
Bath & North East
Somerset Council

Public Protection and Health Improvement Services

Air Quality Action Plans for Keynsham and Saltford

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

2016



Pollution Prevention through Control

Keynsham and Saltford

Air Quality Action Plans 2016

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Report Reference number	DK&SAQAP0516
Date	May 2016

Executive Summary

This Air Quality Action Plan (AQAP) has been produced as part of our statutory duties required by the Local Air Quality Management framework. It outlines the actions recommended to improve air quality in the Keynsham and Saltford areas of Bath and North East Somerset between 2016 and 2021.

Air pollution is associated with a number of adverse health impacts. It is recognised as a contributing factor in the onset of heart disease and cancer. Additionally, air pollution particularly affects the most vulnerable in society; children and older people, and those with heart and lung conditions. There is also often a strong correlation with equalities issues, because areas with poor air quality are also often the less affluent areas^{1,2}.

The annual health cost to society of the impacts of particulate matter alone in the UK is estimated to be around £16 billion³. Bath and North East Somerset is committed to reducing the exposure of people in Bath and North East Somerset to poor air quality in order to improve health.

We have developed actions that can be considered under the following broad topics:

- Alternatives to private vehicle use
- Policy guidance and development control
- Promoting low emission transport
- Promoting travel alternatives
- Public information
- Transport planning and infrastructure
- Traffic management
- Vehicle fleet efficiency

In this AQAP we outline how we propose to effectively tackle air quality issues within our control. However, we recognise that there are a large number of air quality policy areas that are outside of our influence (such as vehicle emissions standards agreed in Europe), but for which we may have useful evidence, and so we will continue to work with regional and central government on policies and issues beyond Bath and North East Somerset's direct influence.

RESPONSIBILITIES AND COMMITMENT

This AQAP was prepared by a team of officers consisting of representatives from Environmental Monitoring, Public Health, Transportation Planning, Development Control, Sustainability of Bath and North East Somerset Council with the support and agreement of the following officers and departments:

Drop in sessions with officers
Questionnaires distributed directly to households along major roads
On line consultation

¹ Environmental equity, air quality, socioeconomic status and respiratory health, 2010

² Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006

³ Defra. Abatement cost guidance for valuing changes in air quality, May 2013

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Secretary of State
Environment Agency
Highways authority
Neighbouring local authorities
Transition Keynsham
Community Transport Networking Group
Keynsham In Bloom
Saltford In Bloom
Old Vicarage Green Residents Association
Lions Club of Keynsham
Chamber of Commerce for Keynsham
Keynsham and District Dial a Ride
Manor Park Woodland group
Abbotts Wood group
B&NES Health and Wellbeing Board
Saltford Business Association
Residents Association
Bus operators
Sirona Care and Health
South Gloucestershire Council

This AQAP has been approved by:

Cllr Martin Veal - Cabinet Member for Community Services

Cllr Anthony Clarke - Cabinet Member for Transport

Communities, Transport and Environment Policy Development and Scrutiny Panel

Keynsham and Saltford each have Air Quality Management Areas (AQMAs) where air pollution levels exceed the governments' objective limit.

The AQMA of Keynsham and Saltford were declared on the basis of annual average nitrogen dioxide concentrations exceeding 40 micrograms per cubic metre [$\mu\text{g}/\text{m}^3$]. In 2013 the annual average level of NO₂ on Keynsham High Street was 44 $\mu\text{g}/\text{m}^3$ and 44 $\mu\text{g}/\text{m}^3$ at The Crown in Saltford.

Nitrogen oxides (NO_x) analysers (providing measurements of NO_x and NO₂ data every 15 minutes) were located in Keynsham High Street and at Saltford News temporarily for a year in order to supplement the on-going monitoring using NO₂ diffusion tubes located at 10 locations in Keynsham and 3 locations in Saltford (6 in 2012).

Bath and North East Somerset Council is legally required to review air quality and designate air quality management areas if improvements are necessary under Part IV of the Environment Act 1995 and the Air Quality Management regulations. Where an air quality management area is designated, an air quality action plan describing the pollution reduction measures must then be put in place in pursuit of the achievement of the Air Quality Strategy and Objectives in the designated area.

The draft Transport Strategy 'Developing a Strategy for Keynsham' states as one of its objectives: 'Improving air quality and reducing vehicle carbon emissions'.

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The aims of the action plans also tie in with the Fit For Life agenda – it's aims including: *'Creating an environment where people actively choose to walk and cycle as part of everyday life'*.

There are an estimated 156 people living within the Keynsham AQMA and 48 living in the Saltford AQMA respectively.

In Keynsham, background NO₂ accounts for 41% of the monitored concentration. This means that 59% of the concentrations can be influenced by measures that reduce emissions in the AQMA.

Keynsham High Street has a different composition of vehicle types compared to the AQMA on the A4 in Saltford and the AQMA in Bath. The majority of vehicles on Keynsham High Street are cars at 93.4%. The second largest proportion of vehicles is Light Goods Vehicles at 4.4%. Motorcycles represent 1.4%. Buses, coaches and lorries only represent a combined total 1.6%

Diesel cars are contributing over 60% to road NO_x in Keynsham whilst constituting an estimated 40% of cars. Petrol cars only contribute about 15% of NO_x emissions, despite constituting an estimated 60% of cars.

The majority of vehicles on the A4 in Saltford are cars at 86.8%. The second largest proportion of vehicles is Light Goods Vehicles at 8%. Of the 5.1% constituted by heavy duty vehicles, 2.8% are rigid HGVs, 1.2% are articulated HGVs and buses and coaches made 1.1% of all traffic.

In Saltford, diesel cars constitute approximately 40% of NO_x emissions, whereas petrol cars only constitute approximately 11%. Cars provide more than 50% of NO_x emissions, but unlike Keynsham, HGVs and buses contribute a higher proportion emitting 27.7% and 8.8% respectively.

Although NO_x emissions overall have been declining as a result of improved engine technology, primary NO₂ emissions have increased due to technology designed to lower the emissions of particles.

In areas where the national air quality objectives are exceeded, there needs to be a reduction of between 17 and 21% in emissions of nitrogen oxides in order to meet the objectives across the Air Quality Management Areas.

A detailed list of potential actions for Keynsham and Saltford were provided for consultees to comment upon. A questionnaire was available to fill in on the Council's website, and hard copies were available on request. The questionnaire listed a number of measures that were anticipated to be the most deliverable and invited comments and suggestions for the final version of the document.

Three informal 'drop-in' consultation events were held where there were displays, technical information and the opportunity for members of the public to provide feedback on the potential measures. The first of these sessions took place at Key Centre on the 15th September between 2pm and 8pm for the Keynsham Action Plan and for the Saltford Action Plan on 14th October at Saltford Village Hall.

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The Air Quality Action Plans will be published following approval by the Cabinet Member for Transport in mid-2016.

This AQAP will be subject to an annual review and appraisal of progress. Progress each year will be reported in the Annual Status Reports (ASRs) produced by Bath and North East Somerset Council, as part of our statutory Local Air Quality Management duties.

If you have any comments on this AQAP please send them to Mr R Spalding or Dr N Courthold at:

Address: Environmental Monitoring Team, Lewis House, Manvers Street, Bath, BA1 1JG

Email: [environmental_monitoring @bathnes.gov.uk](mailto:environmental_monitoring@bathnes.gov.uk)

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1 Introduction

This report outlines the actions that Bath & North East Somerset Council recommend are delivered in Keynsham and Saltford between 2016-2021 in order to reduce concentrations of air pollutants and exposure to air pollution; thereby positively impacting on the health and quality of life of residents and visitors to the local authority's area.

It has been developed in recognition of the legal requirement on the local authority to work towards Air Quality Strategy (AQS) objectives under Part IV of the Environment Act 1995 and relevant regulations made under that part and to meet the requirements of the Local Air Quality Management (LAQM) statutory process.

This Plan will be reviewed every five years and progress on measures set out within this Plan will be reported on annually within Bath & North East Somerset's air quality Annual Status Report (ASR).

THE ISSUE

The Air Quality Management Areas (AQMA) of Keynsham and Saltford were declared on the basis of an exceedance of the national objective limit for annual average nitrogen dioxide (40 micrograms per cubic metre [$\mu\text{g}/\text{m}^3$]). In 2014 the annual average level of NO_2 on Keynsham High Street was $50\mu\text{g}/\text{m}^3$ and $50\mu\text{g}/\text{m}^3$ at The Crown in Saltford.

Particulate Matter (PM_{10} & $\text{PM}_{2.5}$) has not been considered implicitly as part of the action plan as the AQMAs have only been declared for NO_2 . PM_{10} was not measured in either location because measurements in Bath, where pollution levels are generally higher, were substantially below the objective limit for PM_{10} . However, many of the measures considered for reducing NO_2 will also reduce PM_{10} and $\text{PM}_{2.5}$.

MONITORING

Nitrogen oxides (NO_x) analysers (providing measurements of NO_x and NO_2 data every 15 minutes) were located in Keynsham High Street and at Saltford News temporarily for a year in order to supplement the on-going monitoring using NO_2 diffusion tubes located at 10 locations in Keynsham and 3 locations in Saltford (6 in 2012).

HEALTH EFFECTS OF AIR POLLUTION

Air pollution is a factor in an estimated 40,000 early deaths in the UK each year from NO_2 and $\text{PM}_{2.5}$ exposure (Royal College of Physicians 'Every breath you take: the lifelong impact of air pollution', February 2016).

A report by the Cabinet Office estimates that the wider cost of air pollution from transport (in urban areas) alone is between £4.5 and £10.6 billion per annum. The impact of poor air quality on health is unequal with greater effects on unborn and very young children, older people, those with pre-existing heart and lung disease, smokers, the most economically deprived, and those exposed to relatively high levels of pollution due to

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where they live. Rather than being a single cause of death, air pollution is a factor which can exacerbate underlying health problems including respiratory illnesses like asthma, Chronic Obstructive Pulmonary Disease (COPD), as well as cardiovascular conditions.

NO₂

In the short term, NO₂ can affect pulmonary function and increase allergic inflammatory reactions. Long term exposure can reduce lung function and increase the probability of respiratory symptoms. NO₂ can irritate the lungs and inflame airways, increasing symptoms of those suffering from lung diseases and lowering resistance to respiratory infections such as influenza.

The World Health Organisation (WHO) 'Review of evidence on health aspects of air pollution – Technical Report' states:

'Many studies....have documented associations between day-to-day variations in NO₂ concentration and variations in mortality, hospital admissions and respiratory symptoms. Also, more studies have now been published showing associations between long-term exposure to NO₂ and mortality and morbidity.'

'Some epidemiological studies do suggest associations of long-term NO₂ exposures with respiratory and cardiovascular mortality and with children's respiratory symptoms and lung function'

LEGAL REQUIREMENT

Bath and North East Somerset Council is legally required to review air quality and designate air quality management areas if improvements are necessary under Part IV of the Environment Act 1995 and the Air Quality Management regulations. Where an air quality management area is designated, an air quality action plan describing the pollution reduction measures must then be put in place in pursuit of the achievement of the Air Quality Strategy and Objectives in the designated area. The Local Air Quality Management Policy Guidance (PG16) states that:

'Local authorities must consult on their preparation of an Air Quality Action Plan and should be done in accordance with the Cabinet Office 'Consultation Principles'.'

COUNCIL POLICY CONTEXT

The draft Transport Strategy 'Developing a Strategy for Keynsham' states as one of its objectives: 'Improving air quality and reducing vehicle carbon emissions'. It also lists air quality among the specific Key Performance Indicators.

Air quality is listed in the Core Strategy under Policy KE2 as one of the Placemaking Principles: *'Improve air quality in the town centre as part of the Air Quality Management Area.'* Air Quality is also detailed in paragraph 6.101: *'The reduction of the adverse effects of transport on climate change and air quality, particularly in Air Quality Management Areas (AQMA) in Bath and Keynsham and in future AQMAs, will be managed in accordance with the NPPF.'*

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MATERIAL CONSIDERATION

DEFRA states on its Local Air Quality Management web page that '*air quality may be a material consideration where a development would give rise to emissions or increase traffic to such an extent that it would be likely to result in the need to designate an AQMA, or where it would conflict with any proposals in a local Air Quality Action Plan.*'

2 Summary of Current Air Quality levels in Keynsham and Saltford

2.1 Air quality management areas

KEYNSHAM

A detailed assessment in 2008 indicated that an AQMA was required along Keynsham High Street. The area shown in Figure 2.1 was declared in 2010 following public consultation in July 2010. The monitoring showed that the concentrations exceeded the annual mean NO₂ objective at some locations and a detailed assessment was required. The Detailed Assessment (available on the Council's website <http://www.bathnes.gov.uk/services/environment/pollution/air-quality/reports>) for Keynsham indicated that an AQMA was required for annual average NO₂. Following public consultation an AQMA was declared in July 2010.

Population within AQMA

To estimate the population within the AQMA the residential properties within the AQMA were counted. This was then multiplied by the average number of people per household within the Keynsham North and South wards taken from Census 2011 data (9).

Number of residential properties whose façade is within the AQMA	71
Average number of people per household in Keynsham	2.2
Estimated Total population within the AQMA	156

Table 2.1: Population within the Keynsham AQMA

There are also a large number of shops and offices (including the Civic Centre) within or adjacent to the AQMA. These are not considered in Table 2.1, but will also benefit from any improvements in air quality.

