

2011 Air Quality Progress Report for Manchester City Council

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

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Executive Summary

The Environment Act 1995 places a statutory duty on local authorities to undertake periodic review and assessments of air quality within their area.

This report updates air quality monitoring data and progress with the Council's air quality action plan in 2010 to work towards achieving air quality objectives.

This report has established that air quality objectives for PM₁₀ particulate matter, sulphur dioxide, benzene, carbon monoxide, lead and 1,3-butadiene will be met.

Exceedences of the annual mean objective for nitrogen dioxide continue to occur in the air quality management area, primarily in the city centre and along arterial roads.

A detailed assessment of air quality is being progressed, in partnership with the other nine Greater Manchester local authorities and Transport for Greater Manchester.

The Council is continuing to develop and implement its local air quality action plan in partnership with stakeholders to improve local air quality.

Table of contents

1	Introduction	6
1.1	Description of Local Authority Area	6
1.2	Purpose of Progress Report	7
1.3	Air Quality Objectives	7
1.4	Summary of Previous Review and Assessments	9
2	New Monitoring Data	12
2.1	Summary of Monitoring Undertaken	12
2.2	Comparison of Monitoring Results with Air Quality Objectives	19
3	New Local Developments	42
3.1	Road Traffic Sources	42
3.2	Other Transport Sources	42
3.3	Industrial Sources	42
3.4	Commercial and Domestic Sources	43
3.5	New Developments with Fugitive or Uncontrolled Sources	43
4	Local / Regional Air Quality Strategy	44
5	Planning Applications	45
6	Air Quality Planning Policies	47
7	Local Transport Plans and Strategies	48
8	Climate Change Strategies	49
9	Implementation of Action Plans	50
10	Conclusions and Proposed Actions	86
10.1	Conclusions from New Monitoring Data	86
10.2	Conclusions relating to New Local Developments	86
10.3	Proposed Actions	86
11	References	88

Appendices

Appendix A: QA/QC Data

Appendix B: Location maps and photographs of non-automatic monitoring sites

List of Tables

Table 1	Most significant sources of LAQM pollutants in Manchester
Table 2	Air Quality Objectives included in Regulations for the purpose of Local Air Quality Management in England
Table 3	Summary of previous rounds of review and assessment completed by Manchester City Council
Table 4	Details of Automatic Monitoring Sites
Table 5	Details of Non- Automatic Monitoring Sites
Table 6	DEFRA site classification definitions
Table 7	Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with Annual Mean and 1-hour Mean Objectives
Table 8	Results of nitrogen dioxide diffusion tubes
Table 9	Results of PM ₁₀ Automatic Monitoring: Comparison with Annual Mean and 24-hour Mean Objectives
Table 10	Results of Partisol PM ₁₀ Non-automatic Monitoring: Comparison with Annual Mean and 24-hour Mean Objectives
Table 12	Results of Sulphur Dioxide Automatic Monitoring: Comparison with 15 minute, 1-hour and 24-hour Objectives
Table 13	Results of Pumped Benzene Monitoring: Comparison with Annual Objectives
Table 14	Results of Benzene Diffusion Tube Monitoring: Comparison with Annual Objectives
Table 15	Results of Automatic Carbon Monoxide Monitoring: Comparison with Running 8-hour Mean Objective
Table 16	Results of Lead Monitoring: Comparison with Annual Mean Objective
Table 17	National Air Quality Strategy Objective for ozone
Table 18	Results of Automatic Ozone Monitoring: Comparison with 8-hour Running Mean Objective
Table 19	National Air Quality Strategy Objective for PM _{2.5}
Table 20	Results of PM _{2.5} Automatic Monitoring
Table 21	Results of Partisol PM _{2.5} Non-automatic Monitoring

Table 22	New industrial sources in Manchester
Table 23	Major development schemes under construction in 2010/11
Table 24	Manchester's Air Quality Actions – Local Transport Measures
Table 25	Manchester's Air Quality Actions – Energy Efficiency Measures
Table 26	Manchester's Air Quality Actions – Regulatory and Enforcement Measures

List of Figures

Figure 1	Map of Manchester City Council AQMA Boundaries
Figure 2	Maps of Automatic Monitoring Sites
Figure 3	Long-term trends in nitrogen dioxide monitoring at Manchester automatic sites
Figure 4	Variation in hourly nitrogen dioxide concentrations at Piccadilly Gardens
Figure 5	Variation in hourly nitrogen dioxide concentrations at Manchester South
Figure 6	Variation in hourly nitrogen dioxide concentrations at Oxford Road
Figure 7	Daily variation in NO ₂ concentrations
Figure 8	PM ₁₀ concentrations at Manchester Piccadilly Gardens
Figure 9	Annual variation in hourly PM ₁₀ concentration at Piccadilly Gardens
Figure 10	Annual variation in hourly PM ₁₀ concentration at Oxford Road
Figure 11	Daily variation in PM ₁₀ concentrations
Figure 12	Acid rain measured at Manchester monitoring sites
Figure 13	Gamma radiation measured as a 24-hour mean in Manchester

1 Introduction

1.1 Description of Local Authority Area

The city of Manchester is located in the North West of England, and is one of 10 local authorities that form the metropolitan county of Greater Manchester, which was established in 1974. Greater Manchester is a major conurbation that has a population of almost 2.5 million. The Manchester City Council area covers an area of 116 Km² and has a 2009 mid year population estimate of 483,800. It is the most densely populated of the ten Greater Manchester districts at 41.8 persons per hectare.

Much of the area is urban or suburban. Major road routes include the M60 orbital motorway in the north and south of the City Council area, and the M56 motorway in the south of the city. Manchester airport is located to the south of the city, and is the third busiest airport in the country.

The Greater Manchester Authorities have worked closely with the Greater Manchester Transportation Unit (GMTU) (now incorporated into the recently established Transport for Greater Manchester) to annually update the Emissions Inventory for Greater Manchester (EMIGMA) database, which contains information on the emissions of pollutants identified in the UK's Air Quality Strategy from all identifiable sources.

Table 1 highlights the most significant sources of local air quality management (LAQM) pollutants in Manchester, as indicated by the 2006 update of the EMIGMA database.

Table 1 Most significant sources of LAQM pollutants in Manchester

LAQM Pollutant	Most significant sources in Manchester and % contribution to total emissions
Oxides of nitrogen (NO _x)	1. Road transport (51%) 2. Combustion (26%) 3. Air travel (12%)
PM ₁₀ fraction particulate matter (PM ₁₀)	1. Road transport (76%) 2. Part B's (11%) 3. Combustion (4.5%)
Sulphur dioxide (SO ₂)	1. Other area sources (44%) 2. Air travel (14%) 3. Part B's (13%)
Benzene	1. Road transport (54%) 2. Rail (23%) 3. Other area sources (12%)
Carbon monoxide (CO)	1. Road transport (80%) 2. Air travel (12%) 3. Combustion (5.3%)
Lead	1. Part B regulated industrial processes (100%)
1,3 Butadiene	1. Road transport (75%) 2. Rail (25%) 3. Bus stations (0.7%)

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 Local Air Quality Management (LAQM) **in England** are set out in the Air Quality (England) Regulations 2000 (SI 928), and the Air Quality (England) (Amendment) Regulations 2002 (SI 3043). They are shown in Table 2. This table shows the objectives in units of microgrammes per cubic metre $\mu\text{g}/\text{m}^3$ (for carbon monoxide the units used are milligrammes per cubic metre, mg/m^3) and includes the number of permitted exceedences in any given year (where applicable).

Table 2 Air Quality Objectives included in Regulations for the purpose of Local Air Quality Management in England

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Benzene	16.25 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2003
	5.00 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2010
1,3-Butadiene	2.25 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2003
Carbon monoxide	10.0 mg/m^3	Maximum daily running 8-hour mean	31.12.2003
Lead	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	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 (PM₁₀) (gravimetric)	50 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2004
Sulphur dioxide	350 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

1.4 Summary of Previous Review and Assessments

Table 3 outlines the conclusions of previous rounds of local air quality management review and assessment completed by Manchester City Council.

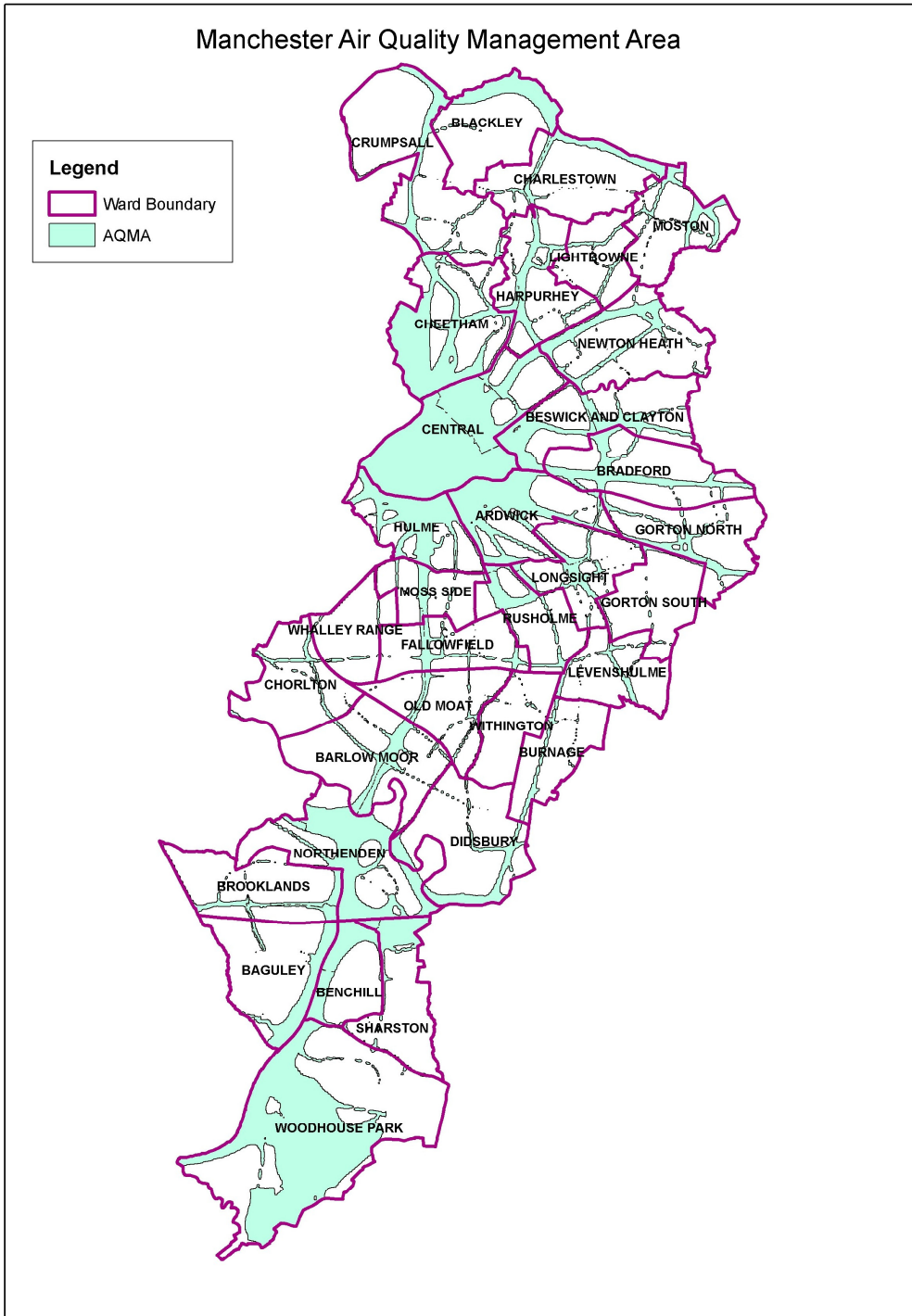
Table 3 Summary of previous rounds of review and assessment completed by Manchester City Council

Previous round of review and assessment	Date completed	Brief outcome of review and assessment
Stage 1 and 2	September 1999	Detailed Assessment of exceedences of the annual NO ₂ and 24-hour PM ₁₀ air quality objectives required.
Stage 3	June 2000	Proposed declaration of air quality management area (AQMA) for the annual NO ₂ objective, and to a lesser extent the 24-hour PM ₁₀ objective along busy roads, the city centre and the area surrounding Manchester airport. An AQMA was declared in July 2001.
Stage 4	July 2002	Stage 3 findings of June 2000 confirmed.
Phase 2 Updating and Screening Assessment	June 2003	Exceedences of NO ₂ and PM ₁₀ objectives predicted. Detailed Assessment of exceedences of the annual NO ₂ and 24-hour PM ₁₀ air quality objectives required.
Phase 2 Detailed Assessment	March 2004	Likely exceedences of only the annual NO ₂ objective were predicted, therefore it was proposed that the boundaries of the AQMA were reviewed. An amendment to the AQMA was agreed by committee in July 2005. The AQMA was amended by variation order in November 2007 to include busy roads, the city centre and the area surrounding Manchester airport.
Progress report	July 2005	NO ₂ annual objectives continue to be exceeded at certain locations.
Stage 4 Review and Assessment	July 2006	Findings of the Phase 2 Detailed Assessment of March 2004 confirmed.
Third round Updating and Screening Assessment	July 2006	NO ₂ annual objectives continue to be exceeded at certain locations, but no new exposures were identified.
Progress report	July 2007	Possible exceedences of the hourly NO ₂ objective identified within the AQMA along certain busy roads in the city centre identified.
Progress report	July 2008	Possible exceedences of the hourly NO ₂ objective identified within the AQMA along certain busy roads in the city centre identified.
Updating and Screening Assessment	July 2009	Identified potential new exposure relevant to NO ₂ objectives at locations close to train lines with large numbers of diesel locomotives. Therefore a more detailed assessment of NO ₂ required - to be part of a wider Greater Manchester detailed assessment. Also identified possible risk of exceeding 15-minute SO ₂ objective at Manchester Victoria and Piccadilly train stations due to stationary idling locomotives. However, further discussions with the national air quality review and assessment helpdesk in 2010 confirmed that exposure locations were not "outdoors" in the general sense of the word, and local air quality management

Previous round of review and assessment	Date completed	Brief outcome of review and assessment
		objectives were not applicable. Therefore no further local air quality management action required.
Progress report	July 2010 (action plan progress report) and November 2010 (air quality monitoring progress report)	No new exceedences of air quality objectives identified. Detailed assessment of NO ₂ and PM ₁₀ as part of a wider Greater Manchester detailed assessment progressing.

Previous rounds of review and assessment have predicted or identified exceedences of the annual NO₂ objective and the 24-hour PM₁₀ objective. However, the most recent detailed assessment (produced in 2004) predicted exceedences of the annual NO₂ objective only. The most recent AQMA was officially amended in 2007 to reflect exceedences of the annual NO₂ objective only. The current AQMA is shown in Figure 1.

Figure 1 Map of Manchester City Council AQMA Boundaries



The current AQMA shows that the areas that may exceed the annual nitrogen dioxide objective are primarily in the City Centre, the arterial traffic routes around the city and in the south of the city adjacent to the M56 motorway reflecting activity associated with Manchester Airport.

2 New Monitoring Data

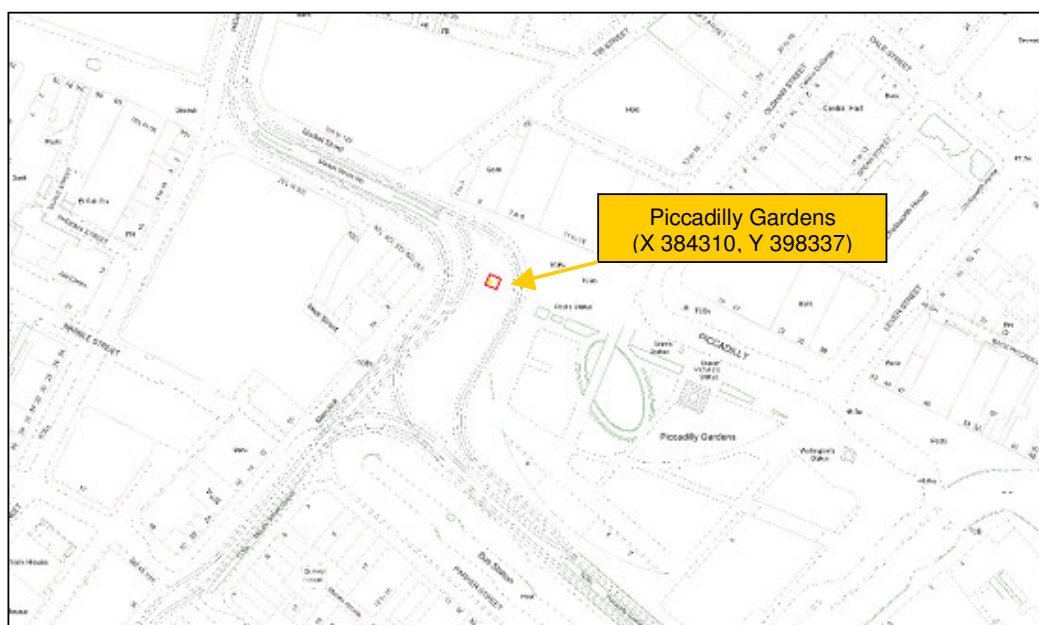
2.1 Summary of Monitoring Undertaken

2.1.1 Automatic Monitoring Sites

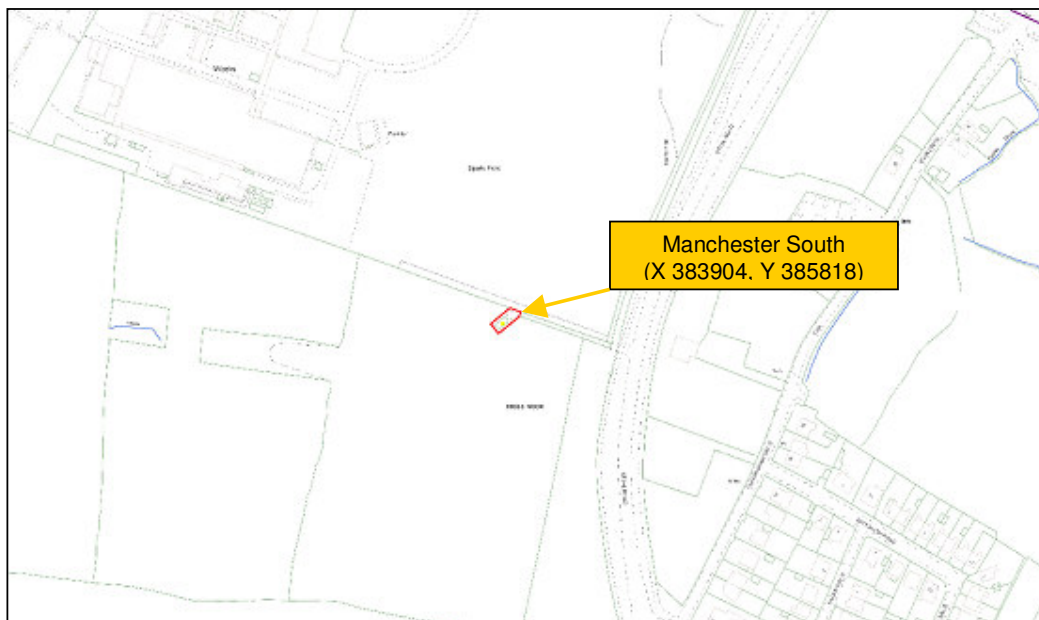
Manchester City Council currently operates 3 automatic air quality monitoring sites (Piccadilly Gardens, Manchester South and Oxford Road), which are shown in Figure 2 and detailed in Table 4. The distance indicated to any relevant exposure is the nearest distance measured using Arcview GIS to the nearest relevant exposure as determined by the averaging periods of the air quality objectives (either annual or hourly).

Figure 2 Maps of Automatic Monitoring Sites

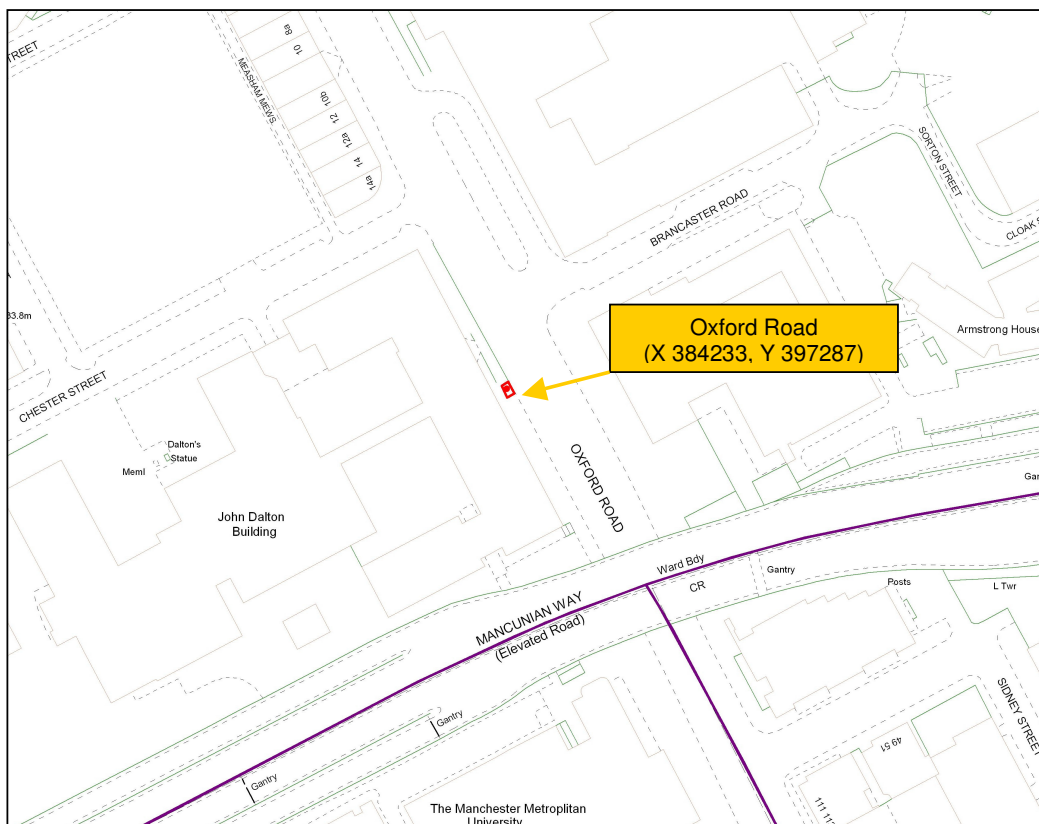
a) Piccadilly Gardens



b) Manchester South



c) Oxford Road



Recent changes in Manchester automatic monitoring sites

In the financial year of 2008/9, Manchester City Council applied for and received a grant award from the Department for Environment, Food and Rural Affairs (Defra) for the purchase of an automatic roadside air quality monitoring station to monitor NO_x and PM₁₀. The monitoring site has been installed along Oxford Road, close to Manchester City Centre. The route is one of the main arterial roads of the city, and is one of the most heavily trafficked by buses in Europe. It is also a very economically vibrant corridor with university campuses, cafe bars, pubs/ nightclubs and associated high levels of pedestrian activity located along it. The monitoring site was commissioned in March 2010.

Table 4 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?
Piccadilly Gardens	Urban Centre	X 384310	Y 398337	NO _x PM ₁₀ PM _{2.5} O ₃ CO SO ₂ Benzene	Chemiluminescence Beta Attenuation TEOM/FDMS UV absorption Non-dispersive infrared UV Fluorescence Pumped benzene unit	Y	Y (1m) for short term objectives	56m (Piccadilly)	N/A
Manchester South	Suburban	X 383904	Y 385818	NO _x O ₃ SO ₂	Chemiluminescence UV absorption UV Fluorescence	N	N (102m)	64m (Styal Road)	N/A
Manchester Oxford Road	Kerbside	X 384233	Y 397287	NO _x PM ₁₀	Chemiluminescence Beta Attenuation	Y	Y (1m) for short term objectives	0.5m (Oxford Road)	Yes

Quality assurance details of automatic monitoring site data can be found in Appendix A.

2.1.2 Non-Automatic Monitoring Sites

Manchester City Council operates 32 non-automatic monitoring sites, which are detailed in Table 5. The distance indicated to any relevant exposure is the nearest distance measured using Arcview GIS to the nearest relevant exposure as determined by the averaging periods of the air quality objectives (either annual or hourly).

The monitoring network is kept under constant review, to:

- respond to current concerns and prioritise sampling resources;
- take into account the results of the Review and Assessment of air quality; and
- take into account any new developments in the City that may affect air quality.

Table 5 Details of Non- Automatic Monitoring Sites

Site Name	Site Type	OS Grid Ref	Pollutants Monitored	In AQMA?	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Worst-case Location?
Alma Road	Roadside	X 387358 Y 393990	NO ₂	Y	Y (3m) for NO ₂ objectives	7m to edge of Piccadilly to Crewe (via Stockport) railway line track	N
Ashton Old Road	Kerbside	X 387951 Y 397430	NO ₂	Y	Y (22m) for NO ₂ objectives	1m (Ashton Old Rd)	Y
Burnage Community Centre	Urban Background	X 386780 Y 392651	NO ₂	N	Y (4m) for NO ₂ objectives	37m (Burnage Lane)	N/A
Cheetham Hill Road	Kerbside	X 383948 Y 401515	NO ₂ , Benzene	Y	Y (1m)	1m (Cheetham Hill Rd)	Y
Chethams School	Urban Centre	X 383971 Y 398876	NO ₂	Y	Y (5m) for NO ₂ objectives	59m (Station Approach)	N
Clayton Day Nursery	Urban Background	X 387656 Y 399016	NO ₂	N	Y (9m) for NO ₂ objectives	7m (Pioneer St)	N/A
Clayton Lane	Urban Background	X 387724 Y 397967	NO ₂	Y	N (90m)	1m (Clayton Lane)	N/A
Great Ancoats Street	Roadside	X 385161 Y 398290	NO ₂	Y	Y (10m) for hourly NO ₂ objective	2m (Great Ancoats St)	Y
Hewitt Street	Urban Centre	X 383602 Y 397488	NO ₂	Y	Y (2m) for NO ₂ objectives	8m to edge of Piccadilly to Wigan railway line track	Y
Hyde Road	Roadside	X 388601 Y 396048	NO ₂	Y	Y (1m) for hourly NO ₂ objective	2m (Hyde Road)	Y
Hulme Adult Learning Centre	Urban Background	X 383428 Y 396699	Background gamma radiation, Wind speed, Wind direction, Rainfall	Y	1m	N/A	N/A

Site Name	Site Type	OS Grid Ref	Pollutants Monitored	In AQMA?	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Worst-case Location?
Kingsway	Roadside	X 385399 Y 390093	NO ₂	Y	Y (7m) for NO ₂ objectives	6m (Kingsway)	N
Liverpool Road	Urban Centre	X 383218 Y 397770	NO ₂	Y	Y (12m) for NO ₂ objectives	1m (Liverpool Rd)	N
Lockton Close	Urban Background	X 384761 Y 397384	NO ₂	Y	Y (7m) for NO ₂ objectives	46m (Mancunian Way)	N/A
M56	Roadside	X 381650 Y 387520	NO ₂ , TSP ¹	Y	N (78m)	2m (M56 hard shoulder)	Y
Manchester South	Suburban	X 383904 Y 385818	NO ₂ , PM ₁₀ , TSP ¹	N	N (102m)	64m (Styal Rd)	N/A
Newton Street	Kerbside	X 384601 Y 398303	NO ₂	Y	Y (1m) for hourly objective	1m (Newton St)	Y
Oldham Road	Kerbside	X 386459 Y 400090	NO ₂	Y	N (103m)	1m (Oldham Rd)	N
Oxford Street	Kerbside	X 384117 Y 397505	NO ₂	Y	Y (2m) for NO ₂ objectives	1m (Oxford St)	Y
Peaceville Road	Urban Background	X 386589 Y 394083	NO ₂	N	Y (10m) for NO ₂ objectives	18m to edge of Piccadilly to Crewe (via airport) railway line track	N
Piccadilly Gardens	Urban Centre	X 384310 Y 398337	NO ₂ , Benzene, Lead, TSP ¹ , Black smoke	Y	Y (5m) for hourly objective	56m (Piccadilly)	N
Princess Parade Service Station	Urban industrial/roadside	X 383906 Y 393927	Benzene	Y	N (30m)	17m (Princess Road)	Y
Princess Road	Roadside	X 382829 Y 391493	NO ₂ , Benzene	Y	Y (10m) for annual and hourly objectives	3m (Princess Rd)	Y
Princess Street	Kerbside	X 383954 Y 398060	NO ₂	Y	Y (18m) for NO ₂ objectives	1m (Princes St)	Y
Rochdale Road	Kerbside	X 385205 Y 399750	NO ₂	Y	Y (7m) for NO ₂ objectives	1m (Rochdale Rd)	N
Rostron Avenue	Urban Background	X 386289 Y 396828	NO ₂	Y	Y (7.5m) for NO ₂ objectives	23m to edge of Piccadilly to Crewe (via Stockport) railway line track	Y
Rusholme Clinic	Roadside	X 384894 Y 396075	TSP ¹	Y	Y (5m) for NO ₂ objectives	15m (Oxford Rd)	Y
St Pauls School	Urban Background	X 381384 Y 387484	NO ₂	Y	Y (10m) for NO ₂ objectives	2m (Firbank Road)	N/A
Stockport Road	Kerbside	X 387363 Y 394617	NO ₂	Y	Y (1m) for hourly objective	1m (Stockport Rd)	Y
Styal	Suburban	X 384200 Y 382958	NO ₂ , Acid rain	N	N (75m)	80m (Styal Rd)	N/A
Manchester Town Hall	Urban Background	X 383860 Y 398025	NO ₂ , Acid rain	Y	N (45m)	35m (Mount St)	N/A

Site Name	Site Type	OS Grid Ref	Pollutants Monitored	In AQMA?	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Worst-case Location?
Victoria Terrace	Urban Background	X 386875 Y 395861	NO ₂	N	Y (3m) for NO ₂ objectives	5m to edge of Piccadilly to Crewe (via Stockport) railway line track	N

¹ TSP = Total suspended particulates using a M-type sampler

Defra has produced a series of monitoring site classifications shown in Table 6 below, which clarify the nature of the sites and the relative influence of local emissions.

Table 6 DEFRA site classification definitions

Site Classification	Site characteristics
Kerbside (U1)	Sites with sample inlets within 1m of the edge of a busy road. Sampling heights are within 2-3m.
Roadside (U2)	Sites with sample inlets between 1m of the kerbside of a busy road and the back of the pavement. Typically this will be within 5m of the kerbside. Sampling heights are within 2-3m.
Urban Centre (U3)	Non-kerbside sites located in an area representative of typical population exposure in town or City Centre areas e.g. pedestrian precincts and shopping areas. Sampling heights are typically within 2-3m.
Urban Background (U4)	Urban locations distanced from sources and broadly representative of city-wide background concentrations e.g. elevated locations, parks and urban residential areas
Urban Industrial (U5)	Sites where industrial emissions make a significant contribution to measured pollution levels.
Suburban (SU)	Sites typical of residential areas on the outskirts of a town or city.
Rural (R1)	Open country locations distanced from population centres, roads and industrial areas.
Remote (R2)	Open country locations within isolated rural areas, experiencing regional background pollution levels for much of the time.

Location maps and photographs of all monitoring sites can be found in Appendix B.

2.2 Comparison of Monitoring Results with Air Quality Objectives

A comparison of monitoring results for local air quality management pollutants against the relevant air quality objectives is presented in the following sections of the report. Automatic and non-automatic data for each pollutant (where this exists) is presented separately. Any monitoring results that identify exceedences of the air quality objectives are highlighted.

2.2.1 Nitrogen Dioxide

Nitrogen dioxide is a gaseous pollutant, which can act as a respiratory irritant.

Both nitrogen dioxide (NO₂) and nitric oxide (NO) are emitted as waste products of combustion processes, (the burning of fossil fuels) and are collectively known as NO_x. NO is oxidised by ozone to form nitrogen dioxide. Motor vehicle exhaust gases are the principal source of NO_x emissions in the UK, and in Manchester make up 51% of the total emissions. The other most significant sources of NO_x in Manchester are from commercial and domestic combustion (for heating etc), rail and air transport.

Automatic Monitoring Data:

Automatic nitrogen dioxide monitoring data is presented for 3 sites in Manchester. These sites are located at Piccadilly Gardens in the city centre (an urban centre site, representative of a busy city centre location close to heavily trafficked roads), Oxford Road (a kerbside site located on a heavily trafficked road close to the city centre with a high proportion of buses) and Manchester South (a suburban location near Manchester Airport).

Summaries of the last 3 years of nitrogen dioxide automatic monitoring data are presented in Table 7. Where the proportion of the year with valid data has been below 90%, the 99.8th percentile concentration figure has been presented.

