoir and three Particulate (PM₁₀) only locations at Abercromby Street, Broomhill and Nithsdale Road. Objectives have been set for both the Annual Mean and a 24 Hour Mean. Table 2.11 shows the measured annual mean at these locations over the last five years. Townhead was commissioned during October 2013; no data has been included from this location.

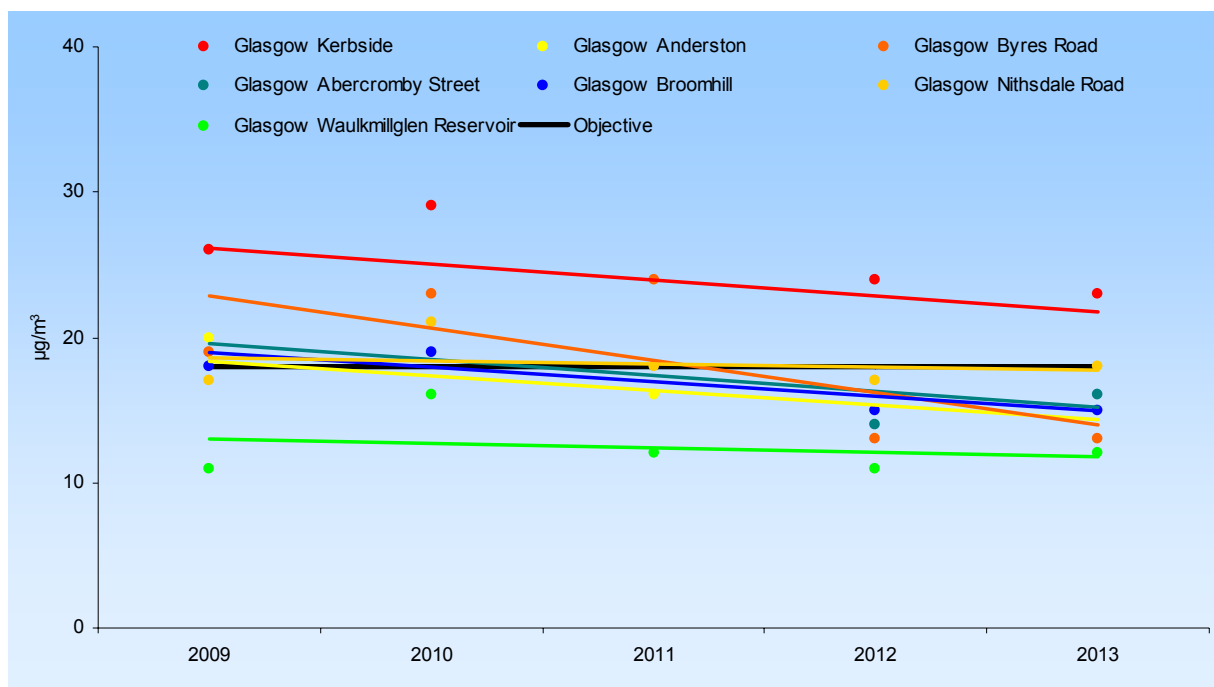
Table 2.11 Results of PM₁₀ Automatic Monitoring Comparison with Annual Mean Objective (18 µg/m³)

Site Name	Within AQMA?	Gravimetric Equivalent	% Valid Data Capture 2013	Annual Mean Concentration (µg/m ³)				
				2009	2010	2011	2012	2013
Glasgow Kerbside	Yes	Yes	85	26	29	18	24	23
Glasgow Anderston	Yes	Yes	92	20	16	16	14	16
Glasgow Byres Road	Yes	Yes	60	19	23	24	13	13
Glasgow Dumbarton Road	Yes	Yes	91	-	-	-	18	19
Glasgow Burgher Street	Yes	Yes	91	-	-	-	15	17
Glasgow Abercromby Street	Yes	Yes	92	18	21	18	14	16
Glasgow Broomhill	Yes	Yes	90	18	19	18	15	15
Glasgow Nithsdale Road	Yes	Yes	65	17	21	18	17	18
Glasgow Waulkmillglen Reservoir	No	Yes	97	11	16	12	11	12

During 2013, the Annual Mean Objective was exceeded at two locations, Glasgow Kerbside AURN and Dumbarton Road. There were particular % data capture issues at several locations, Glasgow Kerbside AURN, Byres Road and Nithsdale Road (both due to air conditioning failures) were all <90%. Figure 2.7 following, shows the generally decreasing trend at these locations over the previous five year period.