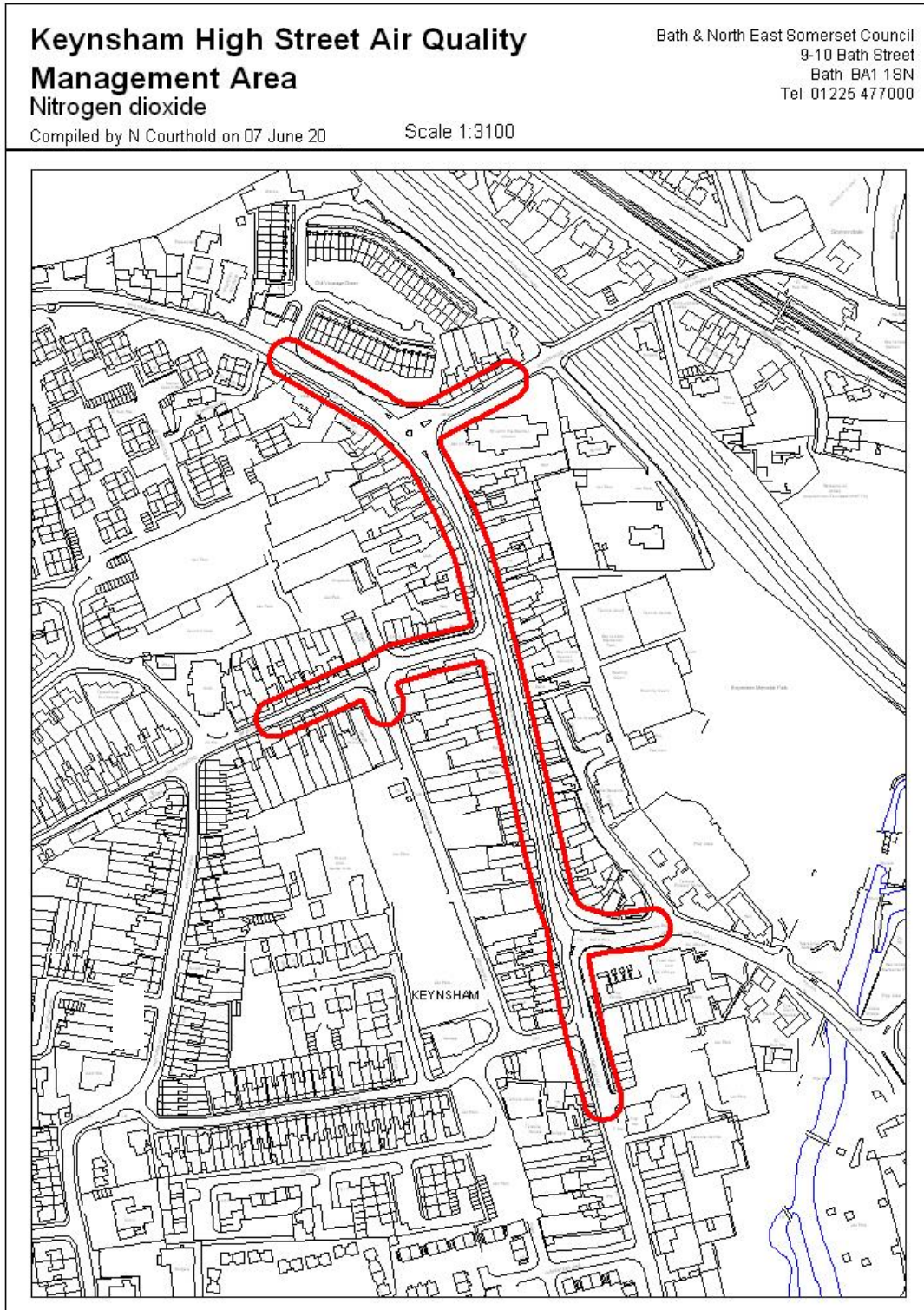


Figure 2.1 Map showing AQMA in Keynsham

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SALTFORD

Following a request from Saltford Parish Council, further nitrogen dioxide diffusion tube monitoring was installed to supplement the existing monitoring site outside the library on the side of the A4 in Saltford. The monitoring showed that the concentrations exceeded the annual mean NO₂ objective at some locations and a detailed assessment was required. The Detailed Assessment (available on the Council's website <http://www.bathnes.gov.uk/services/environment/pollution/air-quality/reports>) for Saltford indicated that an AQMA was required along the A4 for annual average NO₂. Following public consultation an AQMA was declared in July 2013 (Figure 2.2).

Population within AQMA

To estimate the population within the AQMA, the residential properties within the AQMA were counted. This was then multiplied by the average number of people per household within the Saltford ward taken from Census 2011 data(ref).

Number of properties whose façade is within the AQMA	20
Average number of people per household in Saltford	2.4
Estimated Total population within the AQMA	48

Table 2.2: Population within the Saltford AQMA.

There are also a number of businesses adjacent to the AQMA. These are not considered in Table 2.2, but will also benefit from any improvements in air quality.

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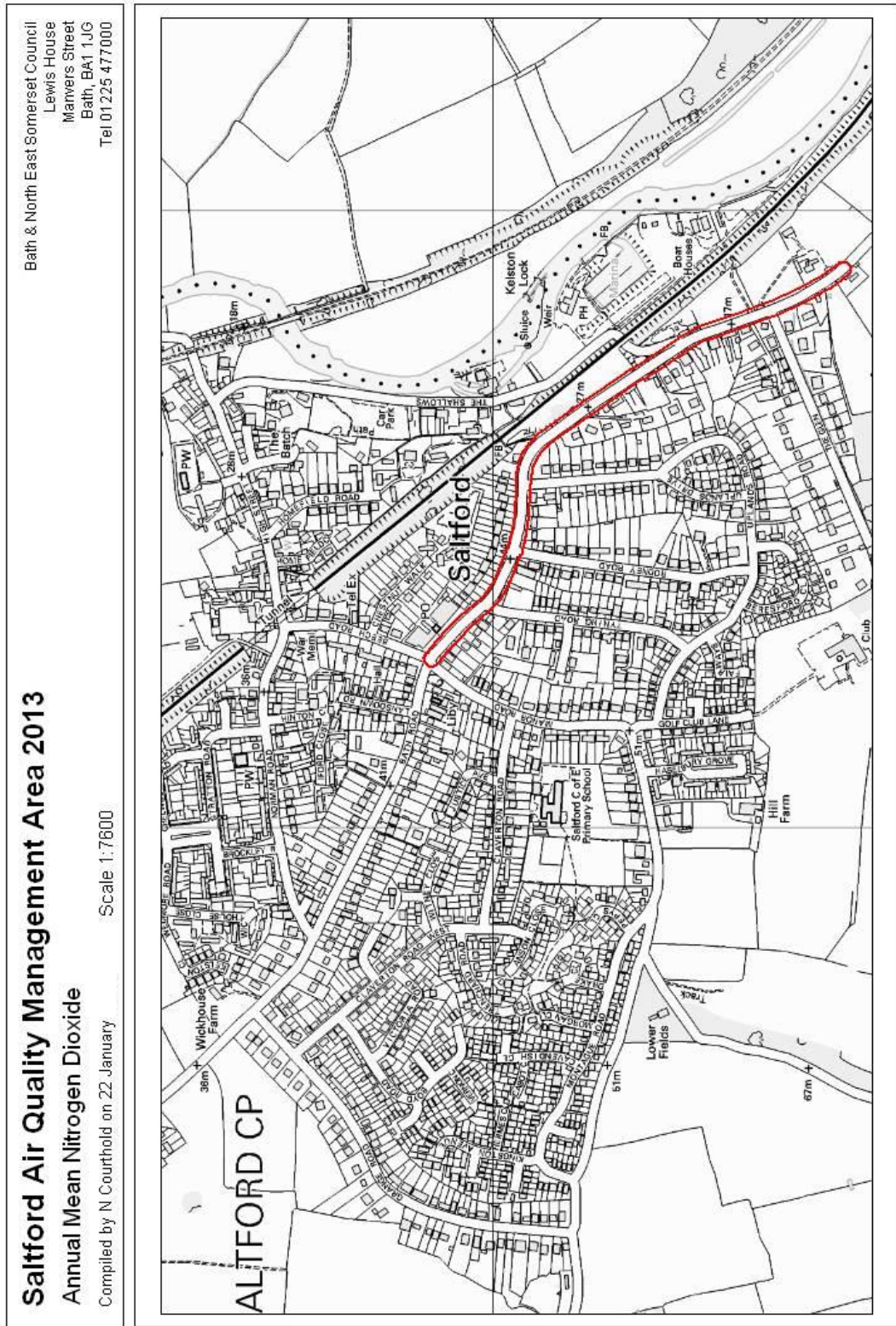


Figure 2.2: Map showing AQMA in Saltford

2.2 Monitoring

KEYNSHAM

Automatic Monitoring

Monitoring of NO_x (nitric oxide (NO) and NO₂) was carried out using an analyser located for a 9 month year period (August 2010-June 2011) at number 62 High Street, Keynsham adjacent to the Bath Hill mini-roundabout. The automatic NO₂ monitor is a PC-sized box of hardware with an air intake, contained in roadside enclosures or buildings by the roadside. The results of the automatic monitoring of nitrogen dioxide are detailed below in table 2.3:

Location	Within AQMA?	Data Capture Aug 2010-June 2011 (%)	Annual mean concentrations (µg/m ³)	
			2010	2011
Keynsham	Y	95	51	45

Table 2.3: Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with Annual Mean Objective of 40µg/m³.

The data capture in Keynsham between August 2010 and June 2011 was 95% with annual mean concentrations of nitrogen dioxide of 51 µg/m³ and there were 2 exceedances of the hourly mean objective (200µg/m³).

Location	Within AQMA?	Data Capture Aug 2010-June 2011 (%)	Number of exceedances of hourly mean (200 µg/m ³)	
			2010	2011
Keynsham	Y	95	0 (171)	0 (165)

Table 2.4: Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with 1-hour Mean Objective (maximum of 18 exceedances permitted)

Non-automatic monitoring

The non-automatic monitoring is carried out using 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 analysed for NO₂ concentration, giving an average reading for the period.

Figure 2.3 below shows the diffusion tube and automatic monitoring locations. Details of the monitoring sites are given in Appendix B. The diffusion tube monitoring is corrected for bias factor, details of the factor used are and detailed analysis methods are given in Appendix B.

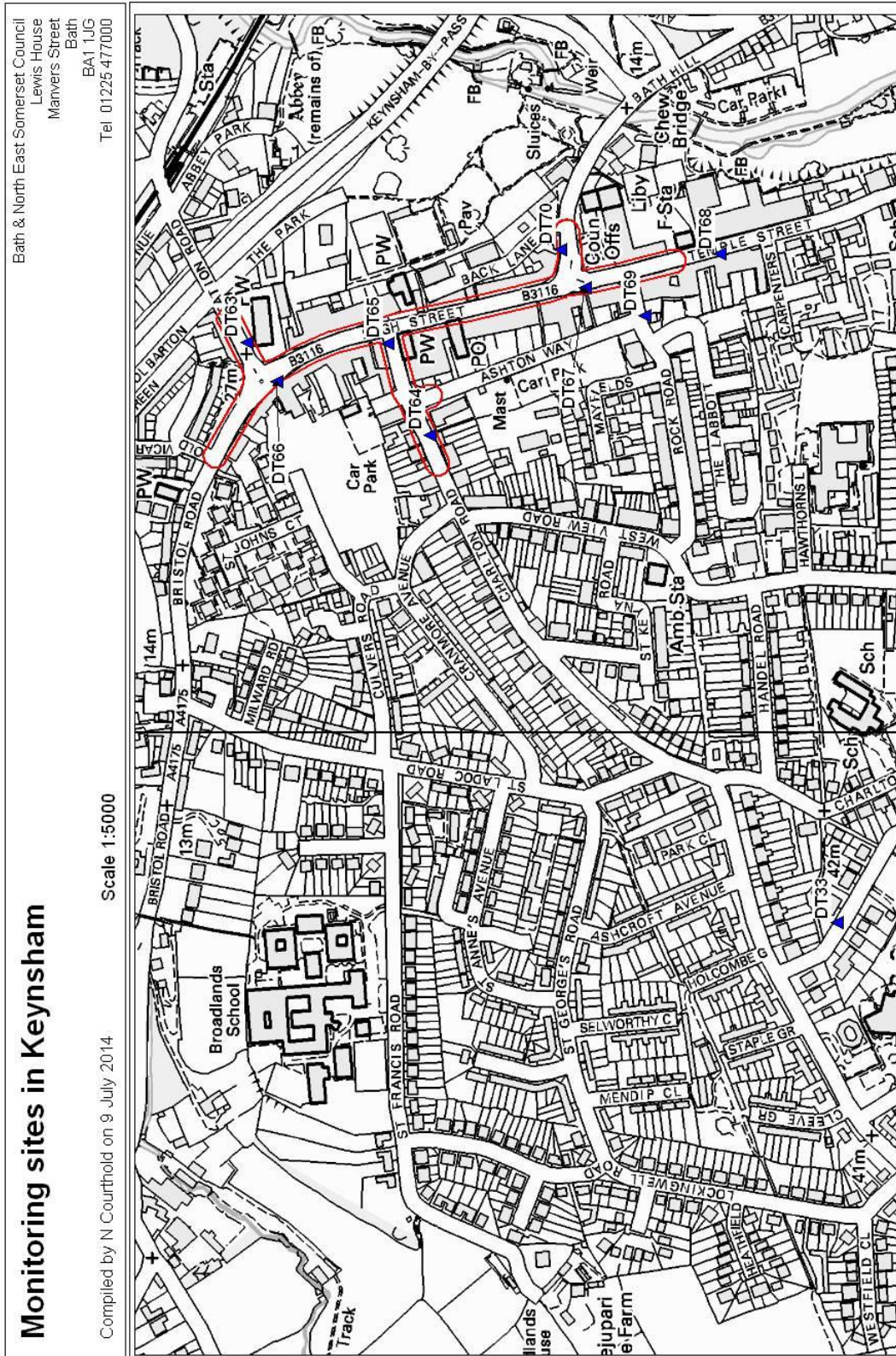


Figure 2.3 Monitoring Sites in Keynsham.

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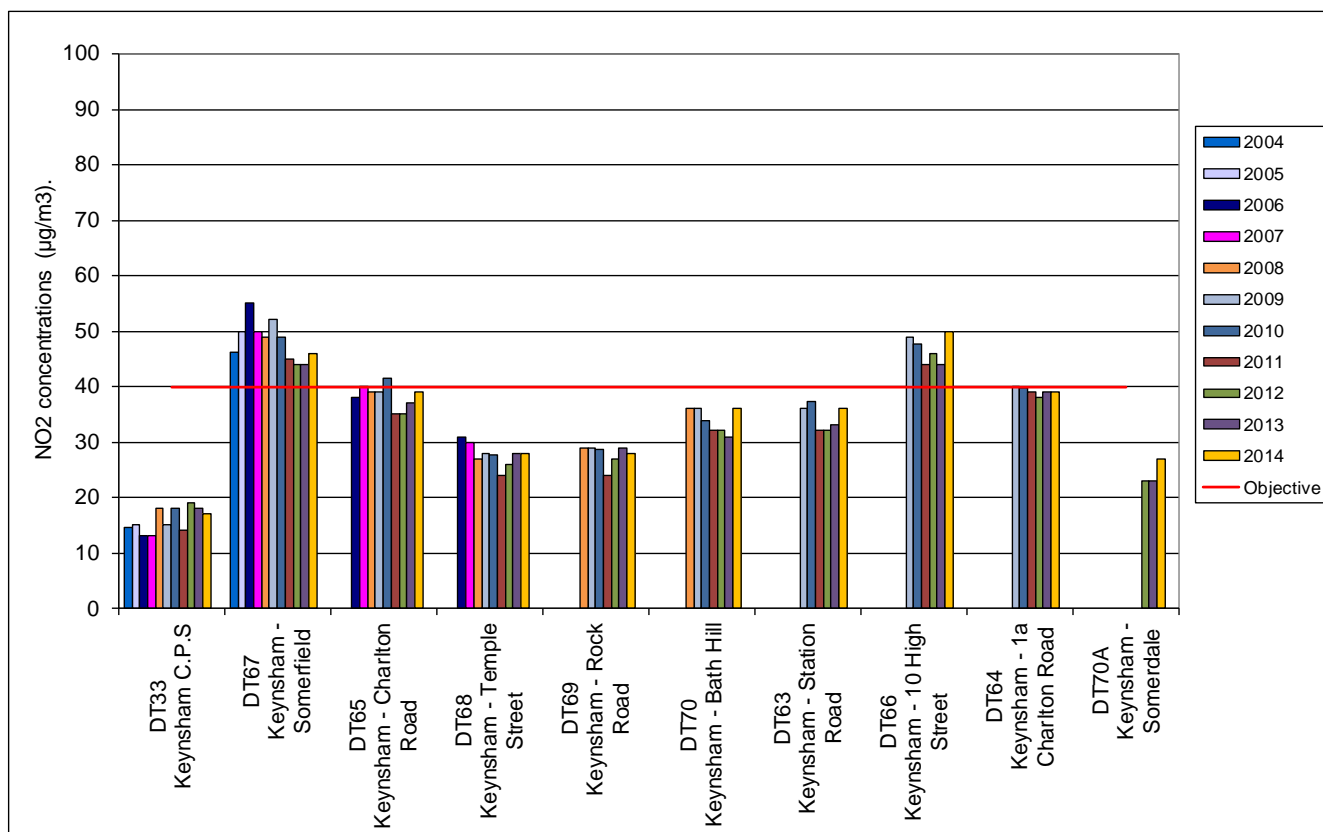


Figure 2.4: Trends in NO₂ Concentrations at Diffusion Tube Sites within Keynsham

Figure 2.4 above shows the trend in annual average measurements of NO₂ in Keynsham.

