Winchester City Council

Detailed Assessment and Associated Studies

February 2016

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Document Control Sheet

Issue/Revision	Issue 1	Issue 2	Issue 3
Remarks	Draft for comment	Draft for comment	Final
Date	October 2015	October 2015	February 2016
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Project number	6270852	6270852	6270852

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Executive Summary

Part IV of the Environment Act 1995 places a statutory duty on local authorities to review and assess the air quality within their area. For local authorities that have identified areas where there is a potential risk of exceedence of Air Quality Strategy (AQS) objectives, a Detailed Assessment is required.

Following the assessment of monitoring results in 2013 that indicated the potential for an exceedence of the hourly mean AQS objective for Nitrogen Dioxide (NO_2), Bureau Veritas UK Ltd has been commissioned by Winchester City Council to undertake a Detailed Assessment of the area surrounding the existing AQMA in Winchester, with particular focus on St George's Street and Romsey Road. In relation to this, further studies have also been commissioned to assess the impact of potential intervention strategies, namely the upgrading of the buses used on Winchester's Park and Ride route to Euro VI vehicles.

The assessment is undertaken in accordance with the methodology agreed with the Council. The area was modelled using the advanced atmospheric dispersion model ADMS-Roads (Version 3.4) and using the latest emissions from the Emissions Factors Toolkit (Version 6.0.2).

The results of the Detailed Assessment confirm the monitored exceedences of the annual mean NO_2 AQS objective. No exceedences were modelled outside of the existing AQMA, validating the current boundary.

The Detailed Assessment also predicts a number of areas where the 1-hour mean NO_2 objective is likely to be exceeded, including Chesil Street, Romsey Road and St George's Street. The gridded outputs demonstrate the geographical extent of these exceedences. Under current conditions, the maximum 99.8th percentile of 1-hour mean NO_2 concentration at an existing receptor was predicted at D181 on Chesil Street, with a predicted concentration of 240.6µg/m^3.

Of these three areas, it is considered that only St George's Street has locations where the public are likely to spend short time periods outdoors, but that Romsey Road and Chesil Street contain residential receptors where both the annual mean and 1-hour objective apply. Therefore it is recommended to declare three AQMAs in relation to the 1-hour mean AQS objective for NO_2 in the areas of St George's Street, Chesil Street and Romsey Road. The potential extent of this AQMA is proposed herein.

The impacts of two potential bus fleet upgrades were also assessed. The first scenario (SC1) considered the effects of replacing only those buses that currently operate on the Park and Ride route with Euro VI vehicles, and the second (SC2) considered the effects of replacing all buses operated by Stagecoach in the Council area, with Euro VI standard vehicles.

It was identified that the average annual mean NO_2 contribution from buses for the base (2014) scenario is 2.0µg/m^3 (or 6.2% of the total NO_2 concentration inclusive of background). This reduced to 1.5µg/m^3 (4.7% of the total NO_2 concentration inclusive of background) and 1.1µg/m^3 (3.5% of the total NO_2 concentration inclusive of background) for SC1 and SC2 respectively. The average beneficial magnitude change across all modelled receptors is therefore small for both SC1 and SC2 in accordance with EPUK guidance.

Consideration of receptors in the three areas known to have elevated concentrations predicts greater beneficial impacts, the largest of which is observed at receptors on St George's Street, where the average annual mean NO_2 contribution from buses at receptors for the base scenario is 10.6µg/m^3 (or 20.5% of the total NO_2 concentration inclusive of background). This reduced to 7.8µg/m^3 (15.9% of the total NO_2 concentration inclusive of background) and 5.9µg/m^3 (12.6% of the total NO_2 concentration inclusive of background) for SC1 and SC2 respectively. The average beneficial magnitude change across receptors on St George's Street is therefore medium for SC1 and large for SC2 in accordance with EPUK guidance.

In summary, both SC1 and SC2 brought about reductions to the predicted NO_2 concentration. In accordance with the EPUK guidance, SC1 resulted in a small beneficial magnitude change on average for all receptors considered, increasing to a medium beneficial change when considering receptors in areas of exceedence or known areas of poor air quality only. This resulted in an impact descriptor of slight beneficial at 93 receptor locations and moderate beneficial at 23 receptor locations.

In accordance with the EPUK guidance, SC2 resulted in a small beneficial magnitude change on average for all receptors considered, increasing to a large beneficial change when considering receptors in areas of exceedence or known areas of poor air quality only. This resulted in an impact descriptor of slight beneficial at 46 receptor locations, moderate beneficial at 71 receptor locations and substantial beneficial at 10 receptor locations.

It should be noted that the improvements in emissions brought about by upgrading the Winchester bus fleet to Euro VI vehicles are not sufficient to remove the areas of likely exceedence completely. It should also be borne in mind that the results represent the meteorological conditions encountered during 2014, and there may be considerable inter-year variability in meteorological conditions and associated 1-hour NO_2 concentrations.

1 Introduction

1.1 Scope of Detailed Assessment

Winchester City Council (the Council) has previously made a declaration of an Air Quality Management Area (AQMA) under the existing Local Air Quality Management (LAQM) regime in relation to exceedences of the nitrogen dioxide (NO_2) annual mean Air Quality Strategy (AQS) objective of 40µg/m^3 and the 24-hour mean of 50µg/m^3 not to be exceeded more than 35 times a year for PM_{10}.

Defra's Local Air Quality Management Technical Guidance 2009 (LAQM TG(09)[1]) details that it is unlikely that the 1-hour mean NO_2 AQS objective will be exceeded if the annual mean objective is achieved, or if the annual mean is less than 60µg/m^3. The 2013 Progress Report, which was completed in conjunction with the 2012 Updating and Screening assessment, identified three locations within the town centre where the annual mean concentration of NO_2 was greater than 60µg/m^3. There is therefore the potential for exceedences of the 1-hour mean NO_2 AQS objective at these locations. It was recommended that a Detailed Assessment be undertaken in respect of the 1-hour mean AQS objective for NO_2, for the St George's Street and Romsey Road areas.

Bureau Veritas UK Ltd has been commissioned by the Council to undertake the Detailed Assessment, with respect to the 1-hour mean AQS objective for NO_2, for the areas surrounding St George's Street and Romsey Road.

PM_{10} objectives have been met for a number of consecutive years, so this pollutant is not considered in this assessment.

The area considered as part of this study is illustrated in Figure 1.

The following are the main objectives of the assessment:

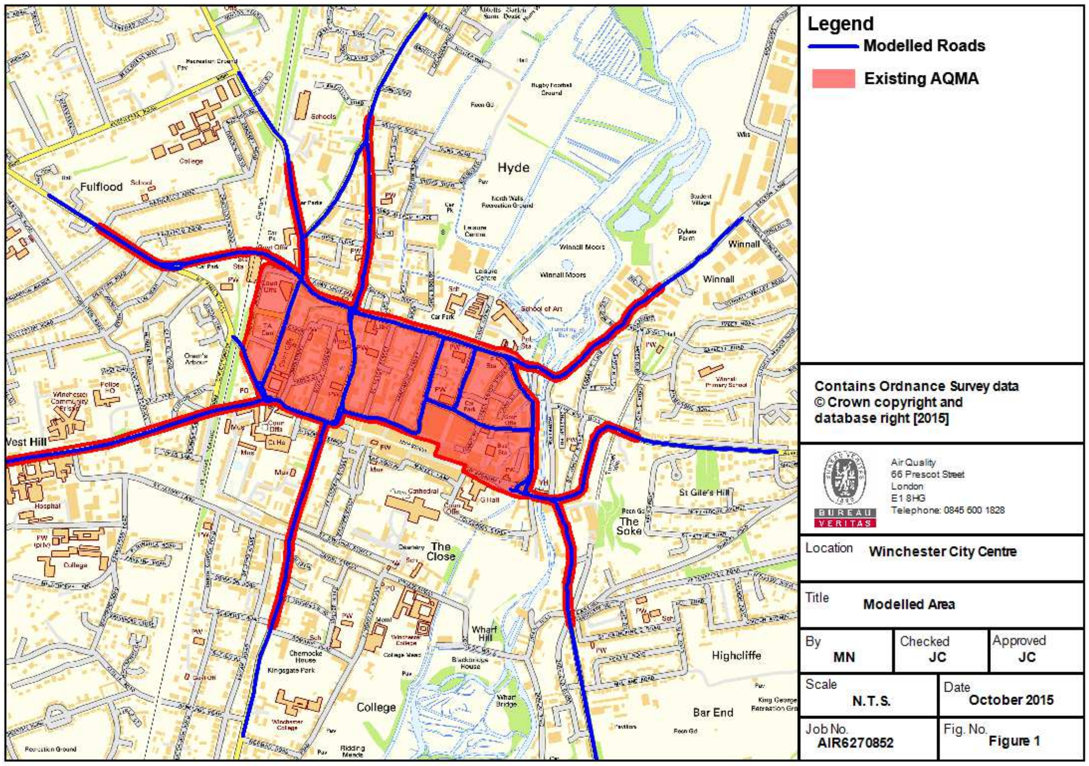
- To assess the air quality at selected locations ("receptors") at the façades of the existing residential units, representative of worst-case exposure, based on modelling of emissions from road traffic on the local road network for 2014;
- To determine the geographical extent of any potential exceedence of the 1-hour AQS objective for NO_2; and
- To put forward conclusions and recommendations as to the extent of any proposed AQMA and necessary future monitoring.

The approach adopted in this assessment to assess the impact of road traffic emissions on air quality utilised the atmospheric dispersion model ADMS Roads version 3.4, focusing on emissions of oxides of nitrogen (NO_x).

In order to provide consistency with the Council's own work on air quality, the guiding principles for air quality assessments as set out in the latest guidance and tools provided by Defra for air quality assessment (LAQM.TG(09)[1]) have been used.

[1] Local Air Quality Management Technical Guidance LAQM.TG(09). February 2009. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.

Figure 1 - Modelled Area



1.2 Associated Modelling Studies

In addition to the Detailed Assessment, the Council has also requested that an assessment is undertaken to predict NO_2 impacts from upgrading the fleet of buses which run on the Winchester Park and Ride route to Euro VI vehicles.

The impacts of two potential bus fleet upgrade scenarios have been considered:

- Scenario 1 (SC1) - 2014 Modified Park and Ride Bus Fleet, assumes those buses used as part of the Winchester Park and Ride bus route are upgraded to Euro VI vehicles; and
- Scenario 2 (SC2) - 2014 Modified All Stagecoach Buses, assumes all buses operated on Council Bus routes by Stagecoach in Winchester are upgraded to Euro VI vehicles.

2 Air Quality – Legislative Context

2.1 Air Quality Strategy

The importance of existing and future pollutant concentrations can be assessed in relation to the national air quality standards and objectives established by Government. The Air Quality Strategy[2] (AQS) provides the over-arching strategic framework for air quality management in the UK and contains national air quality standards and objectives established by the UK Government and Devolved Administrations to protect human health. The air quality objectives incorporated in the AQS and the UK Legislation are derived from Limit Values prescribed in the EU Directives transposed into national legislation by Member States.

The CAFE (Clean Air for Europe) programme was initiated in the late 1990s to draw together previous directives into a single EU Directive on air quality. The CAFE Directive[3] has been adopted and replaces all previous air quality Directives, except the 4th Daughter Directive[4]. The Directive introduces new obligatory standards for $PM_{2.5}$ for Government but places no statutory duty on local government to work towards achievement of these standards.

The Air Quality Standards (England) Regulations[5] 2010 came into force on 11 June 2010 in order to align and bring together in one statutory instrument the Government's obligations to fulfil the requirements of the new CAFE Directive.

The objectives for ten pollutants – benzene (C_6H_6), 1,3-butadiene (C_4H_6), carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), particulate matter - PM_{10} and $PM_{2.5}$, ozone (O_3) and Polycyclic Aromatic Hydrocarbons (PAHs), have been prescribed within the AQS[2].

The EU Limit Values are considered to apply everywhere with the exception of the carriageway and central reservation of roads and any location where the public do not have access (e.g. industrial sites).

Guidance from the UK Government and Devolved Administrations makes clear that exceedences of the health based objectives should be assessed at outdoor locations where members of the general public are regularly present over the averaging time of the objective. Table 1 taken from LAQM TG(09)[1] provides an indication of those locations that may or may not be relevant for each averaging period.

[2] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (2007), Published by Defra in partnership with the Scottish Executive, Welsh Assembly Government and Department of the Environment Northern Ireland

[3] Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe.

[4] Directive 2004/107/EC of the European Parliament and of the Council of 15 December 2004 relating to arsenic, cadmium, mercury, nickel and polycyclic hydrocarbons in ambient air.

[5] The Air Quality Standards Regulations (England) 2010, Statutory Instrument No 1001, The Stationary Office Limited.

Table 1 – Examples of where the Air Quality Objectives should apply

Averaging Period	Objectives should apply at:	Objectives should generally not apply at:
Annual mean	All locations where members of the public might be regularly exposed Building facades of residential properties, schools, hospitals, care homes etc.	Building facades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
24-hour mean and 8-hour mean	All locations where the annual mean objectives would apply, together with hotels Gardens or residential properties[1]	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.
1-hour mean	All locations where the annual mean and 24 and 8-hour mean objectives would apply. Kerbside sites (e.g. pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where the public might reasonably be expected to spend one hour or more. Any outdoor locations at which the public may be expected to spend one hour or longer.	Kerbside sites where the public would not be expected to have regular access.
15-minute mean	All locations where members of the public might reasonably be expected to spend a period of 15 minutes or longer.	

Note [1] For gardens and playgrounds, such locations should represent parts of the garden where relevant public exposure is likely, for example where there is seating or play areas. It is unlikely that relevant public exposure would occur at the extremities of the garden boundary, or in front gardens, although local judgement should always be applied.

This assessment focuses on NO_2 as this is the pollutant of most concern within the Council's administrative area, given monitored exceedences. Moreover, as a result of traffic pollution the UK has failed to meet the EU Limit Values for this pollutant by the 2010 target date. As a result, the Government has had to submit time extension applications for compliance with the EU Limit Values. Continued failure to achieve these limits may lead to EU fines. The AQS objectives for NO_2 are presented in Table 2.

Table 2 – Relevant AQS Objectives for the Assessed Pollutants in England

Pollutant	AQS Objective	Concentration Measured as:	Date for Achievement
Nitrogen dioxide (NO_2)	200µg/m³ not to be exceeded more than 18 times per year	1-hour mean	31 December 2005
	40µg/m³	Annual mean	31 December 2005

2.2 Local Air Quality Management (LAQM)

Part IV of the Environment Act 1995 places a statutory duty on local authorities to periodically Review and Assess the current and future air quality within their area, and determine whether they are likely to meet the AQS objectives set down by Government for a number of pollutants – a process known a Local Air Quality Management (LAQM). The AQS objectives that apply to LAQM are defined for seven pollutants: benzene, 1,3-butadiene, carbon monoxide, lead, nitrogen dioxide, sulphur dioxide and particulate matter.

Where the results of the Review and Assessment process highlight that problems in the attainment of health-based objectives for air quality will arise, the authority is required to declare an Air Quality Management Area (AQMA) – a geographic area defined by high concentrations of pollution and exceedences of health-based standards.

Where an authority has declared an AQMA, and development is proposed to take place either within or near the declared area, further deterioration to air quality resulting from a proposed development can be a potential barrier to gaining consent for the development proposal. Similarly, where a development would lead to an increase of the population within an AQMA, the protection of residents against the adverse long-term impacts of exposure to existing poor air quality can provide the barrier to consent. As such, following an increased number of declarations across the UK, it has become standard practice for planning authorities to require an air quality assessment to be carried out for a proposed development (even where the size and nature of the development indicates that a formal Environmental Impact Assessment (EIA) is not required).

One of the objectives of the LAQM regime is for local authorities to enhance integration of air quality into the planning process. Current LAQM Policy Guidance[6] clearly recognises land-use planning as having a significant role in terms of reducing population exposure to elevated pollutant concentrations. Generally, the decisions made on land-use allocation can play a major role in improving the health of the population, particularly at sensitive locations – such as schools, hospitals and dense residential areas.

[6] LAQM Policy Guidance LAQM.PG(09) - February 2009. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.

3 Review and Assessment of Air Quality Undertaken by the Council

3.1 Local Air Quality Management

The first round of Review and Assessment carried out by Winchester City Council in December 1998 concluded that a Detailed Assessment was required for carbon monoxide, nitrogen dioxide and PM_{10}. A further review undertaken in 2000 concluded that the concentrations of the above named pollutants would comply with the relevant objectives across the District. Defra requested that further assessment of the NO_2 concentrations at properties close to main roads in the town centre was undertaken.

The assessment of the NO_2 concentrations within Winchester City Centre was undertaken in October 2001. The report concluded that a small number of properties close to busy city centre roads may have NO_2 concentrations higher than the objective levels, and that dispersion modelling should be undertaken to assess these locations further.

Dispersion modelling was undertaken in July 2003 using the BREEZE dispersion model. NO_2 concentrations were predicted to exceed the objectives. The report also assessed particulates. However it was concluded that the model performed poorly and further modelling was recommend using a model which took better consideration of topographical effects. On the basis of the dispersion modelling results, it was advised that an AQMA be declared.

In the second round of review and assessment the 2003 Updating and Screening Assessment was undertaken. The report concluded that additional monitoring was required for sulphur dioxide at the Alresford Station of the Watercress Steam Railway Line and that the conclusions from previous reports remained valid. An AQMA for Winchester City Centre was declared in November 2003 for annual mean NO_2 and 24-hour mean PM_{10}. The AQMA boundary can be seen in Figure 1.

Modelling using ADMS roads was undertaken in August 2004. The report concluded that the level of exceedences for particulates was less than that for NO_2 and that any action plan aimed at achieving the NO_2 objective should ensure compliance with the 24-hour PM_{10} objective. It was recommended that additional monitoring sites for PM_{10} be installed to ensure objectives are being met.

A Detailed Assessment of sulphur dioxide levels from the Hampshire Watercress Line was undertaken in February 2005. Sulphur dioxide concentrations were monitored at the Alresford railway station platform from the steam engines operating on the heritage railway between Alresford and Alton. The report concluded that pollutant concentrations showed compliance with all of the sulphur dioxide objectives and therefore an AQMA was not required in this area.

The Progress Report undertaken in 2005 concluded that air quality objectives were likely to be met across the district for all pollutants with the exception of NO_2 at locations adjacent to the M3 in Shawford and Otterbourne.

In 2006 the Winchester City Council Air Quality Action Plan was produced. The report identified 21 actions to reduce NO_2 concentrations as far as reasonably practicable.

The third round of Review and Assessment began with the USA, which was completed in 2006. The report concluded that exceedences of the annual mean NO_2 objective existed within the AQMA. Monitoring of NO_2 in Otterbourne suggested that the annual mean objective for NO_2 was being exceeded. PM_{10} concentrations met the annual mean and 24- hour mean at all monitoring locations, therefore the action plan would focus solely on NO_2, however monitoring of PM_{10} would continue at all locations. Defra advised that consideration should be given to revoking the PM_{10} 24-hour mean AQMA is objectives continue to be met.

The 2007 Progress Report showed that monitoring results were similar to that in preceding years, with concentrations of NO_2 meeting the objectives, with the exception of those locations within the

AQMA. Concentrations of PM_{10} continued to meet all relevant objectives at all locations. Three additional PM_{10} monitors were implemented in Winchester City centre to allow for better assessment of PM_{10} concentrations. One of the new locations was collocated with the existing background location with the other two located at roadside locations within the AQMA boundary. Additional monitoring of NO_2 was also conducted in the Compton to Otterbourne area adjacent to the M3.

The 2008 Progress Report showed that monitoring in 2007 had showed slightly lower concentrations than those observed in 2006. The Compton to Otterbourne diffusion tube study was continued in 2007. The results were below the objective in all locations, with the exception of Site 4, however there was no relevant exposure at this location. Air quality in Otternbourne was therefore deemed acceptable and the monitoring survey discontinued. Monitoring at Site 4 was continued to assess trends in the area.

As part of the fourth round of Review and Assessment an Updating and Screening Assessment was undertaken in 2009. This report concluded that there continued to be exceedences of the NO_2 objectives within the AQMA. Concentrations of PM_{10} remained within objective levels at all monitoring sites. The report also concluded that no new or significantly changed sources were identified and as such there was no requirement for a Detailed Assessment to be undertaken.

The 2010 Progress Report concluded that there were continued to be exceedences of the annual mean objective for NO_2 within the current AQMA. Concentrations of PM_{10} remained within the objective levels and as such it was decided to revoke the AQMA with respect to the 24-hour objective for PM_{10}. Similarly, the 2011 Progress Report concluded there were continued exceedences of the annual mean objective for NO_2 within the current AQMA and identified now new areas of potential exceedence.

The 2012 USA and 2013 Progress reports, completed in conjunction, concluded the annual mean objective for NO_2 was still being exceeded within the AQMA, but identified locations where the annual mean concentration was above 60µg/m³. As detailed in LAQM TG(09)[1], this indicates the potential for exceedences of the 1-hour mean AQS objective, thus the recommendation was for this Detailed Assessment to be undertaken.

3.2 Council Monitoring Data

The Council operates two automatic air quality monitoring stations, both monitoring NO_2 and PM_{10}. One of these is a roadside site on St. Georges St and the other is a background site, is near Friarsgate. The details for these are summarised in Table 3 and Table 4 Annual mean PM_{10} concentrations are well below the 40µg/m^3 AQS objective at both sites, justifying the omission of the pollutant from this assessment.

Table 3 – LAQM Automatic Monitoring Undertaken in the Council area – Annual Mean

Site	Site Name	Site Type	OS Grid Ref	Pollutants Monitored	Annual Mean Concentration (µg/m^3)		
					2012	2013	2014
CM1	Echo Offices	Roadside	448213 129504	NO_2	**46**	**47**	**41**
				PM_{10}	29	31	29
CM2	Godson House	Urban Background	448506 129525	NO_2	26	28	24
				PM_{10}	20	23	23
In **Bold**, exceedence of the annual mean NO_2 AQS objective of 40µg/m^3							

Table 4 - LAQM Automatic Monitoring Undertaken in the Council area – Short-term Means

Site	Site Name	Site Type	OS Grid Ref	Pollutants Monitored	Maximum Concentration (µg/m^3)			Exceedences of Short-term objective (Hourly mean > 200 µg/m^3 for NO_2, Daily mean >50 µg/m^3 for PM_{10})		
					2012*	2013	2014	2012	2013	2014
CM1	Echo Offices	Roadside	448213 129504	NO_2	**-**	**204**	170	0	1	0
				PM_{10}	-	61	110	16	15	19
CM2	Godson House	Urban Background	448506 129525	NO_2	-	105	113	0	0	0
				PM_{10}	-	74	61	1	3	1

In **Bold**, exceedence of the annual mean NO_2 AQS objective of 40µg/m^3
*Not reported

Annual mean NO_2 concentrations at the roadside site CM1 have been above the 40µg/m^3 AQS objective for each of the last three years (2012-2014). CM1 has not exceeded the 18 allowed exceedences of the 200µg/m^3 1-hour NO_2 AQS objective during the last three years, with a maximum number of exceedences being 1 occurring in 2013.

Annual mean NO_2 concentrations at the urban background site CM2 have been well below the 40µg/m^3 AQS objective for each of the last three years (2012-2014). CM2 has not exceeded the 200µg/m^3 1-hour AQS objective during the last three years, with a maximum 1-hour NO_2 concentration of 113µg/m^3 occurring in 2014.

In addition to the automatic monitoring stations, the Council carries out passive monitoring for NO_2 at 26 locations within the city centre. Recent monitoring results for the sites in the vicinity of the modelled area are shown in Table 5.

Table 5 – LAQM Diffusion Tube Monitoring undertaken for NO2 in modelled area

Site	Site Name	Site Type	OS Grid Ref	Distance to Road (m)	Annual Mean NO_2 Concentration (µg/m^3)*		
					2012 Bias (1.06)	2013 (Bias 1.02)	2014 (Bias 0.91)**
DT1	10 Eastgate St	UC	448563 129391	5.55	**41.5**	**40.5**	37.5
DT2	Greyfriars 3	UC	448566 129560	9.70	38.2	36.2	33.7
DT3	Friarsgate	RS	448426 129523	4.25	32.2	27.0	27.8
DT4	Upper Brook St	UC	448227 129504	8.00	**47.4**	**42.2**	38.5
DT5	Roadside Monitor	RS	448213 129504	3.10	**46.4**	**45.6**	**40.1**
DT6	Roadside Monitor	RS	448213 129504	3.10	**46.4**	**44.7**	**40.1**
DT7	Roadside Monitor	RS	448213 129504	3.10	**46.4**	**43.6**	39.9
DT8	St George's Street	RS	448106 129541	4.05	**65.5**	**59.8**	**54.0**
DT9	St George's Street Lad	RS	448163 129512	3.60	**67.5**	**59.9**	**55.6**
DT10	Jewry St	RS	448046 129692	4.05	**53.7**	**48.7**	**46.4**
DT11	Southgate St	RS	447918 129413	3.65	38.3	**42.4**	37.9
DT12	Sussex St	RS	447804 129741	3.60	**42.4**	36.7	35.6
DT13	City Road	UC	447963 129875	6.55	**43.4**	39.4	37.2
DT14	74 Northwalls	RS	448234 129794	3.70	**42.0**	31.4	30.5
DT15	Wales St	RS	448842 129820	1.70	27.8	33.5	31.0
DT16	Alresford Rd	Other	449557 129437	NA (M3)	**42.5**	**45.0**	**40.8**
DT17	Chesil St	RS	448679 129068	1.30	**46.2**	**42.4**	**42.0**
DT18	Stockbridge Rd	UC	447534 130006	5.40	34.0	24.3	24.5
DT19	Andover Rd	UC	447745 130456	6.50	33.1	28.4	27.9
DT20	Worthy Rd 1	RS	448092 130411	2.20	33.4	28.7	28.2
DT21	Worthy Rd 2	RS	448092 130411	2.20	33.4	29.1	29.0
DT22	Worthy Rd 3	RS	448092 130411	2.20	33.4	29.4	29.1
DT23	St Cross Rd	RS	447842 129050	2.40	37.8	37.7	33.2
DT24	Romsey Rd	RS	447495 129511	1.10	**66.8**	**60.9**	**56.9**
DT25	Andover Rd	RS	447898 130065	4.20	**41.2**	36.8	35.9
DT26	Bus Station	Other	448427 129401	NA	**44.6**	38.3	35.5

In **bold**, exceedence of the annual mean NO_2 AQS objective of 40µg/m^3
*Bias Adjustment Factors listed with relevant year
** Agreed National bias adjustment factor with the Council - see appendix 3
RS = Roadside; UC = Urban Centre; Other=covering specific emissions source

The 2014 diffusion tube bias adjustment factor used was 0.91 as agreed with the Council. This is based on the nationally derived factor calculated for the lab preparation method, which was Gradko, 20% TEA in Water.

Further to those sites shown in Table 5, following the recommendations of the 2013 Annual Progress Report, the Council has implemented a further monitoring regime in the two regions considered in this assessment, Romsey Road and St George's Street. 2014 annualised monitoring results for these locations are shown in Table 6.

It was necessary to adjust the monitored concentrations for the diffusion tubes shown in Table 6 as there was reduced data capture at each of these locations. This process, converting a short term to long term mean, is known as 'annualisation'. This was done using the methodology in LAQM TG(09)[1]. The results of this can be seen in Appendix 4.

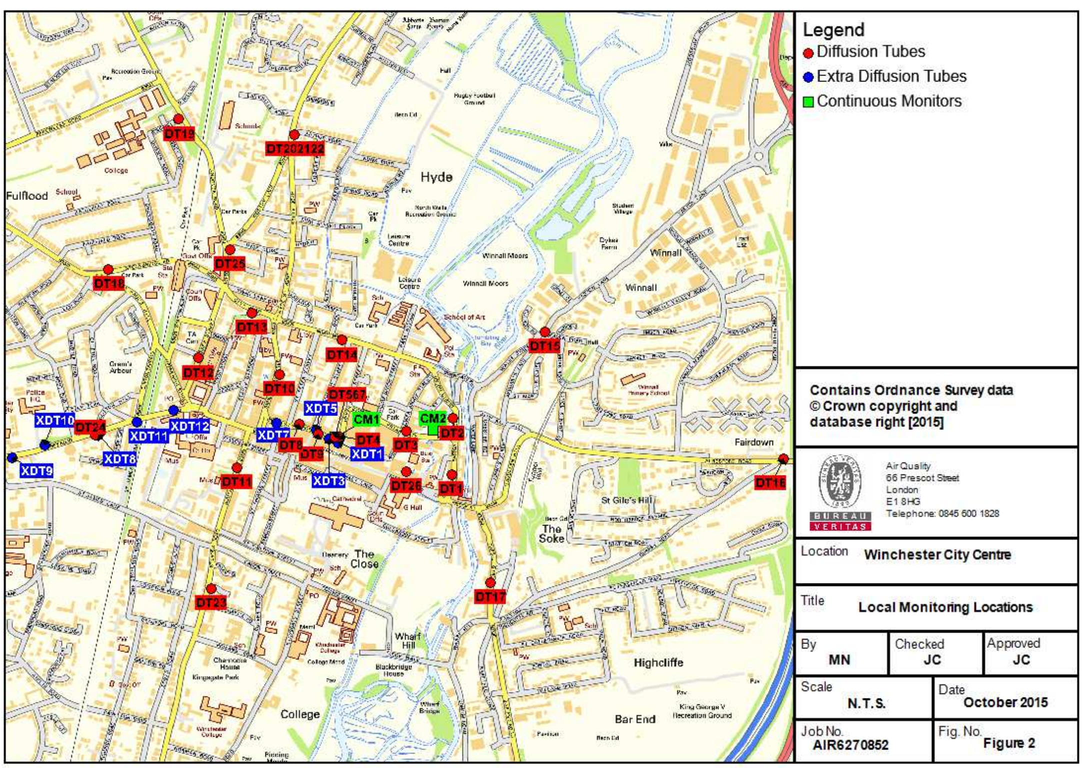
Table 6 - Extra Diffusion Tube Monitoring Network

Site	Site Name	Site Type	OS Grid Ref	Distance to Road (m)	2014 Annual Mean NO_2 Concentration ($\mu g/m^3$)* (Bias 0.91**)
XDT9	63 Romsey Road	RS	447246 129440	2.0	**47.7**
XDT10	Romsey Road Police HQ	RS	447344 129479	2.1	28.7
XDT8	Romsey Road Pump House Mews	RS	447502 129511	2.8	**69.1**
XDT11	St. James Terrace (Romsey Road)	RS	447620 129549	1.95	**42.0**
XDT12	Romsey Road Re-Dress	RS	447729 129584	2.2	**57.5**
XDT1	McDonalds	RS	448223 129486	2.2	**50.7**
XDT3	Toy Cupboard	RS	448194 129499	2.0	**58.1**
XDT5	Café Centro	RS	448158 129526	2.1	**51.0**
XDT7	The Royal Oak	RS	448038 129544	2.3	**63.1**

In **bold**, exceedence of the annual mean NO_2 AQS objective of $40\mu g/m^3$
*Annualised owing to reduced data capture. Full details see Appendix 4
** Agreed National bias adjustment factor with the Council. See Appendix 3

The monitoring results show that exceedences of the annual mean NO_2 objective have been recorded next to busy roads in the area. The 2014 monitoring data supports the Council's decision to progress with a Detailed Assessment, with several locations exceeding the $40\mu g/m^3$ AQS objective for NO_2 and some exceeding the recommended threshold for consideration of the 1-hour mean objective of $60\mu g/m^3$.

