Bath and North East Somerset Council – England
Environmental Monitoring and Licensing

Bath & North East Somerset Council

BATH AIR QUALITY ACTION PLAN

February 2011

Pollution Prevention through Control

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Executive summary

This Action Plan has been developed in recognition of the legal requirement on the local authority to work towards air quality objectives under Part IV of the Environment Act 1995 and relevant regulations made under that part. Present and likely future quality of the air is compared to the National Air Quality Objectives in particular for nitrogen dioxide (NO_2). Where these objectives have been exceeded in areas of public exposure, an Air Quality Management Area (AQMA) must be declared and subsequently an Air Quality Action Plan must also be undertaken.

The publishing of this final version of the Air Quality Action Plan has been delayed, due in part to external factors including the Comprehensive Spending Review. It has been developed at a time when a number of inter-related transport initiatives are at varying stages of development, including the Bath Transport Package; CIVITAS initiative; Pulteney Bridge restrictions; increases in City Centre parking charges; and the Greater Bristol Bus Network.

Bath and North East Somerset Council has adopted a target of 30% reduction in their own Carbon emissions on 2008 levels by 2014 and 45% for all emissions across the district by 2026.

The Joint Local Transport Plan (JLTP) target relating to air quality for 2008 was for annual average concentrations of NO_2 not to exceed 48.1 $\mu g/m^3$. This was the only JLTP target that was not met and was exceeded at a number of locations across the AQMA. The annual average target for 2010 is for it not to exceed 47 $\mu g/m^3$ within the Bath AQMA. The NO_2 target for 2010 is not in line with the national air quality objectives (40 $\mu g/m^3$), as the national trend is that they are not decreasing as quickly as expected nationally and thus it is considered more productive to set realistic targets.

Monitoring of air quality shows that the annual mean national objective for NO_2 is being exceeded at a number of locations along main roads in Bath. This area was consulted on and the major road network area was declared as an Air Quality Management Area for NO_2 in July 2008.

The highest concentration of NO_2 was recorded at a heavily trafficked area with 3 adjacent residential properties at Lambridge (just east of the junction with the old Gloucester Road) with an annual mean of in excess of 80 $\mu g/m^3$ in 2009.

Walcot Terrace (just east of the Cleveland junction on London Road); London Road (Snow Hill); and St James' Parade had at least 60 $\mu g/m^3$ as an annual average concentration in 2009.

Cleveland Place West; Bathwick Street; Broad Street; Somerset Street; The Paragon; Widcombe Parade; Somerset Street (east of Corn Street); Manvers Street; Wells Road (bottom); Kennet House; Morley Terrace; Windsor Bridge; Argyle Terrace and Beckford Road had annual average concentrations in excess of 50 $\mu g/m^3$ in 2009.

Little Stanhope Street; Wells Road (near Upper Oldfield Park); James Street West; Gay Street; Queen Square; Lansdown Road (near Lansdown Crescent and The Belvedere); Lower Bristol Road (near Bath Press); The High Street; Newbridge Road; and Thomas Street all had annual average concentrations of at least 40 µg/m^3 in 2009.

The source apportionment shows road traffic contributes up to 92% of the total NO_x concentration, with Heavy Duty Vehicles (HDV's) contributing between 24 and 57.1%. It is recommended therefore that the Action Plan should focus on measures that reduce emissions from HDV's as the primary source of NO_x emissions within Bath.

This Action Plan supports existing measures in progress in addition to proposing measures. These include a feasibility study into a Low Emission Zone; recharging points for electric cars; improved enforcement of TROs; a promotional website; freight transhipment scheme (CIVITAS initiative); possible Cleveland Bridge HGV restrictions; improve building emission assessments; and the introduction of an ECO Stars vehicle recognition scheme (for HGVs), among others.

There are a number of actions which are not considered for the lifespan of this Action Plan (anticipated as 3 – 5 years), but may constitute future actions or be further investigated at a later date, including: possible electrification of the Great Western Mainline; and the A46/A36 link road.

Air pollution dispersion modelling has been undertaken for the Air Quality Management Area for a number of scenarios including: 2009 base; 2016 future year; and scenarios for base and future year for a Low Emission Zone (with either minimum Euro V and VI engine standards). The air pollution dispersion model testing predicts that a Low Emission Zone covering the AQMA, requiring cleaner HGV engine standards would have the effect of lowering oxides of nitrogen emissions by 17% to 78.43µg/m^3 compared to the 2016 'do nothing' scenario of 94.54µg/m^3 (assuming 50% of HGVs at least EURO V and 50% EURO VI). The model predicts that the measure will reduce NO_2 levels by an average of approximately 14% in the Air Quality Management Area. Further modelling of the actions is being undertaken for a number of measures.

The lifespan of the Action Plan is dependent on future levels of NO_2. An Action Plan Progress Report is published every year until a new Action Plan is written, which will occur if the existing Action Plan is ineffective or if the annual assessments of monitoring data suggest that air quality objectives will not be met outside of the existing air quality management area. It is anticipated that the lifespan of this action plan will be between 3 and 5 years.

2

Introduction

2.1 The air pollution problem

Numerous well conducted studies were undertaken of areas across Europe and the USA in the 1980s and 1990s that linked daily pollution with the number of death and hospital admissions in large cities and these showed a statistically significant association. This included levels of PM10 as well as ozone, NO_2, sulphur dioxide and carbon monoxide. There is no evidence of an absolutely safe level of pollutants from motor vehicles. Particulate matter, carbon monoxide and NO_2 broadly follow similar trends.

The 'CAFE Cost Benefit Analysis report (Hurley et al., 2005)' suggests that a 10 micrograms reduction in $PM_{2.5}$ would result in a 6% all-cause reduction of cardio-respiratory and lung cancer deaths – a 222 day gain in life expectancy for males and 218 for females. Current levels of $PM_{2.5}$ air pollution imply a loss of 8 months life expectancy on average across EU-25. There is strong quantifiable evidence linking increased exposure to PM with increased risks of death, hospital admissions, symptoms and other effects. In monetary terms, the benefits are 5-20 times greater than costs for a 20% reduction in PM2.5. Therefore, there is a strong economic case for even stronger reductions i.e. Europe-wide. The benefits of further reductions are 1-3 times greater than costs. This is bigger than public smoking and motor vehicle accidents in terms of the effects on life expectancy.

2.2 Nitrogen Dioxide and Health

Nitric oxide (NO) is mainly derived from road transport emissions and other combustion processes such as the electricity supply industry. Nitric Oxide is not considered to be harmful to health. However, once released into the atmosphere, NO is usually very rapidly oxidized, mainly by ozone (O_3), to NO_2, which can be harmful to health. NO_2 and NO are both oxides of nitrogen and together are referred to as nitrogen oxides (NO_x).

There is not a clear relationship between per annum average levels of NO_2 and mortality; however NO_2 is easier to measure than - and is a precursor and indicator to - ozone and ambient particulate matter ($PM_{2.5}$ and PM_{10}). NO_2 can be controlled without reducing other gases, so mitigation should not just focus on reducing nitrogen, but rather the source of this and other pollutants.

NO_2 can irritate the lungs, increasing the symptoms of those suffering from lung diseases and lowering resistance to respiratory infections such as influenza. At relatively high concentrations, NO_2 causes inflammation of the airways. There is evidence to show that long-term exposure to NO_2 may affect lung function and enhances the response to allergens in sensitised individuals. Continued or frequent exposure to concentrations that are typically much higher than those normally found in the ambient air may cause increased incidence of acute respiratory illness. Children, the elderly and those already suffering from respiratory illnesses are more vulnerable.

2.3 Policy context

This Action Plan has been developed in recognition of the legal requirement on the local authority to work towards air quality objectives under Part IV of the Environment Act 1995 and relevant regulations made under that part.

The National Air Quality Strategy sets out UK air quality standards and objectives for reducing levels of health-threatening pollutants. These include benzene, 1,3-butadiene, carbon monoxide, lead, NO_2, particles, sulphur dioxide, ground level ozone, and Polycyclic Aromatic Hydrocarbons (PAH). The levels of reduction have been set on the basis of scientific and medical evidence on the health effects of each pollutant, and according to practicability of meeting standards. All of these standards except those for ozone and PAH, are subject to regulations made under the Environment Act 1995, and many are the result of UK incorporation of European law.

Present and likely future quality of the air is compared to the National Air Quality Objectives (see Appendix A), in particular for NO_2. Where these objectives are exceeded and are in areas of public exposure, an Air Quality Management Area (AQMA) must be declared. A 'Further Assessment' should be carried out 12 months following the declaration of the AQMA and an Action Plan must be drawn up 12 to 18 months following the declaration. The process so far is summarised in Appendix B.

This Action Plan may be revised following consultation with the Government. Annual action planning Progress Reports must be submitted by 30th April each year, which also reports on the Review and Assessment of monitoring data.

The lifespan of the Action Plan is dependent on future levels of NO_2. A new Action Plan will be written if the existing Action Plan is ineffective or if the annual assessments of monitoring data suggest that air quality objectives will not be met outside of the existing air quality management area. Given that some time is needed for the effectiveness of the measures identified in this action plan to be assessed, it is estimated that it may need to be updated between 3 and 5 years time.

2.3.1 Corporate Priorities

The Local Development Framework – which replaces the Local Plan – is currently being developed and is being taken into account in the development of this plan.

2.3.2 Core Strategy

The Council published a 'Core Strategy Spatial Options' document and is now in the process of responding to the feedback. This document outlines the Council's preferred approach in addressing issues accommodating necessary change and development. One of the main proposed policy elements will is:

> *'Reduce the adverse effects of transport on climate change and air quality, particularly in the Air Quality Management Areas (AQMA) in*

Bath and Keynsham and in future AQMAs, and ameliorate noise and light pollution'

2.4 Climate Change and Carbon Reduction

Bath and North East Somerset Council has adopted a target of 30% reduction in their own Carbon emissions by on 2008 levels by 2014 and 45% for all emissions across the district by 2026.

The Environmental Audit Commission and DEFRA are encouraging local authorities to consider climate change and air quality together for mutual benefit. There is a relationship between air quality, greenhouse gas emissions and carbon emissions. The Local Air Quality Management process has been in operation for some time and has become technically established, with extensive air quality monitoring and review and assessment reports. With the increasing political will to reduce carbon emissions, there is an opportunity to co-ordinate both climate change and air quality initiatives.

2.5 The City of Bath

Bath is a world heritage site with a population of about 84,000. It is located approximately 10 miles south of the M4 motorway, surrounded by steep hillsides and in the rural setting of the Avon Valley. There are no major industrial air pollution sources left in the City or the surrounding areas and the economy is dominated by the service sector. The City is used as a through route for freight traffic from Bristol and the motorway network to the south coast. The close correlation between air pollution levels and traffic flows on Bath's major road network means that transport is the main source of air pollution in Bath and as such transport improvement measures also relate to air quality improvement.

2.6 Inter-related measures

It must be considered that this Air Quality Action Plan is being undertaken at a time when a number of inter-related transport initiatives are at varying stages of development nationally and locally. This Action Plan supports existing initiatives where evidence suggests that they will lead to an improvement of air quality. These initiatives include:

- The UK Climate Change Act came into force November 2008, setting a legally binding target of an 80% reduction in carbon emissions by 2050 (relative to 1990). Transport is responsible for 21% of all domestic carbon emissions. The Committee for Climate Change (CCC) was created by the same Act to provide advice. Interim budget period set 34% reduction below 1990 levels across the economy by 2020. Differential reductions suggested with 25% - 30% relative to 2007 levels in direct emissions from the transport sector (represents 20% relative to 1990 levels) – by 2020.

Although now under review by the new government, the DfT's 'Delivering a Sustainable Transport System (DaSTS)' programme sets out a process of regional studies to identify areas of funding support. The Low Carbon Transition Plan (LCTP) July 2009 set out the previous government's view on how the 34% target will be met and the Carbon Reduction Strategy for Transport (CRS) published at same time, would achieve 14% reduction relative to 2008 emissions by 2020 (about 5% relative to 1990 levels).

Bristol City Council adopted a related target to reduce transport CO2 emissions in the authority area by 40% from 2005 levels by 2020.

- A consultation on proposals to close Pulteney Bridge to traffic begun at the beginning of August 2010. Should the proposal go ahead, all vehicular traffic will use alternatives routes including North Parade.

- Green Bus funding for 1 'Low Emission' vehicle to be used on the new park and ride contract commencing in 2011.

- The Bath and North East Somerset Sustainable Community Strategy has recently been published. The emissions from Bath and North East Somerset for 2006 were 1,072,000 tonnes. An 80% reduction in the level of carbon produced was agreed at the Kyoto accords of 1997, and as a result there is expected to be considerable growth in developing a low carbon economy. Bath & North East Somerset Council's carbon emissions in the 2007/08 year were 26,000 tonnes. At present there is a requirement to reduce this by 30% by 2014.

- Changes to the Bus Subsidy Operators Grant which encourages the user of lower emission vehicles by making operators pay the full cost of fuel on Council supported bus services and receive the grant on a per passenger payment rate. Transitional arrangements will be in place in 2012 or 2013 with a move to the new system fully in place by 2020.

- Coach restrictions currently apply by way of Traffic Regulation Orders to:
    - The Royal Crescent;
    - The Circus;
    - Milsom Street;
    - The Bus Gate at New Bond Street; and
    - Pulteney Bridge.

- The Bath Transport Package. Following the government's Comprehensive Spending Review, the Council will have to bid for funding from the Local Transport Fund for The Bath Transport Package. The package is in the development pool and the Council are submitting an expression of interest early in 2011, with a final bid submission late in 2011 and the results being announced early in 2012. The Bath Transport Package proposal consists of:

  - Expansion of Park & Ride (P&R) facilities at Odd Down, Lansdown and Newbridge;
  - Creation of the A4 Eastern Bath P&R;
  - A Bus Rapid Transit (BRT) system linking Newbridge P&R to the City Centre and ultimately to the A4 Eastern Bath P&R;
  - 9 Showcase bus routes;
  - Active traffic management with real-time signs for drivers; and
  - Improved City Centre signage and pedestrian enhancements.
  - City Centre Proposals. This involves a number of measures designed to provide better public transport and improve access for pedestrians and cyclists. A consultation exercise was undertaken in 2009 for improved pedestrian crossing areas on the High Street; the expansion of pedestrian areas and improved bus waiting environments on the High Street; and vehicle access restrictions between 10am – 6pm on the following City Centre streets;
    - Upper Borough Walls;
    - Parsonage Lane;
    - Westgate Street;
    - Cheap Street;
    - Bath Street;
    - Hot Bath Street;
    - Beau Street;
    - Stall Street;
    - Lower Borough Walls;
    - Abbeygate Street;
    - Swallow Street;
    - Stall Street;
    - Abbey Green; &
    - York Street.

- The CIVITAS Renaissance initiative is a project funded by the European Union for which Bath and North East Somerset Council have won funding to trial some of the measures:
  - **Freight Transhipment.** Operation has commenced with an electric vehicle which uses the existing Avonmouth freight transhipment depot, as used by retailers in Bristol. CIVITAS funding runs for one year until January 2012, therefore funding is being sought for an extension. Businesses using the service have been recruited on a voluntary basis and it will be free for the first 12 months. At the time of writing 8 retailers were using the service and the target is to increase the number of uses to between 30 and 50 users. UWE are carrying out the monitoring and evaluation report.
  - **Management of freight.** An Automatic Number Plate Recognition system and variable message sign is being installed in March 2011 at the junction of Upper Bristol Road with Windsor Bridge Road. The variable message sign directs traffic approaching the city centre to use the Lower Bristol Road, thus enforcing the Traffic Regulation Order existing on the A4 Upper

Bristol Road corridor. There are 3 City Centre delivery zones (North/South/Central) that have been largely forgotten, so there will be new publicity to reach hauliers.

- First Group are trialling a **low carbon bus** that commenced operation in August 2010. The vehicle has the ability to run on electric power for short sections of route. The engine also switches off at bus stops and starts up again when pulling away. UWE are monitoring the buses for a 1 year trial and will carry out an evaluation by comparing it directly with a 'normal' bus on the same operation.
- **St James' Rampire.** The northern side of the traffic roundabout has been pedestrianised to create a new pedestrian space. Different road surfaces are being trialled (alternatives to Southgate) and a street trading pitch may be introduced.
- **Wayfinding.** This has involved the design of graphic and visual identity for the city, integrating all transport modes. This included a royalty free mapping system for use in a variety of media and the location and information planning for products. In addition wayfinding, public transport shelter and flag products have been established together with transport information web pages. Procurement of a subcontractor to build and install the wayfinding products has commenced and it is expected that the new signs and street furniture will be installed at the end of the year.
- **City Car Club.** 6 new parking bays and signage introduced in April 2010, with 6 new Toyota hybrid vehicles now in use. Each city car can remove the need for between five and eight privately owned vehicles. This helps reduce congestion and pressure on parking places in urban areas. It enables people to drive a new car without any of the cost of owning it yourself and members only pay for the actual journeys they make.
- **Cycle Hire (powered and non-powered).** 4 sites have been identified for the non-powered bicycle hire stations, which will be installed by the end of the year. There will be 5 stations for the powered bicycles at Bath Spa and Oldfield Park Stations, Twerton High Street, RUH, and Newbridge Park and Ride. Bicincitta are an Italian company that will be installing the system and have experience of running a bicycle hire scheme in Rome and other Italian cities. It is possible that an Electric Vehicle charging points could be provided alongside the bicycle stands – in partnership with Powerbyke.

- The Council has introduced a planning list known as 'The Local List' which outlines requirements for the validation of planning applications. This list identifies circumstances where an Air Quality Assessment is required to be submitted as part of a planning application. Where the assessment identifies a likely negative impact on air quality, the applicant must then identify adequate mitigation measures.

- Car Parking charges in Bath have increased from £5 for 4 hours in 2009 to £5.40 for up to 4 hours in 2010. This is used as a means to discourage car journeys, in particular shorter journeys.

- The Greater Bristol Bus Network major scheme is currently being implemented. This involves upgrading ten bus corridors and over 70 bus routes across the West of England, including the A4 and A367 into Bath. The routes are being upgraded to "Showcase" standards with new infrastructure, bus priority measures and, in some cases, new vehicles. Examples of recent improvements in Bath and North East Somerset include the recent enhancements to the Hicks Gate roundabout on the A4 near Keynsham; A367 Odd Down Bus Lane and the Wellsway/Bloomfield Road junction improvements.

- The emerging Joint Local Transport Plan 2011 – 2026[(1)] (covering the former Avon Authorities) includes improving air quality in the Bath AQMA as an objective. The target for 2016 is for annual average concentrations of NO_2 not to exceed 40µg/m^3 within the Bath AQMA. Further detail can found in section 9. In response to the 2008 Annual Progress Report, the Government Office for the South West commented that '*Overall we consider that your LTP2 strategies are being delivered and that you have made considerable progress in the first two years of LTP2 both in delivery and keeping the majority of your targets on track.'* However, the 'Joint Local Transport Plan Progress Report 2009' states that *'air quality – GOSW's main concern – has not improved in 2008/09 as we had hoped and we still have much to do to meet our targets.'*

3 Air Quality Management Area

Following Stage 3 (Round 1) Review and Assessment (see Appendix B), Bath & North East Somerset Council declared an Air Quality Management Area (AQMA) for NO_2 along the A4 London Road in February 2002. From the results of the further assessment (Stage 4) the AQMA was widened in August 2005 from 7 m to 70 m from the centre of the road along the London Road from London Street to Hanover Place and 20 m from the centre of the road from Hanover Place to the Batheaston Roundabout. The area is also extended to include Bathwick Street.

Round 2 assessments identified a number of locations along main roads in Bath with the potential to exceed the annual mean objective for NO_2. This area was consulted on and the major road network area was declared as an AQMA for NO_2 in July 2008. Using the 2001 census, it was established that the average number of people per household in wards in the AQMA is 2.26. 'MapInfo' was used to calculate the number of households in the AQMA (approximately 3,800) and thus it was calculated that the AQMA resident population to be approximately 8,500.

In Round 3 the PM10 24 hour mean objective was highlighted for further work in the London Road/Bathwick Street area following changes to the national background maps. The detailed assessment for PM10 confirmed that no AQMA is required for PM10.

As part of Round 4, a Progress Report has been published (May 2010). The report identified exceedances that were in the existing AQMA and thus no detailed assessment was required.

Figure 3.1 below shows the current Air Quality Management Area. Following the recent completion of the Progress Report[4] of the Air Quality Management Area, a consultation will soon be undertaken for the extension of the Air Quality Management Area as illustrated in Figure 3.2.

