North Hertfordshire District Council

Detailed Assessment Report 2014

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

January 2015

DOCUMENT INFORMATION

Local Authority:

North Hertfordshire District Council
Council Offices
Gernon Road
Letchworth Garden City
Hertfordshire
SG6 3JF

Project Manager: David Carr
Telephone: 01462 474263
Email: david.carr@north-herts.gov.uk

Document Status and Approval Schedule

Issue	Status	Description	Prepared by	Reviewed by
0	Draft report	Prepared – 12/01/2015	David Carr	Shayne Crowe
1	Final Report	Issued to DEFRA – 23/01/2015	David Carr	Shayne Crowe

TABLE OF CONTENTS

FIGURES

TABLES

Executive Summary

This Detailed Assessment of Air Quality has been undertaken in one area of the District of North Hertfordshire. The area is located in the south west of Hitchin and Nitrogen Dioxide (NO_2) is the pollutant of interest. This Detailed Assessment was required following three years of air quality monitoring in the Payne's Park area of Hitchin which has most recently been reported in the NHDC Progress Report 2014 (1). The following describes the area in a little more detail.

Park Way and Upper Tilehouse Street (Hitchin Library / Payne's Park Roundabout), (A505 / A602), Hitchin

Three of the six diffusion tubes located in this area measured annual mean average concentrations above the 40$\mu g/m^3$ objective. The automatic analyser located in the area recorded an annual mean of 35$\mu g/m^3$. Air pollution dispersion modelling was undertaken because of the data from the diffusion tubes and the proximity of housing.

The modelling did not predict exceedences of the annual mean NO_2 objective at the specified receptor locations however the isopleth map (Figure 5.1) did indicate the possibility of an exceedence at the south-eastern façade of 41 Upper Tilehouse Street. A more detailed consideration of the results is included within the following sections of this report and lead to the following conclusion.

There is insufficient evidence of relevant exposure to NO_2 above the air quality objectives at the houses within the area of interest and so an Air Quality Management Area (AQMA) is not being declared.

1 Introduction

1.1 Project Background

North Hertfordshire District Council (NHDC) concluded that it was necessary to undertake an air quality Detailed Assessment for one location in Hitchin following its assessment of 2013 air quality data within its Progress Report 2014 (1). Defra agreed with this conclusion upon review of that report.

Part IV of the Environment Act, 1995 places a statutory duty on Local Authorities to periodically review and assess the air quality within their area. The Detailed Assessment is a requirement arising from the Fifth Round of Review and Assessment for Local Authorities.

The two areas in North Hertfordshire where monitoring data exceeded the Air Quality Strategy (AQS) annual mean objective for NO_2 were:

- Hitchin Hill Roundabout & Stevenage Road, (A602), Hitchin. This was declared an Air Quality Management Area (AQMA) in June 2012.

- Park Way & Upper Tilehouse Street, (Hitchin Library / Paynes Park Roundabout), (A505/A602), Hitchin.

1.2 Legislative Background

The significance of existing and future pollutant levels can be assessed in relation to national air quality standards and objectives, established by the Government. The latest Air Quality Strategy (AQS) (2) updated in 2011 provides the over-arching strategic framework for air quality management in the UK and contains national air quality standards and objectives established by the Government to protect human health. The objectives for ten pollutants, (benzene, 1,3-butadiene, carbon monoxide, lead, nitrogen dioxide, sulphur dioxide, particulates (PM_{10} and $PM_{2.5}$), polycyclic aromatic hydrocarbons and ozone), have been prescribed within the Air Quality Strategy based on The Air Quality Standards (England) Regulations 2010 (3). The objectives set out in the AQS for the protection of human health are presented in Table 1.1.

This detailed assessment only considers the nitrogen dioxide objective.

The Air Quality Standards (England) Regulations 2010 (3) bring together in one statutory instrument the Governments requirements to fulfil separate EU Daughter Directives through a single consolidated statutory instrument, which is fully aligned with the proposed new EU Air Quality Directive (CAFÉ – Clean Air For Europe). The Regulations include objectives for Arsenic, Cadmium and Nickel. These are required to be assessed by member states in response to the proposed new EU Air Quality Daughter Directive (CAFÉ), however, the AQS does not contain objectives for these pollutants and local authorities are not currently required to assess against these.