2.2.2 Particulate Material at PM₁₀ (Cont.)

Figure 2.7 Trends in Annual Mean PM₁₀ Concentration from Automatic Monitoring Comparison with Annual Mean Objective (18µg/m³)



As shown in Table 2.12 below, neither of the two Osiris monitoring locations exceeded the Annual Mean Objective.

Table 2.12 Results of Osiris PM₁₀ Monitoring Comparison with Annual Mean Objective (18 µg/m³)

Site Name	Within AQMA?	Gravimetric Equivalent	% Valid Data Capture 2013	Annual Mean Concentration (µg/m ³)
Sauchiehall Street	Yes	No	65	12
Maryhill Road	Yes	No	89	13

2.2.2 Particulate Material at PM₁₀ (Cont.)

During 2013, there were no exceedences of the Daily Mean Objective, as described previously data capture rates did not attain 90% at Glasgow Kerbside AURN, Byres Road and Nithsdale Road. Townhead AURN was commissioned during October 2013; no data has been included from this location. Table 2.13 shows the exceedences of the Daily Mean Objective over the last five years.

Table 2.13 Results of PM₁₀ Automatic Monitoring Comparison with 24 hour Mean Objective (50 µg/m³)

Site Name	Within AQMA?	Gravimetric Equivalent	% Valid Data Capture 2013	Number of Exceedences of Daily Mean Objective (98 th Percentile of Daily Means) if % Valid Data Capture < 90%				
				2009	2010	2011	2012	2013
Glasgow Kerbside	Yes	Yes	85	18	25	0(28)	7(59)	4(50)
Glasgow Anderston	Yes	Yes	92	12	4(45)	2(25)	3(39)	2
Glasgow Byres Road	Yes	Yes	60	2	9	2(40)	3(37)	0(31)
Glasgow Dumbarton Road	Yes	Yes	91	-	-	-	2(39)	1
Glasgow Burgher Street	Yes	Yes	91	-	-	-	4	3
Glasgow Abercromby Street	Yes	Yes	92	7	9(60)	9	4	2
Glasgow Broomhill	Yes	Yes	90	7	9	6	6	0
Glasgow Nithsdale Road	Yes	Yes	65	6	10(57)	6	9	3(43)
Glasgow Waulkmillglen Reservoir	No	Yes	97	0	4	0(20)	0(29)	0

2.2.3 Sulphur Dioxide

Sulphur Dioxide is measured at two locations, Glasgow Anderston and the Townhead AURN site. Townhead was commissioned during October 2013; no data has been included from this location. There were no exceedences of the Objectives for SO₂ at Anderston during 2013.

Table 2.14 Results of Sulphur Dioxide Automatic Monitoring Comparison with Objectives (15 minute - 266µg/m³), (1 hour - 350µg/m³), (24 hour - 125µg/m³)

Site Name	% Valid Data Capture 2013	Number of Exceedences of : (maximum measured)		
		15 minute Objective	1 hour Objective	24 hour Objective
Glasgow Anderston	92	0 (51µg/m ³)	0 (51µg/m ³)	0 (17µg/m ³)

2.2.4 Benzene

Benzene is measured using diffusion tubes at four sites in Glasgow. The tubes at these sites have been in operation since early 2006. The tubes are exposed for one month at a time and then analysed. The results are shown in Table 2.15 below.

Table 2.15 Results of Diffusion Tube Monitoring for Benzene Comparison with Annual Mean Objective (3.25µg/m³)

Site Name	% Valid Data Capture 2013	Annual Mean Concentration (µg/m ³)
Heilanmans Umbrella North	75	0.7
Hope Street	83	0.5
Ochiltree Avenue	83	0.6
Pollokshaws Road	75	0.8

2.2.5 Carbon Monoxide

Carbon Monoxide is measured at three locations, Glasgow Anderston, Byres Road and Townhead AURN. Townhead was commissioned during October 2013; no data has been included from this location. There was no measured exceedence of the CO Objective at the other two locations. Table 2.16 shows CO concentrations measured at the two locations.