Figure 3.1: The current Bath Air Quality Management Area

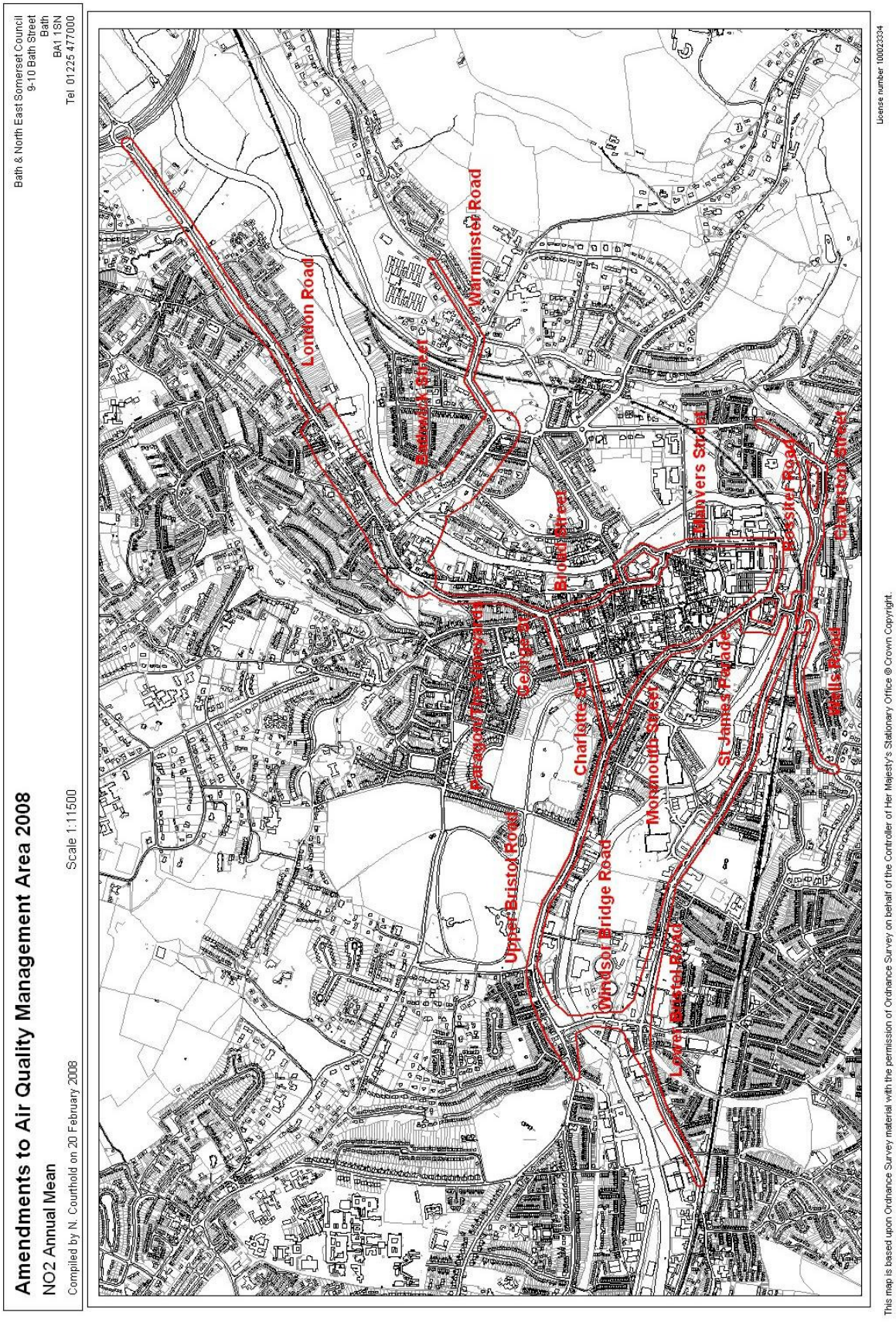
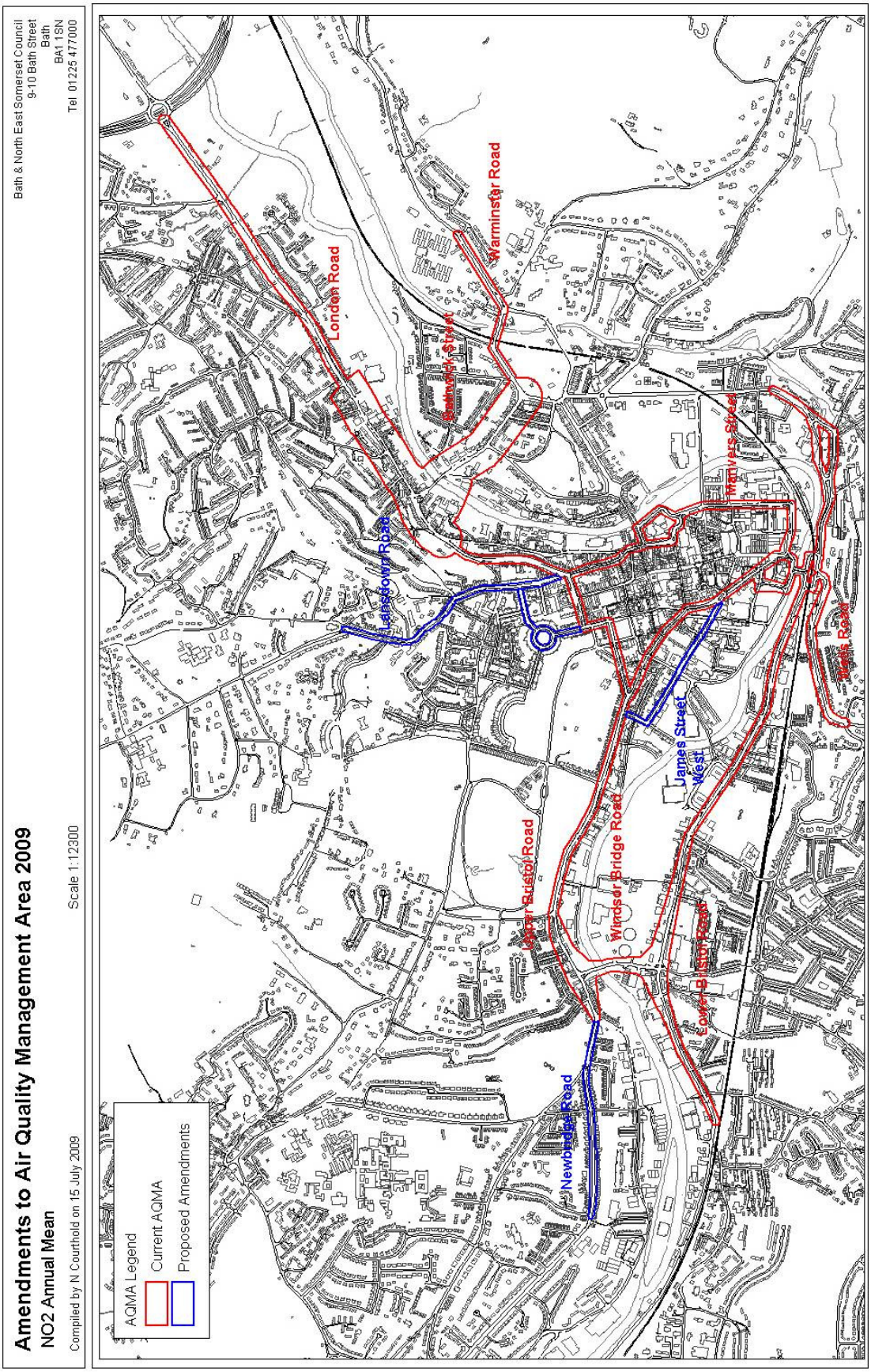


Figure 3.2: The proposed extension to Bath Air Quality Management Area.



4

Monitoring

Air pollution monitoring has taken place in Bath and North East Somerset since the early 1960's with programmes to measure smoke and sulphur dioxide (SO_2). This has been expanded over the years and in 2009 included 90 sites monitoring NO_2, particulate matter (PM10), carbon monoxide (CO) and benzene. Monitoring of NO_x was carried out using chemi-luminesence analysers at three continuous sites: London Road, Guildhall and Windsor Bridge. The London Road site is part of the national network and the other sites have followed a QA/QC method since April 2000.

4.1 Non-automatic monitoring

There are two ways that NO_2 is monitored in Bath. The non-automatic monitoring is done with diffusion tubes. These are pen-size tubes that contain an absorbent gel. They are placed on lamp-posts and road-signs at between 2 and 3 metres above road height on the kerbside. Some are collected fortnightly and some are collected monthly and the gel is tested for NO_2 concentration, giving an average reading for the period.

Diffusion tube monitoring has been carried out at over 40 sites in Bath during 2009 (see Appendix C). The diffusion tube monitoring is corrected for bias where available. The data from the tubes collected every 2-weeks is corrected using a bias calculated from the Walcot Terrace site (now located at Walcot Buildings) which is co-located with the London Road continuous monitor. The data from the tubes collected monthly is corrected using a factor from the database on the government review and assessment helpdesk website.

4.2 Automatic monitoring

The other monitoring is undertaken using automatic or continuous monitoring stations. In Bath, the automatic NO_2 monitors are pc-sized boxes of hardware with an air intake, contained in roadside enclosures or buildings by the roadside. They send the pollution concentration readings for each 15 minute period by internet to a computer in the Council office, where the data is collated and analysed. There are 4 continuous or automatic monitors in Bath. The characteristics of the all the automatic monitoring sites are detailed below in table 4.1:

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?
London Road	Roadside	375461	165843	NO_2 Benzene	Chemiluminescent Pumped BTX tubes	Y	Y (0m)	3m	N
Guildhall	Roadside	375111	164857	NO_2 CO	Chemiluminescent Infra-Red	Y	Y(1m)	2m	N
Windsor Bridge	Kerbside	373540	164868	NO_2 , PM_{10} CO	Chemiluminescent BAM1020 Infra-Red	Y	Y(5m)	2m	Y
Chelsea House	Roadside	375422	165848	NO_2 , PM_{10}	Chemiluminescent BAM1020	Y	Y (0m)	9m	N

Table 4.1: characteristics of automatic monitoring sites.

4.3 Trends in concentrations of Nitrogen Dioxide in Bath

A number of reports have been produced as part of the Local Air Quality Management Process that provides a detailed review of the monitoring data. Excerpts from the latest report '2010 Air Quality Progress Report for Bath and North Somerset Council (May 2010)' A full list of reports produced as part of the Local Air Quality Management process is contained in Appendix B.

The figures below summarise the annual average NO_2 concentrations, in micrograms per cubic metre (µg/m^3). Figure 4.1 and 4.2 include data from the Council's diffusion tube network locations across the whole of the Air Quality Management Area.

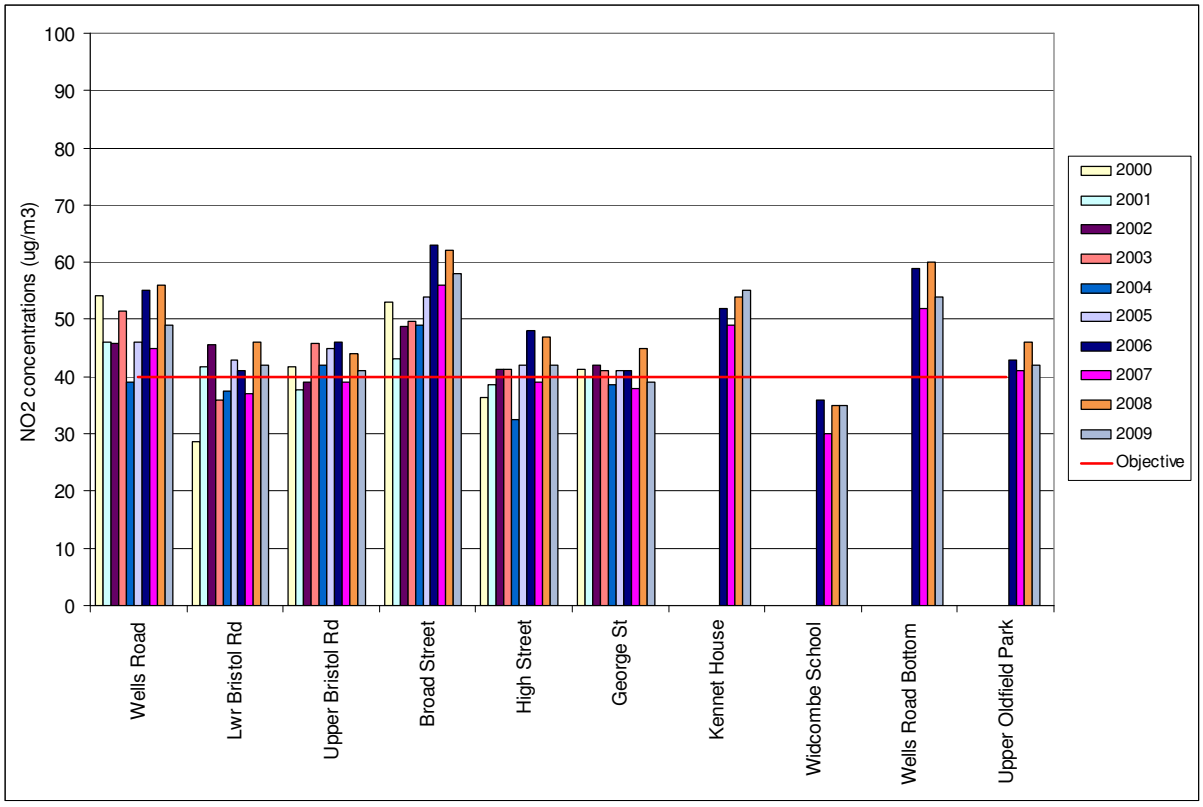


Figure 4.1: AQMA monitoring data, annual averages (monthly sites).

Figure 4.1 shows that following a drop in concentrations of NO_2 in 2007, 2008 saw an increase to greater than 2006 levels across most of the sites, followed by a drop below 2006 levels in 2009. 8 of the 10 sites exceeded the national objective of 40 µg/m^3 for NO_2 in 2009.

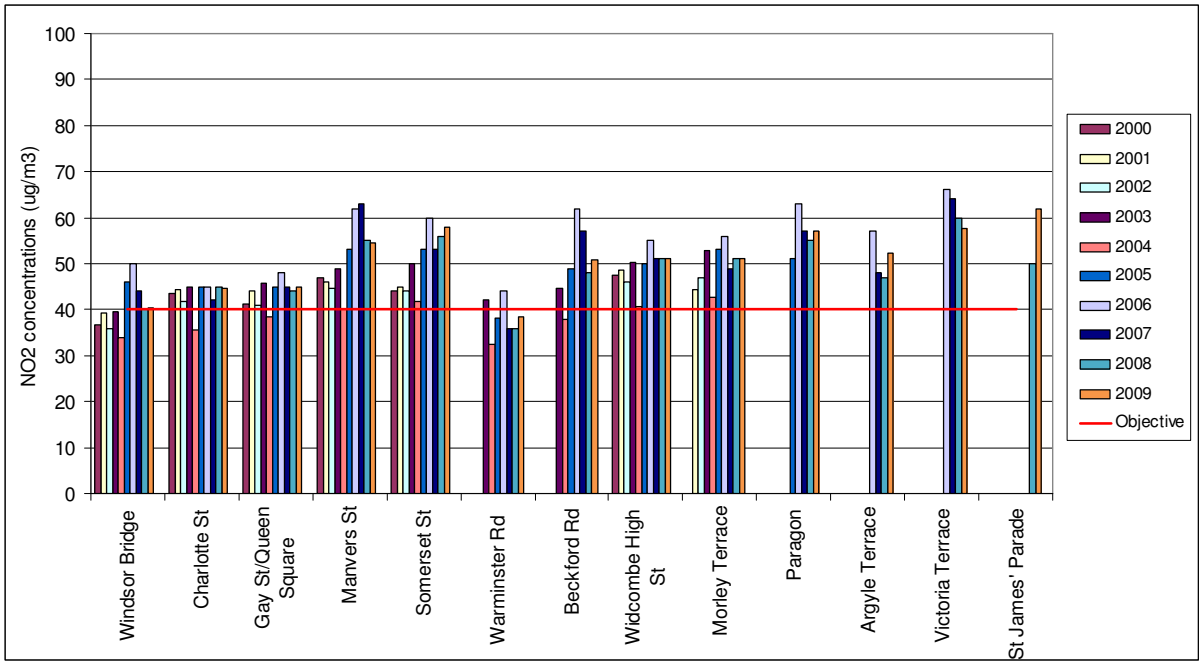


Figure 4.2 AQMA monitoring data, annual averages (fortnightly sites).

Figure 4.2 summarises the annual mean concentrations of NO_2 since 2000 across the AQMA from the diffusion tube network collected every two weeks. These sites show a trend of a slight increase in 2009, with some areas lower than 2008. 11 of the 13 sites exceed the national objective of 40 µg/m^3.

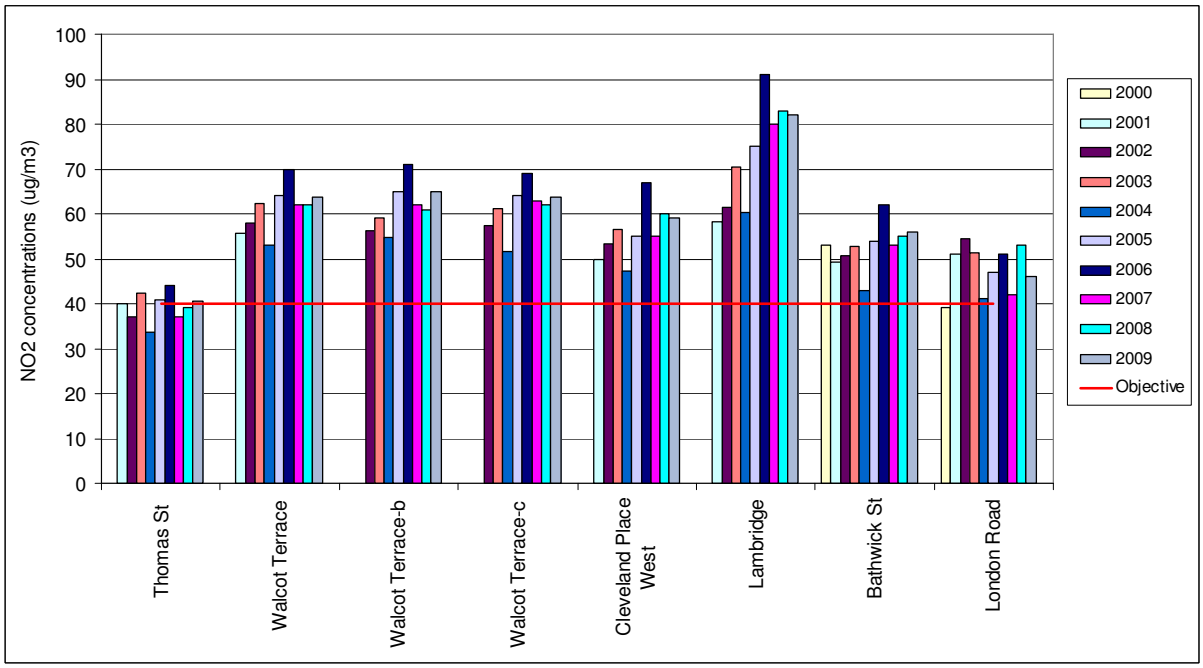


Figure 4.3: London Road AQMA (original AQMA), annual averages.

Figure 4.3 summarises the annual mean concentrations of NO_2 since 2000 across the original AQMA that was declared in 2002 and extended to its

current boundary in July 2008. After peaking in 2006, the 2008 levels of NO_2 are comparable with 2007 and earlier years. There was a marginal increase across 5 of the 8 sites in 2009. All sites exceed the objectives and generally by a larger proportion than the sites in the wider existing AQMA.

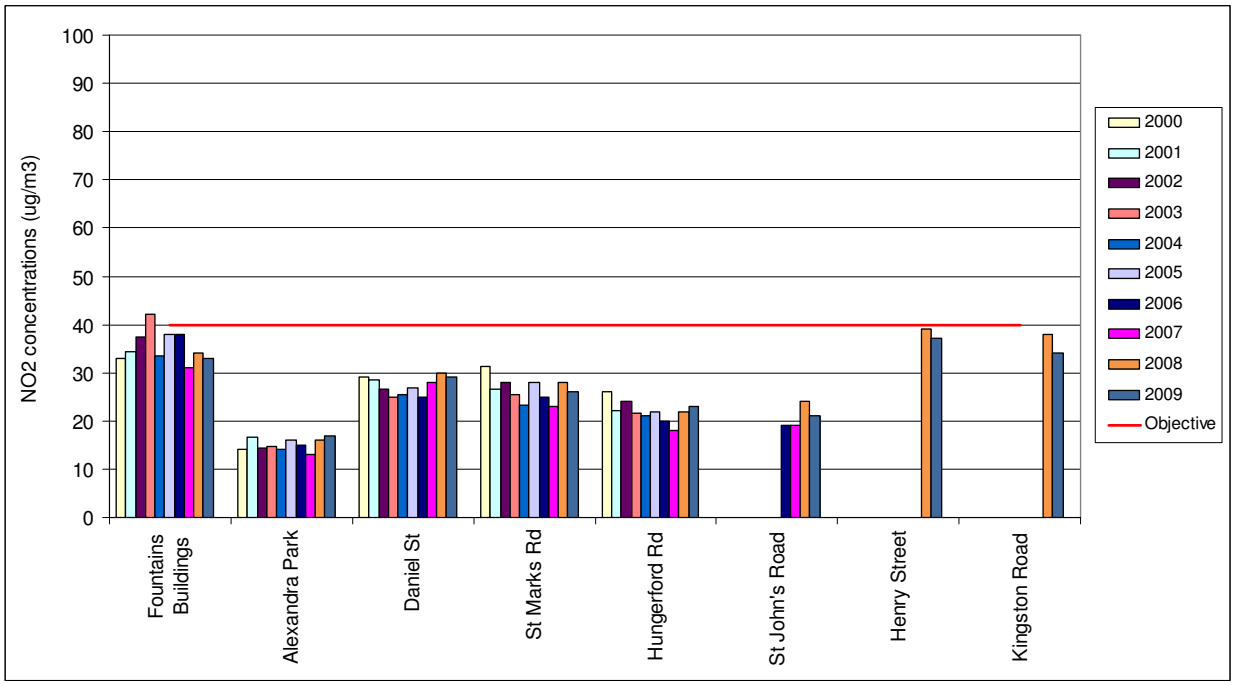


Figure 4.4: Urban centre and background sites, annual averages.