Figure 2 – Local Monitoring Locations



3.3 Background Mapped Concentration Estimates

Defra maintains a nationwide model of existing and future background air quality concentrations at a 1km grid square resolution. The data sets include annual average concentration estimates for NO_x, NO_2, PM_{10} and $PM_{2.5}$, using a base year of 2011. The model used is semi-empirical in nature; it uses the national atmospheric emissions inventory (NAEI) emissions to model-predict the concentrations of pollutants at the centroid of each 1km grid square, but then calibrates these concentrations in relation to actual monitoring data.

Annual mean background concentrations have been obtained from the Defra published background maps[7] for consideration in the assessment, based on the 1km grid squares which cover the modelled area and the affected road network. The Defra mapped background concentrations for 2014 are presented in Table 7.

Table 7 – Background Pollutant Concentrations (Defra Background Maps)

Grid Square (E,N)	2014 Annual Mean Concentration (µg/m^3)	
	NO_x	NO_2
449500, 129500	29.7	21.1
448500, 129500	23.5	17.0
449500, 129500	29.7	21.1
449500, 130500	30.6	21.3
448500, 128500	20.2	14.9
448500, 131500	19.1	14.0
448500, 130500	19.7	14.4
447500, 129500	23.6	17.1
447500, 128500	21.2	15.5
447500, 130500	20.9	15.2
446500, 130500	16.7	12.4
446500, 129500	17.7	13.2
AQS objective	**-**	***40.0***

These mapped background concentrations are below the respective annual mean AQS objectives.

3.4 Background Concentrations used in the Assessment

Annual mean background concentrations for the pollutants of relevance to this assessment have been derived using local monitoring data. The concentrations applied to modelled receptors that have been taken from the urban background site at Godson House, located approximately located 18 metres from the kerb off Friarsgate. Data was independently ratified by AQDM with a data capture of 99%, and the equipment serviced every six months by independent contractors, so was of sufficient quality for application in the assessment.

Monitored data was deemed preferable to the use of the Defra Background maps as it is likely a better representation of local concentrations than those mapped over the relatively coarse spatial resolution. Monitored data also represents a more up-to-date concentration than those forecast from a 2011 base. Finally, given the concentrations were higher for the monitored background than the mapped values for the equivalent grid square, the 'worst-case' has been adopted.

These concentrations are summarised in Table 8. This background concentration was applied to all receptor locations considered.

[7] Defra Background Maps (2014). http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html

Table 8 - Background Concentrations Used in Assessment

	Monitored 2014 Annual Mean Concentrations (µg/m^3) at Godson House Background Site	
Pollutant	**NO_x**	**NO_2**
Concentration	43.0	24.0
AQS objective	-	*40.0*

4 Assessment Methodology

To assess the impact of road traffic emissions on air quality and quantify the benefits of upgrading the bus fleet, the atmospheric dispersion model ADMS Roads version 3.4 was utilised, focusing on emissions of NO_x.

In order to provide consistency with the Council's own work on air quality, the guiding principles for air quality assessments as set out in the latest guidance and tools provided by Defra for air quality assessment (LAQM.TG(09)) have been used.

The approach used in this assessment has been based on the following:

- Prediction of ambient NO_2 concentrations, to which existing receptors may be exposed and comparison with the relevant AQS objectives;
- Application of the ratio between annual mean and 1-hour mean NO_2 concentrations at a number of automatic monitoring locations to determine 99.8th percentile of 1-hour mean concentrations from model predicted annual mean concentrations; and
- Determination of the geographical extent of any potential exceedences.

4.1 Assessment Scenarios

The following scenarios have been considered:

- 2014 Base - assumes existing fleet;
- Scenario 1 (SC1) - 2014 Modified Park and Ride Bus Fleet, assumes those buses used as part of the Winchester Park and Ride bus route are upgraded to Euro VI vehicles; and
- Scenario 2 (SC2) - 2014 Modified All Stagecoach Buses, assumes all buses operated on Council bus routes by Stagecoach in Winchester are upgraded to Euro VI vehicles.

4.2 Traffic Inputs

The traffic data for this assessment has been largely provided by the Council. However, to better inform the study Bureau Veritas commissioned IntelligentData™ to conduct an Automatic Number Plate Recognition Survey (ANPR). The main aim of the survey was to provide detailed information on the Euro Class breakdown of the vehicle fleet, though the survey was also used to calculate fleet composition for some links where satisfactory data did not already exist. The final input traffic data for the 2014 Base scenario is outlined below in Table 9.

Table 9 – Traffic Data Inputs (2014 Base)

Link Name	24hr AADT	% Car	%LGV	% HGV	% Bus/Coach	% Motorcycle	Speed (kph)
Alresford Road (Including Magdalen hill)[a*]	6458	83.4%	9.1%	4.2%	3.4%	0.0%	48.0
Andover Rd [a]	10672	86.3%	10.2%	0.8%	2.2%	0.5%	48.0
Bridge Street [a*]	8843	83.4%	9.1%	4.2%	3.4%	0.0%	48.0
The Broadway (joining Colebrook St)[a*]	8843	83.4%	9.1%	4.2%	3.4%	0.0%	10.0
Chesil St (including Bar End Road) [a*]	11228	83.4%	9.1%	4.2%	3.4%	0.0%	48.0
City Road [a]	12894	81.8%	11.2%	0.9%	5.7%	0.5%	36.0
Durngate Place [a]	12894	81.8%	11.2%	0.9%	5.7%	0.5%	36.0
Eastgate Street (before Friarsgate) [a]	14375	83.6%	11.6%	0.9%	3.2%	0.8%	38.8
Eastgate Street (after Friarsgate) [a]	11228	85.9%	10.7%	0.9%	1.9%	0.5%	38.8
Easton Lane (including Wales St) [a]	12894	80.5%	16.9%	1.6%	0.2%	0.8%	36.0
Friarsgate [a]	13510	84.4%	10.7%	1.0%	3.2%	0.8%	25.9
High Street (joining Tower Street) [a]	7496	86.7%	10.9%	1.1%	0.4%	0.8%	29.6
Jewry St [a]	10936	81.2%	11.0%	1.9%	5.3%	0.7%	33.3
Middle Brook Street	1957	84.4%	10.7%	1.0%	3.2%	0.8%	48.0
North Walls [a]	12894	81.8%	11.2%	0.9%	5.7%	0.5%	36.0
Romsey Rd [a*]	11763	86.6%	6.8%	3.0%	3.6%	0.0%	32.0
St Cross Rd [a]	11605	85.6%	10.7%	1.0%	1.2%	1.4%	48.0
Southgate Street [a]	11605	82.7%	11.8%	1.4%	2.8%	1.3%	48.0
St George's Street [a]	13880	82.4%	11.4%	1.6%	3.8%	0.8%	10.0
Stockbridge Rd [a]	7671	87.3%	9.1%	1.7%	1.0%	0.8%	48.0
Union Street [a]	14375	83.6%	11.6%	0.9%	3.2%	0.8%	38.8
Upper Brook Street [b]	2041	82.4%	11.4%	1.6%	3.8%	0.8%	48.0
Upper High Street [a]	7496	86.7%	10.9%	1.1%	0.4%	0.8%	29.6
Worthy Rd [a]	7977	87.5%	8.5%	1.2%	2.5%	0.4%	50.0
Worthy Lane [a]	5807	87.5%	8.5%	1.2%	2.5%	0.4%	50.0
Hyde Street [a]	5807	87.5%	8.5%	1.2%	2.5%	0.4%	50.0
Sussex St [a]	5270	88.0%	10.5%	0.6%	0.5%	0.4%	36.0

[a] Data provided by Council
[*] Vehicle Split calculated using ANPR survey
[b] Derived using Tempro Adjustment

4.3 Emissions Estimates and Bus Fleet Composition

Using the above data as input, emissions from road traffic have been predicted using version 6.0.2 of the Emissions Factors Toolkit (EFT)[8].

The EFT v6.0.2 used to calculate emissions from road traffic in this assessment assumes a default proportion of vehicles of each vehicle type are a certain Euro emissions standard. This is based on forecasts from 2013 base fleet composition data, as calculated by Ricardo-AEA's fleet turnover model (used for the development of the NAEI), which is based upon:

- The implementation dates of new emission standards and advice from DfT on the early penetration of sales of vehicles meeting these standards in the UK fleet;

[8] EFT_v6.0.2 available at - http://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html

- Assumed survival rates of vehicles in the fleet derived from historic licensing data and estimates of projected new vehicle sales. Projections are from a 2011 base year taking into account the current economic downturn;

- Advice from DfT on future sales of cars and LGVs by conventional and alternative vehicle technologies (i.e. hybrid and electric vehicles);

- Traffic growth assumptions according to the TfL's traffic growth factors for London and DfT's Road Traffic Forecast for the rest of the UK provided in January 2013; and

- Evidence from DfT's Automatic Number Plate Recognition data (2007-2011) on the age mix of vehicles on the road across the country.

ANPR surveys were undertaken at two sites in Winchester (one site on Chesil Street and one site on Romsey Road) on the 19th and 20th July 2015. The surveys provided a count of vehicles split by both vehicle type and vehicle Euro class. This information was included in the EFT calculation of vehicle emissions, thus making the vehicle emissions specific to the traffic observed during the traffic surveys within Winchester.

The data for buses from the ANPR survey was used in combination with information regarding the routes and timetables from the Council’s existing bus fleet to adjust the Euro class proportions in in the bus vehicle category, to quantify the impact of changes to the bus fleet.

Euro class proportions for the buses were adjusted from those assumed in the Base Scenario to account for the changes assumed in SC1 and SC2. A summary of the Euro class compositions assumed for buses in each of the three scenarios is detailed in Table 10. Full details of the Euro class compositions used in the assessment for other vehicle types can be found in Appendix 5.

Table 10 - Bus/Coach Euro class proportions for NO_x

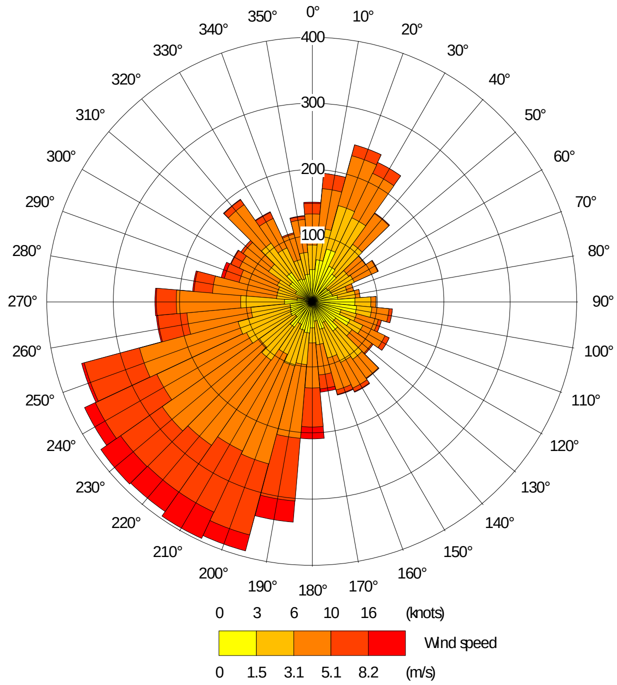
Vehicle Type	Euro class	Default Proportion	User Defined Base Bus Proportion (used in assessment)	User Defined P+R Bus Proportion (used in Scenario 1)	User Defined All Bus Proportion (used in Scenario 2)
Buses (non-London)*	Pre-Euro I	0.00	0.00	0.00	0.00
	Euro I	0.01	0.00	0.00	0.00
	Euro II	0.06	0.00	0.00	0.00
	Euro III	0.26	0.00	0.00	0.00
	Euro IV	0.17	0.67	0.67	0.46
	Euro V_EGR	0.09	0.08	0.01	0.00
	Euro V_SCR	0.28	0.25	0.02	0.00
	Euro VI	0.13	0.01	0.30	0.54
	Euro II SCRRF	0.00	0.00	0.00	0.00
	Euro III SCRRF	0.00	0.00	0.00	0.00
	Euro IV SCRRF	0.00	0.00	0.00	0.00
	Euro V EGR + SCRRF	0.00	0.00	0.00	0.00
Coaches*	Pre-Euro I	0.00	0.00	0.00	0.00
	Euro I	0.01	0.00	0.00	0.00
	Euro II	0.06	0.00	0.00	0.00
	Euro III	0.26	0.00	0.00	0.00
	Euro IV	0.17	0.67	0.67	0.46
	Euro V_EGR	0.09	0.08	0.01	0.00
	Euro V_SCR	0.28	0.25	0.02	0.00
	Euro VI	0.13	0.01	0.30	0.54
	Euro II SCRRF	0.00	0.00	0.00	0.00
	Euro III SCRRF	0.00	0.00	0.00	0.00
	Euro IV SCRRF	0.00	0.00	0.00	0.00
	Euro V EGR + SCRRF	0.00	0.00	0.00	0.00

*No distinction is made between Bus and Coach in either the ANPR survey or the EFT input scenario traffic format ‘Detailed Option 1’, therefore both are assumed the same.

4.4 Meteorological Data

2014 meteorological data from Southampton Airport’s weather station, located approximately 12km to the south-west, has been used in this assessment. A wind rose for this site for the year 2014 is shown in Figure 3.

Figure 3 – Wind Rose for Southampton Airport Meteorological Data 2014

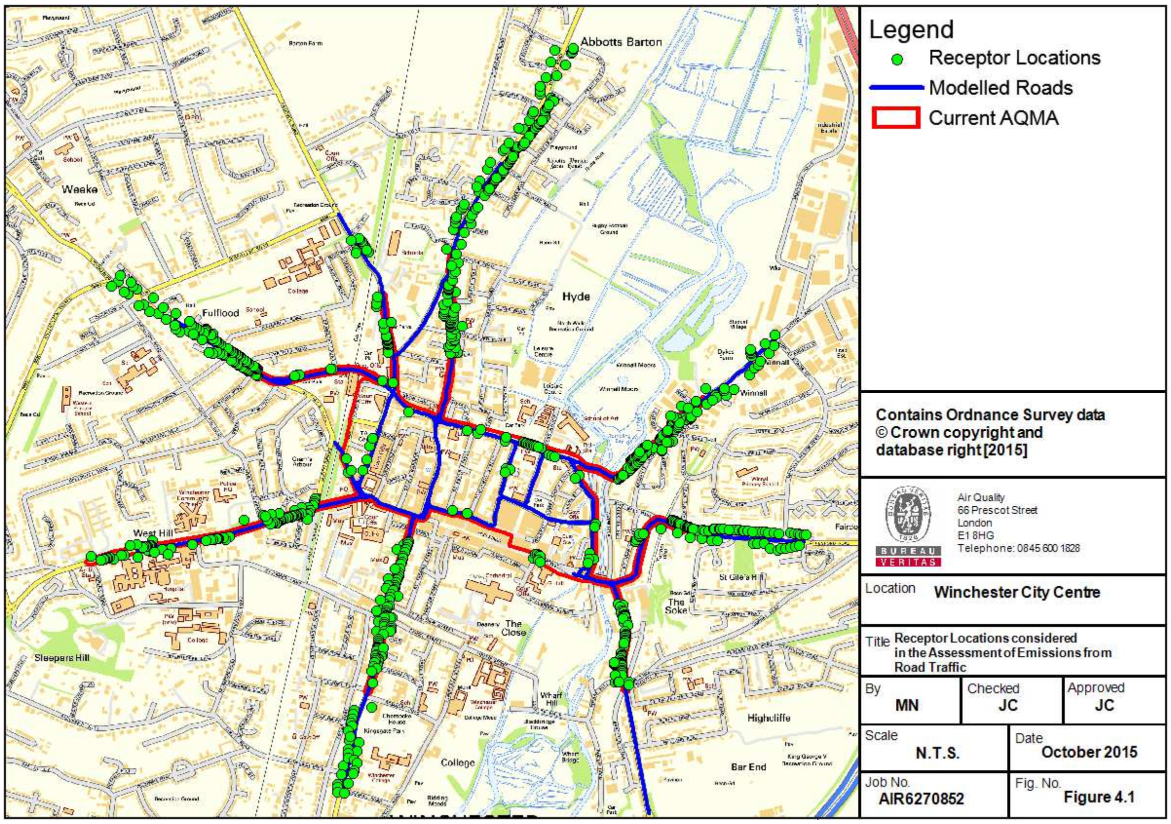


Most dispersion models do not use meteorological data if they relate to calm winds conditions, as dispersion of air pollutants is more difficult to calculate in these circumstances. ADMS-Roads treats calm wind conditions by setting the minimum wind speed to 0.75m/s. It is recommended in LAQM.TG(09) that the meteorological data file be tested within a dispersion model and the relevant output log file checked, to confirm the number of missing hours and calm hours that cannot be used by the dispersion model. This is important when considering predictions of high percentiles and the number of exceedences. LAQM.TG(09) recommends that meteorological data should only be used if the percentage of usable hours is greater than 75%, and preferably 90%. 2014 meteorological data from Southampton Airport include 8,002 lines of usable hourly data out of the total 8,760 for the year, i.e. 91% usable data. This is therefore suitable for the dispersion modelling exercise.

4.5 Sensitive Receptors

A total of 653 receptors are considered in the assessment of emissions from road traffic and their location is illustrated in Figure 4. A full and comprehensive list of these can be found in Appendix 6.

Figure 4 – Receptor Locations considered in the Assessment of Emissions from Road Traffic



4.6 Model Outputs

The monitored background NO_2 concentration has been used in conjunction with the emissions from road traffic calculated in the ADMS-Roads model to calculate predicted total annual mean concentrations of NO_x and NO_2.

For the prediction of annual mean NO_2 concentrations for the modelled scenarios, the output of the ADMS-Roads model for NO_x has been converted to NO_2 following the methodology in LAQM.TG(09)[1] and using the NO_x to NO_2 conversion tool developed on behalf of Defra. This tool also utilises the total background NO_x and NO_2 concentrations. This assessment has utilised version 4.1 (June 2014) of the NO_x to NO_2 conversion tool. The road contribution is then added to the appropriate NO_2 background concentration value to obtain an overall total NO_2 concentration.

Verification of the ADMS assessment has been undertaken using those local authority monitoring locations that are located adjacent to the affected road network. All NO_2 results presented in the assessment are those calculated following the process of model verification, using two factors relating to two verification domains:

- Domain 1 – covering the area of Romsey Road and Sussex Street and using a verification factor of 3.313; and
- Domain 2 – covering the rest of the modelled area and using a verification factor of 1.425.

Full details of the model verification can be found in Appendix 2 – ADMS Model Verification.

4.6.1 Calculation of 1-hour Mean NO_2 Concentrations

The purpose of this Detailed Assessment is to assess the need to declare an AQMA in relation to the 1-hour mean AQS objective on St George's Street and Romsey Road. LAQM.TG(09)[1] advises that exceedences of the 1-hour mean AQS objective for NO_2 are only likely to occur where the annual mean NO_2 concentration is 60µg/m^3 or greater. Monitored concentrations at three diffusion tubes were close to or above this threshold in 2013 as follows:

- DT8 St George's Street - Annual Mean NO_2 Concentration of 59.8µg/m^3;
- DT9 St George's Street Lad - Annual Mean NO_2 Concentration of 59.9µg/m^3; and
- DT24 Romsey Road- Annual Mean NO_2 Concentration of 60.9µg/m^3.

Due to the inherent randomness of short-term meteorological conditions and the extremely challenging process of model verification for short-term model predictions, predicted 1-hour mean NO_2 concentrations have been calculated based on the ratio between the annual mean NO_2 concentration and the 99.8th percentile NO_2 concentration at a number of automatic monitoring sites.

Table 11 provides details of nine automatic monitoring locations in the south-east of England. The ratio between the annual mean NO_2 concentration and the maximum hourly NO_2 concentration has been calculated at each site, in addition to the ratio between the annual mean NO_2 and the 99.8th percentile of the 1-hour NO_2 concentration.

The ratio between the maximum 1-hour and the annual mean, results in a predicted hourly concentration considerably greater than the 1-hour 200µg/m^3 AQS objective when the annual mean is assumed to be 60µg/m^3. Whereas the ratio between the 99.8th percentile of the 1-hour and the annual mean, results in a predicted hourly concentration only marginally greater than the 1-hour 200µg/m^3 AQS objective when the annual mean is assumed to be 60µg/m^3. It has therefore been assumed that when determining the likelihood of a breach of the 1-hour AQS objective, the ratio between the 99.8th percentile of the 1-hour and the annual mean provides the most robust method. Such an approach has therefore been applied in this study.

Two of the sites are within the Winchester Council area, one of which is a roadside site and one an urban background site. Of the seven other sites, three are urban background sites and four roadside sites. The ratios are observed to be generally higher at background sites than roadside sites. As pollutant sources in the area of concern are road traffic vehicles and the areas of concern would be classed as roadside sites, an average ratio calculated for the roadside sites has been assumed to be the most appropriate factor to apply.

A factor of 3.6 has therefore been used in this assessment to provide an estimate of the 99.8th percentile of the 1-hour NO_2 from the model predicted annual mean concentrations. This represents the average ratio of the 99.8th percentile of 1-hour NO_2 and the annual mean NO_2 concentrations for roadside sites, as shown in Table 11.

Table 11 – Summary of Monitoring Data for Calculation of 1-hour Mean NO_2 Concentrations

Site	2014 NO_2 Concentration (µg/m^3)			Ratio of Maximum 1-hour to Annual Mean	Ratio of 99.8th %tile to Annual mean	Predicted 1-hour Concentration at 60 µg/m^3 using ratio	
	Annual Mean	Max 1- hour	99.8th %-tile 1-hour			Max 1- hour	99.89th %-tile 1-hour
Portsmouth (UB)	20.2	122.1	104.5	6.0	5.2	362.2	310.2
Reading New Town (UB)	26.5	109.9	95.7	4.1	3.6	248.7	216.6
Southampton Centre (UB)	31.6	119.9	101.0	3.8	3.2	227.3	191.5
Bath Roadside (RS)	57.3	268.9	199.5	4.7	3.5	281.3	208.7
Storrington Roadside (RS)	20.3	105.2	86.5	5.2	4.3	310.8	255.6
Chatham Roadside (RS)	25.3	102.2	90.2	4.0	3.6	242.7	214.3
Exeter Roadside (RS)	30.5	133.9	116.6	4.4	3.8	263.4	229.4
Winchester Background (UB)	23.9	112.8	93.7	4.7	3.9	283.3	235.2
Winchester Roadside (RS)	40.9	170.2	119.8	4.2	2.9	250.0	175.9
Average at Background Sites				**4.7**	**4.0**	**280.4**	**238.4**
Average at Roadside Sites				**4.5**	**3.6**	**251.8**	**198.2**
Average at All Sites				**4.6**	**3.8**	**274.4**	**226.4**

4.7 Uncertainty in Future Year NO_x and NO_2 Trends

Recent studies have identified analyses of historical monitoring data within the UK that show a disparity between measured concentration data and the projected decline in concentrations associated with emission forecasts for future years[9]. The report identifies that trends in ambient concentrations of NO_x and NO_2 in many urban areas of the UK have generally shown two characteristics; a decrease in concentration from about 1996 to 2002-2004, followed by a period of more stable concentrations from 2002-2004 up until 2009. This trend of more stable recent years is expected to continue in more recent years. Trends in more rural, less densely trafficked areas, tend to show downward trend in either NO_x or NO_2, which are more in line with those expected.

The reason for this disparity is currently not fully understood, but it is thought to be related to the actual on-road performance of vehicles, in particular diesel cars and vans, when compared with calculations based on the Euro emission standards. Preliminary studies suggest the following:

- NO_x emissions from petrol vehicles appear to be in line with current projections and have decreased by 96% since the introduction of 3-way catalysts in 1993;
- NO_x emissions from diesel cars, under urban driving conditions, do not appear to have declined substantially, up to and including Euro 5. There is limited evidence that the same pattern may occur for motorway driving conditions; and

[9] Carslaw, D, Beevers, S, Westmoreland, E, Williams, M, Tate, J, Murrells, T, Steadman, J, Li, Y, Grice, S, Kent, A and Tsagatakis, I. 2011. Trends in NO_x and NO_2 emissions and ambient measurements in the UK. Prepared for DEFRA, 18th July 2011

- NO_x emissions from HDVs equipped with Selective Catalytic Reduction (SCR) are much higher than expected when driving at low speeds.

This disparity in the historical national data highlights the uncertainty of future year projections of both NO_x and NO_2.

Defra and the Devolved Administrations have investigated these issues and have since published an updated version of the Emissions Factors Toolkit (EFT Version 6.0.2) utilising COPERT 4 (v10) emission factors, which may go some way to addressing this disparity, but it is considered likely that a gap still remains. This assessment has utilised the latest EFT version 6.0.2 and associated tools published Defra to help minimise any associated uncertainty when forming conclusions from this assessment.

Given that the year of assessment is 2014, the uncertainty of future year NO_x/NO_2 predictions is a less significant issue than when assessing future years.

4.8 Significance Criteria

Although no formal procedure exists for classifying the magnitude and significance of air quality effects from bus intervention measures, guidance issued by Environmental Protection UK (EPUK)[10] has been used address the issue.

The EPUK guidance has been superseded by the Land-Use Planning & Development Control: Planning For Air Quality (May 2015)[11] produced jointly by EPUK and the Institute of Air Quality Management (IAQM). The 2015 EPUK/IAQM guidance does not, however, include criteria for assessing beneficial impacts and hence cannot be applied so readily for assessing the impacts associated with the bus intervention scenarios, hence the use of the previous EPUK[10] guidance in this assessment.

In the EPUK guidance, the magnitude of impact due to an increase/decrease in annual mean NO_2, PM_{10} and other pollutants is described using the criteria in Table 12. These criteria are based on the change in concentration brought about by the bus interventions as a percentage of the assessment level, or the equivalent mass basis.

Table 12 – Definition of Impact Magnitude for Changes in Pollutant Concentrations

Magnitude of Change	Annual Mean NO_2 and PM_{10} Concentrations	Change in Number of Days with PM_{10} Concentration greater than 50 μg/m^3	Other Pollutants[1]
Large	Increase/decrease > 4 μg/m^3	Increase/decrease > 4 days	Increase/decrease > 10%
Medium	Increase/decrease 2 - 4 μg/m^3	Increase/decrease 2-4 days	Increase/decrease 5-10%
Small	Increase/decrease 0.4 - 2 μg/m^3	Increase/decrease 1-2 days	Increase/decrease 1-5%
Imperceptible	Increase/decrease < 0.4 μg/m^3	Increase/decrease <1 days	Increase/decrease <1%
[1] For other pollutants, increase/decrease is a % relative to the relevant annual mean AQS objective.			

When describing the impact at a specific receptor (either adverse or beneficial), the actual concentration at that receptor should be taken into account, in combination with the magnitude of change, using the approach detailed in Table 13. The shaded cells in Table 13 show those

[10] Environmental Protection UK (EPUK) (2010). Development Control: Planning for Air Quality (2010 Update).

[11] Environmental Protection UK (EPUK) and Institute of Air Quality Management (IAQM) Land-Use Planning & Development Control: Planning For Air Quality (May 2015).

changes which may be considered as significant, whereas the changes in the non-shaded cells can be considered as not significant.