**Table 2.16 Results of Monitoring for Carbon Monoxide
Comparison with 8 hour Running Mean Objective (10mg/m³)**

Site Name	% Valid Data Capture 2013	Maximum 8 hour Running Mean Concentration (mg/m ³)
Glasgow Anderston	56	0.5
Glasgow Byres Road	52	1.4

2.2.6 Ozone

Ozone is measured at two locations, Glasgow Waulkmillglen Reservoir and the Townhead AURN site. Ozone is a secondary pollutant and the highest concentrations are generally measured remotely from sources of pollution. There were 2 exceedences of the Running 8-hour Mean Objective at the rural site at Glasgow Waulkmillglen Reservoir during 2013. Townhead was commissioned during October 2013; no data has been included from this location.

**Table 2.17 Results of Monitoring for Ozone
Comparison with 8 hour Running Mean Objective (100µg/m³)**

Site Name	% Valid Data Capture 2012	Number of Exceedences of 8 hour Running Mean Objective (Maximum Number Allowed = 10)
Glasgow Waulkmillglen Reservoir	99	2

2.2.7 Particulate Material at PM_{2.5}

The Scottish Government has set an Annual Mean Objective for PM_{2.5}. Monitoring of PM_{2.5} is currently carried out at two locations, Glasgow Kerbside and Townhead AURN. Townhead was commissioned during October 2013; no data has been included from this location. Annual mean concentrations for PM_{2.5} measured at Glasgow Kerbside are shown in Table 2.18 below. Annual mean concentrations for PM_{2.5} measured by Osiris are shown in Table 2.19 following.

Table 2.18 Results of PM_{2.5} Automatic Monitoring Comparison with Annual Mean Objective (12 µg/m³)

Site Name	Gravimetric Equivalent	% Valid Data Capture 2013	Annual Mean Concentration (µg/m ³)				
			2009	2010	2011	2012	2013
			Glasgow Kerbside	Yes	80	-	23

Table 2.19 Results of Osiris PM_{2.5} Monitoring Comparison with Annual Mean Objective (12 µg/m³)

Site Name	Gravimetric Equivalent	% Valid Data Capture 2013	Annual Mean Concentration (µg/m ³)
Sauchiehall Street	Yes	65	5
Maryhill Road	Yes	89	5

2.2.8 Summary of Compliance with AQS Objectives

During 2013, Glasgow City Council has measured concentrations of nitrogen dioxide above the Annual Mean Objective at several locations within existing AQMA's and at one location not currently designated as a management area. The Hourly Mean Objective was also exceeded at one of the automatic monitoring stations across the city.

The Annual Mean Objective for PM₁₀ has been exceeded at two monitoring locations; there were no exceedences of the Daily Mean Objective.

NO₂ Annual Mean Objective

The Annual Mean Objective was exceeded at Glasgow Kerbside AURN, Byres Road and Dumbarton Road automatic monitoring stations and at various diffusion tube locations within the city centre AQMA. There was also one exceedence of this objective recorded at a diffusion tube sited on Maryhill Road which is not within an existing AQMA.

NO₂ Hourly Mean Objective

The NO₂ Hourly Mean Objective was exceeded on 42 occasions at Anderston; however 38 of these occurred within an extended weekend 100 hour period. The 99.8th percentile value of the objective measured at those locations where the percentage data capture was <90% did not indicate that this objective would have been exceeded.

PM₁₀ Annual Mean Objective

The PM₁₀ annual mean objective was exceeded at both Glasgow Kerbside AURN and Dumbarton Road.

It should be noted that the objective referred to above is the Annual Mean Objective for Scotland. This objective is set at 18 µg/m³; this is significantly lower than the UK objective of 40 µg/m³.

PM₁₀ Daily Mean Objective

There were no exceedences of the Daily Mean Objective, neither did the 90th percentile value from those sites with <90% data capture indicate that this objective would have been exceeded.

As with the Annual Mean Objective, Scotland has adopted a significantly lower objective for the daily objective. The number of permitted exceedences of the Objective has been set at 7, the UK Objective being set at 35 exceedences.

Other Objectives

Monitoring results for carbon monoxide, sulphur dioxide and benzene continue to show that concentrations of these pollutants are within the objectives set by the Air Quality (Scotland) Regulations. During 2013, concentrations of ozone were within the objective set by the Regulations. The Scottish Government has set an Annual Mean Objective for PM_{2.5}, this objective continues to be exceeded at Glasgow Kerbside.