Figure 4.4 summarises the annual mean concentrations of NO_2 since 1998 at 9 urban centre and background sites outside of the AQMA, but within the City boundary. Following an across the board increase from 2007 to 2008, all but 2 of the sites have shown a decrease in 2009. None of the sites exceed the national objective for annual mean concentrations of NO_2. This highlights that the levels of NO_2 drop-off significantly away from the main roads and thus supports traffic as the main source of NO_x emissions.

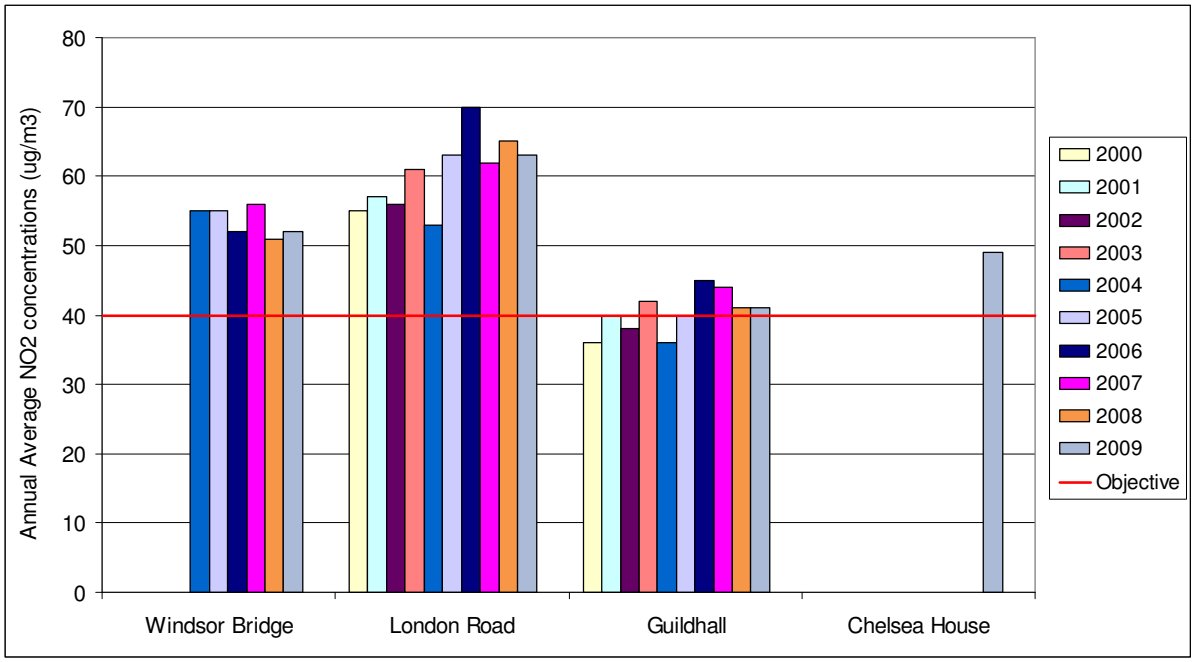


Figure 4.5: Continuous monitoring sites, annual averages.

Figure 4.5 summarises the annual mean concentrations of NO_2 since 2000 at the 4 automatic monitoring sites which also record hourly average pollution levels. Concentrations at the 3 sites in operation during the last 3 years exceeded the national objective for that period. The highest concentrations were at London Road, despite a slight decrease – remaining at an annual average of 63 µg/m^3 for 2009. The Windsor Bridge monitoring station had annual average concentrations in excess of 50 µg/m^3 in 2009 – increasing from 51 in 2008. The Guildhall monitoring station located at the High Street remained at 41 µg/m^3 in 2009 – the same as 2008. The new monitoring station at Chelsea House (London Road) showed an annual average concentration of 49 µg/m^3 in 2009.

4.4 Areas exceeding the national objective for nitrogen dioxide

The highest concentration of NO_2 was recorded at Lambridge (just east of the junction with the old Gloucester Road) with an annual mean of in excess of 80 µg/m^3 in 2009.

Table 4.2 shows the Bath AQMA pollution hotspots in descending order, based on 2009 diffusion tube or automatic monitoring data:

Location	Diffusion Tube (DT) OR Automatic Monitor (AM)	2009 annual mean concentrations ($\mu g/m^3$)
Lambridge	DT	82
Walcot Terrace (3 tubes)	DT	64
London Road	AM	63
St James' Parade	DT	62
Cleveland Place West	DT	59
Broad Street	DT	58
Somerset Street	DT	58
Victoria Buildings	DT	58
Paragon	DT	57
Bathwick Street	DT	56
Kennet House	DT	55
Manvers Street	DT	55
Wells Road – Bottom	DT	54
Argyle Terrace	DT	52
Windsor Bridge	AM	52
Beckford Road	DT	51
Morley Terrace	DT	51
Widcombe High Street/Parade	DT	51
Chelsea House (London Rd)	AM	49
Little Stanhope Street	DT	49
Wells Road	DT	49
James Street West	DT	48
London Road	DT	46
Charlotte Street	DT	45
Gay Street/Queen Sq	DT	45
Lansdown Crescent	DT	45
Belvedere	DT	42
Gay Street – Top	DT	42
High Street/ Guildhall	DT	42
Lower Bristol Road	DT	42
Wells Road/Upper Oldfield Park	DT	42
Guildhall	AM	41
Newbridge Road	DT	41
Thomas Street	DT	41
Upper Bristol Road	DT	41
Windsor Bridge	DT	40

Table 4.2: Bath AQMA areas exceeding the national objectives for annual mean NO_2 concentration.

Broad Street; Walcot Terrace (just east of the Cleveland junction on London Road); London Road and St James's Parade had in excessive of 60 $\mu g/m^3$ as an annual average concentration in 2009.

Cleveland Place West; Broad Street; Somerset Street (east of Corn Street); Victoria Buildings; the Paragon; Bathwick Street; Kennet House; Manvers Street; Wells Road (bottom); Argyle Terrace (Lower Bristol Road); Windsor

Bridge; Beckford Road; Morley Terrace and Widcombe High Street; had annual average concentrations in excess of 50 µg/m^3 in 2009.

5
Oxides of Nitrogen Source Apportionment

Source apportionment has been carried out through the use of air quality dispersion modelling software 'ADMS-Urban' to model receptors representing some of the worst case monitored locations. The model was run using HDV (to include buses and HGVs) only inputs and LDV (to include cars, motorcycles and LGVs) only inputs. The percentage split between the results was then applied to the adjusted road NO_x contribution and combined with the background concentrations (split between Rural [level of NO_x with no sources] and Local [contribution from other sources such as domestic or commercial]). The results are shown in Figure 5.1, Table 5.1 and 5.2 below.

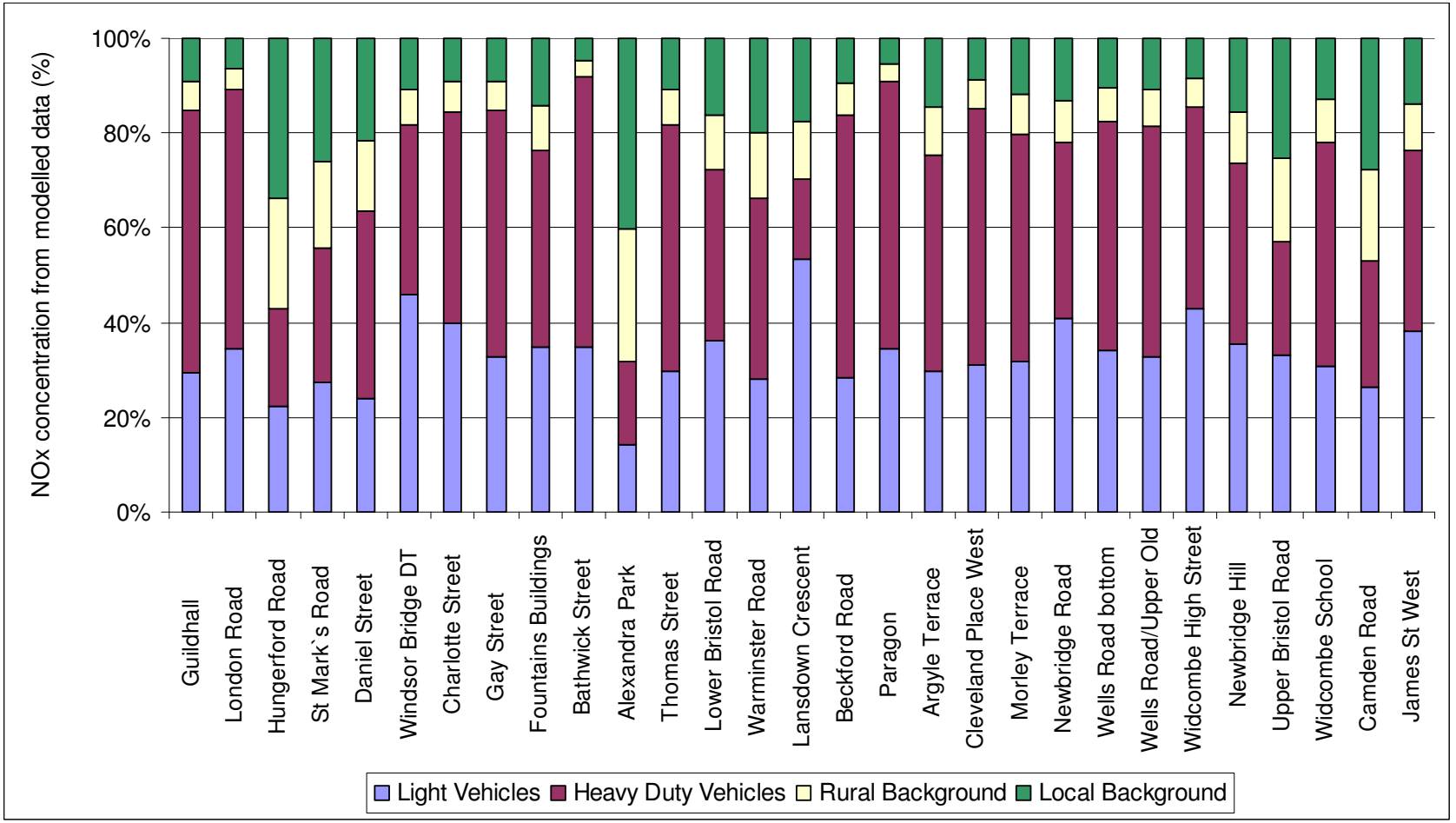


Figure 5.1: source apportionment percentages of emitted NO_x derived from modelling.

The results show that the average % NO_x contributed by HDVs at the roadside receptors is 44.3%, although they are only between 2 and 7% of the total vehicle flows. The highest roadside contribution for NO_x contributed by HDVs is 57.1% at Bathwick Street and the lowest is Lansdown Crescent with 16.9%. The next lowest is 24% on Upper Bristol Road, where a Traffic Regulation Order restricts HGV use. The source apportionment suggests that the Action Plan should focus on Heavy Goods Vehicles to achieve the greatest reduction in NO_x emissions.

Location	% NO_x from HDVs	% NO_x from LDVs	% NO_x from Rural Background	% NO_x from Local Background
Guildhall	55.4	29.3	6.2	9.1
London Road	54.7	34.4	4.5	6.5
Windsor Bridge DT	35.8	46	7.4	10.7
Charlotte Street	44.6	39.8	6.4	9.2
Gay Street	52	32.7	6.2	9.0
Bathwick Street	57.1	34.8	3.3	4.8
Lower Bristol Road	36.3	36.1	11.3	16.3
Warminster Road	38.2	28	13.8	20.0
Beckford Road	55.5	28.4	6.6	9.5
Paragon	56.5	34.3	3.7	5.4
Cleveland Place West	54	31.2	6.0	8.8
Morley Terrace	48	31.9	8.2	11.9
Newbridge Road	37.1	40.9	9.0	13.1
Wells Road bottom	48.3	34.1	7.2	10.4
Wells Road/Upper Old	48.6	32.9	7.5	10.9
Widcombe High Street	42.5	43	5.9	8.5
Newbridge Hill	38.3	35.4	10.7	15.6
Upper Bristol Road	24	33.1	17.5	25.4
Widcombe School	47.5	30.7	8.9	12.9
James St West	38.3	38.2	9.6	13.9

Table 5.1 Contribution of sources to modelled NO_x concentration at main roadside receptors.

Location	% NO_x from HDVs	% NO_x from LDVs	% traffic flows as HDVs	% traffic flow as LDVs	% Buses and coaches	% cars and taxis	% light goods vehicles	% rigid HGVs	% articulated HGVs
Guildhall	55.4	29.3	7.15	92.85	5.06	79.41	12.39	2.08	0.02
London Road	54.7	34.4	6.39	93.61	1.64	79.36	14.25	3.13	1.62
Windsor Bridge DT	35.8	46	3.2	96.8	2.18	81.79	15.01	1.02	0
Charlotte Street	44.6	39.8	3.62	96.38	2.47	81.43	14.95	1.02	0
Gay Street	52	32.7	3.62	96.38	2.47	81.43	14.95	1.02	0
Bathwick Street	57.1	34.8	6.19	93.81	0.68	79.76	12.33	3.57	1.94
Lower Bristol Road	36.3	36.1	4.68	95.32	0.76	80.07	15.25	3.55	1.05
Warminster Road	38.2	28	4.29	95.7	2.05	84.74	9.75	0.33	0.16
Beckford Road	55.5	28.4	4.29	95.7	2.05	84.74	9.75	0.33	0.16
Paragon	56.5	34.3	2.02	97.98	0.34	97.50	0.48	1.68	0.00
Cleveland Place West	54	31.2	4.01	95.99	3.02	86.14	9.85	0.93	0.05
Morley Terrace	48	31.9	5.3	94.7	0.75	79.55	15.15	3.51	1.04

Newbridge Road	37.1	40.9	2.83	97.17	1.93	82.1	15.07	0.9	0
Wells Road bottom	48.3	34.1	5.75	94.25	1.62	81.84	12.86	3.24	0.43
Wells Road/Upper Old	48.6	32.9	5.75	94.25	1.62	81.84	12.86	3.24	0.43
Widcombe High Street	42.5	43	4.48	95.52	0.86	82.84	11.48	2.65	0.97
Newbridge Hill	38.3	35.4	2.00	98	0.60	84.58	12.92	1.30	0.10
Upper Bristol Road	24	33.1	4.68	95.42	2.37	79.74	14.52	2.20	0.01
Widcombe School	47.5	30.7	6.18	93.82	1.34	80.89	11.58	3.89	0.95
James St West	38.3	38.2	3.79	96.21	2.78	85.93	9.43	0.96	0.05

Table 5.2: Modelled road traffic NO_x emissions and proportional vehicle types (source DfT) at locations of highest concentrations.

The required reduction in NO_x varies across the area as some locations are exceeding the objective more than others. This is further explored in table 8.1, section 8. The required reduction of road NO_x to meet the national objectives is up to 73.3 % of the annual mean NO_x concentration.

The source apportionment shows road traffic contributes up to 92% of the total NO_x concentration, with HDV's contributing between 24 and 57.1%. It is recommended therefore that the Action Plan should focus on measures that reduce emissions from HDV's as the primary source of NO_x emissions within Bath.

6
Consultation

The full consultation report that details the response to the Consultation Draft Air Quality Action Plan for Bath is provided as annex 1.

6.1 The Consultation Draft Air Quality Action Plan for Bath

The Consultation Draft Air Quality Action Plan for Bath was circulated to relevant stakeholder groups including residents associations, councillors, neighbouring authorities, the Environment Agency and the Government Office for the South West.

6.2 The leaflet and questionnaire

The consultation leaflet including a questionnaire and summarising this Action Plan, was delivered to every address in the existing and proposed Air Quality Management Area and was made available online and on display at the library and Council Offices. This is available in Annex 1.

The population within the extended AQMA based on 2.26 people per household as an average in the wards in the AQMA (according to census 2001), and approximately 3,800 households (from GIS data), is approximately 8,500. 1 leaflet and questionnaire was distributed to each household in the AQMA.

There were 128 questionnaire responses, from an estimated 3,800 posted. This equates to a return of approximately 4%. The responses are assessed by each action.

Additionally, there were a number of letter responses that were responded to and will receive notification of the publishing of this document.

6.3 DEFRA feedback

The Department for Environment, Food and Rural Affairs provided feedback is contained in Appendix D.

The comments have informed this final draft of the Air Quality Action Plan.

6.4 The Action Plan Steering Group

The Action Plan Steering Group consists of council officer representatives from related teams of the Council, including:

- Transportation Planning;
- Transport Major Projects (CIVITAS renaissance project);
- Planning and Policy;
- Sustainability; and
- Environmental Monitoring.

The steering group met six times during the drafting of the action plan. The main purpose of the group was to co-ordinate related work including the Bath Transport Package; the CIVITAS Renaissance project; the Carbon Reduction Scheme; Corporate Travel Plan; Sustainable Community Strategy; the Joint Local Transport Plan; and the Local Development Framework documents.

7
ACTIONS

Action 1: Bath Transport Package

The Bath Transport Package is a £50 million scheme which includes a range of measures designed to tackle congestion and improve pedestrian access in Bath. Following the governments' Comprehensive Spending Review, the Department for Transport has listed the package in the development pool and will conduct some further analysis on the scheme and the Council will have to bid for funding from the Local Transport Fund pot of £630million to enable the scheme to go ahead. The final bid submission is due in September 2011 with the results announced in early 2012.

The overall costs of the package have been reduced to £50 million by the exclusion of the previously proposed A36 bus lanes, A4 Lambridge bus lanes; a reduction in the variable message sign proposals; and a reduction in the number of planned bus stop upgrades. Funding is also to be sourced from section 106 agreements from land identified for development in Bath, such as Western Riverside.

The Bath Transport Package consists of:

- City Centre Proposals. This involves a number of measures designed to provide better public transport and improve access for pedestrians and cyclists. A consultation exercise was undertaken in 2009 for improved pedestrian crossing areas on the High Street; the expansion of pedestrian areas and improved bus waiting environments on the High Street; and vehicle access restrictions between 10am – 6pm on the following City Centre streets;
  - Upper Borough Walls;
  - Parsonage Lane;
  - Westgate Street;
  - Cheap Street;
  - Bath Street;
  - Hot Bath Street;
  - Beau Street;
  - Stall Street;
  - Lower Borough Walls;
  - Abbeygate Street;
  - Swallow Street;
  - Stall Street;
  - Abbey Green; &
  - York Street.

- Expansion of Park & Ride (P&R) facilities at Odd Down, Lansdown and Newbridge;

- Creation of the A4 Eastern Bath P&R;
- Bus Rapid Transit (BRT) system linking Newbridge P&R to the City Centre and ultimately to the A4 Eastern Bath P&R;
- 9 Showcase bus routes;
- Real Time Information system at bus stops;
- Bus Priority Measures;
- Quality Partnership Scheme; under the Local Transport Act 2008. This scheme allows authorities to specify operator requirements as to bus specifications (new buses), driver training, frequencies, timings or maximum fares in return for allowing use of improved facilities at specific locations along bus routes (e.g. bus stops or bus lanes). Schemes can be route or corridor specific and could cover larger networks or routes. The scheme will be applied on a number of routes including the Bus Rapid Transit;
- Active traffic management with real-time parking availability and congestion warning signs for drivers;
- and Improved City Centre signage and pedestrian enhancements

The planning applications relating to the Bath Transport Package have been approved. However, the Eastern Bath Park and Ride and Newbridge Park and Ride expansion (which include the Bath Rapid Transit route) are subject to the judgment of the Secretary of State.

Section 10 provides a summary assessment of this and all the other actions.

Timescale

The timescale for the implementation of the Bath Transport Package is tied in with the announcements on Local Transport Fund bid results announcements due in June 2012. Assuming successful award of funds, it is estimated that full operation of the scheme may commence in 2014 or 2015.

Monitor and Evaluation

The usage of park and ride sites is already monitored in terms of bus ticket sales and spot car park surveys. Additionally a combination of traffic data and air quality monitoring data will allow a thorough evaluation of the effects of the measures.

Action 2: Cleveland Bridge Area Restrictions Feasibility Study

Undertake feasibility work for the introduction of a Low Emission Zone or other restrictions in the vicinity of Cleveland Bridge and model the options for a reduction in heavy goods vehicles and engine standard stipulations. Modelling work has begun on assessing the potential air pollution reduction from a Low Emission Zone.

The feasibility work will ascertain the potential benefits to air quality and the likely costs for both businesses and for the Council administration.

Cleveland Bridge is part of the Primary Route Network which forms the main network of highways in the country for longer distance journeys. As such there are certain stipulations that roads on the primary network must meet. Weight restrictions associated with heavy goods vehicles provide an opportunity for improving air quality within the Air Quality Management Area. A Low Emission Zone (LEZ) provides an alternative or additional opportunity for imposing stipulations that will also improve air quality. An LEZ is a declared area where operators of vehicles not meeting agreed emission standards can be required to pay a daily charge to enter. The aim is that fleet operators either replace or improve some of the heaviest polluting vehicles operating within the LEZ or use the freight transhipment service that currently operates as a trial from Avonmouth to the centre of Bath.