The national annual average objective for NO₂ of 40 µg/m³ was exceeded at two locations within the Keynsham AQMA in 2014. The diffusion tube location adjacent to number 68 High Street (DT67) showed an annual average of 46 µg/m³. The level of 50 µg/m³ as an annual average of nitrogen dioxide was measured adjacent to number 10 High Street (DT66). The full results are contained in Appendix C.

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SALTFORD

Automatic Monitoring

Monitoring of NO_x (NO and NO₂) was carried out using a chemi-luminescence analyser. The analyser was located for a 17 month period at Saltford News on the A4 between October 2011 and March 2013.

The results of the automatic monitoring of NO₂ are detailed below in Table 2.5. The data capture in Saltford during the 3 month period January to March in 2013 was 87% and 86% for 2012 with annual mean concentrations of nitrogen dioxide of 38 µg/m³ in 2012 and 32 µg/m³ for the 3 month period January to March. There were no exceedences of the hourly mean objective (200µg/m³).

Location	Within AQMA?	Data Capture 2013 (%)	Data Capture 2013 (%) Jan-Mar	Annual mean concentrations (µg/m ³)		
				2011*	2012	2013*
Saltford News	Y	16	87	29	38	32

*partial year

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

Location	Within AQMA?	Data Capture 2013 (%)	Data Capture 2013 (%) Jan-Mar	Number of exceedences of hourly mean (200 µg/m ³) with 98%ile in brackets		
				2011*	2012	2013*
Saltford News	Y	16	87	0 (123)	0 (130)	0 (132)

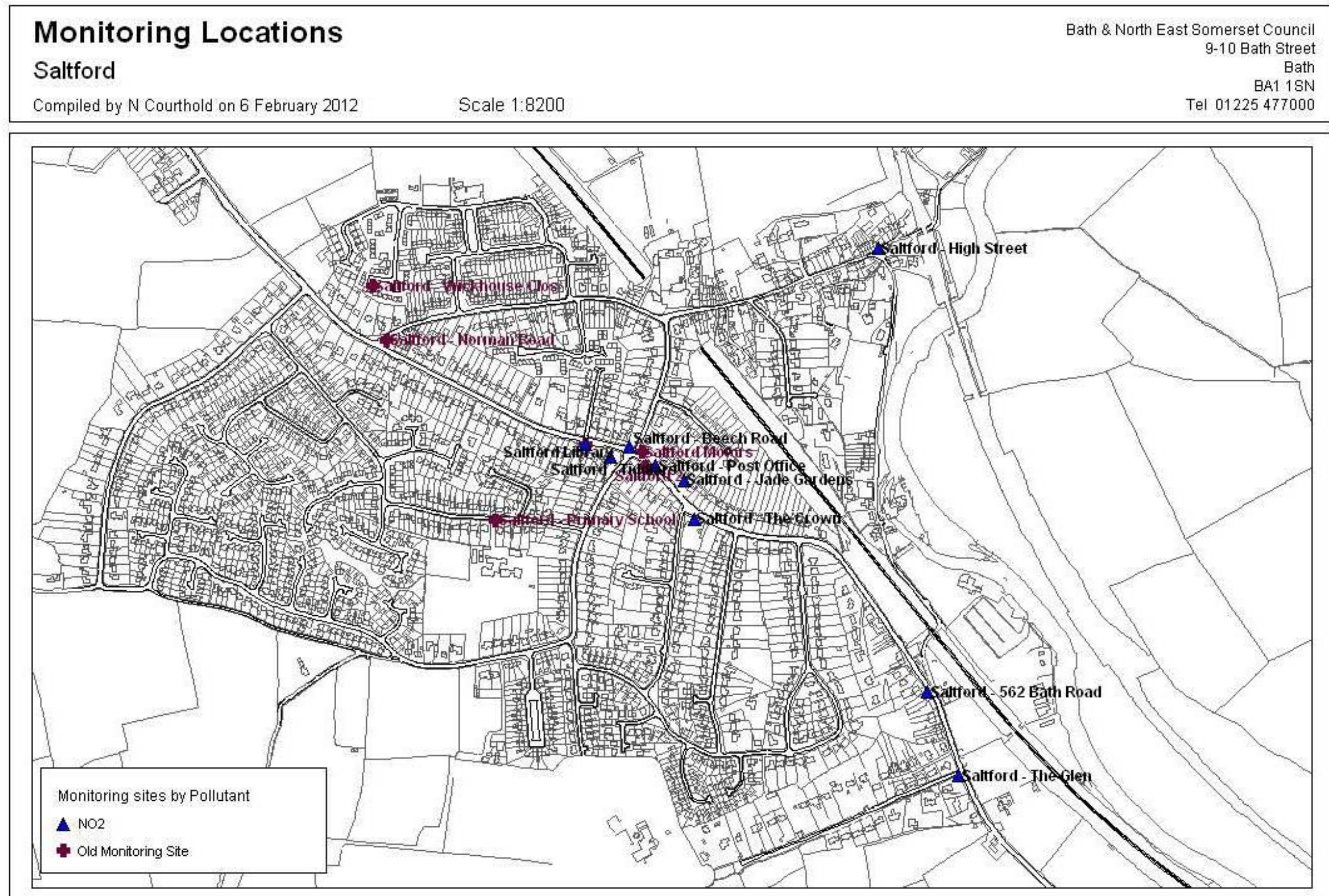
*partial year

Table 2.6: Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with 1-hour Mean Objective (18 exceedences)

Non-Automatic Monitoring

Diffusion tube monitoring has been carried out at a number of locations within Saltford. Figure 2.5 below shows the monitoring locations. Details of the monitoring sites are given in Appendix B. The diffusion tube monitoring is corrected for bias factor, details of the factor used are and detailed analysis methods are given in Appendix B.

Figure 2.5: Monitoring Locations in Salford.



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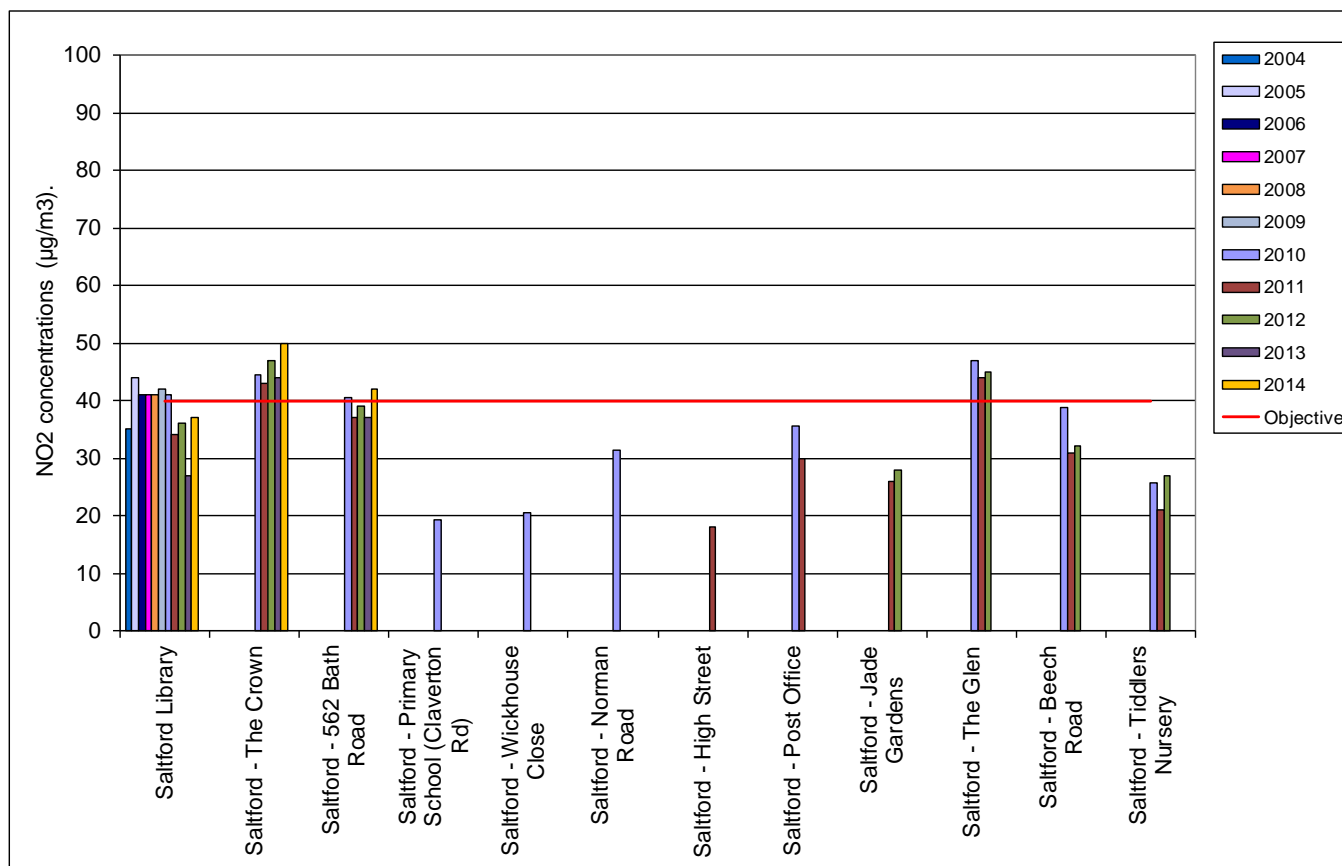


Figure 2.6: Trends in NO₂ Concentrations at Diffusion Tube Sites within Saltford.

In 2014 the national objective for annual average concentration of NO₂ was exceeded with value of 50 µg/m³ at the Crown (DT75) and 42 µg/m³ at 562 Bath Road (DT77). The full results are contained in Appendix C.

3 Bath & North East Somerset's Air Quality Priorities

3.1 Source apportionment

The AQAP measures presented in this report are intended to be targeted towards the predominant sources of emissions within Keynsham and Saltford. A source apportionment exercise was carried out by Bath and North East Somerset Council in 2015.

KEYNSHAM

In Keynsham, background NO₂ accounts for 35% of the monitored concentration at the 10 High Street monitoring site. This means that 65% of the concentrations can be influenced by measures that reduce emissions in the AQMA.

The proportion of traffic made up of each vehicle type is illustrated overleaf on Figure 3.1. Keynsham High Street has a different composition of vehicle types compared to the AQMA on the A4 in Saltford and the AQMA in Bath. The majority of vehicles on Keynsham High Street (according to the most recent available automatic traffic count) are cars at 93%. The second largest proportion of vehicles is Light Goods Vehicles at 4%. Motorcycles represent 2%. Buses, coaches and lorries represent a combined total 1.6%.

Fig 3.1 overleaf

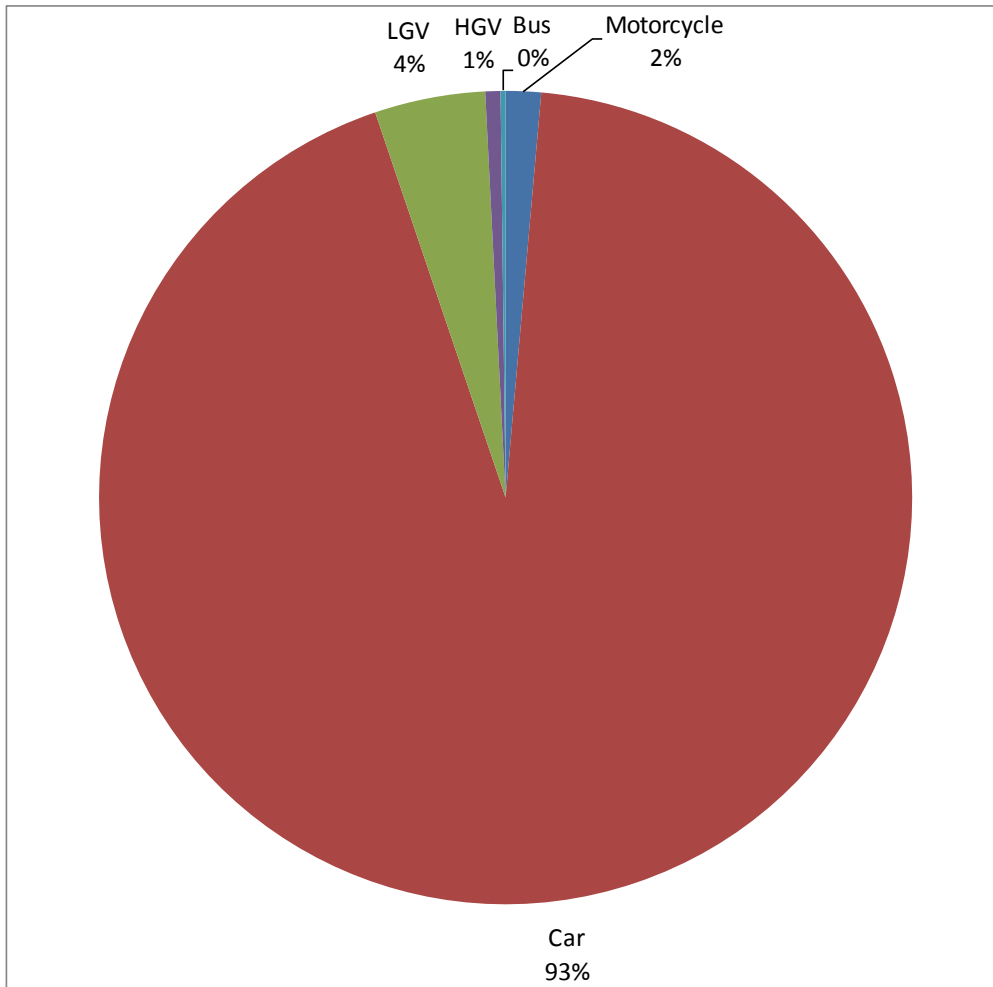


Figure 3.1: Vehicular split of traffic on Keynsham High Street.

Figure 3.2 and Table 3.1 below shows the percentage of the monitored NO₂ concentration which is attributable to the vehicle categories along Keynsham High Street using the most recent available traffic counts (2009) and the Emission Factor Toolkit v6.0.1. This is calculated at the worst monitoring location (10 High Street) using the method set out in Box 7.5 of Local Air Quality Technical guidance 2016 and background concentrations from the national background maps.