Table 13 – Air Quality Impact Descriptors

Annual Mean NO_2 and PM_{10}	Change in Number of Days with PM_{10} Concentration greater than 50 μg/m³	Other Pollutants	Change in Concentration[1]		
			Small	**Medium**	**Large**
Increase with Scheme					
Above Objective/Limit Value *With* Scheme (>40 μg/m³)	Above objective *With* Scheme (> 35 days)	>100% objective/limit value *With* Scheme	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value *With* Scheme (36-40 μg/m³)	Just below objective *With* Scheme (32-35 days)	90-100% objective/limit value *With* Scheme	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value *With* Scheme (30-36 μg/m³)	Below objective *With* Scheme (26-32 days)	75-90% objective/limit value *With* Scheme	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value *With* Scheme (<30 μg/m³)	Well below objective *With* Scheme <26 days)	<75% objective/limit value *With* Scheme	Negligible	Negligible	Slight Adverse
Decrease with Scheme					
Above Objective/Limit Value *Without* Scheme (>40 μg/m³)	Above objective *Without* Scheme (> 35 days)	>100% objective/limit value *Without* Scheme	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value *Without* Scheme (36-40 μg/m³)	Just below objective *Without* Scheme (32-35 days)	90-100% objective/limit value *Without* Scheme	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value *Without* Scheme (30-36 μg/m³)	Below objective *Without* Scheme (26-32 days)	75-90% objective/limit value *Without* Scheme	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value *Without* Scheme (<30 μg/m³)	Well below objective *Without* Scheme <26 days)	<75% objective/limit value *Without* Scheme	Negligible	Negligible	Slight Beneficial

[1] An imperceptible change would be described as 'negligible'.

For short-term pollutant emissions, the magnitude of change is determined based upon the number of predicted exceedences of the short-term AQS objective limit. This makes the EPUK guidance less pragmatic to apply, since it requires data on the existing number of exceedences which is generally not known for most pollutants. The guidance has therefore been applied to annual mean NO_2 concentrations only.

The significance of the impact of the bus intervention scenarios will be determined by applying the magnitude of change to the relevant impact descriptor for the receptors of concern.

5 Detailed Assessment Results

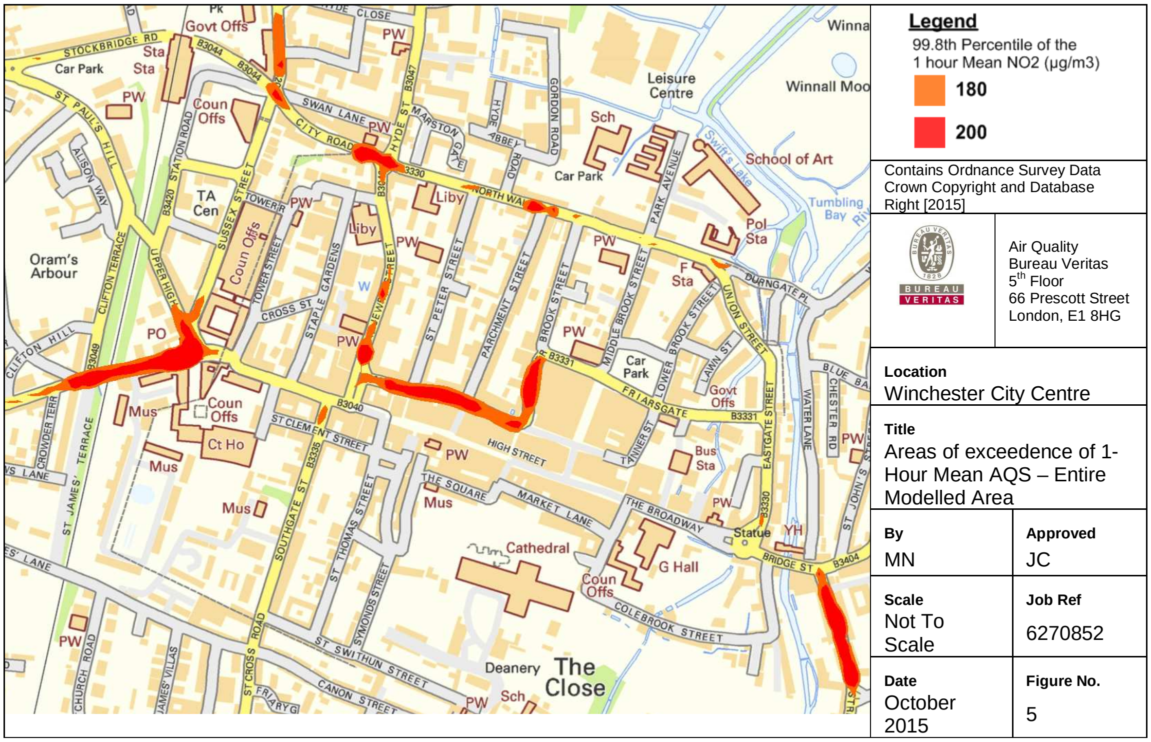
This assessment has considered emissions of NO_2 from road traffic at both existing receptor locations and across a generic output grid with a spatial resolution of 16m, covering the modelled area. The intelligent gridding option was also applied to the ADMS model, meaning further points were added at locations close to roads for greater resolution.

The model suggests that the 40µg/m^3 annual mean AQS objective is observed to be exceeded at a total of 71 receptor locations. All of these locations fall within the currently declared AQMA, confirming its validity and spatial extent. The maximum annual mean NO_2 concentration at an existing receptor was predicted at D181 (located on Chesil Street), with a predicted concentration of 66.6µg/m^3. In addition to Chesil Street, exceedences of the 40µg/m^3 annual mean AQS objective were predicted on Romsey Road, Union Street, Upper High Street, St George's Street, Andover Road, North Walls and Upper Brook Street. A complete list of receptors with predicted annual mean NO_2 concentrations can be found in Appendix 6.

The empirical relationship given in LAQM.TG(09)[1] states that exceedences of the 1-hour mean objective for NO_2 are only likely to occur where annual mean concentrations are 60µg/m^3 or above. As detailed in section 3.2, in recent years, NO_2 concentrations have been recorded close to and above 60µg/m^3 on Romsey Road and St George's Street. This assessment therefore attempts to determine the geographical extent of any potential exceedence of the 1-hour AQS objective for NO_2. As detailed in section 4.6.1, 99.8th percentile 1-hour mean NO_2 concentrations have been estimated based on the observed ratio between monitored annual mean NO_2 concentrations and the 99.8th percentile of the 1-hour mean NO_2 concentrations at nearby monitoring sites. 99.8th percentile of 1-hour mean NO_2 concentrations have therefore been calculated by applying a factor of 3.613 to predicted annual mean NO_2 concentrations. A complete list of receptors with predicted 99.8th percentile of the 1 hour mean NO_2 concentrations can be found in Appendix 6.

Figure 5 shows the areas where 99.8th percentile of the 1-hour mean is predicted to be within 10% of the 200µg/m^3 AQS objective (180µg/m^3) and above the 200µg/m^3 AQS objective. Figure 5 shows that the main areas predicted to show exceedences of the NO_2 1-hour AQS objective are the north end of Chesil Street, St George's Street and the east end of Romsey Road. In addition to these three main areas, small areas are predicted to be close to exceeding or exceeding the 1-hour objective around the Junction of City Road and Hyde Street, and at the Junction of Stockbridge Road and Andover Road.

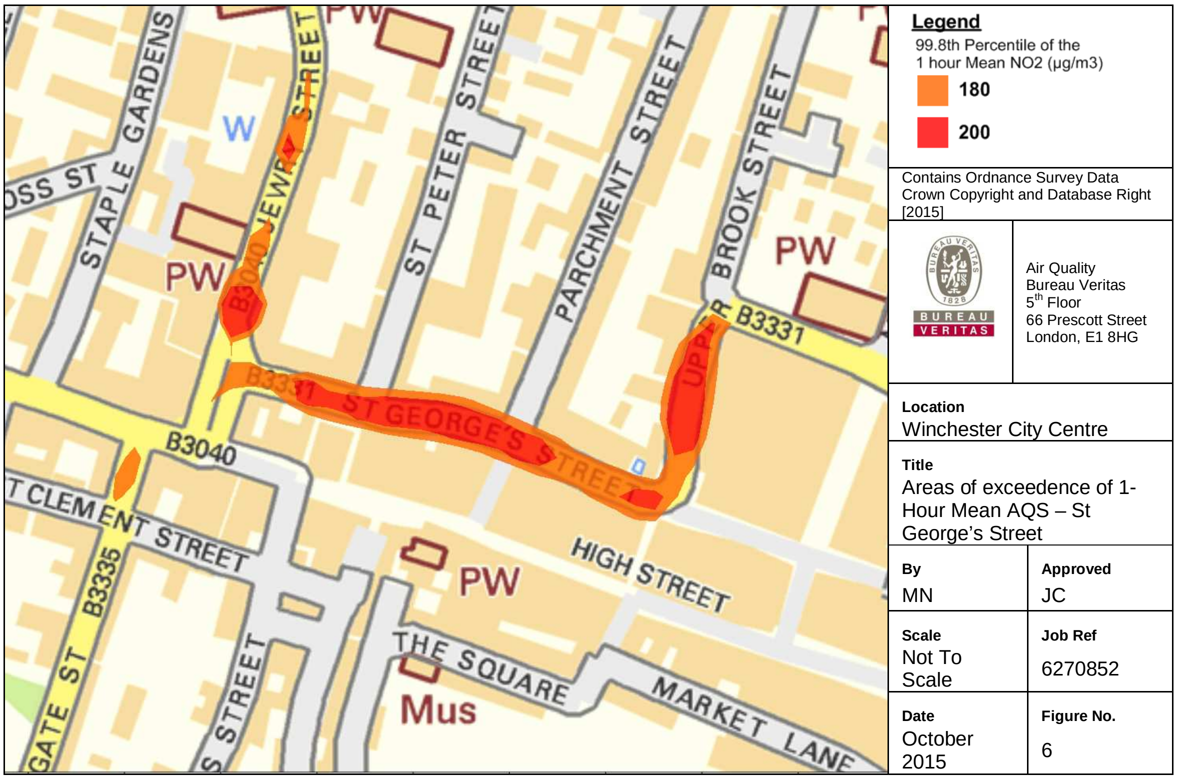
Figure 5 – Town Centre 99.8th percentile of 1-Hour mean NO_2 Concentration



Although exceedences of the 99.8th percentile of the NO_2 1-hour mean are predicted to occur at several locations within Winchester, it is important to consider if exposure relevant to the annual mean is present before considering whether declaration of an AQMA in relation to the 1-hour objective is required.

Figure 6 illustrates the area where the 99.8th percentile of the 1-hour mean is predicted to be within 10% of the 200µg/m^3 AQS objective (180µg/m^3) and above the 200µg/m^3 AQS objective in the area around St George's Street. The figure shows that a large portion of St George's Street and Upper Brook Street are predicted to be in exceedence, in addition to several points on Jewry Street.

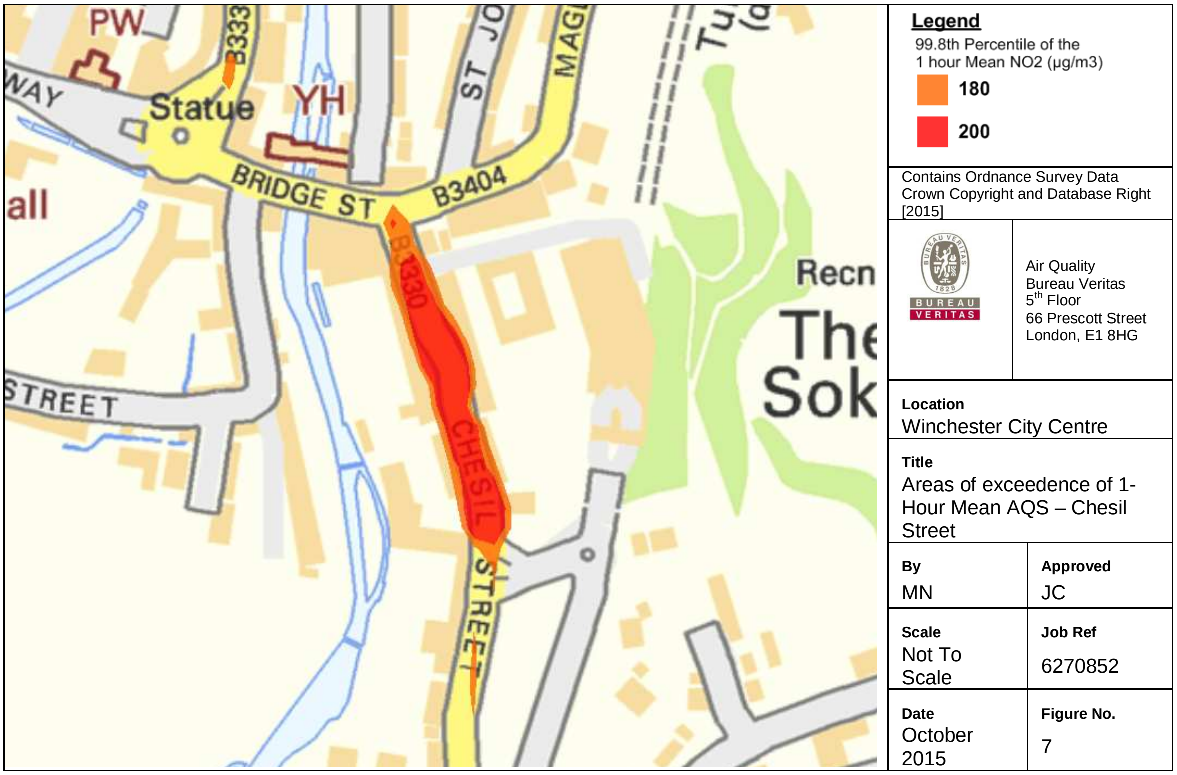
Figure 6 – St George's Street 99.8th percentile of 1-hour mean NO_2 Concentration



There are several locations on St George's Street and Jewry Street where members of the public may feasibly spend an hour or more, providing exposure of relevance to the 1-hour AQS objective (see Table 2). These locations include a number of Cafés and Public Houses on St George's Street and Jewry Street, which have areas of on-street seating. Additionally, this area of George's Street forms one of the areas of Winchester where members of the public may spend an hour or more on foot shopping.

Figure 7 illustrates the area where the 99.8th percentile of the 1-hour mean is predicted to be within 10% of the 200µg/m^3 AQS objective (180µg/m^3) and above the 200µg/m^3 AQS objective in the area around Chesil Street. The figure shows that the 1-hour NO_2 AQS objective is predicted to be close to exceeding or exceeding along Chesil Street from the Bridge Street junction to Barfield Close.

Figure 7 – Chesil Street 99.8th percentile of 1-Hour mean NO_2 Concentration

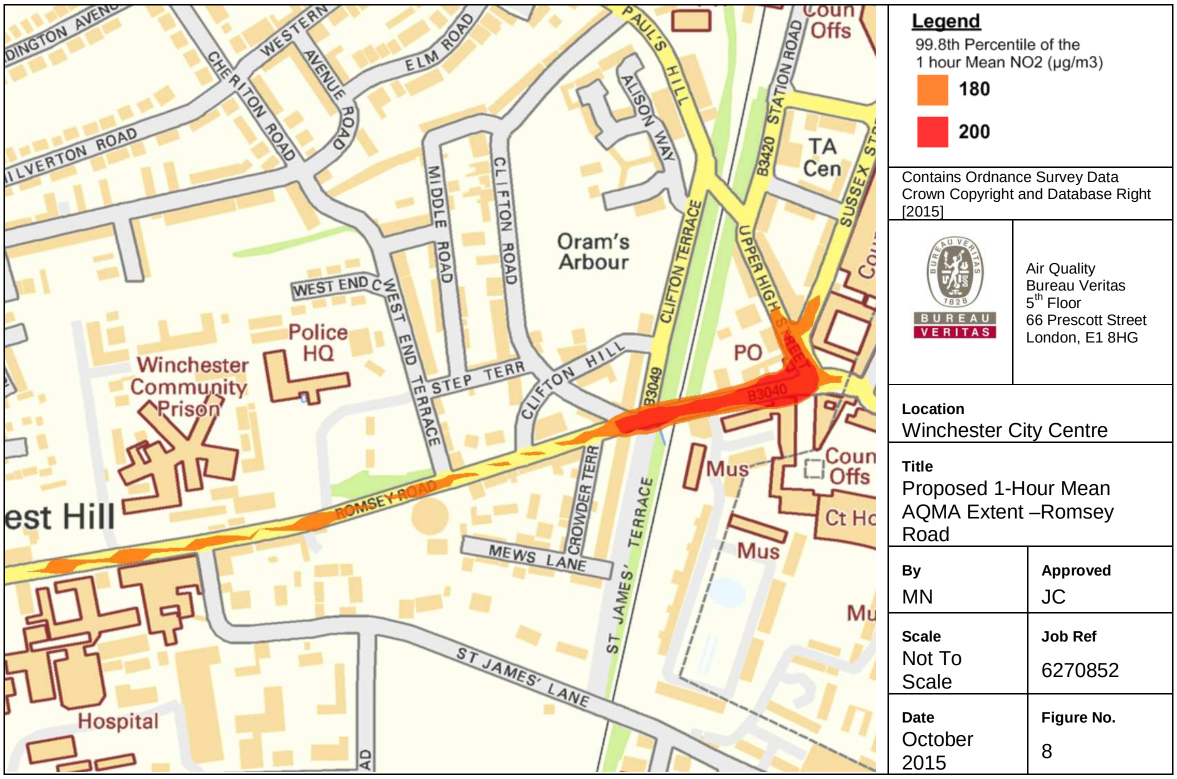


The area of Chesil Street which is predicted to be in exceedence of the 1-hour AQS objective is characterised by relatively narrow pavements with two or three storey buildings on either side. There does not appear to be any businesses along Chesil Street with on-street seating, nor would there be room to place any on-street seating. Therefore, there does not appear to be any receptors which could be considered to experience relevant exposure with regard to the 1-hour mean, other than the existing residential receptors which are already subject to exceedences of the annual mean objective.

Chesil Street is located within the existing Winchester AQMA declared in relation to exceedences of the annual mean NO_2 AQS objective. Although no additional short term receptors have been identified at Chesil Street which represent relevant exposure to the 1-hour objective only, it is considered that any residential receptors which are predicted to experience NO_2 concentrations greater than 200µg/m^3 should be considered relevant exposure with regards to the 1-hour objective.

Figure 8 illustrates the area where the 99.8th percentile of the 1-hour mean is predicted to be within 10% of the 200µg/m^3 AQS objective (180µg/m^3) and above the 200µg/m^3 AQS objective in the area around Romsey Road. The figure shows that the 1-hour NO_2 AQS objective is predicted to be close to exceeding or exceeding along Romsey Road from the Upper High Street junction to Clifton Road, and then close to exceeding intermittently until the Royal Hampshire County Hospital.

Figure 8 – Romsey Road 99.8th percentile of 1-Hour mean NO_2 Concentration



The area of Romsey Road which is predicted to be in exceedence of the 1-hour AQS objective is characterised by relatively narrow pavements with two or three storey buildings on either side. There does not appear to be any businesses along Romsey Road with on-street seating, nor would there be room to place any on-street seating. Therefore, there does not appear to be any receptors which could be considered to experience relevant exposure with regard to the 1-hour mean, other than the existing residential receptors which are already subject to exceedences of the annual mean objective.

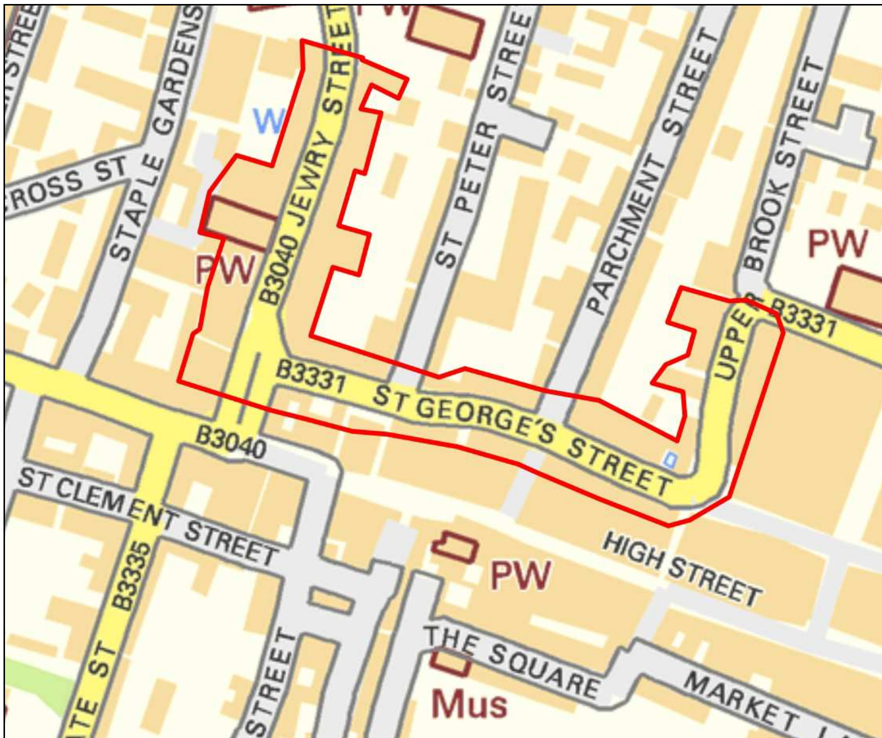
Romsey Road is located within the existing Winchester AQMA declared in relation to exceedences of the annual mean NO_2 AQS objective. Although no additional short term receptors have been identified at Romsey Road which represent relevant exposure to the 1-hour objective only, it is considered that any residential receptors which are predicted to experience NO_2 concentrations greater than 200µg/m^3 should be considered relevant exposure with regards to the 1-hour objective.

5.1 AQMA Declaration

Following consideration of the modelled areas which are predicted to be close to exceeding or exceeding the NO_2 99.8th percentile of the 1-hour mean, and the occurrence of relevant exposure, new AQMAs are recommended in the areas around St George's Street, Chesil Street and Romsey Road.

Figure 9 illustrates the proposed boundary of the AQMA to be declared in relation to predicted exceedences of the NO_2 1-hour mean AQS objective at St George's Street.

Figure 9 – Proposed AQMA Extent – St George's Street



Legend

Proposed AQMA

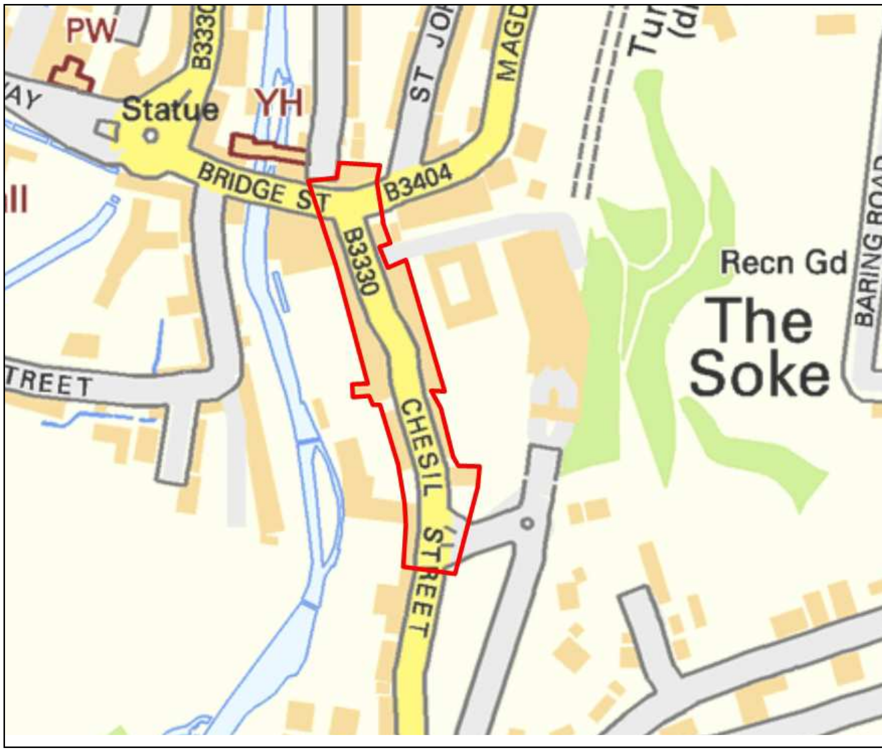
Contains Ordnance Survey Data Crown Copyright and Database Right [2015]

Air Quality
Bureau Veritas
5th Floor
66 Prescott Street
London, E1 8HG

Location Winchester City Centre	
Title Proposed 1-Hour Mean AQMA Extent – St Georges Street	
By MN	**Approved** JC
Scale Not To Scale	**Job Ref** 6270852
Date October 2015	**Figure No.** 9

Figure 10 illustrates the proposed boundary of the AQMA to be declared in relation to predicted exceedences of the NO_2 1-hour mean AQS objective at Chesil Street.

Figure 10 – Proposed AQMA Extent – Chesil Street



Legend

Proposed AQMA

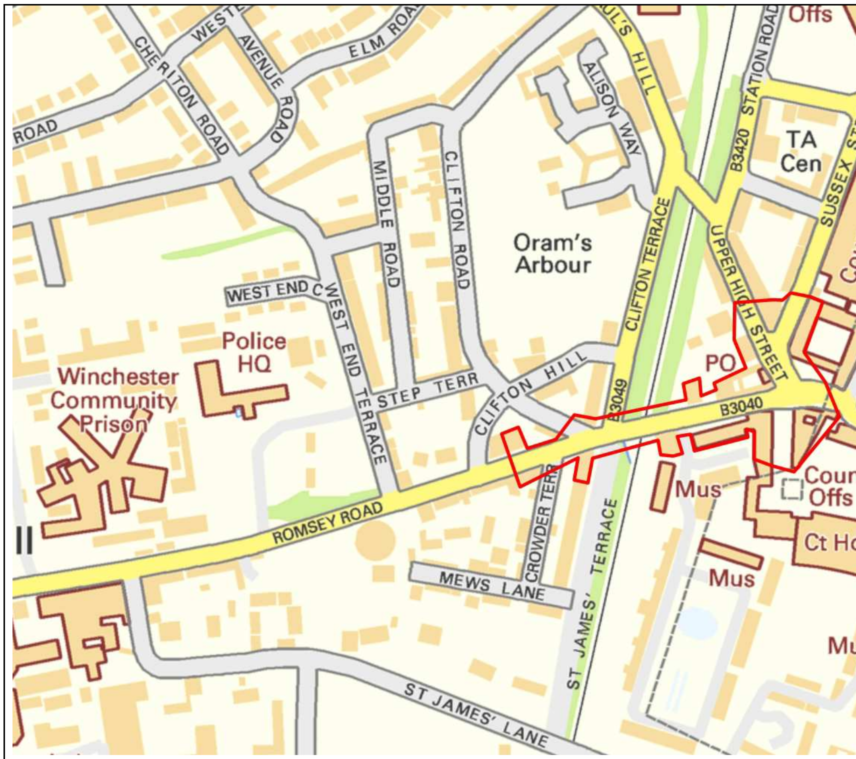
Contains Ordnance Survey Data Crown Copyright and Database Right [2015]

Air Quality
Bureau Veritas
5th Floor
66 Prescott Street
London, E1 8HG

Location Winchester City Centre	
Title Proposed 1-Hour Mean AQMA Extent –Chesil Street	
By MN	**Approved** JC
Scale Not To Scale	**Job Ref** 6270852
Date October 2015	**Figure No.** 10

Figure 11 illustrates the proposed boundary of the AQMA to be declared in relation to predicted exceedences of the NO_2 1-hour mean AQS objective at Romsey Road.

Figure 11 – Proposed AQMA Extent – Romsey Road



Legend

Proposed AQMA

Contains Ordnance Survey Data Crown Copyright and Database Right [2015]

Air Quality
Bureau Veritas
5th Floor
66 Prescott Street
London, E1 8HG

Location Winchester City Centre	
Title Proposed 1-Hour Mean AQMA Extent – Romsey Road	
By MN	**Approved** JC
Scale Not To Scale	**Job Ref** 6270852
Date October 2015	**Figure No.** 11

6 Associated Studies Results

The Council has assessed the impacts of two scenarios that involve the upgrading of buses on Council routes to Euro VI vehicles. The scenarios considered are as follows:

- Scenario 1 (SC1) - 2014 Modified Park and Ride Bus Fleet, assumes those buses used as part of the Winchester Park and Ride bus route are upgraded to Euro VI vehicles; and
- Scenario 2 (SC2) - 2014 Modified All Stagecoach Buses, assumes all buses operated on Council bus routes by Stagecoach in Winchester are upgraded to Euro VI vehicles.

This involves an assessment of the potential emissions reductions and thus reduction in NO_2 that could be brought about by the two potential changes to the Council's bus fleet composition.

6.1 All Modelled Receptors

Table 14 provides the maximum change in NO_2 concentration recorded at a receptor location when comparing SC1 and SC2 to the Base scenario in each of the three areas of Winchester where elevated concentrations are recorded. A complete list of receptors with predicted annual mean NO_2 concentrations for both SC1 and SC2 can be found in Appendix 6.

Table 14 - Changes in Concentrations at worst-case Receptors

Area	Worst-Case Receptor	Annual Mean NO_2 Concentration ($\mu g/m^3$)			% Change (Base-SC1)	Annual Mean NO_2 Concentration ($\mu g/m^3$)		% Change (Base-SC2)
		Base	SC1	Change (Base-SC1)		SC2	Change (Base-SC2)	
Romsey Road	D532	54.7	53.1	-1.6	-2.9	51.5	-3.2	-5.8
Chesil Street	D181	66.6	64.0	-2.6	-3.9	62.2	-4.4	-6.6
St George's Street	D708	58.3	55.5	-2.8	-4.8	53.6	-4.7	-8.1

Table 14 demonstrates that owing to the upgrade of buses on the Winchester Park and Ride route to Euro VI (SC1), annual mean NO_2 concentrations reduce at the worst-case receptor locations (i.e. those locations that experience the highest annual mean concentrations in the Base scenario) by $1.6\mu g/m^3$ to $2.8\mu g/m^3$; this represents a reduction of 2.9% to 4.8% relative to the baseline concentrations. By comparison, upgrading all Stagecoach buses in Winchester to Euro VI (SC2) will reduce annual mean NO_2 concentrations at the worst-case receptor locations by $3.2\mu g/m^3$ to $4.7\mu g/m^3$; this represents a reduction of 5.8% to 8.1% relative to the baseline concentrations.