Table 7 Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with Annual Mean and 1-hour Mean Objectives

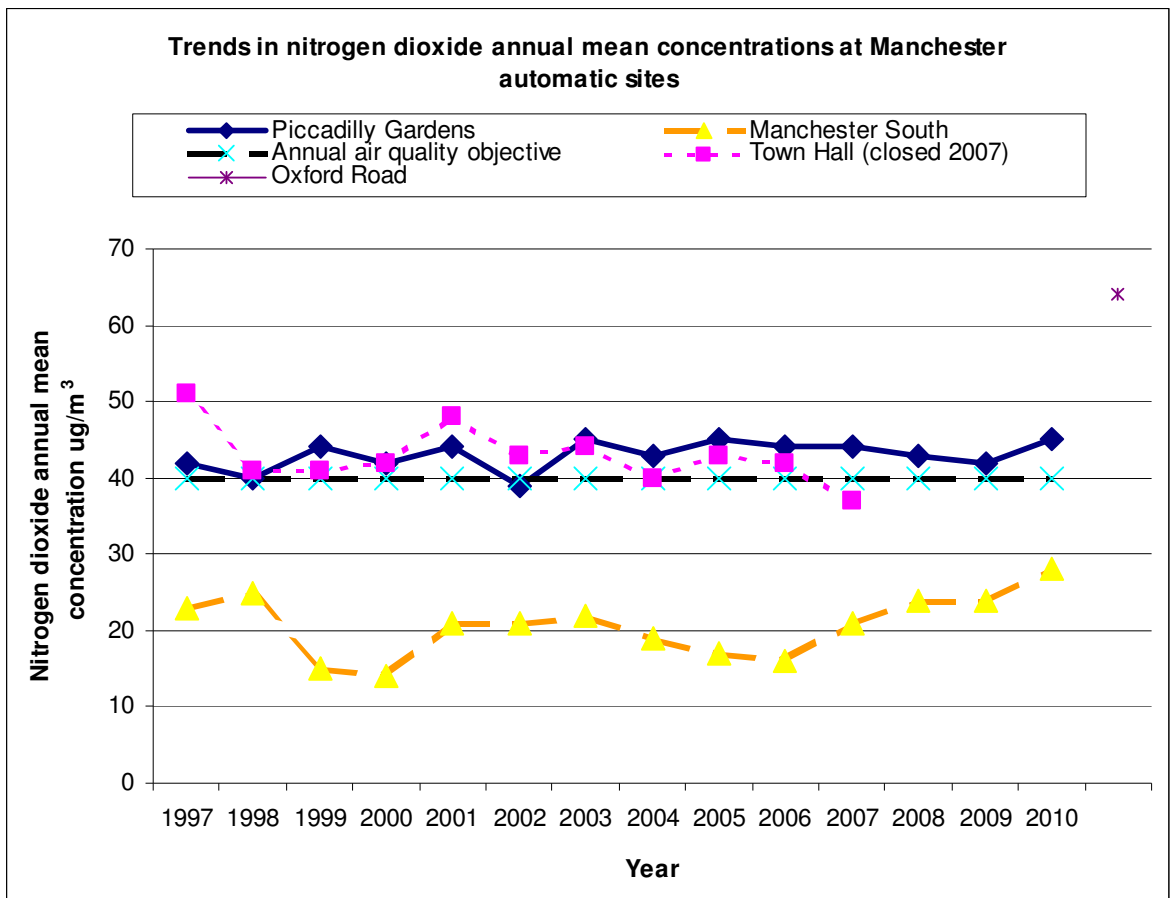
Piccadilly Gardens - Urban Centre site located in the AQMA					
Year	Annual mean NO ₂ concentration (ug/m ³)	Maximum hourly NO ₂ concentration (ug/m ³)	Number of exceedences of hourly mean (200ug/m ³)	99.8 th Percentile of hourly means concentration (ug/m ³)	Proportion of year with valid data %
2008	43	288	12	190	78%
2009	42	128	0	-	92%
2010	45	162	0	-	95%
Oxford Road - Kerbside site located in the AQMA					
Year	Annual mean NO ₂ concentration (ug/m ³)	Maximum hourly NO ₂ concentration (ug/m ³)	Number of exceedences of hourly mean (200ug/m ³)	99.8 th Percentile of hourly means concentration (ug/m ³)	Proportion of year with valid data %
2008	N/A	N/A	N/A	N/A	N/A
2009	N/A	N/A	N/A	N/A	N/A
2010	64	206	2	113	77%*
Manchester South - Suburban site located outside the AQMA					
Year	Annual mean NO ₂ concentration (ug/m ³)	Maximum hourly NO ₂ concentration (ug/m ³)	Number of exceedences of hourly mean (200ug/m ³)	99.8 th Percentile of hourly means concentration (ug/m ³)	Proportion of year with valid data %
2008	24	132	0	-	92%
2009	24	126	0	-	96%
2010	28	258	7	-	99%

* Oxford Road monitoring data was available from when the site became operational (08 March 2010) to 31 December 2010

The results of the automatic monitoring for nitrogen dioxide show that there has not been an exceedence of the hourly objective at any of the monitoring sites. However, there have been exceedences of the annual objective at Manchester Piccadilly and Oxford Road monitoring sites, which are located in the AQMA. The results are in agreement with the location of the current AQMA.

Summaries of annual mean NO₂ concentrations from the automatic monitoring sites over the last 10 years are presented graphically in Figure 3.

Figure 3 Long-term trends in nitrogen dioxide monitoring at Manchester automatic sites



The graph demonstrates that there is considerable year-to-year variability in average annual nitrogen dioxide concentrations, reflecting changes in local emissions and also the significant influence of meteorological conditions. However, there does not appear to be a long-term trend in either increasing or decreasing annual average concentrations.

Results from the automatic analysers have also been used to determine the annual variation in hourly concentrations of nitrogen dioxide. The graphs in Figures 4 to 6 show how the hourly concentration of nitrogen dioxide varies over the course of the year in 2010 at each monitoring site.

Figure 4 Variation in hourly nitrogen dioxide concentrations at Piccadilly Gardens

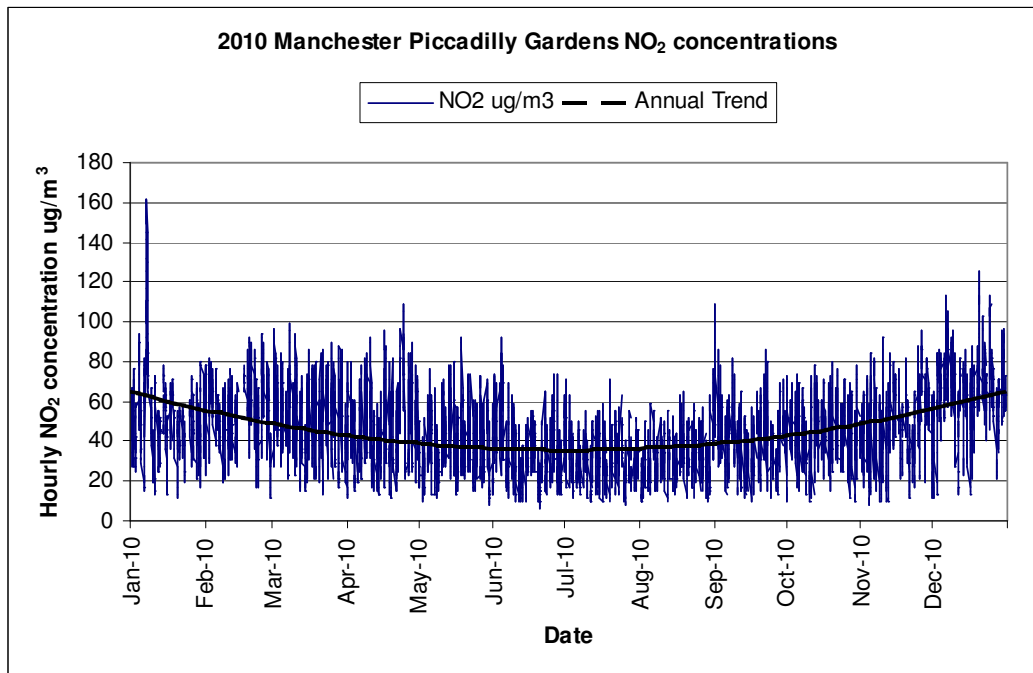


Figure 5 Variation in hourly nitrogen dioxide concentrations at Manchester South

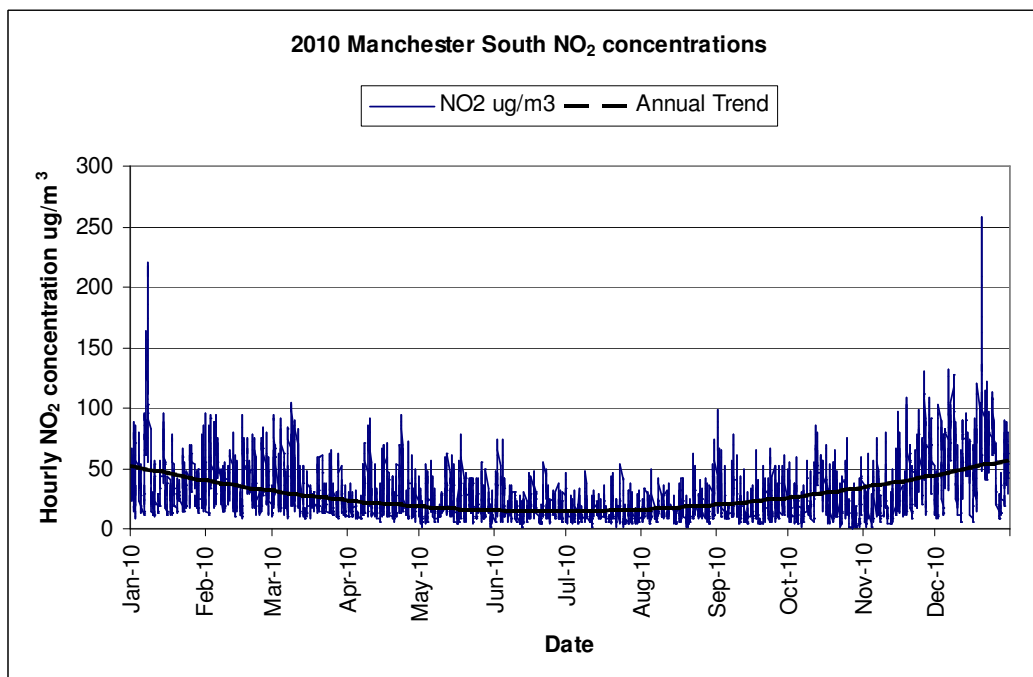
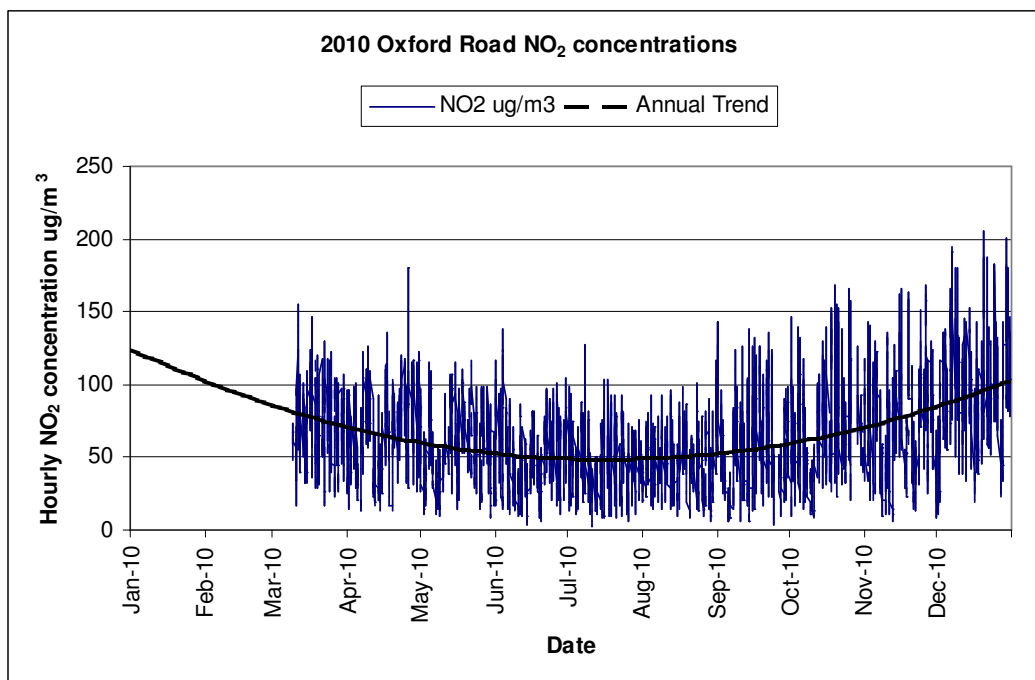


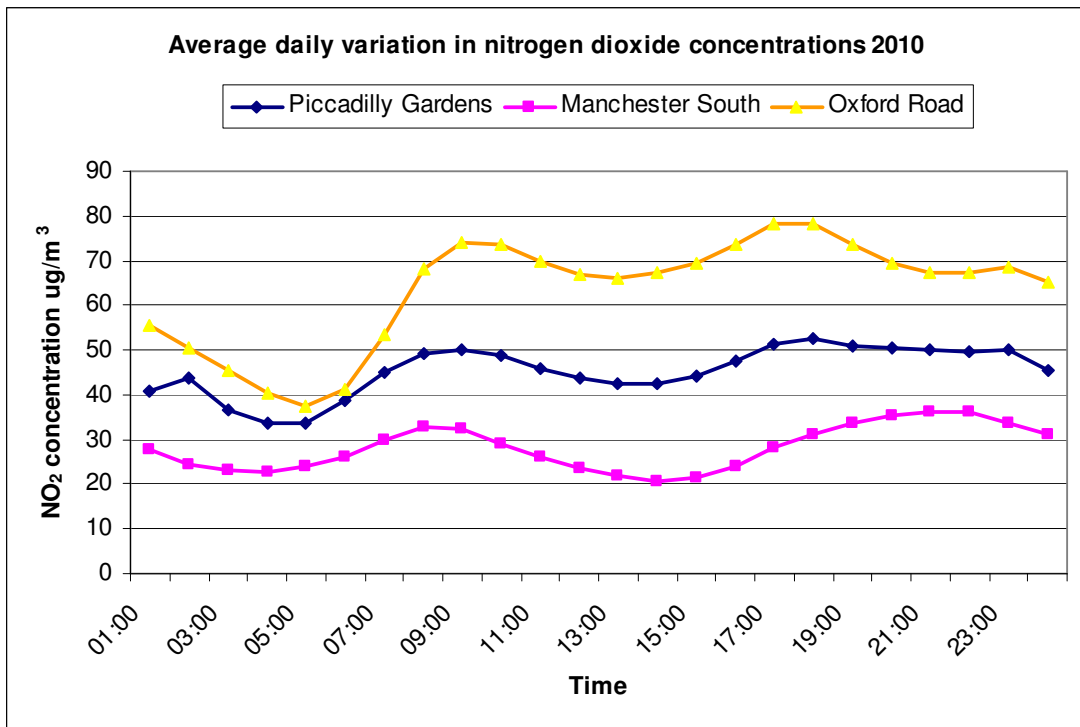
Figure 6 Variation in hourly nitrogen dioxide concentrations at Oxford Road



The time of year can influence the level of nitrogen dioxide in two ways. Firstly, gas fired heating systems are used more often during the cold winter months, leading to greater emissions of oxides of nitrogen (NO_x). Secondly, low wind speeds prevent the efficient dispersal of NO_x emissions, leading to high concentrations of nitrogen dioxide developing at ground level. The prevailing weather conditions also influences the rate of conversion of NO_x to NO₂. While all these factors are reflected in the resulting concentrations shown in the graphs, the highest concentrations and peak events still occur in the winter months when the emissions are highest, indicating that reducing/controlling emissions of NO_x is the key to meeting the current air quality objectives for NO₂.

In addition to measuring the annual variation of hourly nitrogen dioxide concentrations, the results from the automatic analysers have also been used to determine the daily variation in concentration. Figure 7 shows the daily variation in concentrations of nitrogen dioxide in Manchester.

Figure 7 Daily variation in NO₂ concentrations



The graph shows two periods of elevated concentration, one of which is centred around 09:00, and the second of which is centred around 18:00. These times correspond with the periods of peak traffic flow, and clearly show how traffic emissions can influence the concentration of nitrogen dioxide. This influence is particularly pronounced at the Oxford Road site, which is at the kerbside.

The graph also shows that in city centre locations NO_x emissions from traffic remain relatively high until late into the night reflecting the move to Manchester becoming more of a 24-hour city.

Diffusion Tube Monitoring Data

Diffusion tube data is presented for 27 nitrogen dioxide monitoring sites across the city. Diffusion tubes provide a picture of the spatial distribution of nitrogen dioxide across the city, as well as long-term trends at particular locations.

To improve the accuracy of the diffusion tubes, the City Council has co-located some tubes with automatic analysers, and has (in line with DEFRA technical guidance) adjusted the results of the diffusion tubes so that they match those obtained from the analysers. Details of the method used to correct the diffusion tubes results are provided in Appendix A.

Table 8 provides a summary of nitrogen dioxide diffusion tube monitoring data over the last 3 years. Exceedences of the nitrogen dioxide annual objective as measured by the diffusion tubes (> 40 ug/m³) are highlighted in bold.

A full data set of uncorrected 2010 monthly mean values can be found in Appendix A.

Table 8 Results of nitrogen dioxide diffusion tubes

Monitoring site name	Within AQMA?	Relevant public exposure?	Annual mean NO ₂ concentrations (µg/m ³) Adjusted for bias* <i>Data capture for the year is included in brackets</i>		
			2008	2009	2010
Alma Road**	Y	Y	-	40 (33%)	40 (100%)
Ashton Old Road	Y	N	46 (83%)	42 (100%)	50 (100%)
Burnage	N	Y	26 (75%)	30 (58%)	28 (83%)
Cheetham Hill Road	Y	Y	54 (92%)	51 (100%)	47 (92%)
Chethams School	Y	Y	44 (100%)	39 (100%)	40 (100%)
Clayton Day Nursery	N	Y	26 (92%)	25 (75%)	27 (100%)
Clayton Lane	Y	N	36 (100%)	36 (100%)	38 (100%)
Great Ancoats Street	Y	Y	54 (100%)	51 (92%)	50 (100%)
Hewitt Street**	Y	Y	-	43 (25%)	49 (100%)
Hyde Road	Y	Y	51 (92%)	42 (83%)	49 (100%)
Kingsway	Y	Y	41 (92%)	39 (100%)	45 (100%)
Liverpool Road	Y	Y	51 (100%)	48 (100%)	52 (83%)
Lockton Close	Y	Y	45 (100%)	40 (100%)	45 (100%)
M56	Y	N	56 (100%)	57 (100%)	58 (100%)
Newton Street	Y	Y	66 (100%)	60 (100%)	56 (100%)
Oldham Road	Y	N	49 (100%)	43 (100%)	48 (100%)
Oxford Street	Y	Y	79 (83%)	71 (92%)	72 (92%)
Peaceville Road**	N	Y	-	31 (33%)	33 (92%)
Princess Road	Y	Y	45 (100%)	43 (100%)	54 (100%)
Princess Street	Y	Y	62 (92%)	55 (100%)	60 (100%)
Rochdale Road	Y	Y	42 (92%)	42 (100%)	45 (92%)
Rostron Avenue**	Y	Y	-	38 (33%)	42 (100%)
Stockport Road	Y	Y	56 (100%)	52 (100%)	56 (100%)
St Pauls School	Y	Y	35 (100%)	36 (100%)	38 (100%)
Styal	N	N	15 (100%)	17 (100%)	19 (100%)
Town Hall	Y	N	40 (92%)	38 (100%)	42 (92%)
Victoria Terrace**	N	Y	-	33 (33%)	38 (100%)

* 2008 = 0.83
 2009 = 0.79 to be applied to kerbside, roadside, urban centre and urban background locations; 0.75 to be applied to suburban and rural sites.
 2010 = 0.93 to be applied to kerbside, roadside, urban centre and urban background locations; 0.89 to be applied to suburban and rural sites.

** Diffusion tube site set up from 01 September 2009, hence relatively low data capture for 2009.

Nitrogen dioxide diffusion tube monitoring results outside the AQMA

Table 8 shows that monitoring sites outside the AQMA did not measure exceedences of the NO₂ annual objective. Therefore this is in agreement with the location of the current AQMA.

Nitrogen dioxide diffusion tube monitoring results within the AQMA

Monitoring sites within the AQMA generally measured exceedences of the annual objective for NO₂. Two sites measured concentrations close to the annual objective (Clayton Lane and St Pauls School, which both measured annual concentrations of 38 ug/m³).

Two kerbside monitoring sites in the city centre (Oxford Street and Princess Street) measured annual concentrations greater than 60 ug/m³. Technical Guidance LAQM.TG (09) indicates that exceedences of the 1-hour objective may occur at roadside sites if the annual mean is above this concentration. However, monitoring results from the Oxford Road automatic monitor show that the hourly NO₂ objective was not exceeded despite measuring an annual mean exceeding 60 ug/m³.

2.2.2 PM₁₀

Particulate matter refers to microscopic pieces of airborne dust, smoke and particles, which can be inhaled.

A worsening of pre-existing heart and lung conditions may be observed when people are exposed to high concentrations of particulate matter. Other health effects can arise depending upon the exact chemical nature of the particles.

The health effects related to the inhalation of particles are strongly dependent upon the size of the particles involved. Small particles are able to penetrate further into the lungs and so cause more serious health effects, compared to large particles that are unable to penetrate the nose and mouth. Airborne particulate matter smaller than 10 microns in diameter (PM₁₀), are thought to be responsible for the worst health effects though more recent research has indicated that even smaller particles, such as PM_{2.5} or PM₁ may be the particle sizes of most importance to human health.

Particulate matter is emitted by a very wide range of sources. Sea salt, soil erosion, pollen, and fungal spores are all natural sources of airborne particles. Particles are also produced by human activities. In Manchester, the most significant source of PM₁₀ particulate matter is road transport, which makes up 76% of the total emissions. The other most significant sources are industrial processes and commercial and domestic combustion. Other sources include construction and demolition sites.

Particulate matter has been measured in Manchester using 4 different types of monitoring equipment:

1. TEOM/ FDMS (Tapered Element Oscillating Microbalance with Filter Dynamics Measurement System) analyser - provides real time hourly PM₁₀ gravimetric equivalent data, equivalent to standard reference method BS EN 12341:1999.
2. Beta Attenuation Monitor (BAM), using a MetOne BAM 1020 instrument - provides real time hourly PM₁₀ gravimetric equivalent data, equivalent to standard reference method BS EN 12341:1999 by applying a correction factor of 0.833 to the data.

3. Partisol sampler - Provides daily measurements of PM₁₀ particulate matter in accordance with standard reference method BS EN 12341:1999.
4. 'M-type' sampler - Provides weekly measurements of particulate matter. The sampling system is not in fact 'size selective' but previous studies have shown that the size range of the majority of airborne particulate using this method at Piccadilly Gardens is typically below 13.5 microns aerodynamic diameter. Therefore, although the system is not strictly monitoring the PM₁₀ or PM_{2.5} fraction of particulate matter, the results are interpreted as an indication of the airborne inhalable particulates, the majority of which are below 10 microns in diameter. This corresponds to the typical size range of particulate material that penetrates into the lower reaches of the lung.

Automatic Monitoring Data

TEOM/ FDMS monitoring data

Automatic monitoring of PM₁₀ has been carried out in Manchester since 1996 using a TEOM (Tapered Element Oscillating Microbalance) analyser. TEOM analysers have been shown to under measure the concentration under certain conditions. To compensate for this, DEFRA recommended that results obtained from TEOM analysers are multiplied by a factor of 1.3 to produce 'gravimetric equivalent' results. In early 2007, the TEOM at Manchester Piccadilly was fitted with a Filter Dynamics Measurement System (FDMS) unit to overcome the potential measurement inaccuracies through the loss of volatile particulate matter.

Up to the beginning of 2009, the PM₁₀ analyser at Piccadilly Gardens formed part of the AURN. In January 2009, the analyser was adapted by Defra to measure PM_{2.5}.

BAM monitoring data

Following the change to the FDMS at Piccadilly Gardens in 2009, Manchester City Council decided to continue to monitor PM₁₀ at the site for local air quality management purposes. A Beta Attenuation Monitor (BAM) was purchased for this purpose, and was installed in May 2009. The BAM produces gravimetric equivalent results after application of an adjustment factor of 0.833.

Results of real time PM₁₀ monitoring at Piccadilly Gardens for the last 3 years are shown in Table 9. Where the proportion of the year with valid data has been below 90%, the 90th percentile concentration figure has been presented.

Table 9 Results of PM₁₀ Automatic Monitoring: Comparison with Annual Mean and 24-hour Mean Objectives

Piccadilly Gardens - Urban Centre site located in the AQMA					
Year	Annual mean PM ₁₀ concentration (ug/m ³)	Maximum 24-hour mean PM ₁₀ concentration (ug/m ³)	Number of 24-hour averages exceeding 50 ug/m ³	90 th Percentile of hourly means concentration (ug/m ³)	Proportion of year with valid data %
2008*	19.8	84.9	9	-	99%
2009**	21.8	72.3	4	38	60%
2010**	20.5	68.2	1	-	93%
Oxford Road - Kerbside site located in the AQMA					
Year	Annual mean PM ₁₀ concentration (ug/m ³)	Maximum 24-hour mean PM ₁₀ concentration (ug/m ³)	Number of 24-hour averages exceeding 50 ug/m ³	90 th Percentile of hourly means concentration (ug/m ³)	Proportion of year with valid data %
2008	N/A	N/A	N/A	N/A	N/A
2009	N/A	N/A	N/A	N/A	N/A
2010**	30.6	83.8	17	46.3	81%

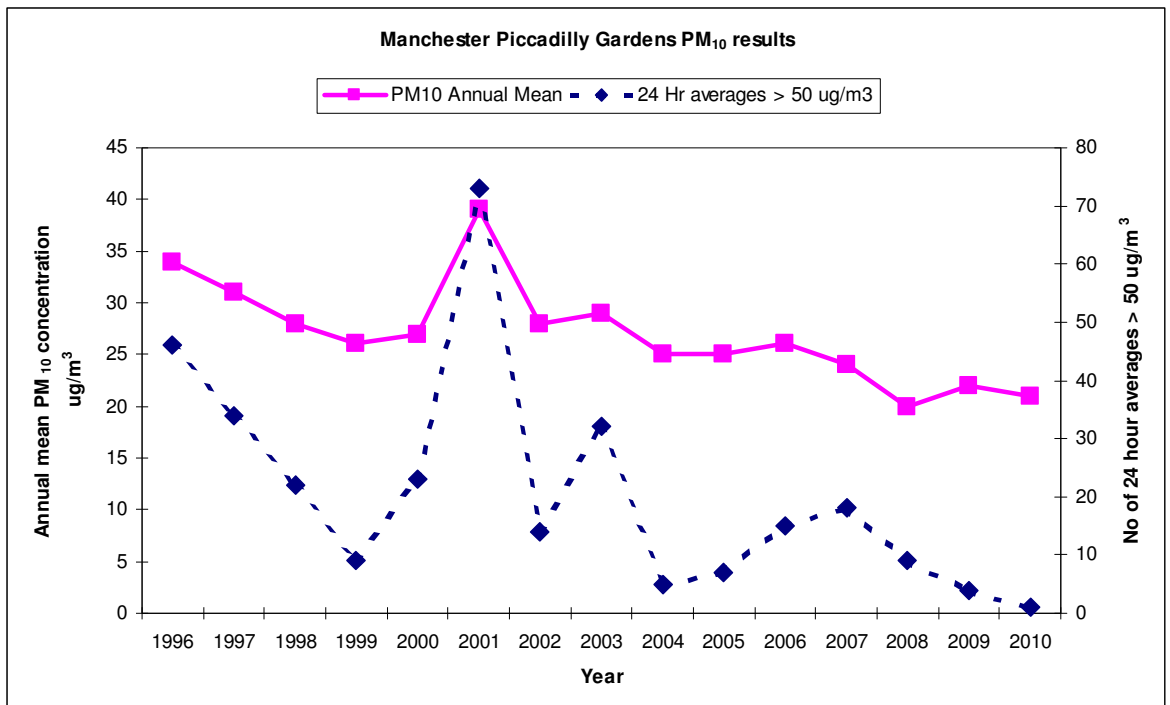
* Measurements made by TEOM/FDMS

** Measurements made by BAM 1020

The results indicate that there have been no exceedences of the annual average objective or the 24-hour objective in the last 3 years.

Figure 8 shows results from the Piccadilly Gardens site since monitoring for PM₁₀ began.

Figure 8 PM₁₀ concentrations at Manchester Piccadilly Gardens



The results indicate that there have been no exceedences of the annual average objective, and there is a general downward trend in annual concentrations. Exceedences of the 24-hour objective occurred during 1996 and 2001. The concentration of PM₁₀ measured in 2001 was unusually high as a consequence of the dust generated by building works associated with the redevelopment of the Piccadilly Gardens area in the immediate vicinity of the monitoring station.

In addition to demonstrating compliance with the air quality objectives, the results from the BAM 1020 instruments at Piccadilly Gardens and Oxford Road have also been used to show how the concentration of PM₁₀ varies over time. Figures 9 and 10 show how the hourly concentration of PM₁₀ varied over the course of 2010.