Category	NO ₂ concentration (µg/m ³)	% contribution
Monitored NO ₂	50	100
<i>Total Background</i>	<i>17.4</i>	<i>34.8</i>
Regional Background	4.8	9.7
Local Background	12.6	25.1
Petrol Cars	5.1	10.2
Diesel Cars	20.6	41.1
LGV	3.1	6.1
HGV	2.7	5.4
Buses	1.0	2.1
Other Vehicles	0.1	0.3

Table 3.1: Percentage of NO₂ concentration by source category

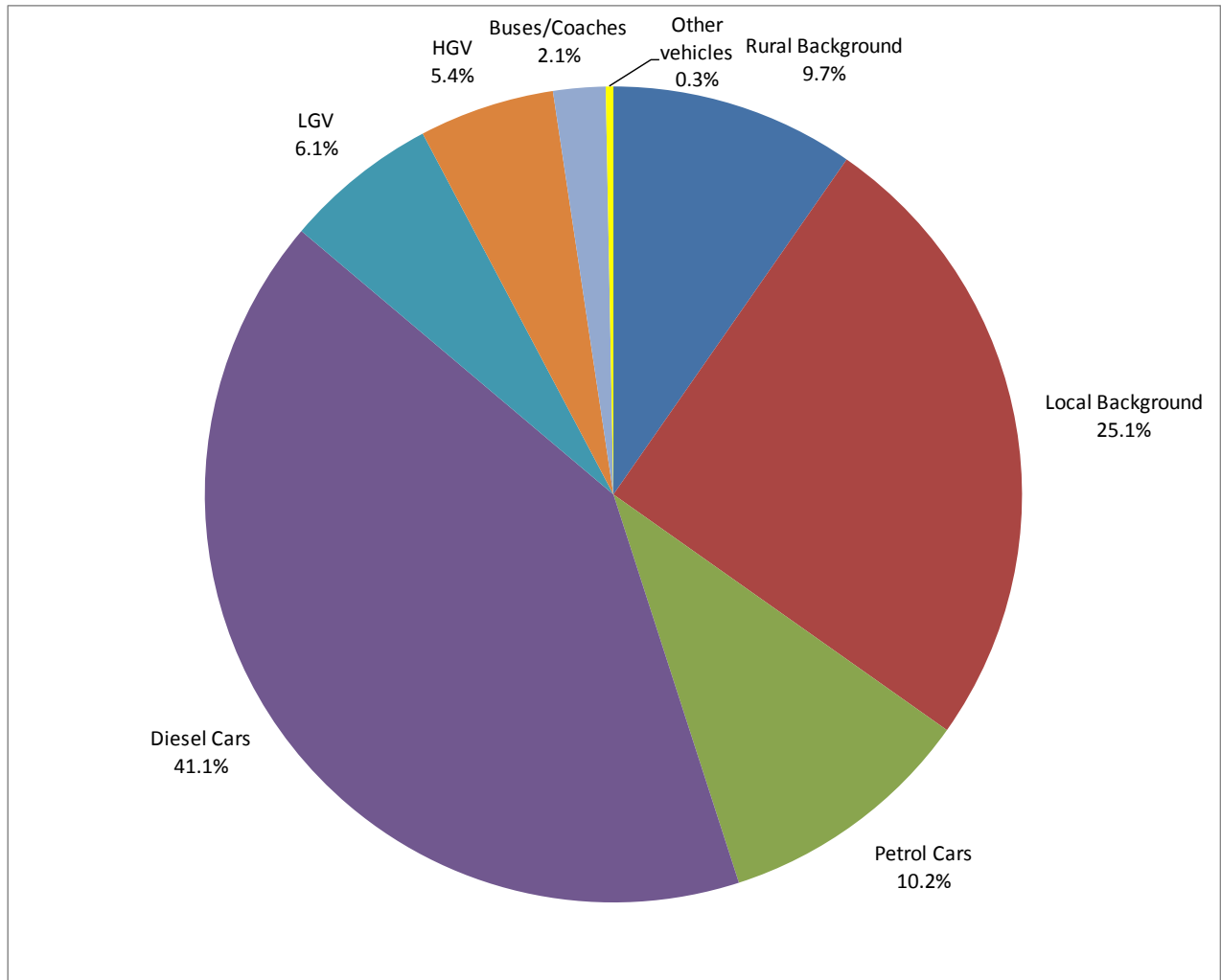


Figure 3.2: NOx emissions by vehicle type in Keynsham.

Earlier source apportionment work was also carried out in 2011 for the Keynsham Further Assessment which is available on the council's website (<http://www.bathnes.gov.uk/services/environment/pollution/air-quality/reports>). The Further Assessment concluded that queuing traffic contributes 21-43% of the NOx road contribution across the modelled area.

As illustrated in Figure 3.2 above, recent work using the Emission Factor Toolkit (v6.0.1) show that diesel cars are contributing over 41% to road NO₂ concentrations whilst constituting an estimated 40% of cars.

Petrol cars only contribute about 10% of NO₂ concentrations, despite constituting an estimated 60% of cars.

Overall, cars contribute 51% to NO₂ concentrations. It can thus be concluded that diesel cars are overwhelmingly the main contributor to NO₂ concentrations; therefore reducing the number of diesel cars (and queuing) on the High Street should be the main focus of the action plan for Keynsham.

SALTFORD

In Saltford, background NO₂ accounts for 25% of the monitored concentration at The Crown. This means that 75% of the concentrations can be influenced by measures that reduce emissions in the AQMA.

The traffic count, vehicle split and average speed were obtained from an automatic traffic count site and are illustrated in Figure 3.3 below.

Figure 3.3 shows that the majority of vehicles on the A4 in Saltford (according to the most recent available automatic traffic count) are cars at 87%. The second largest proportion of vehicles are Light Goods Vehicles at 8%, with HGVs making up 4% and buses 1% of the fleet.

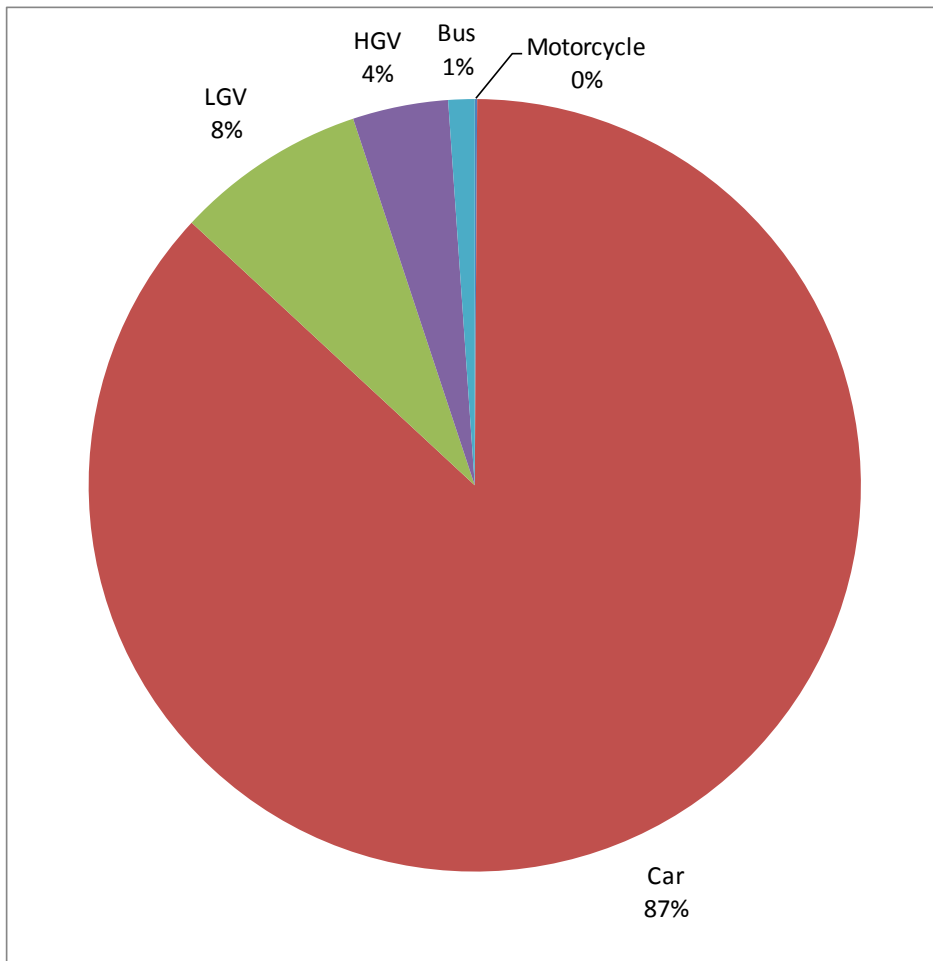


Figure 3.3: Vehicular split of traffic on the A4 in Saltford.

Figure 3.4 below shows the percentage of the monitored NO₂ concentration at The Crown which is attributable to the vehicle categories along the A4 in Saltford using the most recent available traffic counts and the Emission Factor Toolkit (EFT) v6.0.1. This is calculated at the worst monitoring location (The Crown) using the method set out in Box 7.5 of TG16 and background concentrations from the national background maps.

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Category	NO ₂ concentration (µg/m ³)	% contribution
Monitored NO ₂	50	100
<i>Total Background</i>	<i>12.5</i>	<i>24.9</i>
Regional Background	5.0	10.0
Local Background	7.5	14.9
Petrol Cars	4.3	8.6
Diesel Cars	14.9	29.8
LGV	4.6	9.2
HGV	10.4	20.8
Buses	3.3	6.6
Other Vehicles	0.04	0.1

Table 3.2 Percentage of NO₂ concentration by source category

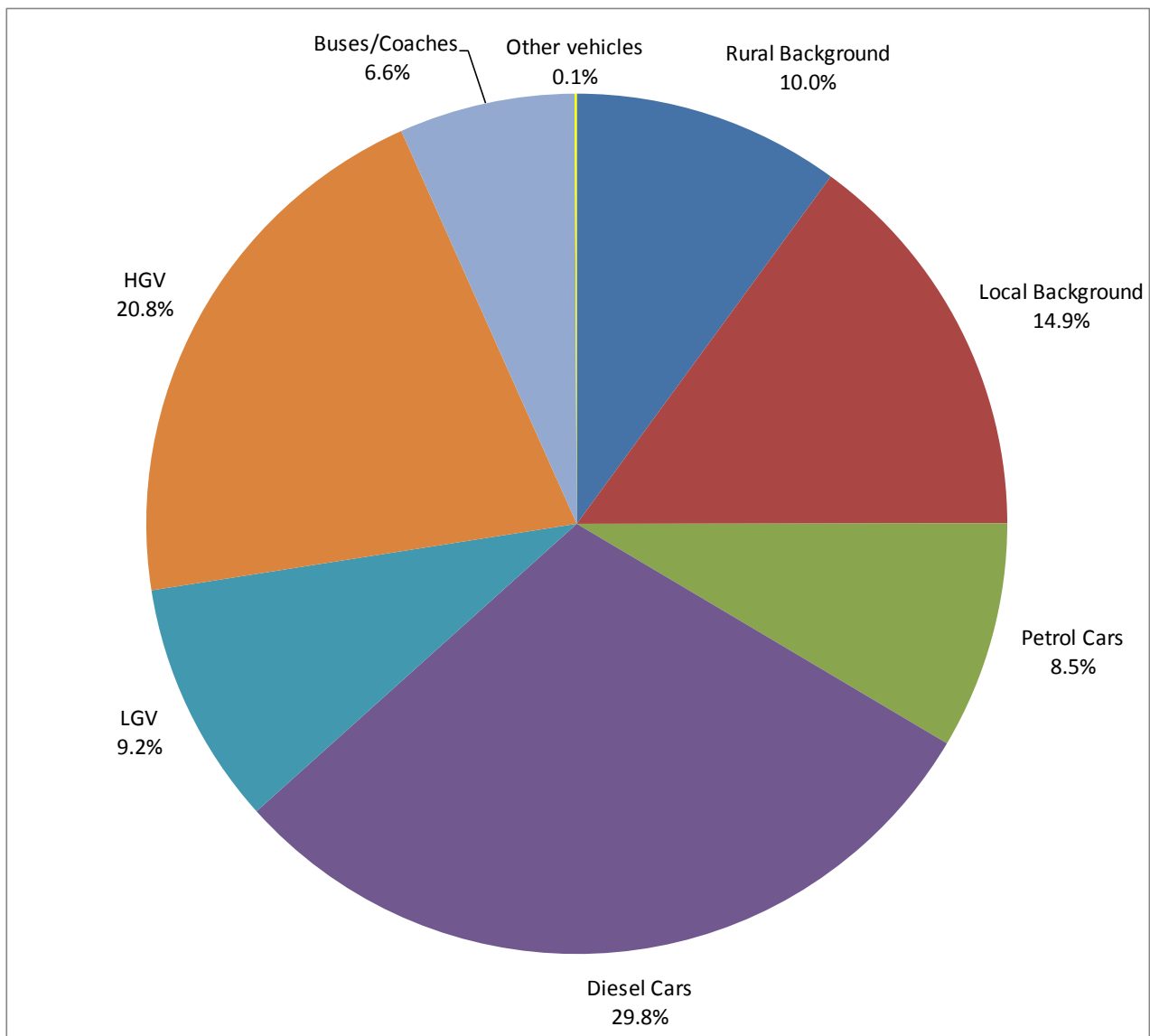


Figure 3.4: NO_x emissions by vehicle type on the A4 in Saltford.

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Figure 3.4 shows that in Saltford, diesels cars constitute approximately 30% of NO₂ concentrations, whereas petrol cars only constitute approximately 9%. Cars provide more than 38% of NO₂ concentrations, but unlike Keynsham, HGVs and buses contribute a higher proportion emitting 21% and 7% respectively.

It can be concluded that the main source of NO₂ concentrations in Saltford are diesel cars, with HGVs contributing the 2nd greatest proportion.

DIESEL CARS AND INCREASED NO₂

The high contribution of diesel cars to NO_x emissions and the resulting concentrations of NO₂ is something that has been widely acknowledged and is an unwanted consequence of a greater uptake of diesel cars due, in part, to government incentives in order to reduce emissions of carbon dioxide.

Although NO_x emissions overall have been declining as a result of improved engine technology, primary NO₂ emissions have increased due to technology designed to lower the emissions of particles. This is explained in the scientific article 'Emission reduction versus NO₂ air quality concentrations, a trade-off?' by Peter J Sturm and Stefan Hausberger of Graz University of Technology, Austria.

(https://online.tugraz.at/tug_online/voe_main2.getVollText?pDocumentNr=145519&pCurrPk=52228):

'The reasons for increasing NO₂ shares are mainly a catalytic exhaust gas after treatment such as diesel oxidation catalysts and coated diesel particulate filter (DPF) and the increasing exhaust gas recirculation rates for modern vehicles. High NO₂ levels at the raw exhaust gas are desired for the passive regeneration of the DPF at lower exhaust gas temperatures. Thus the exhaust gas after treatment to reduce fine particle emissions is at least partly responsible for the actual NO₂ situation.'

New engine emission standards should thus include stipulations for reducing NO₂ emissions.

3.2 Required reduction in emissions

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Although there is no proven safe level of NO₂ concentration, this section deals with the calculation of the level of reduction in emissions that is required for concentrations of NO₂ to fall to below the national objective annual average of 40 µg/m³.

Table 3.3 below details how much NO_x emissions will need to be reduced to meet the national air quality objective for NO₂ at locations currently exceeding the objectives in the Air Quality Management Area. This has been done using the method in DEFRA guidance TG16.

Location	Annual mean concentrations (µg/m ³) Adjusted for bias 2014	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 (%)
Keynsham – 10 High Street	50	10	27.1	35
Keynsham – Peacocks	46	6	15.8	24
Keynsham – Continuous	45 (2011)	5	13.5	21
Saltford – The Crown	50	10	28	32
Saltford – 562 Bath Road	42	2	5.3	8

Table 3.3: Required reduction in oxides of nitrogen emissions.

It can be seen in Table 3.3 above that in areas where the national air quality objectives are exceeded, there needs to be a reduction of between 8 and 35% in emissions of nitrogen oxides in order to meet the objectives across the Air Quality Management Areas.