Over 70 cities and towns in eight countries around Europe have or are preparing LEZs as a means of controlling vehicle emissions in city centres and urban areas. London was the first UK LEZ. A number of other UK authorities are at varying stages of implementation including: Norwich, Oxford and Glasgow who have undertaken to declare LEZs at a number of locations within the city for the 2014 Commonwealth Games.

An LEZ for Bath would target some or all vehicles types classed as Heavy Duty Vehicles (HDVs – heavy goods vehicles and buses). HGVs and buses with a registration year of between 2001 and 2005 are engine standard Euro III; 2006 and 2007 are Euro IV; and Euro V in 2008, 2009 and 2010.

The air pollution dispersion model testing predicts that a Low Emission Zone covering the AQMA, requiring cleaner HGV engine standards could have the effect of lowering oxides of nitrogen emissions by 17% to 78.43μg/m^3 compared to the 2016 'do nothing' scenario of 94.54μg/m^3 (assuming 50% of HGVs at least EURO V and 50% EURO VI). The modelling outputs are detailed below in section 9 for a number of scenarios including: 2009 base; 2016 future year; and scenarios for base and future year for a Low Emission Zone (with either minimum Euro V and VI engine standards). Modelling of

further scenarios is currently being undertaken for measures as part of the feasibility assessment.

Enforcement may be via use of vehicle registration recognition cameras and weigh-bridges beneath the road surfaces. Much like the London Congestion Charge, fines can be automatically issued.

HGV operators are known to make route choice primarily based on distance due to low fuel economy. The Road Haulage Association has stated that HGVs will take the shortest legal route. Therefore it can be assumed that HGVs discouraged from Cleveland Bridge in particular travelling between the south coast and the motorway network the next shortest route of M32/A4 Saltford/A36 Lower Bristol Rd. For M4 East to Radstock, the next shortest route is via the A350/A361. We are not predicting additional HGV traffic in Westbury. The proposed Westbury bypass routed to the east of the town was refused following a public inquiry.

Bathwick Street HGV survey

On Tuesday 20th October 2009 between 05:00 and 23:00 hours, an HGV interview survey was carried out on Bathwick Street. The Council also undertook a classified HGV link count and a turning count for southbound HGVs at the Beckford Rd junction. 75% of all HGV movements travelling south along Bathwick Street were interviewed (426 of 568 movements). Information collected included the origin and destination; whether they were delivering in Bath; load; weight; and vehicle age and type.

Through traffic

39% of vehicles surveyed were making deliveries in Bath and 61% were through traffic. HGVs have alternative routes including from M4 West they would use the A37/A362. From M4 East they would use A350/A361 via Trowbridge/Frome. A potential weight restriction will give exemptions to traffic with an origin or destination in Bath and this may be extended to cover Westfield/Radstock/MSN and potentially the whole of the district.

The majority of through journeys (78%) were in excess of 50km. 46% of vehicles were recorded as travelling over 100km (62 miles) and 13% were travelling over 200km.

The year when the vehicle was registered was ascertained in the survey. HGV Euro standards commence in October of the year of introduction, for example Euro V was required as minimum on all new vehicles built after October 08, and therefore for the worst case it was assumed that only vehicles new in 2009 are Euro V. On this basis, 53% were Euro IV or better (built after 2005); 34% were Euro III (built after 2000); and 13.58% were Euro II or less (built after 1995).

37% of all vehicles were articulated and 63% rigid in the southbound direction. In the northbound direction, the corresponding proportion split was 41% articulated and 59% rigid.

An LEZ may also apply to buses and coaches. First operates most of the bus services in the city. Wessex Connect operates a University service and the part-subsidised circular service (20A/C). Faresaver operate between Weston and the City Centre. Traffic Regulation Condition enforcement by Bath and North East Somerset lead to a reduction in the number of tour buses and a single operator (City Siteseeing) using cleaner vehicles. First renewed their fleet in 2005 and their vehicles are at least Euro III compliant, except where vehicles from other areas are used, for example on inter-urban services. Partly as a result of operating a relatively new vehicle fleet, First have helped minimise the pollution from buses in the city and any new measures should seek to encourage the standards to be maintained.

Feasibility study brief:

- Should the LEZ be regulated through a Traffic Regulation Order (TRO) or a Traffic Regulation Condition (TRC). A TRC gives greater flexibility, as it enables specific conditions to be attached to bus services. This would require a survey of the vehicle age, type, EURO classification, to identify the scope for a TRC. A TRO would take the form of road closures or restrictions on the type of vehicles permitted on certain streets. This may be more troublesome as alternative streets for vehicles are relatively limited in Bath. An example of a TRC is contained in Appendix E as well as an outline of the existing TRC in Bath.
- Engine switch-off zone TRO (except when loading or unloading) – as new laws allow a fixed penalty notice to be issued.
- CO_2 and PM_{10} emissions must also be monitored before and after the LEZ introduction in order to avoid the possible negative effects of abatement technologies on NO_2 emissions.
- Explore retro-fitting emergency service vehicles.
- Possible co-ordination with ECOStars and ECO-Driving course
- Effectiveness and timescales – how much sooner will it achieve the reductions in NO_2 than the predicted meeting of targets in the 'do-nothing' scenario. Follow the example of London in providing a reasonable lead-in time sufficient enough to allow alterations to vehicle fleets.
- Funding source – eg through DEFRA as part of the annual bid for AQMA cash and / or through the JLTP 3, as Air Quality is the only failed target in JLTP 2
- Options should be explored for financial assistance for HDV fleet operators – a retrofitting grant pot (could form part of JLTP bid to government)
- Explore possible grants for retrofitting
- "freight best practice" and "safe and fuel-efficient driving" (Safed) grants

Sections 9 and 10 provide a summary assessment of this and all the other actions.

Timescale

A feasibility study will be completed by late 2011.

Action 3: Low Carbon Buses Trial (CIVITAS measure 1.3)

To demonstrate the feasibility of hybrid diesel-electric double deck bus operation in the City of Bath.

First Group have secured a Wrights diesel electric hybrid double deck bus, which has the ability to operate over short sections of route in the city centre only using electric power.

Emissions of NO_2, $PM_{10,}$ and CO_2 will be taken into account. The public perception will be explored in terms of the vehicle's attractiveness as an alternative to the private car. It is also intended that the low emission vehicle will be used on the Rapid Transit Route as well as around other parts of the City.

Section 10 provides a summary assessment of this and all the other actions.

Timescale
An in-service trial commenced in August 2010 and will run for 12 months.

Monitor and Evaluation
UWE are monitoring the buses for the 6 month trial and will carry out an evaluation by comparing it directly with a 'normal' bus on the same operation. Air quality monitoring sites will be reviewed to ensure that monitoring data is sufficient to evaluate the effects of the measure.

Action 4: Urban Freight Transhipment (CIVITAS measure 7.2)

The measure seeks to reduce the number of large delivery vehicles entering central Bath by providing a facility, outside of the urban area and close to the strategic road network, where goods can be consolidated for onwards dispatch in a smaller, clean fuel vehicle.

The operation commenced in January 2011 and funding will continue for a 1 year trial period. The CIVITAS funding lasts for the trial period only and further funding will be bid for from the Local Sustainable Transport Fund.

The service is currently used by 8 retailers in Bath. It is intended that this will ultimately serve 30 to 50 central retail outlets. This reduces the number of HGVs using the City Centre and ensures that vehicles are as full as possible; avoiding half-empty HGVs and increasing efficiency.

This measure is related to the 'Demand Management Strategy' in action 5 below, as the electric vehicle is not a heavy goods vehicle.

Section 10 provides a summary assessment of this and all the other actions.

Timescale
Freight transhipment operation commenced in January 2011 for a 1 year trial period with an extension dependent on alternative funding streams.

Monitor and Evaluation
The air quality monitoring network (in particular City Centre diffusion tube locations) is being used for a thorough evaluation of the effects of the trial.

Action 5: Improved Enforcement of Traffic Regulation Orders (CIVITAS measure 3.4 – Demand Management Strategies)

A variable message sign and automatic number plate recognition cameras are to be installed at the junction of Upper Bristol Road and Windsor Bridge Road to discourage heavy goods vehicles from using the central A4 corridor where a traffic regulation order exists.

There are 3 City Centre delivery zones (North/South/Central) that have been largely forgotten, so there will be new publicity to reach hauliers. Although a number plate recognition scheme will be investigated, currently the law does not allow for Traffic Regulation Orders to be enforced with fines and by cameras (unlike bus lanes). 'Soft' enforcement will be the approach. The variable message sign will illuminate upon detection of an HGV and direct drivers to the correct route away from the Upper Bristol Road (A4 with TRO).

Should the enforcement consist of fines or other penalties, the system will need to take into account the need for an exemption for deliveries for example to the Milsom Street area.

The Traffic Regulation Orders currently apply to:

- The Royal Crescent;
- The Circus;
- Milsom Street;
- The Bus Gate at New Bond Street; and
- Pulteney Bridge.

Section 10 provides a summary assessment of this and all the other actions.

Timescale

The measure will be in place by March 2011 for a 1 year trial period.

Monitor and Evaluation

A combination of traffic data and air quality monitoring data will allow a thorough evaluation of the effects of the measures.

Action 6: Bicycle Hire including Electric Bikes (CIVITAS measures 6.4 and 6.5)

To introduce a public bicycle hire scheme in the city of Bath. The project is designed to encourage cycling and to improve the modal shift between the bicycle and private car, with consequential reductions in pollution, energy usage and traffic congestion. The project will aim to achieve a modal shift from the private car to the bicycle in Bath with consequential reductions in pollution, energy usage and traffic congestion.

Four sites have been identified and agreed for the non-powered bicycle hire stations, which will be installed early in 2011. There will be 5 stations for the powered bicycles at Bath Spa and Oldfield Park Stations, Twerton High Street, RUH, and Newbridge Park and Ride.

The next phase of this project will involve Bicincitta appointing a local contractor to work with them to install the cycle stands. It is expected that the cycle hire operation will commence in the autumn. Bicincitta are an Italian company that have experience of running a bicycle hire scheme in Rome and other Italian cities. It is possible that an Electric Vehicle charging points could be provided alongside the bicycle stands – in partnership with Powerbyke, so this is action is connected to action 7. It is expected that the cycle hire operation will commence early in 2011.

Although the east – west route in Bath along the Avon Valley (including the National Cycle Route 4) is relatively flat and appropriate for cycling, the north and south sides of the City are steep hillsides and provide strong physical and psychological barrier to more cycling in the city.

The bicycle hire system will be based on card payment or 'smart card' access and GPRS communication between the bicycle stands and the back office control room. This will enable real-time online information about bicycle availability. The service will aim to be inter-modal with other existing transport modes such as trains, buses and private cars. Business partners have already been found for the electric technology (Metroelectric) and the bike hire scheme (Bicincitta).

Section 10 provides a summary assessment of this and all the other actions.

Timescale
The CIVITAS Renaissance project has received funding for installation and an eighteen month demonstration commencing early 2011.

Monitor and Evaluation

A combination of cycling surveys, traffic and air quality monitoring data will allow a thorough evaluation of the effects of the measures

Action 7: Electric vehicle recharging points

Installation of electric vehicle recharging point infrastructure. The Council is submitting a bid to government for funding to provide a number of charging points in a various locations.

Background

Electric vehicles offer a good opportunity to reduce tailpipe emissions within the City Centre. There are at least 15 electric vehicles on the market, including delivery vehicles, with a further 25 coming onto the market imminently. The latest cars typically have a range of about 90 miles typically with acceleration comparable to petrol cars; a maximum speed in excess of 60mph and a full recharge time of between 4 and 8 hours. There are electric high performance vehicles, such as the Tesla roadster which has a range of over 240 miles and is capable of 130 mph and goes from 0 to 60 mph in 4 seconds.

This is now a rapidly developing market with ever-improving energy storage technology, meaning the performance is likely to improve greatly within the next few years and lead to a high growth in the use of electric vehicles. Fast partial recharges are also available. A 50% charge can be achieved in 10 minutes in some instances. This requires a bespoke recharging point, whereas for slow charging, all that is required is access to a standard 13 Amp socket. Some models use regenerative braking which tops-up the battery when the brakes are applied. The relatively low speeds of current lower price models mean that they are ideal for congested urban streets.

The Office for Low Emission Vehicles (DfT) state that “Not only are they zero emission at the point of use but research suggests, using the current UK power mix, EVs could realise up to a 40% benefit in CO2 savings compared with a typical petrol family car in the UK over the full life cycle.”

According to the ‘WhatGreenCar’ website: “Taking greenhouse gases into account, electric vehicles charged using average 'mains' electricity show a significant reduction in emissions – the figures suggest a reduction of around 40% compared to petrol. Using average 'mains' electricity, some lifecycle regulated emissions such as particulates, nitrogen oxides and sulphur oxides are actually increased.”

It must be considered that nitrous oxide is produced by the burning of fossil fuels and as a greenhouse it has 298 times more impact per unit weight than carbon dioxide when considered over a 100 year period (2007 IPCC Fourth Assessment Report).

One of the benefits of electric vehicles is that any pollutants are emitted at power-stations which are well away from urban areas and their overall impact tends to be much less than when emitted from the exhausts of petrol and diesel cars. As is the case with greenhouse gas emissions, if renewable electricity is used, then lifecycle regulated emissions are also virtually eliminated.

National consumer incentives

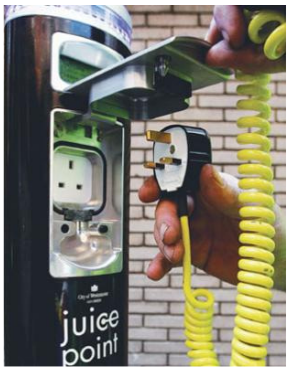
The Ultra-low carbon cars grant will be 25% of the purchase price of a qualifying car, up to a maximum of £5,000. £43m has initially been made available for the period January 2011 to March 2012. The level of the incentive will be reviewed in January 2012, taking into consideration a number of factors such as the cost of vehicles and how the early market is developing, in order to inform the level of the incentive for subsequent years.

Several car manufacturers will be introducing electric cars over the next two to three years and there are plug-in hybrid cars in the final stages of development. Fuel cell cars which are currently undergoing limited trials are unlikely to be available for general sale in the near future.

Cost and funding

Electric recharging points are about the size of a parking meter and cost up to approximately £7,000 to purchase and install. Although a joint bid for 'Plugged In Places' funding was unsuccessful, the Council are bidding for further money from the Local Sustainable Transport Fund for the installation of charging points at a number of locations.

There are two main manufacturers of recharging points – Elektromotive and POD. The photos below show the Elektromotive 'Elektrobay' in London.



A recharging point may also only consist of a lower cost outside electrical socket. These would be suitable in covered public car parks. Public charging points no longer need planning permission.

In most cases free parking and free charging is offered in order to encourage use. The parking space with a recharging post in Cabot Circus, Bristol requires the normal parking fee but provides a free charge. Added incentives could include free residential parking permits.

The installation of recharging points could also be incorporated into planning conditions or be part of the parking standards for developments.

Section 10 provides a summary assessment of this and all the other actions.

Timescale

Work has commenced on an expression of interest for a bid from the Local Transport Fund in co-ordination with the bid submission for the Bath Transport Package. The final bid submission is due in September 2011 with the results announced in early 2012.

Monitor and Evaluation

A combination of user surveys, traffic and air quality monitoring data will allow a thorough evaluation of the effect of the measures.

Action 8: Improve Building Emission Assessments

Promote Planning Emissions Reduction Assessment Tool (PERAT) for emissions of nitric oxide and other pollutants from commercial buildings and introduce it as a requirement for inclusion in Air Quality Assessments in planning applications. Enables developers to reduce emissions from a development site relative to its previous or current use.

The assessment of emissions from domestic and commercial premises in terms of non-point and non-traffic related nitric oxide emissions, such as from boilers, is relatively under-developed. Under the Building Regulations 2006, new build commercial properties must have a simplified building energy model (SBEM), which provides a carbon dioxide emission rate. However, there are currently no requirements for the assessment of NO_2 emissions from buildings as part of the planning process in Bath and North East Somerset. Background emissions are creeping up due to a large number of developments with a small negative impact and only significant impacts on air quality from each development are considered.

The Planning Emissions Reduction Assessment Tool (PERAT) is one example of a building emissions assessment tool currently in development. It requires inputting data from the NAEI database to attach emission factors to land uses (i.e. emissions per cubic metre of each building or land-use) and CIBSE building type energy density consumption figures.

It could be introduced as part of local planning guidance as best practise. It could also become a stipulation in 'The Local List' to undertake an emission assessment of the building and to identify appropriate mitigation measures. It will not in itself halt development in areas where Air Quality Objectives are exceeded, but could for example be used under section 106 of the Town and Country Planning Act, to retrofit low nitric oxide boilers. It could also be used to assess whether emissions targets (should they be introduced) are likely to be met for new build homes.

It is possible that PERAT or a similar initiative will become a tool of the Local Air Quality Management as prescribed by DEFRA.

Sections 10 provides a summary assessment of this and all the other actions.

Timescale
Assuming the final report of PERAT is complete, internal consultation on whether PERAT should be incorporated into the planning list and could commence in 2011.

Monitor and Evaluation

The tool itself will provide relevant data. The Council could provide information on how to reduce emissions where they exceed a specific benchmark.

Action 9: ECOStars Vehicle Recognition Scheme

Review effectiveness of ECOStars Scheme in other authority areas and undertake a feasibility study into the introduction of an ECOStars scheme in Bath and North East Somerset and neighbouring authorities.

ECO Stars is a free membership scheme that gives recognition to operators for using existing best practice in commercial vehicle fleet composition and operational management in terms of fuel efficiency.

A rating of between 1 and 5 stars is given (5 as best) for individual vehicles, in terms of European engine standards, type of fuel used and exhaust after-treatment, plus 'booster' stars for in-cab technology.

A rating of between 1 and 5 is also awarded the overall fleet operation including proportion of fleet achieving minimum star ratings and evidence of fuel management process, driver skills development, vehicle specification, use of supporting systems and performance monitoring.

Star rating certificates are awarded for overall performance and a 'Road map' is provided for improved operational efficiency, including advice from specialists.

A number of local authorities and businesses have already introduced the scheme including: 'Hastings Freight (Chesterfield); Ventura Network Distribution (NEXT Retail) – 5 star operation; Cranleigh Freight Services, Surrey; Barnsley MBC; Berneslai Homes; Sheffield City Council; and Stagecoach. More than 2,000 vehicles have been assessed.

Section 10 provides a summary assessment of this and all the other actions.

Timescale
A review and feasibility study could be undertaken early 2011.

Monitor and Evaluation
ECOStars schemes include a regular review of vehicle fleets. Further monitoring and evaluation can be carried out using the Council's air quality monitoring network.

Action 10: Review council and emergency service vehicle fleet

Review the vehicle fleets in terms of Euro emission standards, vehicle age, particulate traps and general specification. Identify cleaner vehicles, emissions abatement technologies and related funding sources for their introduction.

It may be the case that there are no alternative vehicles that match the required specification for emergency service or council service vehicles. However, there may be an opportunity for introducing cleaner refuse vehicles, with diesel-electric hybrids now available.

This action is connected to Action 13 (Alternative Exhaust Emissions Abatement).

Action 11: Monitoring of bus fleet quality

Monitor and review the bus fleet age, specification and maintenance in Bath. Identify and promote cleanest available vehicles.

First introduced over 100 new vehicles to the Bath fleet in 2005. This resulted in a significant improvement in emissions and helped to encourage greater use of public transport.

The new vehicles are all fitted with Euro III engines and Catalysed Regenerative Trap CRT exhaust traps, which helps reduce the emissions of fine particles. However it is possible that the trade off is higher emissions of NO_2.

In order to maintain the high standard of vehicles operating in Bath, the bus fleet should be monitored following the acquisition of a vehicle inventory. It is also necessary to carry out a review of the existing particulate traps and available retro-fitting technology in order to promote best practice.

Older vehicles may benefit from engine management reconfiguration software. A partnership between Bristol City Council and First Bus led to 16 buses being upgraded from Euro IV engine classification to Euro V, using the software.

Vehicles using the Bath Transport Package infrastructure including the Bus Rapid Transit route will be required to meet stringent emission standards, with one or two exceptions, such as one day a week services coming in from Wiltshire.

This action will be linked to Action 1 relating to the Bath Transport Package, in particular the Quality Partnership Scheme.

Section 10 provides a summary assessment of this and all the other actions.

Timescale
Monitoring could commence in early 2011.

Monitor and Evaluation
Monitoring and evaluation can be carried out using the Council's air quality monitoring network.

Action 12: Transport and Travel Information (CIVITAS measure 4.3)

Introduce a 'Wayfinding and Information System' for Bath, in connection with improved bus stop waiting environments in the Southgate area; and onboard public transport information. The Bath Legible City project is essentially about revealing and presenting the City of Bath in a way that improves the experience of all the city's users.

A new Wayfinding system for the City of Bath has been developed in the study phase of this measure. This has involved the design of graphic and visual identity for the city, integrating all transport modes. This included a royalty free mapping system for use in a variety of media and the location and information planning for products. In addition wayfinding, public transport shelter and flag products have been established together with transport information web pages. Procurement of a subcontractor to build and install the wayfinding products has commenced and it is expected that the new signs and street furniture will be installed in 2011.

Sections 10 provide a summary assessment of this and all the other actions.

Timescale
The design phase was completed in March 2010. The system will be installed by February 2011.

Action 13: Alternative Exhaust Emissions Abatement

Undertake a review of available retrofit technologies and fuel additives for exhaust emissions abatement and promote use in vehicle fleets operating in Bath.