Figure 9 Annual variation in hourly PM₁₀ concentration at Piccadilly Gardens

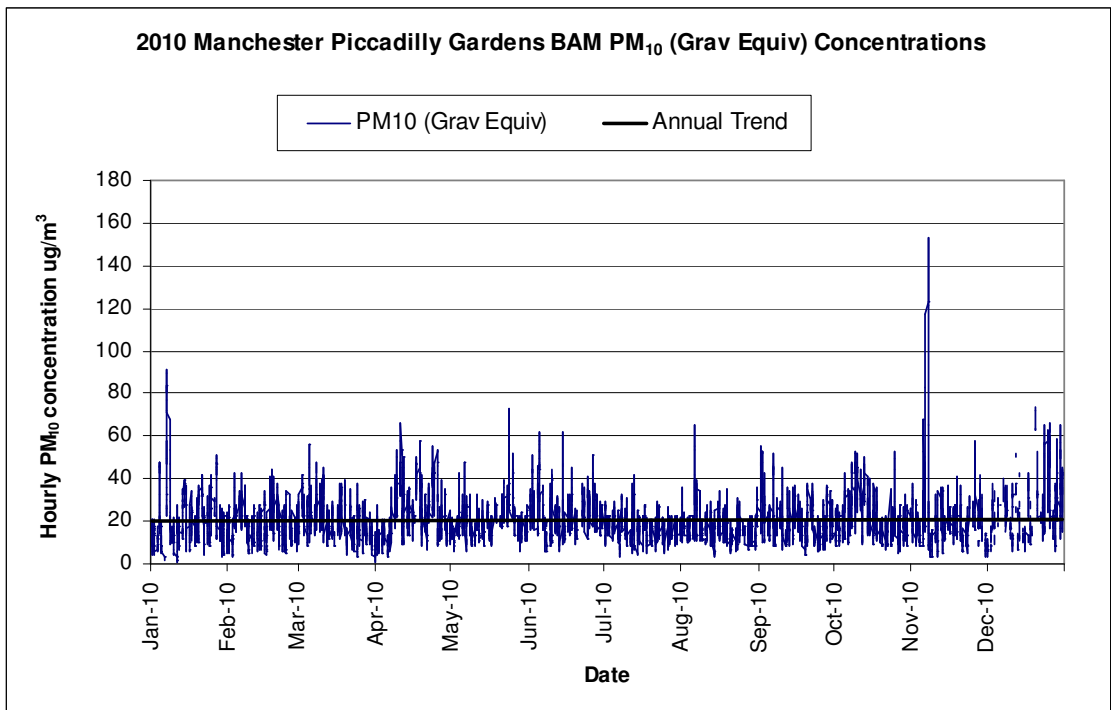
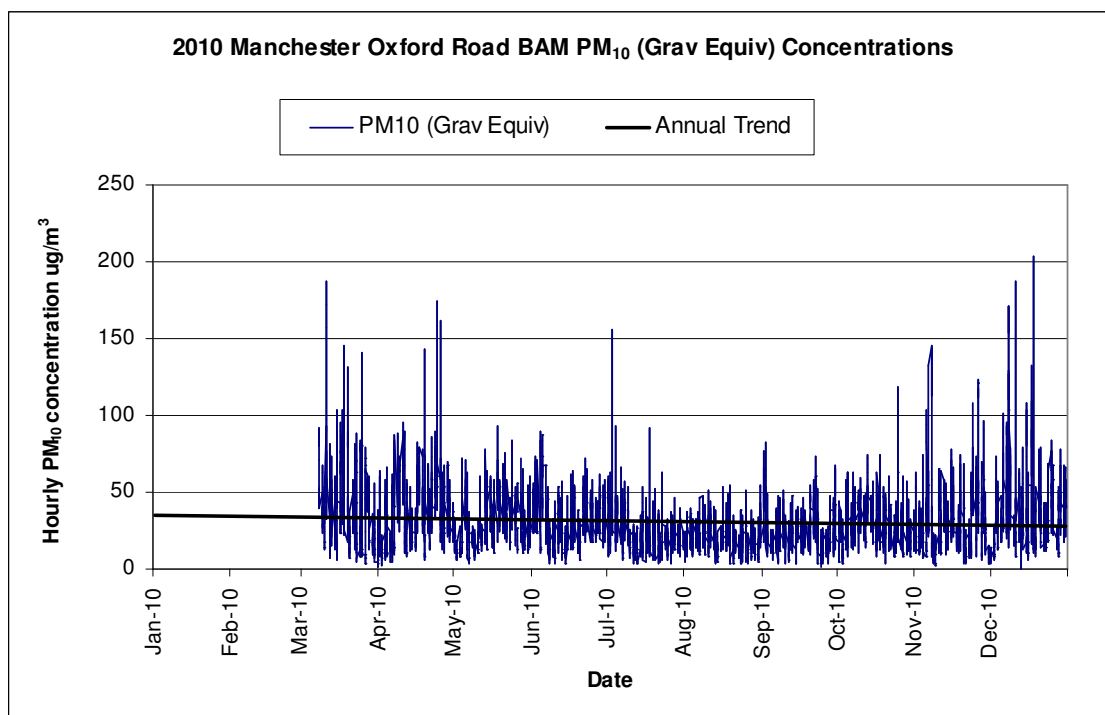


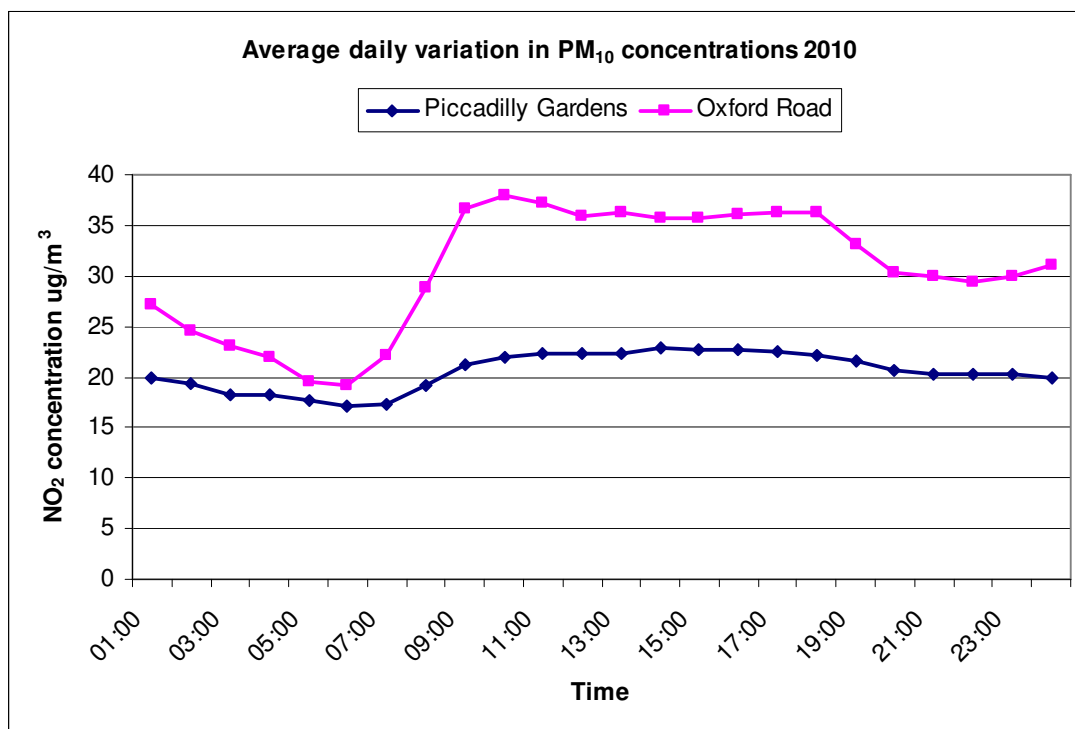
Figure 10 Annual variation in hourly PM₁₀ concentration at Oxford Road



The graphs show that at Manchester Piccadilly, the highest peak of PM₁₀ concentration occurred in November. However, peaks occur throughout the year at the Oxford Road site - this is a kerbside location near the city centre and therefore represents worse case relevant exposure.

In addition to measuring the annual variation of hourly PM₁₀ concentrations, the results from the automatic analysers have also been used to determine the daily variation in concentration. Figure 11 shows the daily variation in concentrations of PM₁₀ at Piccadilly Gardens and Oxford Road.

Figure 11 Daily variation in PM₁₀ concentrations



The graph shows that lowest PM₁₀ concentrations occur during the early hours of the morning, when road traffic is at its lowest level, and most industrial activity has ceased. A peak in the concentration is shown from around 08:00 at both monitoring sites, which corresponds to the morning rush hour. Concentrations then remain relatively high before reducing during the evening. The graph shows that changes in PM₁₀ concentration match changes in transport activity and industrial activity, and the graph clearly shows how local emissions derived from human activities influence concentrations.

Non-automatic Monitoring Data

Partisol sampler monitoring data

PM₁₀ particulate matter is measured at the Manchester South monitoring site using a Partisol gravimetric sampler, which is capable of size selective measurements of the particles in the atmosphere. The results for the last 3 years from both sites are shown in Table 10. The number of PM₁₀ 24-hour exceedences of 50 ug/m³ has also been presented, as well as the 90th percentile concentration figure.

Table 10 Results of Partisol PM₁₀ Non-automatic Monitoring: Comparison with Annual Mean and 24-hour Mean Objectives

Manchester South - Suburban site located outside the AQMA				
Year	Annual mean PM ₁₀ concentration (ug/m ³)	Number of 24-hour exceedences of 50 ug/m ³	PM ₁₀ 90 th Percentile	Proportion of year with valid data %
2008	23.5	17	38.0	98%
2009	17.7	11	32.6	98%
2010	16.5	4	28.9	93%

Partisol sampler monitoring results from the Manchester South site do not show exceedences of the annual or 24-hour PM₁₀ objectives.

M-type sampler monitoring data

Total suspended particulate mater is currently measured at 4 sites in Manchester (Manchester Piccadilly, Manchester South, M56 and Rusholme Clinic) using an M-type sampler. Although these simple samplers cannot collect size specific particles as well as the TEOM/FDMS, BAM or Partisol sampler systems, they provide a cost effective method of weekly measurements that can be used at a number of locations to provide the spatial distribution of particles at locations across the city. To improve the accuracy of the M-type sampler results, a sampler has been co-located with the Manchester Piccadilly BAM. A correction factor has been derived to allow the results from the 'M' type unit to be expressed as a PM₁₀ equivalent. Detail of the correction factor applied can be found in Appendix A.

The results from the 'M-type' sampler network for the last 3 years are shown in Table 11.

Table 11 Results of M-type Particulate Non-automatic Monitoring: Comparison with Annual Mean Objective

Year	Piccadilly Gardens - Urban Centre site located within the AQMA			Manchester South - Suburban site located outside the AQMA		
	Annual Mean total suspended particulate concentration (ug/m ³)	Annual mean PM ₁₀ equiv (ug/m ³)	Proportion of year with valid data %	Annual Mean total suspended particulate concentration (ug/m ³)	Annual mean PM ₁₀ equiv (ug/m ³)	Proportion of year with valid data %
2008	19.5	19.9	92%	15.9	16.3	87%
2009	22.1	22.1	94%	12.2	12.2	94%
2010	20.2	20.6	98%	14.5	14.8	92%
Year	M56 junction 4 - Roadside site located within the AQMA			Rusholme Clinic - Roadside site located within the AQMA		
	Annual Mean total suspended particulate concentration (ug/m ³)	Annual mean PM ₁₀ equiv (ug/m ³)	Proportion of year with valid data %	Annual Mean total suspended particulate concentration (ug/m ³)	Annual mean PM ₁₀ equiv (ug/m ³)	Proportion of year with valid data %
2008	27.8	28.4	90%	18.2	18.5	94%
2009	24.6	24.6	98%	14.4	14.4	94%
2010	26.8	27.3	100%	19.5	19.9	96%

PM₁₀ monitoring results outside the AQMA

PM₁₀ monitoring outside the AQMA indicates that the annual objective is met at the monitoring locations.

PM₁₀ monitoring results within the AQMA

PM₁₀ monitoring within the AQMA also indicates that the annual objective is met at the monitoring locations. The Piccadilly Gardens monitoring site is an Urban Centre site and would be representative of air pollution concentrations experienced in the city centre. The Rusholme clinic site is a roadside site that would be represent relevant exposure for the annual and 24-hour objectives. The M56 and Oxford Road sites should represent a 'worse case' scenario for PM₁₀ monitoring (however the M56 site would not represent relevant exposure).

2.2.3 Sulphur Dioxide

Sulphur dioxide is a gaseous pollutant, which acts as a respiratory irritant. Exposure to high concentrations of sulphur dioxide can lead to a worsening of pre-existing respiratory conditions. Sulphur dioxide is emitted when sulphur-bearing fuels such as coal, wood, oil, and diesel are burned. The most significant source of sulphur dioxide emissions in the UK is the burning of coal in electricity generating power stations, which accounted for 40% of the total in 2009. In Manchester, the most significant sources of sulphur dioxide emissions are air travel (14%) and other area sources (44%). Industrial processes and road vehicle emissions all also make a contribution to emissions.

Sulphur dioxide is currently measured at two automatic sites in Manchester (Piccadilly Gardens and Manchester South). The results for the last 3 years are shown in Table 12.

Table 12 Results of Sulphur Dioxide Automatic Monitoring: Comparison with 15 minute, 1-hour and 24-hour Objectives

Piccadilly Gardens - Urban Centre site located within the AQMA					
Year	Max 15 minute SO ₂ concentration (ug/m ³)	Number of 15 minute periods over 266 ug/m ³	Number of hourly mean periods over 350 ug/m ³	Number of daily mean periods over 125 ug/m ³	Proportion of year with valid data %
2008	85	0	0	0	97%
2009	40	0	0	0	80%
2010	40	0	0	0	92%
Manchester South - Suburban site located outside the AQMA					
Year	Max 15 minute SO ₂ concentration (ug/m ³)	Number of 15 minute periods over 266 ug/m ³	Number of hourly mean periods over 350 ug/m ³	Number of daily mean periods over 125 ug/m ³	Proportion of year with valid data %
2008	56	0	0	0	98%
2009	32	0	0	0	100%
2010	59	0	0	0	98%

The results indicate that there have been no exceedences of any of the sulphur dioxide air quality objectives at the monitoring sites. Piccadilly Gardens is an Urban Centre site representative of locations exposed to high concentrations. Manchester South is a suburban location near Manchester Airport, which is representative of background locations away from any major sources of emissions.

2.2.4 Benzene

Benzene is a volatile organic compound, which has been shown to have carcinogenic effects.

Benzene is a constituent of petrol, and emissions from petrol stations, refineries, and petrol engined vehicles account for the majority of benzene emissions in the UK. The petrochemical industry, and other organic chemical industries also make a contribution to benzene concentrations. In Manchester, the most significant sources of benzene are road transport (54% of total emissions), rail (23% of total emissions) and industrial processes (13% of total emissions).

There are no major industrial installations in Manchester that have significant emissions of benzene, and the city is not thought to be generally at risk of suffering an exceedence of the air quality objective for benzene. Nonetheless, Manchester City Council monitor benzene levels across the city, to ensure that benzene concentrations do not approach the objective level.

Benzene is measured in Manchester using two types of monitoring apparatus. The Piccadilly Gardens AURN monitoring site includes a 'pumped benzene' monitor, which forms part of the national Non-automatic Hydrocarbon Network of air quality monitors. In addition to this monitor, the City Council also operates a network of

benzene diffusion tubes, which are used to identify the geographical distribution of benzene concentrations across the city. A diffusion tube has been co-located with pumped benzene sampler. A bias adjustment factor has been derived to improve the accuracy of diffusion tube monitoring across the city. Detail of the correction factor applied can be found in Appendix A.

Results from the last 3 years for the pumped benzene sampler at Manchester Piccadilly are shown in Table 13.

Table 13 Results of Pumped Benzene Monitoring: Comparison with Annual Objectives

Year	Piccadilly Gardens - Urban Centre site located within the AQMA	
	Annual mean benzene concentration (ug/m ³)	Proportion of year with valid data %
2008	0.78	100%
2009	0.86	96%
2010	0.89	100%

Results from the last 3 years for the network of benzene diffusion tubes across the city are shown in Table 14.

Table 14 Results of Benzene Diffusion Tube Monitoring: Comparison with Annual Objectives

Monitoring site name	Site type	Within AQMA?	Annual mean benzene concentrations (ug/m ³) Adjusted for bias*		
			<i>Data capture for the year is included in brackets</i>		
			2008	2009	2010
Piccadilly Gardens	Urban Centre	Y	0.78 (92%)	0.86 (100%)	0.89 (100%)
Cheetham Hill Road	Kerbside	Y	1.35 (100%)	1.07 (100%)	1.14 (92%)
Princess Road	Roadside	Y	0.93 (100%)	0.96 (100%)	1.10 (92%)
Princess Parade Service Station	Urban Industrial/ Roadside	Y	11.94 (58%)	8.34 (100%)	6.63 (92%)

* Bias factors: 2008 = 1.30; 2009 = 1.19; 2010 = 0.90

Benzene monitoring results outside the AQMA

There are no benzene monitoring sites located outside the AQMA in Manchester.

Benzene monitoring results within the AQMA

Results from the benzene monitoring sites located within the AQMA indicate that annual mean benzene concentrations have been consistently below the 2010 air quality objective value of 5.0 ug/m³. The only exception is the annual mean concentration measured by the Princess Parade Service Station monitoring site. However, this is located next to the petrol pumps, where petrol vapours will effect the local concentration of benzene. Concentrations of benzene measured at this site are likely to be much higher than those experienced by any Manchester residents, and

would not represent relevant exposure for the annual objective. The site is in operation to demonstrate the contrast between a worse case location and concentrations likely to be experienced by Manchester residents. Monitoring commenced at the site in mid 2008, hence the relatively low data capture (58%) for the year. The Princess Road and Cheetham Hill Road monitoring sites are roadside locations, representative of highest concentrations normally experienced by residents. The Piccadilly Gardens site is representative of city centre benzene concentrations.

2.2.5 Carbon monoxide

Carbon monoxide is a gaseous pollutant, which is released when carbon based fuel (gas, oil, coal and petrol) is burned.

Emissions from motor vehicles are the biggest source of carbon monoxide in the UK. Outdoor concentrations of carbon monoxide are highest in places very close to major roads and motorways. In Manchester, the most significant source of carbon monoxide is also motor vehicles, which accounts for 80% of the total emissions.

Carbon monoxide is measured in Manchester at the Piccadilly Gardens monitoring site. The results for the last 3 years are shown in Table 15.

Table 15 Results of Automatic Carbon Monoxide Monitoring: Comparison with Running 8-hour Mean Objective

Year	Piccadilly Gardens - Urban Centre site located within the AQMA		
	Annual mean CO concentration mg/m ³	Max running 8-hour mean CO concentration mg/m ³	Proportion of year with valid data %
2008	0.3	3.5	97%
2009	0.4	2.5	94%
2010	0.3	2.4	93%

The results show that there have been no exceedences of the carbon monoxide objective at the monitoring site, which is an urban site representative of the city centre.

2.2.6 Lead

Lead is a toxic heavy metal. The long-term exposure to low concentrations of lead has been shown to impair the mental development of young children. At present, the most significant sources of lead emissions in Manchester are industrial processes, which make up 100% of the total emissions.

Lead in air is currently measured using a 'M-type' sampler at Piccadilly Gardens in Manchester, which is an urban centre location. Results from the monitoring site are shown in Table 16.

Table 16 Results of Lead Monitoring: Comparison with Annual Mean Objective

Year	Piccadilly Gardens - Urban Centre site located within the AQMA	
	Annual mean lead concentration ($\mu\text{g}/\text{m}^3$)	Proportion of year with valid data %
2008	0.02	91%
2009	0.01	98%
2010	0.02	100%

Monitoring results for lead indicate that both the 2004 and 2008 air quality objectives are currently achieved in Manchester. The Piccadilly Gardens monitoring site is representative of concentrations experienced in the city centre.

2.2.7 Ozone

Ozone (O_3) is a gaseous pollutant, which acts as a respiratory irritant. Exposure to high concentrations of ozone can lead to a worsening of pre-existing respiratory conditions.

Ozone occurs naturally high in the atmosphere, where it is formed during electrical storms. However, high concentrations of ozone can occur at low altitudes, where it is formed by the interaction of volatile organic compounds (VOC) and NO_x in the presence of sunlight. As sunlight is needed to activate the ozone forming reaction, concentrations of ozone are highest on very hot summer days.

Once formed, ozone can actually be removed from the atmosphere by chemical reactions with other types of air pollution such as nitric oxide and carbon monoxide. For this reason, ozone concentrations are often highest in rural areas, where there is less pollution available to be oxidised by the ozone.

Ozone is not a pollutant relevant to Local Air Quality Management but an objective to be met nationally is specified in the National Air Quality Strategy, as shown in Table 17.

Table 17 National Air Quality Strategy Objective for ozone

Pollutant	National Air Quality Strategy Objective		Date to be achieved by
	Concentration	Measured as	
Ozone	100 $\mu\text{g}/\text{m}^3$ not to be exceeded more than 10 times per year	8 hour running mean	31.12.2005

Ozone measured in Manchester at two automatic monitoring sites (Piccadilly Gardens and Manchester South). The results for the last 3 years are shown in Table 18.

Table 18 Results of Automatic Ozone Monitoring: Comparison with 8-hour Running Mean Objective

Year	Piccadilly Gardens - Urban Centre site located within the AQMA			Manchester South - Suburban site located outside the AQMA		
	Maximum running 8 hour mean O ₃ concentration ug/m ³	Number of daily maximum 8 hour running mean periods > 100 ug/m ³	Proportion of year with valid data %	Maximum running 8 hour mean O ₃ concentration ug/m ³	Number of daily maximum 8 hour running mean periods > 100 ug/m ³	Proportion of year with valid data %
2008	134	1	97%	121	1	98%
2009	80	0	97%	101	1	98%
2010	105	10	97%	102	2	99%

The results in Table 18 show that there is considerable year-to-year variability in maximum running 8-hour mean concentrations. However, the National Air Quality Strategy objective for ozone has been met at the monitoring sites.

2.2.8 PM_{2.5}

PM_{2.5} typically makes up around two thirds of PM₁₀ emissions and concentrations, and gives a stronger association with the observed ill health effects.

PM_{2.5} is not a pollutant relevant to Local Air Quality Management but an objective to be met nationally is specified in the National Air Quality Strategy, as shown in Table 19.

Table 19 National Air Quality Strategy Objective for PM_{2.5}

Pollutant	National Air Quality Strategy Objective		Date to be achieved by
	Concentration	Measured as	
PM _{2.5}	25 µg/m ³	Annual mean	2020

Automatic Monitoring Data

TEOM/ FDMS monitoring data

Automatic monitoring of PM_{2.5} has been carried out in Manchester using a TEOM/ FDMS analyser since 2009 as part of the Defra AURN network. Results are presented in Table 20.

Table 20 Results of PM_{2.5} Automatic Monitoring

Piccadilly Gardens - Urban Centre site located in the AQMA		
Year	Annual mean PM _{2.5} concentration (ug/m ³)	Proportion of year with valid data %
2009	12	82%
2010	18	26%

Table 20 shows that the annual mean PM_{2.5} concentration in 2009 was below the National Air Quality Strategy objective of 25 ug/m³. A large proportion of the data for 2010 was deleted following the third party data ratification process, as it was

suspected that there was an air leak in the analyser leading to spurious results (and hence the low data capture for 2010).

Non-automatic Monitoring Data

Partisol sampler monitoring data

PM_{2.5} particulate matter has been measured at the Manchester South site, using a Partisol gravimetric sampler, which is capable of size selective measurements of the particles in the atmosphere. The results for the last 3 years from both sites are shown in Table 21.

Table 21 Results of Partisol PM_{2.5} Non-automatic Monitoring

Manchester South - Suburban site located outside the AQMA		
Year	Annual mean PM _{2.5} concentration (ug/m ³)	Proportion of year with valid data %
2008	N/A	N/A
2009	9.4	76%
2010	10.4	95%

The Partisol PM_{2.5} sampler became operational at Manchester South in February 2009, hence the relatively low data capture for 2009.

Monitoring data for PM_{2.5} shows that there have not been any exceedences of the National Air Quality Strategy objective at this location.

2.2.9 Acid Rain

Rainwater is usually slightly acidic, but emissions of oxides of sulphur and oxides of nitrogen can lead to rain water becoming far more acidic than would arise from natural atmospheric processes. All industrial processes that involve the combustion of fossil fuels emit these pollutants, but the burning of coal with its high sulphur content is a major source of acidifying emissions.

There are no direct health implications from being exposed to acid rain. However, acid rain can cause damage buildings, vegetation and aquatic ecosystems.

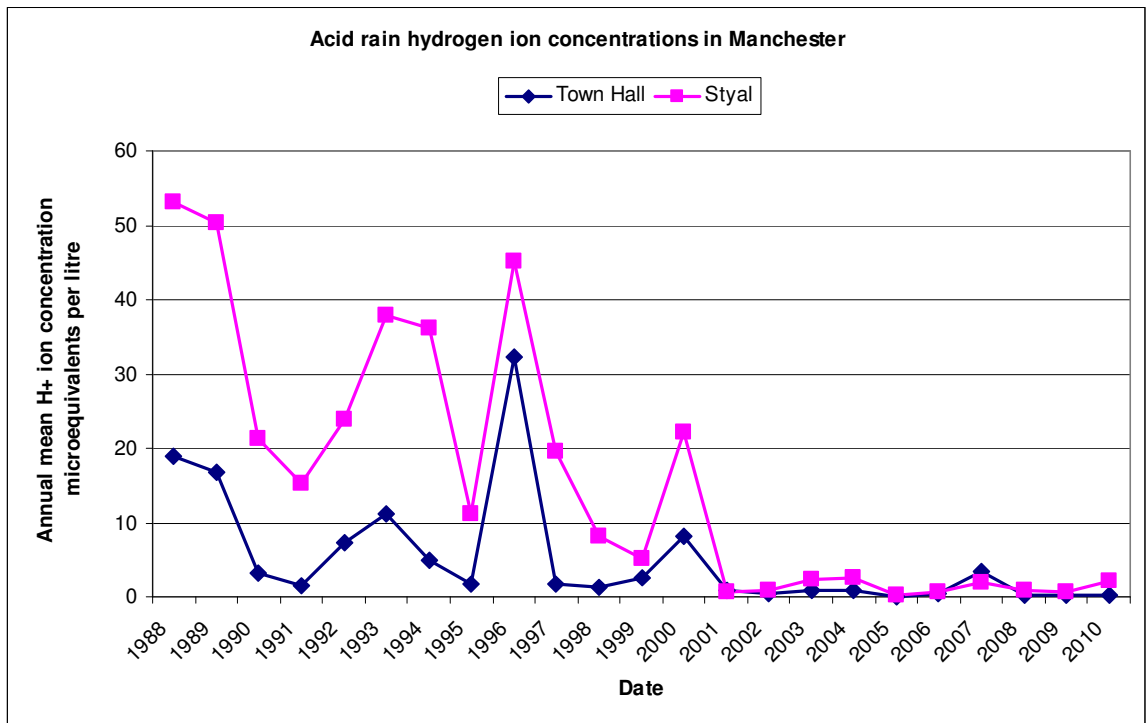
As with other urban areas, Manchester has seen a reduction in acidifying emissions, as the use of coal has declined. However, since 1971 the Fiddlers Ferry coal fired power station has been operated in the borough of Warrington, approximately 37 km from Manchester. It is likely that emissions from the site had an impact on levels of acid rain in Manchester.

Fiddlers Ferry was fitted with Flue Gas Desulphurisation (FGD) between 2006 - 2008, which has reduced sulphur emissions by 70%. There is also a proposal to fit Selective Catalytic Reduction (SCR) technology before 2016 to reduce emissions of oxides of nitrogen.

Emissions from local industry and sulphur dioxide emitted from road vehicles, also contribute to acid rain in Manchester.

Manchester City Council measures acid rain at Manchester Town Hall in the city centre, and at a suburban site near the village of Styal. The level of acidity will depend upon the concentration of hydrogen ions in the rainwater (acidity increases with an increasing concentration of hydrogen ions). Acid rain monitoring results from both sites are shown in Figure 12.

Figure 12 Acid rain measured at Manchester monitoring sites



The graph indicates that there has been a decrease in the acidity of rainwater over the duration of the monitoring period. However, despite this long-term trend, there is still annual variability in acid rain concentrations due to short-term periods of acid rain events throughout the year.

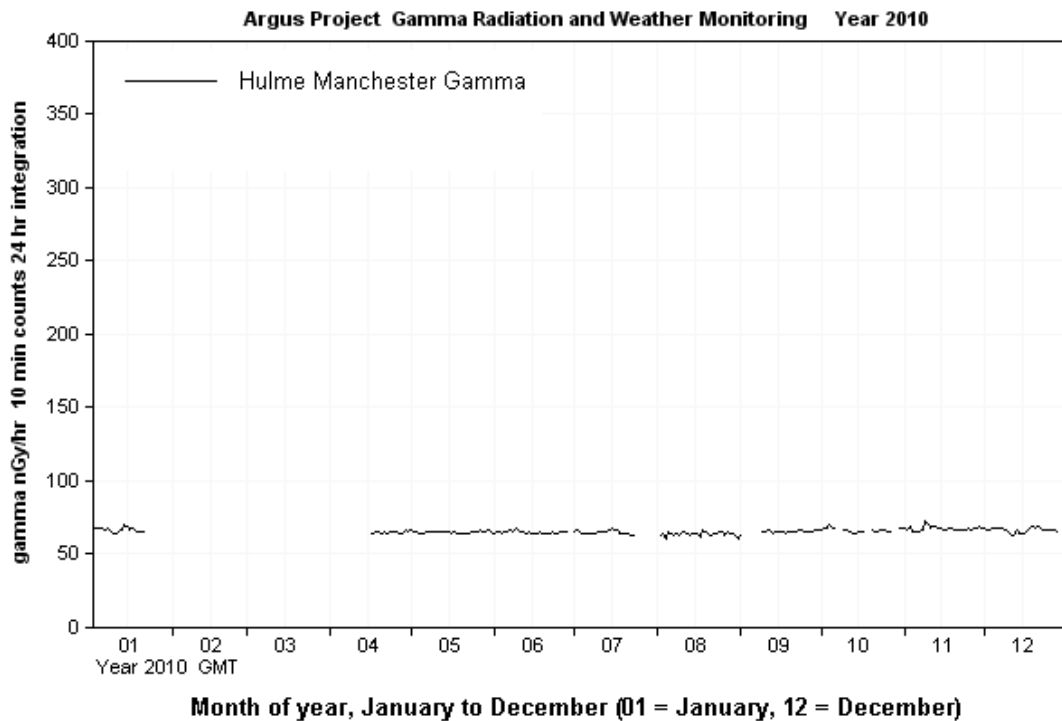
2.2.10 Gamma Radiation

Gamma radiation is a measurement of background radiation levels and is monitored by Manchester City Council on a routine basis. Radiation levels are measured in Nano Grays (10^{-9} Grays) per hour.

Health effects have been observed in people who have been exposed to gamma radiation levels of 0.5 Grays, which is equal to 500 milli sieverts. Average annual background radiation in UK is 2.2 milli sieverts. The majority of this is in the form of natural background radiation, with a smaller amount from medical radiation sources.

The level of gamma radiation measured as a 24-hour mean in Manchester in 2010 is shown in Figure 13.

Figure 13 Gamma radiation measured as a 24-hour mean in Manchester



The graph in Figure 13 shows that average radiation in Manchester in 2010 was measured at 65.8 nGy per hour, which over a year would result in an exposure of 0.58 milli sieverts - well below the level at which health effects would be expected and below the UK average exposure. Radiation monitoring results have remained relatively constant, and therefore the 2010 average figure can be considered as representative for the year.

Summary of Compliance with AQS Objectives

Manchester City Council has examined new monitoring results in the district against air quality objectives relevant to Local Air Quality Management. No new exceedences of the air quality objectives have been identified.

3 New Local Developments

3.1 Road Traffic Sources

Manchester City Council confirms that there are no new or newly identified road traffic sources that may have an impact on air quality within the Local Authority area.

3.2 Other Transport Sources

Manchester City Council confirms that there are no new or newly identified other transport sources that may have an impact on air quality within the Local Authority area.

3.3 Industrial Sources

Manchester City Council Environmental Protection Group provided a list of regulated industrial processes that were granted an Environmental Permit in the financial year of 2010/11, which are shown in Table 22.

Table 22 New industrial sources in Manchester

Address / location of the installation	Description of the installation	Manchester City Council Environmental Permit ref No	Date Environmental Permit granted
E.Delaney Demolition Ltd - location variable	Mobile crushing and screening process falling under under Defra process guidance note PG3/16 (04) – 'Mobile crushing and screening'.	PPC/B/07/10/RM	08/10/2010
Vale Park Demolition Services, Unit 11, Valepark Industrial Estate, Hazelbottom Road, Crumpsall, Manchester, M8 0GD	Mobile crushing and screening process falling under under Defra process guidance note PG3/16 (04) – 'Mobile crushing and screening'.	PPC/B/03/10/RM	23/07/2010
Vale Park Demolition Services, Unit 11, Valepark Industrial Estate, Hazelbottom Road, Crumpsall, Manchester, M8 0GD	Mobile crushing and screening process falling under under Defra process guidance note PG3/16 (04) – 'Mobile crushing and screening'.	PPC/B/06/10/RM	22/09/2010
Euro Garages Ltd, Wilbraham Road Service Station, 32 Wilbraham	Petrol filling station falling under under Defra process guidance note PG1/14 (06) –	PPC/PFS/RM/052/10	16/06/2010

Road, Fallowfield, M14 7LW	'Unloading of petrol into storage at petrol stations'.		
CMI Refinishing Ltd, Unit 2, Vaughan Industrial Estate, Vaughan Street, West Gorton, M12 5DU	Commercial vehicle respraying process falling under under Defra process guidance note PG6/34 (11) – 'Respraying of road vehicles'.	PPC/B/05/10/RM	18/08/2010
GB Auto's, Unit 10/11, Longsight Industrial Estate, Newton Avenue, Manchester M12 4EY	Waste oil burner falling under under Defra process guidance note PG1/1 (04) – 'Waste oil and recovered oil burners less than 0.4MW'.	PPC/B/04/10/RM	10/08/2010

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

3.4 Commercial and Domestic Sources

Manchester City Council confirms that there are no new or newly identified commercial and domestic sources that may have an impact on air quality within the Local Authority area.

3.5 New Developments with Fugitive or Uncontrolled Sources

Manchester City Council confirms that there are no new or newly identified new developments with fugitive or uncontrolled sources that may have an impact on air quality within the Local Authority area.

4 Local / Regional Air Quality Strategy

In Greater Manchester, a regional approach to dealing with air pollution has been adopted, recognising that the sources of pollution do not respect political boundaries.

The original Greater Manchester Air Quality Strategy, 'Clearing the Air', was produced in 1997 setting out the framework for improving air quality in the region. The objectives of the strategy were to:

- make improvements to quality of life;
- promote sustainability and Local Agenda 21;
- promote partnerships for change; and
- maximise inward investment opportunities

by linking air quality to planning, transport, sustainability and environmental health functions.

To deliver the strategy, the ten local authorities that make up Greater Manchester published an Air Quality Action Plan in 2004 following extensive consultation in order to improve air quality in the conurbation. Each of the 10 Greater Manchester authorities also produced a local annex setting out what they intended to do within their own area.

Good progress has been made with implementing the strategy on a local level. Progress in Manchester is outlined in section 9 of this report.

5 Planning Applications

Manchester City Council Planning Department have provided a list of major development schemes (a floorspace exceeding 500 m² or having a site area of over 0.25 hectares) that have been given planning permission and were under construction in the financial year of 2010/11. Development schemes that have been considered include hotel, industrial, office, retail and leisure and biomass schemes. Each scheme may have the potential to change traffic flows and therefore may have an impact on local air quality. The list is presented in Table 23.