The monitored concentrations at roadside locations have been projected forward using the method and factors given in TG16. 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 3.4 below shows the estimate of the year when the objective will be met. This is based on a formula provided in the DEFRA guidance TG16.

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Location	Annual mean concentrations ($\mu\text{g}/\text{m}^3$) Adjusted for bias 2014	Year Objective will be met
Keynsham – 10 High Street	50	2019
Keynsham – Peacocks	46	2018
Keynsham – Continuous	45 (2011)	2017
Salford – The Crown	50	2019
Salford – 562 Bath Road	42	2016

Table 3.4: Estimated achievement date of targets according to DEFRA guidance.

The estimated year of the objective being met in both Keynsham and Salford is between 2016-2019. 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 (local developments).

4 Development and Implementation of the AQAP for Keynsham and Saltford

4.1 Consultation and Stakeholder Engagement

In developing/updating this AQAP, we have worked with other local authorities, agencies, businesses and the local community to improve local air quality. Schedule 11 of the Environment Act 1995 requires local authorities to consult the bodies listed in Table 4.2. In addition, we have undertaken the following stakeholder engagement:

- Drop in sessions with officers
- Questionnaires distributed directly to households along major roads
- On line consultation

The response to our consultation stakeholder engagement is given in our Consultation Report (ref).

Table 4.2 – Consultation Undertaken

Yes/No	Consultee
Yes	the Secretary of State
Yes	the Environment Agency
Yes	the Highways Authority
Yes	all neighbouring local authorities
Yes	other public authorities as appropriate, such as Public Health officials
Yes	bodies representing local business interests and other organisations as appropriate

Circulation of the consultation draft document

The consultation draft document was developed by the Air Quality working group and circulated for comment from 14th September for 12 weeks.

The document was also circulated to the following groups:

- Transition Keynsham
- Community Transport Networking Group
- Keynsham In Bloom
- Saltford In Bloom
- Old Vicarage Green Residents Association

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- Lions Club of Keynsham
- Chamber of Commerce for Keynsham
- Keynsham and District Dial a Ride
- Manor Park Woodland group
- Abbots Wood group
- B&NES Health and Wellbeing Board
- Saltford Business Association
- Residents Association
- Bus operators
- Sirona Care and Health
- South Gloucestershire Council

Online questionnaire

A questionnaire was available to complete on the Council's website. The questionnaire detailed a number of measures that are anticipated to be the most deliverable and invite comment and suggestions for the final draft of the document.

'Drop-in' consultation evenings

Three drop-in consultation evenings were held, 2 based in Keynsham and one in Saltford.

Further information can be obtained from the full post consultation report available on www.bathnes.gov.uk

5. AQAP Measures

5.1 Keynsham Action Plan

Table 5.1 lists the measures in the Action Plan for Keynsham. A further description of each action is provided in the text below the table.

An indicative cost and benefit score has also been provided for each action in Appendix D. The potential actions have been scored for cost; benefit and the resulting rank in order to identify the most deliverable actions. Estimated costs (1 for high cost to 5 for low cost) were multiplied by a sum of the likely benefit from reducing pollution and people's exposure to the pollution (10 for high and 1 for low) to provide a score. The highest score shows the greatest cost benefit according to the opinions of the project team. The measures in Table 5.1 are listed in order of their ranking score (most deliverable at the top), as detailed in Appendix D.

It is acknowledged that some measures may score highly despite not affecting air pollution, because they instead may help reduce people's exposure to the pollution.

Some of the measures listed in Table 5.1 reflect the measures from the draft Keynsham Transport Strategy, which is yet to be adopted and thus are subject to the development of the strategy.

Further detail of each measure is provided following the table.

Table 5.1 AQAP measures for Keynsham

	Measure	EU category	EU Classification	Responsibility/lead authority	Key Performance indicator	Target pollution reduction in the AQMA	Associated Improvements	Timescale
1	Quantify the benefits from the one way system pilot for the High Street including monitoring and modelling of air quality impacts.	Traffic management	Strategic highways improvement	Project Delivery.	Reduction in nitrogen dioxide concentrations. Traffic Counts. Reduction in emissions of nitrogen oxides.	Predicted reduction of approximately 3 micrograms per cubic metre NO ₂ on High Street and approximately 1 microgram increase on some areas of alternative route. No significant improvement predicted on Charlton Road.	Reduction in PM ₁₀ and PM _{2.5}	During and within 6 months of completion of the trial.
2	Targeted information campaign for the most vulnerable groups (i.e. asthmatics, Chronic Obstructive Pulmonary Disease etc.).	Public Information	Other	B&NES Public Protection and Health Improvement, Public Health, Research and Intelligence Team, Clinical Commissioning Group, Sirona Care and Health.	The number of hits on website. Number of initiatives delivered.	No reduction in concentration in Nitrogen Dioxide, however there would be an exposure reduction for residents.	N/A	May 2018
3	This Action Plan influences planning policy to require electric vehicle charge points for each new property.	Promoting Low Emission Transport	Other	Developer and B&NES Planning Development Control.	Number of properties where a power spur for an electric vehicle charge point is installed. Number of planning applications approved with a vehicle charge point as an advisory or required condition.	% reduction in NO _x emissions compared to a diesel.	Reduction in PM ₁₀ and PM _{2.5} .	Adopted by planning Policy by May 2017, and then dependent upon developer implementation.
4	Increase public charging points through 'Ultra Low West' (Source West) EV charging infrastructure programme.	Promoting Low Emission Transport	Procuring alternative refuelling infrastructure	B&NES Public Protection and Health Improvement	Number of charge points. Number of charging sessions per year.	% reduction in NO _x emissions compared to a diesel.	Reduction in PM ₁₀ and PM _{2.5}	Between August 2016 and August 2021
5	Recommend tree planting in future infrastructure programmes	Other	Other	Keynsham Connecting Communities Forum, Keynsham in Bloom (town council), Public Protection and Health Improvement, Public Health, Highways & Parks.	Number of trees planted.	Provision of a barrier to protect residents and visitors	Absorption of Greenhouse gas emissions	Recommend 6 months during trial and then implemented fully if air quality benefits are identified.
6	This Action Plan influences planning policy to encourage the provision of cycle	Promoting Travel Alternatives	Promotion of cycling	Developer and B&NES Planning DC.	Number of new properties with cycle storage.	% reduction in NO _x emissions compared to a	Reduction in PM ₁₀ and PM _{2.5}	Adopted by planning Policy by May 2017, and

	Measure	EU category	EU Classification	Responsibility/lead authority	Key Performance indicator	Target pollution reduction in the AQMA	Associated Improvements	Timescale
	parking for each new property.				Number of planning applications approved with cycle storage as advisory or required condition.	diesel.		then dependent upon developer implementation.
7	Explore the promotion of an “Electric Zone”.	Promoting Low Emission Transport	Other	Public Protection and Health Improvement & Highways.	Number of signs erected. Number of electric vehicles in peak hours on High Street/Ashton Way with a manual traffic count. Number of charging sessions.	N/A		May 2018
8	Influence the design of developments to improve access to public transport, cycling and walking routes.	Transport Planning and Infrastructure	Other	B&NES Placemaking Plan / Planning DC.	Number of approved planning applications with minimum 30 minute bus frequency in or adjacent to site (with 100 metre of the site).	Negligible	Reduction in congestion Health related improvements	Core Strategy plan period up to 2029.
9	Support the creation of a local “Air Quality Action Group”.	Public Information	Other	Connecting Communities Forum	Established as part of the remit of existing of new group.	N/A	Improved awareness of the issues locally	December 2017
10	Keynsham Greenway links to National Cycle Network 4, Wellsway School and riverside path into Bristol and S Glos with new bridge over River Avon.	Transport Planning and Infrastructure	Cycle network	Transportation, Bristol City Council, South Gloucestershire Council, Sustrans, developers.	Delivery of project. Number of cycle trips from annual surveys.	N/A	Reduction in congestion Health related improvements	2018-2023
11	Work with Community Transport to promote the use of Low emission dial-a-ride vehicles.	Promoting Low Emission Transport	Public Vehicle Procurement	Keynsham and District Dial and Ride	Low emission vehicle journeys / miles.	% reduction in NOx emissions compared to a diesel.	Reduction in PM ₁₀ and PM _{2.5} Reduction in Greenhouse gas emissions	2020.
12	Identify, influence and publicise pedestrian and cycling facility improvements	Transport Planning and Infrastructure	Other	B&NES & First Group.	Audit of infrastructure completed. Recommendation will be integrated into this plan. Walking and cycling surveys	N/A	Reduction in congestion Health related improvements	Part of Strategy for Keynsham document – yet to be adopted.
13	Lobby government for incentivising uptake of non-diesel cars.	Other	Other	Public Protection and Health Improvement & Public Health.	Letter sent.	In itself, no improvement, however, there is a quantifiable reduction in emissions with each new Ultra Low	N/A	Ongoing

	Measure	EU category	EU Classification	Responsibility/lead authority	Key Performance indicator	Target pollution reduction in the AQMA	Associated Improvements	Timescale
						Emission Vehicle which is introduced to replace a diesel vehicle		
14	Identify and publicise priority cycling routes to support a cycling culture for all.	Transport Planning and Infrastructure	Cycle Network	B&NES Environmental Services, Sustrans & South Gloucestershire Council.	Cycling routes identified.	n/a	Reduction in congestion Health related improvements	Part of Strategy for Keynsham document – yet to be adopted.
15	Encourage low emission bus services in Keynsham	Vehicle Fleet Efficiency	Promoting Low Emission Public Transport	B&NES Public Transportation	Number of bus routes serviced by a Low emission vehicle	% reduction in NOx emissions compared to a diesel. (or milligrams)	Reduction in PM ₁₀ and PM _{2.5} Reduction in Greenhouse gas emissions	May 2020
16	Increase public education messages which promote healthier choices for short journeys	Promoting Travel Alternatives	Incentivise active travel campaign & infrastructure	B&NES Public Protection and Health Improvement	Delivery of a public education campaign	No reduction in concentration. Exposure reduction	Reduction in congestion Health related improvements	May 2018
17	Work with bus operators on improved services, ticketing and simplified fare structure.	Transport Planning and Infrastructure	Bus route improvements	B&NES Public Transportation	B&NES area bus usage figures. Annually Bus Passenger Satisfaction surveys for B&NES (Transport Focus).	n/a	Reduction in congestion Health related improvements	Part of Strategy for Keynsham document – yet to be adopted.
18	Support the provision of improved lighting on cycle path.	Transport Planning and Infrastructure	Cycle network	B&NES Property Services	Lighting provided to key locations.	n/a	Reduction in congestion Health related improvements	May 2019
19	Advocate increased rail service via “MetroWest” – resulting in increase from hourly to half-hourly rail service.	Transport Planning and Infrastructure	Other	B&NES Environmental Services & other former Avon authorities.	Project implementation. Rail patronage per service at Keynsham (annual rail survey).	Offsets less efficient modes.	Reduction in congestion Health related improvements	Spring 2019

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1. QUANTIFY THE BENEFITS FROM THE ONE WAY SYSTEM PILOT FOR THE HIGH STREET INCLUDING MONITORING AND MODELLING OF AIR QUALITY IMPACTS

This measure will quantify the benefits from the pilot one-way system for Keynsham High Street due to be undertaken. The impacts will be reported back to provide Transportation with the evidence on whether the scheme would support long-term improvements to air quality.

Traffic modelling undertaken as part of the development of the Keynsham Transport Strategy showed that a south bound one way system with Ashton Way remaining as two-way would result in the least congestion. The next step is for the air pollution impact of the forthcoming final scheme to be modelled in house by the Environmental Monitoring Team and then monitored during the forthcoming trial. This will require additional diffusion tubes and the placement of one or more of the AQ Mesh monitors.

This scores relatively highly in terms of the preliminary cost benefit analysis in Appendix D because it would improve air quality in the High Street by diverting the traffic elsewhere (e.g. Ashton Way). This would be beneficial in terms of air quality as the overall number of people exposed to air pollution is reduced. The proposal for implementing a one way system along the High Street was part of the town centre redevelopment proposals. There are obviously considerations relating to the potential knock-on effects such as congestion at other junctions.

The Council's Public Protection and Health Improvement team can undertake air pollution dispersion modelling to test the impact on air pollution concentrations of a scheme.

Monitoring and evaluation

The effect of an implemented scheme can be monitored by continued measurement of NO₂ and traffic counts on the High Street and alternative routes.

2. TARGETED INFORMATION ADVICE FOR THE MOST VULNERABLE GROUPS

The people most vulnerable to poor air quality are those with respiratory conditions such as Asthma, Emphysema or Chronic Obstructive Pulmonary Disease. A text or phone message could inform people who are identified as vulnerable and registered to the service, if and when the pollution levels are high. However, the thresholds above which a warning is sent – if in accordance with the national 'Daily Air Quality Index' – is too high for regular enough messages and may never be triggered. Similar schemes throughout the Country have had varying success.

There are alternative ways of providing health advice, information and awareness targeted at vulnerable groups most at risk from the health effects of air pollution, so it should be possible to make better use of what is already available nationally and locally e.g. DEFRA have a number of public facing information and advice services and the Council have local information on their website.

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Other ways of providing information and health advice include:

- Working with GP practices, NHS BANES Clinical Commissioning Group and other organisations to identify those most at risk and identify how targeted awareness could be channelled through existing mechanisms.
- By providing health advice and information directly to residents and vulnerable groups within air quality management areas.
- Improve the awareness within specific settings e.g. care homes and childcare settings
- Live air quality data on Bath and North East Somerset website and regular information updates

The bodies involved are Bath and North East Somerset Public Protection and Health Improvement Team, Public Health, Research and Intelligence Team, the Clinical Commissioning Group and Sirona Care and Health.

Monitoring and evaluation

This measure could be monitored by the number of initiatives completed and hits on advice websites.

3. INFLUENCE PLANNING POLICY TO SUPPORT THE INCREASE OF ELECTRIC VEHICLE CHARGE POINT FOR EACH NEW PROPERTY

This measure entails influencing planning policy with a view to ensuring that there is a separate electric spur is provided for the provision of charging points at new properties where there is off-street or adjacent on-street parking. This facilitates the further uptake of electric vehicles, which helps reduce local air pollution where the user would have previously used petrol or diesel vehicle. A standard fast charger uses 32amps for each socket.

The Council are able to lever this through the Placemaking Plan and design policies within it.

It is recommended that at developments of >10 residential properties; an electric vehicle charge point is installed every new property with dedicated parking or 1 charge point per 10 car parking spaces for those with shared parking. For commercial properties 5% of the parking spaces have electric vehicle charge points.

The costs of this measure are relatively low for the developer and the responsibility is on the developer.

Monitoring and evaluation

This can be monitored using the number of properties with electric vehicle charge points and the number of planning applications approved with charge points as conditions.

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4. INCREASE PUBLIC CHARGING POINTS THROUGH 'ULTRA LOW WEST' (SOURCE WEST) ELECTRICAL VEHICLE CHARGING

The Ultra-Low West (Source West) electric vehicle charging network includes the public charging infrastructure that has been installed across Bath and North East Somerset, Bristol, South Gloucestershire and Gloucestershire. Users can register for a unique smart card that enables charging. The first public charge point in Keynsham was installed at the Fox and Hounds car park on Bath Hill in 2015. Electric vehicle uptake is climbing steeply and charge points will be provided dependent on resources. The Council in partnership with the other West of England authorities has won funds as part of the Office for Low Emission Vehicles 'Go Ultra Low City Scheme' to implement a number of measures to further stimulate the uptake of electric vehicles including further charge point installations.