3.0 New Local Policies and Developments

3.1 Policies (Air Quality Action Plan)

In response to the implementation of the AQMA's in the city, Glasgow Council produced Air Quality Action Plans in 2004 and 2009 introducing a range of measures aimed at reducing pollution in the city. The Action Plan is an evolving project, several measures such as vehicle idling enforcement, vehicle emission testing and initiatives towards cleaner taxis and passenger vehicles remain ongoing. Other measures such as a council workplace travel plan and easier public access to air quality information have been introduced. The Air Quality Action Plan in its current form is shown in Appendix A. Measures recently introduced by the council include.

3.1.1 City Development Plan

Glasgow is currently undertaking consultation on a proposed City Development Plan. The Plan will set out the planning framework for the city for the next ten years and will include spatial strategy, policies and proposals for the future use of land and infrastructure.

Supplementary Guidance relating to air quality in the planning process is currently being produced. This will update and replace the current Air Quality and Planning Guidance and Biomass Air Quality Guidance documents described below.

Policy on the Introduction of Biomass Installations

Recent years have seen an increase in the uptake of biomass as a fuel source for domestic, commercial and industrial sources. While there may be some environmental benefits in the use of renewable sources of fuel, the replacement of cleaner burning sources such as gas with biomass could have negative impacts on local air quality.

In November 2010 Glasgow City Council introduced a policy on biomass installations which made the following recommendations:

- All new biomass plant should be of high quality, corresponding to the best performing units currently on the market.
- Biomass heat uptake should only be used to replace or displace existing coal and oil fired heating in urban areas.
- Uptake levels of new biomass installations should be substantially lower in AQMAs and areas of known poor air quality than in other locations.

Additionally, the policy document sets out a requirement for biomass installations in, or in close proximity to AQMAs to be assessed for a range of environmental impacts, and only approved where a detailed environmental cost benefit analysis can demonstrate an overall net positive environmental benefit and no unacceptable deterioration in air quality.

3.1.1 City Development Plan (Cont.)

Air Quality and Planning Guidance

In October 2011 Glasgow City Council introduced Air Quality and Planning Guidance for developers acting within the city. This guidance is intended to inform developers of the importance with which air quality issues are taken in the planning process. It also serves to ensure a consistency in approach and that the following will be considered by the planning authority:

- Is an air quality assessment required?
- If so then has the air quality assessment produced been carried out in line with relevant guidance and agreed by the planning authority?
- How significant is the impact of the development on air quality?
- Are the proposed mitigation measures to address any air quality issues adequate?

3.1.2 Construction / Demolition Site Code of Practice for Dust and Emissions

Construction activities can give rise to a number of sources of dust and emissions. In October 2011 Glasgow City Council introduced a code of practice for developments within the city. The aim of this code of practice is to improve air quality within Glasgow through the adoption of the best possible techniques for the control of dust emissions from construction and demolition sites.

Developers within Glasgow are encouraged to reference the appropriate mitigation strategies for their particular circumstances and to commit to these strategies both within their air quality assessment and in practice.

3.1.3 City Centre Strategy

Glasgow has recently adopted a new City Centre Strategy (2014) which has potential effects on traffic routes throughout the city centre including changes to bus routes, the adoption of avenues and increased cycling infrastructure. The Strategy will be in place from 2014 to 2019 and the potential air quality impacts of individual aspects will be assessed as and when they are approved for implementation.

3.2 Developments

3.2.1 Road Traffic Sources

M74 Completion

The M74 Completion opened in June 2011, extending the M74 through to the M8 motorway immediately west of the Kingston Bridge in Glasgow city centre, completing the motorway network around Glasgow. The M74C has several intersections within Glasgow where traffic can join/exit the surface street network. Whilst the route generally avoids residential areas, the Environment Statement concluded that a marginal non compliance with annual air quality objectives at locations close to the route and at junctions with the surface street network was possible. Monitoring and modelling is being carried out on behalf of Transport Scotland as part of the Project Evaluation which is scheduled to be published in 2016. Initial analysis of the data has resulted in several additional NO₂ diffusion tubes being placed at locations adjacent to the route. Results from these locations will be included in the 2015 Progress Report.

East End Regeneration Route

The EERR was intended to be a motorway to motorway link through Glasgow's east end, the latest completed section Phase 2 opened in April 2012. This section links the Commonwealth Games venues at Parkhead, the National Indoor Sports Arena and the athletes' village with the previously completed Phase 1 link to the M74C motorway. Construction of the final phase of the route, linking with the M8 motorway, has been delayed till after the Commonwealth Games in 2014.