The annual mean NO_2 concentrations predicted across the modelled area, for both of the bus upgrade scenarios, are expressed in Table 15 with reference to the corresponding EPUK 2010[12] impact magnitudes and descriptors at all modelled locations, including the monitoring points within the study area (i.e. 677 receptor locations in total).

[12] EPUK (2010) Development Control: Planning for Air Quality (2010 Update) Updated guidance from Environmental Protection UK on dealing with air quality concerns within the development control process.

Bureau Veritas is aware that updated guidance is available, released in May 2015. This was not applied in this case as it was not deemed appropriate to assess and quantify beneficial impacts.

Table 15 – Magnitude of Change and Impact

Scenario	Descriptor	SC1	SC2
Magnitude of Change	Imperceptible	494	354
	Small	160	233
	Medium	23	80
	Large	0	10
Impact	Substantial Adverse	0	0
	Moderate Adverse	0	0
	Slight Adverse	0	0
	Negligible	561	550
	Slight Beneficial	93	46
	Moderate Beneficial	23	71
	Substantial Beneficial	0	10

As can be seen in Table 15, SC2 provides 80 receptors and 10 receptors with a 'medium' and 'large' magnitude of change respectively; this compares to 23 receptors experiencing a 'medium' and none experiencing a 'large' change relative to the Base for SC1. Carrying this forwards, SC2 results in 71 receptors experiencing a 'moderate beneficial' impact due to the bus upgrade, whilst 10 experience a 'substantial beneficial' impact. This compares to 23 receptors experiencing a 'moderate beneficial' impact due to the bus upgrade in SC1, whilst 10 experience a 'substantial beneficial' impact. Upgrading all Stagecoach buses to Euro VI (SC2) therefore is predicted to provide more significant air quality benefits when compared to those operating on the Park and Ride route alone (SC1).

6.2 Receptors in Areas of Exceedence

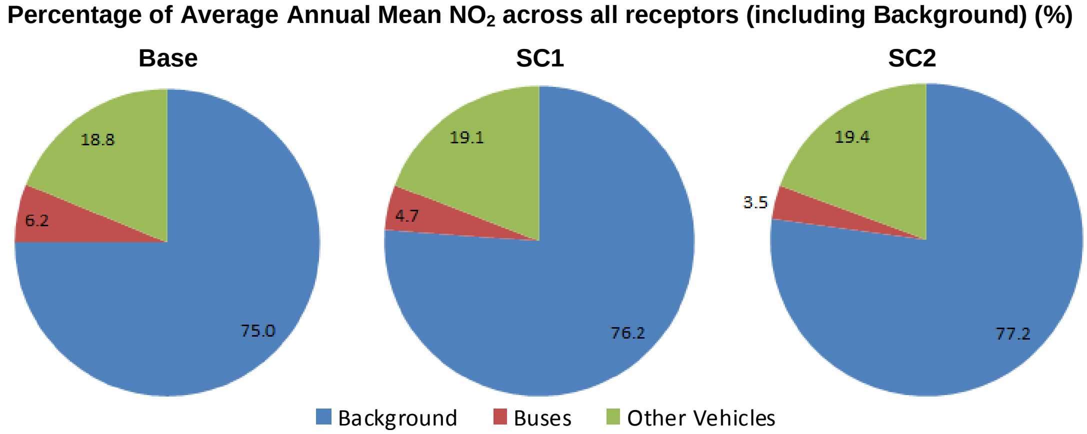
To better understand the contribution of bus emissions to the total annual mean NO_2 concentrations, a source apportionment exercise was undertaken; Table 16 presents these results as an average of the concentrations predicted across all receptor locations. It can be seen that the average annual mean NO_2 contribution from buses for the base scenario is 2.0µg/m^3 (or 6.2% of the total NO_2 concentration inclusive of background). This reduces to 1.5µg/m^3 (4.7% of the total NO_2 concentration inclusive of background) and 1.1µg/m^3 (3.5% of the total NO_2 concentration inclusive of background) for SC1 and SC2 respectively. If the NO_2 contribution from road traffic is considered in isolation from the background, then the percentage of contribution from buses decreases from 24.6% (base) to 19.7% (SC1) and 15.2% (SC2).

Table 16 – NO_2 Source Apportionment

Scenario	Average Annual Mean NO_2 Concentration across all receptors (µg/m^3)			Percentage of Average Annual Mean NO_2 across all receptors (including Background) (%)			Percentage of Average Annual Mean NO_2 from road traffic across all receptors (not including Background) (%)	
	Background	Buses	Other Vehicles	Background	Buses	Other Vehicles	Buses	Other Vehicles
Base	24.0	2.0	6.0	75.0	6.2	18.8	24.6	75.4
SC1	24.0	1.5	6.0	76.2	4.7	19.1	19.7	80.3
SC2	24.0	1.1	6.0	77.2	3.5	19.4	15.2	84.8

There is therefore predicted to be a reduction in the source contribution of NO_2 from buses as a result of both proposed upgrade scenarios, with SC2 offering a further improvement over SC1. Figure 12 further illustrates this reduction in the bus source contribution to total NO_2 due to upgrading the Stagecoach buses to Euro VI.

Figure 12 – NO_2 Source Apportionment



The results presented in Table 16 are an average of all receptors included in the model. This therefore includes many areas where elevated NO_2 concentrations are not predicted. This therefore understates the impact of the bus intervention scenarios in the areas of elevated NO_2 concentrations. Table 17 presents the average source apportionment at receptors with an NO_2 concentration above the 40µg/m^3 AQS objective.

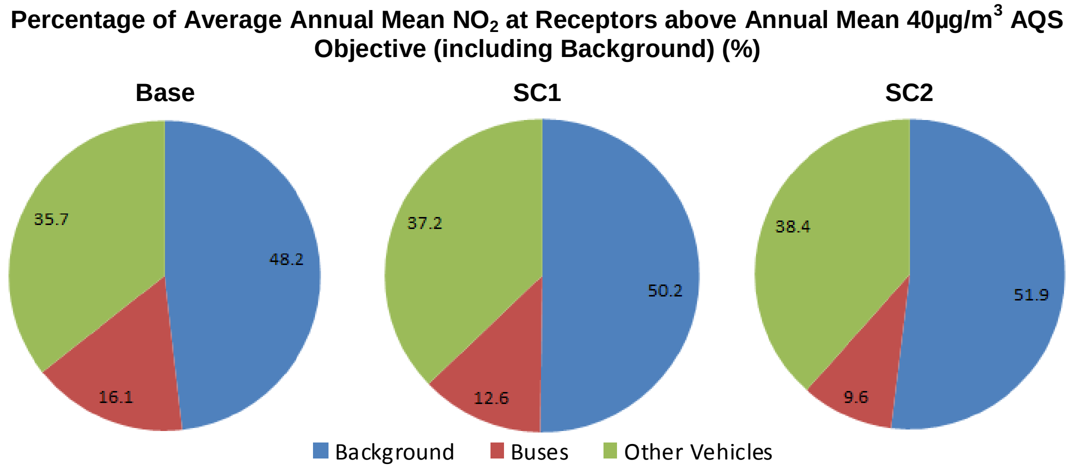
Table 17 – NO_2 Source Apportionment at Receptors above Annual Mean 40µg/m^3 AQS Objective

Scenario	Number of Receptors	Average Annual Mean NO_2 Concentration across all receptors (µg/m^3)			Percentage of Average Annual Mean NO_2 (including Background) (%)			Percentage of Average Annual Mean NO_2 from road traffic (not including Background) (%)	
		Background	Buses	Other Vehicles	Background	Buses	Other Vehicles	Buses	Other Vehicles
Base	94	24.0	8.0	17.8	48.2	16.1	35.7	31.1	68.9
SC1	79	24.0	6.0	17.8	50.2	12.6	37.2	25.3	74.7
SC2	70	24.0	4.5	17.8	51.9	9.6	38.4	20.1	79.9

For receptors where the annual mean NO_2 concentration is above the 40µg/m^3 AQS objective, it can be seen that the average annual mean NO_2 contribution from buses for the base scenario is 8.0µg/m^3 (or 16.1% of the total NO_2 concentration inclusive of background). This reduces to 6.0µg/m^3 (12.6% of the total NO_2 concentration inclusive of background) and 4.5µg/m^3 (9.6% of the total NO_2 concentration inclusive of background) for SC1 and SC2 respectively. If the NO_2 contribution from road traffic is considered in isolation from the background, then the percentage of contribution from buses decreases from 31.1% (base) to 25.3% (SC1) and 20.1% (SC2).

There is therefore predicted to be larger relative reduction in the source contribution of NO_2 from buses at receptors which are in exceedences of the 40µg/m^3 AQS objective as a result of both proposed upgrade scenarios, with SC2 offering a further improvement over SC1. Figure 13 further illustrates this reduction in the bus source contribution to total NO_2, at receptors where the concentration is above the 40µg/m^3 AQS objective, due to upgrading the Stagecoach buses to Euro VI.

Figure 13 – NO_2 Source Apportionment at Receptors above Annual Mean 40µg/m^3 AQS Objective



6.3 Receptors in Areas of known Elevated NO_2 Concentrations

The effects of SC1 and SC2 can be further illustrated by considering the receptors in the three areas of Winchester which are known to have elevated NO_2 concentrations (Chesil Street, St George's Street and Romsey Road). Table 18 presents the average source apportionment at receptors in each of the three areas.

Table 18 – NO_2 Source Apportionment at Receptors in Areas of Elevated NO_2 concentrations

Scenario	Average Annual Mean NO_2 Concentration across all receptors (µg/m^3)			Percentage of Average Annual Mean NO_2 across all receptors (including Background) (%)			Percentage of Average Annual Mean NO_2 from road traffic across all receptors (not including Background) (%)	
	Background	Buses	Other Vehicles	Background	Buses	Other Vehicles	Buses	Other Vehicles
Receptors on Chesil Street								
Base	24.0	6.6	15.1	52.4	14.5	33.1	30.4	69.6
SC1	24.0	4.8	15.1	54.6	11.0	34.4	24.2	75.8
SC2	24.0	3.7	15.1	56.0	8.6	35.4	19.5	80.5
Receptors on St George's Street								
Base	24.0	10.6	17.1	46.4	20.5	33.1	38.2	61.8
SC1	24.0	7.8	17.1	49.1	15.9	35.0	31.3	68.7
SC2	24.0	5.9	17.1	51.0	12.6	36.4	25.8	74.2
Receptors on Romsey Road								
Base	24.0	4.8	11.9	59.0	11.7	29.3	28.5	71.5
SC1	24.0	3.7	11.9	60.5	9.3	30.1	23.7	76.3
SC2	24.0	2.6	11.9	62.3	6.8	31.0	17.9	82.1

For receptors on Chesil Street, it can be seen that the average annual mean NO_2 contribution from buses for the base scenario is 6.6µg/m^3 (or 14.5% of the total NO_2 concentration inclusive of background). This reduces to 4.8µg/m^3 (11.0% of the total NO_2 concentration inclusive of background) and 3.7µg/m^3 (8.6% of the total NO_2 concentration inclusive of background) for SC1 and SC2 respectively. If the NO_2 contribution from road traffic is considered in isolation from the background, then the percentage of contribution from buses decreases from 30.4% (base) to 24.2% (SC1) and 19.5% (SC2).

For receptors on St George's Street, it can be seen that the average annual mean NO_2 contribution from buses for the base scenario is 10.6µg/m^3 (or 20.5% of the total NO_2 concentration inclusive of background). This reduces to 7.8µg/m^3 (15.9% of the total NO_2 concentration inclusive of background) and 5.9µg/m^3 (12.6% of the total NO_2 concentration inclusive of background) for SC1 and SC2 respectively. If the NO_2 contribution from road traffic is considered in isolation from the background, then the percentage of contribution from buses decreases from 38.2% (base) to 31.3% (SC1) and 25.8% (SC2).

For receptors on Romsey Road, it can be seen that the average annual mean NO_2 contribution from buses for the base scenario is 4.8µg/m^3 (or 11.7% of the total NO_2 concentration inclusive of background). This reduces to 3.7µg/m^3 (9.3% of the total NO_2 concentration inclusive of background) and 2.6µg/m^3 (6.8% of the total NO_2 concentration inclusive of background) for SC1 and SC2 respectively. If the NO_2 contribution from road traffic is considered in isolation from the background, then the percentage of contribution from buses decreases from 28.5% (base) to 23.7% (SC1) and 17.9% (SC2).

Table 19 – Magnitude of Change and Impact in Areas of Elevated NO_2 concentrations

Scenario	Descriptor	Chesil Street		St George's Street		Romsey Road	
		SC1	SC2	SC1	SC2	SC1	SC2
Magnitude of Change	Imperceptible	8	0	0	0	9	3
	Small	32	22	5	1	64	42
	Medium	13	27	6	5	0	28
	Large	0	4	0	5	0	0
Impact	Substantial Adverse	0	0	0	0	0	0
	Moderate Adverse	0	0	0	0	0	0
	Slight Adverse	0	0	0	0	0	0
	Negligible	12	12	1	1	26	26
	Slight Beneficial	28	10	4	0	47	19
	Moderate Beneficial	13	27	6	5	0	28
	Substantial Beneficial	0	4	0	5	0	0
Total Receptors		**53**		**11**		**73**	

The annual mean NO_2 concentrations predicted in each of the three areas of Winchester which are known to have elevated NO_2 concentrations, for both of the bus upgrade scenarios, are expressed in Table 19 with reference to the corresponding EPUK 2010[13] impact magnitudes and descriptors at all modelled receptor locations in that area.

Table 19 details that, in the Chesil Street area out of the 53 assessed receptor locations, SC1 results in a 'moderate beneficial' impact at 13 receptors and a 'slight beneficial' impact at 28 receptors, this compares to a 'substantial beneficial' impact at 4 receptors, a 'moderate beneficial' impact at 27 receptors and a 'slight beneficial' impact at 10 receptors resulting from SC2.

Table 19 details that, in the St George's Street area out of the 11 assessed receptor locations, SC1 results in a 'moderate beneficial' impact at 6 receptors and a 'slight beneficial' impact at 4 receptors, this compares to a 'substantial beneficial' impact at 5 receptors and a 'moderate beneficial' impact at 5 receptors resulting from SC2.

Table 19 details that, in the Romsey Road area out of the 73 assessed receptor locations, SC1 results in a 'slight beneficial' impact at 47 receptors, this compares to a 'moderate beneficial' impact at 28 receptors and a 'slight beneficial' impact at 19 receptors resulting from SC2.

[13] EPUK (2010) Development Control: Planning for Air Quality (2010 Update) Updated guidance from Environmental Protection UK on dealing with air quality concerns within the development control process.

Bureau Veritas is aware that updated guidance is available, released in May 2015. This was not applied in this case as it was not deemed appropriate to assess and quantify beneficial impacts.

6.4 Source Apportionment of Background Concentration

The background NO_2 concentration at all receptors considered in the modelled area has been assumed to be 24.0µg/m^3 representing the annual mean recorded at the Godson House urban background site in 2014.

The background concentration makes up a significant portion (75% in the base scenario on average across all receptors) of the total NO_2 concentration. The origin of sources recorded at an urban background site can be understood by considering Defra description of background site. Defra details that background sites should be:

> *"Located such that its pollution level is not influenced significantly by any single source or street, but rather by the integrated contribution from all sources upwind of the station e.g. by all traffic, combustion sources etc. upwind of the station in a city, or by all upwind source areas (cities, industrial areas) in a rural area. These sampling points shall, as a general rule, be representative for several square kilometres"*[14].

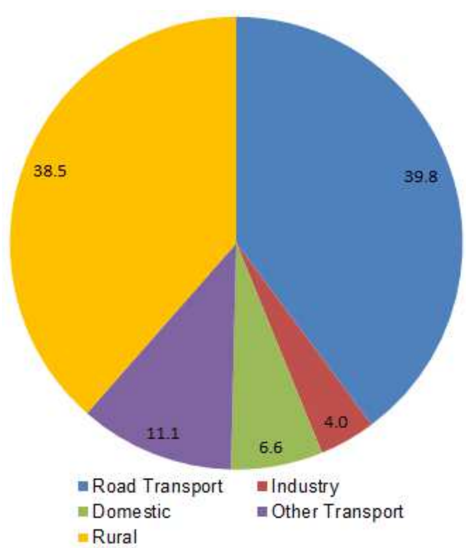
Table 20 provides the average NO_x source apportionment for the Defra background map grid squares covered by the modelled area for 2014. This provides an indication of the sources of NO_2 recorded at the Godson House urban background site. The background source apportionment is additionally illustrated in Figure 14.

Table 20 – 2014 Average Background NO_x Source Apportionment across the modelled area

Source	Road Transport	Industry	Domestic	Other Transport	Rural
Percentage of Background NO_x concentration *	39.8	4.0	6.6	11.1	38.5

*based on an average of Defra background map grid squares covered by the modelled area

Figure 14 – 2014 Average Background NO_x Source Apportionment across the modelled area



The largest source group in the background is therefore Road Transport. It is therefore possible that further small improvements in the NO_2 concentration may be observed with adoption of SC1 and SC2 due to a reduction in the road transport (bus) proportion of the background which has not been considered in this study.

[14] http://uk-air.defra.gov.uk/networks/site-types

7 Conclusions and Recommendations

Bureau Veritas UK Ltd has been commissioned by Winchester City Council to produce a Detailed Assessment with reference to the potential for exceedences of the NO_2 1-hour mean AQS objective within the area covered by the existing Winchester AQMA. Additionally, the Council has commissioned Bureau Veritas to assess NO_2 impacts from upgrading the fleet of buses to Euro VI standard. The following section provides the conclusions of these assessments.

7.1 Detailed Assessment Conclusions

The ADMS-Roads dispersion model (version 3.4) has been used to determine the likely NO_2 concentrations at existing receptor locations.

Assessed locations included 673 residential receptors around the main roads links of concern, representative of worst-case exposure. Annual mean NO_2 concentrations were found to be exceeding the 40µg/m^3 annual mean AQS objective at 71 locations. The maximum annual mean NO_2 concentration at an existing receptor was predicted at D181 (located on Chesil Street), with a predicted concentration of 66.6µg/m^3. In addition to Chesil Street, exceedences of the 40µg/m^3 annual mean AQS objective were predicted on Romsey Road, Union Street, Upper High Street, St George's Street, Andover Road, North Walls and Upper Brook Street.

As detailed in section 4.6.1, 99.8th percentile of 1-hour mean NO_2 concentrations have been estimated based on the ratio between monitored annual mean NO_2 concentrations and the 99.8th percentile of the 1-hour mean NO_2 concentrations. 99.8th percentile 1-hour mean NO_2 concentrations have therefore been calculated by applying a factor of 3.613 to predicted annual mean NO_2 concentrations.

Exceedences of the NO_2 1-hour AQS objective were predicted at the north end of Chesil Street, St George's Street and the east end of Romsey Road. In addition to these three main areas, small areas are predicted to be close to exceeding or exceeding the 1-hour AQS objective around the Junction of City Road and Hyde Street, and at the Junction of Stockbridge Road and Andover Road.

Following consideration of the modelled areas which are predicted to be close to exceeding or exceeding the NO_2 99.8th percentile of the 1-hour mean, and the occurrence of relevant exposure, three new AQMAs are recommended in the area around St George's Street, Chesil Street and Romsey Road. Figure 9, Figure 10 and Figure 11 illustrates the proposed boundaries of the AQMA to be declared in relation to predicted exceedences of the NO_2 1-hour mean AQS.

In conclusion, this assessment has predicted that that local air quality is in breach of the 99.8th percentile of the 1-hour mean AQS objective for NO_2, so the declaration of three AQMAs is recommended.

7.2 Associated Studies Conclusions

Two potential bus fleet upgrade scenarios were considered:

- Scenario 1 (SC1) - 2014 Modified Park and Ride Bus Fleet, assumes those buses used as part of the Winchester Park and Ride bus route are upgraded to Euro VI vehicles; and

- Scenario 2 (SC2) - 2014 Modified All Stagecoach Buses, assumes all buses operated on Council bus routes by Stagecoach in Winchester are upgraded to Euro VI vehicles.

In accordance with EPUK guidance, SC1 brought about a slight beneficial impact at 93 receptor locations and a moderate beneficial impact at 23 receptor locations. Whilst SC2 brought resulted in a slight beneficial impact at 46 receptor locations, a moderate beneficial impact at 71 receptor locations and substantial beneficial impact at 10 receptor locations.

It was identified that the average annual mean NO_2 contribution from buses for the base scenario is 2.0µg/m^3 (or 6.2% of the total NO_2 concentration inclusive of background). This reduced to 1.5µg/m^3 (4.7% of the total NO_2 concentration inclusive of background) and 1.1µg/m^3 (3.5% of the total NO_2 concentration inclusive of background) for SC1 and SC2 respectively. The average beneficial magnitude change across all modelled receptors is therefore small for both SC1 and SC2 in accordance with EPUK guidance.

Considering receptors which are predicted to be in exceedence of the 40µg/m^3 annual mean greater beneficial impacts are predicted. It was identified that the average annual mean NO_2 contribution from buses at receptors which are predicted to be in exceedence of the 40µg/m^3 annual mean for the base scenario is 8.0µg/m^3 (or 16.1% of the total NO_2 concentration inclusive of background). This reduced to 6.0µg/m^3 (12.6% of the total NO_2 concentration inclusive of background) and 4.5µg/m^3 (9.6% of the total NO_2 concentration inclusive of background) for SC1 and SC2 respectively. The average beneficial magnitude change across modelled receptors above the 40µg/m^3 AQS objective is therefore medium for both SC1 and SC2 in accordance with EPUK guidance.

Consideration of receptors in the three areas known to have elevated concentrations predicts greater beneficial impacts, the largest of which is observed at receptors on St George's Street where it was identified that, the average annual mean NO_2 contribution from buses at receptors for the base scenario is 10.6µg/m^3 (or 20.5% of the total NO_2 concentration inclusive of background). This reduced to 7.8µg/m^3 (15.9% of the total NO_2 concentration inclusive of background) and 5.9µg/m^3 (12.6% of the total NO_2 concentration inclusive of background) for SC1 and SC2 respectively. The average beneficial magnitude change across receptors on St George's Street is therefore medium for SC1 and large for SC2 in accordance with EPUK guidance.

In summary both SC1 and SC2 brought about reductions to the predicted NO_2 concentration. In accordance with the EPUK guidance, SC1 resulted in a small beneficial magnitude change on average for all receptors considered, increasing to a medium beneficial change when considering receptors in areas of exceedence or known areas of poor air quality only. This resulted in an impact descriptor of slight beneficial at 93 receptor locations and moderate beneficial at 23 receptor locations.

In accordance with the EPUK guidance, SC2 resulted in a small beneficial magnitude change on average for all receptors considered, increasing to a large beneficial change when considering receptors in areas of exceedence or known areas of poor air quality only. This resulted in an impact descriptor of slight beneficial at 46 receptor locations, moderate beneficial at 71 receptor locations and substantial beneficial at 10 receptor locations.

It should be noted that the improvements in emissions brought about by upgrading the Winchester bus fleet to Euro VI vehicles are not sufficient to remove the areas of likely exceedence completely. It should also be borne in mind that the results represent the meteorological conditions encountered during 2014, and there may be considerable inter-year variability in meteorological conditions and associated 1-hour NO_2 concentrations.

Appendices

Appendix 1 – Background to Air Quality

Emissions from road traffic contribute significantly to ambient pollutant concentrations in urban areas. The main constituents of vehicle exhaust emissions, produced by fuel combustion are carbon dioxide (CO_2) and water vapour (H_2O). However, combustion engines are not 100% efficient and partial combustion of fuel results in emissions of a number of other pollutants, including carbon monoxide (CO), particulate matter (PM), Volatile Organic Compounds (VOCs) and hydrocarbons (HC). For HC, the pollutants of most concern are 1,3 - butadiene (C_4H_6) and benzene (C_6H_6). In addition, some of the nitrogen (N) in the air is oxidised under the high temperature and pressure during combustion; resulting in emissions of oxides of nitrogen (NO_x). NO_x emissions from vehicles predominately consist of nitrogen oxide (NO), but also contain nitrogen dioxide (NO_2). Once emitted, NO can be oxidised in the atmosphere to produce further NO_2.

The quantities of each pollutant emitted depend upon a number of parameters; including the type and quantity of fuel used, the engine size, the vehicle speed, and the type of emissions abatement equipment fitted. Once emitted, these pollutants disperse in the air. Where there is no additional source of emission, pollutant concentrations generally decrease with distance from roads, until concentrations reach those of the background.

This air quality assessment focuses on NO_2 as this pollutant is least likely to meet its respective Air Quality Strategy (AQS) objectives near roads. This has been confirmed over recent years by the outcome of the Local Air Quality Management (LAQM) regime. Recent statistics[15] regarding Air Quality Management Areas (AQMAs) show that, 699 AQMAs were declared in the UK, of which 597 include NO_2 and 95 include PM_{10} (a number of AQMAs have been declared for both pollutants). The majority (92%) of existing AQMAs have been declared in relation to road traffic emissions.

In line with these results, the reports produced by the Council under the LAQM regime have confirmed that road traffic within their administrative area is the main issue in relation to air quality.

An overview of NO_x/NO_2, describing briefly the sources and processes influencing the ambient concentrations, is presented below.

Nitrogen Oxides (NO_x)

NO and NO_2, collectively known as NO_x, are produced during the high temperature combustion processes involving the oxidation of N. Initially, NO_x are mainly emitted as NO, which then undergoes further oxidation in the atmosphere, particularly with ozone (O_3), to produce secondary NO_2. Production of secondary NO_2 could also be favoured due to a class of compounds, VOCs, typically present in urban environments, and under certain meteorological conditions, such as hot sunny days and stagnant anti-cyclonic winter conditions.

Of NO_x, it is NO_2 that is associated with health impacts. Exposure to NO_2 can bring about reversible effects on lung function and airway responsiveness. It may also increase reactivity to natural allergens, and exposure to NO_2 puts children at increased risk of respiratory infection and may lead to poorer lung function in later life.

In the UK, emissions of NOx have decreased by 62% between 1990 and 2010. For 2010, NO_x (as NO_2) emissions were estimated to be 1,106kt. The transport sector remained the largest source of NO_x emissions with road transport contribution 34% to NO_x emissions in 2010.

[15] Statistics from the UK AQMA website available at http://aqma.defra.gov.uk – Figures as of October 2015

Appendix 2 – ADMS Model Verification

The ADMS-Roads dispersion model has been widely validated for this type of assessment and is specifically listed in the Defra's LAQM.TG(09)[1] guidance as an accepted dispersion model.

Model validation undertaken by the software developer (CERC) will not have included validation in the vicinity of the proposed development site. It is therefore necessary to perform a comparison of modelled results with local monitoring data at relevant locations. This process of verification attempts to minimise modelling uncertainty and systematic error by correcting modelled results by an adjustment factor to gain greater confidence in the final results.

The predicted results from a dispersion model may differ from measured concentrations for a large number of reasons, including uncertainties associated with:

- Background concentration estimates;
- Source activity data such as traffic flows and emissions factors;
- Monitoring data, including locations; and
- Overall model limitations.

Model verification is the process by which these and other uncertainties are investigated and where possible minimised. In reality, the differences between modelled and monitored results are likely to be a combination of all of these aspects.

Model setup parameters and input data were checked prior to running the models in order to reduce these uncertainties. The following were checked to the extent possible to ensure accuracy:

- Traffic data;
- Distance between sources and monitoring as represented in the model;
- Speed estimates on roads;
- Background monitoring and background estimates; and
- Monitoring data.

Traffic data was obtained from the Council as detailed in Section 4.1. Separation distances between road sources and receptors were checked using electronic OS mapping data.

Winchester City Council, as part of its 'City Study' undertakes passive monitoring as part of its LAQM commitments at 35 locations, most of which are located in proximity to the modelled road network. Details of the 35 LAQM monitoring sites used for the purposes of model verification are presented in Table A1 below.

Table A1 – Local Monitoring Data Suitable for Model Verification

Site	Site Name	Site Type	OS Grid Ref	2014 Annual Mean NO_2 Concentration (µg/m^3)* (Bias 0.91*)
DT1	10 Eastgate St	UC	448563 129391	37.5
DT2	Greyfriars 3	UC	448566 129560	33.7
DT3	Friarsgate	RS	448426 129523	27.8
DT4	Upper Brook St	UC	448227 129504	38.5
DT567	Roadside Monitor	RS	448213 129504	**40.0**
DT8	St George's Street	RS	448106 129541	**54.0**
DT9	St George's Street Lad	RS	448163 129512	**55.6**
DT10	Jewry St	RS	448046 129692	**46.4**
DT11	Southgate St	RS	447918 129413	37.9
DT12	Sussex St	RS	447804 129741	35.6
DT13	City Road	UC	447963 129875	37.2
DT14	74 Northwalls	RS	448234 129794	30.5
DT15	Wales St	RS	448842 129820	31.0
DT16	Alresford Rd	Other	449557 129437	**40.8**
DT17	Chesil St	RS	448679 129068	**42.0**
DT18	Stockbridge Rd	UC	447534 130006	24.5
DT19	Andover Rd	UC	447745 130456	27.9
DT202122	Worthy Rd 1	RS	448092 130411	28.8
DT23	St Cross Rd	RS	447842 129050	33.2
DT24	Romsey Rd	RS	447495 129511	**56.9**
DT25	Andover Rd	RS	447898 130065	35.9
DT26	Bus Station	Other	448427 129401	35.5
XDT9	63 Romsey Road	RS	447246 129440	**47.7**
XDT10	Romsey Road Police HQ	RS	447344 129479	28.7
XDT8	Romsey Road Pump House Mews	RS	447502 129511	**69.1**
XDT11	St. James Terrace (Romsey Road)	RS	447620 129549	**42.0**
XDT12	Romsey Road Re-Dress	RS	447729 129584	**57.5**
XDT1	McDonalds	RS	448223 129486	**50.7**
XDT3	Toy Cupboard	RS	448194 129499	**58.1**
XDT5	Café Centro	RS	448158 129526	**51.0**
XDT7	The Royal Oak	RS	448038 129544	**63.1**
CMRS	Echo Offices	RS	448215 129510	**41.0**

In **bold**, exceedence of the annual mean NO_2 AQS objective of 40µg/m^3
*Bias Adjustment Factors listed with relevant year
** Agreed National bias adjustment factor with the Council. See appendix 3 for explanation
+ Triplicate Site modelled as one location

Verification calculations

The verification of the modelling output was performed in accordance with the methodology provided in Annex 3 of LAQM.TG(09)[1].