The Source West network is run jointly by the member authorities. There is already some promotion of the network through www.sourcewest.info, but further promotion can be carried out in the form of signage and adverts in publications, on websites and on radio and television.

Monitoring and evaluation

Monitoring will be carried out using the number of charge points installed and the number of charging sessions.

5. RECOMMEND TREE PLANTING IN FUTURE INFRASTRUCTURE PROGRAMMES

Planting of suitable trees or shrubs that have a positive effect on air quality between the traffic and the building facades can provide a barrier between air pollution and residents or pedestrians and can absorb some pollutants over time. Consideration will be given to safety concerns re the spatial and visual implications. Consideration will also be given to the effect of tree planting on the Conservation Area. This measure could be developed in collaboration with Keynsham Town Council. Any future public realm schemes developed by the Council for Keynsham High Street should consider the opportunity for tree planting as a key part of the design. An assessment will be made to identify the most appropriate species for each potential site. Evergreen trees with low porosity such as the Yew Tree or Juniper tree may suit smaller spaces and grow to a modest height. In wider spaces, broadleaf deciduous trees may be more efficient in pollution scrubbing due to higher leaf surface area. Trees that have high Urban tree air quality scores (UTAQS) according to Donovan et al. (2005) include Alder, Field Maple, Hawthorn, Larch, Laurel, Lawson Cypress, Norway Maple, Pine and Silver Birch.

There are a number of considerations (according to the latest research) in relation to planting on the street, to ensure planting doesn't worsen air quality, such as:

- canopy cover not exceeding 30% to prevent trapping pollutants;
- maintain air flow to allow dispersion of pollutants;
- chose a species that do not have a high ozone index of negative effects on air quality (e.g. pollen or volatile organic compounds)

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Monitoring and evaluation

The main indicator will be the number of trees planted. Continued monitoring of NO₂ concentrations and a comparison with other monitoring locations where there has been no planting will enable evaluation of the effect of this measure on local air quality.

6. INFLUENCE PLANNING POLICY TO ENCOURAGE THE PROVISION OF CYCLE PARKING FOR EACH NEW PROPERTY

This measure seeks to ensure that residents of all new properties have somewhere safe and convenient to store their bicycles in order that cycling is a viable and attractive means of transport. The draft Placemaking Plan requires that if there is no garage or secure area provided, one secure covered stand per dwelling must be provided in a communal area for residents plus one stand per eight dwellings for visitors.

The costs of this measure are relatively low and the responsibility is on the developer.

Monitoring and evaluation

Key indicators for this measure are the number of new properties with secure cycle storage and the number of approved planning applications with secure cycle storage as a condition.

7. EXPLORE THE PROMOTION OF AN "ELECTRIC ZONE"

This would be a branding of the central area of the town broadly reflecting the coverage of the air quality management area. It would include a package of measures that encourage the use of plug-in and hybrid vehicles and would request drivers that have the option to switch to electric mode, to do so in the central area. This would need to minimise the effect of signage and appearance of clutter in the Conservation Area.

This measure scores relatively highly in terms of cost effectiveness, because it utilises existing assets, namely hybrid and electric cars and the electric vehicle charging points installed both at the Fox and Hounds car park and Civic Centre. By alerting road users to the AQMA and electric zone, it will encourage hybrid cars to switch to electric mode in the vicinity of the AQMA.

This measure can be implemented jointly by Public Protection and Health Improvement and the Highways team. It is also eligible for financial support from the Go Ultra Low City Scheme fund that includes work packages for charging point infrastructure (measure 4) and Clean Air Zones.

Monitoring and evaluation

This is inherently difficult to monitor, as it is impossible to know how many hybrid cars switch to electric. A manual traffic count may identify the number of hybrid and electric cars overall. The presence of these will be affected by other factors. The number of charging sessions undertaken at the charge points is also a key indicator.

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8. INFLUENCE THE DESIGN OF DEVELOPMENTS TO IMPROVE ACCESS TO PUBLIC TRANSPORT, CYCLING AND WALKING ROUTES

This option requires stipulation through the Transport Strategy and Placemaking Plan. Policies D1 to D4 of the draft Placemaking Plan stipulate that new development proposals should be well connected, with the needs of pedestrians, cyclists and public transport users considered before vehicles; designed for ease of walking and cycling and provide safe and high quality routes; and be permeable by offering a choice of routes.

Monitoring and evaluation

This can be assessed by looking at the number of planning applications with improved access to alternative modes of transport.

9. SUPPORT THE CREATION OF A LOCAL "AIR QUALITY ACTION GROUP"

Identify and encourage existing groups that may be interested in helping to promote air quality improvement measures, such as tree or shrub planting. If a need is found for a specific community air quality group this could be created, with the aim of producing a local community air quality action plan.

Monitoring and evaluation

Number of groups established and the number of initiatives they have been involved in.

10. KEYNSHAM GREENWAY LINKS TO NATIONAL CYCLE NETWORK 4

These measures are included in the draft transport strategy for Keynsham. The three Councils, South Gloucestershire, Bath and North East Somerset and Bristol City have come together to deliver a high quality 6km long walking and cycling route along the riverside from Keynsham Town Centre to Bristol. This route will link via the river with the Bristol to Bath cycle path and an upgraded route along the River Avon via the Somerdale area of Keynsham.

Monitoring and evaluation

The effect of this action can be measured using walking and cycling surveys.

11. WORK WITH COMMUNITY TRANSPORT TO PROMOTE THE USE OF LOW EMISSION DIAL A RIDE VEHICLES

The relatively short distance of journeys of the Keynsham Dial-a-ride service means that the service could be operated by electric or low emission vehicles. Bath and North East Somerset Council will work with Community Transport to encourage development of a business plan for replacement of existing vehicles with low emission vehicles.

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Monitoring and evaluation

This will be monitored using the number of low emission journeys and the distance travelled using low emission vehicles.

12. IDENTIFY, INFLUENCE AND PUBLICISE PEDESTRIAN AND CYCLING FACILITY IMPROVEMENTS

This measure covers two measures included in the draft document: 'Developing a Strategy for Keynsham'. This includes the potential walking and cycling spine route from Station Road to the town centre through the park. It is stated in the draft strategy that they should take account of access for those with mobility impairments.

This reflects a measure in the developing Keynsham Transport Strategy. The draft Place-making Plan identifies proposed new transport infrastructure improvements, including the Keynsham High Street public realm improvements. This can be implemented in part through the Sustainable Transport Transition Year funding just awarded that follows on from the Local Sustainable Transport Fund. The next funding opportunity for a resource to undertake this measure is the DfT's Access Fund that would commence in the financial year of 2017-18 if successful.

Monitoring and evaluation

The effect of this action can be measured using walking and cycling surveys and railway passenger surveys.

13. LOBBY GOVERNMENT FOR INCENTIVISE NON-DIESEL VEHICLES

There is an acceptance among policy makers and air quality professionals that diesel cars emit more NO_x than petrol cars and thus make reduction in NO₂ more difficult to achieve. A change in central government policy is required to incentivise the uptake of non-diesel vehicles. As such, lobbying in co-ordination with other authorities is required to bring about this change.

Monitoring and evaluation

Monitoring and evaluation would consist of whether there has been a shift in central policy.

14. IDENTIFY AND PUBLICISE PRIORITY CYCLING ROUTES TO SUPPORT A CYCLING CULTURE FOR ALL

This measure is included as a key action in the draft transport strategy for Keynsham. It is an overarching action that will ensure a comprehensive cycling network.

The Placemaking Plan identifies proposed new cycling corridors.

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Monitoring and evaluation

Monitoring will be looking at the number of new cycle routes and the results of cycling surveys.

15. ENCOURAGE LOW EMISSION BUS SERVICES IN KEYNSHAM

The Council will work with Public Transport Operators to encourage the use of low emission vehicles on routes within Bath and North East Somerset.

Monitoring and evaluation

The number of routes which are utilised by low emission vehicles.

16. INCREASE PUBLIC EDUCATION MESSAGES WHICH PROMOTE HEALTHIER CHOICES FOR SHORT JOURNEYS

The aim will be to work with the Bath & North East Somerset Health Active Lifestyle's team to encourage healthier transport choices for short journeys by providing the air quality information to support the campaigns.

Monitoring and evaluation

The number of initiatives which are delivered.

17. WORK WITH BUS OPERATORS TO ENCOURAGE IMPROVED SERVICES, TICKETING AND FARES TO ENCOURAGE MORE PEOPLE TO USE PUBLIC TRANSPORT

This measure is one of those taken from the draft transport strategy for Keynsham. The strategy also lists the following specific measures:

- Better multi-media service information, including the TravelWest.info website giving service information for the whole sub-region (joint initiative between operators, the Council and users);
- Improved linkages between bus and rail services;
- Smart ticketing, as being introduced currently, and mobile phone ticketing;
- Revised fare structure, especially for inter-urban services; and
- Measures to reduce delays to buses e.g. as part of capacity improvements at key junctions.

Monitoring and evaluation

Annual Bus Passenger Survey Results. Bus usage statistics can be obtained from operators to help assess the effectiveness of these measures. There are also statistics percentage change in fares relative to inflation and passenger satisfaction surveys.

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18. SUPPORT THE PROVISION OF IMPROVED LIGHTING ON CYCLE PATHS

This will identify cycling routes which would benefit from improved lighting and support the upgrade work to the network. Opportunity for funding may arise from the forthcoming bidding opportunity for DfT Access Fund grant that would commence in the 2017-18 financial year.

Monitoring and evaluation

The number of lights installed and cycling surveys.

19. ADVOCATE INCREASED RAIL SERVICE VIA "METRO WEST"

This is another action listed in the draft transport strategy as a key action: *'The growth in rail capacity and the range of services available as part of the MetroWest and other schemes will support significantly more rail journeys to/from Keynsham. Access provision to the station has to be improved if the take up of these enhanced services is to be maximised.'*

The strategy also lists local improvements proposed for access to Keynsham station, including:

- Links into a wider cycle route network;
- Incorporating a new bus stop in the vicinity of the station;
- Improved and more secure cycle parking facilities;
- Improved disabled access to give step-free access to platforms (currently being constructed);
- New pedestrian crossing on Keynsham Road for improved access from Somerdale site;
- Pedestrian routes assessed (and improved) as part of a non-motorised users audit;
- Improved waiting facilities for passengers;
- Provision of real time service information on platforms and in the town centre, such as in the Town Hall;
- Provision of CCTV cameras for improved security;
- An increase in capacity in the over-flow car park;
- Marketing to 'relaunch' Keynsham station once the main improvements are in place.

Monitoring and evaluation

The effect of this action can be measured using railway passenger surveys, cycling and walking surveys and the utilisation of the cycle parking infrastructure at the station.

5.2 Saltford Action Plan

Table 5.2 lists the measures in the Action Plan for Saltford. A further description of each action is provided in the text below the table.

An indicative cost and benefit score has also been provided for each action in Appendix D. The potential actions have been scored for cost; benefit and the resulting rank in order to identify the most deliverable actions. Estimated costs (1 for high cost to 5 for low cost) were multiplied by a sum of the likely benefit from reducing pollution and people's exposure to the pollution (10 for high and 1 for low) to provide a score. The highest score shows the greatest cost benefit according to the opinions of the project team. The measures in Table 5.2 are listed in order of their ranking score (most deliverable at the top), as detailed in Appendix D.

It is acknowledged that some measures may score highly despite not affecting air pollution, because they instead may help reduce people's exposure to the pollution.

Some of the measures listed in Table 5.2 reflect the measures from the draft Keynsham Transport Strategy, which is yet to be adopted and thus are subject to the development of the strategy.

Further detail of each measure is provided following the table.

Table 5.2 AQAP measures for Saltford

	Measure	EU category	EU Classification	Responsibility/Lead authority	Key Performance indicator	Target pollution reduction in the AQMA	Associated Improvements	Timescales
1	Targeted information campaign advice for the most vulnerable groups (i.e. asthmatics, Chronic Obstructive Pulmonary Disorder etc.).	Public Information	Other	B&NES Public Protection and Health Improvement, Public Health, Research and Intelligence Team, Clinical Commissioning Group, Sirona Care and Health.	The number of hits on website Number of initiatives	No reduction in concentration. Reduction in exposure to NO ₂ and fine particles.	N/A	May 2018
2	Recommend tree planting in future infrastructure programmes	Other	Other	Community Air Quality Group (utilising Keynsham Connecting Communities Forum).	Number of trees planted.	Provision of a barrier to protect residents and visitors	Absorption of Greenhouse gas emissions	Throughout lifetime of action plan.
3	Advice to land owners on planting that can help to protect their properties from air pollution.	Other	Other	B&NES Public Protection and Health Improvement, Highways & Planning	Number of hits on website	No reduction in concentration. Reduction in exposure to NO ₂ and fine particles.	Deflects air pollution from property facades, absorbs carbon dioxide	May 2018
4	Influence planning policy to support the increase of electric vehicle charge point infrastructure for each new property.	Promoting Low Emission Transport	Other	Developer and B&NES Planning DC	Number of properties where a power spur for an electric vehicle charge point is installed. Number of planning applications approved with a vehicle charge point as an advisory or required condition.	% reduction in NOx emissions compared to a diesel.	Reduction in PM ₁₀ and PM _{2.5} Reduction in Greenhouse gas emissions	
5	Increase public charging points through 'Ultra-Low West' (Source West) electric vehicle charging infrastructure programme	Promoting Low Emission Transport	Procuring alternative refuelling infrastructure	B&NES Public Protection and Health Improvement,	Number of charge points. Number of charging sessions.	% reduction in NOx emissions compared to a diesel.	Reduction in PM ₁₀ and PM _{2.5} Reduction in Greenhouse gas emissions	Between August 2016 and August 2021
6	Explore the promotion of an "Electric Zone".	Promoting Low Emission Transport	Other	B&NES Public Protection and Health Improvement, & Highways.	Number of signs. Number of electric vehicles in peak hour on A4.	N/A		May 2018
7	Support the creation of a local "Air Quality Action Group".	Public Information	Other	Connecting Communities Forum and B&NES Public Protection and Health Improvement,	Established as part of the remit of existing of new group.	N/A	Improved awareness of the issues locally	December 2016
8	Influence planning policy to encourage the	Promoting Travel	Promotion of	Developer and B&NES	Number of new	% reduction in NOx	Reduction in PM ₁₀ and	Adopted by planning

	Measure	EU category	EU Classification	Responsibility/Lead authority	Key Performance indicator	Target pollution reduction in the AQMA	Associated Improvements	Timescales
	provision of cycle parking for each new property.	Alternatives	cycling	Planning DC	properties with cycle storage. Number of planning applications approved with cycle storage as advisory or required condition.	emissions compared to a diesel.	PM _{2.5} Reduction in Greenhouse gas emissions Reduction in congestion Health related improvements	Policy by May 2017, and then dependent upon Developer implementation.
9	Work with Community Transport to promote the use of Low emission dial-a-ride vehicles.	Promoting Low Emission Transport	Public Vehicle Procurement	KADDAR.	Low emission vehicle journeys / miles.	% reduction in NOx emissions compared to a diesel.	Reduction in PM ₁₀ and PM _{2.5} Reduction in Greenhouse gas emissions	2020
10	Encourage low emission bus services in Salford.	Vehicle Fleet Efficiency	Promoting Low Emission Public Transport	B&NES Public Transportation	Number of bus routes serviced by a Low emission vehicle	% reduction in NOx emissions compared to a diesel.	Reduction in PM ₁₀ and PM _{2.5} Reduction in Greenhouse gas emissions	May 2020
11	Lobby government for incentivising uptake of non-diesel cars.	Other	Other	B&NES Public Protection and Health Improvement	Government response and changes to legislation.	In itself, no improvement, however, there is a reduction with each new ULEV introduced replaced a diesel vehicle	N/A	Ongoing
12	Increase public education messages which promote healthier choices for short journeys	Promoting Travel Alternatives	Incentivise active travel campaign & infrastructure	B&NES Public Protection and Health Improvement	Delivery of a public education campaign	No reduction in concentration. Exposure reduction	Reduction in congestion Health related improvements	May 2018
13	Support the provision or improved lighting on cycle path.	Transport Planning and Infrastructure	Cycle network	B&NES Property Services	Lighting provided to key locations at least	n/a	Reduction in congestion Health related improvements	May 2019
14	Continue feasibility work on reopening Salford Station.	Transport Planning and Infrastructure	Public transport improvements - station	B&NES, First Group, Network Rail & MetroWest partners	Completed feasibility study	Requires air quality assessment	Greenhouse gas emissions from trains accelerating from station – unless electric overheads used for stopping service	5 years

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1. TARGETED INFORMATION CAMPAIGN FOR THE MOST VULNERABLE GROUPS

The people most vulnerable to poor air quality are those with respiratory conditions such as Asthma, Emphysema or Chronic Obstructive Pulmonary Disease. A text or phone message could inform people who are identified as vulnerable and registered to the service, if and when the pollution levels are high. However, the thresholds above which a warning is sent – if in accordance with the national ‘Daily Air Quality Index’ – is too high for regular enough messages and may never be triggered. Similar schemes throughout the Country have had varying success.