3.2.2 Industrial Sources

Polmadie Recycling Centre

Planning consent has been granted for the construction and operation of a major recycling centre to be housed on the site of an existing council facility on Polmadie Road. The development included plans for a CHP plant running on anaerobic digestion derived biogas and gasifiers fuelled by non-recyclable waste. This facility will be licensed by the Scottish Environment Protection Agency and has been subject to an Environmental Impact Assessment. The EIA included modelling of impacts on a variety of pollutants including those covered by the Local Air Quality Management process. The modelling predicted negligible or imperceptible impacts at all modelled receptors.

An agreement has been reached for the provision of funding for an ambient air quality monitoring station to be sited in the area.

3.2.3 Commercial and Domestic Sources

Gorbals District Heating

Planning consent has been granted for the construction and operation of a district heating project serving five multi-storey residential blocks in the Gorbals area. This system will utilise biomass as the major energy source.

Given the recent introduction of the Council's policy on the implementation of biomass installations, this development undertook a detailed assessment of air quality impacts. The developers also undertook a detailed environmental cost benefit analysis as part of the planning process.

The air quality assessment predicted negligible impacts on air quality at all receptors.

4.0 Conclusions and Proposed Actions

4.1 New Monitoring Data

NO₂ Annual Mean Objective

Automatic analyser and diffusion tube monitoring of NO₂ indicates that concentrations are likely to continue to exceed the Annual Mean Objective at locations within the existing City Centre and Byres Road / Dumbarton Road Air Quality Management Areas. Concentrations within the Parkhead AQMA whilst below this Objective during 2013 require further monitoring prior to any consideration in regard to progressing to a Detailed Assessment. This Objective was also exceeded at one location outwith an existing AQMA (Maryhill Road), monitoring at this location and others in this area will continue during 2014. It is not considered that any further amendment to the existing AQMA's is required or that any new areas progress to Detailed Assessment.

NO₂ Hourly Mean Objective

Automatic monitoring results show that the Hourly Mean Objective was exceeded at one monitoring location within the City Centre Air Quality Management Area, Anderston. Additionally, several diffusion tubes within this AQMA continue to produce an annual mean concentration in excess of 60µg/m³. It is not considered that any further amendment to the existing AQMA is required or that any new areas progress to Detailed Assessment.

PM₁₀ Annual Mean Objective

Monitoring results show that the PM₁₀ Annual Mean Objective was exceeded at two locations within the city, Glasgow Kerbside AURN and Dumbarton Road. Glasgow City Council is currently producing a detailed assessment of PM₁₀ across the city.

PM₁₀ 24-hour Mean Objective

There were no exceedences of the Daily Mean Objective, neither did the 90th percentile value from those sites with <90% data capture indicate that this objective would have been exceeded. It is not considered that any amendment to the existing Citywide AQMA is required.

4.2 New Local Developments

4.2.1 Road Traffic Sources

The Environment Statement for the M74 Completion concluded that a marginal non compliance with annual air quality objectives was possible at locations close to the route and at junctions with the surface street network. Monitoring and modelling is being carried out on behalf of Transport Scotland as part of the Project Evaluation which is scheduled to be published in 2016. Initial analysis of the data has resulted in several additional NO₂ diffusion tubes being placed at locations adjacent to the route. Results from these locations will be included in the 2015 Progress Report.

Appendix A Air Quality Action Plan

Measure	Lead Authority / Focus	Planning / Implementation	Progress	Progress During 2013	Completion Date
Vehicle Idling	GCC / Council will expand programme of vehicle idling enforcement	NA / 2003 onwards	Regular scheduled patrols to enforce and/or educate regarding vehicle idling	6 FPN's issued	Ongoing
Emission Testing	GCC / Council will continue a programme of roadside emission testing	NA / 2003 onwards	27000+ vehicles tested	2675 vehicles tested 32 FPN's issued	Ongoing
Low Emission Zones	GCC / The Council will undertake a detailed feasibility study with a view to introducing LEZs in Glasgow	2009 / 2009 -10	Feasibility study into LEZs in Glasgow was completed in 2010. Scottish Government are working towards a national low emission strategy with Glasgow involved as a partner authority.	LEZ proposals prepared and passed to CWG OC Trial of LEZ camera technology completed. Date to be set for debrief.	2014
Cleaner Taxis	GCC / Council will prepare an emissions strategy to reduce emissions from taxi and private hire vehicles	2009 onwards / ongoing	Proposals to limit the maximum age and increase the emission testing frequency for taxis researched and discussed with interested parties	Taxis have been preferentially selected for roadside emissions testing. Further discussions with Licensing and Test centre re-taxi maximum age and increased testing.	2014