Table 23 Major development schemes under construction in 2010/11

Planning permission details	Address / location of the scheme	Description of the scheme
087301/FO/2008/N1 Recv: 13.08.2008 Application Approved - 12.11.2008 Under construction	Plant Hill High School, Plant Hill Road, Blackley, Manchester, M9 0WQ	CITY COUNCIL DEVELOPMENT Redevelopment of school site involving erection of part 3, part 2 storey building to form 900 place High School and 120 place post 16 element with associated works including playing fields, car parking area and subsequent demolition of existing school buildings (existing sports hall to be retained).
087757/FO/2008/N1 Recv: 06.10.2008 Application Approved - 20.02.2009 Under construction	Site Of Former St Marks Church Of England Primary School, Holland Street, Ancoats, Manchester, M40 7DA	Erection of a two-storey primary school and associated landscaping, car park and play areas.
088200/MO/2008/N1 Recv: 19.02.2009 Application Approved - 02.04.2009 Under construction	Plot 4, Central Park, Northampton Road, Newton Heath, Manchester, M40 5BJ	RESERVED MATTERS application for the erection of a six storey office building (Class B1) with plant equipment on the roof (total floorspace 22,531 sqm with decked and surface car parking (730 spaces) and associated landscaping, boundary treatments and public realm works (matters being considered, access, appearance, landscaping, layout and scale).
088309/VO/2008/S2 Recv: 20.11.2008 Application Approved - 23.04.2009 Completed 4/11/2010	Brookway High School, Moor Road, Brooklands, Manchester, M23 9BP	CITY COUNCIL DEVELOPMENT Redevelopment of existing school site involving the erection of a part three storey, part two storey building to form 600 place Academy plus 120 place Sixth Form and Community Library, including demolition of existing buildings, retention of existing sports hall and installation of 48 space car park and bus turning facility with associated landscaping.
088332/VO/2008/N1 Recv: 18.11.2008 Application Approved - 02.03.2009 Completed 2/9/2010	Land At Queens Road/Rochdale Road, Harpurhey, Manchester, M8 8UQ	CITY COUNCIL DEVELOPMENT Erection of a three-storey secondary school building with vehicular access from Silchester Drive and associated playing pitches, landscaping, sports hall, car parking bus drop off facility and boundary treatments.
088469/VO/2008/N1 Recv: 27.11.2008 Application Approved - 16.02.2009 Under construction	King Davids High School, Eaton Road, Crumpsall, Manchester, M8 5DY	CITY COUNCIL DEVELOPMENT Erection of a new four storey building comprising nursery, primary and high schools, associated car parking, landscaping, boundary treatments and sports hall and subsequent demolition of existing main school building, nursery unit, infant and junior school.

<p>089903/FO/2009/N2 Recv: 31.07.2009 Application Approved - 11.09.2009</p> <p>Under construction</p>	<p>Land Between The Velodrome And Bank Street, Manchester Velodrome, Stuart Street, Manchester, M11 4DQ</p>	<p>Proposed erection of a fully enclosed 70 x 100 metre BMX racing track for a maximum of 2000 spectators with a new entrance concourse linked to the existing Velodrome building, all support ancillary accommodation for the BMX track, 110 sqm of retail floorspace (A1), 401 sqm of restaurant/cafe floorspace (A3), 1326 sqm of office space (B1) and 421 sqm of storage space (B8), all with associated highway works, public realm works, landscaping and car parking.</p>
<p>090606/FO/2009/N1 Recv: 13.07.2009 Application Approved - 11.09.2009</p> <p>Under construction</p>	<p>Car Park, Miller Street, Ancoats, Manchester, M4 4DY</p>	<p>Erection of 14 storey office (Class B1) building (Co-operative Headquarters) with associated basement car parking on two levels providing 151 car parking spaces with associated public realm works including the closure of part of Dantzic Street and associated alterations to the highway including formation of mini roundabout at corner of Angel Street and Dantzic Street.</p>
<p>090965/FO/2009/N1 Recv: 04.08.2009 Application Approved - 15.10.2009</p> <p>Under construction</p>	<p>Plots 3 And Part Of Plot 2, Central Park, Northampton Road, Manchester, M40 5BP</p>	<p>Proposed erection of a part single, part three and part four storey building with additional plant on the roof to provide the divisional headquarters for Greater Manchester Police (sui generis) with associated car parking, new vehicular access points onto Northampton Road and landscaping.</p>

6 Air Quality Planning Policies

Manchester City Council continues to use Unitary Development Plan (UDP) policies and develop Local Development Framework Core Strategy policies to ensure air quality issues are considered in the planning process. The Core Strategy is timetabled to be adopted in March 2012.

Draft Core Strategy Policy EN 16 seeks to improve the air quality within Air Quality Management Areas, by expecting developers to take measures to help minimise and mitigate the local impact of emissions from traffic generated by the development, as well as emissions created by the use of the development itself including from Combined Heat and Power and biomass plant. In assessing the appropriateness of locations for new development the impact on air quality including the cumulative impact will be considered.

Draft Core Strategy Policy EN7 requires the cumulative impact of energy generation to be taken into account when considering applications, including impact on local air quality.

Draft Core Strategy Policy T1 supports proposals that help to deliver a sustainable integrated transport system including facilitating modes of transport that reduce carbon emissions, congestion and air pollution.

The Environmental Standards section within the Guide to Development in Manchester Supplementary Planning Document and Planning Guidance (April 2007) sets out design principles to assist developers in achieving energy efficiency targets for new development and measures to increase the use of renewable energy in new developments. In addition, measures are set out for developers to submit travel plans aimed at reducing the need to travel by car and encouraging more sustainable forms of transport.

7 Local Transport Plans and Strategies

The primary source of nitrogen dioxide and most of the other key air pollutants in the conurbation is road transport. "Better Air Quality" was a key shared priority in the second round of local transport plans (LTP2), and so for this reason the Air Quality Action Plan was fully integrated into the Greater Manchester Local Transport Plan 2 (LTP2) Air Quality Strategy and Action Plan, which was produced in 2006. This outlined the delivery of a five-year programme being taken by Greater Manchester authorities up to 2011 to develop the transport infrastructure across the Manchester area. The overall objective of the strategy was to "sustainably reduce the negative impact of local transport related emissions to a minimum; in doing so contribute towards meeting national health based air quality objectives and national greenhouse gas reduction commitments".

However, despite progress with implementing actions, the plan has made limited difference to NO₂ concentrations at most roadside locations, since the impact of the individual measures was dispersed across the conurbation.

Greater Manchester's third Local Transport Plan (LTP3) outlines delivery of transport plans in the period 2011/12 to 2015/16. 'Other goods vehicles' (OGVs), including rigid and articulated HGVs, are the major contributors to NO_x. The potential impact of measures targeted at OGVs is high, given that they represent only 6.5% of the total vehicle distance travelled on major roads (including motorways) in Greater Manchester. Buses are also significant because emissions are concentrated on urban corridors where relevant exposure for air quality objectives is high. Therefore it is recognised in LTP3 that to reduce NO₂ concentrations in the short term will require a focus on HGV and bus emissions.

In the longer term the approach will be to influence and integrate air quality strategy with parallel climate change strategy, e.g. by:

- reducing acute pollution incidents from traffic;
- improving vehicle efficiency including vehicle and fuel technology and efficient driving techniques;
- reducing trips by motor vehicles; and
- improving network efficiency.

Through the Local Sustainable Transport Fund, the LTP3 aims to bring together technology, smarter choices travel marketing and active travel measures. A key component bid was made in April 2011 to support delivery of a Greater Manchester Commuter Cycle Project, designed to increase the number of people cycling to work at a number of major commuting destinations through a series of interventions, which should open up cycling as a genuine commuting option for many more employees.

8 Climate Change Strategies

Manchester: A Certain Future is the city's climate change action plan for 2010-20. It lists a detailed set of actions designed to make Manchester a greener, cleaner, healthier, wealthier, and greater city. The aim is to become a low carbon city by 2020, and achieve a 41% reduction in CO₂ emissions from 2005.

The primary goals of the action plan are to reduce our carbon emissions drastically over the coming decade, promote and develop green infrastructure, promote business practice that is both green and profitable, and engage with the public. The City Council is working with businesses, residents and community groups in order to deliver the plan.

In 2010 a Stakeholder Steering Group was formed to guide the work at a citywide level and the group held a conference in November 2010 that brought a variety of stakeholders together to engage them in action on climate change.

In order to achieve the vision set out in *Manchester: A Certain Future* (M:ACF), the Council's Environmental Strategy Team has developed a Delivery Plan for the next ten years, which includes both an inward and externally facing actions to help achieve the 41% and culture change targets by 2020. Service plans have also been created to help embed low carbon thinking into service delivery and the second annual Carbon Reduction Plan has been completed. Over the past year, the Green City Team has been planning projects to address the actions and visions within M:ACF and engaging organisations with the plan, to endorse it and commit to producing their own carbon reduction plans. Work has progressed on retrofitting proposals and on energy planning within the City and approval has been given for a City Centre District Heat Network that will encompass the Town Hall complex. Other successes are listed below:

- Heating controls have been remotely turned down on 250 buildings and 35 through sites visits. It can be ascertained that this work saved approximately 229 tonnes of carbon and £30,124.
- The City Council installed 325 gas and 200 electric smart meters in 2010/11.

By April 2011 improvements to street lighting and signalling will save per annum 177,120 kg of carbon. Through the Council's £1million Carbon Innovation Fund, ranges of pilot projects have been completed.

9 Implementation of Action Plans

The ten local authorities that make up Greater Manchester published an Air Quality Action Plan in 2004 in order to improve air quality in the conurbation. Each authority also produced a local Air Quality Action Plan, which are contained within the Greater Manchester Air Quality Action Plan (GMAQAP) document as local annexes. The Manchester Air Quality Action Plan includes measures to work towards achieving air quality objectives in specific 'hot-spots', and also reducing background levels of air pollution in order to benefit all residents and people who visit or work in the City.

The policies and programmes in the Manchester AQAP were developed in partnership with stakeholders and are fully integrated with the Manchester Community Strategy. The City Council recognises that it must work in partnership with businesses and other interested parties across the City if it is to meet the air quality objectives. This builds upon the existing relationship with the other Greater Manchester authorities, related organisations such as Transport for Greater Manchester, Manchester Airport and external agencies such as the city centre businesses.

Transport, as the primary source of nitrogen dioxide and most of the other key air pollutants is the focus of much of the Manchester AQAP, with a suite of transport related policies and schemes to tackle this source of emissions. For this reason the AQAP was fully integrated into the Greater Manchester LTP2 and air quality is also a priority for LTP3.

However, a number of other non-transport related schemes have also been included, all of which have an important and positive benefit for air quality. The Manchester AQAP policies to achieve the necessary improvements in air quality have therefore been separated into the following categories:

- Transport measures
- Energy efficiency measures
- Regulatory and enforcement measures

Good progress has been made with the Manchester AQAP to date. Action has progressed on all of the policies and measures originally set out.

However, despite some improvements in air quality over the last decade, it is recognised that there is a need to implement further measures to reduce concentrations of NO₂ in Manchester, particularly in the city centre. The single most significant improvement will be Metrolink, which upon completion is predicted to reduce traffic by an additional 5.5 million car journeys a year.

It is also recognised by the Council that the pace of improvement needs to quicken and more work needs to be concentrated on the city centre in order to meet the nitrogen dioxide air quality objective. The achievement of the plans within the Council's Climate Change Strategy and Energy Strategy will also greatly assist in reducing emissions.

Both the Manchester and Greater Manchester AQAP are under constant review and are being developed further with increased links to climate change. In summary, the Council will need to use a combination of regulatory controls, influence and awareness raising to ensure that effective action is taken to improve air quality for residents and visitors to Manchester.

Progress with action plan measures and outcomes to date are outlined in Tables 24 to 26.

Table 24 Manchester's Air Quality Actions – Local Transport Measures

GM LTP AQ REF	Action plan measure / target	Lead Authority	Original timescale for completion	Progress with measure	Outcome to date
D7	<p>Public Transport:</p> <p>Metrolink network development: including the full completion of Phase 3, - the cornerstone of Manchester's transport and air quality programmes encouraging modal shift away from the car.</p> <p>It is estimated that Metrolink 3a will save 5 million car journeys each year.</p>	Transport for Greater Manchester (TfGM)	<p>Full Phase 3 funding reinstated in 2005. Funding for 3b has been reconfirmed by Government in June following spending savings.</p> <p>£102m funding package for upgrading existing (Phases 1 and 2) system was approved July 2006.</p> <p>Phase 3 will be delivered through the following stages: Phase 3a extension to Chorlton will open Spring 2011; Droylsden will open Spring 2012, and conversion of the existing Oldham – Rochdale line; planned for completion by Spring 2012</p> <p>Phase 3b 'Accelerated Elements': Chorlton to East Didsbury and Droylsden to Ashton are funded and under construction.</p> <p>Target completion date of 2014.</p> <p>A funding agreement is in place for the remaining Metrolink line to Manchester Airport, spurs into Oldham</p>	<p>Delivery of £102m investment programme commenced July 2007.</p> <p>Renewal of large sections of worn-out track on Bury and Altrincham lines was completed on time and to budget in September 2007.</p> <p>Upgrade work on Phases 1 and 2, including city centre track renewals was completed in November 2009</p> <p>8 new trams introduced to relieve peak congestion and meet suppressed demand.</p> <p>Metrolink 3a construction contract awarded in summer 2008 and works are underway and progressing well.</p>	<p>The number of non-car trips to Regional Centre has increased to nearly 70 percent of all journeys.</p> <p>Percentage non-car trips in 2009 were 3.4 percentage points above target and 7.0 percentage points above base in 2002.</p> <p>Car trips decreased by 18% and bus trips decreased by 4%. Rail trips increased by 16%, Metrolink by 11%, walk by 19% and cycle trips more than doubled.</p> <p>Too early for data on Metrolink expansion, but forecasts are for an increase in Metrolink patronage from 18.2 million passengers (2009/10) to 21.07 million passengers in 2010/11</p>

GM LTP AQ REF	Action plan measure / target	Lead Authority	Original timescale for completion	Progress with measure	Outcome to date
	<p>Rail: Continued improvement in local rail performance complemented by public/private sector investment in minor station improvement schemes</p> <p>Bus: GMLTP investment in quality bus corridors and supporting marketing with bus operators</p> <p>Development of Bus Codes of Conduct to raise environmental performance of bus industry</p> <p>Improvements to Metroshuttle network (free city centre bus service) and fleet</p>		<p>and Rochdale Town Centres and a second city-centre line. All due for completion by 2016-17.</p> <p>Ongoing improvements to rail infrastructure through TfGM Rail Stations Improvement Strategy and Government 'Access for All' programme.</p> <p>Ongoing improvements to bus network, including highway schemes to improve journey times, better waiting facilities and ticketing</p> <p>Launch of codes in Autumn 2010 to drive forward a greening of bus fleets.</p> <p>Ongoing promotion of Metroshuttle services and ensuring reliable service.</p>	<p>Progress on delivery of rail station improvements including: investments to improve the safety and comfort of waiting facilities, installation of CCTV, improved passenger information.</p> <p>£88m Quality Bus Corridor programme completed</p> <p>Obligations relating to idling vehicles and increased proportion of fleet with lower emission engines.</p> <p>Launched in 2002, the network has expanded to 3 routes. The service was recently put out to tender with First being awarded the contract. The entire fleet has been</p>	<p>16% rise in rail passengers travelling to the Regional Centre since the base year 2002.</p> <p>4% increase in rail journeys to the Regional Centre between 2009 and 2010</p> <p>Reversal of historical decline in bus patronage in recent years, but 4% fall in bus patronage from 2008/09, probably due to recession.</p> <p>To early for data but targets will be set for reduction in carbon including the proportion of the bus fleet considered to be Low Carbon as defined by the DfT</p> <p>Expected improvement in fuel consumption of approximately 30%, thus reduced emissions.</p> <p>Patronage levels are increasing reducing car dependency for city centre journeys.</p>

GM LTP AQ REF	Action plan measure / target	Lead Authority	Original timescale for completion	Progress with measure	Outcome to date
	Introduction of cleaner vehicles: Delivering 'cleaner' vehicles through improved engine technology or alternative power.		Ongoing improvements in public transport bus services	replaced with diesel-electric hybrid Optare Solo and Verso vehicles TfGM, on behalf of the Transport for Greater Manchester Committee (TfGMC) has been awarded a grant of over £3m from DfT, covering 66 vehicles.	Patronage on Manchester Metroshuttle's showed an annual increase of 14% for the year ending March 2009.
E15	City Council Transport Policies: Delivering a highway network that is safe, sustainable and accessible for all. Promoting sustainable transport and cutting car use by placing Public Transport at the heart of the transport network whilst encouraging more cycling and walking.	Manchester City Council	Ongoing improvements to highway network through Local Transport Plan to address air quality objectives and promote cleaner, more sustainable modes of travel and improve efficiency of network. Ongoing	Over £1m spend on Congestion Management schemes to be deliver 2010/11 Good progress; see below	7 % percentage point increase in non-car modal share of journeys to the Regional Centre since 2002. Car trips decreased by 18% since 2002. Congestion improved on 5 out of 6 measured routes. LTP3 is much more focused on active travel than in previous versions. The LSTF bid will also seek to deliver a number of active travel initiatives.

GM LTP AQ REF	Action plan measure / target	Lead Authority	Original timescale for completion	Progress with measure	Outcome to date
	<p>Joined-up working with the health policy agenda to improve health through active travel.</p> <p>Tackling Climate Change through reducing carbon emissions: Influencing the Local Development Framework to ensure land-use strategies reduce the need to travel and help deliver air quality policy objectives.</p> <p>Development of Transport Strategy for Manchester City Centre (TSfMCC) includes policies and schemes that will have positive outcomes on air quality by removing through traffic,</p>		<p>Ongoing</p> <p>41% reduction in city emissions by 2020</p> <p>TSfMCC was published in Autumn 2010.</p>	<p>Creation of a walking strategy with NHS partners. JHU working with Transport Policy to develop cycling strategy</p> <p>An intervention strategy is being developed to discourage through traffic in the city centre and to redirect it via strategic network and better use of ring roads.</p> <p>Proposals for Deansgate and Victoria Street are at an advanced stage</p> <p>Work underway on City Centre East Bus Re-Routing.</p> <p>Cross City Bus BAFO submitted to DfT</p>	<p>Improved joint working with NHS public health partners. Have contributed to development of NICE guidance.</p> <p>Work nearing completion on agreeing a measurement tool. Work to cut emissions ongoing.</p> <p>Transport considerations included in LDF; formal adoption forthcoming. A transport strategy will provide the framework for implementation of schemes that will directly contribute to air quality improvements</p>

GM LTP AQ REF	Action plan measure / target	Lead Authority	Original timescale for completion	Progress with measure	Outcome to date
	<p>prioritising bus routes and improving the public realm for pedestrians and cyclists</p> <p>Parking policies to discourage long stay commuter parking in city centre and efficiently direct vehicles into available parking</p>		<p>Ongoing</p>	<p>LSTF bid for funding to better manage traffic submitted June 2010.</p> <p>Delivered a city centre signing and Variable Messaging System to reduce the levels of circulating vehicles searching for parking thus relieving congestion and improving air quality.</p>	<p>Signing to different zones and key destinations improved. Parking pricing policy is discouraging long stay parking in central area.</p> <p>7 % percentage point increase in non-car modal share of journeys to the Regional Centre since 2002.</p>
E3	<p>Activities by Manchester City Council Travel Change Team to increase journeys made by sustainable modes.</p> <p>TCT work includes:</p> <ul style="list-style-type: none"> • Linking workless residents with jobs • Improving residents' health through active travel • Delivering MCC's staff travel plan (see below) • Promoting 	Manchester City Council	<p>Travel Change Team (TCT) in place. Has worked with schools, businesses and communities in Manchester.</p>	<p>Travel Change Team working on promotion of sustainable travel in Manchester with particular emphasis on Smarter Choices.</p> <p>JobCentrePlus travel adviser in place (June 2010) to show jobseekers in Wythenshawe how they can access a full range of workplaces.</p> <p>Ongoing cycle training to 100 adults and children in Wythenshawe.</p> <p>City Car Club has expanded to include bays</p>	<p>Good success in meeting target of March 2010; almost all LA schools have travel plans.</p> <p>This has delivered a fall in number of children going to school by car (more detail in School travel plans section below).</p> <p>A range of workplaces have travel plans in place, helping deliver modal shift particularly in the city centre.</p> <p>See E7</p> <p>Too early to quantify outcomes, but data reports will become available</p> <p>Bike Week 2010 successfully engaged 581 people at the main event.</p>

GM LTP AQ REF	Action plan measure / target	Lead Authority	Original timescale for completion	Progress with measure	Outcome to date
	<p>active travel to schools and reducing school-run car use (see below)</p> <ul style="list-style-type: none"> • Travel plans, particularly for major traffic generators (e.g. large employers) (see below) • Expansion of car club (see below) • Cycling promotion events to promote sustainable travel • Delivering cycle training 			<p>in Chorlton and Didsbury.</p>	<p>500 Adult Cycle Training places were delivered from July 2010- March 2011.</p>
E9	<p>School Travel Plans:</p> <p>School travel plans to reduce the number of car trips to and from schools thereby improving local air quality (amongst other objectives).</p>	<p>Manchester City Council</p>	<p>Target is for all Manchester schools to have a Travel Plan by March 31 2010.</p> <p>However, it should be noted that this target is now very out-of-date and has been replaced with one based around modal share measured through the school census.</p>	<ul style="list-style-type: none"> • New schools being built under the academies programme have a travel plan forthcoming • Continuation of the successful Green Miles Competition (sustainable transport competition) • Database of schools 	<ul style="list-style-type: none"> • Fall in travel to school by car delivered – School census first undertaken in January 2007 when 28.2% of Manchester school journeys were made by car. In Jan 2010, this had fallen to 26.2% unofficial results from Jan 2011 suggest a further fall to 24.7% car usage (official results expected summer 2011, so may change) • 73 schools took part in the Green Miles competition, which awards prizes to the schools that are most

GM LTP AQ REF	Action plan measure / target	Lead Authority	Original timescale for completion	Progress with measure	Outcome to date
				<p>maintained to target resources, recording travel plans, safety schemes and highway infrastructure</p> <ul style="list-style-type: none"> • Development of information service to schools, pupils and parents of sustainable modes of travel to school (website and printed information to starters). • Development of pupil cycle allowance instead of bus pass • Programme of 'Focus Schools' – intensive work with targeted schools to deliver increased modal shift (begun Sept 2010) 	<p>successful in encouraging pupils to travel to school by cycling or walking.</p> <ul style="list-style-type: none"> • The winning school [Temple Primary] achieved a figure of 93.7% of pupils arriving by sustainable modes. • The most improved school [Cavendish Primary] saw an increase of 53% arriving by cycle or walking during the competition period. • Some pupils issued with cycle vouchers instead of a bus pass. <p>The following engineering measures implemented to make sustainable transport more attractive:</p> <ul style="list-style-type: none"> • 118 schools with 20 mph zones • 61 schools with Safer Routes to School schemes • 21 schools linked to the National Cycle network
E8	<p>Workplace travel plans:</p> <p>Travel Change Team to continue to engage workplaces in travel planning and deliver modal shift to reduce car use and so improve local air quality.</p>	Manchester City Council	Ongoing work with Manchester workplaces to implement Travel Plans both through the Planning process for future developments and voluntary arrangements by existing organisations.	<p>Currently work with organisations to deliver their workplace travel plans.</p> <p>Corporate usage of the City Car Club a major part of this work programme.</p> <p>Total membership currently standing at</p>	<p>Quality travel plans in major employers including:</p> <ul style="list-style-type: none"> ▪ Higher Education Precinct (universities & hospital) ▪ The Co-Operative headquarters complex ▪ Manchester Airport ▪ Wythenshawe & North Manchester hospitals <p>Also Wythenshawe area travel plan</p>

GM LTP AQ REF	Action plan measure / target	Lead Authority	Original timescale for completion	Progress with measure	Outcome to date
	To assess planning applications and condition travel plans to relevant developments in Manchester			1291. 597 Corporate members and 694 individual.	being developed and implemented.
E8	Manchester City Council Travel Plan 'Get on Board'	Manchester City Council	<p>Pilot scheme in operation since 1998, full launch in 2005.</p> <p>Ongoing work to deliver, improve and monitor the effectiveness of the Travel Plan.</p>	<p>Delivery of a strong package of measures that has cut emissions.</p> <p>Get on Board re-branded in April 2009 to refresh profile. Refreshed marketing plan in place May 2010.</p> <p>Staff Business Travel policies to be adopted in 2011.</p> <p>Launch of 'Bike to Work' salary sacrifice scheme May 2009.</p> <p>Car Sharing scheme re-launched June 2010 .</p> <p>Targets set across departments to achieve 7% reduction (35% Single Vehicle Occupancy).</p>	<p>Fall in the number of city council staff driving to work (single occupancy) from 42% to 35% in 2009 staff survey.</p> <p>Launch and promotion of walkit.com/Manchester, pedestrian journey planner, March 2009. User statistics growing and highest in Greater Manchester.</p> <p>Actions include:</p> <ul style="list-style-type: none"> • Discounted public transport tickets • Interest free public transport loans • Salary sacrifice 'bike to work' scheme- Over 600 staff have taken up (April 2011). • Emergency ride home scheme • Improvement of cycle facilities (showers, lockers and cycle stands, etc.) • Pool Bikes at 3 council buildings • Promotion of walkit.com, online pedestrian journey planner and 'Bike to Work' campaign • Car Club extended to Didsbury and Chorlton districts. • Car sharing website service
E1	Bus Lane Enforcement Strategy:	Manchester City Council	Enforcement commenced in September 2006.	Measures introduced in September 2006 and supported by associated	Bus lane enforcement figures for 2010/11:

GM LTP AQ REF	Action plan measure / target	Lead Authority	Original timescale for completion	Progress with measure	Outcome to date
	To undertake the civil enforcement of bus lanes in Manchester to provide more reliable bus journeys thus encouraging modal shift.			<p>publicity.</p> <p>Currently undertaking a rolling programme of enforcement at a number of locations using 9 fixed cameras, and 2 camera enabled smart cars. The 2 smart cars operate on a daily basis on a random rolling rota covering a number of key locations.</p>	<ul style="list-style-type: none"> • 32901 Penalty Charge Notices (PCNs) have been issued • Currently issuing an average of 90 PCNs per day • High recovery rate for fines around 72%
E16	Street lighting installations and associated lighting levels to comply with British Standard recommendations, to encourage pedestrian activity within the night time environment and thus encourage the use of public transport.	Manchester City Council	Responsibility for street lighting taken over by contractor Amey Highways (Manchester) Ltd in 2004, following the award of a 25 year PFI Contract. Works continue for the duration of the contract.	In January 2009 Amey completed their 'Initial Asset Replacement Programme'. Replacing 41,698 dilapidated lighting columns.	Amey continue to carry out planned and reactive maintenance on all the street lighting stock to ensure lighting levels are maintained and lights are kept working. Due to recent progress in LED technology a trial is being carried out on a number of street lights across the City
E7	<p>Deliver a Wythenshawe Community Travel - Plan Demonstration Pilot with Workwise.</p> <p>1. Identification of local issues that act as a barrier to the</p>	Manchester City Council	March 2010 for first phase, estimate a minimum of 12 months through to September 2010 with a view to roll-out to other areas if proven successful.	<p>Pilot has been developed in partnership with key agencies (Job Centre Plus, Wythenshawe Regeneration, Manchester Airport)</p> <p>Formed stakeholder steering group</p>	<p>Pilot project successful – 1025 people given travel advice, and helped into employment</p> <p>42 parents and children received cycle training together</p> <p>163 school children received a session on journey planning and going on a</p>

GM LTP AQ REF	Action plan measure / target	Lead Authority	Original timescale for completion	Progress with measure	Outcome to date
	<p>community using sustainable modes of travel (Public Transport, Cycling and Walking)</p> <p>2. Developing a range of transport solutions to tackle issues</p> <p>3. Improving residents access to employment and training opportunities to tackle worklessness.</p>			<p>Project plan being developed</p> <p>Appointment of company to undertake household survey to identify travel issues.</p>	<p>journey on public transport, to familiarize them with routes and how to use p/t</p> <p>Initial household survey undertaken, follow up survey scheduled for September 2011 .</p> <p>Following completion of pilot period, project set to continue in 2 parts :</p> <p>1) Travel Advice / tickets to workless people 2) Community travel plan</p>
E7	<p>Increase in Cycling:</p> <p>The Greater Manchester (GM) Cycling Strategy and proposed Cycling Vision for Manchester will contribute to encouraging modal shift away from the car, reducing emissions.</p>	<p>Transport for Greater Manchester / MCC / British Cycling</p>	<p>The production of a revised GM Cycling Strategy was required to respond to changes within GMLTP2 2006/07.</p>	<p>The Third Local Transport Plan has a key aim of increasing the Active Travel across Greater Manchester. Furthermore, the Local Sustainable Transport Fund bid will be focused on these modes.</p> <p>MCC is working with British Cycling and the Joint Health Unit to deliver a combined cycling strategy covering commuter, leisure and sport activities. This process is also being replicated at a Greater Manchester level.</p>	<p>The proportion of journeys to the Regional Centre by cycle has increased by 4% between 2009-2010 and have more than doubled since a baseline of 2002.</p>

July 2011

Manchester City Council - England

GM LTP AQ REF	Action plan measure / target	Lead Authority	Original timescale for completion	Progress with measure	Outcome to date
				<p>Implementation of automatic cycle monitoring of cycling routes in Manchester, especially on key commuter routes into the regional centre and leisure routes are showing steady growth in usage.</p> <p>Cyclegm website redesigned and re-launched, including online cycle maps</p> <p>Further distribution of popular free cycle maps</p> <p>Greater Manchester Cycle Journey Planner developed and available on Transport Direct</p> <p>Cycle route leaflets and 'On Yer Bike' Greater Manchester Magazine produced to encourage cycling in the city.</p> <p>Promotion of national bike week</p> <p>Sky Ride now in third year</p>	<p>Pedal cycles formed a higher proportion of the total traffic in Manchester compared to Greater Manchester as a whole.</p> <p>Number of participants increasing year-on-year</p>

GM LTP AQ REF	Action plan measure / target	Lead Authority	Original timescale for completion	Progress with measure	Outcome to date
	<p>Improving cycling infrastructure at Rail/Tram stations</p> <p>Deliver Cycle Training</p>		<p>Cycle storage at Piccadilly Station 2010/2011</p> <p>Ongoing Bikeability training in schools.</p> <p>500 free adult cycle training places over 8 months 2010/11</p>	<p>Funding secured to open a Cycle Centre at Piccadilly Rail. Station, providing safe storage. Virgin Rail scheme to provide additional storage and bike hire.</p> <p>Involvement in planning applications for expansion of light rail network to encourage adequate cycling facilities.</p> <p>Additional funding secured for 2011/12 but unlikely to cover the full year. Alternative sources being sought</p>	<p>Project cancelled due to funding being withdrawn.</p> <p>Scheme still in development due to unresolved security concerns from TRANSEC.</p> <p>Current provision at risk due to budget cuts</p> <p>Post-training surveys indicate that people are riding more often and further as a result of the training.</p>
E7	<p>Walking – Delivery of Greater Manchester Walking Strategy and the Public Rights of Way Improvement Plan (PROWIP)</p>	<p>Greater Manchester Integrated Transport Authority (GMITA) & Manchester City Council</p>	<p>Ongoing work to deliver the Greater Manchester Pedestrian Action Plan</p> <p>PROWIP was completed in November 2007 a programme of priorities was developed in 2008 following interrogation of the definitive rights of way map for the PROWIP to identify existing and potentially additional pedestrian networks and access for walking activity.</p> <p>Launched March 2009.</p>	<p>In line with the GM Walking Strategy and the recently updated GM Action Plan, Manchester continues to identify and where appropriate enhance pedestrian accessibility to local services and centres.</p> <p>Some district centres have already been targeted: Northenden, Withington, Longsight, Rusholme, Cheetham, Wythenshawe and</p>	<p>Between 2006 and 2009 walking trips into the Regional Centre have increased by 19%.</p>

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			<p>Sport and Physical Activity Alliance developed the Green Corridor project that links Manchester's parks through Active Travel.</p>	<p>Gorton.</p> <p>A further improvement programme of access to district centres has been developed and will be delivered by the end of 2009.</p> <p>Walkit.com user statistics growing and highest in Greater Manchester.</p>	<p>The Green Corridor project is ongoing.</p> <p>New analysis tools are being investigated to specifically monitor the high levels of use the website has in Manchester.</p>
E15	<p>Congestion Target Delivery Action Plan</p> <p>To out-perform the LTP2 congestion target.</p>	Transport for Greater Manchester	<p>Delivery during LTP2 period 2005/06 – 2010/11</p> <p>Improve network journey times and reduce unnecessary standing traffic, which impacts on local air quality.</p>	<p>Delivery of a £1m Congestion Management Programme of interventions has been agreed for the 2010/11 including £500,000 funding for 5 new congestion schemes.</p>	<p>Most recent survey indicates that Manchester has improved journey times on 5 out of 6 of its congestion routes.</p> <p>MCC was unsuccessful in its bid for funding from the last CPF funding tranche.</p>
E13	<p>Promotion of Car Club</p> <p>City Car Club Manchester</p>	Manchester City Council	<p>Launched in November 2006.</p> <p>Manchester City Council supports City Car Club with policy advice and on-street parking bays. The City Council is a corporate member. Work is in progress to include car club within the planning framework.</p> <p>City Car Club is contributing to an integrated transport system and improving air quality in the city.</p>	<p>Fastest expanding of any of the City Car Club cities.</p> <p>Average car usage of 20% i.e. 4 hours and 48 minutes a day.</p> <p>Over 1,300 members, 55% corporate members.</p> <p>Increase in number of locations and cars across the city, growth according to demand.</p>	<p>Fleet of 29 low-emission vehicles, at 16 dedicated parking locations, with more planned, including expansion into areas outside of the city centre.</p> <p>Membership results in lower car ownership – every car club car replaces up to 23 private vehicles – equivalent to over 667 cars across Manchester.</p> <p>Members typically drive fewer miles over time, and significant behaviour change has been affectively demonstrated. Public transport usage is significantly higher among car club members than national average.</p>