There are alternative ways of providing health advice, information and awareness targeted at vulnerable groups most at risk from the health effects of air pollution, so it should be possible to make better use of what is already available nationally and locally e.g. DEFRA have a number of public facing information and advice services and the Council have local information on their website.

Other ways of providing information and health advice include:

- Working with GP practices, NHS BANES Clinical Commissioning Group and other organisations to identify those most at risk and identify how targeted awareness could be channelled through existing mechanisms.
- By providing health advice and information directly to residents and vulnerable groups within air quality management areas.
- Improve the awareness within specific settings e.g. care homes and childcare settings
- Live air quality data on Bath and North East Somerset website and regular information updates

The bodies involved are Bath and North East Somerset Public Protection and Health Improvement Team, Public Health, Research and Intelligence Team, the Clinical Commissioning Group and Sirona Care and Health.

Monitoring and evaluation

This measure could be monitored by the number of initiatives completed and hits on advice websites.

2. RECOMMEND TREE PLANTING IN FUTURE INFRASTRUCTURE PROGRAMMES

Planting of suitable trees or shrubs that have a positive effect on air quality between the traffic and the building facades can provide a barrier between air pollution and residents or pedestrians and can absorb some pollutants over time. Consideration will be given to safety concerns re the spatial and visual implications. Consideration will also be given to the effect of tree planting on the Conservation Area. This measure could be developed in collaboration with Saltford Parish Council. Any future public realm schemes developed by the Council for Saltford should consider the opportunity for tree planting as a key part of the design. An assessment will be made to identify the most appropriate species for each potential site. Evergreen trees with low porosity such as the Yew Tree or Juniper tree may suit smaller spaces and grow to a modest height. In wider spaces, broadleaf deciduous trees may be more efficient in pollution scrubbing due to higher leaf surface

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area. Trees that have high Urban tree air quality scores (UTAQS) according to Donovan et al. (2005) include Alder, Field Maple, Hawthorn, Larch, Laurel, Lawson Cypress, Norway Maple, Pine and Silver Birch.

There are a number of considerations (according to the latest research) in relation to planting on the street, to ensure planting doesn't worsen air quality, such as:

- canopy cover not exceeding 30% to prevent trapping pollutants;
- maintain air flow to allow dispersion of pollutants;
- chose a species that do not have a high ozone index of negative effects on air quality (e.g. pollen or volatile organic compounds)

Monitoring and evaluation

The main indicator will be the number of trees planted. Continued monitoring of NO₂ concentrations and a comparison with other monitoring locations where there has been no planting will enable evaluation of the effect of this measure on local air quality.

3. ADVICE TO LAND OWNERS ON PLANTING THAT PROTECTS FROM AIR POLLUTION

This measure is connected to measure 2 but relates to private land. There is some scope for planting in gardens that front the main road in Saltford. An online leaflet with suggestions for the most effective way for tree or bush planting to help reduce air pollution in the vicinity of properties adjacent to the main road will be developed.

Monitoring and evaluation

The uptake of planting advice.

4. INFLUENCE PLANNING POLICY TO SUPPORT THE INCREASE OF ELECTRIC VEHICLE CHARGE POINT INFRASTRUCTURE FOR EACH NEW PROPERTY

This measure entails influencing planning policy with a view to ensuring that there is a separate electric spur is provided for the provision of charging points at new properties where there is off-street or adjacent on-street parking. This facilitates the further uptake of electric vehicles, which helps reduce local air pollution where the user would have previously used petrol or diesel vehicle. A standard fast charger uses 32amps for each socket.

The Council are able to lever this through the Placemaking Plan and design policies within it. This was submitted to the Planning Inspectorate in April 2016, and is estimated to be adopted in Winter 2016.

It is recommended that at developments of >10 residential properties, an electric vehicle charge point is installed every new property with dedicated parking or 1 charge point per 10 car parking spaces for those with shared parking. For commercial properties 5% of the parking spaces have electric vehicle charge points.

The costs of this measure are relatively low for the developer with whom the responsibility lies

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Monitoring and evaluation

This can be monitored using the number of properties with electric vehicle charge points and the number of planning applications approved with charge points as conditions.

5. INCREASE PUBLIC CHARGING POINTS THROUGH ‘ULTRA LOW WEST’ (SOURCE WEST) ELECTRIC VEHICLE CHARGING INFRASTRUCTURE PROGRAMME

The Ultra-Low West (Source West) electric vehicle charging network includes the public charging infrastructure that has been installed across Bath and North East Somerset, Bristol, South Gloucestershire and Gloucestershire. Users can register for a unique smart card that enables charging. The first public charge point in Keynsham was installed at the Fox and Hounds car park on Bath Hill in 2015. Electric vehicle uptake is climbing steeply and charge points will be provided dependent on resources. The council in partnership with the other West of England authorities has won funds as part of the Office for Low Emission Vehicles ‘Go Ultra Low City Scheme’ to implement a number of measures to further stimulate the uptake of electric vehicles including further charge point installations.

The Source West network is run jointly by the member authorities. There is already some promotion of the network through www.sourcewest.info, but further promotion can be carried out in the form of signage and adverts in publications, on websites and on radio and television.

Monitoring and evaluation

Monitoring will be carried out using the number of charge points installed and the number of charging sessions.

6. EXPLORE THE PROMOTION OF AN “ELECTRIC ZONE“

This would be a branding of the central area of the village broadly reflecting the coverage of the air quality management area. It would include a package of measures that encourage the use of plug-in and hybrid vehicles and would request drivers that have the option to switch to electric mode, to do so in the central area. This would need to minimise the effect of signage and appearance of clutter in the Conservation Area.

By alerting road users to the AQMA and electric zone, it will encourage hybrid cars to switch to electric mode in the vicinity of the AQMA.

This measure can be implemented jointly by Public Protection and Health Improvement and the Highways team. It is also eligible for financial support from the Go Ultra Low City Scheme fund that includes work packages for charging point infrastructure (measure 5) and Clean Air Zones.

Monitoring and evaluation

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This is inherently difficult to monitor, as it is impossible to know how many hybrid cars switch to electric. A manual traffic count may identify the number of hybrid and electric cars overall. The presence of these will be affected by other factors. The number of charging sessions undertaken at the charge points is also a key indicator.

7. SUPPORT THE CREATION OF A LOCAL" AIR QUALITY ACTION GROUP"

Identify and encourage existing groups that may be interested in helping to promote air quality improvement measures, such as tree or shrub planting. If a need is found for a specific community air quality group this could be created, with the aim of producing a local community air quality action plan.

Monitoring and evaluation

Number of groups established and the number of initiatives they have been involved in.

8. INFLUENCE PLANNING POLICY TO ENCOURAGE THE PROVISION OF SECURE CYCLE STORAGE AT EACH NEW PROPERTY

This measure seeks to ensure that residents of all new properties have somewhere safe and convenient to store their bicycles in order that cycling is a viable and attractive means of transport. The draft Placemaking Plan makes requires that if there is no garage or secure area provided, one secure covered stand per dwelling must be provided in a communal area for residents plus one stand per eight dwellings for visitors.

The costs of this measure are relatively low for the developer with whom the responsibility lies.

Monitoring and evaluation

Key indicators for this measure are the number of new properties with secure cycle storage and the number of approved planning applications with secure cycle storage as a condition.

9. WORK WITH COMMUNITY TRANSPORT TO PROMOTE THE USE OF LOW EMISSION DIAL-A-RIDE VEHICLES

The relatively short distance of journeys of the Keynsham Dial-a-ride service that also serves Saltford means that the service could be operated by electric or low emission vehicles. Bath and North East Somerset Council will work with Community Transport to encourage development of a business plan for replacement of existing vehicles with low emission vehicles.

Monitoring and evaluation

This will be monitored using the number of low emission journeys and the distance travelled using low emission vehicles.

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10. ENCOURAGE LOW EMISSION BUS SERVICES IN SALTFFORD

The Council will work with Public Transport Operators to encourage the use of low emission vehicles on routes within Bath and North East Somerset.

Monitoring and evaluation

The number of routes which are used by low emission vehicles.

11. LOBBY GOVERNMENT FOR INCENTIVISING UPTAKE OF NON-DIESEL VEHICLES

There is an acceptance among policy makers and air quality professionals that diesel cars emit more NO_x than petrol cars and thus make reduction in NO₂ more difficult to achieve. A change in central government policy is required to incentivise the uptake of non-diesel vehicles. As such, lobbying in co-ordination with other authorities is required to bring about this change.

Monitoring and evaluation

Monitoring would require collection of vehicle registrations and obtaining vehicle details from the DVLA to determine whether they are diesel or other. It would not be possible to ascertain the reason why the split in diesel and other vehicles may have changed.

12. INCREASE PUBLIC EDUCATION MESSAGES WHICH PROMOTE HEALTHIER CHOICES FOR SHORT JOURNEYS

Working with the Bath & North East Somerset Active Lifestyle's team to encourage healthier transport choices for short journeys by providing the air quality information to support the campaigns.

Monitoring and evaluation

The number of initiatives which are delivered.

13. SUPPORT THE PROVISION OF IMPROVED LIGHTING ON CYCLE PATHS

This will identify cycling routes which would benefit from improved lighting and support the upgrade work to the network.

Monitoring and evaluation

The number of lights which are installed and the results from cycling surveys.

14. CONTINUE FEASIBILITY WORK FOR REOPENING OF A STATION AT SALTFFORD

This measure is consistent with a resolution at the Bath and North East Somerset Council Cabinet meeting on 3rd December 2014:

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‘that work should continue to develop the Business Case for a station at Saltford and that this should include the option of opening a station to the west of the village where future development may support the new facility’

This follows a report assessing options of a station by CH2MHill on behalf of the Council. This report concluded that stopping trains would most likely be those currently serving Oldfield Park and Keynsham currently an hourly service. The Metro West project Phase 1 aims to increase the frequency of local trains serving Keynsham and Oldfield Park providing a ½ hourly service, and it is these trains that could serve Saltford. The Metro West project is not due to be completed until 2019 at the earliest.

Further feasibility work will need to consider the air quality impacts of a reopened station in relation to generated road traffic and potential congestion as a result of a new junction and alterations to other existing junctions.

The opportunity for re-opening a station at Saltford has arisen from work undertaken by the West of England on the MetroWest Project. This will provide an additional train service between Bath and Bristol each hour (in both directions) and the potential for an additional station as well.

No timescale has currently been set for the delivery of the project; however progress is dependent on the successful completion of Phase 1 of the MetroWest project which is due for completion in 2019.

The next step will be to consider site options for the new station, which will require an estimated 200 parking spaces in order to be viable, and prepare a business case for financial viability. However, it may need to be addressed as part of any future Local Plan review.

Monitoring and evaluation

A completed feasibility study including a detailed air quality assessment.
Progress dependent on outcome of business case.

6. Glossary

AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
DEFRA	Department of Environment, Food and Rural Affairs
GHG	Green House Gases
HGVs	Heavy Goods Vehicles
JLTP	Joint Local Transport Plan (former Avon Authorities)
LEZ	Low Emission Zone
LTP	Local Transport Plan
NAEI	National Atmospheric Emissions Inventory
NO	Nitric Oxide
NO ₂	Nitrogen Dioxide
NOx	Oxides of Nitrogen
O ₃	Ozone
PM _{2.5}	Particulate matter up to 2.5 micrometres (100 times thinner than human hair). These can travel long distances so 40-50% of PM _{2.5} sources will be from sources outside the area.
PM ₁₀	Particulate matter up to 10 micrometres
QA/QC	Quality Assurance / Quality Control
TIF	Transport Innovation Fund (£1.4billion central government fund)
TRC	Traffic Regulation Condition
TRO	Traffic Regulation Order
µg/m ³	micrograms per cubic metre

7. References

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8. Appendices

Appendix A: Air Quality Objectives and Exposure

Appendix B: Quality Assurance and Quality Control Data

Appendix C: Diffusion Tube Monitoring Results

Appendix D: Cost Benefit Analysis

Appendix E: Measures Considered But Not Pursued

APPENDIX A: Air Quality Objectives and Exposure

Table A1: 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 µg/m ³	Running annual mean	31.12.2003
	5.00 µg/m ³	Running annual mean	31.12.2010
1,3-Butadiene	2.25 µg/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 µg/m ³	Annual mean	31.12.2004
	0.25 µg/m ³	Annual mean	31.12.2008
Nitrogen dioxide	200 µg/m ³ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 µg/m ³	Annual mean	31.12.2005
Particles (PM ₁₀) (gravimetric)	50 µg/m ³ , not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 µg/m ³	Annual mean	31.12.2004
Sulphur dioxide	350 µg/m ³ , not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 µg/m ³ , not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 µg/m ³ , not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

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Table A2: Relevant Exposure for the NO₂ objectives (TG16)

Objective	Concentration	Relevant Exposure
Annual Mean NO ₂	40 µg/m ³	All locations where members of the public might be regularly exposed. Building facades of residential properties, schools, hospitals, care homes etc. Not offices, gardens of residential properties or Kerbside sites
1-hour NO ₂	200 µg/m ³ with 18 exceedences per year. Guidance indicates that an annual mean NO ₂ concentration greater than 60 µg/m ³ may indicate an exceedance of the 1-hour objective.	As above plus hotels, gardens, any outside location where members of the public might reasonably be expected to spend 1 hour or longer e.g. gardens of residential properties.

APPENDIX B: Quality Assurance/Quality Control Data

Diffusion Tube Bias Adjustment Factors

The diffusion tubes are analysed by Somerset Scientific Services in 2012-14 and prior to that by Bristol Scientific Services. The method of analysis is 20% triethanolamine (TEA) in water. They confirm that they are following the harmonised practice guidance document and have a satisfactory AIR-PT results⁽¹²⁾.