Measure	Lead Authority / Focus	Planning / Implementation	Progress	Progress During 2013	Completion Date
Council Workplace Travel Plan	GCC / Council will prepare a workplace travel plan for all employees	2009 - 10 / 2011 onwards	The travel plan has been completed, however it is a living document – tasks have no finite life span	Cycling Infrastructure improvements Liftshare car share facility for GCC Pool bike scheme Site Bike Scheme Cycle to work scheme Improvements at council premises including secure parking facilities. Travel Plan to be relaunched in an updated form in 2014.	Ongoing
Car Clubs	GCC / The Council will make on street spaces available for car club vehicles.	2009 - 10 / 2010 onwards	Car club has 30 vehicles including 8 hybrids in operation within Glasgow located on street in council provided bays. New spaces provided as club expanded. Land & Environmental services now use club as a corporate member.	Phase 3 launched 13no. additional spaces in Southside and East end in 2013 bringing current total to 37.	Ongoing. Further expansion in the West End with approx 11 new spaces being rolled out in 2015.

Measure	Lead Authority / Focus	Planning / Implementation	Progress	Progress During 2013	Completion Date
Public Service Vehicles	GCC / The Council will pursue the use of traffic regulation conditions to control bus emissions within AQMAs	2009 onwards / 2009 ongoing	The Quality Partnership Scheme in the city requires that buses have to meet set emission standards by pre-agreed dates on certain routes.	From January 2014 100% of each operator's streamline journeys within Glasgow City boundary will be operated with vehicles meeting EURO 3 emission engine standard for particulates (PM10). The implementation of the Fastlink route linking the City Centre and the new Southern General Hospital scheduled to commence in 2015 will introduce emission standards of initially Euro Cat 4 or 5	2014 2021
Boiler Emissions	GCC / The Council will raise awareness and provide information to assist in energy efficiency in the home and workplace	2010 / 2011 onwards	Biomass Guidance produced 2011 addressing boiler emissions Glasgow Home Energy Advice Team (G-HEAT) has been established to provide independent advice on energy related issues to householders in the city	Attention of developers is drawn to biomass guidance at the planning stage Awareness raising continues through G-HEAT	Ongoing
Planning Guidance	GCC / The Council will produce revised planning guidance	2010 – 11/ 2012	Guidance produced.	Guidance complete and available on council website	

Measure	Lead Authority / Focus	Planning / Implementation	Progress	Progress During 2013	Completion Date
Air Quality Information	GCC / The Council will provide data and information regarding current and longer term air quality monitoring on our web site and at variable message signs throughout the city	2010 onwards / 2010 ongoing	All air quality review and assessment reports are available on the GCC website. Further reports, guidance documents and links to be added when complete.	Daily Update of Air Quality Data now also published on the GCC website. Discussions ongoing with Transport Scotland re-motorway network VMS	Ongoing
Construction Sites	GCC / The Council will produce a code of practice for construction / demolition contractors	2011 / 2012	Guidance produced	Guidance completed and available on the web site	2012
Fire Reduction	GCC / The Council will investigate multi agency strategic level actions aimed at reducing the number of fires and harmful emissions	2011 / 2011	The Council have promoted and facilitated educational visits to schools to highlight the dangers of fires and fire starting to children.	SF&R visits to schools within the city.	2011

Measure	Lead Authority / Focus	Planning / Implementation	Progress	Progress During 2013	Completion Date
Cycling Strategy	GCC / Air Quality grants will be sourced for funding cycling improvements in the city	2011 onwards / 2011 ongoing	Over £350,000 grant has been obtained from Scottish Govt and used for provision of various bike shelters and stances across the city	<p>A programme of cycle rack installation in the outlying areas of Glasgow was progressed in the North, North West and West of the city.</p> <p>43 cycle racks installed at local hubs (shopping, cafés, community centres and other key trip generators).</p> <p>Further expansion of facilities in the City Centre via an additional 130 cycle racks</p> <p>As part of the Travel Plan development, depot and office locations were targeted to provide secure cycle parking. Cycle Parking at Exchange House was expanded from 46 to 72 cycle spaces, a further 20 spaces were installed at each of Darnick St, Daldowie Training Centre, Garscadden Depot and Dawsholm Complex.</p>	<p>Ongoing</p> <p>A further grant application was submitted for 2014/15</p>