Some catalysed particulate trap systems can bring older vehicles up to Euro IV particulate standards. Products offer a similar effect on reducing fine particles, however emissions of nitric oxide and primary NO_2 vary greatly and often increase, depending on the product used.

Stagecoach has been using 'Envirox' fuel borne catalyst (by Oxonica) on over 1,000 vehicles since 2003/4 with a 5-7% fuel consumption improvement.

Iron-based additives are known to be effective in reducing tailpipe nitrogen dioxide emissions by greater than 50%.

Retrofit technologies include:

- Partial Filter System
  - reduces PM by up to 50% (can be much less)
- Catalysed Particulate Trap System
  - virtually eliminates PM, HC and CO
- Fuel Borne Catalyst Filter System
  - virtually eliminates PM, some reduce HC and CO, some NO_2
- SCR –Selective Catalytic Reduction System
  - reduces NO_x by 50-70%
- Combined Technology: eg SCRT®= SCR +CRT®
  - virtually eliminates PM, HC and CO
  - reduces NO_x by 70-90%

Section 10 provides a summary assessment of this and all the other actions.

Timescale
A study could be undertaken in early 2011 subject to funding.

Action 14: Rossiter Road and Widcombe Parade Traffic Management Measures

Undertake air pollution dispersion modelling assessment for the proposed traffic management measures for Rossiter Road and Widcombe Parade.

The Widcombe Resident's Association commissioned an 'Assessment of Air Quality in Widcombe High Street' published in 2005. This report assumes that the reduction in emissions from the removal of through traffic on the High Street would be likely to be ½ due to high proportion of emissions originating from HGVs. It uses the DEFRA 'calculator' to establish that a reduction in nitrogen oxides emissions by half would result in a roadside annual average level of NO_2 µg/m^3 of 38.1 (below the objective). However, at the time of writing a scheme was being finalised and subsequent traffic modelling was being undertaken. In addition to traffic modelling, the scheme is modelled using the air pollution dispersion model (ADMS Urban).

Timescale

Traffic modelling is nearing completion at the time of writing and air pollution dispersion modelling is scheduled to follow and be completed by late February 2011. If it is decided that the scheme would bring traffic and environmental improvements and assuming that funds remain available, it is anticipated that construction would commence in either late 2011 or early 2012.

Action 15: Promotional website

Launch and maintain a website providing data and promotion of less polluting modes of transport and energy use.

This website can include advice on the most environmentally friendly vehicles (and associated subsidies), school transport (incentives for walking and cycling), 'eco-driving' courses, public transport ticket deals, car share schemes, City Car Club membership information (with hybrid cars available), cycling incentives (information on the cycle hire scheme – see measure 6), walking routes, health statistics and up to date air quality data (as already provided on the Council's website). There has been preliminary discussion with the Council's Sustainability team for this being a joint initiative including the aspirations for an 'Environmental Sustainability Partnership' site.

The website can also be used in the context of encouraging lower carbon travel to school initiatives.

The Department for Environment Food and Rural Affairs have highlighted a similar initiative that is in existence in Tyne and Wear as an example of good practice - namely www.beairaware.co.uk . As with the Tyne and Wear example, there is potential for co-ordination with the other former Avon authorities.

Section 10 provides a summary assessment of this and all the other actions.

Timescale
Assuming agreement with partnering teams, work can commence early in 2011 with a view to a launch of the website in late 2011.

Action 16: Corporate Travel Plan

Bath and North East Somerset Council are in the process of developing a Corporate Travel Plan to reduce the transport-related carbon emissions we produce as a Council during our day-to-day work. There are many other good reasons for having a travel plan, including benefits to the health and well-being of Council staff, potentially reducing Council staff transport costs, reducing traffic congestion and providing greater choice and information relating to travel options.

The plan includes detailed analysis of staff's travel patterns to and from work as well as in-work travel, and will contain a series of measures that will help staff to make the best travel choices. It is expected that whilst some of the measures will be quick to put in place the travel plan will take several years to fully implement as some of the measures will take time develop.

Section 10 provides a summary assessment of this and all the other actions.

Timescale
The Corporate Travel Plan is scheduled to be submitted to Divisional Directors within the Council to be agreed and signed off early 2011.

8

Targets and Indicators

8.1 Target for nitrogen dioxide at specific sites

The target for NO_2 concentrations as specified by the National Air Quality Objectives is for an annual mean 40 µg/m^3 (see Appendix A).

Table 8.1 below details by how much oxides of nitrogen emissions will need to be reduced to meet the national air objective for NO_2 at locations currently exceeding the objectives in the Air Quality Management Area. This has been done using the method in DEFRA guidance TG (09).

Location	Annual mean concentrations (µg/m^3) Adjusted for bias 2009	Reduction in NO_2 concentration required (µg/m^3)	Reduction in Road NO_x concentration required (µg/m^3)	Reduction in Road NO_x concentration required (%)
Argyle Terrace	**52**	12	38.7	40.1
Bathwick Street	**56**	16	52.6	49.7
Beckford Road	**51**	11	34.6	39.4
Belvedere	**42**	2	5.9	9.4
Broad Street	**58**	18	60.2	53.0
Charlotte Street	**45**	5	14.4	24.8
Cleveland Place West	**59**	19	64.1	54.6
Gay Street/Queen Sq	**45**	5	15.1	21.0
Gay Street – Top	**42**	2	5.9	9.4
High Street/ Guildhall	**42**	2	5.7	10.1
Kennet House	**55**	15	48.5	48.8
Lambridge	**82**	42	169.1	73.3
Lansdown Crescent	**45**	5	15.1	21.0
Little Stanhope Rd	**49**	9	26.8	38.1
London Road	**46**	6	18.0	25.3
Lower Bristol Road	**42**	2	5.9	9.3
Manvers Street	**55**	15	48.5	48.8
Morley Terrace	**51**	11	35.2	37.8
Newbridge Road	**41**	1	2.9	4.9
The Paragon	**57**	17	56.4	51.4
Somerset Street	**58**	18	59.7	54.0
St James' Parade	**62**	22	75.5	59.8
Thomas Street	**41**	1	2.9	5.1
Upper Bristol Road	**41**	1	2.9	4.9
Victoria Buildings	**58**	18	58.2	57.1
Walcot Terrace (3 tubes)	**64**	24	84.3	61.3
Wells Road	**49**	9	26.8	38.1
Wells Road – Bottom	**54**	14	43.7	50.0
Wells Road/Upper Oldfield Pk	**42**	2	5.6	11.3
Widcombe High Street	**51**	11	34.3	40.3
London Road Cont	**63**	23	80.2	60.1
Guildhall Cont	**41**	1	2.8	5.3
Windsor Bridge Cont	**52**	12	38.7	40.1

Table 8.1: Required reduction in oxides of nitrogen emissions.

It can be seen in table 8.1 above that in areas where the national air quality objectives are exceeded, there needs to be a reduction of between 4.9 and 73.3% in emissions of nitrogen oxides in order to meet the objectives across the Air Quality Management Area.

The monitored concentrations at roadside locations have been projected forward using the method and factors given in TG (09). This estimates when the objectives will be met if no actions are taken. This assumes a reduction in emissions per vehicle due to an improvement in engine and fuel technology. This mainly occurs through a renewal of commercial vehicle fleets and the purchasing of new private cars.

Table 8.2 below shows the estimate of the year when the objective will be met. This is based on a formula provided in the DEFRA guidance LAQM.TG(09) (January 2010).

Location	Within AQMA?	Data Capture 2009 %	Annual mean concentrations ($\mu g/m^3$) Adjusted for bias **2009**	Predicted year when the target will be met
Argyle Terrace	Y	100	**52**	2013
Bathwick Street	Y	93	**56**	2014
Beckford Road	Y	100	**51**	2013
Belvedere	N	100	**42**	2010
Broad Street	Y	100	**58**	2015
Charlotte Street	Y	100	**45**	2011
Chelsea Road	N	92	**33**	
Cleveland Place West	Y	93	**59**	2015
Daniel Street	Y	100	**29**	
Gay Street/Queen Sq	Y	100	**45**	2011
Gay Street – Top	N	100	**42**	2010
George Street	Y	92	**39**	
Henry Street	N	100	**37**	
High Street/ Guildhall	Y	100	**42**	2010
Kennet House	Y	100	**55**	2014
Kingston Road	N	100	**34**	
Lambridge	Y	100	**82**	2020
Lansdown Crescent	N	100	**45**	2011
Little Stanhope Rd	N	93	**49**	2012
London Road	Y	92	**46**	2011
Lower Bristol Road	Y	92	**42**	2010
Manvers Street	Y	100	**55**	2014
Morley Terrace	Y	100	**51**	2013
Newbridge Hill	N	100	**38**	
Newbridge Road	N	100	**41**	2010
The Paragon	Y	100	**57**	2014
Rackfield Place	Y	100	**37**	
Somerset Street	Y	100	**58**	2015
St James' Parade	Y	100	**62**	2016
Thomas Street	Y	100	**41**	2010
Upper Bristol Road	Y	100	**41**	2010
Victoria Buildings	Y	100	**58**	2015
Walcot Terrace (3 tubes)	Y	93	**64**	2016
Warminster Road	Y	100	**38**	
Wells Road	Y	100	**49**	2012
Wells Road – Bottom	Y	100	**54**	2014
Wells Road/Upper Oldfield Park	Y	100	**42**	
Widcombe High Street	Y	100	**51**	2013
Widcombe School	Y	83	**35**	
Windsor Bridge	Y	93	**40**	
London Road Cont	Y	95	**63**	2016
Guildhall Cont	Y	98	**41**	2010
Windsor Bridge Cont	Y	95	**52**	2013

Table 8.2: Estimated achievement date of targets according to DEFRA guidance.

In the context of the upwards trend in NO_2 in Bath (since 2004) it is evident that the DEFRA guidance method is for table 8.2 above provides an optimistic prediction. The estimated year of the objectives being met varies around the AQMA as some areas are exceeding more than others. This formula assumes no changes in traffic flow and does not take into account the effect of changes in road layouts, car parks or demand centres (such as Southgate Shopping Centre). The table illustrates that the guidance predicts that objectives for NO_2 concentrations will be met at every location by 2020, assuming traffic flows remain unchanged.

8.2 Target for average nitrogen dioxide concentration across the Air Quality Management Area.

Bath and North East Somerset Council also has an annually decreasing target in relation to the objectives of the Joint Local Transport Plan. The Annual Progress Report for 2009 sets a target for reducing concentrations in the Bath AQMA at 48.1 µg/m^3 in 2009 and 47 in 2010.

Figure 8.1 below shows the target trajectory for reducing NO_2 levels as an average across the Bath Air Quality Management Area. This trajectory is consistent with the target set for NO_2 in the Bath AQMA in the emerging Joint Local Transport Plan – the lifespan of which extends to 2026, with 3-yearly reviews.

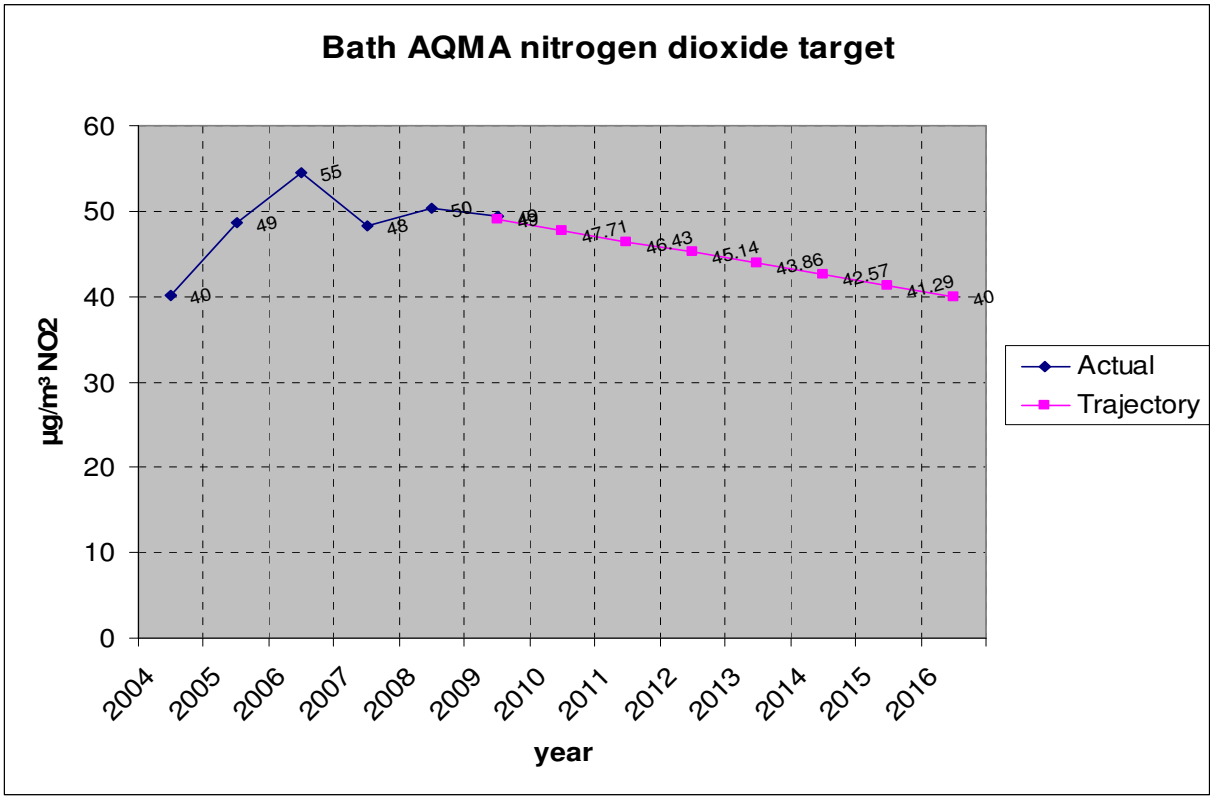


Figure 8.1.: Bath AQMA annual average NO_2 actual and target trend.

Figure 8.1 above shows the annual average values are taken from all monitoring location sites in the AQMA. The target is for the average levels of NO_2 across the AQMA to not exceed 40µg/m^3 by 2016.

8.3 Key Indicators for Actions identified in section 7.

Table 8.3 below summarises the measures as identified in section 7 above and the indicators that can be used to assess the impact.

Due to the onerous nature of setting targets for the indicators detailed in table 8.3, no further targets have been set beyond reducing the concentration of NO_2 as detailed above in section 8.2.

No.	Measure	Focus	Lead/Key Organisation	Implementation Phase	Indicators
1	Bath Transport Package	P&R expansion, BRT, new P&R to the east of the City, Real Time Information for buses, new bus priority measures and vehicle access restrictions on some city centre streets.	Bath and North East Somerset Council	2012 -	Public transport patronage (P&R). Traffic flows on radial routes (growth comparisons). Vehicle mix comparison (proportion of traffic that is private cars). Average journey time.
2	Cleveland Bridge area restrictions feasibility study	Operators of vehicles not meeting agreed emission targets would pay a daily charge to enter.	Bath and North East Somerset Council	2011	Modelled NO_2 levels.
3	Low Carbon Bus Trial (CIVITAS 1.3)	To demonstrate the feasibility of hybrid diesel-electric double deck bus operation in the City of Bath.	University of the West of England, First Group and Bath and North East Somerset Council.	08/2010-2011	Fuel usage / costs. Vehicle emissions.
4	Urban Freight Transhipment (CIVITAS 7.2)	A facility close to the motorway, where goods are consolidated for dispatch in a smaller, clean fuel vehicle.	University of the West of England, Bath and North East Somerset Council and DHL.	01/2011 – 01/2012	HGV traffic flows. Number of participating businesses. NO_2 levels.
5	Improved Enforcement of TROs (CIVITAS 3.4 – Demand Management Strategies)	A variable message sign and automatic number plate recognition cameras at Upper Bristol Road/Windsor Bridge Road to discourage heavy goods vehicles from using the central A4 corridor where a traffic regulation order exists.	Bath and North East Somerset Council	2011	HGV traffic flows. NO_2 levels.

6	Bicycle Hire including Electric Bikes (CIVITAS 6.4 and 6.5)	Installation and operation of a number of cycle stands with some for electric powered bikes.	Bath and North East Somerset Council	2011	Vehicle mix (% that are bicycles). No. of hires.
7	Electric Vehicle Recharging Points	Installation of charging points to enable greater use of electric vehicles.	Bath and North East Somerset Council	2011	Vehicle mix (count of electric vehicles). Number of charges p.a.
8	Improve Building Emission Assessments	Develop spreadsheet tool for emissions of nitric oxide and other pollutants from commercial buildings, for inclusion in planning application Air Quality Assessments.	Bath and North East Somerset Council	2011	Number of air quality assessments including spreadsheet tool.
9	ECO Stars Vehicle Recognition Scheme	Review effectiveness of ECOStars Scheme in other authority areas and undertake a feasibility study into the introduction of a scheme in the district.	Bath and North East Somerset Council	2011	Number of haulage operators & vehicles audited. HGV vehicle mix survey (number plate and engine standard).
10	Review Council and Emergency Service Vehicle Fleet	Review the vehicle fleets in terms of Euro emission standards, vehicle age, particulate traps and general specification. Identify cleaner vehicles, emissions abatement technologies and related funding sources for their introduction.	Bath and North East Somerset Council	2011	Euro engine standard survey.
11	Monitoring of Bus Fleet Quality	Monitor and review the bus fleet age, specification and maintenance in Bath.	First Group and Bath and North East Somerset Council	2011	Euro engine standard survey. Number of emissions abatement retrofit / original design.
12	Transport & Travel Information	Free mapping system, wayfinding signage, public transport shelter and flag products together with transport information web pages.	Bath and North East Somerset Council	2011	Number of signs.

13	Alternative Exhaust Emissions Abatement	Review of available retrofit technologies and fuel additives for exhaust emissions abatement and a feasibility study for the introduction into vehicle fleets operating in Bath.	Bath and North East Somerset Council	2011	Number of retrofitted HGVs.
14	Rossiter Road Traffic Management Measures	Review of options for improvement in road layout to improve air quality and reduce congestion.	Bath and North East Somerset Council	2011 -	Traffic flows. NO_2 levels.
15	Promotional Website	Offering advice and incentives for helping improve air quality.	Bath and North East Somerset Council	2011	Number of visits to website.
16	Corporate Travel Plan		Bath and North East Somerset Council	2011	Modal shift (eg number of employees transferred from private car to bike or bus).

Table 8.3: Key indicators for actions.

8.4 Target monitoring framework

An Action Plan Progress Report is published every year until a new Action Plan is written, which will occur if the existing Action Plan is ineffective or if the annual assessments of monitoring data suggest that air quality objectives will not be met outside of the existing air quality management area.

9

Air Pollution Dispersion Modelling

ADMS-Urban is an Air Pollution Dispersion Model created by Cambridge Environmental Research Consultants (CERC). It is a widely used and accepted industry standard air pollution dispersion modelling software package.

The council has also used the emissions inventory toolkit software 'EMIT' that enables manipulation and assessment of emissions data from road traffic and other sources. EMIT holds emissions data that has been directly imported, or else it calculates emissions from source activity data (such as traffic flow, speed and source length for roads).

This model is being used to confirm the area of the Air Quality Management Area; to apportion pollution sources and to test options for this Action Plan.

9.1 Model inputs

The model requires the input of data including; average hourly traffic flows, diurnal profiles of each road source, road width, canyon heights, one years' meteorological data; average traffic speeds, geographical characteristics, etc.

Road sources
Traffic flows were derived from a variety of data including long term automatic traffic counts; single day fully classified 12 hour counts and Department for Transport daily average counts. The 12 hour counts were factored to 24 hour counts using the 7-day averages from the automatic traffic counts. A traffic flow diagram illustrating the average daily flows used on each road source link is contained in **Appendix F.** The model requires the input of average daily flows of heavy duty vehicles (including lorries, buses and coaches) and light duty vehicles (including light goods vehicles, taxis, private cars and motorcycles).

Separate diurnal profiles were used for each road source, taken from the nearest automatic traffic count. This means that the daily flows are distributed into each hour according to empirical evidence and the peak hour traffic scenarios are fully taken into account.

Average traffic speeds to the nearest 5 kilometres per hour were obtained from detailed journey time surveys across the Bath network.

The road sources were built in the mapping software – 'Mapinfo'. The model required that geometric data was entered, including the values which reflect the 'canyon' characteristics, where the effect of roads lined with high-sided buildings is taken into account.

Background concentrations of pollutants
A background level from the background maps were used in the model.

Meteorological data
The model includes a full years' meteorological data including wind speed, wind direction, rainfall, temperature and sunshine. The nearest available full dataset for the base year is from RAF Lyneham - approximately 20 miles to the east of Bath. The fact that this may not be fully representative of the weather in Bath is taken into account in the modelling and an appropriate adjustment is applied according to the geographic differences of each area.

9.2 Existing situation

The base year of 2009 has been calculated from traffic counts in 2009 and other counts factored up according to NRTF and TEMPRO.

One of the model outputs is a map of calculated annual mean concentrations of NO_2 in $\mu g/m^3$ across the Bath major road network in 2009.

The model under-predicted levels of NO_2 at most of the receptor points for which monitoring data was available. A verification exercise (see **Appendix G**) was carried out in order to reconcile monitoring and modelling data using the method specified in the DEFRA technical guidance [LAQM - TG(09)].