Table 1.1 – UK Air Quality Strategy Objectives (England)

Pollutant	Objective	Concentration measured as	Date to be achieved by
Benzene	16.25 μg/m^3	running annual mean	31.12.2003
	5.00 μg/m^3	annual mean	31.12.2010
1,3-Butadiene	2.25 μg/m^3	running annual mean	31.12.2003
Carbon monoxide	10 mg/m^3	maximum daily running 8 hour mean	31.12.2003
Lead	0.5 μg/m^3	annual mean	31.12.2004
	0.25 μg/m^3	annual mean	31.12.2008
Nitrogen dioxide	200 μg/m^3, not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 μg/m^3	annual mean	31.12.2005
Particles (PM_{10}) (gravimetric)	50 μg/m^3, not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 μg/m^3	annual mean	31.12.2004
Sulphur dioxide	350 μg/m^3, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 μg/m^3, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 μg/m^3, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

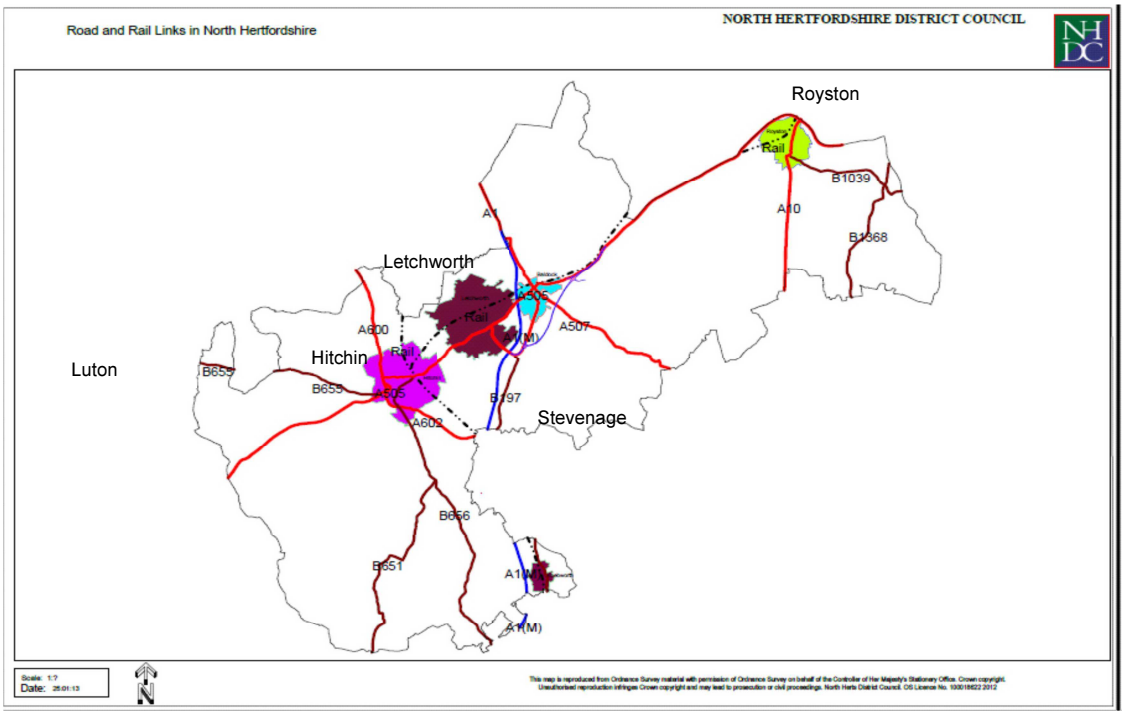

Figure 1.1: North Hertfordshire District

2. Review and Assessment of Air Quality undertaken by North Hertfordshire District Council

The Local Air Quality Management (LAQM) regime was first set down in the 1997 National Air Quality Strategy (NAQS) and introduced the idea of Local Authority 'Review and Assessment'. The Government subsequently published policy and technical guidance related to the review and assessment processes in 1998. The guidance has since been reviewed and the latest guidance includes the policy guidance LAQM.PG.(09) (4) and Technical Guidance LAQM.TG (09) (5). The guidance lays down a progressive, but continuous framework for the Local Authorities to carry out their statutory duties to monitor, assess and review air quality in their area and where necessary produce action plans to meet the air quality objectives.