For the verification and adjustment of NOx/NO_2, the LAQM diffusion tube monitoring data was used as shown in Table A1. Data capture for 2014 at a majority of the sites was above the 75% threshold. However, at the extra monitoring sites (denoted with an 'X' prefix) the data capture was below this threshold, and thus was annualised. Table A2 shows an initial comparison of the monitored and unverified modelled NO_2 results for the year 2014, in order to determine if verification and adjustment was required.

Table A2 – Comparison of Unverified Modelled and Monitored NO_2 Concentrations

Site ID	Site Type	Background NO_2	Monitored total NO_2 ($\mu g/m^3$)	Modelled total NO_2 ($\mu g/m^3$)	% Difference (modelled vs. monitored)
DT1	UC	24.0	37.5	29.9	-20.1
DT2	UC	24.0	33.7	29.1	-13.5
DT3	RS	24.0	27.8	31.0	11.6
DT4	UC	24.0	38.5	36.5	-5.2
DT567	RS	24.0	**40.0**	37.9	-5.4
DT8	RS	24.0	**54.0**	40.3	-25.4
DT9	RS	24.0	**55.6**	50.0	-10.2
DT10	RS	24.0	**46.4**	42.3	-8.9
DT11	RS	24.0	37.9	28.5	-24.7
DT12	RS	24.0	35.6	26.9	-24.5
DT13	UC	24.0	37.2	33.4	-10.2
DT14	RS	24.0	30.5	41.5	36.2
DT15	RS	24.0	31.0	30.8	-0.8
DT16	Other	24.0	**40.8**	24.2	-40.8
DT17	RS	24.0	**42.0**	36.2	-13.9
DT18	UC	24.0	24.5	28.0	14.3
DT19	UC	24.0	27.9	25.9	-7.1
DT202122	RS	24.0	28.8	27.7	-3.8
DT23	RS	24.0	33.2	28.1	-15.5
DT24	RS	24.0	**56.9**	32.8	-42.3
DT25	RS	24.0	**42.0**	36.2	-13.9
DT26	Other	24.0	24.5	28.0	14.3
CMRS	RS	24.0	27.9	25.9	-7.1
XDT9	RS	24.0	28.8	27.7	-3.8
XDT10	RS	24.0	33.2	28.1	-15.5
XDT8	RS	24.0	**56.9**	32.8	-42.3
XDT11	RS	24.0	35.9	35.3	-1.7
XDT12	RS	24.0	35.5	25.4	-28.6
XDT1	RS	24.0	**41.0**	37.9	-7.7
XDT3	RS	24.0	**47.7**	32.7	-31.5
XDT5	RS	24.0	28.7	28.0	-2.4
XDT7	RS	24.0	**69.1**	29.6	-57.1

The model was observed to be under predicting at most locations and no further improvement of the modelled results could be obtained on this occasion. Therefore adjustment of modelled results was necessary. The relevant data was gathered to allow the adjustment factor to be calculated.

Model adjustment needs to be undertaken based on NO_x and not NO_2. For the diffusion tube monitoring results used in the calculation of the model adjustment, NO_x was derived from NO_2; these calculations were undertaken using a spreadsheet tool available from the LAQM website[16].

Table A3 provides the relevant data required to calculate the model adjustment based on regression of the modelled and monitored road source contribution to NO_x.

[16] http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc

Table A3 – Data Required for Adjustment Factor Calculation

Site ID	Monitored total NO_2 (µg/m^3)	Monitored total NO_x (µg/m^3)	Background NO_2 (µg/m^3)	Background NO_x (µg/m^3)	Monitored road contribution NO_2 (total - background) (µg/m^3)	Monitored road contribution NO_x (total - background) (µg/m^3)	Modelled road contribution NO_x (excludes background) (µg/m^3)
DT1	37.5	72.2	24.0	43.0	13.5	29.2	12.3
DT2	33.7	63.5	24.0	43.0	9.7	20.5	10.6
DT3	27.8	50.8	24.0	43.0	3.8	7.8	14.6
DT4	38.5	74.6	24.0	43.0	14.5	31.6	26.9
DT567	40.0	78.3	24.0	43.0	16.0	35.3	30.1
DT8	54.0	115.7	24.0	43.0	30.0	72.7	36.0
DT9	55.6	120.6	24.0	43.0	31.6	77.6	61.3
DT10	46.4	94.5	24.0	43.0	22.4	51.5	40.8
DT11	37.9	73.1	24.0	43.0	13.9	30.1	9.3
DT12	35.6	67.9	24.0	43.0	11.6	24.9	5.9
DT13	37.2	71.7	24.0	43.0	13.2	28.7	20.0
DT14	30.5	56.5	24.0	43.0	6.5	13.5	39.0
DT15	31.0	57.7	24.0	43.0	7.0	14.7	14.2
DT16	40.8	80.2	24.0	43.0	16.8	37.2	0.3
DT17	42.0	83.2	24.0	43.0	18.0	40.2	26.2
DT18	24.5	44.0	24.0	43.0	0.5	1.0	8.2
DT19	27.9	50.9	24.0	43.0	3.9	7.9	3.8
DT202122	28.8	52.9	24.0	43.0	4.8	9.9	7.6
DT23	33.2	62.4	24.0	43.0	9.2	19.4	8.3
DT24	56.9	124.4	24.0	43.0	32.9	81.4	18.6
DT25	42.0	68.5	24.0	43.0	11.9	25.5	24.1
DT26	24.5	67.6	24.0	43.0	11.5	24.6	2.7
CMRS	27.9	80.7	24.0	43.0	17.0	37.7	30.1
XDT9	28.8	98.1	24.0	43.0	23.7	55.1	18.3
XDT10	33.2	52.6	24.0	43.0	4.7	9.6	8.2
XDT8	56.9	164.2	24.0	43.0	45.1	121.2	11.7
XDT11	35.9	83.2	24.0	43.0	18.0	40.2	25.3
XDT12	35.5	126.4	24.0	43.0	33.5	83.4	28.3
XDT1	41.0	106.4	24.0	43.0	26.7	63.4	59.4
XDT3	47.7	128.1	24.0	43.0	34.1	85.1	50.0
XDT5	28.7	107.2	24.0	43.0	27.0	64.2	34.9
XDT7	69.1	144.1	24.0	43.0	39.1	101.1	63.6

Figure A1 provides a comparison of the Monitored Road NO_x Contribution versus the Unverified Modelled Road NO_x and the equation of the trend line based on linear regression through zero. The Total Monitored NO_x concentration has been derived by back-calculating NO_x from the NO_x/NO_2 empirical relationship using the spreadsheet tool available from Defra's website[7]. The equation of the trend lines presented in Figure A1 gives an adjustment factor for the modelled results of 1.516.

Figure A1 - Comparison of the Modelled Road Contribution NO_x versus Monitored Road Contribution NO_x

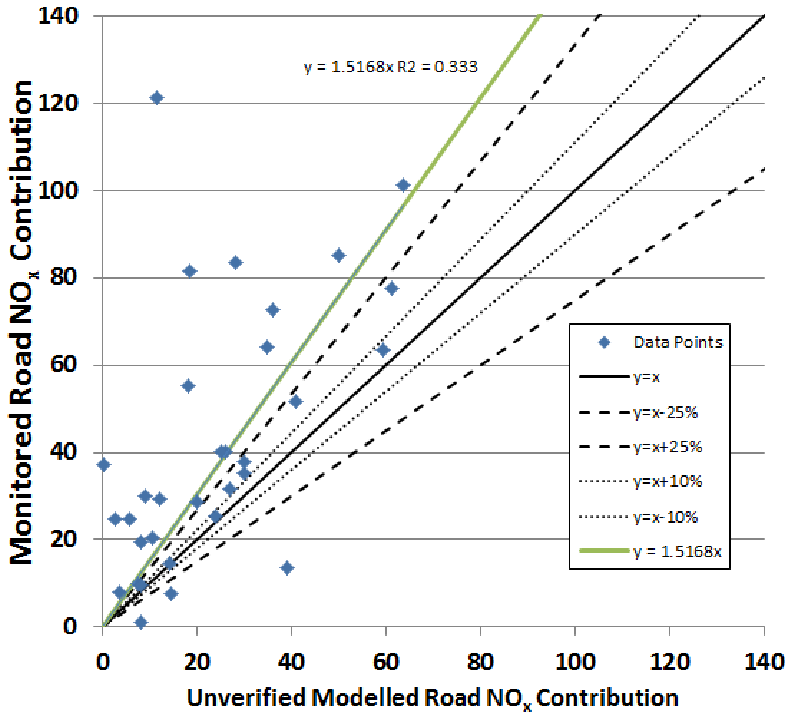


Figure A1 and Table A4 show the ratios between monitored and modelled NO_2 for each monitoring location. The sites do not show an acceptable level of agreement, a factor of 1.516 could therefore not be used for verification.

Table A4 - Verification Zone Split by Monitoring Location

Site ID	Ratio of monitored road contribution NO_x / modelled road contribution NO_x	Adjustment factor for modelled road contribution NO_x	Adjusted modelled road contribution NO_x (µg/m^3)	Adjusted modelled total NO_x (including background NO_x) (µg/m^3)	Modelled total NO_2 (based upon empirical NO_x / NO_2 relationship) (µg/m^3)	Monitored total NO_2 (µg/m^3)	% Difference (adjusted modelled NO_2 vs. monitored NO_2)
DT1	2.37	1.516	18.6	61.6	32.9	37.5	-12.3
DT2	1.94		16.1	59.1	31.7	33.7	-6.0
DT3	0.53		22.2	65.2	34.4	27.8	23.8
DT4	1.17		40.8	83.8	42.2	38.5	9.8
DT567	1.17		45.7	88.7	44.2	40.0	10.4
DT8	2.02		54.6	97.6	47.5	54.0	-11.9
DT9	1.27		92.9	135.9	60.6	55.6	8.9
DT10	1.26		61.9	104.9	50.2	46.4	8.2
DT11	3.25		14.1	57.1	30.8	37.9	-18.8
DT12	4.23		8.9	51.9	28.3	35.6	-20.4
DT13	1.43		30.3	73.3	37.9	37.2	1.9
DT14	0.35		59.1	102.1	49.2	30.5	61.4
DT15	1.04		21.5	64.5	34.1	31.0	9.9
DT16	112.33		0.5	43.5	24.3	40.8	-40.6
DT17	1.54		39.7	82.7	41.8	42.0	-0.5
DT18	0.12		12.4	55.4	30.0	24.5	22.4
DT19	2.07		5.8	48.8	26.8	27.9	-3.6
DT202122	1.30		11.5	54.5	29.6	28.8	2.7
DT23	2.34		12.6	55.6	30.1	33.2	-9.4
DT24	4.38		28.2	71.2	37.0	56.9	-34.9
DT25	1.06		36.5	79.5	40.5	35.9	12.9
DT26	9.00		4.1	47.1	26.1	35.5	-26.6
CMRS	1.25		45.7	88.7	44.2	41.0	7.7
XDT9	3.01		27.8	70.8	36.9	47.7	-22.8
XDT10	1.18		12.4	55.4	30.0	28.7	4.5
XDT8	10.39		17.7	60.7	32.4	69.1	-53.1
XDT11	1.59		38.3	81.3	41.3	42.0	-1.8
XDT12	2.94		43.0	86.0	43.1	57.5	-25.1
XDT1	1.07		90.0	133.0	59.7	50.7	17.6
XDT3	1.70		75.8	118.8	55.0	58.1	-5.3
XDT5	1.84		53.0	96.0	46.9	51.0	-8.0
XDT7	1.59		96.5	139.5	61.7	63.1	-2.3

Although the model was performing well at most monitoring sites, at a number of monitoring sites the model was not performing well or was not showing consistency across similar monitoring sites. A number of monitoring locations were therefore removed from the model verification process in order that the verification factor would only be calculated from locations where the model was performing well. Table A4 provides a list of monitoring sites which have been removed from the verification process along with the reason for the sites removal.

Table A5 – Monitoring sites removed from Verification Process

Site ID	Ratio of monitored road contribution NO_x / modelled road contribution NO_x	Monitored total NO_2 ($\mu g/m^3$)	Reason for removal of Site from Verification
DT3	0.53	27.8	The monitoring site appears to be located further back from the road than the grid location provided resulting in very low ratio.
DT16	112.33	**40.8**	Site located outside model area.
DT18	0.12	24.5	Monitored NO_2 very close to assumed background value and so yields artificially low ratio.
DT19	2.07	27.9	Site located at model periphery and so a large under prediction results.
DT202122	1.30	28.8	Site located at model periphery and so a large under prediction results.
DT26	9.00	24.5	Site located at Bus Station with large separation distance from modelled roads.
XDT10	1.18	33.2	Observed to have significantly lower ratio than other tubes on Romsey Road. This is thought to be due to the road being fairly open on both sides at this point.
XDT8	10.39	**56.9**	Annualised site location which does not show good agreement with DT24 located only 7 metres away.
XDT11	1.59	35.9	Observed to have significantly lower ratio than other tubes on Romsey Road. This is thought to be due to its location on pedestrianized St James' Terrace.

A further review of the monitored and modelled ratios revealed that the model was performing differently in different areas. It was noted that in the area of Romsey Road and Sussex Street the model was under predicting by a greater degree to the rest of the modelled area.

The model has therefore been split into two verification domains, one covering receptors on Romsey Road and Sussex Street (Domain 1) and one covering the rest of the modelled area (Domain 2). The areas of the two domains are illustrated in Figure A2.

Figure A2 - Verification Zone Split

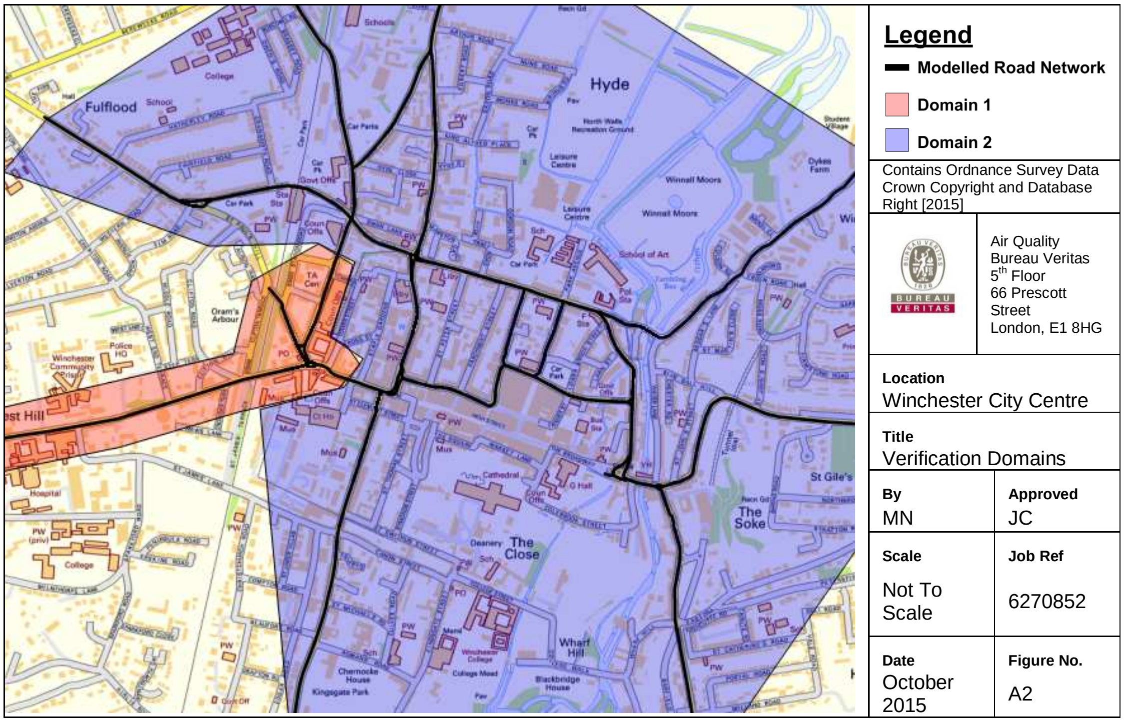


Figure A3 provide a comparison of the Modelled Road Contribution NO_x versus Monitored Road Contribution NO_x, and the equations of the trend line based on linear regression through zero for the monitoring locations in Domain 1. The equation of the trend lines presented in Figure A3 gives an adjustment factor for Domain 1 of 3.313.

Figure A3 – Domain 1 Comparison of the Modelled Road Contribution NO_x versus Monitored Road Contribution NO_x

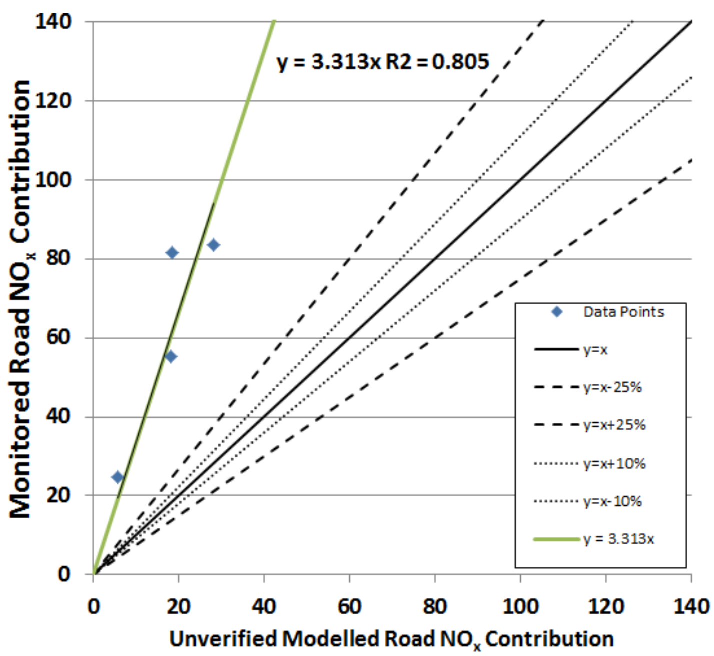
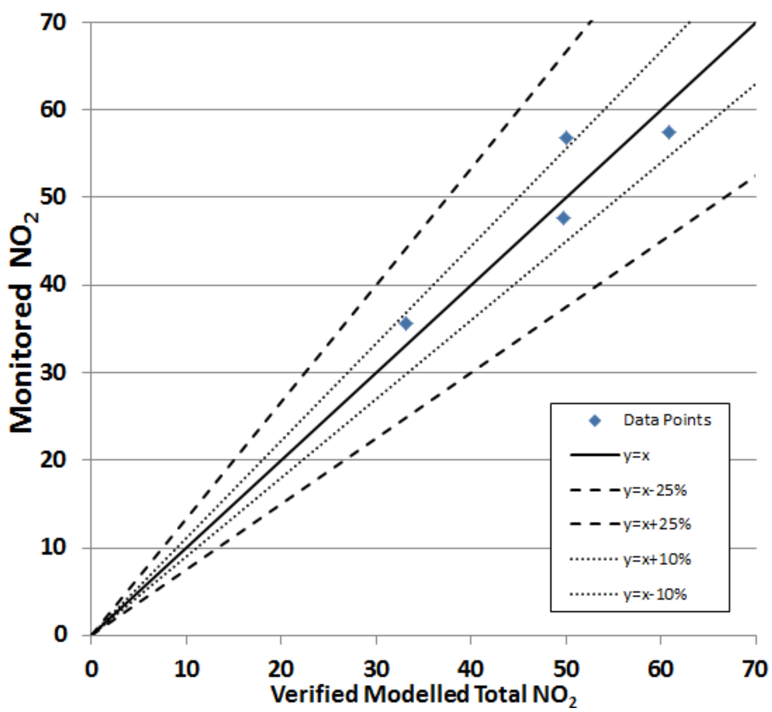


Table A6 and Figure A4 show the ratios between monitored and modelled NO_2 for each monitoring locations in Domain 1. All sites considered show acceptable agreement between the ratios of monitored and modelled NO_2 all being ±25%. A verification factor of 3.313 was therefore used to adjust the model results in Domain 1. A factor of 3.313 reduces the Root Mean Square Error (RMSE) from a value of 18.0 to 4.1.

Table A6 - Model Verification - Domain 1

Site ID	Ratio of monitored road contribution NO_x / modelled road contribution NO_x	Adjustment factor for modelled road contribution NO_x	Adjusted modelled road contribution NO_x (µg/m^3)	Adjusted modelled total NO_x (including background NO_x) (µg/m^3)	Modelled total NO_2 (based upon empirical NO_x / NO_2 relationship) (µg/m^3)	Monitored total NO_2 (µg/m^3)	% Difference (adjusted modelled NO_2 vs. monitored NO_2)
DT12	4.23	3.313	19.5	62.5	33.2	35.6	-6.7
DT24	4.38		61.6	104.6	50.1	56.9	-12.0
XDT9	3.01		60.8	103.8	49.8	47.7	4.3
XDT12	2.94		93.9	136.9	60.9	57.5	5.8

Figure A4 - Comparison of the Modelled NO_2 versus Monitored NO_2 – Domain 1



The adjustment factor 3.313 was applied to the road-NO_x concentrations predicted by the model to arrive at the final NO_2 concentrations in Domain 1.

Figure A5 provide a comparison of the Modelled Road Contribution NO_x versus Monitored Road Contribution NO_x, and the equations of the trend line based on linear regression through zero for the monitoring locations in Domain 2. The equation of the trend lines presented in Figure A3 gives an adjustment factor for Domain 2 of 1.425.

Figure A5 – Domain 2 Comparison of the Modelled Road Contribution NO_x versus Monitored Road Contribution NO_x

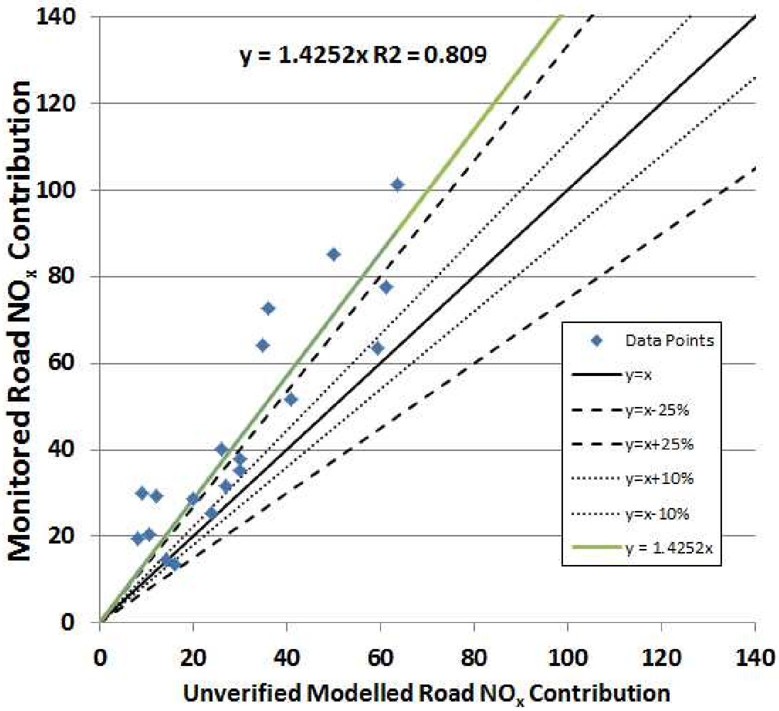
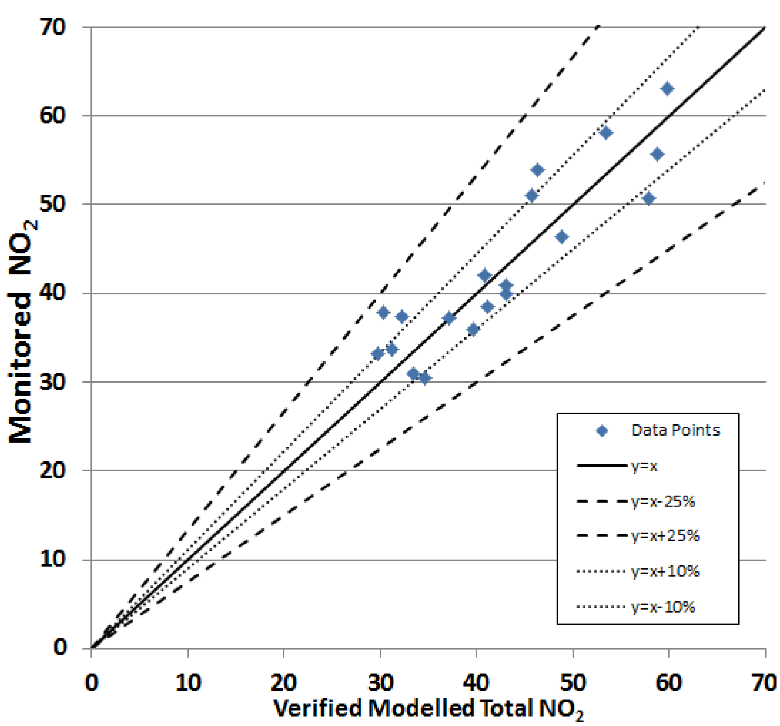


Table A7 and Figure A6 show the ratios between monitored and modelled NO_2 for each monitoring locations in Domain 2 All sites considered show acceptable agreement between the ratios of monitored and modelled NO_2 all being ±25%. A verification factor of 1.425 was therefore used to adjust the model results in Domain 2. A factor of 1.425 reduces the Root Mean Square Error (RMSE) from a value of 7.0 to 4.3.

Table A7 - Model Verification Split – Domain 2

Site ID	Ratio of monitored road contribution NO_x / modelled road contribution NO_x	Adjustment factor for modelled road contribution NO_x	Adjusted modelled road contribution NO_x (µg/m^3)	Adjusted modelled total NO_x (including background NO_x) (µg/m^3)	Modelled total NO_2 (based upon empirical NO_x / NO_2 relationship) (µg/m^3)	Monitored total NO_2 (µg/m^3)	% Difference (adjusted modelled NO_2 vs. monitored NO_2)
DT1	2.37	1.425	17.52	60.52	32.34	37.46	-13.66
DT2	1.94		15.09	58.09	31.23	33.69	-7.29
DT4	1.17		38.32	81.32	41.24	38.47	7.19
DT567	1.17		42.96	85.96	43.09	40.01	7.71
DT8	2.02		51.29	94.29	46.30	53.99	-14.24
DT9	1.27		87.32	130.32	58.80	55.63	5.70
DT10	1.26		58.18	101.18	48.86	46.39	5.34
DT11	3.25		13.23	56.23	30.37	37.86	-19.78
DT13	1.43		28.47	71.47	37.15	37.23	-0.22
DT14	0.84		22.85	65.85	34.72	30.49	13.89
DT15	1.04		20.17	63.17	33.53	31.04	8.02
DT17	1.54		37.35	80.35	40.85	42.02	-2.78
DT23	2.34		11.85	54.85	29.73	33.20	-10.46
DT25	1.06		34.34	77.34	39.62	35.88	10.42
XDT1	1.07		84.59	127.59	57.92	50.75	14.14
XDT3	1.70		71.19	114.19	53.46	58.09	-7.98
XDT5	1.84		49.77	92.77	45.73	51.02	-10.36
XDT7	1.59		90.66	133.66	59.86	63.10	-5.14
CMRS	1.25		42.96	85.96	43.09	41.00	5.10

Figure A6 - Comparison of the Modelled NO_2 versus Monitored NO_2 – Domain 2



The adjustment factor 1.425 was applied to the road-NO_x concentrations predicted by the model to arrive at the final NO_2 concentrations in Domain 2.

NO_2 results presented and discussed herein within Domain 1 and Domain 2 are those calculated following the process of model verification using adjustment factors 3.313 and 1.425 respectively.

Appendix 3 – Diffusion Tube Bias

Figure A7 – Diffusion Tube Bias Adjustment Factors Calculation

National Diffusion Tube Bias Adjustment Factor Spreadsheet — Spreadsheet Version Number: 06/15

Follow the steps below in the correct order to show the results of relevant co-location studies
Data only apply to tubes exposed monthly and are not suitable for correcting individual short-term monitoring periods
Whenever presenting adjusted data, you should state the adjustment factor used and the version of the spreadsheet
This spreadhseet will be updated every few months: the factors may therefore be subject to change. This should not discourage their immediate use.

This spreadsheet will be updated at the end of September 2015
LAQM Helpdesk Website

The LAQM Helpdesk is operated on behalf of Defra and the Devolved Administrations by Bureau Veritas, in conjunction with contract partners AECOM and the National Physical Laboratory.

Spreadsheet maintained by the National Physical Laboratory. Original compiled by Air Quality Consultants Ltd.