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				<p>In 2010/11 further expansion in the City Centre and cars now also located in Chorlton-cum-Hardy, Didsbury and Exchange Quay.</p>	<p>Car club cars are typically 30% more efficient than the national average, and are well maintained, so emissions are lower.</p> <p>Residential members, companies etc reporting significant cost savings. One MCC department saving approx £5,000 per year.</p> <p>Recent emissions comparison completed for MCC mileage in direct comparison with taxi mileage. Estimated savings 198kg CO₂, 0.04 kg NO_x, 0.01 kg PM₁₀. Very conservative estimate, with savings growing over time.</p> <p>Corporate members typically replace rush hour journeys into the city centre in private vehicles with journeys by public transport based upon the car club service meeting their needs for business travel. Very significant emissions and carbon savings are created as result and travel by public transport is reinforced as the norm.</p> <p>City Car Club fleet has average emissions of 115 co2 g/km with five vehicles less than 100 co2 g/km. City Car Club will be further reducing the average emissions in 2011/12.</p> <p>In 2010 City Car Club added a VW transporter Van to the Car Club</p>

GM LTP AQ REF	Action plan measure / target	Lead Authority	Original timescale for completion	Progress with measure	Outcome to date
					operation in Manchester giving members to a pay as you go Van located in the City Centre at Duke Street.
E5	<p>Council fleet procurement policy. The City Council will move towards operating a 'green' fleet of vehicles, by ensuring City Council vehicles are Euro 4 or better.</p> <p>Plan submitted to include in the "green fleet policy" all vans purchased for MCC will be speed limited to 62mph reducing emissions and providing fuel savings.</p> <p>Due to budget cuts and the plan to introduce the SRF areas no new vehicles have been ordered or procured until the effects on the status of MCC's current fleet are known next year.</p>	Manchester City Council	<p>Vehicle emissions are now part of the vehicle purchasing programme. All vehicles purchased by the Council must meet the latest European emission standards.</p> <p>Targets are under regular review to consider a timescale for moving to a Euro 5 fleet.</p> <p>As previous note in column 1.</p>	<p>Currently the majority of Council vehicles are Euro 4 or better. The whole Council fleet now also runs on 5% bio diesel. Significant reductions in emissions have been achieved with the retirement of older, more polluting vehicles. As part of the Carbon Reduction plan 2010/11 and after successful trials, we have recommended the fitment of secondary fuel saving devices to the MCC fleet of vehicles reducing emissions and fuel usage by 10% 15 wagons and 25 sweepers have been modified and the monthly monitoring report is showing a 10% reduction in fuel usage with subsequent reduction in emissions. and that all new vehicles are speed limited to 62mph reducing emissions by as much as 18% when measured against 70mph. As per</p>	<p>A number of Euro 5 vehicles are now in use and it is the intention to increase numbers of these at every opportunity. The Council fleet also includes a fully electric car, producing zero emissions, which is used in the city centre and other ward locations. An all electric coffin and personnel carrier for use in Blackley Cemetery and an electric powered push bike for use in Southern Cemetery.</p> <p>An electric petrol hybrid car has been procured for the Licensing enforcement unit for their work across the city.</p> <p>Work will continue to follow the development of electric vehicles until the cost of purchase and reliability becomes realistic on a working scale. Trials are being undertaken using all electric mopeds to see if they can be included in the fleet.</p> <p>The Fleet section continually researches developments in alternative fuel / vehicle technology and is keen to embrace those which show potential environmental advantages. MCC have been working with SCC to produce an AGMA framework for suppliers to fit or re-map engines to</p>

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				previous note in column 1, no new vehicles have been procured since the recommendation to speed limit.	provide fuel savings and reduce emissions. The tender is still in the “in progress “ stage, but hopefully will be completed later this year.
E5 and E8	Installation of electric vehicle infrastructure through the Department of Transport 'Plugged in Places' programme - a partnership between the public and private sectors and intended to incentivise the market for electric vehicles (EV)	Greater Manchester Environment Commission/ Transport for Greater Manchester	Provision of electric vehicle infrastructure from 2011.	In December 2010 a consortium of Greater Manchester authorities and businesses was awarded £3.6 million from the Government’s ‘Plugged in Places’ programme to provide match funding for over 300 charging points for electric vehicles across Greater Manchester, including points in Manchester city centre and along a number of major roads.	Scheme is in development - it is intended that it will include several electric vehicle hubs that will provide charging points, vehicle sales and consumer information. Details of the scheme e.g. the precise mix of facilities, the source of electricity to be used and the potential to work with neighbouring authorities, are still to be developed.
E5 and A8	Electric vehicle trial: Pilot project to trial an electric vehicle and make the vehicle effectively ‘emission free’ by offsetting emissions produced from the charging of the vehicle using solar power.	Manchester City Council	Pilot project to be operational by April 2008	Solar cells were installed in August 2008. The Smart electric vehicle was delivered in July 2008, and is being used by staff in the Council’s Regulatory and Enforcement Services to travel around the city in the course of their duties.	The project aims to increase awareness of alternative methods of transport and electricity generation from renewable sources. A comparison between utilising an average internal combustion engine vehicle and the smart electric vehicle (including accounting for emissions created from national grid electricity consumption) has been made. Findings are that total CO ₂ , NO _x and PM ₁₀ emissions were reduced by 118%, 127% and 50% respectively over the study period. This resulted in savings of 1.69 tonnes of CO ₂ , 2.54 kg NO _x and

GM LTP AQ REF	Action plan measure / target	Lead Authority	Original timescale for completion	Progress with measure	Outcome to date
					<p>0.13 kg PM₁₀.</p> <p>Results will be publicised and will be incorporated into the continuing awareness raising campaign to encourage greater rates of utilisation.</p>
E15 and E8	<p>Airport ground travel emissions reduction schemes:</p> <ul style="list-style-type: none"> • Construction of a ground transport interchange • Ongoing implementation and promotion of staff travel plan • Construction of a third rail platform 	Manchester Airport	<p>The airport introduced a Ground Transport Strategy in 1997 and a travel plan in 1998 to reduce ground vehicle movements per air passenger to 1.35 by 2005, and increase staff bus usage to 10% by 2015.</p> <p>Construction of the third rail platform to be completed by December 2008.</p>	<p>A Revised Ground Travel Plan was published in 2004. The new plan was part of Manchester Airport's Master Plan published in 2007.</p> <p>The Manchester Airport Master Plan was written and a public consultation was undertaken in 2006. The Master Plan was published in 2007 along with 4 supporting policy documents: Environment Plan, Ground Transport Plan, Community Plan and Land Use Plan. The Environment Plan makes a commitment for Manchester Airport to be carbon neutral for energy use and vehicle fuel use by 2015.</p> <p>The third rail platform opened on time in December 2008.</p>	<p>Outcomes:</p> <ul style="list-style-type: none"> • Ground Transport Interchange now open. • 3rd rail platform opened in December 2008 - rail modal share has increased from 7% to 10% in 2009 • Work has been undertaken by the airport with train operators to adjust rail timetable to match air travel movements • Introduced new direct train service to Glasgow and Edinburgh in 2008, enhanced in 2009, and followed by 3 services to N Wales and Chester in 2009 • £200K was invested in bus services in 2009 to support off peak and weekend travel to encourage employee use of public transport. • Implemented forecourt management plan to direct private car and taxi pick up into the short stay car parks to cut down on congestion. • Work began in early 2011 on the construction of a new Metrolink tram line to the Airport and a new platform for the trams at The Station.

GM LTP AQ REF	Action plan measure / target	Lead Authority	Original timescale for completion	Progress with measure	Outcome to date
					<p>Latest monitoring results:</p> <ul style="list-style-type: none"> • The vehicle trip per air passenger ratio 1.34 at end 2009 • 9% local bus and 4% rail use by staff walk & cycle 4% at end 2007 • Car usage was down to 80%, drive alone 73% at end 2009
E4	<p>Low emission taxi scheme by implementing age limits on vehicles through the Council's Licensing Unit.</p>	<p>Manchester City Council</p>	<p>To introduce a scheme to lower emissions from taxis by the end of 2007.</p> <p>Report produced in August 2005 on behalf of the GM Authorities and Warrington on the potential effectiveness of introducing an age limit vehicle licensing policy on controlling exhaust emissions from taxis.</p> <p>A report was also produced by the City Council in June 2007 'Hackney carriage fares increase and age policy' that went to the licensing appeals committee for agreement on a 12 year maximum age limit.</p>	<p>Implementation of a 12-year maximum age limit policy on all hackney carriages, and 7-year age limit on all private hire vehicles.</p> <p>The policy was updated in February 2009 to close a loophole of vehicle proprietors purchasing Euro 3 compliant vehicles and then replacing the engine with one that was not Euro 3 compliant.</p> <p>Emission testing is carried out on all vehicles when first licensed thereafter annually.</p> <p>The policy was further updated in April 2011 to allow for additional testing of older vehicles – it is hoped that this will improve the maintenance of the vehicles- which</p>	<p>Hackney carriages: With effect from 1st January 2008 no hackney carriage vehicle license will be issued or renewed for a vehicle:</p> <ol style="list-style-type: none"> 1. more than 12 years since the date of its first registration in this or any other country. 2. more than 10 years since the date of its first registration in this or any other country, unless the vehicle has been manufactured to Euro 3 or higher specification or has fitted either a PCO/Energy Saving Trust approved emissions reduction scheme, installed in a garage approved by the Council, or a conversion approved by the Council to run on alternative fuels such that the vehicle meets Euro 3 emission standards, such approval not to be unreasonably withheld. <p>With effect from 16 February 2009, any vehicle that has been manufactured with an engine that is Euro 3 or higher specification (manufactured after 1 January 2001) that has been replaced with an engine that is not Euro 3 compliant will be required to have an approved emission reduction kit fitted</p>

GM LTP AQ REF	Action plan measure / target	Lead Authority	Original timescale for completion	Progress with measure	Outcome to date
				<p>should in turn have a positive effect on emissions.</p> <p>The Committee also agreed to emission testing at every mechanical inspection which will also assist in maintaining satisfactory emission levels</p>	<p>approved emission reduction kit fitted. Any reduction kit must be fitted by the next routine scheduled vehicle inspection.</p> <p>With effect from 16 February 2009, any vehicle which has been manufactured with an engine that is Euro 1 or Euro 2 specification (manufactured before 1 January 2001) which has been replaced with a re-conditioned engine, will not be required to have an approved emission reduction kit to achieve Euro 3 fitted until the vehicle has reached the age of 10 years since the date of its first registration in this or any other country.</p> <p>Private hire: With effect from 1st November 2006 the Council shall not renew the license of any vehicle if it is more than 7 years since the date of its first registration in this or any other country. This provision became fully implemented on 1st November 2007 so after this date there would be no private hire vehicle older than 7 years 11 months licensed by the Council.</p> <p>With effect from 16 February 2009, any vehicle that has been manufactured with a diesel engine that is Euro 3 or higher specification (manufactured after 1 January 2001) that has been fitted with a replacement engine will be required to have an approved emission reduction kit fitted. Any reduction kit</p>

GM LTP AQ REF	Action plan measure / target	Lead Authority	Original timescale for completion	Progress with measure	Outcome to date
					<p>must be fitted by the next routine scheduled vehicle inspection.</p> <p>Private Hire and Hackney Carriage Vehicles – Additional testing: With effect from 1 April 2011 all hackney carriage vehicles that have reached the age of 7 years will be subject to an additional annual inspection, to take effect following the renewal of the licence. These vehicles to then have three tests in all subsequent licensed twelve-month periods. Such tests to be undertaken at 4 monthly intervals.</p> <p>With effect from 1 April 2011 all private hire vehicles that have reached the age of 5 years will be subject to an additional annual inspection, to take effect following the renewal date of the license. These vehicles to be then have three tests in all subsequent twelve-month licensed periods. Such tests to be undertaken four monthly intervals.</p> <p>Emissions: With effect from 1 April 2011 emission tests will be carried out on all hackney carriage and private hire vehicles at every mechanical inspection</p>

GM LTP AQ REF	Action plan measure / target	Lead Authority	Original timescale for completion	Progress with measure	Outcome to date
E3	<p>Tree Planting:</p> <p>Tree planting will help to ameliorate air quality issues</p>	Manchester City Council	The project started in 1995 when feasibility work was carried out to encourage planting and establish more woodland in Manchester.	<p>The Manchester Tree and Woodland Strategy was produced in July 2006. I</p> <p>The City Council aim to plant 3600 trees per annum and 1000 hedgerow species.</p> <p>It is hoped that woodland management plans will be completed for all Manchester Woodland by 2010.</p>	<p>In 2010/11 highlights included:</p> <ul style="list-style-type: none"> • In total, approx 2850 trees planted • 5 Community orchard/fruit tree groves planted • Manchester now has nearly 100 registered voluntary tree wardens. • Itrees Project installed • New trees along Whitworth Street in City Centre • Over 6000 People attended the Manchester Tree Party in Heaton Park in October. • Long-term woodland Management Plan has been produced for Baileys Wood.
A9	Improvement and upgrading of Emissions Inventory for Greater Manchester Area (EMIGMA) database to be used as a tool to inform the air quality action plan,	Greater Manchester Authorities in partnership with The Greater Manchester Transportation Unit (GMTU)	<p>Development of best practice emissions database including CO₂ and energy use (electricity) by June 2007.</p> <p>Annual updates of EMIGMA. Data for 2008, 2009 and 2010 is currently being collected to input into the</p>	Transport for Greater Manchester (TFGM, encompassing the former Greater Manchester Transportation Unit) has developed web-based access for industrial processes and large point source information.	EMIGMA 2006 was published in July 2009 with updated source apportionment information. Since 2005 the database has provided a measure of carbon dioxide including electricity consumption at point of use, to be used as a comparison with UK Kyoto targets. Collection of 2007 inventory data is completed and EMIGMA report is due in

GM LTP AQ REF	Action plan measure / target	Lead Authority	Original timescale for completion	Progress with measure	Outcome to date
	target priority emission sources and quantify action plan emission reductions.		database for dispersion modelling.	Dispersion modelling work across Greater Manchester to enable comparison with the national air quality objectives for NO ₂ and PM ₁₀ has been commissioned by the GM local authorities and is currently being undertaken by TFGM.	October 2011.
E9	<p>Eco-Schools / Sustainable Schools</p> <p>Eco-Schools is an international award programme that guides schools on their sustainable journey, providing a framework to help embed these principles into the heart of school life.</p> <p>The Sustainable Schools Framework sets out challenging long-term aspirations for schools to mainstream learning about sustainable development issues and sustainable</p>	Manchester City Council	Ongoing	<ul style="list-style-type: none"> • Sustainable Schools Working Group with membership of lead councillors and departmental representatives has updated audit of service provision to schools around sustainable issues. This shows progression towards targets. • Annual Eco-Schools Forum event on theme of Sustainable Schools – Sharing Good Practice • Encourage schools to complete School Travel Plans (Travel and Traffic doorway – Sustainable 	<p>137 schools taking part in Eco-Schools (over 80% of Manchester Schools)</p> <p>37schools have achieved Bronze award</p> <p>51 schools have achieved Silver award</p> <p>10 schools have achieved the highest level of award – the Eco Schools Green Flag. Number of Green Flag schools has doubled from 5 schools to 10</p> <p>25 children’s centres taking part in Eco-Schools (around 50%)</p> <p>17 children’s centres have achieved Bronze award</p> <p>4 children’s centres have achieved Silver award</p> <p>2 children’s centres have achieved the highest level of award – the Eco Schools Green Flag</p>

GM LTP AQ REF	Action plan measure / target	Lead Authority	Original timescale for completion	Progress with measure	Outcome to date
	practices into everyday school life.			<p>Schools / Eco Schools Transport theme.)</p> <ul style="list-style-type: none"> • Encourage schools to take part in Walk to School Week • Encourage schools to take part in Bike Week activities • Tree planting with schools, awareness raising on benefits of trees to contribute to (Eco-Schools Biodiversity theme / Buildings and Grounds doorway – Sustainable Schools) • Encourage schools to use school grounds, parks and local green spaces for environmental studies thus reducing need to use transport for longer journeys for field trips • Termly eco-bulletins sent to all schools with advice and information on resources, training 	<p>200 people attended Eco-Schools Forum 2010 with representatives from 45 different schools and 20 environmental organisations</p> <p>Over 100 Wildaboutnature Environmental Education handbooks distributed to schools and children's centres.</p>

GM LTP AQ REF	Action plan measure / target	Lead Authority	Original timescale for completion	Progress with measure	Outcome to date
				and events around the environment and sustainability. <ul style="list-style-type: none"> • 	

Table 25 Manchester’s Air Quality Actions – Energy Efficiency Measures

GM LTP AQ REF	Action plan measure / target	Lead Authority	Original timescale for completion	Progress with measure	Outcome to date
NTA4	City Council 'Green' energy policy: The City Council is moving towards the use of electricity generated by renewable resources.	Manchester City Council	The switch to renewable electricity generation to take place by end of 2004.	Renewable energy contracts have been secured from certified renewable sources for 100% of all operational building electricity and 50% of all street lighting electricity. This gives an aggregated total in the region of 85% of the Council's electricity consumption coming from renewable sources. This has resulted in annual savings of 32,382 tonnes of CO ₂ . An additional annual saving of 3,010 tonnes has been made by including the AGMA wide Traffic Signals electricity use into the City Council's existing un-metered supply contract that is 50% supplied by renewables.	Green energy tariffs have been renewed for council contracts and have been extended to include GMUTC Traffic Signals load. Other operational building electricity contracts have been extended on the basis of 100% CCL exempt renewables. A new tariff for green energy is now offered to GM residents and a number of local businesses have switched to 100% renewable energy purchase.

GM LTP AQ REF	Action plan measure / target	Lead Authority	Original timescale for completion	Progress with measure	Outcome to date
NTA2	Home Energy Conservation Act (HECA) 1995 energy efficiency programme	Manchester City Council	In line with HECA 1995, the Housing Services Energy Team aims to improve the energy efficiency of housing stock across the city and collate information about improvements carried out by other housing providers. The target set by the Government was a 30% improvement by 2010.	<p>Delivering the Warm Homes Project that offers free and discounted insulation measures to homeowners throughout the city. In 2009/10, the outputs for the £1.5m scheme were:</p> <ul style="list-style-type: none"> • 3,638 properties were improved with 5,301 measures. The lifetime saving of CO2 as a result of these measures being installed is 71,910 tonnes. • Energy saving improvements to Council owned housing stock and the newly formed Registered Social Landlords from the stock transfer process – the CO2 saved as a result of the measures installed by the above in 2009/10 is 6,884 tonnes. This is just for the year 2009/10, not lifetime savings. • Warm Front grants – 2,079 energy saving measures have been 	<p>Since HECA reporting began in 1996, Manchester has reported the following:</p> <ul style="list-style-type: none"> • a percentage improvement of 25.75% up to 31st March 2008 • Total tonnes of CO2 saved = 331,684 <p>DEFRA has not requested information for 2008/09 or 2009/10 as they are due to repeal the HECA Act.</p> <p>Further planned work for 2010/11 includes:</p> <ul style="list-style-type: none"> • continuation of the Warm Homes project; • energy saving improvements as part of the Bowes Street eco-renewal project; and • continuing with energy saving improvements made to Council owned housing stock by registered social landlords and arms length management organisations (ALMO).

GM LTP AQ REF	Action plan measure / target	Lead Authority	Original timescale for completion	Progress with measure	Outcome to date
				installed in 1,914 properties within Manchester at a cost of £4,136,540. Unfortunately we have not yet received the information from EAGA (the managing agents for the grants) about how much CO2 saving these measures equate to.	
NTA2	Energy Saving Trust Advice Centre (ESTac).	Manchester City Council	The ESTAC has been operational since April 2008. It is funded by the Energy Saving Trust and provides free and impartial information and advice to householders in Manchester and across the other 9 Greater Manchester Local Authorities. The advice service expanded into Energy Saving Trust Advice Centre from the old Energy Efficiency Advice Centre (EEAC).	The following services were delivered by the Energy Saving Trust advice centre to Manchester residents in 2009/10: <ul style="list-style-type: none"> • 26616 households received advice in the form of a Home Energy Report • 21869 households received telephone advice on a range of energy issues • 4325 households received advice at General Events • 3432 households received advice at Business Events • 819 households received advice at Community Events • 3294 households 	The assumed CO ₂ savings as a result of this ESTac activity is 348,278 tonnes.

GM LTP AQ REF	Action plan measure / target	Lead Authority	Original timescale for completion	Progress with measure	Outcome to date
				completed on-line Home Energy Checks <ul style="list-style-type: none"> • 10672 households received Transport Advice • 9261 Measures were installed. 	
NTA3	Environmental Business Pledge (now incorporating the City Centre Campaign): A joint venture between the City Council and Groundwork Manchester to promote and develop best practice for green travel, fleet management, and energy efficiency to reduce emissions and improve air quality across the cities business community.	Manchester City Council	Pilot scheme of volunteer companies in 2004. Campaign rolled out to businesses across the city centre since mid 2005. The scheme is now incorporated into the Manchester City Council Environmental Business Pledge (EBP) to provide a 'one stop shop' for green action across businesses in the city, in partnership with the Council.	The recent development of the Manchester – A Certain Future (A stakeholder climate change action plan for Manchester) has provided greater exposure for the scheme. The scheme is seen as a delivery mechanism for the Businesses to achieve environmental improvements in line with the Manchester – A certain Future. The scheme has seen significant outputs over the last 12 months, with increases in all monitored areas. The scheme has expanded to over 1450 registered businesses city wide with a greater focus on carbon reduction	Businesses of all sectors and sizes across the city are working on environmental improvements through structured criteria with a focus on measuring and reducing their Carbon Footprint by identifying and reducing areas of energy consumption throughout their business. To date out puts achieved are: <ul style="list-style-type: none"> • CO₂ savings of 4174 tonnes • Water savings of 49,991m³ • 3700 tonnes of waste diverted from landfill
NTA4	Planning Policies: Development of policies and supplementary	Manchester City Council	Manchester City Council will continue to use Unitary Development Plan (UDP) policies and develop Local Development Framework Core Strategy policies	Ongoing implementation of UDP policy E1.1 under the objective 'To Foster a Cleaner and Less Polluted City'.	The Environmental Standards section within the Guide to Development in Manchester Supplementary Planning Document and Planning Guidance (April 2007) sets out design principles to

GM LTP AQ REF	Action plan measure / target	Lead Authority	Original timescale for completion	Progress with measure	Outcome to date
	guidance on reducing environmental impact for new developments to reduce emissions.		to ensure air quality issues are considered in the planning process. The Core Strategy is timetabled to be adopted in December 2011.	<p>Draft Core Strategy policy approaches have been prepared that will require the reduction of CO₂ emissions from new development and other emissions generated by the development and associated traffic.</p> <p>Draft Core Strategy policy approach En 14 seeks to improve the air quality within Air Quality Management Areas, by expecting developers to meet at least the minimum standards set out in the North West sustainability checklist and to take measures to help minimise and mitigate the local impact of emissions from traffic generated by the development, as well as emissions created by the use of the development itself. Policy approach En4 requires the cumulative impact of energy generation to be taken into account when considering applications, including impact on local air quality.</p>	<p>assist developers in achieving energy efficiency targets for new development and measures to increase the use of renewable energy in new developments.</p> <p>The statutory consultation on the final Core Strategy document is planned for November 2010.</p>

GM LTP AQ REF	Action plan measure / target	Lead Authority	Original timescale for completion	Progress with measure	Outcome to date
NTA3	<p>Environmental Management System (EMS) project:</p> <p>A pilot project to engage with selected commercial organisations to assist them with implementing Phase 1 of the British Standard BS 8555 environmental management system guidance.</p>	Manchester City Council	Financial year of 2010/11.	<p>Defra funding was received through the air quality grant programme in August 2009.</p> <p>2 organisations are now being engaged with, to progress the project:</p> <ol style="list-style-type: none"> 1. Stormproofings Ltd - a Part B industrial process (a textile and fabric coating operation falling under PG note 6/8). 2. Arriva UK Bus - A major bus operator in the city. 	<p>Assistance has been given with meeting the requirements of stages 2,3 & 4 of Phase 1 of the standard, and a written report produced of findings.</p> <p>This project has raised awareness of their wider impact on air quality and begins to address changes in their operations that reduce emissions of key pollutants such as NO_x and PM₁₀.</p> <p>The project will continue in this financial year and it is intended that outcomes of the project will be publicised via a City Council internet page.</p>

Table 26 Manchester's Air Quality Actions – Regulatory and Enforcement Measures

GM LTP AQ REF	Action plan measure / target	Lead Authority	Original timescale for completion	Progress with measure	Outcome to date
NTA4	<p>Cleaner Vehicles Campaign:</p> <p>A campaign of voluntary and formal regulatory emissions testing of vehicles.</p> <p>Enforcement action taken against vehicles that fail to</p>	Manchester City Council	<p>Phase 1 of the campaign began in 2003 and was completed in March 2009.</p> <p>Phase 2 of the campaign commenced in 2009 and is ongoing.</p>	<p>Phase 1 of the campaign focused on a regulatory approach and formal test days, and was completed in March 2009.</p> <p>A report was produced by GMTU in March 2009, which analysed the results of the roadside tests of vehicle emissions</p>	<p>Annual vehicle pass / fail results have shown an overall decline in vehicles failing the test over the 8 years that Phase 1 of the campaign has been running. Nevertheless, it has identified that there is still a significant number of vehicles on the road that have polluting potential, particularly diesel engines.</p> <p>The progress of Phase 2 of the campaign was reviewed at the end of</p>

GM LTP AQ REF	Action plan measure / target	Lead Authority	Original timescale for completion	Progress with measure	Outcome to date
	<p>meet MOT test emission limits.</p> <p>Phase 2 of the CVC also includes educating drivers on fuel saving measures, leading to emission reductions from transport.</p>			<p>in Greater Manchester and Warrington from 2003-2009.</p> <p>Phase 2 of the campaign continues to include a regulated approach with formal roadside emission test days, but also encompasses targeting fuel saving and CO₂ reduction through informal educational events for the general public and local authority staff in partnership with the Energy Savings Trust.</p> <p>In 2010/11, 14 vehicle emissions test days were completed across Greater Manchester, with 375 vehicles tested.</p> <p>1 smarter driving day was completed in partnership with the Energy Savings Trust.</p>	<p>2010 and is considered to have been successful. The ability to collate quantitative results is limited but, based on staff fuel usage prior to and following receiving training on techniques for saving fuel, a 6.5 percent improvement has been observed in fuel consumption and therefore vehicle emissions.</p>
NTA4	<p>Dirty Diesel Campaign:</p> <p>Encouraging the public to report smoky, grossly polluting vehicles.</p>	Manchester City Council	Implemented in 2004/5 and ongoing.	<p>The campaign began in November 2004 and is still publicised via the hotline and website: www.cleanervehicles.org.uk. The website was redesigned and updated in 2010/11.</p>	<p>Smoky vehicles are reported to the City Council's Licensing Unit for taxis or VOSA for commercial vehicle operators for enforcement action. Private vehicles are investigated through the DVLA.</p> <p>Partnership working with TfGM is also enabling us to deal with individual</p>

GM LTP AQ REF	Action plan measure / target	Lead Authority	Original timescale for completion	Progress with measure	Outcome to date
	Targeted to reduce PM ₁₀ but also reflecting badly tuned vehicles that have higher emissions of a range of pollutants.			Leaflets are also handed out to drivers during the Cleaner Vehicles Campaign days to increase awareness. The leaflets were updated during 2010/11 and distributed to public Council buildings such as libraries, leisure centres and museums, and also to universities, student unions and local environmental groups.	buses / companies that have excessive emissions. The total number of vehicles reported in Manchester during 2010/11 was 71.
NTA4	Idling Vehicles Campaign: Advice and enforcement (Fixed Penalty Notices) against drivers idling their vehicles unnecessarily.	Manchester City Council	Enforcement procedures developed and agreed with Council. The Campaign was launched in May 2005 as part of '100 Days to a Clean Manchester' Campaign.	Raising awareness of emissions and energy issues of idling vehicles. 391 Fixed Penalty Notices (FPN's) have been served since the launch of the campaign up to end of March 2010 (8 FPN's in 2010/11). Partnership working with the Street Crime Wardens has also enabled pro-active work to focus on idling vehicles during periods when air quality is moderate or worse.	Initial indications showed a high level of compliance from commercial operators following publicity as part of the implementation of the scheme. In addition, Manchester City Council Street Management Team removed 714 untaxed vehicles and 61 abandoned vehicles in the financial year 2009/10.
NTA4	Campaign against the Burning of	Manchester City Council	Updated commercial and domestic bonfire leaflets were	Domestic bonfire campaign operational	In 2010/11 there were 69 reported incidents of commercial bonfires and

GM LTP AQ REF	Action plan measure / target	Lead Authority	Original timescale for completion	Progress with measure	Outcome to date
	<p>Waste:</p> <p>Proactive policy to stop the burning of waste at domestic and commercial premises and resulting emissions to air.</p>		<p>produced in February 2006 in partnership with the other 9 Greater Manchester Authorities. The leaflets are now used widely across Greater Manchester.</p>	<p>throughout Greater Manchester.</p> <p>Commercial bonfire / trade waste leaflet produced and widely used in Manchester.</p>	<p>115 domestic bonfires. There were also 8 reported incidents of commercial chimney smoke and 7 from domestic chimneys. In relation to this, 2 statutory notices were served.</p>
NTA4	<p>Campaign against the Burning of Waste (continued):</p>	<p>Manchester City Council</p>		<p>The Council is taking a proactive approach to encourage proper disposal of waste to reduce instances of burning. Street Environment Managers aim to educate local businesses of their responsibilities regarding waste disposal by informal means, providing literature and ongoing advice.</p>	<p>In accordance with the sections 34 and 47 of the Environmental Protection Act 1990:</p> <ul style="list-style-type: none"> • 45 notices have been issued to businesses in 2009/10 requiring them to provide written evidence of how they dispose of their waste • 175 notices have been issued to businesses in 2009/10 instructing them on how to correctly store and dispose of their waste • 6 businesses have been prosecuted for failing to comply with s.34 of the Environmental Protection Act 1990 (failure to evidence a waste disposal contract/allowing waste to escape).
NTA1	<p>Regulation of industrial processes under the Environmental Permitting Programme to</p>	<p>Manchester City Council</p>	<p>Timescale and emission standards prescribed in, and enforced through legislation and procedures set out by DEFRA.</p>	<p>All targets for regulatory inspections in 2010/11 have been met.</p> <p>Although there have been some minor excursions</p>	<p>Minimising industrial pollution by ensuring emission limits are met.</p> <p>Manchester City Council have currently permitted:</p>

GM LTP AQ REF	Action plan measure / target	Lead Authority	Original timescale for completion	Progress with measure	Outcome to date
	control emissions to air including particulates, heavy metals and hydrocarbons.			from compliance, these have been dealt with effectively with assistance from the process operators. No formal action has been necessary. All permitted activities were risk assessed during this period as required.	<ul style="list-style-type: none"> • 2 Part A2 industrial process • 34 Part B industrial processes • 48 petrol filling stations • 22 dry cleaning premises
A8 and A9	Improvements to air quality information on Manchester City Council's website	Manchester City Council	<p>Staged approach of annual programme of updates and improvements to the Council's website air quality pages.</p> <p>Air quality work in Manchester is also highlighted on several other websites such as http://www.greatairmanchester.org.uk/ and http://www.cleanervehicles.org.uk/</p>	Air quality sites have been re-written and updated in the last 12 months with key reports and information. The pages now include a customer feedback section in order to promote continual improvement. The focus for the future is on more interactive sites providing improved facilities and self-service for customers.	<p>The Council's air quality pages are regularly reviewed so that information is regularly updated and any broken links can be rectified.</p> <p>The GreatAir Manchester website is updated periodically with air quality news items and daily with air pollutant levels.</p> <p>Air quality work in Manchester, including both LAQM and action plan work, is now well documented on this site and will be further augmented subject to funding.</p>
A8 & A9	Development of web-based user friendly guidelines on air quality for construction and demolition sites across the Greater Manchester region - a partnership between Environmental	Greater Manchester Authorities	Financial year of 2010/11.	<p>Defra funding was received through the air quality grant programme in August 2009.</p> <p>A stakeholder consultation event was held in February 2010 to consult on the possible content of guidelines that could be developed for</p>	<p>A website has been set up for the project (www.greatairconstruction.org.uk).</p> <p>Views of stakeholders from the consultation event have been collated into a report and are being considered as a way forward.</p> <p>Interactive best practice guidelines are to be published on the website</p>

GM LTP AQ REF	Action plan measure / target	Lead Authority	Original timescale for completion	Progress with measure	Outcome to date
	Protection UK and the Greater Manchester Public Protection Partnership.			the Greater Manchester area to minimise the air quality impacts of construction/ demolition sites. Development of interactive best practice guidelines is underway.	imminently.