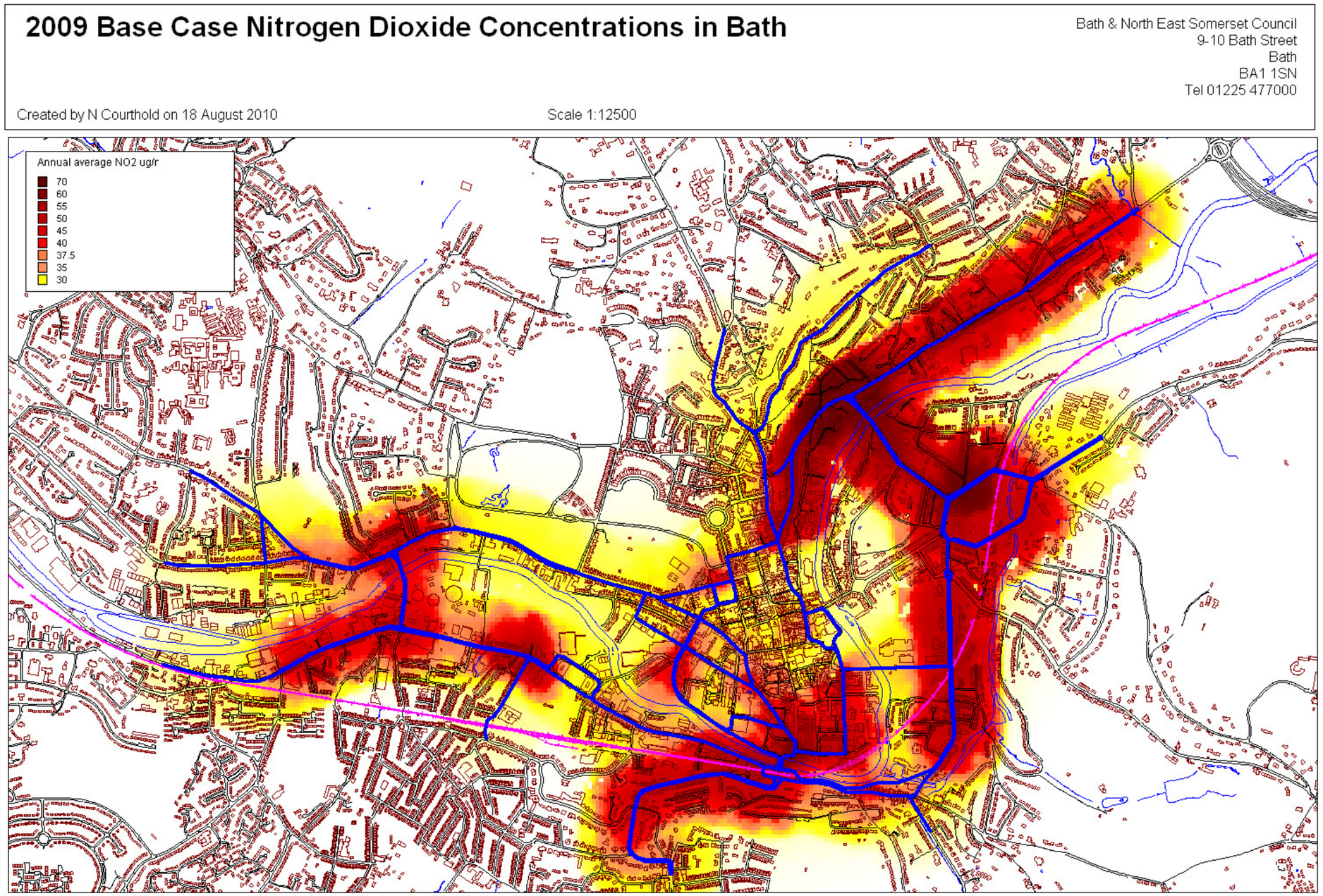


Figure 9.1: ADMS-Urban and EMIT model output: 2009 base case annual mean NO_2 concentrations in Bath.

Figure 9.1 above shows the approximate concentrations of NO_2 as an annual mean across the Bath major road network. The blue lines indicate the major roads that have been specifically modelled. The areas shaded a dark red colour are those where NO_2 concentrations exceeded 40 µg/m^3 in 2009.

The model output shows the pollution covering a large distance either side of the road sources, because it is based on annual mean concentrations and takes into account the weather conditions for the whole year. Pollution levels during an hourly or daily period would cover a smaller area closer to the road source.

The annual mean NO_2 concentration levels at the road sources are broadly consistent with the monitoring data summarised in table 4.2 (section 4) and as such can be used to indicate the future impact of measures.

9.3 2016 do nothing scenario

As detailed above in section 8.1 (table 8.2), the DEFRA projections for NO_x emissions are broadly considered to be optimistic. However, as required, these predictions are the basis for the modelling for the 2016 'do nothing' scenario. The predictions assume a particular rate of improvement in engine technology and take up of new vehicles which results in an improvement in air quality across the modelled area. They also assume that traffic has increased in line with the joint TEMPRO and National Road Traffic Forecast growth factor (except for on the additional queue links where traffic is at full capacity).

Figure 9.2 below shows the output map for the modelled annual average concentrations of NO_2 for the '2016 do nothing' scenario. This shows the pollution covering a wider area than on the average day, due to the fact that it takes into account the average weather conditions for the whole year.

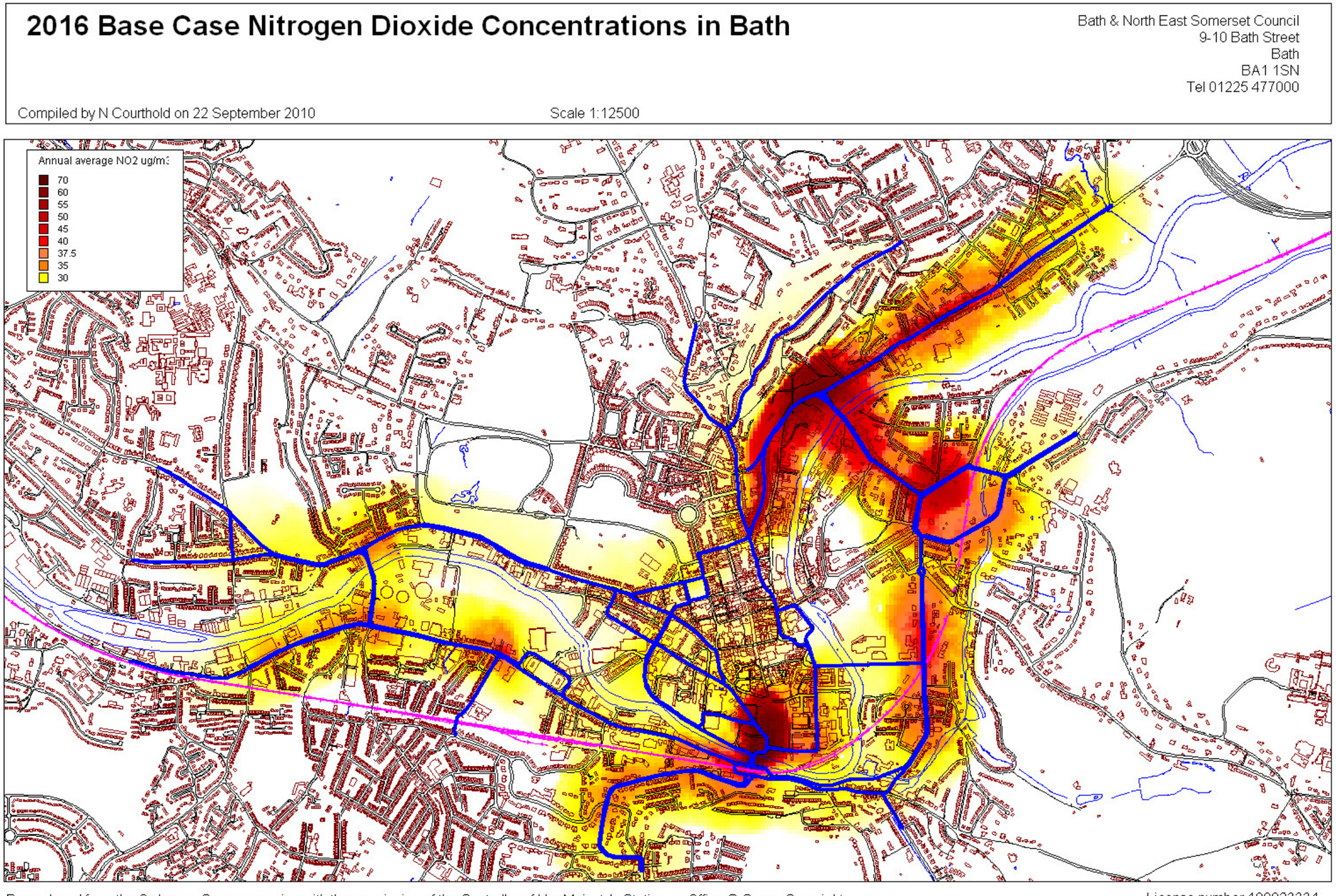


Figure 9.2: ADMS-Urban and EMIT model output: 2016 'do nothing' annual mean NO_2 concentrations in Bath.

The model shows that the air pollution is predicted to improve broadly across the modelled area with areas such as Bathwick Street, London Road, Pulteney Road, St James' Parade, Brougham Hayes and Windsor Bridge junctions in particular still exceeding the national objectives by a significant margin.

9.4 2016 LEZ scenarios

9.4.1 2016 LEZ - Euro V minimum

EMIT software was used to assess the potential impact of a Low Emission Zone coming into force in 2016 with a minimum of Euro V standard. It is predicted that approximately 23% of Heavy Duty Vehicles will not meet the Euro V standard by 2016.

We have assumed that half of the new vehicles bought in response to the LEZ will be Euro V and the other half will be Euro VI. This means that approximately 45% of the Heavy Duty Vehicles will meet Euro V and 55% will meet Euro VI standards at the commencement of the LEZ in 2016.

Figure 9.3 below shows the output map for the modelled annual average concentrations of NO_2 for the '2016 LEZ Euro V and VI scenario. This shows the pollution covering a wider area than on the average day, due to the fact that it takes into account the average weather conditions for the whole year.

2016 Low Emission Zone with Euro V and Euro VI
Nitrogen Dioxide Concentrations in Bath

Bath & North East Somerset Council
9-10 Bath Street
Bath
BA1 1SN
Tel 01225 477000

Compiled by R Spalding on 23 September 2010 Scale 1:12500

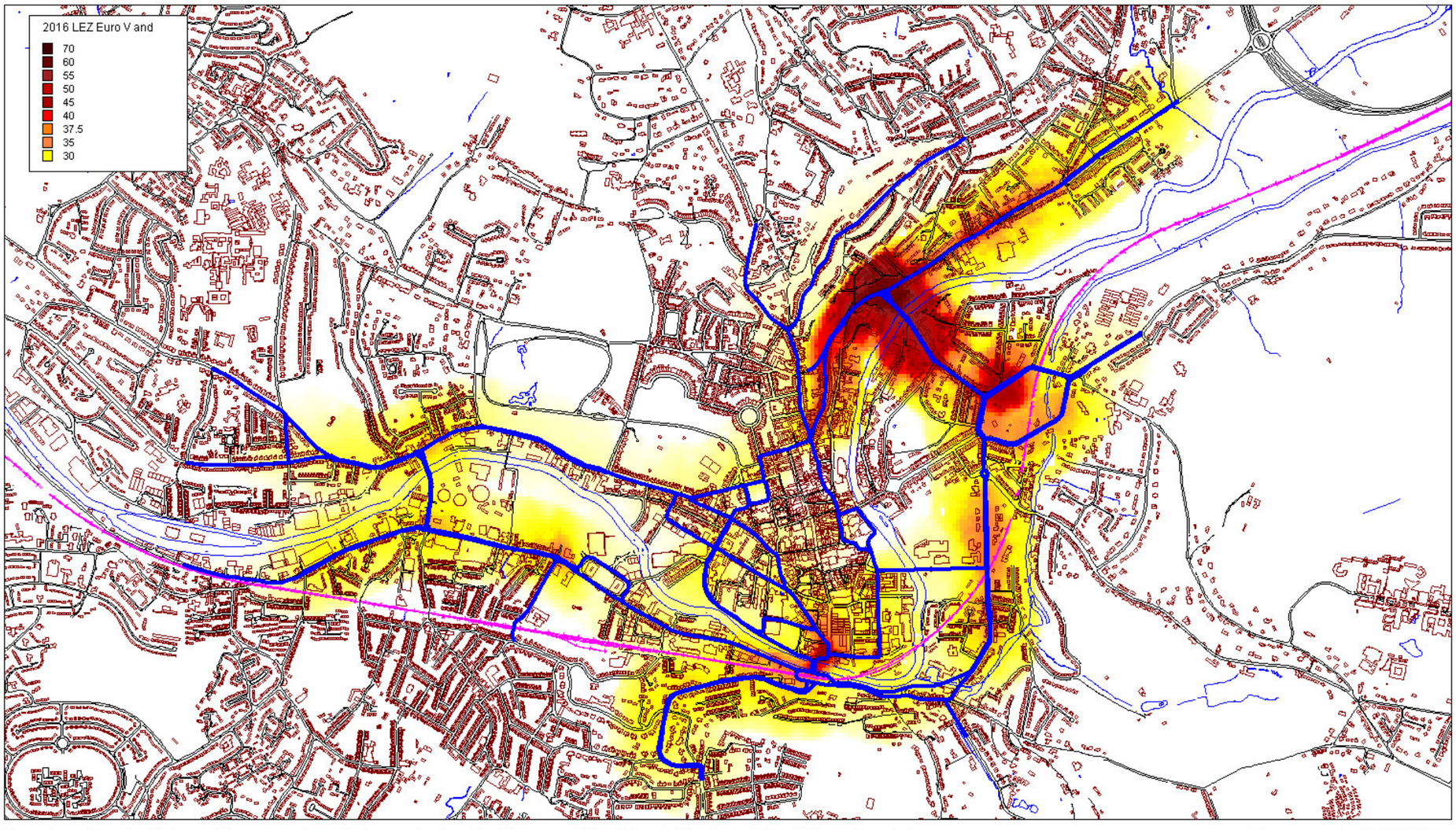


Figure 9.3: ADMS-Urban and EMIT model output: 2016 Low Emission Zone with minimum Euro V and assuming 50% Euro VI annual mean NO_2 concentrations in Bath

The model shows that the air pollution is predicted to improve broadly across the modelled area with the introduction of a low emission zone stipulating at least Euro V engine standards, compared to the 2016 do nothing scenario. Although the output map shows that NO_2 levels are predicted to remain above the national objectives in some of the more heavily congested areas, the model predicts that the measure will reduce NO_2 levels by an average of approximately 14% in the Air Quality Management Area.

9.5 Conclusion

The air pollution dispersion model testing predicts that a Low Emission Zone covering the AQMA, requiring cleaner HGV engine standards could have the effect of lowering oxides of nitrogen emissions by 17% to 78.43μg/m^3 compared to the 2016 'do nothing' scenario of 94.54μg/m^3 (assuming 45% of HGVs at least EURO V and 55% EURO VI). The corresponding reduction for road NO_2 is an average 13.75% over the modelled area.

The model results suggest that further work is required to establish the predicted reduction in NO_2 that could occur with a range of Euro engine standard requirements.

10

Actions Assessment

10.1 Cost Benefit Analysis

Table 10.1 below provides an indicative cost benefit assessment of the actions identified in section 7 above. This assessment is intended to assist in the prioritisation of future work associated with the measures. The cost effectiveness and air quality improvements in the short to medium term are both estimated. The modelling exercise detailed in section 9 above provides a prediction of the air quality improvements of some of the actions.

For the purpose of this assessment those measures that are in this action plan listed as feasibility studies have been assessed in this table as measures that would be fully implemented.

No.	Measure	Estimated cost	Air quality improvement		% people positively affected	Benefits	Possible disbenefits	Cost benefit results	
		1 = >£3m 2 = £1-3m 3 = £500k - £1m 4 = £100k - £500k 5 = <£100k	%-age reduction in NO_2	Score (10 = greatest gain)	√ = low % √√√ = medium % √√√√√ =high %			**Score** (Est. cost x improvement score x people affected. Higher value indicates greater cost effectiveness)	**Ranking** (1 = most cost effective action)
1	Bath Transport Package	1	n/a	7	√√√√ (commuters, shoppers & residents)	Improved City Centre environment encourages cycling, walking & public transport use – paving the way for modal shift and pollution reduction measures.		28	5

2	Low Emission Zone	2		8	√√√ (residents & commuters)	Cleaner HGVs and lower emissions on main HGV routes.	Increases the cost of deliveries relative to competing areas and could affect smaller businesses.	48	3
3	Low Carbon Bus Trial (CIVITAS 1.3)	4	n/a	2	√√ (residents & commuters)	Cleaner mass transit, greater attractiveness for public transport.		16	9
4	Urban Freight Transhipment (CIVITAS 7.2)	2		7	√√√√ (residents & commuters)	Reduces the number of HGVs without a full load entering the City Centre and thus reduces the number of HGV trips, reducing emissions.		56	2
5	Improved Enforcement of TROs (CIVITAS 3.4 – Demand Management Strategies)	4		4	√√ (residents & commuters)	Reduces congestion and emissions from HGVs in sensitive areas.	Increased HGVs on other city routes.	32	4
6	Bicycle Hire including Electric Bikes (CIVITAS 6.4 and 6.5)	3	n/a	3	√√√ (residents, commuters & shoppers)	Reduces shorter car journeys and thus congestion & pollution.		27	6
7	Electric Vehicle Recharging Points	5	n/a	6	√√ (residents & commuters)	Reduces vehicle emissions in the city.		60	1
8	Improve Building Emission Assessments	5	n/a	1	√ (residents)	Reduces NO_2.		5	11
9	ECO Stars Vehicle Recognition Scheme	4		4	√√√ (residents & commuters)	Encourages cleaner HGVs and lower emissions by offering positive promotion.		48	3

10	Review Council and Emergency Service Vehicle Fleet	5	n/a	2	√ (residents)	Potential to identify vehicles improvements to reduce harmful emissions.		10	10
11	Monitoring of Bus Fleet Quality	5	n/a	2	√√ (residents & commuters)	Potential to identify vehicles improvements to reduce harmful emissions.		20	8
12	Transport & Travel Information	4	n/a	3	√√√√ (residents, shoppers & commuters)	Improved information encouraging alternative modes of transport and thus reducing emissions.		48	3
13	Alternative Exhaust Emissions Abatement	4		3	√√√√ (residents, shoppers & commuters)			48	3
14	Rossiter Road Traffic Management Measures	1	(awaiting traffic modelling results)	n/a - *	√ (residents)	Possible reduction in vehicle emissions on Widcombe Parade (awaiting traffic modelling of latest proposed scheme).	Possible displacement of traffic to other residential areas.	n/a - *	n/a
15	Promotional Website	5	n/a	3	√√√√ (residents, shoppers & commuters)			60	1
16	Corporate Travel Plan	4	(awaiting assessment or forecast modal shift)	3	√√ (residents & Council workers)			24	7

Table 10.1: Indicative action assessment and cost benefit analysis.
* - awaiting traffic flows from model of proposed scheme.

Some of the actions summarised in table 10.1 above will provide significant air quality improvements for a large number of people and yet may rate poorly in terms of a cost benefit analysis, as above. For example, the Bath Transport Package would provide public transport improvements for a large number of people and the opportunity for further pollution reduction measures, but will cost more in comparison to an urban freight transhipment service, with possibly more immediate air quality improvements.

In terms of cost benefit, the assessment in table 10.1 above indicates that the most cost effective measure might be either the introduction of electric vehicle charging points; or a promotional website.

11

Possible Future Actions

11.1 A46/A36 link road

The A36 and A46 together form a key north-south route linking the Motorway network with the south coast. They are also major routes into and out Bath. This route is related to the A350 north-south route in that they each represent an alternative to the other for north south movements. As such, improvements to the A350 may lead to less traffic or lower growth on the A46/A36. The Bristol / Bath to South Coast Study was published in 2004, predicts that the package of an A36/A46 link road and Park and Ride was predicted to reduce traffic flows on London Road by between 6,000 and 7,000 vehicles per day. However, there are significant challenges relating to the topography and environment of the Avon Valley.

11.2 Rail Electrification

Network Rail is developing a long-term electrification strategy in tandem with the Government's announcement in July 2009 for electrification of the Great Western Main Line between London and Swansea. This will be followed by a new Rolling Stock Plan in the autumn of 2009.

Electric trains generally perform better than equivalent diesel vehicles even on the basis of the current electricity generation mix. Typically an electric train emits 20–35% less carbon per passenger mile than a diesel train. The development of collecting energy through regenerative breaking is also helping to push this percentage up.

Subject to detailed planning work, the government propose that electric services will be introduced progressively: London to Oxford, Newbury and Bristol by the end of 2016, and London to Swansea by the end of 2017.