Step 1:	Step 2:	Step 3:	Step 4:								
Select the Laboratory that Analyses Your Tubes from the Drop-Down List	Select a Preparation Method from the Drop-Down List	Select a Year from the Drop-Down List	Where there is only one study for a chosen combination, you should use the adjustment factor shown with caution. Where there is more than one study, use the overall factor[3] shown in blue at the foot of the final column.								
If a laboratory is not shown, we have no data for this laboratory.	If a preparation method is not shown, we have no data for this method at this laboratory.	If a year is not shown, we have no data[2]	If you have your own co-location study then see footnote[4]. If uncertain what to do then contact the Local Air Quality Management Helpdesk at LAQMHelpdesk@uk.bureauveritas.com or 0800 0327953								
Analysed By[1]	Method To undo your selection, choose (All) from the pop-up list	Year[5] To undo your selection, choose (All)	Site Type	Local Authority	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) (µg/m³)	Automatic Monitor Mean Conc. (Cm) (µg/m³)	Bias (B)	Tube Precision[6]	Bias Adjustment Factor (A) (Cm/Dm)
Gradko	20% TEA in water	2014		Overall Factor[3] (21 studies)				Use		0.91

Appendix 4 – Diffusion Tube Annualisation

Table A8 - Annualisation Summary

Site	Raw Data Average* (µg/m^3)	Months	Annualisation Factor					Annualised Data Average* (µg/m^3)	Bias Adjusted Finalised Average* (µg/m^3)
			Bournemouth	Reading New Town	Southampton Centre	Winchester Background	Average		
XDT9	54.6	7	0.932	0.960	0.990	0.964	0.962	52.5	47.7
XDT10	31.4	8	1.001	0.996	1.015	1.009	1.005	31.5	28.7
XDT8	73.7	7	1.020	1.021	1.047	1.029	1.029	75.9	69.1
XDT11	44.1	7	1.095	1.023	1.048	1.015	1.045	46.1	42.0
XDT12	59.2	7	1.121	1.034	1.067	1.051	1.068	63.2	57.5
XDT1	58.2	7	0.980	0.946	0.957	0.952	0.959	55.8	50.7
XDT3	62.3	9	1.032	1.009	1.030	1.026	1.024	63.8	58.1
XDT5	55.6	8	0.998	0.996	1.035	1.004	1.008	56.1	51.0
XDT7	66.4	8	1.058	1.032	1.040	1.051	1.045	69.3	63.1
* - Averages are time weighted									

Appendix 5 – Fleet Euro Proportions

Table A9 - Car Euro proportions

Pollutant	Vehicle Type	Euro class	Default Proportion	User Defined Proportion (used in assessment)
NO_x	Petrol Car	Pre-Euro 1	0.02	0.00
		Euro 1	0.00	0.00
		Euro 2	0.04	0.00
		Euro 3	0.26	0.00
		Euro 4	0.31	0.44
		Euro 5	0.37	0.48
		Euro 6	0.00	0.07
	Diesel Car	Pre-Euro 1	0.00	0.00
		Euro 1	0.00	0.00
		Euro 2	0.01	0.00
		Euro 3	0.15	0.00
		Euro 4	0.31	0.34
		Euro 5	0.52	0.60
		Euro 6	0.00	0.06

Table A10 – LGV Euro proportions

Pollutant	Vehicle Type	Euro class	Default Proportion	User Defined Proportion (used in assessment)
NO_x	Petrol LGV	Pre-Euro 1	0.14	0.14*
		Euro 1	0.02	0.02*
		Euro 2	0.15	0.15*
		Euro 3	0.25	0.25*
		Euro 4	0.28	0.28*
		Euro 5	0.16	0.16*
		Euro 6	0.00	0.00*
	Diesel LGV	Pre-Euro 1	0.00	0.00
		Euro 1	0.00	0.00
		Euro 2	0.01	0.00
		Euro 3	0.09	0.00
		Euro 4	0.35	0.34
		Euro 5	0.54	0.60
		Euro 6	0.00	0.06

* No Petrol LGVs were captured in the ANPR survey, meaning it was not possible to ascertain a user proportion for this vehicle class, so the default proportions were used.

Table A11 - HGV Euro proportions

Pollutant	Vehicle Type	Euro class	Default Proportion	User Defined Proportion (used in assessment)
NO_x	Rigid* HGV	Pre-Euro I	0.00	0.00
		Euro I	0.00	0.00
		Euro II	0.02	0.00
		Euro III	0.19	0.00
		Euro IV	0.17	0.27
		Euro V_EGR	0.11	0.18
		Euro V_SCR	0.32	0.51
		Euro VI	0.19	0.04
		Euro II SCRRF	0.00	0.00
		Euro III SCRRF	0.00	0.00
		Euro IV SCRRF	0.00	0.00
		Euro V EGR + SCRRF	0.00	0.00
	Artic* HGV	Pre-Euro I	0.00	0.00
		Euro I	0.00	0.00
		Euro II	0.00	0.00
		Euro III	0.05	0.00
		Euro IV	0.09	0.27
		Euro V_EGR	0.14	0.18
		Euro V_SCR	0.41	0.51
		Euro VI	0.31	0.04
		Euro II SCRRF	0.00	0.00
		Euro III SCRRF	0.00	0.00
		Euro IV SCRRF	0.00	0.00
		Euro V EGR + SCRRF	0.00	0.00
*No distinction is made between the two HGV types in either the ANPR survey or the EFT input scenario traffic format ‘Detailed Option 1’, therefore both are assumed the same.				

Table A12 - Bus/Coach Euro proportions

Pollutant	Vehicle Type	Euro class	Default Proportion	User Defined Base Bus Proportion (used in assessment)	User Defined P+R Bus Proportion (used in Scenario 1)	User Defined All Bus Proportion (used in Scenario 2)
NO_x	Buses (non-London)*	Pre-Euro I	0.00	0.00	0.00	0.00
		Euro I	0.01	0.00	0.00	0.00
		Euro II	0.06	0.00	0.00	0.00
		Euro III	0.26	0.00	0.00	0.00
		Euro IV	0.17	0.67	0.67	0.46
		Euro V_EGR	0.09	0.08	0.01	0.00
		Euro V_SCR	0.28	0.25	0.02	0.00
		Euro VI	0.13	0.01	0.30	0.54
		Euro II SCRRF	0.00	0.00	0.00	0.00
		Euro III SCRRF	0.00	0.00	0.00	0.00
		Euro IV SCRRF	0.00	0.00	0.00	0.00
		Euro V EGR + SCRRF	0.00	0.00	0.00	0.00
	Coaches*	Pre-Euro I	0.00	0.00	0.00	0.00
		Euro I	0.01	0.00	0.00	0.00
		Euro II	0.06	0.00	0.00	0.00
		Euro III	0.26	0.00	0.00	0.00
		Euro IV	0.17	0.67	0.67	0.46
		Euro V_EGR	0.09	0.08	0.01	0.00
		Euro V_SCR	0.28	0.25	0.02	0.00
		Euro VI	0.13	0.01	0.30	0.54
		Euro II SCRRF	0.00	0.00	0.00	0.00
		Euro III SCRRF	0.00	0.00	0.00	0.00
		Euro IV SCRRF	0.00	0.00	0.00	0.00
		Euro V EGR + SCRRF	0.00	0.00	0.00	0.00

*As above, no distinction is made between the Bus and Coach in either the ANPR survey or the EFT input scenario traffic format ‘Detailed Option 1’, therefore both are assumed the same.

Appendix 6 – Full List of Receptors

Table A13 - Comprehensive List of All Modelled Locations for all three Scenarios

ID	Road Name	X	Y	Z	2014 Annual Mean NO_2 ($\mu g/m^3$)			2014 99.8th %-tile of 1-Hour Mean NO_2 ($\mu g/m^3$)		
					Base	SC1	SC2	Base	SC1	SC2
D1	Alresford Road	449126.9	129470.7	1.5	25.9	25.8	25.8	93.6	93.2	93.1
D2	Alresford Road	448926.4	129477.2	1.5	27.8	27.6	27.5	100.3	99.5	99.2
D3	Alresford Road	448933.8	129474.5	1.5	27.9	27.7	27.6	100.9	100.1	99.8
D4	Alresford Road	448942.3	129474.0	1.5	27.7	27.5	27.4	100.0	99.2	99.0
D5	Alresford Road	448951.4	129447.3	1.5	26.8	26.6	26.6	96.8	96.3	96.0
D6	Alresford Road	448984.4	129438.3	1.5	26.2	26.1	26.0	94.7	94.3	94.1
D7	Alresford Road	449005.1	129439.9	1.5	26.5	26.4	26.3	95.7	95.2	95.0
D8	Alresford Road	448955.3	129476.9	1.5	27.0	26.8	26.7	97.5	96.9	96.6
D9	Alresford Road	448962.7	129472.4	1.5	27.5	27.3	27.2	99.2	98.6	98.3
D10	Alresford Road	448975.0	129474.1	1.5	27.0	26.8	26.8	97.6	96.9	96.7
D11	Alresford Road	448993.5	129480.1	1.5	26.3	26.1	26.1	94.9	94.4	94.3
D12	Alresford Road	448996.8	129479.8	1.5	26.3	26.1	26.1	94.9	94.4	94.2
D13	Alresford Road	449011.2	129478.8	1.5	26.2	26.1	26.0	94.7	94.2	94.0
D14	Alresford Road	449015.6	129478.6	1.5	26.2	26.1	26.0	94.6	94.1	93.9
D15	Alresford Road	449025.6	129478.7	1.5	26.1	26.0	25.9	94.3	93.8	93.6
D16	Alresford Road	449047.1	129476.9	1.5	26.0	25.9	25.9	94.0	93.6	93.4
D17	Alresford Road	449063.7	129475.7	1.5	26.0	25.9	25.8	93.9	93.5	93.3
D18	Alresford Road	449079.1	129474.6	1.5	26.0	25.8	25.8	93.8	93.4	93.2
D19	Alresford Road	449092.4	129471.0	1.5	26.1	26.0	25.9	94.2	93.8	93.6
D20	Alresford Road	449096.4	129471.1	1.5	26.1	25.9	25.9	94.1	93.7	93.5
D21	Alresford Road	449109.5	129471.7	1.5	25.9	25.8	25.8	93.7	93.3	93.2
D22	Alresford Road	449142.5	129470.2	1.5	25.9	25.8	25.7	93.4	93.0	92.9
D23	Alresford Road	449129.3	129429.9	1.5	26.3	26.2	26.1	95.1	94.6	94.4
D24	Alresford Road	449143.9	129429.9	1.5	26.4	26.3	26.2	95.4	94.9	94.7
D25	Alresford Road	449166.9	129428.4	1.5	26.4	26.3	26.2	95.3	94.8	94.6
D26	Alresford Road	449160.4	129469.3	1.5	25.8	25.7	25.7	93.3	92.9	92.7
D27	Alresford Road	449170.2	129468.3	1.5	25.8	25.7	25.7	93.3	92.9	92.8
D28	Alresford Road	449182.3	129465.8	1.5	25.9	25.8	25.8	93.6	93.2	93.0
D29	Alresford Road	449199.4	129465.3	1.5	25.8	25.7	25.7	93.4	93.0	92.8
D30	Alresford Road	449216.1	129463.9	1.5	25.8	25.7	25.7	93.3	92.9	92.8
D31	Alresford Road	449187.2	129410.6	1.5	25.4	25.3	25.2	91.6	91.3	91.2
D32	Alresford Road	449214.1	129406.9	1.5	25.3	25.2	25.2	91.2	91.0	90.9
D33	Alresford Road	449224.1	129410.9	1.5	25.4	25.3	25.3	91.7	91.4	91.3
D34	Alresford Road	449241.8	129413.2	1.5	25.5	25.4	25.4	92.1	91.8	91.6
D35	Alresford Road	449257.8	129466.0	1.5	25.5	25.4	25.4	92.1	91.8	91.7
D36	Alresford Road	449257.2	129416.6	1.5	25.7	25.6	25.5	92.7	92.4	92.3
D37	Alresford Road	449273.4	129418.2	1.5	25.8	25.7	25.6	93.1	92.7	92.6
D38	Alresford Road	449271.1	129461.0	1.5	25.6	25.5	25.5	92.6	92.2	92.1
D39	Alresford Road	449285.4	129461.1	1.5	25.5	25.4	25.4	92.0	91.7	91.6
D40	Alresford Road	449291.6	129460.7	1.5	25.4	25.3	25.3	91.7	91.5	91.3
D41	Alresford Road	449289.2	129421.3	1.5	26.0	25.8	25.8	93.8	93.4	93.2
D42	Alresford Road	449306.0	129459.6	1.5	25.2	25.1	25.1	90.9	90.7	90.5
D43	Alresford Road	449312.1	129459.5	1.5	25.0	25.0	24.9	90.4	90.2	90.1
D44	Easton Lane	449120.3	130100.0	1.5	26.1	26.1	26.1	94.4	94.3	94.2
D45	Easton Lane	448999.1	129941.6	1.5	29.2	29.1	29.1	105.3	105.1	105.0
D46	Easton Lane	449002.9	129934.8	1.5	27.6	27.5	27.5	99.6	99.4	99.3
D47	Easton Lane	449034.8	129941.8	1.5	26.5	26.4	26.4	95.6	95.4	95.3
D48	Easton Lane	449032.4	129948.7	1.5	27.0	27.0	26.9	97.5	97.4	97.3
D49	Easton Lane	449030.5	129955.6	1.5	27.9	27.8	27.8	100.7	100.5	100.4
D50	Easton Lane	449028.9	129962.8	1.5	29.6	29.6	29.5	107.1	106.9	106.7
D51	Easton Lane	449061.9	129961.6	1.5	26.5	26.4	26.4	95.6	95.4	95.3

ID	Road Name	X	Y	Z	2014 Annual Mean NO_2 (µg/m^3)			2014 99.8th %-tile of 1-Hour Mean NO_2 (µg/m^3)		
					Base	SC1	SC2	Base	SC1	SC2
D52	Easton Lane	449117.5	130009.4	1.5	26.4	26.4	26.3	95.4	95.2	95.1
D53	Easton Lane	449134.4	130033.1	1.5	26.7	26.7	26.7	96.6	96.5	96.4
D54	Easton Lane	449148.7	130045.3	1.5	26.5	26.5	26.5	95.8	95.7	95.6
D55	Easton Lane	449153.7	130057.5	1.5	26.9	26.9	26.9	97.3	97.2	97.0
D56	Easton Lane	449123.4	130075.7	1.5	28.9	28.9	28.8	104.5	104.3	104.2
D57	Easton Lane	449122.3	130083.7	1.5	27.4	27.4	27.4	99.1	99.0	98.9
D58	Easton Lane	449121.4	130088.6	1.5	26.9	26.8	26.8	97.1	97.0	96.9
D59	Easton Lane	449120.7	130095.6	1.5	26.4	26.3	26.3	95.2	95.1	95.0
D60	Easton Lane	449183.6	130086.3	1.5	26.8	26.8	26.7	96.8	96.6	96.6
D61	Easton Lane	449199.4	130113.1	1.5	27.9	27.9	27.8	100.8	100.7	100.5
D62	Easton Lane	449171.5	130117.4	1.5	29.3	29.3	29.2	105.9	105.7	105.5
D63	Easton Lane	449202.7	130148.5	1.5	25.9	25.9	25.9	93.7	93.6	93.5
D64	Easton Lane	448930.1	129919.1	1.5	28.5	28.5	28.4	103.0	102.8	102.6
D65	Easton Lane	448841.4	129780.4	1.5	27.2	27.1	27.1	98.3	98.0	97.9
D66	Easton Lane	448847.0	129782.2	1.5	27.0	26.9	26.9	97.6	97.3	97.2
D67	Easton Lane	448851.8	129783.4	1.5	26.8	26.8	26.7	96.9	96.7	96.6
D68	Easton Lane	448844.5	129823.4	1.5	33.9	33.8	33.7	122.3	122.0	121.7
D69	Easton Lane	448846.1	129826.9	1.5	33.7	33.7	33.6	121.9	121.6	121.3
D70	Easton Lane	448848.8	129831.5	1.5	33.9	33.8	33.8	122.6	122.2	121.9
D71	Easton Lane	448848.7	129841.7	1.5	29.8	29.7	29.7	107.7	107.4	107.2
D72	Easton Lane	448851.8	129846.1	1.5	29.9	29.8	29.8	108.0	107.7	107.6
D73	Easton Lane	448856.0	129852.1	1.5	30.0	29.9	29.8	108.2	107.9	107.7
D74	Easton Lane	448860.0	129857.9	1.5	30.0	29.9	29.8	108.2	108.0	107.7
D75	Easton Lane	448863.7	129863.3	1.5	29.8	29.7	29.6	107.5	107.2	107.1
D76	Easton Lane	448862.4	129824.2	1.5	29.8	29.7	29.7	107.7	107.4	107.2
D77	Easton Lane	448866.3	129829.0	1.5	29.5	29.5	29.4	106.7	106.4	106.2
D78	Easton Lane	448870.5	129833.0	1.5	29.1	29.1	29.0	105.2	105.0	104.8
D79	Easton Lane	448871.9	129839.4	1.5	29.8	29.7	29.7	107.7	107.5	107.3
D80	Easton Lane	448875.9	129846.2	1.5	30.0	29.9	29.8	108.3	108.0	107.8
D81	Easton Lane	448878.4	129850.1	1.5	30.1	30.1	30.0	108.8	108.6	108.4
D82	Easton Lane	448882.7	129853.6	1.5	29.8	29.7	29.7	107.7	107.4	107.2
D83	Easton Lane	448892.4	129862.5	1.5	29.7	29.7	29.6	107.5	107.2	107.0
D84	Easton Lane	448852.8	129867.3	1.5	27.3	27.2	27.2	98.7	98.4	98.3
D85	Easton Lane	448842.6	129870.0	1.5	26.5	26.5	26.4	95.8	95.6	95.4
D86	Easton Lane	448896.7	129855.4	1.5	28.0	27.9	27.9	101.1	100.9	100.7
D87	Easton Lane	448912.5	129858.5	1.5	27.2	27.1	27.1	98.2	98.0	97.8
D88	Easton Lane	448913.9	129861.3	1.5	27.3	27.3	27.2	98.7	98.5	98.4
D89	Easton Lane	448914.7	129866.3	1.5	27.8	27.7	27.7	100.3	100.0	99.9
D90	Easton Lane	448916.0	129869.0	1.5	28.0	27.9	27.9	101.1	100.9	100.7
D91	Easton Lane	448879.7	129904.0	1.5	26.5	26.5	26.4	95.8	95.6	95.5
D92	Easton Lane	448905.5	129898.0	1.5	28.9	28.9	28.8	104.5	104.2	104.1
D93	Easton Lane	448934.1	129881.8	1.5	28.0	27.9	27.9	101.1	100.9	100.8
D94	Easton Lane	448968.8	129909.5	1.5	27.7	27.7	27.7	100.2	100.0	99.9
D95	Easton Lane	448989.1	129923.7	1.5	27.5	27.4	27.4	99.2	99.0	98.9
D96	Easton Lane	448964.1	129965.0	1.5	26.6	26.6	26.6	96.2	96.1	96.0
D97	Magdaeln Hill	448892.3	129491.2	1.5	27.6	27.3	27.3	99.6	98.8	98.5
D98	Magdaeln Hill	448732.4	129443.9	1.5	27.3	27.1	27.0	98.7	97.9	97.6
D99	Magdaeln Hill	448733.6	129448.6	1.5	27.3	27.1	27.0	98.6	97.8	97.5
D100	Magdaeln Hill	448727.1	129442.1	1.5	27.0	26.8	26.7	97.6	96.9	96.5
D101	Magdaeln Hill	448723.6	129437.2	1.5	26.9	26.7	26.6	97.2	96.5	96.2
D102	Magdaeln Hill	448736.4	129452.3	1.5	27.4	27.2	27.1	99.1	98.4	98.0
D103	Magdaeln Hill	448737.1	129456.7	1.5	27.4	27.2	27.1	99.0	98.2	97.8
D104	Magdaeln Hill	448737.1	129464.0	1.5	27.2	27.0	26.9	98.3	97.6	97.2
D105	Magdaeln Hill	448751.7	129462.5	1.5	30.8	30.4	30.3	111.4	109.9	109.3
D106	Magdaeln Hill	448808.9	129480.6	1.5	27.8	27.6	27.4	100.5	99.5	99.0
D107	Magdaeln Hill	448846.1	129511.2	1.5	29.0	28.7	28.5	104.9	103.6	102.9

ID	Road Name	X	Y	Z	2014 Annual Mean NO_2 (µg/m^3)			2014 99.8th %-tile of 1-Hour Mean NO_2 (µg/m^3)		
					Base	SC1	SC2	Base	SC1	SC2
D108	Magdaeln Hill	448850.3	129509.5	1.5	28.7	28.4	28.2	103.7	102.5	101.9
D109	Magdaeln Hill	448855.0	129507.5	1.5	28.4	28.1	27.9	102.6	101.5	100.9
D110	Magdaeln Hill	448861.3	129504.7	1.5	28.1	27.8	27.7	101.5	100.5	100.0
D111	Magdaeln Hill	448865.4	129503.0	1.5	28.0	27.7	27.6	101.0	100.1	99.6
D112	Magdaeln Hill	448870.0	129501.1	1.5	27.8	27.6	27.5	100.5	99.6	99.2
D113	Magdaeln Hill	448874.0	129499.6	1.5	27.7	27.5	27.4	100.1	99.3	98.9
D114	Magdaeln Hill	448878.3	129497.5	1.5	27.7	27.4	27.3	100.0	99.1	98.8
D115	Magdaeln Hill	448896.4	129489.6	1.5	27.5	27.3	27.2	99.4	98.7	98.3
D116	Magdaeln Hill	448900.9	129487.7	1.5	27.5	27.3	27.2	99.4	98.6	98.3
D117	Magdaeln Hill	448905.0	129486.0	1.5	27.5	27.3	27.2	99.3	98.6	98.2
D118	Magdaeln Hill	448908.7	129484.5	1.5	27.5	27.3	27.2	99.3	98.6	98.2
D119	Magdaeln Hill	448912.9	129482.7	1.5	27.5	27.3	27.2	99.4	98.7	98.4
D120	Magdaeln Hill	448917.2	129481.0	1.5	27.6	27.4	27.3	99.6	98.9	98.5
D121	Magdaeln Hill	448921.8	129479.2	1.5	27.6	27.4	27.3	99.9	99.1	98.8
D122	Magdaeln Hill	448869.2	129464.5	1.5	26.8	26.6	26.5	96.6	96.0	95.7
D123	Magdaeln Hill	448910.0	129450.2	1.5	26.5	26.3	26.3	95.7	95.1	94.9
D124	Wales Street	448837.5	129778.5	1.5	27.3	27.3	27.2	98.7	98.5	98.3
D125	Wales Street	448752.7	129734.1	1.5	37.2	37.1	36.9	134.3	133.9	133.4
D126	Wales Street	448756.6	129738.3	1.5	37.3	37.2	37.1	134.8	134.3	133.9
D127	Wales Street	448761.6	129744.1	1.5	37.1	37.0	36.9	134.0	133.5	133.1
D128	Wales Street	448775.6	129752.1	1.5	32.7	32.6	32.5	118.3	117.9	117.6
D129	Wales Street	448782.6	129759.1	1.5	37.4	37.3	37.2	135.2	134.8	134.4
D130	Wales Street	448751.3	129759.6	1.5	30.1	30.0	30.0	108.9	108.5	108.3
D131	Wales Street	448755.6	129763.3	1.5	30.1	29.9	29.9	108.6	108.2	108.0
D132	Wales Street	448759.3	129766.1	1.5	30.0	29.9	29.8	108.4	108.0	107.8
D133	Wales Street	448761.8	129768.3	1.5	29.8	29.7	29.7	107.7	107.4	107.2
D134	Wales Street	448805.9	129789.3	1.5	33.8	33.7	33.7	122.2	121.9	121.6
D135	Wales Street	448812.6	129748.4	1.5	26.9	26.8	26.8	97.2	96.9	96.8
D136	Wales Street	448814.6	129753.2	1.5	27.1	27.0	26.9	97.8	97.5	97.3
D137	Wales Street	448809.8	129794.5	1.5	33.0	32.9	32.8	119.2	118.9	118.6
D138	Wales Street	448812.7	129797.4	1.5	32.8	32.7	32.7	118.7	118.3	118.0
D139	Wales Street	448815.0	129799.6	1.5	32.8	32.7	32.6	118.4	118.1	117.8
D140	Wales Street	448817.7	129802.3	1.5	32.6	32.5	32.4	117.8	117.5	117.2
D141	Wales Street	448831.6	129777.2	1.5	27.6	27.6	27.5	99.8	99.5	99.4
D142	Wales Street	448830.0	129813.4	1.5	31.9	31.8	31.7	115.1	114.7	114.5
D143	Wales Street	448832.1	129815.5	1.5	31.4	31.4	31.3	113.6	113.3	113.0
D144	Wales Street	448834.6	129818.2	1.5	31.0	31.0	30.9	112.1	111.8	111.6
D145	Wales Street	448662.9	129650.4	1.5	32.7	32.4	32.2	118.1	117.2	116.5
D146	Wales Street	448667.1	129654.0	1.5	33.9	33.6	33.4	122.4	121.5	120.7
D147	Wales Street	448671.2	129657.6	1.5	34.8	34.6	34.3	125.7	124.9	124.0
D148	Wales Street	448675.4	129661.6	1.5	35.6	35.4	35.2	128.8	127.9	127.1
D149	Wales Street	448679.1	129664.7	1.5	35.6	35.3	35.1	128.5	127.6	126.8
D150	Wales Street	448691.0	129672.3	1.5	37.3	37.1	36.9	134.6	133.9	133.3
D151	Wales Street	448696.2	129677.0	1.5	36.6	36.4	36.3	132.2	131.5	131.0
D152	Wales Street	448701.9	129682.0	1.5	36.2	36.1	35.9	130.9	130.2	129.8
D153	Wales Street	448694.6	129692.9	1.5	37.1	37.0	36.8	134.2	133.5	133.0
D154	Wales Street	448706.8	129687.1	1.5	36.5	36.3	36.2	131.8	131.2	130.7
D155	Wales Street	448712.0	129691.9	1.5	36.9	36.7	36.6	133.2	132.6	132.1
D156	Wales Street	448717.4	129697.0	1.5	37.0	36.8	36.7	133.5	133.0	132.5
D157	Wales Street	448706.2	129713.3	1.5	30.5	30.4	30.3	110.3	109.8	109.5
D158	Wales Street	448710.1	129716.6	1.5	30.7	30.5	30.4	110.8	110.2	109.9
D159	Wales Street	448714.0	129719.7	1.5	30.9	30.8	30.7	111.7	111.2	110.8
D160	Wales Street	448717.0	129722.0	1.5	31.2	31.1	31.0	112.8	112.4	112.0
D161	Wales Street	448720.7	129724.8	1.5	31.7	31.6	31.5	114.7	114.2	113.8
D162	Wales Street	448722.0	129701.0	1.5	36.5	36.3	36.2	131.8	131.3	130.8
D163	Wales Street	448726.9	129706.2	1.5	36.7	36.6	36.4	132.6	132.1	131.6