Monthly Bias	2009	0.79 (Bristol, 4 studies) ⁽⁷⁾
	2010	0.85 (Bristol, 7 studies) ⁽⁷⁾
	2011	0.83 (Bristol, 8 studies) ⁽⁷⁾
	2012	0.95 (Somerset, 2 studies) ^(7 v06/13)
	2013	0.90 (Somerset, 3 studies) ^(7 v03/14)
	2014	0.89 (Somerset, 8 studies) ^(26 v03/15)

Factor from Local Co-location Studies

A local bias factor has been calculated following the FAQ guidance on R&A website⁽⁷⁾. This has been calculated using monitoring data from the Walcott Terrace sites (now located at Walcott Buildings) (triplicate tubes) which are co-located with the London Road continuous monitor. Prior to 2011 diffusion tube sampling frequency at this site was 2-weekly, this changed to monthly in 2011. In 2012 the bias factor showed poor precision. The overall CV was >20%, mainly due to a couple of results with poor precision early in the year.

2-weekly Bias	2009	0.96 (Bristol)
	2010	0.90 (Bristol)
Monthly Bias	2011	0.89 (Bristol) (own)
	2012	0.95 (Somerset)
	2013	1.01 (Somerset)
	2014	1.09 (Somerset)

Discussion of Choice of Factor to Use

In 2014 our own bias factor was used as it was higher than the national factor leading to a worse case result. In 2012-13 the local bias adjustment factors were used to correct the diffusion tube data. This bias factor was the same or higher than the national factor.

Prior to 2011 the diffusion tubes were split into two networks, Round 1 was changed fortnightly and the local bias factor calculated at the London Road continuous monitor was used. The Round 2 was changed on a monthly basis. The national bias factor was applied to this network as it is more appropriate. All sites are classed as Round 1 except DT33 – Keynsham which was Round 2.

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Table A1: Site details

Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	In AQMA?	Relevant Exposure? (distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?	Dates site active
CM7a	Keynsham High Street	Roadside	365447	168531	3	Y	Y (0m)	3m		Aug 10-May 11
CM7	Saltford News	Roadside	368431	166962	2.7	Y	Y (0m)	3m	Y	Oct 11-Mar 13
DT33	Keynsham	Urban Background	364803	168237	2.6	N	Y (8m)	1m		01-Apr-93
DT66	Keynsham – 10 High Street	Roadside	365360	168814	2.5	Y	Y (1m)	1m		16-Sept-08
DT64	Keynsham – 1a Charlton Road	Roadside	365317	168663	2.8	Y	Y (4m)	1m		16-Sept-08
DT70	Keynsham – Bath Hill	Roadside	365496	168522	2.3	Y	Y (1m)	4m		20-Aug-07
DT65	Keynsham - Charlton Rd	Roadside	365404	168703	2.7	Y	Y (3m)	1m		06-Jan-06
DT69	Keynsham – Rock Road	Roadside	365428	168435	3.0	N	Y (0m)	2m		20-Aug-07
DT70a	Keynsham – Somerdale	Urban Background	365553	168990	2.2	N	Y (6m)	1.9m		29-Mar-12

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Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	In AQMA?	Relevant Exposure? (distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?	Dates site active
DT67	Keynsham – Somerfield	Kerbside	365451	168523	2.8	Y	Y (2m)	1m	Y	19-Jun-02
DT63	Keynsham – Station Road	Roadside	365409	168850	2.7	Y	Y (3m)	1m		16-Sept-08
DT68	Keynsham - Temple St	Roadside	365489	168363	2.8	N	Y (0m)	3m		06-Jan-06
DT71	Salford Library	Roadside	368187	167117	2.6	N	Y (11.5 m)	2.5 m		16-Feb-99
DT72	Salford – Beech Road	Roadside	368263	167113	2.7	N	Y (7 m)	2 m		15-Sept-09-04-Jan-13
DT72a	Salford – Norman Road	Roadside	367840	167298	2	N	Y (1 m)	12 m		15 Sept 09-07-Jan-11
DT77	Salford – 562 Bath Road	Roadside	368778	166687	2.2	Y	Y (0 m)	2 m		15-Sept-09
DT76	Salford – The Glen	Roadside	368834	166541	2.7	Y	Y (8 m)	2 m		15-Sept-09-04-Jan-13
DT75	Salford – The Crown	Roadside	368375	166988	2.5	Y	Y (0 m)	3 m	Y	15-Sept-09

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Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	In AQMA?	Relevant Exposure? (distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?	Dates site active
DT74	Saltford – Post Office	Roadside	368308	167081	2	N	Y (12 m)	7 m		15 Sept 09-18-Jan-12
DT75a	Saltford – Primary School	Urban Back	368030	166984	2.5	N	Y (9 m)	N/A		15 Sept 09-07-Jan-11
DT73	Saltford – Tiddlers Nursery	Urban Centre	368229	167095	2.1	N	Y (0 m)	16 m		15-Sept-09-04-Jan-13
DT76a	Saltford – Wickhouse Close	Urban Back	367816	167393	2	N	Y (5 m)	N/A		15 Sept 09-07-Jan-11
DT79	Saltford – Jade Gardens	Roadside	368357	167055	2.6	N	Y (0m)	19m		07-Jan-12-04-Jan-13
DT78	Saltford – High Street	Urban Back	368963	167458	2	N	Y (1m)	N/A		07-Jan-11-18-Jan-12

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Quality Assurance /Quality Control (QA/QC) of automatic monitoring

The Council's continuous analysers follow a QA/QC programme; the London Road Monitor is the Bath Automatic Urban and Rural Network (AURN Monitor) affiliate site and is managed as part of that network. The Saltford and Keynsham site followed the QA/QC programme below:

- There are daily checks on the data to ensure analysers and communications are working and faults are reported as soon as possible.
- The sites are inspected and calibrated checks are made once a month by a member of the Environmental Quality Team at Bristol City Council, using certified traceable gases. The sites are also visited once a month by a trained AURN Local Site Operator (LSO) to change the filters and check the analysers. These are planned so the site is visited once a fortnight.
- The analysers are also serviced and re-calibrated at six monthly intervals by the equipment suppliers.
- The results of all service, maintenance and calibration checks are held and used for ratification and scaling of the data.

The data is scaled on a time-linear basis from the zero and span readings obtained from the calibration checks. The instrument span is calculated using the method in TG(09)(3) and the span and offset values are applied to the data using Opsis Enviman software. The data is viewed and spurious data is identified and removed where appropriate. A copy of the original data is kept for reference.

QA/QC of diffusion tube monitoring

The diffusion tubes are analysed by Somerset Scientific Services since 2012 and prior to that by Bristol City Council Scientific Services. They are not UKAS accredited for the analysis of the diffusion tubes but they do participate in the AIR-PT scheme formally the Workplace Analysis Scheme for Proficiency (WASP). The latest AIR-PT report⁽¹²⁾ for nitrogen dioxide for the laboratory indicates a performance classification as satisfactory for all periods.

APPENDIX C: Diffusion Tube Monitoring Results

Site ID	Site Name	Site Type	Within AQMA ?	Annual Mean Concentration ($\mu\text{g}/\text{m}^3$) - Adjusted for Bias					
				2009 (Bias Adjustment Factor = 0.96)	2010 (Bias Adjustment Factor = 0.90)	2011 (Bias Adjustment Factor = 0.89)	2012 (Bias Adjustment Factor = 0.95)	2013 (Bias Adjustment Factor = 1.01)	2014 (Bias Adjustment Factor = 1.07)
DT33	Keynsham	Urban Background	N	15	18	14	19	18	17
DT66	Keynsham – 10 High Street	Roadside	Y	49	48	44	46	44	50
DT64	Keynsham – 1a Charlton Rd	Roadside	Y	40	40	39	38	39	39
DT70	Keynsham – Bath Hill	Roadside	Y	36	34	32	32	31	36
DT65	Keynsham – Charlton Road	Roadside	Y	39	42	35	35	37	39
DT69	Keynsham – Rock Road	Roadside	N	29	29	24	27	29	28
DT70A	Keynsham – Somerdale	Urban Background	N	-	-	-	23	23	27
DT67	Keynsham – Somerfield	Kerbside	Y	52	49	45	44	44	46

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Site ID	Site Name	Site Type	Within AQMA ?	Annual Mean Concentration ($\mu\text{g}/\text{m}^3$) - Adjusted for Bias					
				2009 (Bias Adjustment Factor = 0.96)	2010 (Bias Adjustment Factor = 0.90)	2011 (Bias Adjustment Factor = 0.89)	2012 (Bias Adjustment Factor = 0.95)	2013 (Bias Adjustment Factor = 1.01)	2014 (Bias Adjustment Factor = 1.07)
DT63	Keynsham – Station Road	Roadside	Y	36	37	32	32	33	36
DT68	Keynsham – Temple Street	Roadside	N	28	28	24	26	28	28
DT71	Saltford Library	Roadside	N	42	41	34	36	27	37
DT72	Saltford – Beech Road	Roadside	N	-	39	31	32	-	-
DT72a	Saltford – Norman Road	Roadside	N	-	31	-	-	-	-
DT77	Saltford – 562 Bath Road	Roadside	Y	-	40	37	39	37	42
DT76	Saltford – The Glen	Roadside	Y	-	47	44	45	-	-
DT75	Saltford – The Crown	Roadside	Y	-	44	43	47	44	50
DT74	Saltford – Post Office	Roadside	N	-	36	30	-	-	-
DT75a	Saltford – Primary School	Urban Back	N	-	19	-	-	-	-
DT73	Saltford – Tiddlers Nursery	Urban Centre	N	-	26	21	27	-	-

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Site ID	Site Name	Site Type	Within AQMA ?	Annual Mean Concentration ($\mu\text{g}/\text{m}^3$) - Adjusted for Bias					
				2009 (Bias Adjustment Factor = 0.96)	2010 (Bias Adjustment Factor = 0.90)	2011 (Bias Adjustment Factor = 0.89)	2012 (Bias Adjustment Factor = 0.95)	2013 (Bias Adjustment Factor = 1.01)	2014 (Bias Adjustment Factor = 1.07)
DT76a	Salford – Wickhouse Close	Urban Back	N	-	21	-	-	-	-
DT79	Salford – Jade Gardens	Roadside	N	-	-	26	28	-	-
DT78	Salford – High Street	Urban Back	N	-	-	18	-	-	-

APPENDIX D: Cost Benefit Analysis

An indicative cost and benefit score has been given to each potential measure by the project team. The potential actions have been scored for cost; benefit and the resulting rank in order to assist identify the most deliverable actions. Estimated costs (1 for high cost to 5 for low cost) were multiplied by a sum of the likely benefit from reducing pollution and people's exposure to the pollution (10 for high and 1 for low) to provide a score. The highest score shows the greatest cost benefit according to the opinions of the project team.

KEYNSHAM

Table D1: Cost Benefit Analysis for Keynsham measures

	Measure	Cost benefit (cost x [pollution reduction + exposure reduction] = score)				
		Cost 1 = >£1m 2 = £250k-1m 3 = £50k - 250k 4 = £10k - £50k 5 = <£10k	Air pollution reduction 10 = greatest air quality gain 1 = least air quality gain	Exposure reduction 10 = greatest exposure reduction 1 = least exposure reduction	Score = cost x benefit	Rank 1 = most cost benefit effective
1	Quantify the benefits from the one way system pilot for the High Street including monitoring and modelling of air quality impacts.	3	6	7	39	1
2	Targeted information campaign for the most vulnerable groups (i.e. asthmatics, COPD etc.).	4	2	6	32	2
3	This Action Plan influences planning policy to require electric vehicle charge points for each new property.	5	3	2	25	3
4	Increase public charging points through 'Ultra Low West' (Source West) EV charging infrastructure programme.	5	3	2	25	3
5	Recommend tree planting in future infrastructure programmes	4	2	4	24	4
6	This Action Plan influences planning policy to encourage the provision of cycle parking for each new property.	5	3	1	20	5
7	Explore the promotion of an "Electric Zone".	5	2	2	20	5
8	Influence the design of developments to improve access to public transport, cycling and walking routes.	5	2	2	20	5
9	Support the creation of a local "Air Quality Action Group".	5	2	1	15	6
10	Keynsham Greenway links to National Cycle Network 4	2	3	4	14	7
11	Work with Community Transport to promote the use of Low emission dial-a-ride vehicles.	3	2	2	12	8
12	Identify, influence and publicise pedestrian and cycling facility improvements.	3	2	2	12	8
13	Lobby government for incentivising uptake of non-diesel cars.	5	1	1	10	9
14	Identify and publicise priority cycling routes to support a cycling culture for all.	5	1	1	10	9
15	Encourage low emission bus services in Keynsham	2	3	2	10	9
16	Increase public education messages which promote healthier choices for short journeys	5	1	1	10	9
17	Work with bus operators on improved services, ticketing and simplified fare structure.	3	2	1	9	10
18	Support the provision or improved lighting on cycle path.	4	1	1	8	11
19	Advocate increased rail service via "MetroWest" – resulting in increase from hourly to half-hourly rail service.	1	4 (possibly worse for Saltford)	1	5	12

SALTFORD

Table D2: Cost Benefit Analysis for Salford measures

	Measure	Cost benefit (cost x [pollution reduction + exposure reduction] = score)				
		Cost 1 = >£1m 2 = £250k-1m 3 = £50k - 250k 4 = £10k - £50k 5 = <£10k	Air pollution reduction 10 = greatest air quality gain 1 = least air quality gain	Exposure reduction 10 = greatest exposure reduction 1 = least exposure reduction	Score = cost x benefit	Rank 1 = most cost effective
1	Targeted information campaign advice for the most vulnerable groups (i.e. asthmatics, COPD etc.).	4	2	6	32	1
2	Recommend tree planting in future infrastructure programmes	4	3	4	28	2
3	Advice to land owners on planting that protects from air pollution.	5	2	3	25	3
4	Influence planning policy to support the increase of electric vehicle charge point infrastructure for each new property.	5	2	2	20	4
5	Increase public charging points through 'Ultra-Low West' (Source West) electric vehicle charging infrastructure programme	5	2	2	20	4
6	Explore the promotion of an "Electric Zone".	5	2	2	20	4
7	Support the creation of a local "Air Quality Action Group".	5	2	1	15	5
8	Influence planning policy to encourage the provision of cycle parking for each new property.	5	2	1	15	5
9	Work with Community Transport to promote the use of Low emission dial-a-ride vehicles.	3	2	2	12	6
10	Encourage low emission bus services in Keynsham	2	4	2	12	6
11	Lobby government for incentivising uptake of non-diesel cars.	5	1	1	10	7
12	Increase public education messages which promote healthier choices for short journeys	5	1	1	10	7
13	Support the provision or improved lighting on cycle path.	4	1	1	8	8
14	Continue feasibility work on reopening Salford Station.	1	1	1	2	9

APPENDIX E: Measures Considered but not Pursued

Table B.1 – Action Plan Measures Not Pursued and the Reasons for that Decision – needs finalising

Action category	Action description	Reason action is not being pursued (including Stakeholder views)
Public Information	Air Quality Messaging service	This was substituted for a targeted information campaign as the levels of pollution are not likely trigger the alert.
Traffic Management	Saltford Bypass	There is no proposal for a bypass for Saltford in the current Core Strategy that runs until 2029. There will be a chance to put a case for bypass as part of the consultation for the next Core Strategy.
Traffic Management	Extended Keynsham one way system	This is not part of the project brief for the trial scheme.