12

References

1. Final Joint Local Transport Plan 2006/07 – 2010/11

2. Further Assessment of Air Quality, Bath and North East Somerset Council (July, 2009)

3. 2009 Update and Screening Assessment for Bath and North East Somerset Council (May, 2009)

4. 2010 Air Quality Progress Report for Bath and North Somerset Council (May 2010)

5. DEFRA Local Air Quality Management Technical Guidance LAQM.TG(09) (February 2009)

13

Glossary

AQMA	Air Quality Management Area
CRT	Continuous Regenerative Trap
CO	Carbon Monoxide
DEFRA	Department of Environment, Food and Rural Affairs
HC	Hydro-carbons
HDVs	Heavy Duty Vehicles (buses and HGVs greater than 3.5T)
HGVs	Heavy Goods Vehicles
JLTP	Joint Local Transport Plan (former Avon Authorities)
LDVs	Light Duty Vehicles (cars and LGV less than 3.5T)
LGVs	Light Goods Vehicles
LEZ	Low Emission Zone
LTP	Local Transport Plan
NAEI	National Atmospheric Emissions Inventory
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NO_x	Oxides of Nitrogen
O_3	Ozone
PAH	Polycyclic Aromatic Hydrocarbons
PM_{10}	Particulate Matter (not exceeding 10 micrometres)
QA/QC	Quality Assurance / Quality Control
SO_2	Sulphur Dioxide
SCR	Selective Catalytic Reduction
SCRT®	This is a trademark of 'Eminox's' name of a combination of SCR and CRT technology.
TIF	Transport Innovation Fund (£1.4billion central government fund)
TRC	Traffic Regulation Condition
TRO	Traffic Regulation Order
µg/m³	Micrograms per cubic metre

APPENDIX A

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 $\mu g/m^3$	Running annual mean	31.12.2003
	5.00 $\mu g/m^3$	Running annual mean	31.12.2010
1,3-Butadiene	2.25 $\mu g/m^3$	Running annual mean	31.12.2003
Carbon monoxide	10.0 mg/m^3	Running 8-hour mean	31.12.2003
Lead	0.5 $\mu g/m^3$	Annual mean	31.12.2004
	0.25 $\mu g/m^3$	Annual mean	31.12.2008
Nitrogen dioxide	200 $\mu g/m^3$ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 $\mu g/m^3$	Annual mean	31.12.2005
Particles (PM_{10}) (gravimetric)	50 $\mu g/m^3$, not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 $\mu g/m^3$	Annual mean	31.12.2004
Sulphur dioxide	350 $\mu g/m^3$, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 $\mu g/m^3$, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 $\mu g/m^3$, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

APPENDIX B

Stage	Work undertaken	Outcome	Date
Round 1			
Stage 1	Initial review and assessment	Further assessment required for PM_{10} and NO_2.	April 1999
Stage 2	Assessment using DMRB for NO_2 and PM_{10}.	Detailed assessment required.	February 2000
Stage 3	Detailed review and assessment for PM_{10} and NO_2 using SEIPH model.	Declaration of AQMA for NO_2 along London Road	March 2001 (AQMA declared February 2002)
Stage 4	Detailed assessment of NO_2 in the London Road area.	Proposed extension of AQMA	February 2003
Action Plan	Work to develop an improvement plan for air quality in the London Road area	Describes measures to improve Air Quality in the London Road Area	January 2006
Round 2			
Updating and Screening Assessment	Assess air quality and determine any changes in monitored concentrations or emission sources	Further assessments for NO_2 and PM_{10} required at a number of locations.	June 2003
Detailed Assessment	Assess the areas highlighted in the updating and screening assessment in detail	Recommendation to extend AQMA to include main roads in city centre	March 2005 (AQMA declared July 2008)
Progress Report	Report the latest monitoring data etc.	Further work needed for Keynsham and Batheaston.	June 2005
Further Assessment	Detailed assessment of new AQMA area for NO_2.	Minor adjustments needed to AQMA.	July 2009
Action Plan	Work to develop an improvement plan for air quality in the region of the new AQMA	Describes measures to improve Air Quality in Bath.	*Draft Nov 2009*
Round 3			
Updating and Screening Assessment	Assess air quality and determine any changes in monitored concentrations or emission sources	Further work needed for NO_2 in Keynsham and Batheaston and PM_{10} in the London Road area.	May 2006
Detailed Assessment	Keynsham & Batheaston Assess the areas highlighted in the updating and screening assessment in detail / Report the latest monitoring data etc.	Keynsham – Recommendation to declare AQMA along High Street, area being declared. Batheaston – No AQMA required	August 2008 November 2009
Detailed Assessment	PM_{10} London Road	No AQMA required	December 2009
Progress Report	Report the latest monitoring data etc.	No further work needed.	April 2008
Round 4			

Stage	Work undertaken	Outcome	Date
Updating and Screening Assessment	Assess air quality and determine any changes in monitored concentrations or emission sources	No further work needed.	May 2009
Progress Report	Report the latest monitoring data etc.	No further work needed.	May 2010

APPENDIX C – Non-automatic monitoring sites (diffusion tube network)

Site Name	Site Type	OS Grid Ref	In AQMA?	Relevant Exposure? *(distance (m) to relevant exposure)*	Distance to kerb of nearest road *(N/A if not applicable)*	Worst-case Location?
Alexandra Park	Urban Background	375105 163991	N	N	N/A	
Argyle Terrace	Roadside	373211 164743	Y	Y (4m)	3m	
Argyle Street	Kerbside	375264 164987	N	Y (2m)	3m	
Bathwick Street	Roadside	375602 165365	Y	Y (1m)	1m	Y
Beckford Road	Roadside	375732 165416	Y	Y (7m)	1m	Y
Bellots Road	Roadside	373490 164804	N	Y (2m)	44m	
Belvedere	Roadside	374933 165496	N	Y (0m)	2m	
Broad Street	Kerbside	375008 165145	Y	Y (2m)	0.5m	Y
Brock Street	Urban Centre	374572 165323	N	Y (2m)	N/A	
Charlotte Street	Roadside	374622 164994	Y	Y (3m)	1m	
Chelsea Road	Roadside	373044 165120	N	Y (0m)	12m	
Cleveland Place West	Roadside	375251 165718	Y	Y (0m)	6m	Y
Daniel Street	Urban Centre	375544 165331	Y	Y (3m)	N/A	
Fountains Buildings	Urban centre	375005 165290	N	Y (1m)	N/A	
Gay Street	Roadside	374791 165038	Y	Y (6m)	3m	
Gay Street – Top	Roadside	374797 165161	N	Y (3m)	1m	
George Street	Kerbside	374899 165159	Y	Y (3m)	1m	
Henry Street	Urban Centre	375185 164594	N	Y (3m)	N/A	
High Street/ Guildhall	Roadside	375108 164866	Y	Y (2m)	1m	
Hungerford Road	Urban Centre	373361 165216	N	Y (1m)	N/A	
James Street West	Roadside	374695 164763	N	Y (0m)	4m	
Kennet House	Roadside	375009 164489	Y	Y (1m)	1m	
Kingston Road	Urban Centre	375223 164525	N	Y (3m)	N/A	
Lambridge	Roadside	376413 166493	Y	Y (0m)	4m	Y

Site Name	Site Type	OS Grid Ref	In AQMA ?	Relevant Exposure? *(distance (m) to relevant exposure)*	Distance to kerb of nearest road *(N/A if not applicable)*	Worst-case Location ?
Lansdown Crescent	Roadside	374785 165704	N	Y (1m)	3m	
Little Stanhope Road	Roadside	374490 164971	N	Y (0m)	2m	
London Road	Roadside	375492 165866	Y	Y (3m)	1m	Y
Lower Bristol Road	Roadside	373833 164799	Y	N	1m	
Manvers Street	Kerbside	375249 164498	Y	Y (3m)	2m	
Morley Terrace	Roadside	373484 164843	Y	Y (0m)	4m	Y
Newbridge Hill	Roadside	373106 165200	N	Y (7m)	2m	
Newbridge Road	Roadside	373092 165106	N	Y (5m)	1m	
Paragon	Roadside	375040 165515	Y	Y (1m)	1m	Y
Rackfield Place	Roadside	372639 164743	Y	Y (0m)	6m	
Somerset Street	Kerbside	375043 164438	Y	N	1m	
St James' Parade	Roadside	375053 164418	Y	Y (2m)	1m	
St John's Road	Urban Centre	373553 165230	N	Y (3m)	N/A	
St Marks Road	Urban Centre	375189 164221	N	Y (10m)	N/A	
Thomas Street	Urban Centre	375318 165812	Y	Y (0m)	N/A	
Upper Bristol Road	Kerbside	373993 165174	Y	Y (5m)	1m	
Victoria Terrace	Roadside	374039 164760	Y	Y (2m)	2m	
Walcot Terrace (3 tubes)	Roadside	375462 165843	Y	Y (0m)	3m	
Warminster Road	Roadside	376062 165495	Y	Y (18m)	4m	
Wells Road	Kerbside	374716 164303	Y	Y (2m)	1m	
Wells Road – Bottom	Roadside	374794 164310	Y	Y (1m)	1m	Y
Wells Road – Oldfield Road	Roadside	374427 164003	N	Y (4m)	3m	
Wells Road/Upper Oldfield Park	Roadside	374454 164202	Y	Y (3m)	1m	

Site Name	**Site Type**	**OS Grid Ref**	**In AQMA ?**	**Relevant Exposure?** *(distance (m) to relevant exposure)*	**Distance to kerb of nearest road** *(N/A if not applicable)*	**Worst-case Location ?**
Widcombe High Street	Roadside	375422 164227	Y	Y (5m)	1m	
Widcombe School	Roadside	375634 164406	Y	Y (5m)	1m	
Windsor Bridge	Roadside	373426 165107	Y	Y (4m)	2m	

APPENDIX D – DEFRA feedback on Consultation Draft Air Quality Action Plan

AP3-082 Bath & North East Somerset Council

Feb 2010

Appraisal Report on
Air Quality Action Plan, Bath and North East Somerset Council – October 2009

The plan by Bath and North East Somerset Council (BNESC) proposes a series of measures to improve air quality throughout the Bath Air Quality Management Area (AQMA). The measures therein are primarily aimed at reducing traffic flows in the AQMA.

The air quality issue(s):

Air quality assessments identified a number of locations along main roads in Bath exceeding the annual mean objective for NO_2. This area was consulted on and the major road network area was declared as an AQMA for NO_2 in July 2008.

The highest concentration of nitrogen dioxide was recorded at Lambridge with an annual mean NO_2 concentration exceeding 80 $\mu g.m^{-3}$ in 2008.

Monitoring at Broad Street; Walcot Terrace; Wells Road; and Victoria Terrace recorded 60 $\mu g.m^{-3}$ of NO_2 as the annual average concentration in 2008.

Monitoring at Bathwick Street; The Paragon; Somerset Street; Wells Road; Kennet House and St James's Parade recorded annual mean NO_2 concentrations exceeding 50 $\mu g.m^{-3}$ in 2008.

Monitoring at The High Street, Lower Bristol Road and George Street recorded annual mean NO_2 concentrations exceeding 45 $\mu g.m^{-3}$ in 2008.

The source apportionment shows road traffic contributes up to 90% of the total NO_2 concentrations, with heavy duty vehicles (HDV's) contributing between 29 and 53%.

The draft AQAP:

The draft AQAP states that a reduction in NOx emissions from HDVs will be the primary objective they will strive to achieve in order to meet the NO2 annual mean objective.

Additionally, BNESC have identified a number of measures that will help to reduce NO2 emissions including designating a Low Emission Zone; recharging points for electric cars; improve building emission assessments; feasibility study for the use of titanium dioxide paint; electrification of the Great Western Mainline; monitoring of bus fleet emissions and a feasibility study for the introduction of an ECOStars vehicle recognition scheme.

We welcome BNESC's commitment to improving air quality and its thorough draft AQAP. The draft AQAP contains enough detailed information to justify the measures in the plan, while offering concise commentary therefore making the plan understandable to a lay audience. The discussion of policy linkages, existing air quality initiatives and the statutory basis for the plan will be very useful for those new to action planning.

The purpose of the draft AQAP is to provide the focal point through which discussion is driven forward with stakeholders and throughout which BNESC, in collaboration with relevant stakeholders, can discuss, identify and deliver cost effective measures that will enable them to achieve the air quality objectives within an AQMA.

By presenting information on policy linkages and highlighting the various bodies involved in the consultation process, BNESC have shown that they have encouraged the local community to

participate in the creation of a final Action Plan and have raised the general awareness of air pollution issues throughout the local area.

The draft consultation AQAP is a thorough plan that presents a guide as to the expected impacts resulting from implementation of actions within the plan. The discussion of policy linkages, existing air quality initiatives and the statutory basis for the plan is useful to those not familiar to the action planning process.

Many of the actions proposed in the action plan are specific to the Bath AQMA while the AQAP acknowledges the role BNESC have to play across the wider area in supporting the implementation of the JLTP and other associated policies.

The measures contained in the plan have been "ranked" in a number of ways. Firstly, actions have been ranked in terms of air quality impact, on a scale 1 to 10 with 10 being the greatest impact. This scale should be defined in with regards to why the numbers that were assigned to each of the actions were chosen. Discussion should be provided as to what the level of impact of reduction in NO2 in terms of $\mu g.m^{-3}$.

Cost benefit analysis has been carried out by multiplying the cost score with the air quality impact score which should be commended, however this should also be framed with respect to $\mu g.m^{-3}$ improvement in air quality.

Suggestions for future AQAP revisions

The draft AQAP is presented well and it is evident that BNESC recognise the importance of improving air quality in the AQMA and in the County as a whole. A thorough approach is evident although minor revisions to the plan could further improve the ability of readers to quantify the impact measures described in the plan will have. This should be taken on board when compiling the final AQAP and future Progress Reports.

We present suggestions for the final AQAP revision. Additionally, suggestions can be used to support the impact of Progress Reports. However, it is clear that the Council have taken account of both statutory and non-statutory guidance and we would encourage them to continue to do so when addressing our suggestions.

Steering group and implementation plan

The AQAP outlines the different areas in which steering groups have been involved as a result of describing the different polices and plans the AQAP will link with.

Steering and consultation groups that have contributed to the creation of the final AQAP should be listed in the final AQAP. The activities of the steering group should be presented along with each group's responsibilities and current involvements.

Some comments have been provided in section 2.1, although we would encourage BNESC to provide more information regarding the findings of the final consultation exercise in the final AQAP.

Indicators and targets for actions

For the majority of actions each action has a defined quantifiable indicator or indicators that can be analysed to demonstrate progress in each reporting period. We would encourage these to be geared towards air quality indicators where possible.

For example, progress with the measures aimed at reducing traffic flows in the AQMA should be reported in terms of traffic counts or altered fleet mix. By including a column in the table in Appendix F of measures headed "Progress Indicator" we assume BNESC are minded to use this as an indicator of progress. Ultimately the indicator of progress chosen by BNESC should be explicitly stated in the table.

AP3-082 Bath & North East Somerset Council

A summary of possible indicators are shown in the textual descriptions in the main body of the AQAP. Although this welcomed, BNESC should be specific with regards to the chosen indicators in the final AQAP.

Other indicators may be more suitable to measures such as awareness raising or behavioural change, and could include indicators like % of employees participating in workplace or schools travel plans, or public transport patronage. We recommend that the Council consult the National Society of Clean Air (now Environmental Protection UK) guidance on setting indicators. Further advice can be sought from the action planning helpdesk.

Many local authorities use NO_2 concentration in their areas as the overall indicator of successful air quality management. We welcome the use of this indicator and would look forward to thorough discussion of the relationship between monitoring data and the impact AQAP measures have on air quality in future Review and Assessment, and Progress Reports. However, the use of NO_2 concentration in combination with surrogate indicators would provide additional evidence that the Council is meeting its statutory requirement to "work towards" meeting the relevant objective.

The Council should also consider how often it intends to monitor against the chosen indicators, how this data will be reported, and what it intends to do should progress not be as successful as planned.

Essentially, indicators should be chosen that allow the emission and air quality impacts of the measures to be quantified wherever possible. Options should be presented in tabular format with an additional column added outlining the indicator that has been selected for each measure. See Box 4.3 of LAQM TG (09) which shown an example of the expected tabular format.

Targets for actions

We advise that targets should be set for key indicators. The target would indicate how far the actions are intended to be implemented. Targets will indicate a) the potential air quality benefits of the actions (where the quantified targets and indicators can be used in an emissions or air quality assessment) and b) when the action is due to be completed.

Conclusions

BNESC should be commended on the progress made to date. This report is well structured and contains a large amount of relevant information although implementing the suggestions provided in this appraisal will make any future revisions of the AQAP more robust. BNESC is advised to act on the comments above in order to present future revised AQAPs and Progress Reports that show, in a transparent manner, progress made with striving to achieve the relevant air quality objectives.

The overall purpose of an action plan is to detail the actions that will be implemented, detail the indicators that will be monitored to follow progress and to set out targets for these indicators along with an assessment of the overall air quality benefits that would accrue from implementation and whether this is sufficient to achieve the air quality objectives.

Contact details for further enquiries

Issues can be followed up through the Air Quality Action Plan helpdesk as follows:

Action Planning Helpdesk telephone: 0870 190 6050

Action Planning Helpdesk email: lasupport@aeat.co.uk

Action Planning Web-site: www.airquality.co.uk/archive/actionplan.php

APPENDIX E
Norwich TRC

Traffic Regulation Condition

Traffic Regulation Condition to be attached to the PSV operator licences of all operators currently operating or wishing to operate local bus services registered under the Transport Act 1985 where the registered route of the service includes Castle Meadow, Norwich, except for services meeting one of the following criteria.

1. Local bus services with less than five departures per week from Castle Meadow

As from 1 April 2008, 40 per cent of the vehicles used on local bus services operating in Castle Meadow, Norwich and with both registered terminal points within the area defined in Figure 1 will be required to comply with the Euro III (or equivalent) or higher exhaust emission standard.

As from 1 April 2008, 20 per cent of the vehicles used on local bus services operating in Castle Meadow, Norwich and with a registered terminal point outside the area defined in Figure 1 will be required to comply with the Euro III (or equivalent) or higher exhaust emission standard.

As from 1 April 2009, 70 per cent of the vehicles used on local bus services operating in Castle Meadow, Norwich and with both registered terminal points within the area defined in Figure 1 will be required to comply with the Euro III (or equivalent) or higher exhaust emission standard.

As from 1 April 2009, 35 per cent of the vehicles used on local bus services operating in Castle Meadow, Norwich and with a registered terminal point outside the area defined in Figure 1 will be required to comply with the Euro III (or equivalent) or higher exhaust emission standard.

As from 1 April 2010, all vehicles used on local bus services operating in Castle Meadow, Norwich and with both registered terminal points within the area defined in Figure 1 will be required to comply with the Euro III (or equivalent) or higher exhaust emission standard.

As from 1 April 2010, 50 per cent of the vehicles used on local bus services operating in Castle Meadow, Norwich and with a registered terminal point outside the area defined in Figure 1 will be required to comply with the Euro III (or equivalent) or higher exhaust emission standard.

In order to monitor compliance with this Condition, as from 1 April 2008 PSV operators must supply details of the emissions capability as defined by the equivalent Euro exhaust emissions standards of each vehicle within their bus fleet used on local bus services operating in Castle Meadow to the Director of Planning and Transportation, Norfolk County Council. Updated information is to be supplied to the Council at six monthly intervals for receipt by 31 March and 30 September each year.

New Restrictions for Bath's Tour Buses

On 3rd July 2006 the Government's Senior Traffic Commissioner announced that restrictions will be imposed on the operation of tour buses in Bath, as requested by Bath & North East Somerset Council.

The announcement followed the Public Inquiry that was held at the Lansdown Grove Hotel in Bath on 15 and 16 May 2006. Having received all the written evidence and heard verbal representations at the Public Inquiry, the Traffic Commissioner decided that from 31 July 2006, all tour bus services in Bath are subject to the following restrictions:

80 per cent of all tour buses must meet the EURO III, low exhaust emission standard (rising to 100 per cent from 1 April 2008).

Loud speakers are banned - only hand sets or headphones can be used.

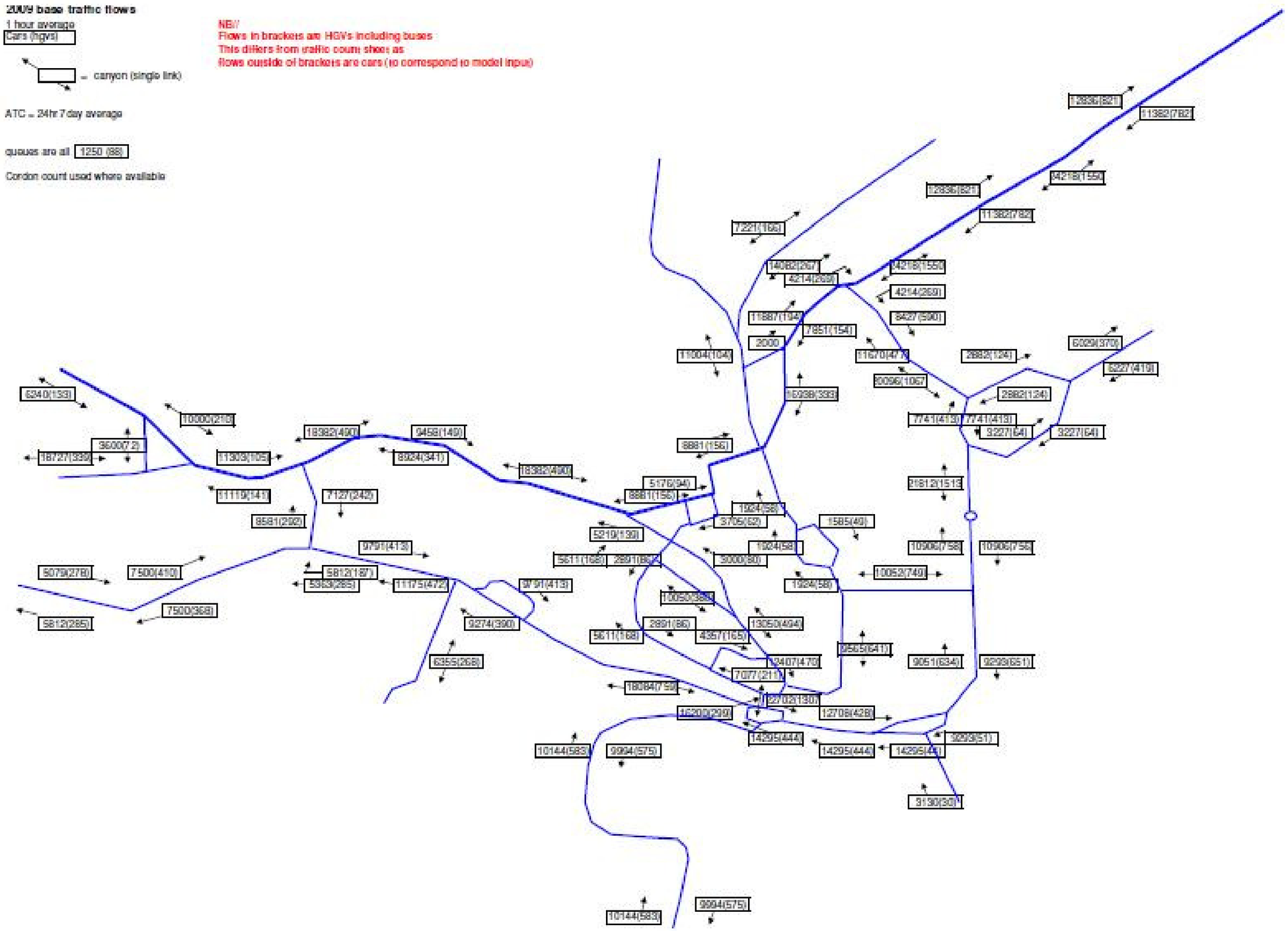
No more than 10 tour buses will be in operation at only one time, excluding duplicate vehicles.*

Only specified bus stops can be used by tour buses and waiting times at these stops will be restricted.