10 Conclusions and Proposed Actions

10.1 Conclusions from New Monitoring Data

Nitrogen dioxide

Nitrogen dioxide monitoring results have not identified any exceedences of the ambient air quality objectives outside the current AQMA.

Annual monitoring results from diffusion tube sites are generally in agreement with the AQMA. However, two monitoring sites (Clayton Lane and St Pauls School) within the AQMA measured annual average NO₂ concentrations below the annual NO₂ objective (38 ug/m³ at both sites).

Two city centre roadside sites (Oxford Street and Princess Street) measured annual mean concentrations of NO₂ greater than 60 ug/m³. Paragraphs 5.17 and 5.18 of Technical Guidance LAQM.TG (09) advise that there is a risk of the hourly objective being exceeded where such concentrations are measured, and that Local Authorities may choose to amend their current AQMA to reflect exceedences of the 1-hour objective, and review their Air Quality Action Plans. However, monitoring results from the Oxford Road automatic monitor (on a busy road close to the city centre) show that the hourly NO₂ objective was not exceeded despite measuring an annual mean exceeding 60 ug/m³. Therefore it seems likely that these sites experience relatively high concentrations for a large proportion of the day, rather than shorter term hourly peaks in concentrations.

Other local air quality management (LAQM) pollutants

All other pollutants relevant to LAQM monitored within Manchester were below their respective air quality objectives.

10.2 Conclusions relating to New Local Developments

Although several new industrial processes were granted an Environmental permit in 2010/11, none would require a detailed air quality assessment.

10.3 Proposed Actions

The 2009 Updating and Screening Assessment report identified the need to proceed to a detailed assessment for nitrogen dioxide, which involves partnership working with the other 9 Greater Manchester local authorities for dispersion modelling. Transport for Greater Manchester Forecasting and Analytical Services (formerly the

Greater Manchester Transportation Unit) is currently undertaking the dispersion modelling work, and the resulting Detailed Assessment report will be produced in due course. The dispersion modelling for the Detailed Assessment report will include both NO₂ and PM₁₀, and will highlight areas at risk of exceeding relevant objectives for these pollutants in 2010 and 2015/6.

The Greater Manchester Combined Authority has been established and will exercise statutory local air quality management duties in Greater Manchester concurrently with the constituent local authorities. This provides the Greater Manchester authorities with an opportunity to further ensure a 'joined-up' approach to the management of air quality in issues in the conurbation.

It is proposed that:

- a single Dispersion Modelling report will be produced in 2011/12, with recommendations by Transport for Greater Manchester and individual Constituent Councils, to fulfil the detailed review and assessment requirements, and to propose any necessary amendments to the individual Constituent Councils' designated Air Quality Management Areas; and
- from April 2012 there will be joint Greater Manchester air quality review and assessment reports.

The City Council will continue to progress its air quality action plan with co-operation from Defra and all other relevant stakeholders.

11 References

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Appendices

Appendix A: QA/QC Data

Diffusion Tube Bias Adjustment Factors

Laboratory supplying NO ₂ diffusion tubes (from July 2009):	Staffordshire Scientific Services 14 Martin Street Stafford ST14 2LG
Preparation method used:	20% TEA in water
Harmonisation Practical Guidance followed:	Yes
National bias adjustment factor from Defra LAQM tools website (Version 06/11):	0.85

Factor from Local Co-location Studies

Manchester City Council undertook two NO₂ diffusion tube co-location studies in 2010. Triplicate NO₂ diffusion tubes were co-located with automatic chemiluminescent NO_x analysers at the Manchester Piccadilly and Manchester South monitoring sites. Results of the co-location studies are shown in the figures below. Results have been produced using the latest version (Version 4 - February 2011) of the diffusion tube bias adjustment spreadsheet tool produced by AEA Energy and Environment, available from the following website:


http://laqm.defra.gov.uk/documents/AEA_DifTPAB_v04.xls

Manchester Piccadilly - Urban Centre site

Checking Precision and Accuracy of Triplicate Tubes

Period	Diffusion Tubes Measurements									Automatic Method		Data Quality Check	
	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 µgm ⁻³	Tube 2 µgm ⁻³	Tube 3 µgm ⁻³	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
1	05/01/2010	02/02/2010	56.9	56.2	53.5	56	1.8	3	4.5	52.62131	90.63893016	Good	Good
2	02/02/2010	02/03/2010	48.0	56.8	53.6	53	4.5	8	11.1	55.80556	90.93610698	Good	Good
3	02/03/2010	30/03/2010	42.9	43.8	44.1	44	0.6	1	1.6	51.58699	98.21693908	Good	Good
4	30/03/2010	27/04/2010	39.7	31.4	35.1	35	4.2	12	10.3	45.25426	95.83952452	Good	Good
5	27/04/2010	01/06/2010			40.1					40	99.76218787		Good
6	01/06/2010	29/06/2010	42.9	36.9	47.0	42	5.1	12	12.6	36	99.55423477	Good	Good
7	29/06/2010	03/08/2010	37.0	37.0	38.0	37	0.6	2	1.4	31	94.41141498	Good	Good
8	03/08/2010	31/08/2010	39.3	38.9	39.9	39	0.5	1	1.3	32	91.67904903	Good	Good
9	31/08/2010	28/09/2010	47.9	47.3	89.9	62	24.4	40	60.7	41	95.39375929	Poor Precision	Good
10	28/09/2010	02/11/2010	53.7	48.0	59.7	54	5.9	11	14.5	46	95.48156856	Good	Good
11	02/11/2010	30/11/2010	54.0	57.0	55.0	55	1.5	3	3.8	49.31931	95.39375929	Good	Good
12	30/11/2010	04/01/2011	66.0	63.0	64.0	64	1.5	2	3.8	63.01485	96.43281807	Good	Good
13													

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



From the AEA group

Overall survey -> Precision 10 out of 11 periods have a CV smaller than 20% (Check average CV & DC from Accuracy calculations)

Accuracy (with 95% confidence interval)
without periods with CV larger than 20%

Bias calculated using 10 periods of data

Bias factor A 0.96 (0.87 - 1.08)

Bias B 4% (-7% - 15%)

Diffusion Tubes Mean: 48 µgm⁻³

Mean CV (Precision): 6

Automatic Mean: 46 µgm⁻³

Data Capture for periods used: 95%

Adjusted Tubes Mean: 46 (42 - 52) µgm⁻³

Accuracy (with 95% confidence interval)
WITH ALL DATA

Bias calculated using 11 periods of data

Bias factor A 0.93 (0.82 - 1.06)

Bias B 8% (-6% - 21%)

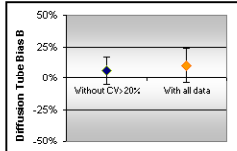
Diffusion Tubes Mean: 49 µgm⁻³

Mean CV (Precision): 9

Automatic Mean: 46 µgm⁻³

Data Capture for periods used: 95%

Adjusted Tubes Mean: 46 (40 - 52) µgm⁻³



Diffusion Tube Bias B

Jaume Targa, for AEA
Version 04 - February 2011

Manchester South - Suburban site

AEA Energy & Environment
From the AEA group

Checking Precision and Accuracy of Triplicate Tubes

Diffusion Tubes Measurements										Automatic Method		Data Quality Check	
Period	Start Date	End Date	Tube 1	Tube 2	Tube 3	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
1	05/01/2010	02/02/2010	41.5	43.8	46.1	44	2.3	5	5.7	39.42579	99.10846954	Good	Good
2	02/02/2010	02/03/2010	46.4	45.8	47.5	47	0.9	2	2.1	38.39441	95.69093611	Good	Good
3	02/03/2010	30/03/2010	23.8	32.4	26.5	28	4.4	16	10.9	29.88525	99.70282318	Good	Good
4	30/03/2010	27/04/2010	20.0	17.9	18.8	19	1.1	6	2.6	24.53889	99.85141159	Good	Good
5	27/04/2010	01/06/2010	23.2	20.5	21.1	22	1.4	7	3.5	20	99.88109394	Good	Good
6	01/06/2010	29/06/2010	25.6	23.9	23.5	24	1.1	5	2.8	18	99.85141159	Good	Good
7	29/06/2010	03/08/2010	20.0	20.0	20.0	20	0.0	0	0.0	13	99.52437574	Good	Good
8	03/08/2010	31/08/2010	21.3	21.1	20.2	21	0.6	3	1.5	16	94.79940565	Good	Good
9	31/08/2010	28/09/2010	28.2	28.0	26.8	28	0.8	3	1.9	21	99.85141159	Good	Good
10	28/09/2010	02/11/2010	29.4	32.4	32.6	31	1.8	6	4.5	24	99.88109394	Good	Good
11	02/11/2010	30/11/2010	42.0	41.0	41.0	41	0.6	1	1.4	35.67857	99.85141159	Good	Good
12	30/11/2010	04/01/2011	54.0	52.0	57.0	54	2.5	5	6.3	54.88081	99.88109394	Good	Good
13													

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

Overall survey →	Good precision	Good Overall DC
-------------------------	-----------------------	------------------------

(Check average CV & DC from Accuracy calculations)

Site Name/ ID:

Accuracy (with 95% confidence interval)
without periods with CV larger than 20%
Bias calculated using 12 periods of data
Bias factor A 0.89 (0.79 - 1)
Bias B 13% (0% - 26%)
Diffusion Tubes Mean: 32 µgm⁻³
Mean CV (Precision): 5
Automatic Mean: 28 µgm⁻³
Data Capture for periods used: 99%
Adjusted Tubes Mean: 28 (25 - 32) µgm⁻³

Precision 12 out of 12 periods have a CV smaller than 20%
Accuracy (with 95% confidence interval)
WITH ALL DATA
Bias calculated using 12 periods of data
Bias factor A 0.89 (0.79 - 1)
Bias B 13% (0% - 26%)
Diffusion Tubes Mean: 32 µgm⁻³
Mean CV (Precision): 5
Automatic Mean: 28 µgm⁻³
Data Capture for periods used: 99%
Adjusted Tubes Mean: 28 (25 - 32) µgm⁻³

Jaume Targa, for AEA
Version 04 - February 2011

Summary of co-location results

Parameter	Manchester Piccadilly (Urban Centre)	Manchester South (Suburban)
NO ₂ diffusion tubes annual mean ug/m ³	49	32
Automatic monitor annual mean ug/m ³	46	28
Bias adjustment factor	0.93	0.89
Precision of NO ₂ diffusion tubes	Good	Good
Overall data capture for automatic analyser	Good	Good

Discussion of Choice of Factor to Use

A bias adjustment factor of 0.93 (derived from the Manchester Piccadilly co-location study) to be applied to kerbside, roadside, urban, centre and urban background locations.

In addition, a bias adjustment factor of 0.89 (derived from the Manchester South co-location study) to be applied to suburban and rural sites.

Reason: both monitoring sites show good overall precision for diffusion tubes and good overall data capture for the co-located real time analyser. The Piccadilly site is more representative of urban and roadside locations. The Manchester South site is more representative of suburban locations.

QA/QC of diffusion tube monitoring

Laboratory performance in the Defra QA/QC framework (Workplace Analysis Scheme for Proficiency (WASP), operated by the Health and Safety Laboratory) was obtained for Staffordshire Scientific Services from the Defra LAQM Internet pages:

<http://laqm.defra.gov.uk/diffusion-tubes/ga-qc-framework.html>

Performance was found to be 'Good' from April 2009 to April 2010 (the latest available performance data).

2010 NO₂ diffusion tube monthly mean values

Site Name	Dates of monitoring period 2010												Raw annual mean concentration
	05/01 to 02/02	02/02 to 02/03	02/03 to 30/03	30/03 to 27/04	27/04 to 01/06	01/06 to 29/06	29/06 to 03/08	03/08 to 31/08	31/08 to 28/09	28/09 to 02/11	02/11 to 30/11	30/11 to 04/01/11	
Alma Road	55	56	40	32	32	39	30	35	40	44	51	68	43
Ashton Old Road	63	65	47	34	65	50	33	44	54	45	69	79	54
Burnage	43	41	25	-	19	22	18	21	25	-	31	53	30
Cheetham Hill Road	59	-	45	42	41	50	42	45	48	48	57	75	50
Chethams School	53	50	37	32	36	39	32	34	45	43	50	65	43
Clayton Day Nursery	40	38	25	21	16	21	17	21	26	32	40	52	29
Clayton Lane	50	50	33	27	33	32	27	32	42	45	52	68	41
Great Ancoats Street	58	56	49	37	44	54	51	49	60	58	57	80	54
Hewitt Street	67	67	54	47	42	41	40	43	53	52	59	71	53
Hyde Road	71	72	48	39	47	48	37	44	50	46	58	82	53
Kingsway	60	62	43	36	41	43	35	38	43	40	60	73	48
Liverpool Road	63	59	54	42	-	52	43	-	52	54	61	80	56
Lockton Close	59	60	44	33	41	46	36	40	42	43	59	69	48
M56	66	73	62	53	52	65	51	46	66	65	67	83	62
Newton Street	65	66	67	51	51	51	50	56	67	62	65	73	60
Oldham Road	59	65	44	40	43	55	41	44	49	52	59	74	52
Oxford Street	77	82	70	64	75	86	68	75	81	79	-	88	77
Peaceville Road	48	48	32	28	28	30	24	26	32	36	-	67	36
Princess Road	63	68	48	42	47	46	42	48	52	56	94	86	58
Princess Street	69	69	40	82	58	70	58	58	63	60	67	73	64
Rochdale Road	59	62	41	-	37	41	32	36	47	45	54	74	48
Rostron Avenue	58	51	35	36	34	34	30	37	40	45	70	66	45
Stockport Road	72	76	59	47	48	61	47	49	56	62	64	79	60
St Pauls School	54	54	38	34	31	36	27	27	36	43	50	59	41
Styal	30	30	19	14	14	16	11	15	16	19	27	38	21
Town Hall	54	57	-	47	36	35	31	33	43	46	53	63	45
Victoria Terrace	52	52	37	32	33	33	29	32	38	43	48	64	41

All results are expressed as ug/m³

QA/QC of automatic monitoring

Automatic air quality analysers within the Manchester City Council area are subject to a high level of quality assurance/ quality control. Analysers are either operated as part of the national Automatic Urban and Rural Network (AURN) of air quality monitors owned by the Department of Environment, Food and Rural Affairs (Defra), or are part of the 'Calibration Club' scheme run by AEA Technology. Details of the QA/QC schemes that the analysers conform to are detailed in the following table.

Monitoring site	Analyser	QA/QC scheme	Frequency of calibrations	Data captured and screened by	Data ratified by	Frequency of site audits
Manchester Piccadilly	NO _x	National AURN owned by DEFRA	Every 4 weeks	Bureau Veritas	AEA Technology	Approx every 6 months
	PM _{2.5}	National AURN owned by DEFRA	Every 4 weeks	Bureau Veritas	AEA Technology	Approx every 6 months
	O ₃	National AURN owned by DEFRA	Every 4 weeks	Bureau Veritas	AEA Technology	Approx every 6 months
	SO ₂	National AURN owned by DEFRA	Every 4 weeks	Bureau Veritas	AEA Technology	Approx every 6 months
	CO	Calibration Club run by AEA Technology	Every 4 weeks	AEA Technology	AEA Technology	Approx every 6 months
	PM ₁₀	Calibration Club run by AEA Technology	Every 4 weeks	AEA Technology	AEA Technology	Approx every 6 months
Manchester South	NO _x	Affiliated to national AURN owned by DEFRA	Every 4 weeks	Bureau Veritas	AEA Technology	Approx every 6 months
	O ₃	Affiliated to national AURN owned by DEFRA	Every 4 weeks	Bureau Veritas	AEA Technology	Approx every 6 months
	SO ₂	Calibration Club run by AEA Technology	Every 4 weeks	AEA Technology	AEA Technology	Approx every 6 months
Oxford Road	NO _x	Calibration Club run by AEA Technology	Every 4 weeks	AEA Technology	AEA Technology	Approx every 6 months
	PM ₁₀	Calibration Club run by AEA Technology	Every 4 weeks	AEA Technology	AEA Technology	Approx every 6 months

Analysers that are operated as part of the AURN

Measurements produced are subject to a high level of quality assurance/ quality control. Data is captured and screened by a third party (Bureau Veritas), and then further ratified by AEA Energy and Environment before being published on the UK Air Quality Archive internet website. In order to be deemed representative, there is a minimum data capture requirement of 90% for an annual period. Manchester City Council act as Local Site Operators (LSOs) for the site on behalf of DEFRA, and perform calibration and system checks on the analysers every 4 weeks. The City

Council also performs basic fault finding duties and aims to arrive on site within 2 hours of a fault being reported. If the fault cannot be rectified by the LSO, an engineer from a designated equipment support unit will arrive on site within 2 working days of the fault being reported. AEA Technology performs periodic audits of the equipment located at the site and local site operator staff approximately every 6 months.

Analysers that are operated as part of the 'Calibration Club'

These analysers are subject to the same level of QA/QC as for those that form part of the AURN. The only difference is that AEA Technology carries out the initial capture and screening of the data, as well as the data ratification. In addition, the data is not published on the UK Air Quality Archive internet website, as it belongs solely to Manchester City Council. However, data is available via the Association of Greater Manchester Authorities GreatAir Manchester website.

PM₁₀ 'M-type' sampler bias correction

Manchester City Council has co-located an 'M-type' sampler with a reference PM₁₀ analyser at the Manchester Piccadilly monitoring site. This is in an attempt to derive a correction factor for the 'M-type' sampler. A bias adjustment factor has been derived in a similar way to the nitrogen dioxide diffusion tubes. This allows results from the 'M-type' samplers to be expressed as a PM₁₀ equivalent. A comparison of the results of the reference sampler and 'M-type' sampler are shown in the following table.

Year	Reference sampler annual mean PM ₁₀ concentration (ug/m ³)	Reference sampler % data Capture	'M-type' sampler annual mean total suspended particulate concentration (ug/m ³)	'M-type' % data capture	Bias factor A
1995 ¹	44.2	96%	35.3	64%	1.25
1996 ¹	34.0	98%	29.4	100%	1.16
1997 ¹	31.2	94%	29.3	98%	1.06
1998 ¹	27.7	97%	25.6	96%	1.08
1999 ¹	26.3	98%	25.8	100%	1.02
2000 ¹	27.5	98%	25.5	100%	1.08
2001 ¹	38.9	97%	38.3	29%	1.01
2002 ¹	27.7	95%	25.0	78%	1.11
2003 ¹	29.7	98%	22.7	90%	1.28
2004 ¹	24.7	98%	21.0	98%	1.18
2005 ¹	25.2	98%	22.9	100%	1.10
2006 ¹	26.3	96%	24.9	92%	1.05
2007 ²	24.4	98%	22.3	98%	1.09
2008 ²	19.8	99%	19.5	92%	1.02
2009 ³	22.0	60%	22.1	94%	1.0
2010 ³	20.5	93%	20.2	98%	1.02

¹ M-type sampler co-located with TEOM analyser

² M-type sampler co-located with FDMS analyser

³ M-type sampler co-located with Met One BAM analyser

The results show a good correlation between measured PM₁₀ and total suspended particulate matter, however M-type sampler results have historically usually been lower than the reference sampling method.

Benzene diffusion tube bias correction

Manchester City Council has co-located 1 benzene diffusion tube with the pumped benzene sampler at Piccadilly Gardens, in an attempt to improve the accuracy of the benzene diffusion tube results. The pumped benzene sampler is a more accurate method of sampling benzene because a known volume of air is drawn through the absorbent tube and duplicate tubes are sampled. A bias adjustment factor has been derived for the benzene diffusion tubes in a similar way to the nitrogen dioxide diffusion tubes.

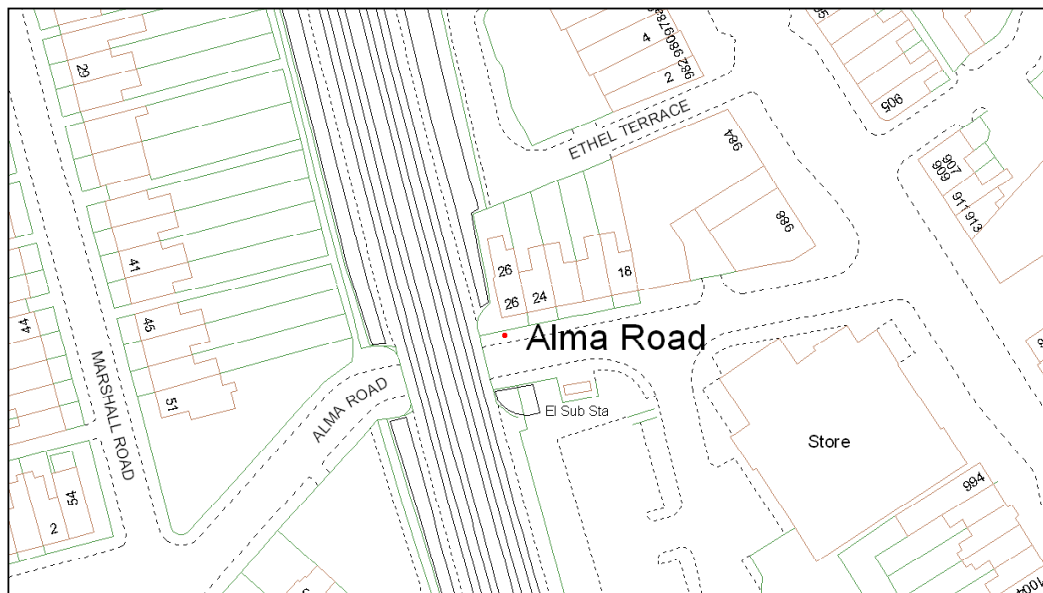
Bias adjustment results for recent years from the Piccadilly Gardens monitoring site are presented in the following table.

Year	Pumped benzene sampler results		Benzene diffusion tube results		Bias factor A
	Annual mean benzene concentration (ug/m ³)	Data capture	Annual mean benzene concentration (ug/m ³)	Data capture	
2006	1.02	100%	1.12	92%	0.91
2007	1.00	100%	0.66	100%	1.52
2008	0.78	100%	0.60	92%	1.30
2009	0.86	96%	0.72	100%	1.19
2010	0.89	100%	0.99	100%	0.90

The benzene diffusion tubes used by Manchester City Council are currently supplied by Staffordshire Scientific Services, but preparation and analysis is subcontracted out to another UKAS accredited laboratory.