Measure	Lead Authority / Focus	Planning / Implementation	Progress	Progress During 2013	Completion Date
Bus Retro-fit Scheme	GCC – SPT / Grant funding to retro-fit Buses with new exhaust tech to reduce harmful emissions	2011 onwards / 2011 ongoing	Grant of ~ £250k agreed from Scot Gov Discussions with bus operators / SPT / Retrofit companies and procurement	Follow up proposals rejected by bus companies. Revised proposal to redirect funding towards joint purchase with SPT of 2 fully electric buses for use on Route 100 to Transport museum.	2014
Tree Planting	GCC / The Council will investigate the potential for a programme of tree planting as a means of city centre PM10 reduction	2011 - 12 / 2012 - 13	Programme of tree planting within the city continues	Tree planting continues including approx 250 new trees during 2013.	Ongoing
CARBOTRAF	EU – Air Monitors Ltd / EU project to bring about real-time reduction in traffic pollution through active traffic management.	2011 ongoing	Participation in EU project (2 cities Glasgow and Graz, Austria)	Equipment installed within our monitoring stations. Traffic counting camera locations identified	2014
Promote Greener Vehicles	The Council will investigate the potential for reduced rate street parking for electric and hybrid vehicles	2012 / 2012 -13	Glasgow City Council has introduced a network of public charging points, each point is capable of simultaneously charging 2 vehicles. Charging points have also been provided within council car parking facilities.	Commenced work on the next phase which will see the network of charging facilities expanded with the possible inclusion of dedicated free “on street” parking / charging bays and at commonwealth games legacy venues, leisure centres and car parks. There are now 56 public charging points available.	2013

Measure	Lead Authority / Focus	Planning / Implementation	Progress	Progress During 2013	Completion Date
Leading by Example	The Council will demonstrate best practice in the operation of its vehicle fleet	Ongoing / Ongoing	The Council have introduced a fleet of electric vehicles through a government backed scheme and trained staff in the efficient use of these vehicles.	<p>Expanded the use of electric vehicles within the fleet including new Nissan Note vehicles.</p> <p>Ecdriver training undertaken</p> <p>Council now has a total of 13 electric vehicles, (including utility vehicles), plus others which are used by partner agencies</p>	Ongoing

References

- Department of the Environment, Food and Rural Affairs (2000). Part IV The Environment Act 1995, Local Air Quality Management, Technical Guidance, LAQM.TG(09);
- The Scottish Executive (2002). Air Quality (Scotland) Amended Regulations
- Glasgow City Council (1998). Local Air Quality Management, Review and Assessment of Air Quality in Glasgow Stage 1;
- Glasgow City Council (2000). Local Air Quality Management, Review and Assessment of Air Quality in Glasgow Stage 2;
- Glasgow City Council (2001). Local Air Quality Management, Review and Assessment of Air Quality in Glasgow Stage 3;
- Glasgow City Council (2003). Local Air Quality Management, Review and Assessment of Air Quality in Glasgow Stage 4;
- Glasgow City Council (2003). LAQM Updating and Screening Assessment;
- Glasgow City Council (2004). Local Air Quality Action Plan;
- Glasgow City Council (2005). LAQM Detailed Assessment;
- Glasgow City Council (2005). LAQM Progress Report;
- Glasgow City Council (2006). LAQM Updating and Screening Assessment;
- Glasgow City Council (2007). LAQM Detailed Assessment;
- Glasgow City Council (2008). LAQM Further Assessment;
- Glasgow City Council (2008). LAQM Progress Report;
- Glasgow City Council (2009). LAQM Updating and Screening Assessment;
- Glasgow City Council (2010). LAQM Detailed Assessment;
- Glasgow City Council (2010). LAQM Progress Report;
- Glasgow City Council (2011). LAQM Progress Report;
- Glasgow City Council (2012). LAQM Updating and Screening Assessment;
- Glasgow City Council (2013). LAQM Further Assessment;
- Glasgow City Council (2013). LAQM Progress Report;
- Glasgow City Council (2013). LAQM Detailed Assessment;



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