Only two routes can be used by tour buses; one route around the historic city centre, the other route via North Road and Prior Park.

* Duplicate Vehicles - Traffic Regulation Condition 2 limits the maximum number of tour buses in operation at any one time to 10 buses, excluding duplicate vehicles. In order to cater for passenger demand arising from block advance bookings for tours mainly from customers based in London arriving in Bath by train, a concession has been made to allow tour bus operators to operate duplicate vehicles. However duplicate vehicles can only be used on occasions where the passenger demand cannot be met within the capacity of the 10 buses.

APPENDIX F - Traffic flows



APPENDIX G – Details of Dispersion Modelling and Verification

ADMS-Urban has been used to confirm the area of the AQMA, source apportionment work and will also be used to test the actions detailed in the Action Plan.

The model has been set up with a network of road traffic sources covering the main routes with Bath city centre. Traffic count data from both automatic counts and 12-hour manual counts have been used. The 12 hour counts have been scaled up using a factor from the nearest appropriate automatic counter. Diurnal profiles were also applied to the model with specific links to represent queuing traffic. Appropriate speeds have been applied to the links calculated from a journey time survey.

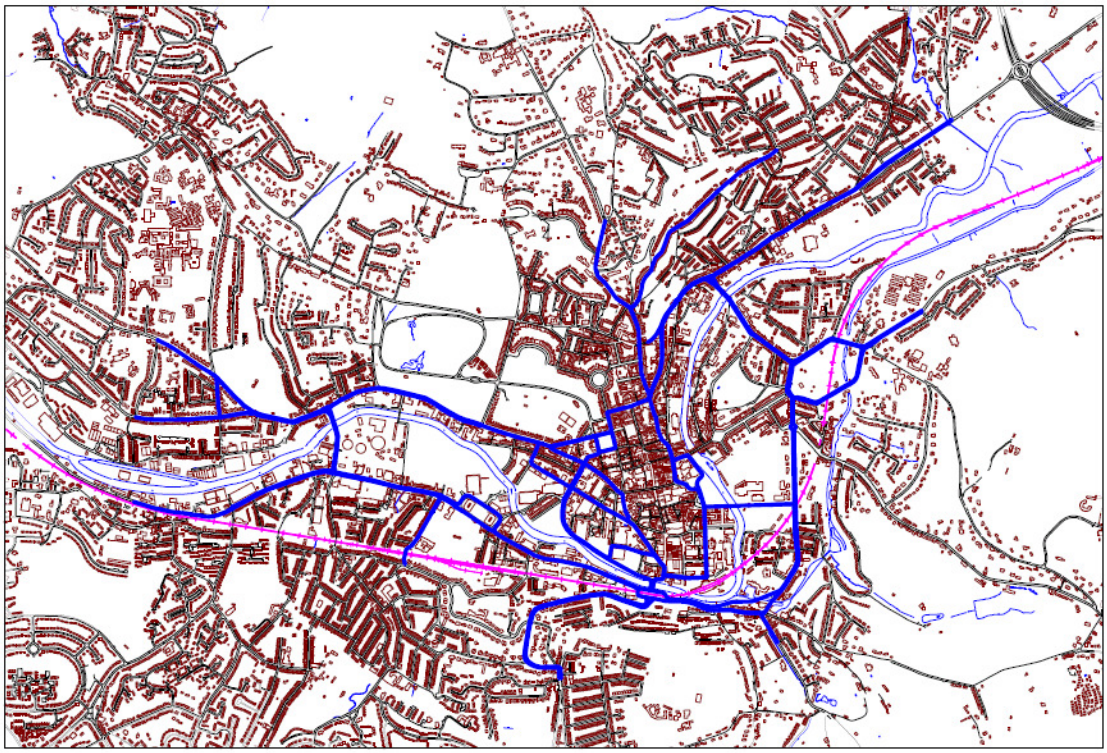


Figure J1: Map showing Road Links input into ADMS-Urban

Meteorological data was taken from RAF Lyneham as one of the closest meteorological stations with appropriate parameters. Background data was taken from the background maps. The model was run using the GRS chemistry model to model NO_2 at a number of diffusion tube and continuous monitoring locations. The model was found to not perform well so road contribution NO_x was modelled without chemistry and NO_2 calculated using the DEFRA spreadsheet tool.

The model was set up using 2009 as a baseline. The model was verified using 2009 monitoring data. Table J1 below shows the results compared to monitoring data.

Receptor name	Site type	Loc	X(m)	Y(m)	Z(m)	Model Roads	Monitor	Road NO_x from Monitor
						NO_2	**NO_2**	
Guildhall	Cont	Road	375111	164857	0.5	32.35	41	69.57
London Road	Cont	Road	375461	165843	3	48.19	63	150.16
Hungerford Road	DT	UC	373361	165216	3	4.58	23	22.49
St Mark`s Road	DT	UC	375189	164221	3	7.58	26	29.41
Daniel Street	DT	UC	375544	165331	2	10.56	29	36.66
Windsor Bridge DT	DT	Road	373426	165107	2	26.66	40	66.55
Charlotte Street	DT	Road	374622	164994	2	31.87	45	82.18
Gay Street	DT	Road	374791	165038	2	32.72	45	82.18
Fountains Buildings	DT	UC	375005	165290	3	18.98	33	46.88
Bathwick Street	DT	Road	375602	165365	2	66.10	56	121.6
Alexandra Park	DT	UB	375104	163991	2	2.83	17	9.5
Thomas Street	DT	UC	375318	165812	2	26.52	41	69.57
Lower Bristol Road	DT	Road	373833	164799	3	15.64	42	72.64
Warminster Road	DT	Road	376062	165495	3	11.65	38	60.68
Lansdown Crescent	DT	Road	374785	165704	4	14.11	45	82.18
Beckford Road	DT	Road	375732	165416	4	30.85	51	102.82
Paragon	DT	Road	375040	165515	2	57.52	57	125.53
Argyle Terrace	DT	Road	373211	164743	3	18.20	52	106.46
Cleveland Place West	DT	Road	375251	165718	4	34.17	59	133.54
Morley Terrace	DT	Road	373484	164843	2	23.46	51	102.82
Newbridge Road	DT	Road	373092	165106	2	21.11	41	69.57
Wells Road bottom	DT	Road	374794	164310	3	28.09	54	113.92
Wells Road/Upper Old	DT	Road	374454	164202	3	25.64	42	72.64
Widcombe High Street	DT	Road	375422	164227	3	34.86	51	102.82
Newbridge Hill	DT	Road	373106	165200	2	16.58	38	60.68
Upper Bristol Road	DT	Road	373993	165174	3	7.95	41	69.57
Widcombe School	DT	Road	375634	164406	3	20.98	35	52.26
Camden Road	DT	Road	375300	166112	3	6.79	34	49.54
James St West	DT	Road	374697	164763	4	19.36	48	92.24

Table J1: Model results compared to monitoring data.
[DT = Diffusion tube, UC = Urban Centre, UB = Urban Background]

The following table J2 shows the adjustments made to the model.

Receptor name	Model Roads	Road NO_x Monitor	Ratio Mon road /Model Road	Adjusted Road NO_x	Model NO_2	Road NO_2	Monitor	% Diff
	NO_x	NO_x	NO_x	**Fact 2.8395**	**Empirical**		**NO_2**	
Guildhall	32.35	69.57	2.151	108.95	47.9	35.6	41	16.8
London Road	48.19	150.16	3.116	153.94	59.8	47.5	63	-5.1
Hungerford Road	4.58	22.49	4.908	30.11	18.7	6.4	23	-18.8
St Mark`s Road	7.58	29.41	3.881	38.62	22.6	10.3	26	-13.2
Daniel Street	10.56	36.66	3.472	47.08	26.2	13.9	29	-9.5
Windsor Bridge DT	26.66	66.55	2.496	92.81	43.0	30.7	40	7.4
Charlotte Street	31.87	82.18	2.579	107.58	47.5	35.2	45	5.5
Gay Street	32.72	82.18	2.512	110.00	48.2	35.9	45	7.1
Fountains Buildings	18.98	46.88	2.470	70.99	35.6	23.3	33	7.8
Bathwick Street	66.10	121.6	1.840	204.79	71.5	59.2	56	27.6

Alexandra Park	2.83	9.5	3.354	25.14	16.3	4.0	17	-4.2
Thomas Street	26.52	69.57	2.623	92.41	42.9	30.6	41	4.5
Lower Bristol Road	15.64	72.64	4.645	61.51	32.1	19.8	42	-23.7
Warminster Road	11.65	60.68	5.206	50.19	27.5	15.2	38	-27.5
Lansdown Crescent	14.11	82.18	5.826	57.15	30.4	18.1	45	-32.5
Beckford Road	30.85	102.82	3.333	104.70	46.6	34.3	51	-8.6
Paragon	57.52	125.53	2.183	180.42	66.0	53.7	57	15.9
Argyle Terrace	18.20	106.46	5.849	68.79	34.8	22.5	52	-33.1
Cleveland Place West	34.17	133.54	3.908	114.13	49.4	37.1	59	-16.3
Morley Terrace	23.46	102.82	4.383	83.70	40.0	27.7	51	-21.5
Newbridge Road	21.11	69.57	3.295	77.05	37.7	25.4	41	-8.0
Wells Road bottom	28.09	113.92	4.055	96.87	44.3	33.0	54	-18.1
Wells Road/Upper Old	25.64	72.64	2.833	89.89	42.1	29.8	42	0.1
Widcombe High Street	34.86	102.82	2.949	116.09	49.9	37.6	51	-2.1
Newbridge Hill	16.58	60.68	3.659	64.19	33.1	20.8	38	-12.9
Upper Bristol Road	7.95	69.57	8.748	39.68	23.0	10.7	41	-43.8
Widcombe School	20.98	52.26	2.492	76.66	37.6	25.3	35	7.5
Camden Road	6.79	49.54	7.293	36.39	21.6	9.3	34	-36.6
James St West	19.36	92.24	4.766	72.06	36.0	23.7	48	-25.0

Table J2: model adjustments.

Model verification was carried out by:

1. Modelled Road NO_x contribution
2. Calculate Monitored Road NO_x contribution using spreadsheet tool. (Background NO_x was taken as 17.1 µg/m^3, Background NO_2 12.3 µg/m^3 taken from urban background maps for Bath, averaged over the modelled area)
3. Adjustment factor calculated from plot (Figure J2). The ratio of modelled road NO_x to monitored road NO_x was calculated.
4. Adjustment factor applied to Road NO_x contributions (Table J2 and Figure J3).
5. Total NO_2 concentrations calculated from the adjusted Road NO_x concentrations using spreadsheet tool, using background as 2 (Table J2).
6. Final plots of NO_2 concentrations to confirm verification (Figure J4 and Table J3).

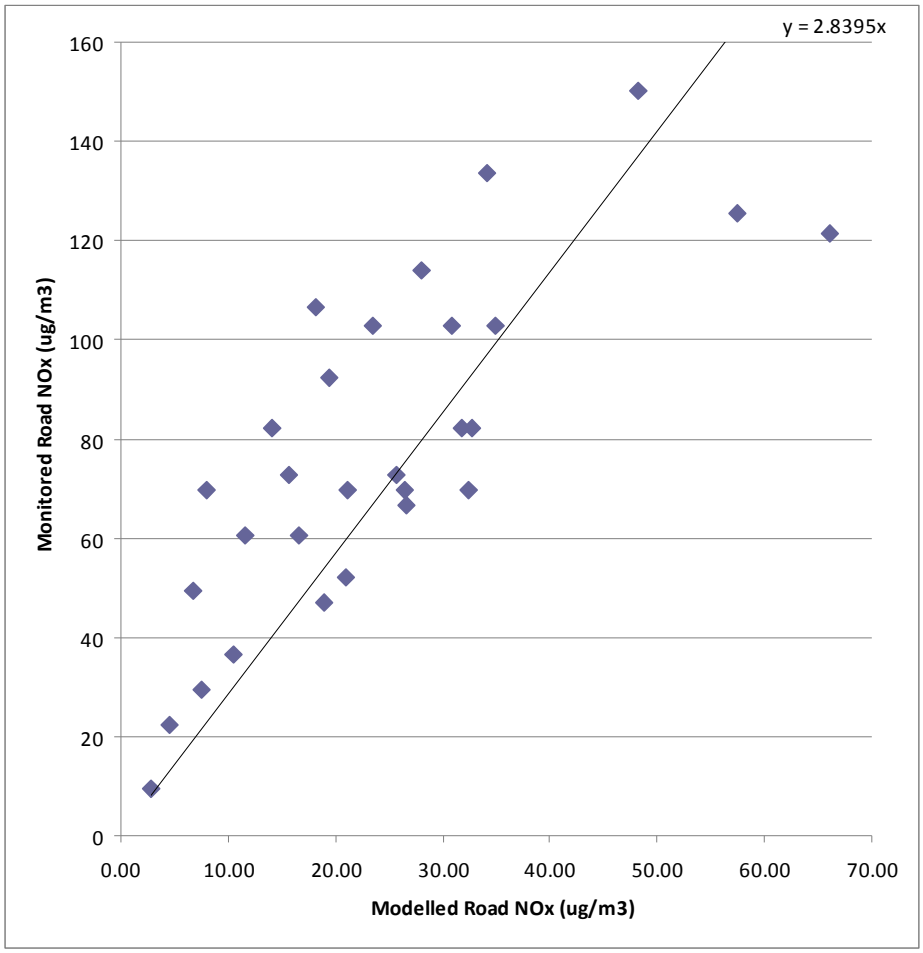


Figure J2: Annual Average Road NO_x

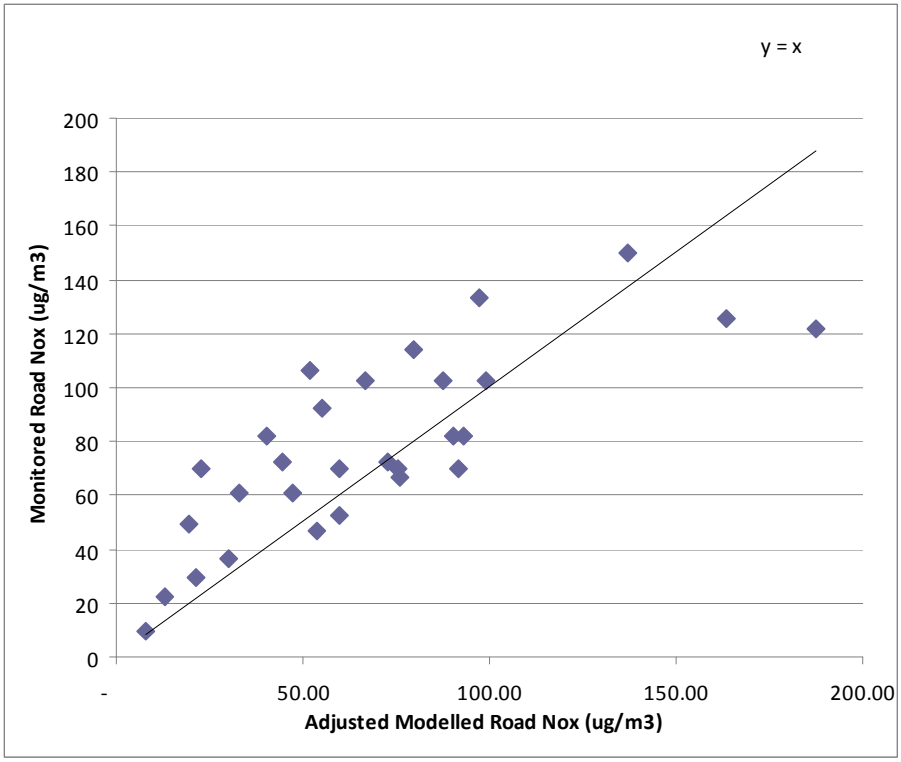


Figure J3: Annual Average Adjusted Road NO_x

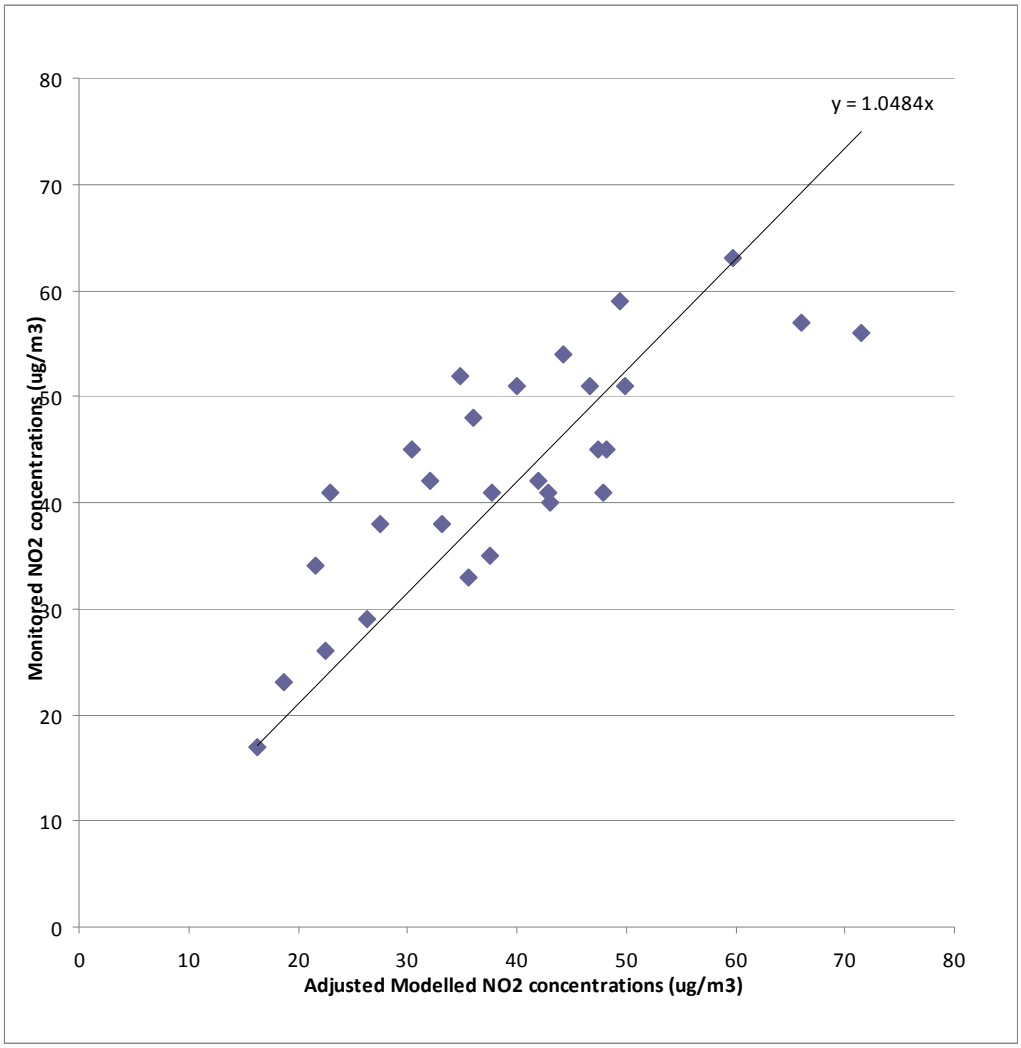


Figure J4: Annual Average Adjusted Total NO_2

Within +10%	7
Within -10%	6
Within +-10%	**13**
Within +10 to 25%	2
Within -10 to 25%	6
Within +-10 to 25%	**8**
Over +25%	1
Over -25%	6
Greater +-25%	**7**
Within +-25%	**21**

Table J3: Summary table Adjusted NO_2