Appendix B: Location maps and photographs of non-automatic monitoring sites

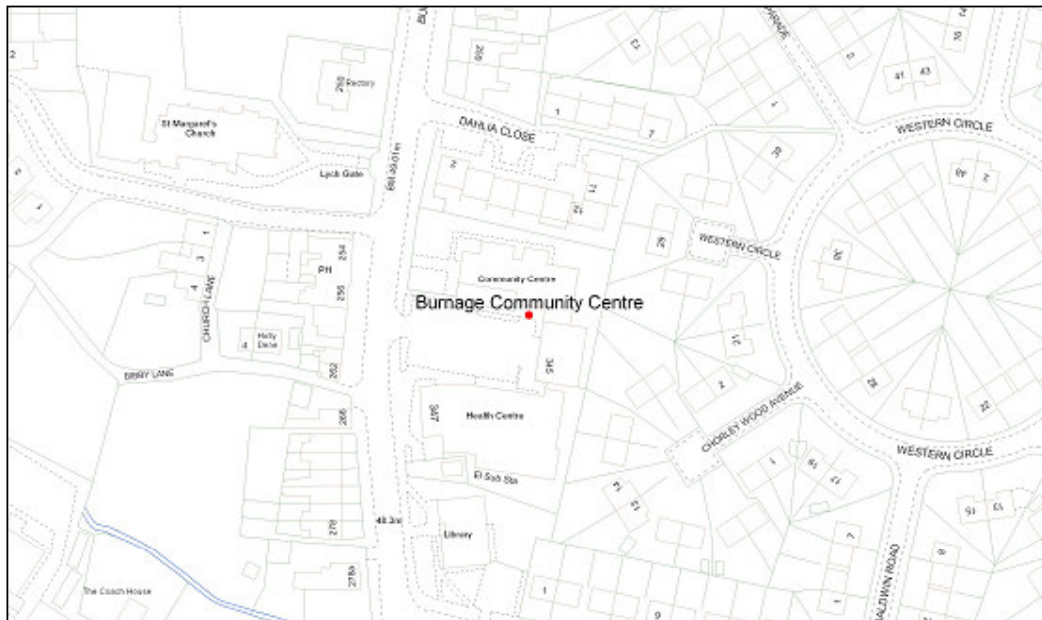
1. Alma Road



2. Ashton Old Road



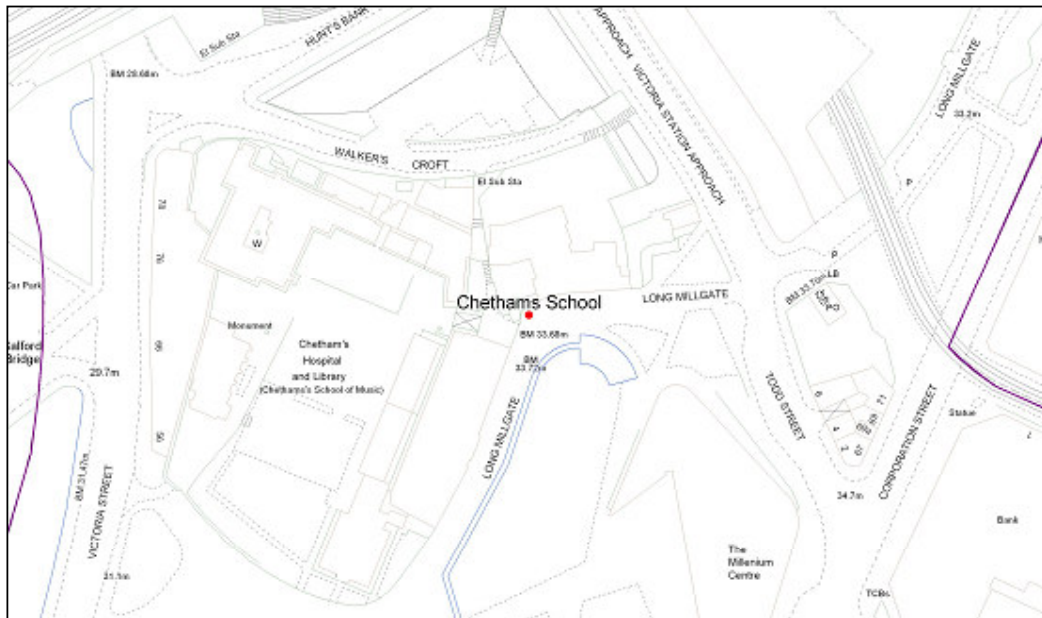
3. Burnage Community Centre



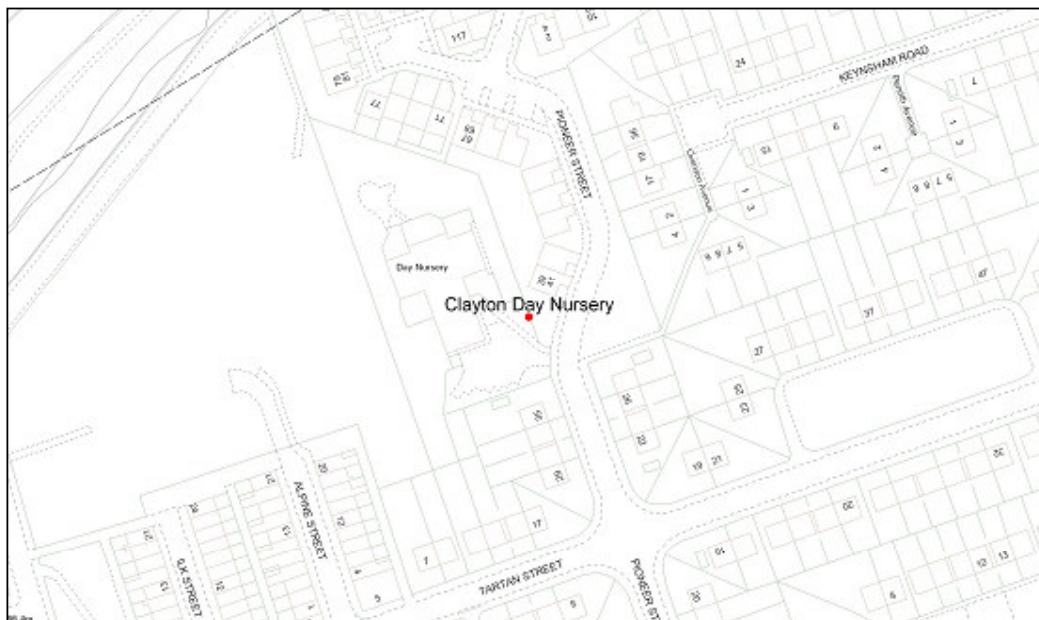
4. Cheetham Hill Road



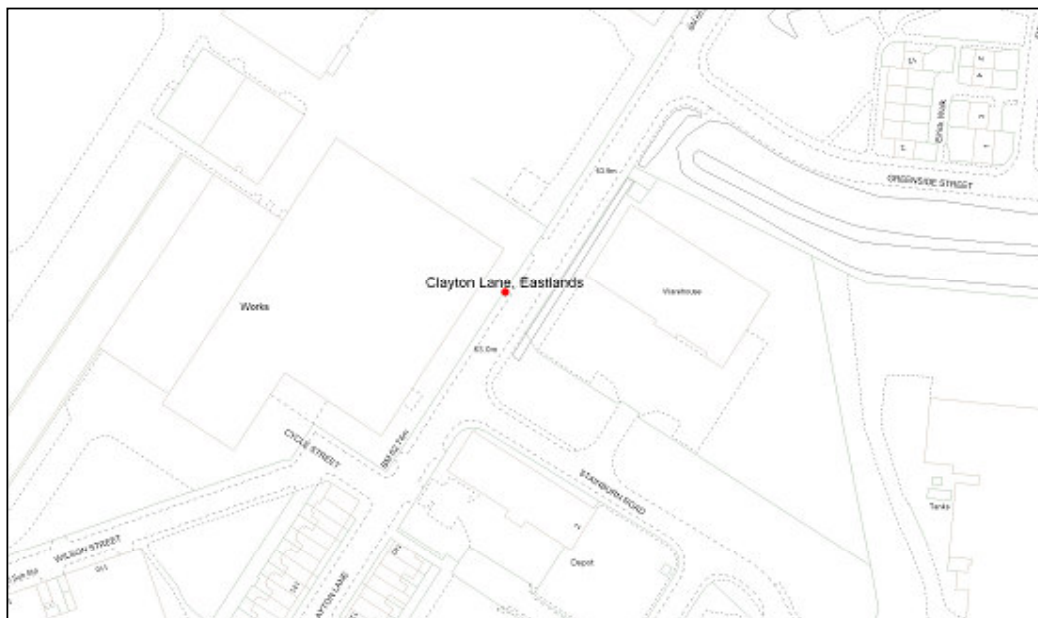
5. Chethams School



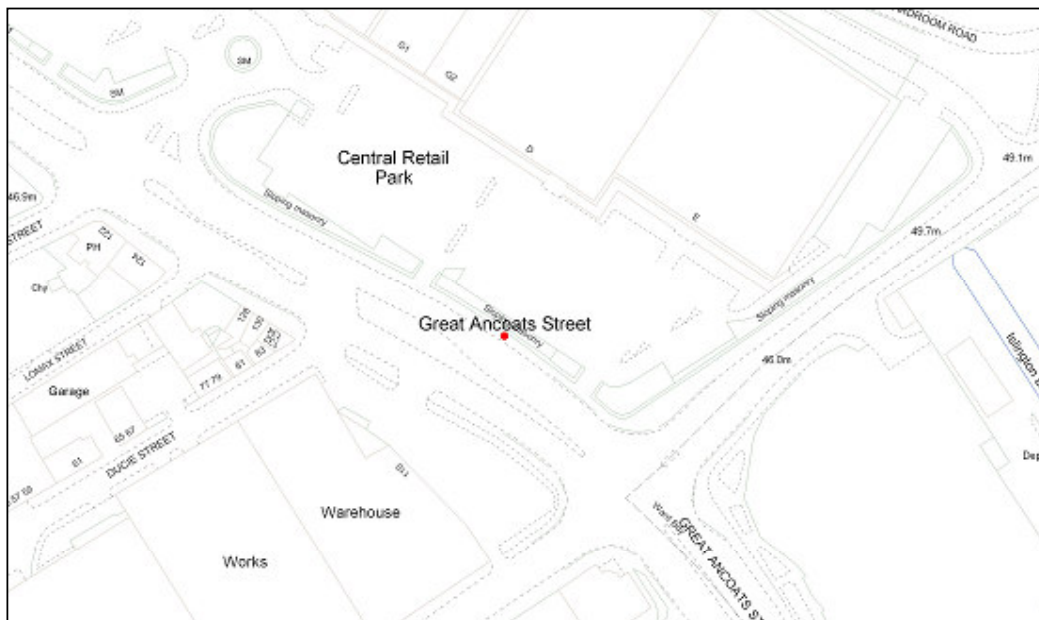
6. Clayton Day Nursery



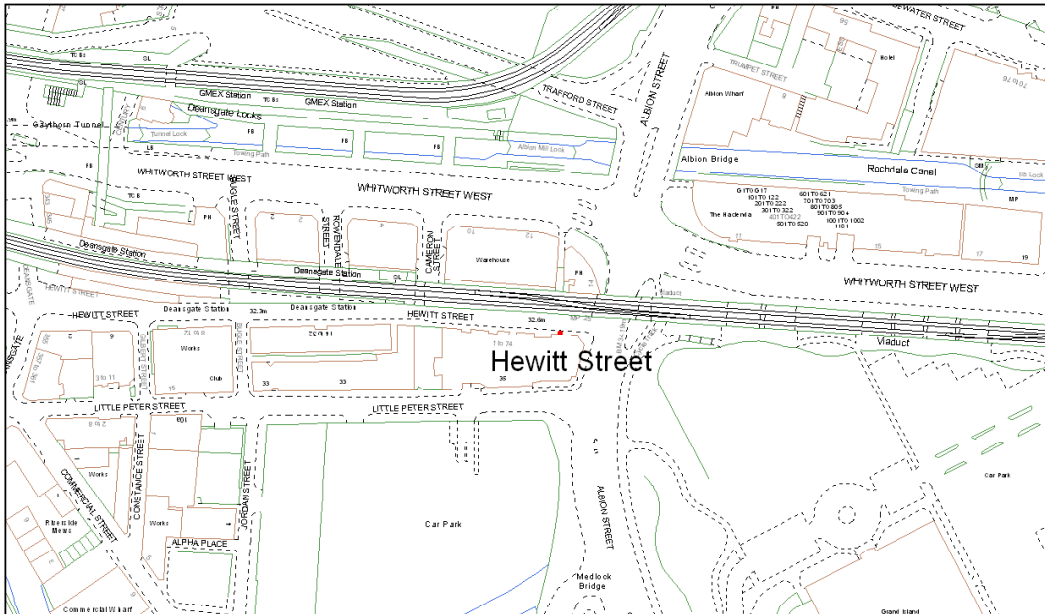
7. Clayton Lane



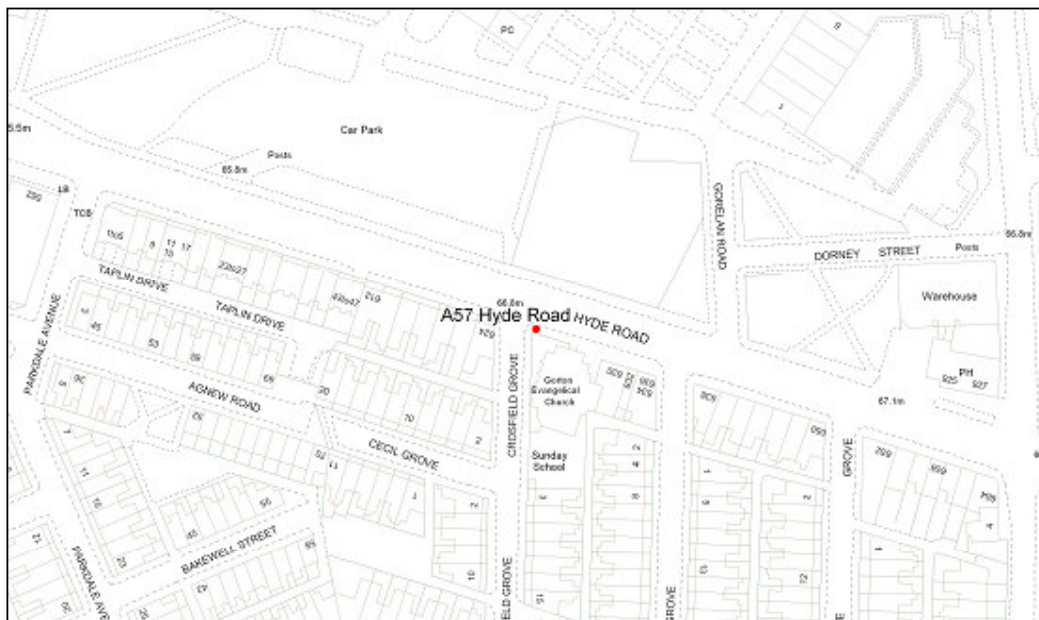
8. Great Ancoats Street



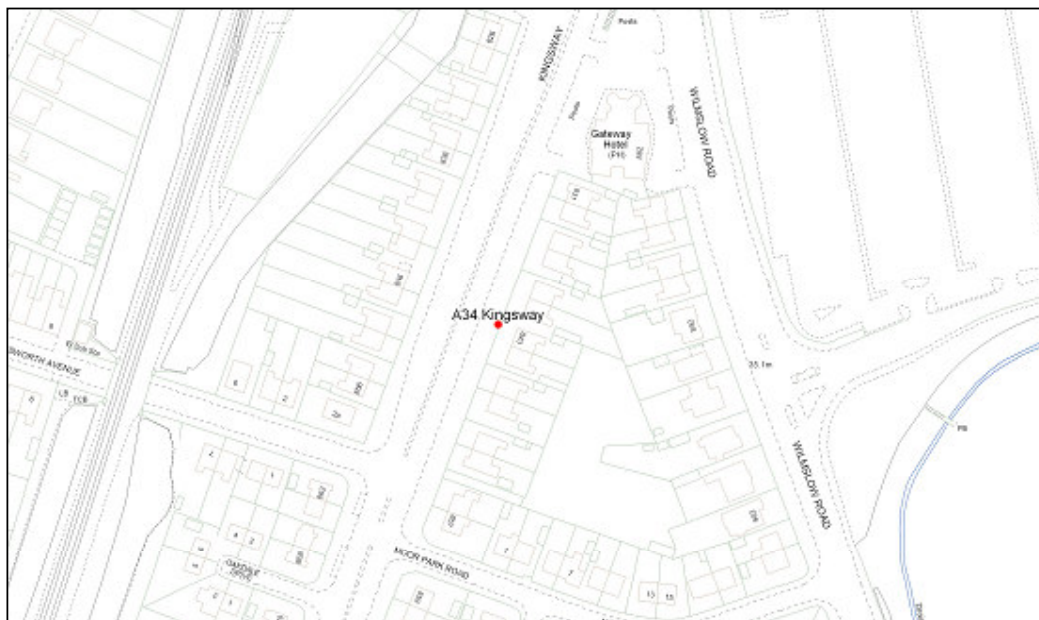
9. Hewitt Street



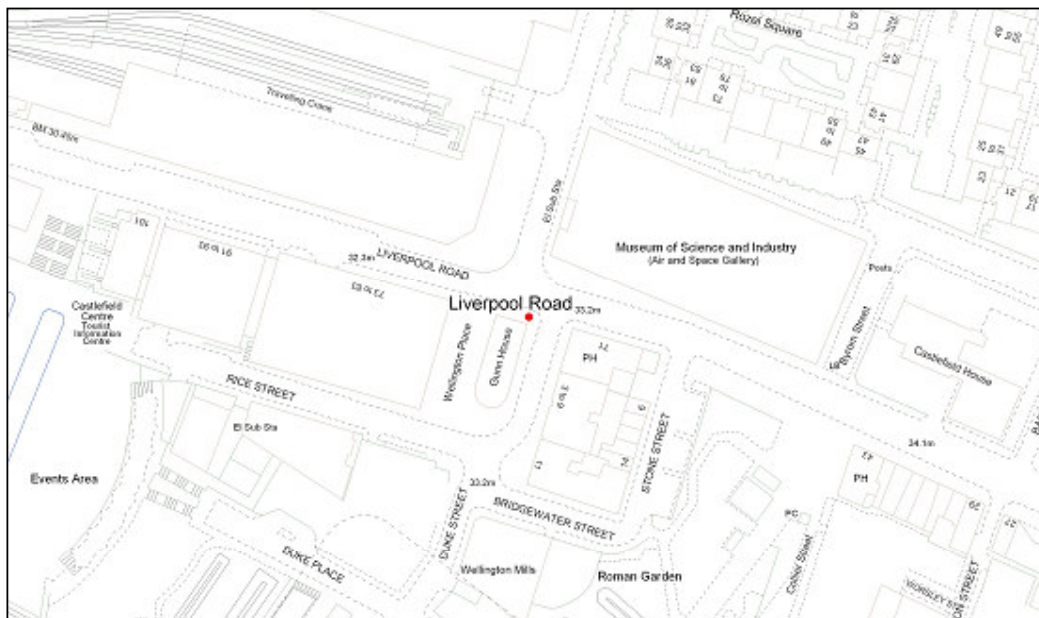
10. Hyde Road



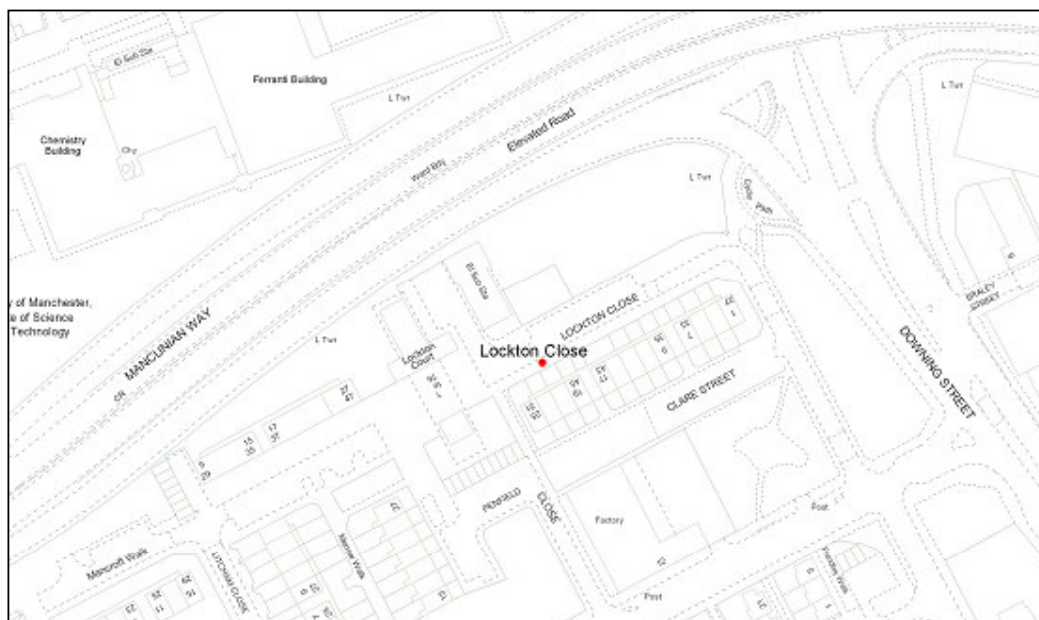
11. Kingsway



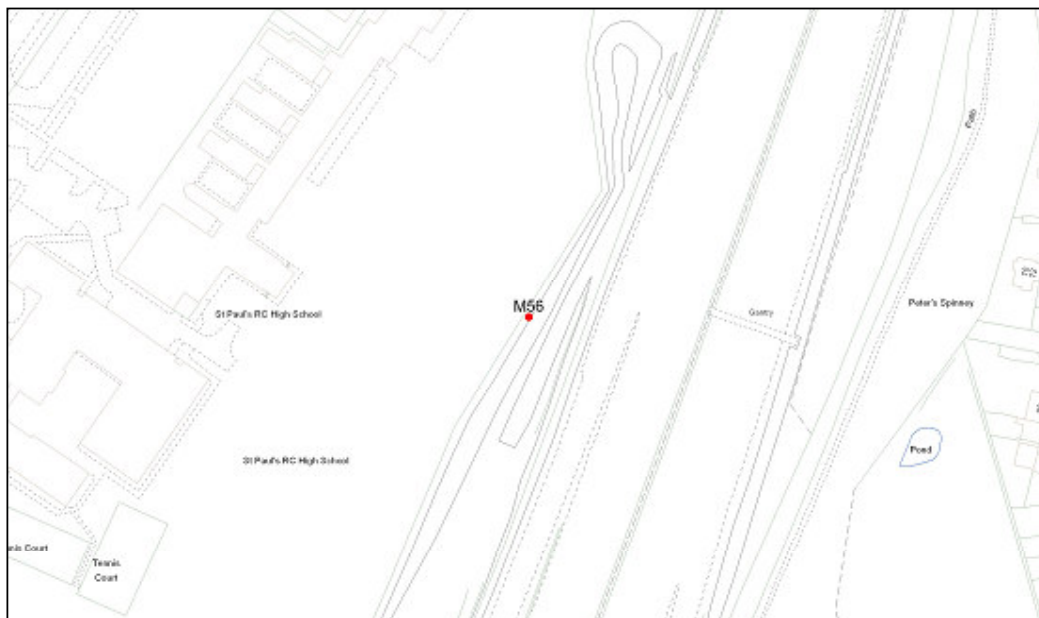
12. Liverpool Road



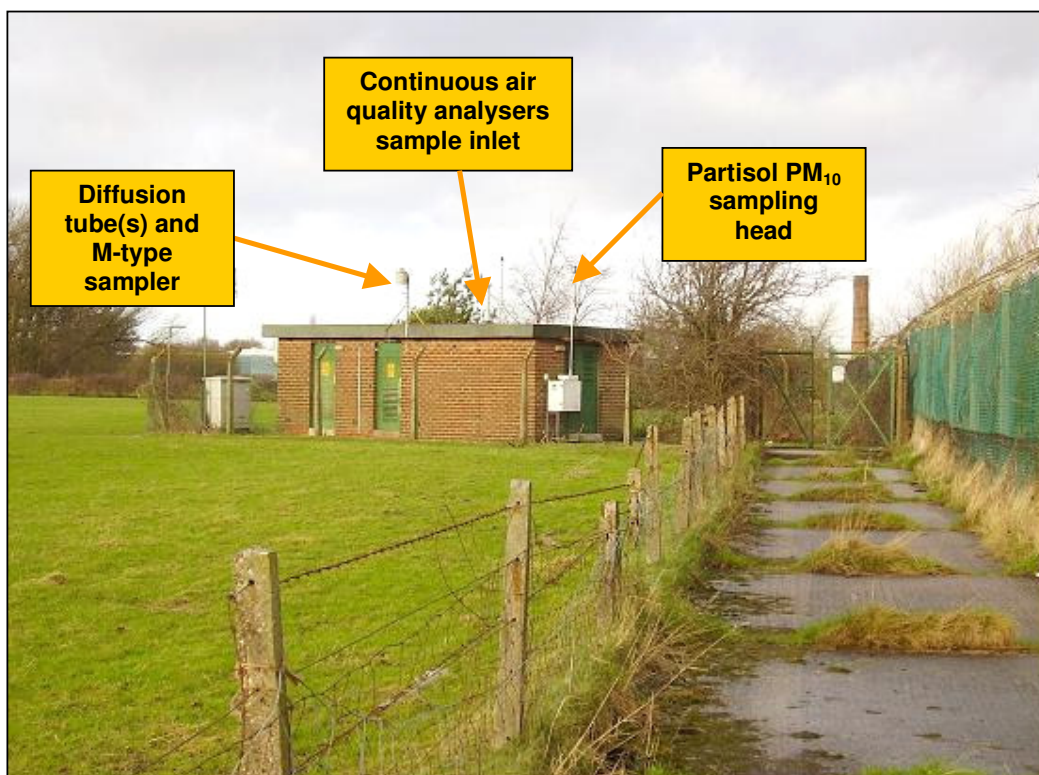
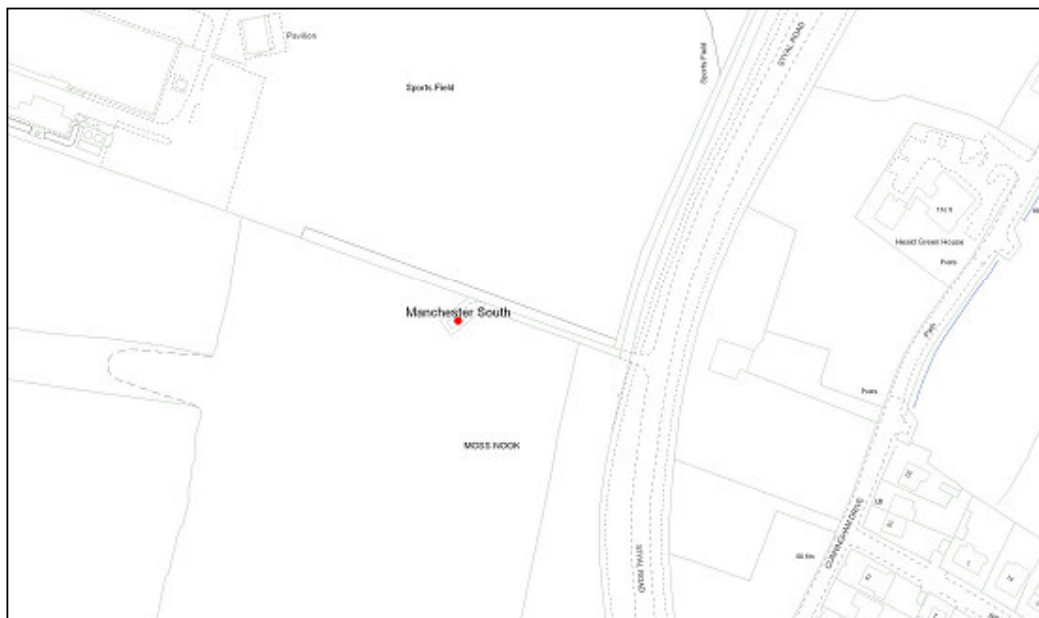
13. Lockton Close



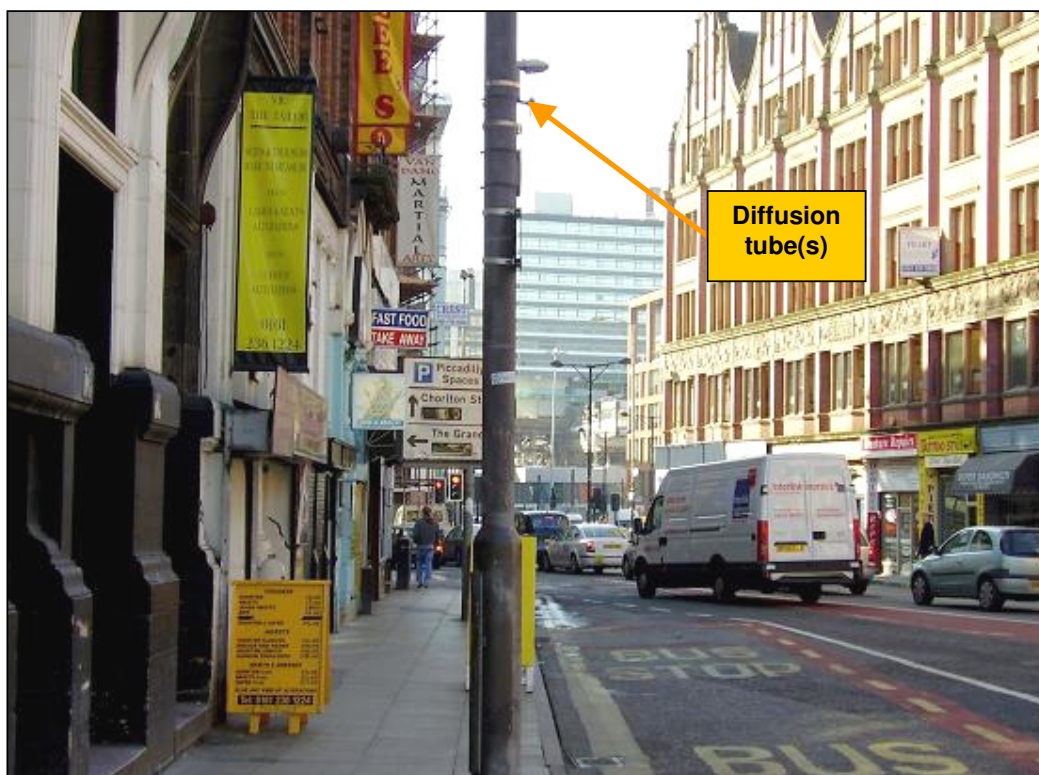
14. M56



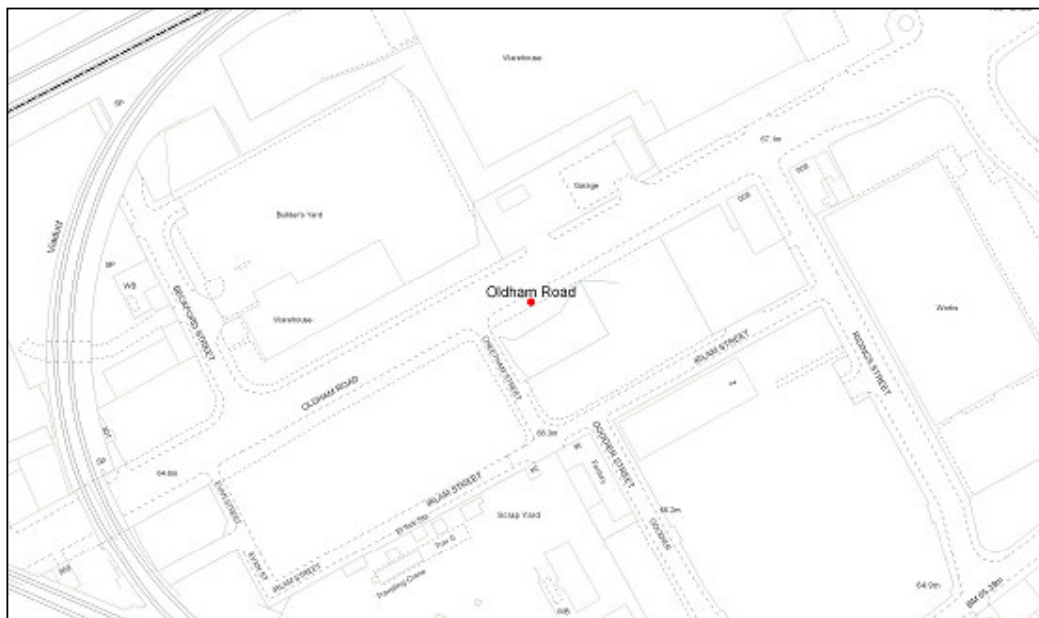
15. Manchester South



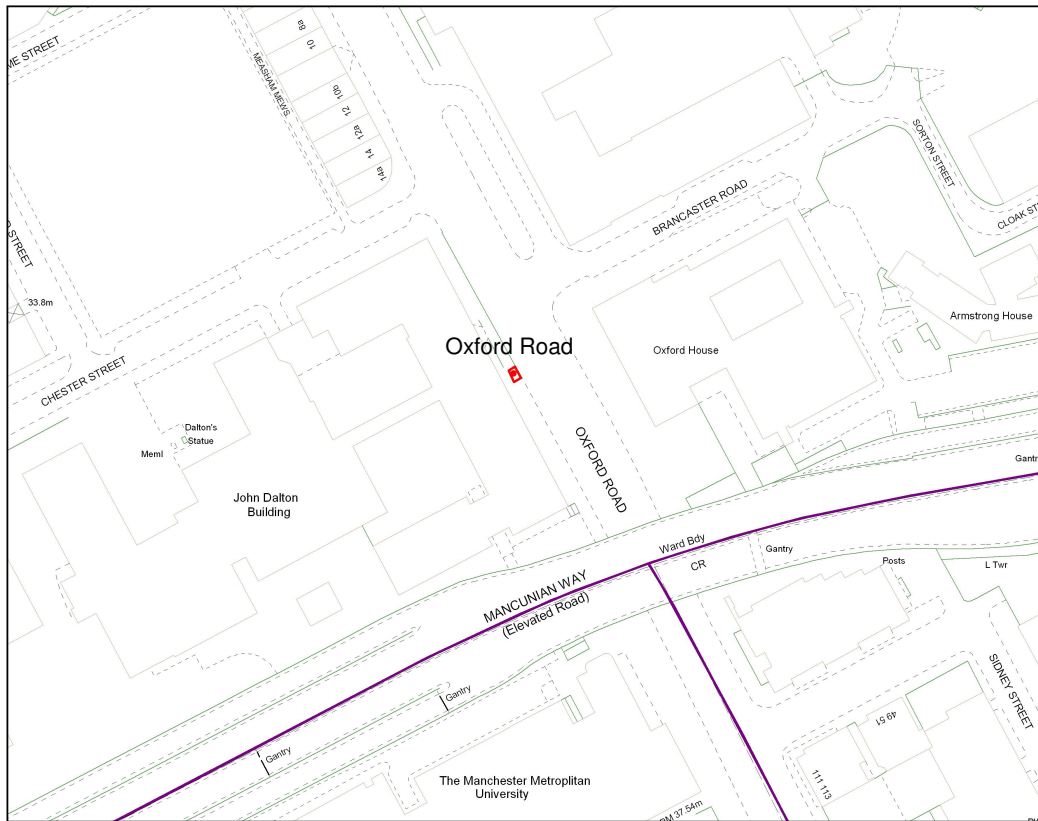
16. Newton Street



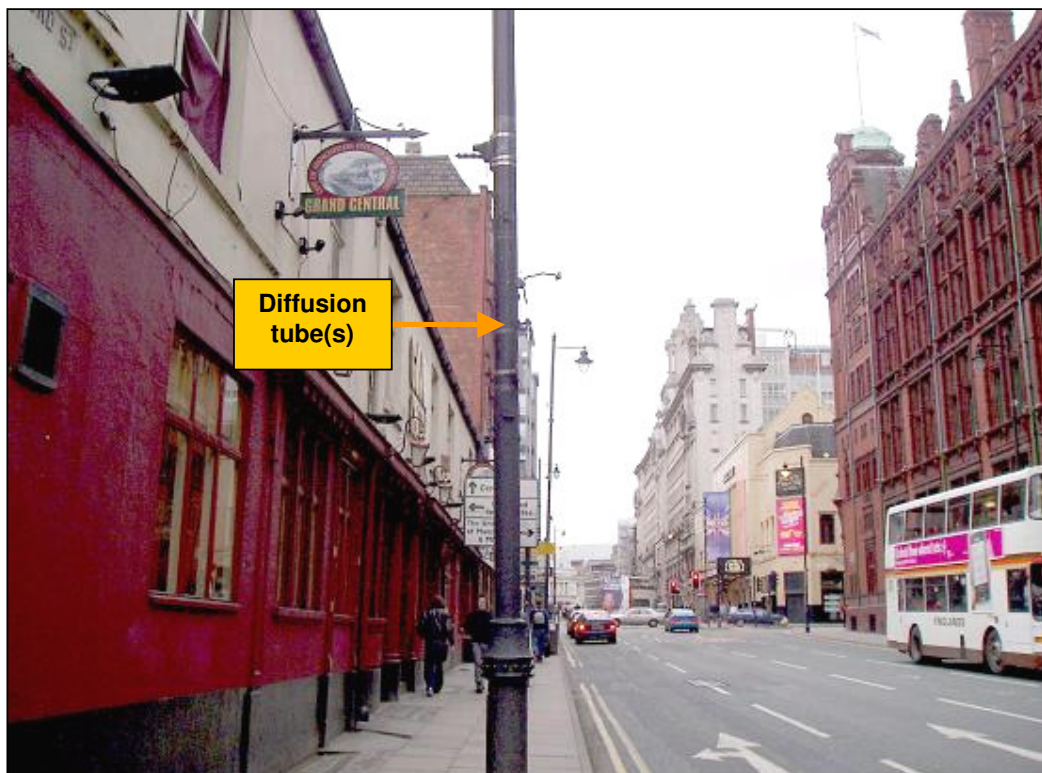
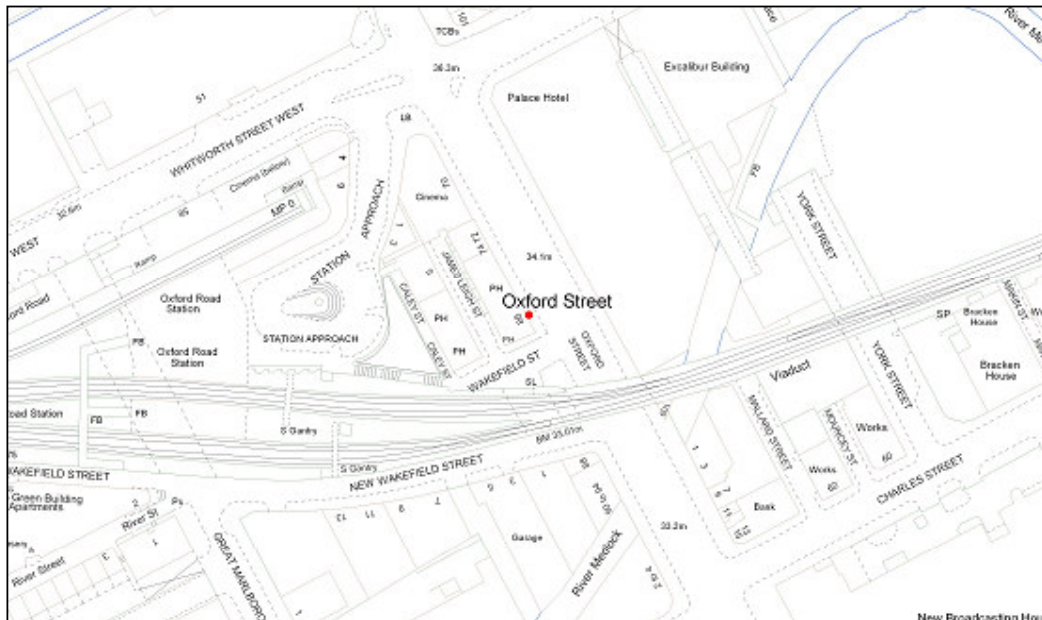
17. Oldham Road



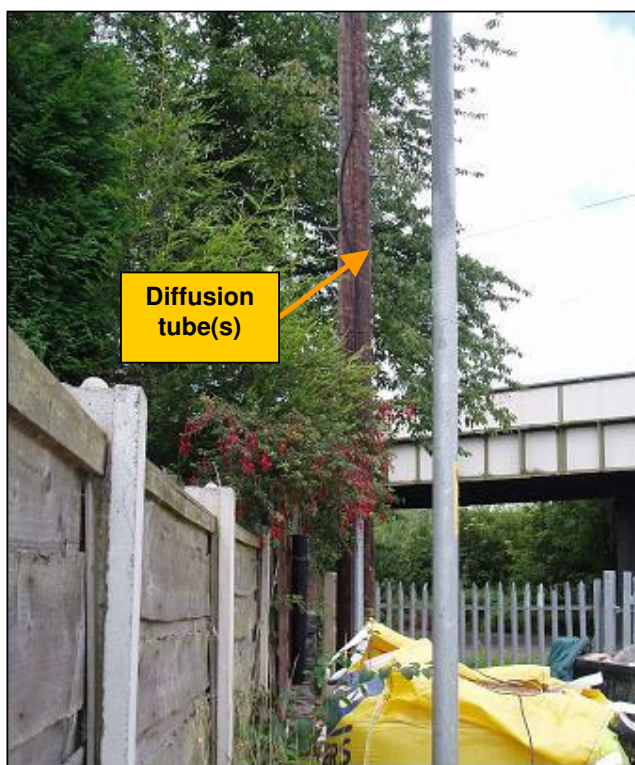
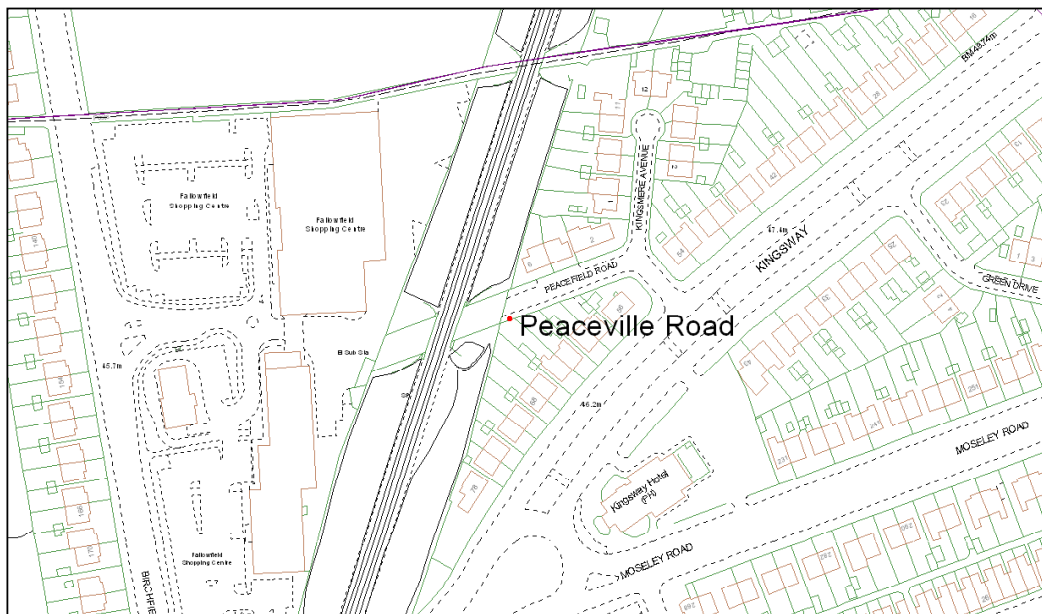
18. Oxford Road