ID	Road Name	X	Y	Z	2014 Annual Mean NO_2 (µg/m^3)			2014 99.8th %-tile of 1-Hour Mean NO_2 (µg/m^3)		
					Base	SC1	SC2	Base	SC1	SC2
D164	Wales Street	448732.3	129711.0	1.5	36.4	36.2	36.1	131.4	130.8	130.4
D165	Wales Street	448738.9	129718.7	1.5	35.8	35.7	35.6	129.3	128.8	128.4
D166	Wales Street	448743.2	129724.1	1.5	35.9	35.8	35.7	129.7	129.2	128.8
D167	Wales Street	448748.2	129729.1	1.5	36.0	35.9	35.7	130.0	129.5	129.1
D168	Wales Street	448726.3	129730.6	1.5	32.1	32.0	31.9	116.0	115.5	115.2
D169	Wales Street	448728.9	129733.8	1.5	31.8	31.7	31.6	114.9	114.5	114.1
D170	Wales Street	448731.3	129736.4	1.5	31.9	31.8	31.7	115.3	114.9	114.6
D171	Wales Street	448733.9	129740.1	1.5	31.4	31.3	31.2	113.4	112.9	112.6
D172	Wales Street	448737.0	129743.8	1.5	31.1	31.0	30.9	112.4	111.9	111.7
D173	Wales Street	448740.9	129748.2	1.5	31.0	30.9	30.8	111.9	111.5	111.2
D174	Wales Street	448742.9	129750.7	1.5	30.7	30.6	30.5	110.9	110.4	110.2
D175	Wales Street	448745.6	129753.8	1.5	30.4	30.3	30.3	110.0	109.5	109.3
D176	Wales Street	448748.1	129756.5	1.5	30.3	30.1	30.1	109.3	108.9	108.6
D177	Chesil Street	448688.9	129171.0	1.5	57.3	55.2	53.8	207.1	199.4	194.4
D178	Chesil Street	448661.4	129220.2	1.5	38.2	37.2	36.5	138.0	134.3	131.9
D179	Chesil Street	448679.8	129217.1	1.5	45.7	44.2	43.3	165.2	159.8	156.3
D180	Chesil Street	448670.6	129210.5	1.5	66.2	63.6	61.9	239.1	229.7	223.6
D181	Chesil Street	448672.2	129195.9	1.5	66.6	64.0	62.3	240.6	231.1	224.9
D182	Chesil Street	448673.4	129191.1	1.5	63.9	61.4	59.8	230.9	221.9	216.1
D183	Chesil Street	448684.1	129192.1	1.5	46.9	45.3	44.3	169.4	163.7	160.1
D184	Chesil Street	448677.3	129181.9	1.5	62.6	60.2	58.7	226.3	217.5	211.9
D185	Chesil Street	448678.5	129178.3	1.5	61.4	59.0	57.5	221.7	213.1	207.6
D186	Chesil Street	448680.0	129173.7	1.5	60.7	58.3	56.8	219.1	210.7	205.3
D187	Chesil Street	448684.6	129184.0	1.5	60.6	58.3	56.8	219.0	210.6	205.3
D188	Chesil Street	448685.7	129180.8	1.5	59.0	56.8	55.4	213.3	205.3	200.1
D189	Chesil Street	448687.0	129176.8	1.5	58.0	55.9	54.5	209.7	201.9	196.8
D190	Chesil Street	448693.9	129155.4	1.5	58.6	56.4	54.9	211.5	203.6	198.4
D191	Chesil Street	448683.7	129154.9	1.5	60.9	58.6	57.1	220.0	211.6	206.1
D192	Chesil Street	448680.6	129169.6	1.5	60.3	58.0	56.5	218.0	209.6	204.3
D193	Chesil Street	448696.7	129147.6	1.5	46.7	45.1	44.1	168.7	163.0	159.4
D194	Chesil Street	448686.4	129125.4	1.5	40.6	39.4	38.6	146.5	142.2	139.5
D195	Chesil Street	448688.4	129117.4	1.5	46.5	44.9	43.9	167.9	162.3	158.7
D196	Chesil Street	448687.8	129112.6	1.5	45.1	43.7	42.7	163.0	157.7	154.3
D197	Chesil Street	448687.3	129108.5	1.5	44.8	43.4	42.5	161.9	156.7	153.4
D198	Chesil Street	448686.7	129103.5	1.5	45.1	43.7	42.7	163.1	157.7	154.4
D199	Chesil Street	448685.7	129096.9	1.5	45.6	44.1	43.2	164.7	159.3	155.9
D200	Chesil Street	448684.8	129092.0	1.5	45.3	43.8	42.8	163.5	158.2	154.8
D201	Chesil Street	448683.4	129085.8	1.5	43.6	42.2	41.4	157.5	152.6	149.4
D202	Chesil Street	448653.6	128950.7	1.5	27.2	27.0	26.9	98.3	97.5	97.0
D203	Chesil Street	448681.5	129075.6	1.5	43.7	42.4	41.5	158.0	153.0	149.8
D204	Chesil Street	448672.0	129051.6	1.5	35.5	34.6	34.1	128.2	125.1	123.2
D205	Chesil Street	448675.4	129043.8	1.5	42.5	41.2	40.4	153.5	148.8	145.8
D206	Chesil Street	448674.8	129040.2	1.5	41.6	40.4	39.6	150.3	145.8	142.9
D207	Chesil Street	448674.3	129037.1	1.5	40.8	39.6	38.9	147.5	143.2	140.4
D208	Chesil Street	448669.1	129032.2	1.5	34.3	33.5	33.1	123.9	121.2	119.4
D209	Chesil Street	448673.7	129025.0	1.5	39.6	38.5	37.8	143.2	139.1	136.6
D210	Chesil Street	448673.9	129018.1	1.5	39.6	38.5	37.8	143.0	139.0	136.4
D211	Chesil Street	448674.2	129014.6	1.5	39.9	38.7	38.0	144.1	140.0	137.4
D212	Chesil Street	448674.6	129011.2	1.5	40.3	39.2	38.4	145.7	141.5	138.8
D213	Chesil Street	448675.1	129007.2	1.5	40.8	39.6	38.9	147.5	143.2	140.4
D214	Chesil Street	448650.9	129008.7	1.5	28.3	27.9	27.7	102.1	100.9	100.2
D215	Chesil Street	448649.0	129012.0	1.5	28.1	27.8	27.6	101.4	100.3	99.6
D216	Chesil Street	448649.9	129016.6	1.5	28.2	27.9	27.7	101.9	100.8	100.0
D217	Chesil Street	448650.4	129019.3	1.5	28.3	28.0	27.8	102.2	101.1	100.3
D218	Chesil Street	448674.7	128998.4	1.5	39.6	38.5	37.8	143.0	138.9	136.4
D219	Chesil Street	448675.8	128991.3	1.5	41.9	40.6	39.8	151.2	146.7	143.8

ID	Road Name	X	Y	Z	2014 Annual Mean NO_2 (µg/m^3)			2014 99.8th %-tile of 1-Hour Mean NO_2 (µg/m^3)		
					Base	SC1	SC2	Base	SC1	SC2
D220	Chesil Street	448675.9	128986.8	1.5	41.9	40.6	39.8	151.3	146.8	143.9
D221	Chesil Street	448675.7	128981.5	1.5	41.1	39.9	39.2	148.6	144.3	141.6
D222	Chesil Street	448675.6	128975.1	1.5	40.3	39.2	38.5	145.7	141.6	139.0
D223	Chesil Street	448676.1	128964.7	1.5	39.1	38.1	37.5	141.4	137.7	135.5
D224	Chesil Street	448652.8	128974.3	1.5	27.9	27.6	27.4	100.8	99.8	99.1
D225	Chesil Street	448661.0	128951.3	1.5	28.0	27.7	27.6	101.2	100.2	99.6
D226	Chesil Street	448667.5	128951.2	1.5	29.1	28.8	28.6	105.1	103.9	103.2
D227	Chesil Street	448698.9	128950.1	1.5	30.1	29.7	29.5	108.8	107.4	106.7
D228	Chesil Street	448700.0	128942.4	1.5	29.8	29.5	29.3	107.7	106.4	105.8
D264	Worthy Road	448287.5	130747.5	1.5	24.8	24.8	24.7	89.6	89.4	89.3
D265	Worthy Road	448291.2	130752.9	1.5	24.7	24.7	24.7	89.3	89.1	89.1
D266	Worthy Road	448295.0	130758.6	1.5	24.7	24.6	24.6	89.1	88.9	88.8
D267	Worthy Road	448298.1	130763.3	1.5	24.6	24.6	24.6	88.9	88.8	88.7
D268	Worthy Road	448301.5	130768.4	1.5	24.6	24.5	24.5	88.7	88.6	88.6
D293	Worthy Road	448241.2	130689.5	1.5	26.2	26.0	26.0	94.5	94.1	93.9
D294	Worthy Road	448173.7	130661.9	1.5	25.6	25.5	25.5	92.4	92.1	92.0
D295	Worthy Road	448221.0	130659.7	1.5	26.2	26.1	26.0	94.6	94.1	94.0
D296	Worthy Road	448224.7	130665.1	1.5	26.2	26.1	26.0	94.5	94.1	93.9
D297	Worthy Road	448227.8	130669.5	1.5	26.2	26.0	26.0	94.5	94.1	93.9
D298	Worthy Road	448231.2	130674.7	1.5	26.2	26.1	26.0	94.5	94.1	93.9
D299	Worthy Road	448234.9	130680.1	1.5	26.2	26.0	26.0	94.5	94.1	93.9
D300	Worthy Road	448238.4	130685.2	1.5	26.2	26.0	26.0	94.5	94.1	93.9
D301	Worthy Road	448184.6	130679.7	1.5	25.5	25.4	25.4	92.2	91.9	91.8
D302	Worthy Road	448211.2	130719.4	1.5	25.4	25.3	25.2	91.6	91.3	91.2
D303	Worthy Road	448252.4	130694.1	1.5	25.6	25.5	25.5	92.5	92.2	92.1
D304	Worthy Road	448254.4	130697.1	1.5	25.6	25.5	25.5	92.5	92.2	92.1
D305	Worthy Road	448258.5	130703.4	1.5	25.6	25.5	25.5	92.4	92.1	92.0
D306	Worthy Road	448260.9	130707.3	1.5	25.6	25.5	25.4	92.3	92.0	91.9
D307	Worthy Road	448264.1	130712.0	1.5	25.5	25.4	25.4	92.2	91.9	91.8
D308	Worthy Road	448266.8	130716.1	1.5	25.5	25.4	25.4	92.0	91.7	91.6
D309	Worthy Road	448221.4	130743.1	1.5	25.0	25.0	25.0	90.4	90.2	90.1
D310	Worthy Road	448280.9	130737.6	1.5	25.0	25.0	24.9	90.3	90.1	90.0
D311	Worthy Road	448284.0	130742.1	1.5	24.9	24.8	24.8	90.0	89.7	89.7
D312	Worthy Road	448264.2	130784.7	1.5	24.6	24.6	24.6	88.9	88.7	88.7
D313	Worthy Road	448270.7	130793.0	1.5	24.5	24.5	24.5	88.6	88.5	88.5
D314	Worthy Road	448092.5	130512.5	1.5	25.8	25.7	25.6	93.1	92.7	92.6
D315	Worthy Road	448129.8	130501.8	1.5	26.6	26.5	26.4	96.1	95.6	95.4
D316	Worthy Road	448100.0	130537.5	1.5	25.6	25.5	25.5	92.5	92.1	92.0
D317	Worthy Road	448152.9	130532.8	1.5	25.9	25.8	25.8	93.7	93.3	93.2
D318	Worthy Road	448152.3	130552.7	1.5	26.8	26.6	26.6	96.7	96.2	96.0
D319	Worthy Road	448102.1	130548.4	1.5	25.5	25.4	25.4	92.0	91.7	91.6
D320	Worthy Road	448156.4	130561.8	1.5	26.9	26.7	26.7	97.1	96.6	96.4
D321	Worthy Road	448102.9	130556.9	1.5	25.4	25.3	25.2	91.6	91.3	91.2
D322	Worthy Road	448119.9	130581.7	1.5	25.4	25.4	25.3	91.9	91.6	91.5
D323	Worthy Road	448128.8	130588.3	1.5	25.6	25.5	25.5	92.5	92.2	92.1
D324	Worthy Road	448171.7	130581.7	1.5	26.4	26.3	26.3	95.5	95.0	94.8
D325	Worthy Road	448178.9	130590.8	1.5	26.3	26.1	26.1	94.8	94.4	94.2
D326	Worthy Road	448130.6	130599.9	1.5	25.4	25.3	25.3	91.8	91.6	91.4
D327	Worthy Road	448179.8	130642.2	1.5	27.6	27.5	27.4	99.9	99.2	99.0
D328	Worthy Road	448201.0	130628.7	1.5	26.2	26.1	26.1	94.7	94.3	94.1
D329	Worthy Road	448213.4	130648.5	1.5	26.2	26.1	26.0	94.6	94.2	94.0
D330	Worthy Road	448217.7	130654.8	1.5	26.2	26.0	26.0	94.5	94.1	93.9
D331	Hyde Street	448087.6	130168.2	1.5	32.3	31.9	31.7	116.7	115.1	114.6
D332	Hyde Street	448107.9	130087.9	1.5	26.7	26.5	26.4	96.4	95.7	95.5
D333	Hyde Street	448094.1	130088.5	1.5	29.1	28.8	28.7	105.0	103.9	103.5
D334	Hyde Street	448085.2	130086.2	1.5	28.6	28.4	28.3	103.4	102.4	102.1

ID	Road Name	X	Y	Z	2014 Annual Mean NO_2 ($\mu g/m^3$)			2014 99.8th %-tile of 1-Hour Mean NO_2 ($\mu g/m^3$)		
					Base	SC1	SC2	Base	SC1	SC2
D335	Hyde Street	448079.4	130096.9	1.5	27.1	26.9	26.8	97.9	97.2	96.9
D336	Hyde Street	448099.7	130105.2	1.5	27.7	27.5	27.4	100.0	99.2	98.9
D337	Hyde Street	448078.3	130108.4	1.5	26.9	26.7	26.6	97.2	96.5	96.2
D338	Hyde Street	448085.0	130116.0	1.5	28.1	27.8	27.7	101.4	100.5	100.2
D339	Hyde Street	448088.6	130129.4	1.5	33.4	32.9	32.8	120.8	119.0	118.4
D340	Hyde Street	448098.1	130128.7	1.5	32.1	31.7	31.5	116.1	114.5	114.0
D341	Hyde Street	448098.2	130132.4	1.5	32.0	31.6	31.4	115.5	114.0	113.4
D342	Hyde Street	448101.8	130146.3	1.5	27.6	27.4	27.3	99.7	98.9	98.6
D343	Hyde Street	448088.4	130141.7	1.5	33.3	32.8	32.6	120.2	118.5	117.8
D344	Hyde Street	448087.7	130151.2	1.5	32.2	31.8	31.6	116.3	114.8	114.2
D345	Hyde Street	448096.7	130168.8	1.5	31.5	31.1	31.0	114.0	112.5	112.0
D346	Hyde Street	448096.4	130184.2	1.5	29.0	28.7	28.6	104.8	103.8	103.4
D347	Hyde Street	448084.2	130175.8	1.5	27.8	27.5	27.5	100.3	99.5	99.2
D348	Hyde Street	448084.1	130180.1	1.5	27.8	27.6	27.5	100.4	99.6	99.3
D349	Hyde Street	448083.9	130184.9	1.5	27.8	27.6	27.5	100.4	99.6	99.4
D350	Hyde Street	448083.8	130189.1	1.5	27.8	27.6	27.5	100.5	99.8	99.4
D351	Hyde Street	448095.0	130193.6	1.5	31.1	30.8	30.6	112.5	111.1	110.6
D352	Hyde Street	448083.6	130193.8	1.5	27.9	27.6	27.6	100.6	99.8	99.5
D353	Hyde Street	448083.4	130198.4	1.5	27.9	27.7	27.6	100.8	99.9	99.6
D354	Hyde Street	448083.2	130202.7	1.5	27.9	27.7	27.6	100.8	100.0	99.7
D355	Hyde Street	448083.1	130207.8	1.5	27.9	27.7	27.6	100.9	100.1	99.8
D356	Hyde Street	448095.0	130208.7	1.5	29.0	28.7	28.6	104.7	103.7	103.4
D357	Hyde Street	448095.1	130216.8	1.5	28.3	28.1	28.0	102.2	101.4	101.1
D358	Hyde Street	448123.1	130178.7	1.5	25.9	25.8	25.7	93.6	93.1	93.0
D359	Hyde Street	448062.5	130211.7	1.5	26.2	26.0	26.0	94.5	94.0	93.8
D360	Hyde Street	448061.7	130217.1	1.5	26.2	26.0	26.0	94.6	94.0	93.9
D361	Hyde Street	448061.4	130224.6	1.5	26.2	26.1	26.0	94.7	94.2	94.0
D362	Hyde Street	448062.0	130229.8	1.5	26.2	26.1	26.0	94.8	94.3	94.1
D363	Hyde Street	448062.9	130236.3	1.5	26.3	26.2	26.1	95.0	94.5	94.3
D364	Hyde Street	448094.9	130225.6	1.5	28.3	28.0	28.0	102.1	101.3	101.0
D365	Hyde Street	448110.6	130396.4	1.5	26.4	26.2	26.2	95.2	94.7	94.5
D366	Hyde Street	448101.4	130243.8	1.5	26.9	26.8	26.7	97.3	96.6	96.4
D367	Hyde Street	448061.4	130254.2	1.5	26.4	26.3	26.2	95.5	94.9	94.7
D368	Hyde Street	448073.0	130261.8	1.5	26.8	26.6	26.6	96.8	96.2	96.0
D369	Hyde Street	448099.9	130297.7	1.5	27.1	26.9	26.9	98.0	97.3	97.0
D370	Hyde Street	448072.4	130288.7	1.5	27.1	26.9	26.9	98.0	97.3	97.1
D371	Hyde Street	448078.4	130304.9	1.5	28.1	27.9	27.8	101.7	100.8	100.4
D372	Hyde Street	448078.3	130308.3	1.5	28.3	28.0	27.9	102.1	101.2	100.8
D373	Hyde Street	448078.0	130312.0	1.5	28.4	28.1	28.0	102.7	101.7	101.3
D374	Hyde Street	448077.8	130316.1	1.5	28.6	28.4	28.2	103.5	102.4	102.0
D375	Hyde Street	448076.6	130319.6	1.5	28.8	28.5	28.3	103.9	102.8	102.4
D376	Hyde Street	448090.2	130338.0	1.5	31.9	31.3	31.1	115.1	113.0	112.2
D377	Worthy Road	448092.3	130360.9	1.5	30.0	29.5	29.4	108.3	106.7	106.1
D378	Worthy Road	448102.0	130368.2	1.5	27.5	27.2	27.1	99.2	98.3	97.9
D379	Worthy Road	448088.4	130387.7	1.5	29.6	29.2	29.1	106.8	105.6	105.2
D380	Worthy Road	448089.6	130396.4	1.5	29.3	29.0	28.9	106.0	104.9	104.5
D381	Worthy Road	448102.6	130428.9	1.5	27.3	27.1	27.1	98.7	98.1	97.8
D382	Worthy Road	448070.4	130443.5	1.5	26.0	25.8	25.8	93.8	93.4	93.2
D383	Worthy Road	448120.8	130461.5	1.5	26.3	26.1	26.1	94.9	94.4	94.2
D384	Southgate Street	447926.3	129402.8	1.5	31.7	31.5	31.4	114.6	113.6	113.3
D385	Southgate Street	447921.2	129424.8	1.5	30.2	29.9	29.8	109.0	108.1	107.8
D386	Southgate Street	447914.6	129404.8	1.5	29.9	29.6	29.6	107.9	107.1	106.8
D387	Southgate Street	447899.6	129410.0	1.5	26.9	26.8	26.7	97.2	96.7	96.5
D388	Southgate Street	447937.8	129434.6	1.5	31.5	31.2	31.1	113.6	112.6	112.2
D389	Southgate Street	447937.0	129431.6	1.5	31.1	30.8	30.7	112.2	111.2	110.8
D390	Southgate Street	447934.3	129424.2	1.5	31.1	30.8	30.7	112.2	111.2	110.8

ID	Road Name	X	Y	Z	2014 Annual Mean NO_2 ($\mu g/m^3$)			2014 99.8th %-tile of 1-Hour Mean NO_2 ($\mu g/m^3$)		
					Base	SC1	SC2	Base	SC1	SC2
D391	Southgate Street	447931.5	129415.2	1.5	31.0	30.7	30.6	111.9	110.9	110.6
D392	Southgate Street	447928.3	129408.5	1.5	31.6	31.4	31.2	114.2	113.3	112.9
D393	Southgate Street	447924.7	129397.5	1.5	31.6	31.4	31.3	114.3	113.3	112.9
D394	Southgate Street	447920.6	129385.6	1.5	31.9	31.6	31.5	115.1	114.1	113.7
D395	Southgate Street	447919.8	129379.3	1.5	30.9	30.7	30.6	111.6	110.8	110.4
D396	Southgate Street	447914.8	129366.0	1.5	31.2	31.0	30.9	112.7	111.8	111.5
D397	Southgate Street	447912.6	129358.6	1.5	31.1	30.8	30.7	112.2	111.3	111.0
D398	Southgate Street	447909.7	129341.0	1.5	29.8	29.6	29.6	107.8	107.1	106.8
D399	Southgate Street	447906.4	129326.3	1.5	29.2	29.0	28.9	105.4	104.7	104.5
D400	Southgate Street	447903.9	129319.3	1.5	29.2	29.0	28.9	105.4	104.8	104.5
D401	Southgate Street	447901.5	129312.4	1.5	29.2	29.0	29.0	105.5	104.8	104.6
D402	Southgate Street	447899.1	129304.6	1.5	29.1	28.9	28.9	105.2	104.6	104.3
D403	Southgate Street	447893.6	129341.0	1.5	29.2	29.0	28.9	105.4	104.7	104.5
D404	Southgate Street	447869.3	129308.0	1.5	26.7	26.6	26.6	96.6	96.2	96.0
D405	Southgate Street	447863.3	129200.6	1.5	32.1	31.8	31.6	115.9	114.8	114.3
D406	Southgate Street	447896.1	129295.2	1.5	29.1	28.9	28.8	105.0	104.3	104.1
D407	Southgate Street	447892.1	129283.2	1.5	29.0	28.9	28.8	104.9	104.3	104.1
D408	Southgate Street	447890.4	129277.6	1.5	29.0	28.8	28.8	104.8	104.2	103.9
D409	Southgate Street	447867.2	129285.2	1.5	27.3	27.2	27.1	98.6	98.1	97.9
D410	Southgate Street	447862.2	129275.1	1.5	27.1	26.9	26.9	97.8	97.3	97.2
D411	Southgate Street	447887.9	129270.0	1.5	29.0	28.9	28.8	104.9	104.3	104.1
D412	Southgate Street	447886.5	129266.3	1.5	29.1	28.9	28.8	105.0	104.4	104.2
D413	Southgate Street	447878.9	129254.7	1.5	30.9	30.7	30.6	111.5	110.7	110.4
D414	Southgate Street	447875.5	129242.9	1.5	30.8	30.6	30.5	111.2	110.4	110.1
D415	Southgate Street	447873.0	129235.2	1.5	30.8	30.6	30.5	111.3	110.5	110.2
D416	Southgate Street	447857.3	129220.4	1.5	30.7	30.5	30.4	111.1	110.3	109.9
D417	Southgate Street	447854.5	129211.8	1.5	30.7	30.4	30.3	110.8	109.9	109.6
D418	Southgate Street	447871.7	129213.4	1.5	29.0	28.9	28.8	104.9	104.3	104.0
D419	Southgate Street	447901.9	129246.0	1.5	26.4	26.3	26.3	95.4	95.0	94.9
D420	Southgate Street	447841.5	129234.0	1.5	26.4	26.3	26.3	95.5	95.1	94.9
D421	Southgate Street	447866.5	129209.1	1.5	30.8	30.5	30.4	111.1	110.3	109.9
D422	St Cross Road	447861.6	129195.4	1.5	33.6	33.2	33.0	121.4	120.0	119.3
D423	St Cross Road	447860.5	129190.0	1.5	34.4	33.9	33.7	124.2	122.6	121.9
D424	St Cross Road	447857.6	129183.8	1.5	37.1	36.5	36.2	133.9	131.9	130.9
D425	St Cross Road	447849.4	129187.2	1.5	35.4	34.9	34.7	127.8	126.0	125.2
D426	St Cross Road	447847.5	129181.2	1.5	34.6	34.1	33.9	124.9	123.2	122.4
D427	St Cross Road	447833.3	129186.0	1.5	27.3	27.1	27.1	98.6	98.0	97.8
D428	St Cross Road	447828.1	129195.3	1.5	26.5	26.3	26.3	95.6	95.2	95.0
D429	St Cross Road	447865.4	129179.1	1.5	30.1	29.8	29.7	108.7	107.7	107.3
D430	St Cross Road	447867.6	129178.0	1.5	29.3	29.1	29.0	106.0	105.1	104.7
D431	St Cross Road	447870.9	129176.3	1.5	28.5	28.3	28.2	102.8	102.1	101.7
D432	St Cross Road	447828.3	129054.6	1.5	28.9	28.7	28.7	104.3	103.7	103.5
D433	St Cross Road	447882.0	129174.7	1.5	26.9	26.8	26.7	97.3	96.8	96.6
D434	St Cross Road	447875.0	129174.4	1.5	27.7	27.5	27.5	100.0	99.4	99.2
D435	St Cross Road	447855.7	129172.0	1.5	36.7	36.2	35.9	132.6	130.6	129.7
D436	St Cross Road	447836.1	129158.5	1.5	28.3	28.1	28.1	102.3	101.7	101.3
D437	St Cross Road	447854.9	129154.8	1.5	33.3	32.9	32.8	120.3	119.0	118.4
D438	St Cross Road	447854.6	129150.4	1.5	32.2	31.9	31.7	116.2	115.1	114.6
D439	St Cross Road	447853.4	129143.3	1.5	31.9	31.6	31.5	115.3	114.3	113.9
D440	St Cross Road	447827.8	129127.4	1.5	26.7	26.6	26.6	96.5	96.1	95.9
D441	St Cross Road	447853.7	129127.2	1.5	30.4	30.2	30.1	109.9	109.1	108.8
D442	St Cross Road	447879.1	129141.6	1.5	26.5	26.4	26.3	95.7	95.3	95.1
D443	St Cross Road	447878.0	129135.2	1.5	26.4	26.3	26.3	95.5	95.1	95.0
D444	St Cross Road	447877.5	129130.8	1.5	26.4	26.3	26.3	95.3	95.0	94.8
D445	St Cross Road	447876.7	129125.8	1.5	26.4	26.3	26.2	95.3	94.9	94.8
D446	St Cross Road	447852.4	129114.4	1.5	30.3	30.1	30.0	109.4	108.7	108.4

ID	Road Name	X	Y	Z	2014 Annual Mean NO_2 (µg/m^3)			2014 99.8th %-tile of 1-Hour Mean NO_2 (µg/m^3)		
					Base	SC1	SC2	Base	SC1	SC2
D447	St Cross Road	447836.1	129097.8	1.5	28.8	28.7	28.6	104.1	103.6	103.4
D448	St Cross Road	447835.7	129093.7	1.5	28.9	28.8	28.7	104.5	103.9	103.7
D449	St Cross Road	447835.0	129085.1	1.5	29.2	29.0	29.0	105.5	104.9	104.6
D450	St Cross Road	447833.7	129079.1	1.5	29.1	28.9	28.8	105.0	104.4	104.2
D451	St Cross Road	447832.3	129072.6	1.5	29.0	28.8	28.8	104.7	104.2	103.9
D452	St Cross Road	447831.4	129069.0	1.5	28.9	28.7	28.7	104.3	103.8	103.5
D453	St Cross Road	447830.6	129064.5	1.5	28.9	28.7	28.7	104.4	103.8	103.6
D454	St Cross Road	447829.5	129059.5	1.5	28.9	28.7	28.7	104.4	103.8	103.6
D455	St Cross Road	447826.6	129046.4	1.5	29.0	28.8	28.8	104.6	104.1	103.9
D456	St Cross Road	447825.7	129041.6	1.5	29.1	28.9	28.9	105.0	104.5	104.3
D457	St Cross Road	447847.3	129044.8	1.5	27.7	27.6	27.6	100.2	99.7	99.6
D458	St Cross Road	447851.8	129067.8	1.5	27.9	27.7	27.7	100.7	100.2	100.0
D459	St Cross Road	447845.9	129038.8	1.5	27.7	27.6	27.5	100.1	99.6	99.5
D460	St Cross Road	447835.7	129032.0	1.5	30.9	30.7	30.6	111.5	110.8	110.5
D461	St Cross Road	447834.7	129027.5	1.5	30.7	30.5	30.4	111.0	110.2	110.0
D462	St Cross Road	447833.7	129022.3	1.5	30.5	30.4	30.3	110.3	109.7	109.4
D463	St Cross Road	447832.7	129018.0	1.5	30.5	30.3	30.2	110.1	109.4	109.2
D464	St Cross Road	447831.7	129012.5	1.5	30.4	30.2	30.1	109.7	109.0	108.8
D465	St Cross Road	447825.7	129031.5	1.5	30.8	30.6	30.5	111.3	110.6	110.3
D466	St Cross Road	447824.5	129026.5	1.5	30.9	30.7	30.6	111.5	110.7	110.4
D467	St Cross Road	447822.6	129019.2	1.5	30.8	30.6	30.5	111.1	110.4	110.1
D468	St Cross Road	447818.9	129005.5	1.5	30.0	29.8	29.7	108.2	107.6	107.4
D469	St Cross Road	447827.5	128998.2	1.5	31.4	31.2	31.1	113.4	112.7	112.4
D470	St Cross Road	447811.9	128987.2	1.5	28.7	28.5	28.5	103.5	103.0	102.8
D471	St Cross Road	447826.4	130246.0	1.5	26.1	26.0	25.9	94.3	93.9	93.7
D472	Andover Road	447868.6	130104.7	1.5	29.1	28.7	28.6	105.0	103.8	103.4
D473	Andover Road	447869.2	130087.0	1.5	29.6	29.3	29.1	107.1	105.7	105.2
D474	Andover Road	447868.2	130113.9	1.5	29.0	28.7	28.6	104.8	103.8	103.4
D475	Andover Road	447867.0	130119.4	1.5	28.9	28.6	28.5	104.3	103.3	102.9
D476	Andover Road	447866.4	130122.8	1.5	28.8	28.5	28.4	104.1	103.1	102.7
D477	Andover Road	447865.5	130127.3	1.5	28.7	28.5	28.4	103.8	102.9	102.5
D478	Andover Road	447864.5	130132.0	1.5	28.7	28.4	28.3	103.6	102.6	102.3
D479	Andover Road	447863.6	130136.5	1.5	28.6	28.4	28.3	103.4	102.5	102.1
D480	Andover Road	447862.6	130141.0	1.5	28.6	28.3	28.2	103.2	102.3	102.0
D481	Andover Road	447862.1	130144.6	1.5	28.6	28.3	28.2	103.3	102.4	102.0
D482	Andover Road	447855.5	130168.0	1.5	28.1	27.9	27.8	101.4	100.6	100.3
D483	Andover Road	447850.9	130189.4	1.5	28.0	27.8	27.7	101.1	100.4	100.1
D484	Andover Road	447878.1	130194.4	1.5	27.9	27.7	27.6	100.7	100.0	99.7
D485	Andover Road	447828.2	130257.0	1.5	26.2	26.1	26.1	94.8	94.4	94.2
D486	Andover Road	447830.2	130268.9	1.5	26.4	26.3	26.3	95.5	95.1	94.9
D487	Andover Road	447832.2	130281.3	1.5	26.8	26.6	26.6	96.6	96.1	95.9
D488	Andover Road	447799.7	130433.6	1.5	26.8	26.7	26.6	96.9	96.4	96.3
D489	Andover Road	447795.5	130441.3	1.5	26.7	26.6	26.6	96.6	96.1	95.9
D490	Andover Road	447791.4	130447.9	1.5	26.7	26.6	26.5	96.4	96.0	95.8
D491	Andover Road	447787.4	130453.5	1.5	26.7	26.6	26.5	96.5	96.0	95.9
D492	Andover Road	447761.9	130440.5	1.5	28.0	27.8	27.7	101.1	100.4	100.2
D493	Andover Road	447757.1	130430.1	1.5	26.3	26.2	26.1	95.0	94.6	94.4
D494	Andover Road	447782.2	130461.9	1.5	26.7	26.5	26.5	96.4	95.9	95.7
D495	Andover Road	447779.3	130466.2	1.5	26.7	26.6	26.5	96.4	95.9	95.7
D496	Andover Road	447776.1	130471.5	1.5	26.7	26.5	26.5	96.3	95.9	95.7
D497	Andover Road	447771.0	130479.9	1.5	26.6	26.5	26.5	96.3	95.8	95.6
D498	Andover Road	447768.9	130483.0	1.5	26.7	26.5	26.5	96.3	95.9	95.7
D499	Andover Road	447741.6	130475.0	1.5	28.1	27.9	27.9	101.6	100.9	100.7
D500	St Cross Road	447733.2	128747.7	1.5	26.7	26.6	26.6	96.5	96.2	96.1
D501	St Cross Road	447813.5	128946.2	1.5	30.4	30.2	30.2	109.9	109.3	109.0
D502	St Cross Road	447810.6	128862.0	1.5	25.9	25.8	25.8	93.4	93.1	93.1