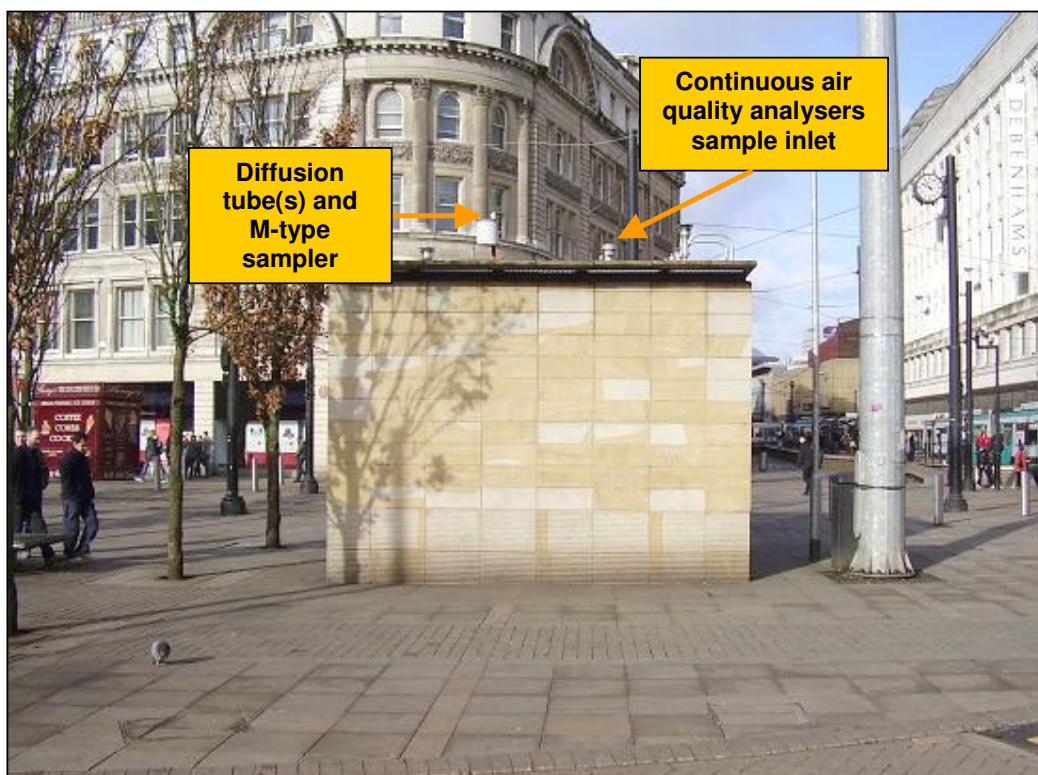
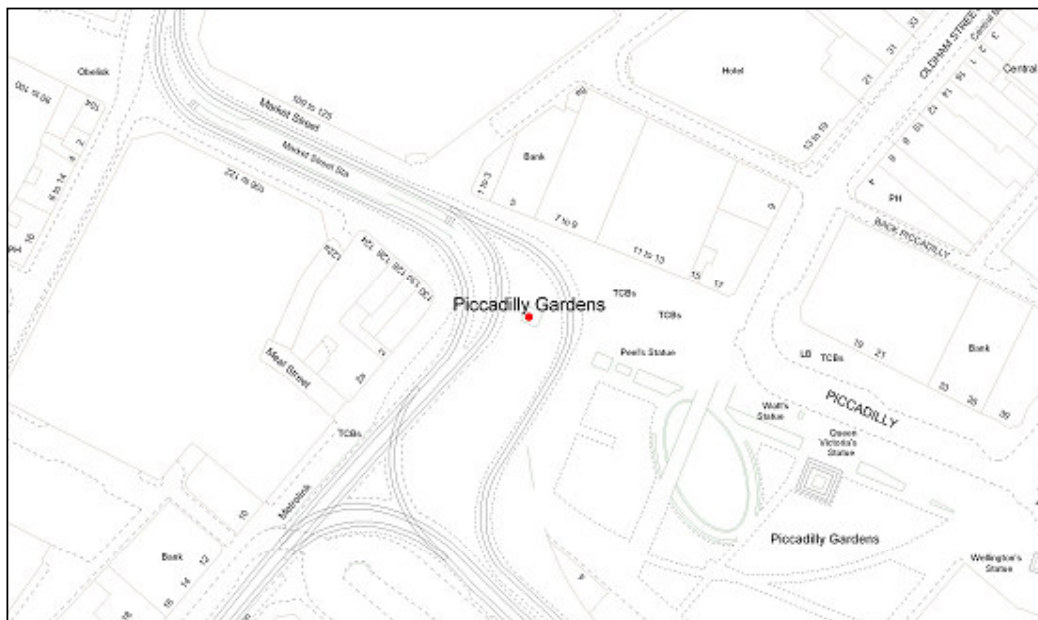
19. Oxford Street



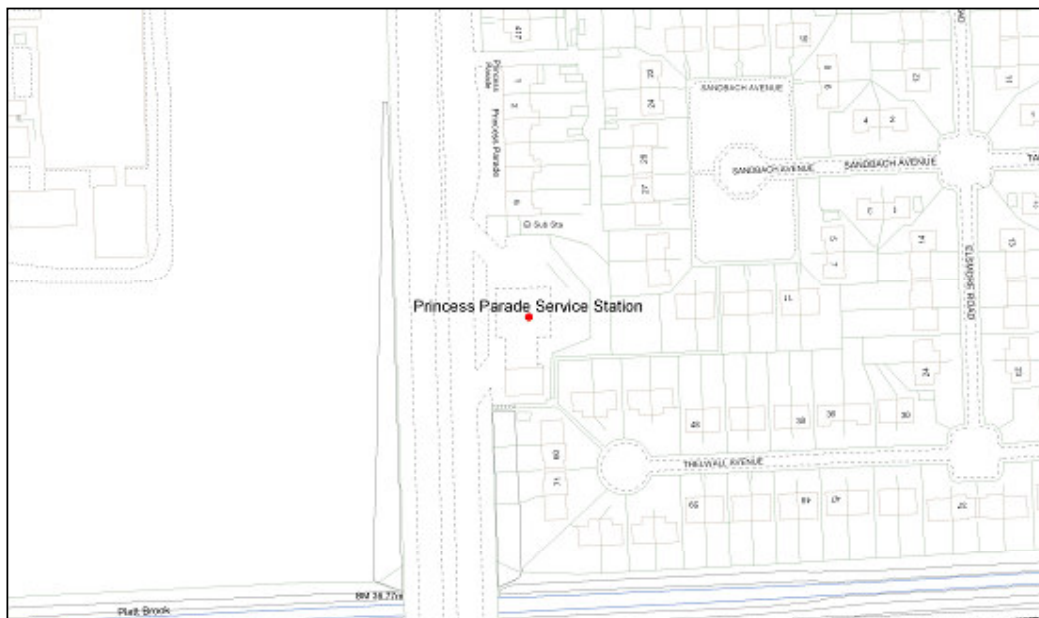
20. Peaceville Road



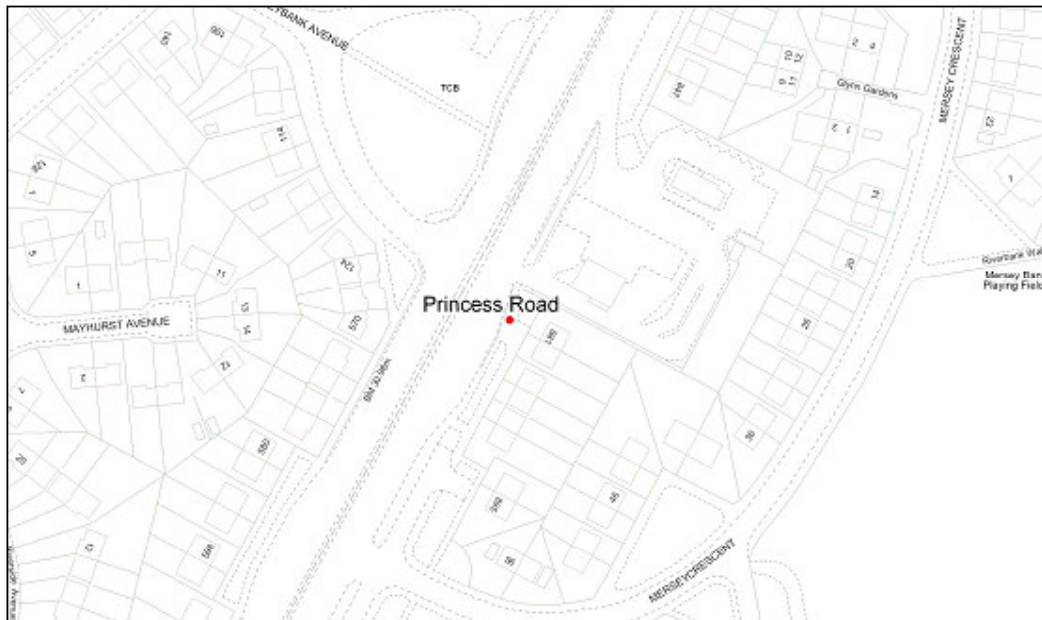
21. Piccadilly Gardens



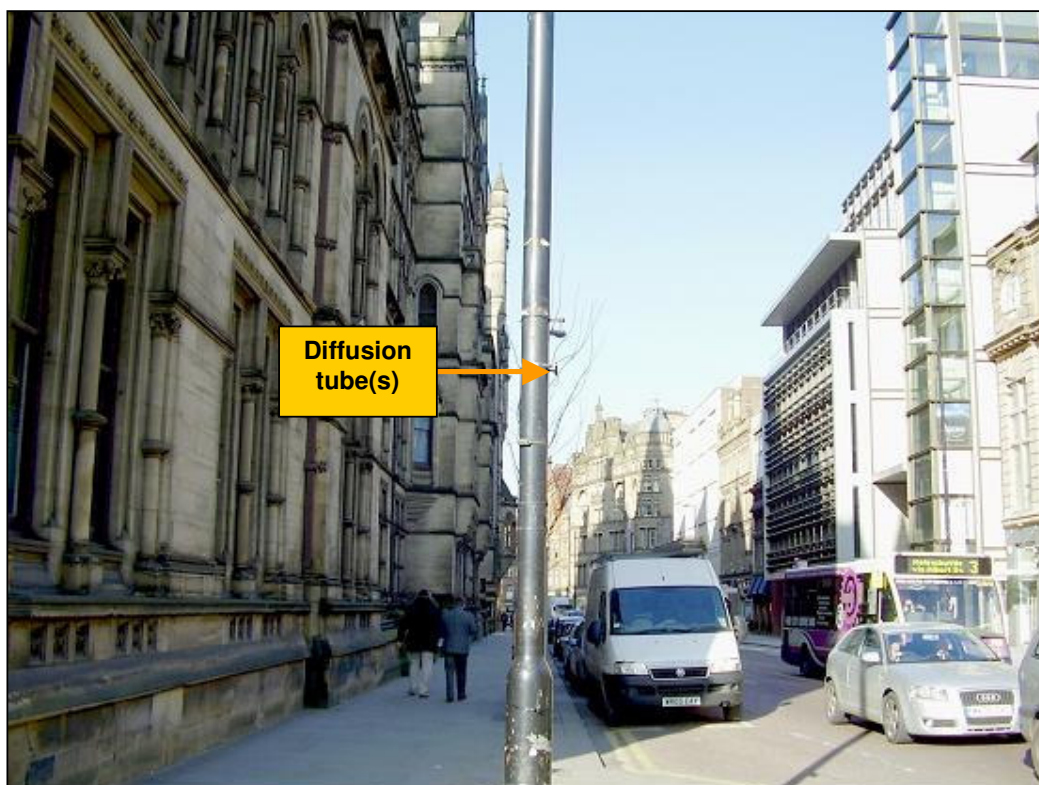
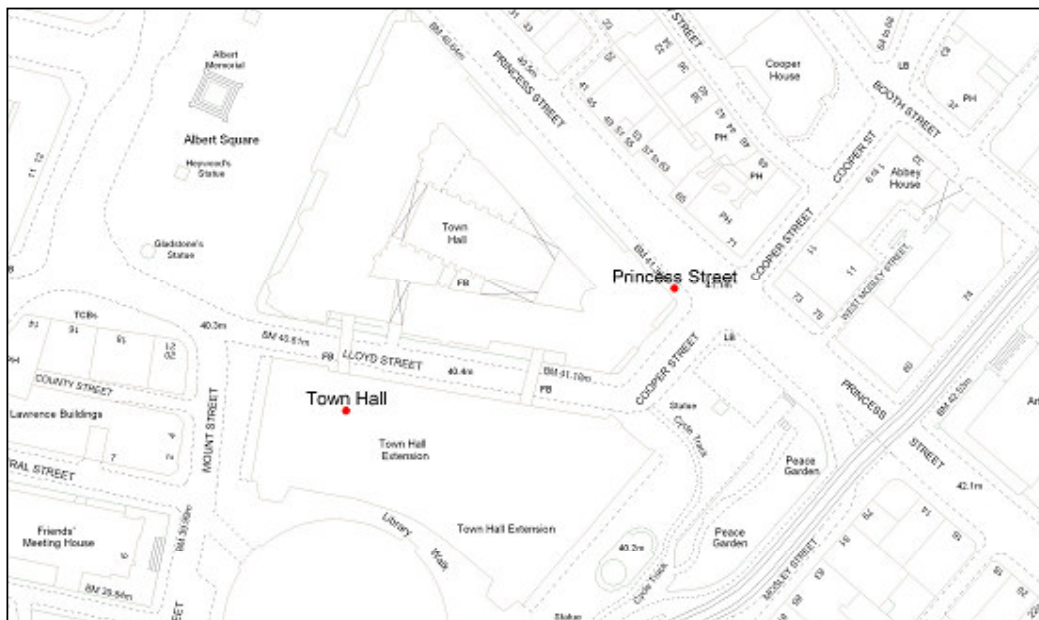
22. Princess Parade Service Station



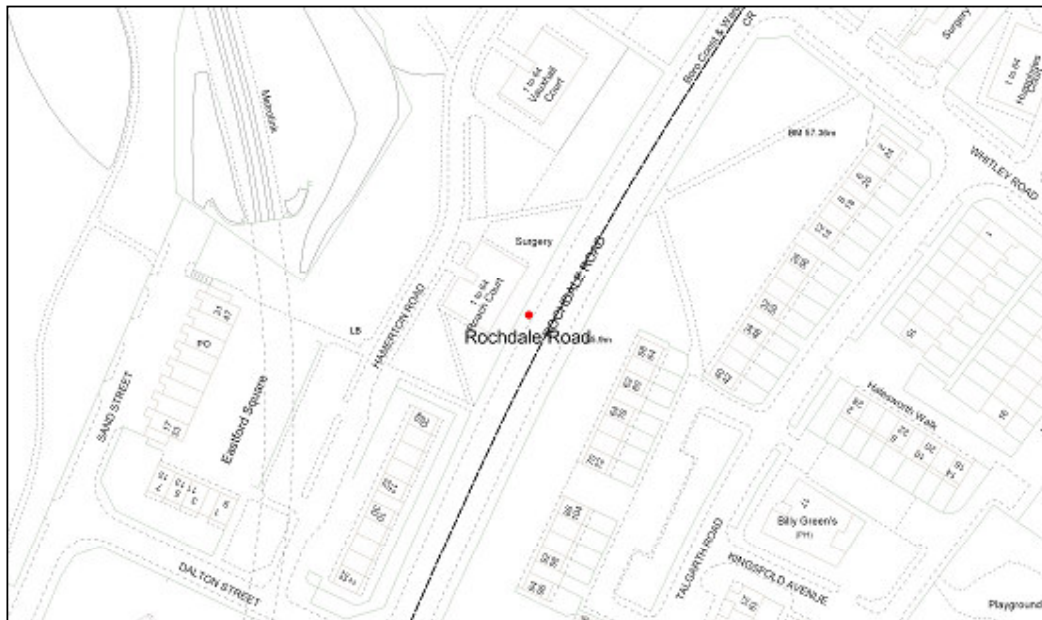
23. Princess Road



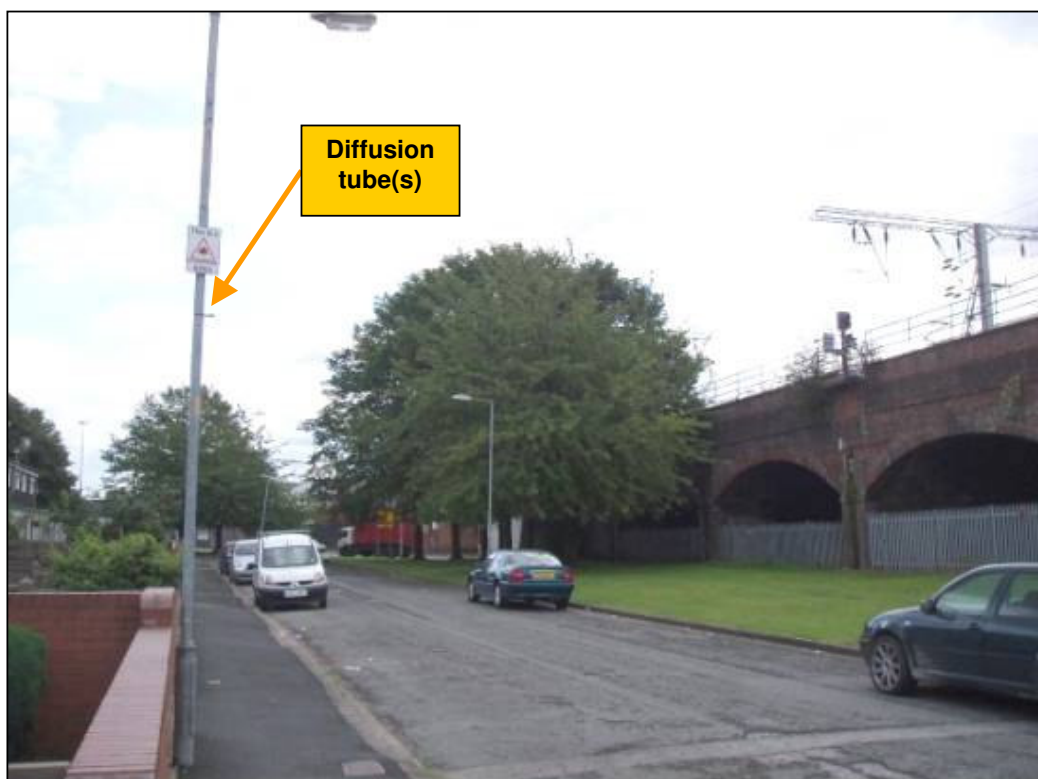
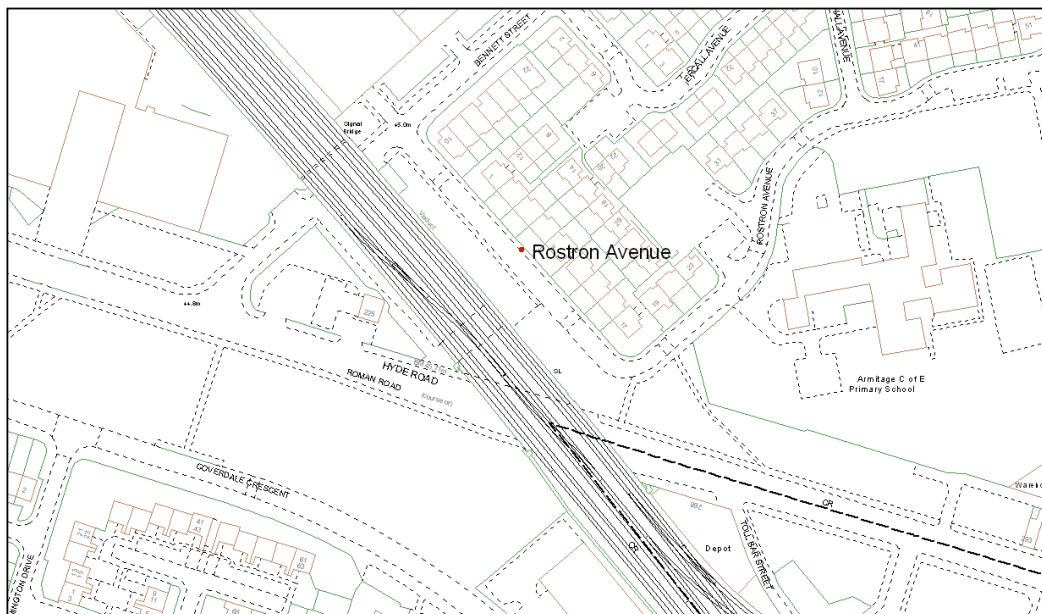
24. Princess Street



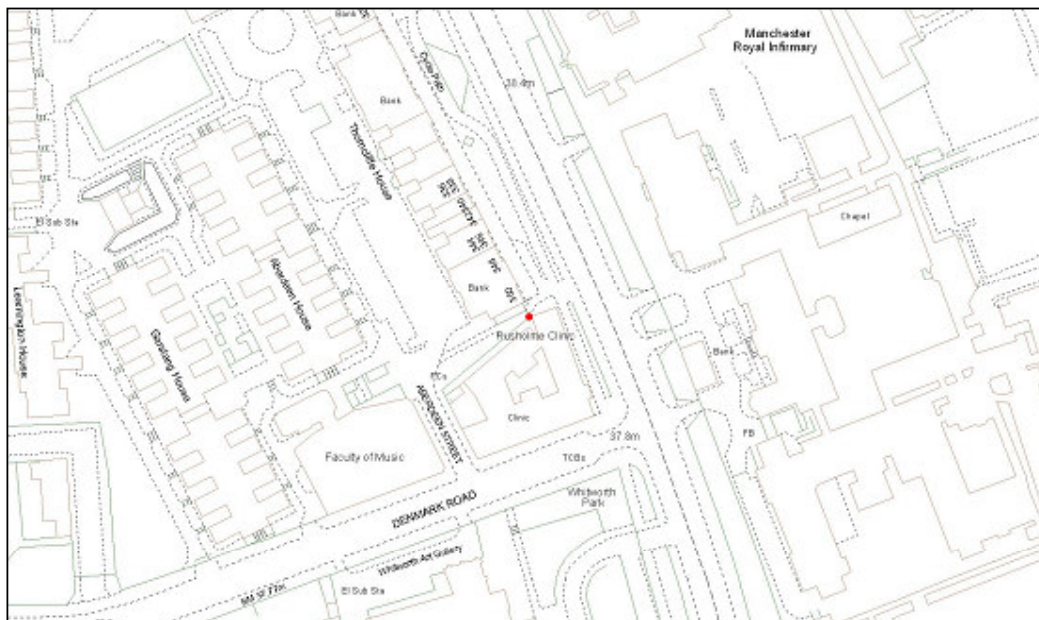
25. Rochdale Road



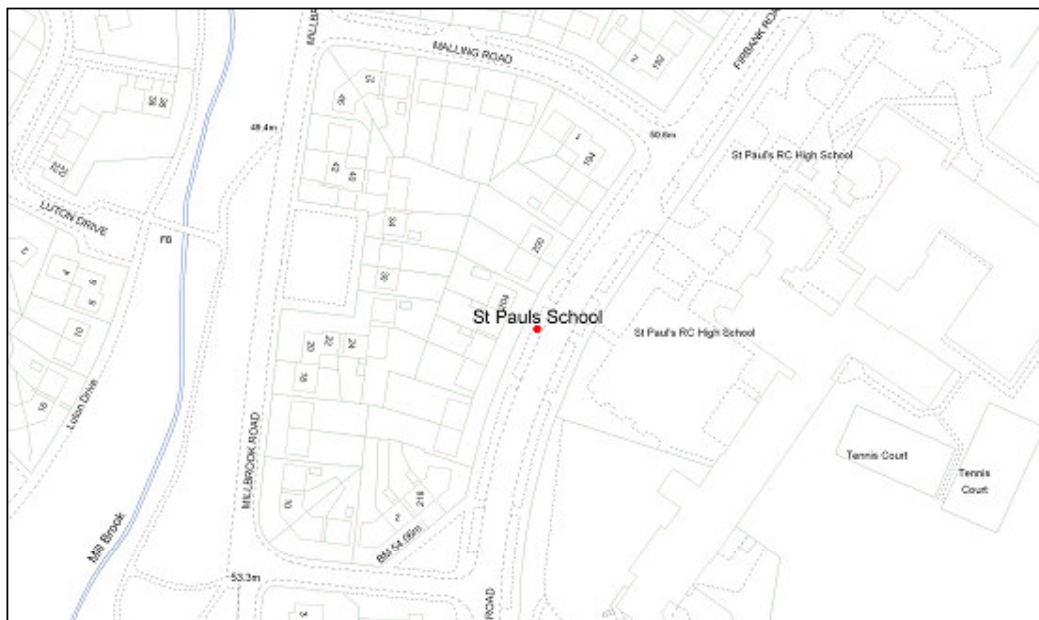
26. Rostron Avenue



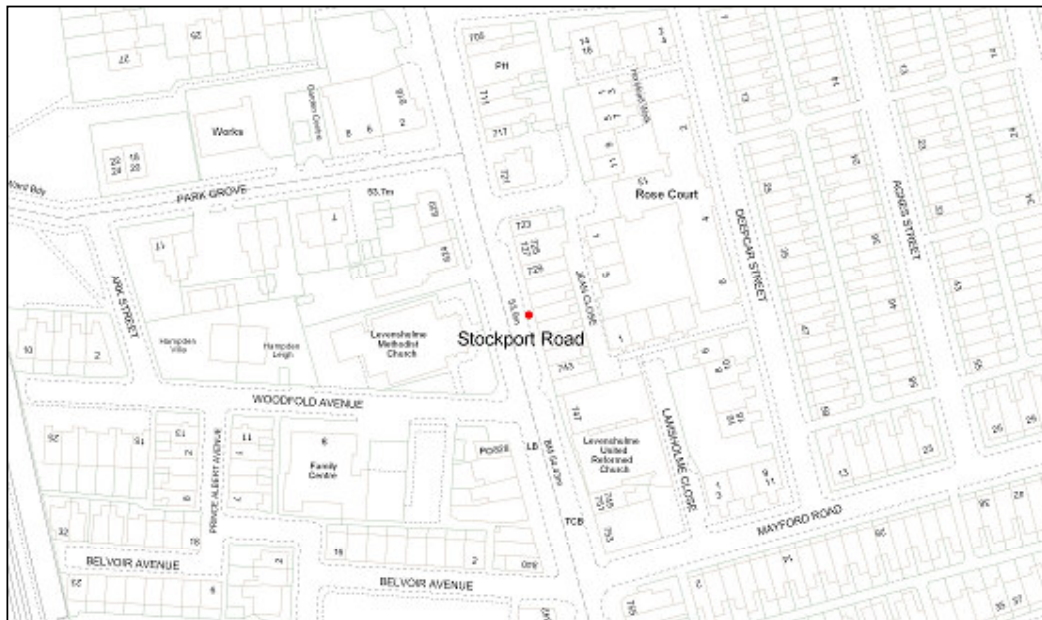
27. Rusholme Clinic



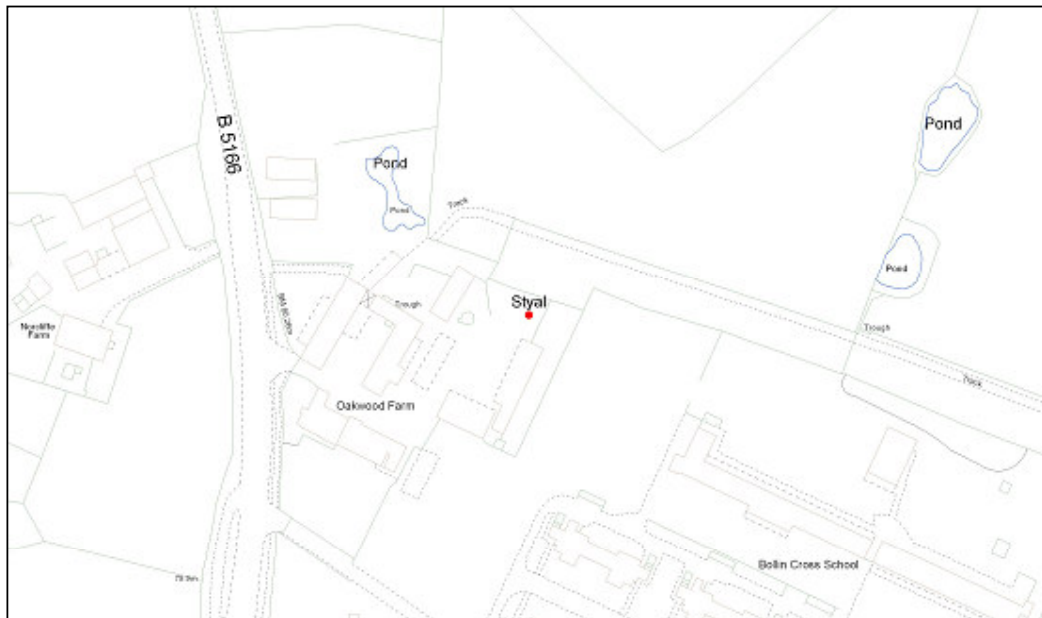
28. St Pauls School



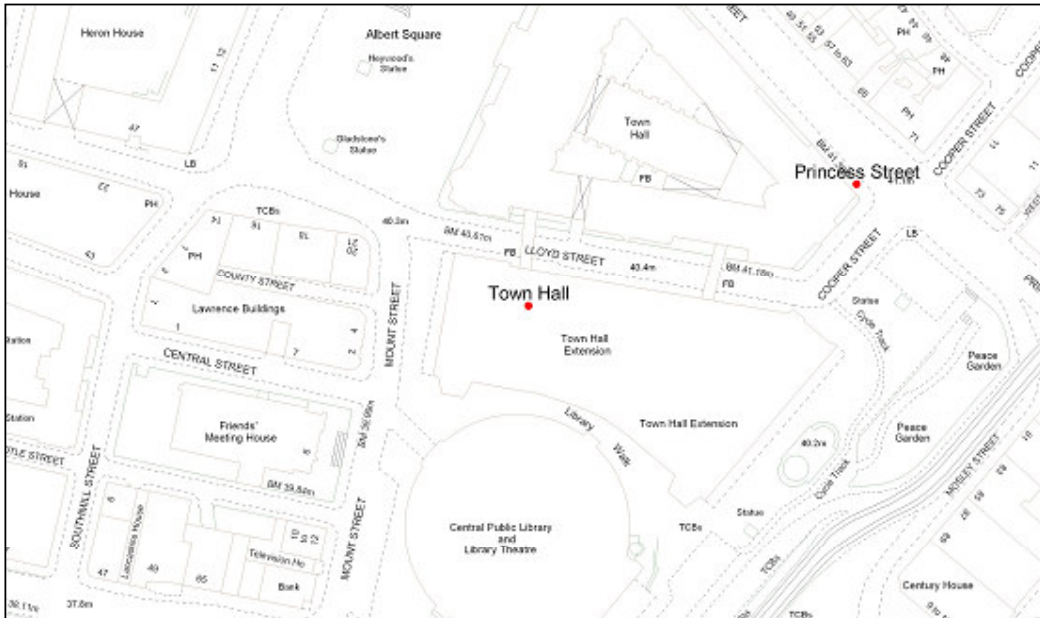
29. Stockport Road



30. Styal



31. Manchester Town Hall



32. Victoria Terrace