ID	Road Name	X	Y	Z	2014 Annual Mean NO_2 (µg/m^3)			2014 99.8th %-tile of 1-Hour Mean NO_2 (µg/m^3)		
					Base	SC1	SC2	Base	SC1	SC2
D503	St Cross Road	447752.1	128853.2	1.5	26.2	26.1	26.1	94.7	94.4	94.3
D504	St Cross Road	447747.2	128838.6	1.5	26.2	26.1	26.1	94.7	94.4	94.3
D505	St Cross Road	447744.4	128824.7	1.5	26.3	26.2	26.2	95.1	94.8	94.7
D506	St Cross Road	447740.2	128809.5	1.5	26.3	26.2	26.2	94.9	94.7	94.6
D507	St Cross Road	447743.3	128798.3	1.5	27.0	26.9	26.9	97.6	97.2	97.1
D508	St Cross Road	447730.2	128783.1	1.5	25.9	25.8	25.8	93.5	93.2	93.1
D509	St Cross Road	447736.9	128761.9	1.5	26.9	26.8	26.8	97.3	97.0	96.9
D510	St Cross Road	447768.5	128743.6	1.5	26.5	26.4	26.4	95.7	95.4	95.3
D511	St Cross Road	447730.2	128719.8	1.5	27.1	27.0	26.9	97.7	97.4	97.3
D512	St Cross Road	447759.9	128710.9	1.5	26.7	26.6	26.6	96.5	96.2	96.1
D513	St Cross Road	447730.4	128704.9	1.5	27.8	27.7	27.6	100.4	100.0	99.9
D514	St Cross Road	447730.6	128689.4	1.5	29.3	29.2	29.1	106.0	105.4	105.2
D515	St Cross Road	447752.3	128681.0	1.5	26.8	26.7	26.7	96.8	96.4	96.3
D516	St Cross Road	447761.9	128672.0	1.5	25.8	25.7	25.7	93.1	92.9	92.8
D517	St Cross Road	447713.9	128662.7	1.5	26.5	26.4	26.4	95.6	95.3	95.2
D518	St Cross Road	447751.0	128646.1	1.5	26.0	25.9	25.9	93.8	93.5	93.4
D519	St Cross Road	447747.7	128635.6	1.5	25.9	25.9	25.9	93.7	93.5	93.4
D520	St Cross Road	447705.5	128630.7	1.5	26.2	26.2	26.1	94.8	94.6	94.4
D521	St Cross Road	447728.9	128600.6	1.5	26.5	26.4	26.4	95.7	95.5	95.3
D522	St Cross Road	447694.2	128597.4	1.5	25.3	25.3	25.3	91.5	91.3	91.3
D523	St Cross Road	447693.0	128589.2	1.5	25.1	25.1	25.1	90.8	90.7	90.6
D524	St Cross Road	447692.5	128569.5	1.5	24.7	24.7	24.7	89.3	89.2	89.2
D525	St Cross Road	447718.2	128567.8	1.5	24.8	24.8	24.8	89.7	89.6	89.6
D526	Romsey Road	447530.8	129521.3	1.5	49.5	48.2	47.7	178.8	174.0	172.2
D527	Romsey Road	447615.6	129583.5	1.5	31.3	30.9	30.7	113.2	111.5	110.7
D528	Romsey Road	447613.7	129572.5	1.5	34.1	33.4	33.2	123.2	120.8	119.8
D529	Romsey Road	447612.0	129566.5	1.5	36.9	36.1	35.7	133.4	130.3	129.0
D530	Romsey Road	447609.6	129561.4	1.5	41.0	39.9	39.4	148.1	144.1	142.5
D531	Romsey Road	447591.7	129551.7	1.5	51.8	50.4	49.8	187.2	181.9	179.8
D532	Romsey Road	447599.2	129543.1	1.5	54.7	53.1	52.4	197.7	191.8	189.4
D533	Romsey Road	447567.6	129553.5	1.5	34.6	33.9	33.7	124.9	122.6	121.8
D534	Romsey Road	447545.9	129542.3	1.5	37.2	36.4	36.1	134.3	131.6	130.5
D535	Romsey Road	447595.5	129532.7	1.5	34.6	33.9	33.7	125.0	122.6	121.6
D536	Romsey Road	447588.8	129529.0	1.5	33.6	33.0	32.8	121.5	119.4	118.5
D537	Romsey Road	447587.2	129517.5	1.5	30.6	30.2	30.0	110.4	108.9	108.4
D538	Romsey Road	447590.0	129511.3	1.5	29.6	29.2	29.1	106.9	105.6	105.1
D539	Romsey Road	447568.6	129533.3	1.5	49.9	48.6	48.1	180.4	175.5	173.6
D540	Romsey Road	447561.1	129530.9	1.5	49.8	48.5	47.9	179.9	175.0	173.2
D541	Romsey Road	447557.5	129529.7	1.5	49.7	48.3	47.8	179.5	174.6	172.7
D542	Romsey Road	447551.8	129528.0	1.5	49.7	48.4	47.8	179.5	174.7	172.8
D543	Romsey Road	447547.1	129526.5	1.5	49.6	48.2	47.7	179.0	174.3	172.4
D544	Romsey Road	447543.4	129525.1	1.5	49.3	48.0	47.5	178.2	173.5	171.6
D545	Romsey Road	447538.9	129523.7	1.5	49.3	48.0	47.5	178.3	173.5	171.7
D546	Romsey Road	447534.9	129522.8	1.5	49.7	48.4	47.9	179.6	174.7	172.9
D547	Romsey Road	447526.2	129520.1	1.5	49.7	48.4	47.8	179.5	174.7	172.8
D548	Romsey Road	447522.7	129518.9	1.5	49.6	48.3	47.8	179.2	174.4	172.5
D549	Romsey Road	447514.3	129516.8	1.5	49.9	48.5	48.0	180.2	175.4	173.5
D550	Romsey Road	447505.4	129512.5	1.5	48.1	46.9	46.4	173.9	169.3	167.6
D551	Romsey Road	447499.8	129509.8	1.5	40.4	39.5	39.2	146.1	142.8	141.5
D552	Romsey Road	447494.5	129508.1	1.5	40.3	39.4	39.1	145.7	142.5	141.2
D553	Romsey Road	447489.2	129506.2	1.5	40.0	39.1	38.8	144.5	141.3	140.0
D554	Romsey Road	447484.0	129500.7	1.5	35.6	34.9	34.6	128.5	126.1	125.2
D555	Romsey Road	447480.3	129499.3	1.5	35.4	34.8	34.5	128.0	125.6	124.7
D556	Romsey Road	447475.3	129501.5	1.5	39.6	38.7	38.4	143.0	139.8	138.6
D557	Romsey Road	447467.5	129499.1	1.5	39.6	38.8	38.4	143.2	140.1	138.8
D558	Romsey Road	447461.0	129497.1	1.5	39.7	38.8	38.5	143.3	140.2	139.0

ID	Road Name	X	Y	Z	2014 Annual Mean NO_2 ($\mu g/m^3$)			2014 99.8th %-tile of 1-Hour Mean NO_2 ($\mu g/m^3$)		
					Base	SC1	SC2	Base	SC1	SC2
D559	Romsey Road	447491.8	129533.7	1.5	32.3	31.9	31.7	116.8	115.1	114.4
D560	Romsey Road	447466.0	129528.4	1.5	31.4	31.0	30.8	113.6	112.0	111.4
D561	Romsey Road	447452.0	129509.3	1.5	40.8	39.9	39.5	147.5	144.2	142.9
D562	Romsey Road	447445.0	129521.6	1.5	31.4	31.0	30.8	113.4	111.8	111.2
D563	Stockbridge Road	447371.1	130062.7	1.5	27.0	26.9	26.9	97.6	97.3	97.2
D564	Stockbridge Road	447418.3	130030.8	1.5	27.5	27.4	27.4	99.4	99.0	98.9
D565	Stockbridge Road	447413.8	130033.7	1.5	27.5	27.4	27.3	99.2	98.9	98.7
D566	Stockbridge Road	447410.9	130035.8	1.5	27.4	27.3	27.3	99.0	98.7	98.5
D567	Stockbridge Road	447406.4	130038.9	1.5	27.3	27.2	27.2	98.7	98.4	98.2
D568	Stockbridge Road	447403.3	130041.2	1.5	27.3	27.2	27.1	98.5	98.2	98.0
D569	Stockbridge Road	447387.1	130052.0	1.5	27.1	27.1	27.0	98.1	97.7	97.6
D570	Stockbridge Road	447382.1	130055.5	1.5	27.1	27.0	27.0	97.8	97.5	97.4
D571	Stockbridge Road	447376.7	130059.0	1.5	27.1	27.0	26.9	97.7	97.4	97.3
D572	Stockbridge Road	447365.7	130066.4	1.5	27.0	26.9	26.9	97.4	97.1	97.0
D573	Stockbridge Road	447360.5	130070.0	1.5	26.9	26.9	26.8	97.3	97.0	96.9
D574	Stockbridge Road	447355.7	130073.1	1.5	26.9	26.8	26.8	97.3	97.0	96.8
D575	Stockbridge Road	447349.6	130077.0	1.5	26.9	26.8	26.8	97.3	97.0	96.8
D576	Stockbridge Road	447345.7	130079.8	1.5	26.9	26.8	26.8	97.1	96.8	96.7
D577	Stockbridge Road	447338.6	130084.1	1.5	26.9	26.8	26.8	97.2	96.9	96.8
D578	Stockbridge Road	447418.7	130008.7	1.5	28.8	28.6	28.6	103.9	103.4	103.2
D579	Stockbridge Road	447415.3	130010.5	1.5	28.7	28.5	28.5	103.5	103.1	102.9
D580	Stockbridge Road	447412.0	130012.6	1.5	28.6	28.5	28.4	103.4	102.9	102.7
D581	Stockbridge Road	447392.9	130022.8	1.5	28.1	28.0	27.9	101.5	101.1	100.9
D582	Stockbridge Road	447387.3	130023.2	1.5	26.7	26.6	26.6	96.5	96.2	96.0
D583	Stockbridge Road	447383.2	130025.9	1.5	26.7	26.6	26.6	96.5	96.2	96.1
D584	Stockbridge Road	447378.9	130028.5	1.5	26.7	26.6	26.6	96.4	96.1	95.9
D585	Stockbridge Road	447375.6	130030.8	1.5	26.7	26.6	26.6	96.4	96.1	96.0
D586	Stockbridge Road	447371.1	130033.6	1.5	26.6	26.6	26.5	96.3	96.0	95.9
D587	Stockbridge Road	447365.4	130037.5	1.5	26.7	26.6	26.6	96.3	96.0	95.9
D588	Stockbridge Road	447351.8	130044.3	1.5	26.3	26.3	26.2	95.1	94.8	94.7
D589	Stockbridge Road	447346.6	130047.9	1.5	26.3	26.3	26.2	95.2	94.9	94.8
D590	Stockbridge Road	447337.7	130053.6	1.5	26.3	26.3	26.2	95.1	94.8	94.8
D591	Stockbridge Road	447334.7	130086.9	1.5	26.9	26.8	26.8	97.0	96.8	96.6
D592	Romsey Road	447265.5	129443.4	1.5	48.2	46.9	46.5	174.1	169.6	167.9
D593	Romsey Road	447439.3	129525.1	1.5	30.2	29.9	29.7	109.3	107.9	107.4
D594	Romsey Road	447370.7	129510.6	1.5	29.1	28.8	28.7	105.1	104.0	103.5
D595	Romsey Road	447318.4	129453.5	1.5	40.8	39.9	39.5	147.4	144.1	142.8
D596	Romsey Road	447305.7	129442.7	1.5	32.9	32.4	32.2	118.8	117.0	116.3
D597	Romsey Road	447298.1	129450.1	1.5	50.0	48.6	48.1	180.5	175.6	173.8
D598	Romsey Road	447284.6	129447.0	1.5	48.5	47.3	46.8	175.3	170.7	168.9
D599	Romsey Road	447279.1	129446.0	1.5	48.4	47.1	46.7	174.9	170.3	168.5
D600	Romsey Road	447274.8	129445.3	1.5	48.7	47.5	47.0	176.1	171.4	169.7
D601	Romsey Road	447269.9	129444.1	1.5	41.8	40.8	40.5	151.0	147.5	146.2
D602	Romsey Road	447261.9	129442.5	1.5	41.7	40.7	40.3	150.6	147.0	145.7
D603	Romsey Road	447256.2	129441.5	1.5	41.8	40.8	40.4	150.9	147.4	146.0
D604	Romsey Road	447237.6	129439.4	1.5	50.3	49.0	48.5	181.8	177.0	175.0
D605	Romsey Road	447191.4	129426.0	1.5	35.8	35.2	34.9	129.5	127.1	126.1
D606	Stockbridge Road	447247.8	130146.6	1.5	26.0	26.0	26.0	94.1	93.9	93.8
D607	Stockbridge Road	447332.3	130057.2	1.5	26.3	26.3	26.2	95.1	94.8	94.7
D608	Stockbridge Road	447325.5	130061.0	1.5	26.2	26.2	26.1	94.8	94.6	94.4
D609	Stockbridge Road	447298.7	130079.8	1.5	26.4	26.3	26.3	95.4	95.2	95.1
D610	Stockbridge Road	447330.3	130089.5	1.5	26.9	26.8	26.8	97.2	96.9	96.8
D611	Stockbridge Road	447324.0	130093.9	1.5	26.8	26.8	26.7	97.0	96.7	96.6
D612	Stockbridge Road	447317.3	130098.2	1.5	26.8	26.8	26.7	97.0	96.7	96.6
D613	Stockbridge Road	447312.7	130101.7	1.5	26.8	26.7	26.6	96.6	96.4	96.3
D614	Stockbridge Road	447290.2	130116.2	1.5	26.6	26.6	26.5	96.3	96.0	95.9

ID	Road Name	X	Y	Z	2014 Annual Mean NO_2 (µg/m^3)			2014 99.8th %-tile of 1-Hour Mean NO_2 (µg/m^3)		
					Base	SC1	SC2	Base	SC1	SC2
D615	Stockbridge Road	447294.8	130082.6	1.5	26.5	26.4	26.4	95.6	95.3	95.2
D616	Stockbridge Road	447285.2	130086.5	1.5	26.1	26.1	26.0	94.3	94.1	94.0
D617	Stockbridge Road	447277.9	130091.3	1.5	26.1	26.0	26.0	94.3	94.0	93.9
D618	Stockbridge Road	447262.5	130084.6	1.5	25.2	25.1	25.1	90.9	90.7	90.7
D619	Stockbridge Road	447283.3	130121.0	1.5	26.4	26.3	26.3	95.4	95.2	95.1
D620	Stockbridge Road	447277.6	130125.1	1.5	26.3	26.3	26.2	95.1	94.9	94.8
D621	Stockbridge Road	447271.4	130129.0	1.5	26.3	26.3	26.2	95.1	94.8	94.8
D622	Stockbridge Road	447264.2	130133.8	1.5	26.3	26.2	26.2	94.9	94.7	94.6
D623	Stockbridge Road	447261.0	130135.9	1.5	26.3	26.2	26.2	94.9	94.7	94.6
D624	Stockbridge Road	447250.1	130089.6	1.5	25.1	25.0	25.0	90.5	90.4	90.4
D625	Stockbridge Road	447261.6	130152.2	1.5	25.4	25.3	25.3	91.6	91.5	91.4
D626	Stockbridge Road	447255.3	130147.8	1.5	25.7	25.6	25.6	92.8	92.6	92.5
D627	Stockbridge Road	447240.2	130169.7	1.5	25.2	25.2	25.2	91.1	90.9	90.9
D628	Stockbridge Road	447238.0	130166.1	1.5	25.4	25.3	25.3	91.6	91.4	91.4
D629	Stockbridge Road	447236.0	130162.8	1.5	25.5	25.5	25.5	92.2	92.0	92.0
D630	Stockbridge Road	447233.2	130155.4	1.5	26.1	26.0	26.0	94.1	93.9	93.8
D631	Stockbridge Road	447216.1	130166.3	1.5	26.0	25.9	25.9	93.9	93.7	93.6
D632	Stockbridge Road	447206.8	130171.9	1.5	26.0	25.9	25.9	93.9	93.7	93.6
D633	Stockbridge Road	447226.5	130133.1	1.5	27.4	27.3	27.3	99.0	98.7	98.5
D634	Stockbridge Road	447194.6	130180.1	1.5	25.9	25.9	25.8	93.6	93.4	93.4
D635	Stockbridge Road	447188.1	130184.2	1.5	25.9	25.8	25.8	93.5	93.3	93.3
D636	Stockbridge Road	447183.0	130197.7	1.5	25.3	25.3	25.2	91.4	91.3	91.2
D637	Stockbridge Road	447199.9	130147.9	1.5	26.9	26.8	26.8	97.2	96.9	96.8
D638	Stockbridge Road	447194.9	130151.1	1.5	26.9	26.8	26.8	97.2	96.9	96.8
D639	Stockbridge Road	447190.7	130154.3	1.5	27.0	26.9	26.9	97.6	97.3	97.2
D640	Stockbridge Road	447183.8	130158.3	1.5	26.9	26.9	26.8	97.3	97.0	96.9
D641	Stockbridge Road	447178.4	130161.9	1.5	27.0	26.9	26.9	97.4	97.2	97.0
D643	Stockbridge Road	447149.4	130158.2	1.5	25.0	25.0	25.0	90.4	90.2	90.2
D644	Stockbridge Road	447134.2	130168.2	1.5	24.9	24.9	24.9	90.0	89.9	89.8
D645	Stockbridge Road	447129.9	130182.1	1.5	25.2	25.2	25.2	91.0	90.9	90.9
D652	Stockbridge Road	447022.8	130252.7	1.5	24.2	24.2	24.2	87.5	87.4	87.4
D662	Romsey Road	447117.1	129412.8	1.5	34.7	34.1	33.9	125.4	123.2	122.3
D663	Romsey Road	447088.0	129407.5	1.5	33.6	33.1	32.8	121.4	119.4	118.6
D664	Romsey Road	447108.1	129393.4	1.5	28.5	28.2	28.1	103.0	102.0	101.6
D665	Romsey Road	447060.2	129397.1	1.5	30.5	30.2	30.0	110.3	109.0	108.4
D666	Romsey Road	447048.5	129402.0	1.5	33.7	33.2	33.0	121.9	119.8	119.0
D667	Romsey Road	447038.5	129406.3	1.5	48.7	47.4	46.9	175.9	171.3	169.5
D668	Romsey Road	447054.6	129437.9	1.5	29.7	29.4	29.2	107.3	106.1	105.6
D669	Romsey Road	447051.9	129422.3	1.5	37.8	37.0	36.7	136.6	133.8	132.7
D670	Romsey Road	447046.7	129421.2	1.5	38.0	37.2	36.9	137.1	134.3	133.2
D671	Romsey Road	447042.8	129420.7	1.5	37.7	36.9	36.6	136.1	133.3	132.2
D672	Romsey Road	447038.1	129419.8	1.5	37.7	36.9	36.6	136.1	133.3	132.2
D673	Romsey Road	447034.0	129419.2	1.5	37.5	36.8	36.5	135.6	132.9	131.8
D674	Romsey Road	447029.4	129418.5	1.5	37.2	36.5	36.2	134.5	131.9	130.8
D675	Romsey Road	447024.0	129417.4	1.5	37.2	36.4	36.1	134.2	131.5	130.5
D676	Romsey Road	447019.9	129416.7	1.5	36.9	36.1	35.9	133.2	130.6	129.6
D677	Romsey Road	446999.6	129426.0	1.5	27.6	27.4	27.3	99.8	99.0	98.7
D678	Romsey Road	446977.8	129423.1	1.5	25.7	25.6	25.6	92.9	92.6	92.4
D679	Romsey Road	447005.3	129381.2	1.5	26.9	26.8	26.7	97.3	96.6	96.4
D680	Romsey Road	446956.8	129388.9	1.5	25.1	25.0	25.0	90.5	90.3	90.2
D690	Eastgate Street	448564.1	129395.7	1.5	32.4	31.9	31.7	116.9	115.2	114.5
D691	Eastgate Street	448586.0	129496.7	1.5	33.9	33.3	33.1	122.3	120.2	119.4
D692	Eastgate Street	448582.0	129485.7	1.5	35.6	35.0	34.7	128.6	126.3	125.5
D693	Eastgate Street	448556.6	129361.5	1.5	36.1	35.3	34.9	130.4	127.5	126.1
D694	Eastgate Street	448580.0	129375.2	1.5	35.0	34.4	34.1	126.5	124.2	123.2
D695	Eastgate Street	448561.4	129375.1	1.5	33.7	33.1	32.8	121.6	119.4	118.5

ID	Road Name	X	Y	Z	2014 Annual Mean NO_2 ($\mu g/m^3$)			2014 99.8th %-tile of 1-Hour Mean NO_2 ($\mu g/m^3$)		
					Base	SC1	SC2	Base	SC1	SC2
D696	Union Street	448528.3	129663.8	1.5	42.4	41.2	40.8	153.3	149.0	147.4
D697	Union Street	448513.1	129655.4	1.5	31.9	31.3	31.1	115.3	113.1	112.4
D698	Brook Street	448275.6	129688.1	1.5	28.2	27.8	27.7	101.9	100.5	100.0
D699	Brook Street	448288.7	129684.7	1.5	28.4	28.0	27.9	102.7	101.2	100.8
D700	Brook Street	448272.0	129674.1	1.5	28.4	28.0	27.9	102.7	101.3	100.8
D701	Sussex Street	447814.7	129791.3	1.5	31.9	31.5	31.4	115.1	113.8	113.3
D702	Sussex Street	447804.5	129764.9	1.5	31.4	31.0	30.9	113.3	112.1	111.7
D703	Sussex Street	447779.8	129681.6	1.5	35.3	34.9	34.7	127.6	126.2	125.4
D704	Sussex Street	447793.0	129719.2	1.5	32.9	32.6	32.4	118.9	117.7	117.1
D705	Upper High Street	447730.0	129675.2	1.5	44.0	43.5	43.3	158.8	157.2	156.3
D706	Upper High Street	447741.9	129679.8	1.5	39.7	39.3	39.1	143.4	141.9	141.1
D707	Upper High Street	447723.9	129722.9	1.5	42.1	41.8	41.5	152.3	150.9	150.1
D708	St George's Street	448089.2	129542.3	1.5	58.3	55.5	54.4	210.7	200.3	196.4
D709	Stockbridge Road	447678.1	130032.0	1.5	28.1	28.0	27.9	101.6	101.1	100.9
D710	Stockbridge Road	447670.0	130030.0	1.5	28.2	28.1	28.0	102.0	101.5	101.3
D711	Stockbridge Road	447849.1	129991.6	1.5	29.6	29.2	29.1	106.9	105.5	105.0
D712	Andover Road	447884.2	129984.6	1.5	55.7	53.6	52.8	201.1	193.5	190.8
D713	North Walls	448177.0	129809.3	1.5	39.2	37.4	36.9	141.7	135.2	133.3
D714	North Walls	448139.5	129819.2	1.5	37.0	35.5	35.0	133.5	128.2	126.5
D715	North Walls	448186.4	129822.4	1.5	38.3	36.6	36.1	138.5	132.3	130.5
D716	North Walls	448272.2	129783.3	1.5	57.0	53.4	52.3	206.0	192.8	188.9
D717	North Walls	448276.7	129795.9	1.5	40.7	38.7	38.1	147.0	139.8	137.7
D718	North Walls	448395.5	129758.5	1.5	37.8	36.3	35.8	136.6	131.0	129.2
D719	North Walls	447940.8	129884.1	1.5	37.1	35.8	35.4	133.9	129.3	127.8
D720	St George's Street	448141.6	129533.0	1.5	34.1	33.1	32.8	123.1	119.6	118.3
D721	Stockbridge Road	447551.1	130008.5	1.5	29.5	29.3	29.1	106.6	105.8	105.3
D722	Stockbridge Road	447555.8	130009.4	1.5	29.3	29.1	29.0	105.8	105.1	104.6
D723	Stockbridge Road	447560.6	130010.4	1.5	28.9	28.7	28.6	104.4	103.7	103.3
D724	Stockbridge Road	447546.1	130007.6	1.5	29.6	29.3	29.2	106.8	106.0	105.5
D725	North Walls	448337.2	129778.2	1.5	35.8	34.5	34.1	129.2	124.6	123.2
D726	North Walls	448341.9	129776.5	1.5	35.2	34.0	33.6	127.1	122.8	121.5
D727	North Walls	448347.6	129774.8	1.5	34.6	33.5	33.2	125.1	121.1	119.8
D728	North Walls	448353.0	129773.1	1.5	34.4	33.3	33.0	124.3	120.3	119.1
D729	North Walls	448358.3	129771.5	1.5	34.2	33.2	32.8	123.7	119.9	118.7
D730	North Walls	448364.0	129769.6	1.5	34.3	33.2	32.9	123.8	120.0	118.8
D731	North Walls	448369.0	129768.0	1.5	34.3	33.3	32.9	124.0	120.2	118.9
D732	North Walls	448374.3	129766.3	1.5	34.4	33.3	33.0	124.3	120.4	119.2
D733	North Walls	448380.1	129764.6	1.5	34.6	33.5	33.1	125.0	121.0	119.7
D734	North Walls	448385.0	129762.8	1.5	35.2	34.0	33.6	127.2	122.9	121.5
D735	North Walls	448423.8	129735.1	1.5	38.2	36.7	36.2	137.9	132.5	130.8
D736	North Walls	448434.3	129731.3	1.5	35.9	34.7	34.3	129.8	125.4	124.0
D737	North Walls	448444.2	129727.8	1.5	35.0	33.9	33.5	126.3	122.4	121.1
DT1	10 Eastgate St	448563.5	129390.9	1.5	32.3	31.9	31.6	116.8	115.1	114.3
DT2	Greyfriars 3	448566.0	129560.0	1.5	31.2	30.7	30.6	112.8	111.0	110.4
DT4	Upper Brook St	448227.0	129504.0	1.5	41.2	39.6	39.1	149.0	143.2	141.1
DT567	Roadside Monitor	448213.0	129504.0	1.5	43.1	41.3	40.7	155.7	149.3	146.9
DT8	St George's Street	448106.0	129541.0	1.5	46.3	44.3	43.6	167.3	160.1	157.3
DT9	St George's Street Lad	448163.0	129512.0	1.5	58.8	55.9	54.8	212.4	202.0	198.0
DT10	Jewry St	448046.0	129692.0	1.5	48.9	46.8	46.0	176.5	168.9	166.3
DT11	Southgate St	447918.0	129413.0	1.5	30.4	30.1	30.0	109.7	108.9	108.5
DT12	Sussex St	447802.0	129741.5	1.5	33.2	32.9	32.7	120.0	118.8	118.3
DT13	City Road	447963.0	129875.0	1.5	37.2	35.9	35.4	134.2	129.6	128.0
DT14	74 Northwalls	448234.0	129794.0	1.5	34.7	33.5	33.1	125.4	121.1	119.7

ID	Road Name	X	Y	Z	2014 Annual Mean NO_2 (µg/m^3)			2014 99.8th %-tile of 1-Hour Mean NO_2 (µg/m^3)		
					Base	SC1	SC2	Base	SC1	SC2
DT15	Wales St	448842.0	129820.0	1.5	33.5	33.4	33.4	121.1	120.8	120.5
DT17	Chesil St	448679.0	129068.0	1.5	40.9	39.6	38.9	147.6	143.2	140.5
DT18	Stockbridge Rd	447538.4	130006.3	1.5	29.6	29.4	29.3	107.0	106.2	105.7
DT23	St Cross Rd	447842.0	129050.0	1.5	29.7	29.6	29.5	107.4	106.8	106.5
DT24	Romsey Rd	447495.0	129511.0	1.5	50.1	48.7	48.2	180.9	176.1	174.2
DT25	Andover Rd	447898.0	130065.0	1.5	39.6	38.5	38.1	143.1	139.2	137.7
XDT9	Echo Offices	447246.4	129440.6	1.5	49.8	48.5	48.0	179.9	175.1	173.2
XDT10	McDonalds	447344.0	129479.0	1.5	36.6	35.9	35.6	132.1	129.5	128.5
XDT1	Toy Cupboard	448223.0	129486.0	1.5	57.9	55.1	54.0	209.3	199.0	195.1
XDT3	Café Centro	448194.0	129499.0	1.5	53.5	50.9	50.0	193.1	184.0	180.5
XDT5	The Royal Oak	448158.0	129526.0	1.5	45.7	43.8	43.0	165.2	158.1	155.5
XDT7	63 Romsey Road	448038.0	129544.0	1.5	59.9	56.9	55.8	216.3	205.5	201.4
CMRS	Romsey Road Re-Dress	448213.0	129504.0	1.5	43.1	41.3	40.7	155.7	149.3	146.9