2.1 The First, Second and Third round of Review and Assessment.

Table 1.2 summaries all previous local air quality management reports.

Table 2.1 Summary of Previous Review and Assessments

Round / Reports	Date	Description / Outcomes
1st Round	1999 – 2003	Assessments concluded that all pollutant levels complied with Air Quality Objectives (AQO).
2nd Round:		
USA	2003	AQO not exceeded.
Progress Reports	2004 & 2005	AQO not exceeded.
3rd Round:		Diffusion tube data indicated the annual NO_2 AQO was exceeded at
USA	2006	Stevenage Road, Hitchin, Payne's Park, Hitchin & Whitehorse Street, Baldock.
Detailed Assessment	2007	Concluded that there was no evidence of a need for an Air Quality Management Area at the two Hitchin sites. But recommended enhancing the monitoring network in those areas. Concluded that NO_2 concentrations at Whitehorse Street, Baldock would exceed the annual AQO, but that because of the Baldock By-Pass being opened in 2006 the decision about an AQMA should be postponed until its impact could be assessed.
Progress Report	2008	Due to low data capture at the three areas of concern it was not possible to provide conclusive evidence about whether AQO were exceeded.
4th Round:		
USA	2009	NO_2 data showed the annual AQO was exceeded at: - Whitehorse St, (B656) Baldock - Payne's Park (A505) roundabout, Hitchin - Stevenage Road/Hitchin Hill (A602), Hitchin - Nightingale Road (A505), Hitchin And that a Detailed Assessment was required for each area.
Detailed Assessment	2010	Concluded that the AQO was not being exceeded in any of the 4 areas. However, DEFRA considered that the data collected was not robust enough to be confident of the conclusion and required NHDC to undertake another Detailed Assessment in 2011.
Progress Report	2011	Concluded that no new areas were at risk of AQO being exceeded. But confirmed that there was justification for a Detailed Assessment of the 4 areas previously identified as being at risk.
Detailed Assessment	2011	Concluded that there was relevant exposure above the annual AQO for NO_2 at properties on the south of Stevenage Road, Hitchin and that work to designate an AQMA should commence. Concluded that the AQO was not being exceeded at points of relevant exposure at Nightingale Road, Hitchin and the Payne's Park roundabout, Hitchin. Concluded that there was inconclusive evidence of the AQO being exceeded at Whitehorse Street, Baldock.

Table 2.1 Summary of Previous Review and Assessments (continued)

Round / Reports	Date	Description / Outcomes
4th Round (continued)	2011	In September 2011 DEFRA accepted the conclusions of the 2011 Detailed Assessment and advised NHDC to proceed with the process of designating an Air Quality Management Area at Stevenage Road.
5th Round		
USA	2012	Confirmed that there was relevant exposure above the annual AQO for NO_2 at properties on the south side of Stevenage Road (A602), Hitchin within the AQMA. Identified a location of relevant exposure above the annual AQO for NO_2 at Park Way (A602) on the Paynes Park roundabout, Hitchin; a location that had previously not been assessed as such.
Progress Report	2013	Reiterated the NO_2 pollution issues identified in 2012 at Stevenage Road Hitchin and Park Way Hitchin.
AQMA Action Plan	2013	In support of the AQMA designation at Stevenage Road an Action Plan was finalised in September 2013 .
Progress Report	2014	Confirmed the NO_2 pollution issues identified in 2012 at the AQMA at Stevenage Road Hitchin and the elevated concentrations at Park Way (Payne's Park area)

2.3 Scope and Methodology of the 2011 Detailed Assessment.

This Detailed Assessment aims to identify with reasonable certainty whether or not the AQS objective is likely to be exceeded and if so, define the extent and magnitude of that exceedence.

This is to be achieved by supplementing the air quality data that has been gathered for the Payne's Park area of Hitchin with pollution dispersion modelling in order to more accurately assess the impact of pollution sources on local receptors.

The ADMS-Roads v3.2 dispersion model was used by Air Quality Consultants (AQC) on behalf of NHDC to predict the concentrations of NO_2 at the worst case receptor locations.

3. 2011-2013 Air Quality Monitoring

From 2011 onwards there were six diffusion tubes positioned in the vicinity of the Payne's Park roundabout as well as the monitoring station containing a nitrogen oxide (NO_x) automatic analyser and a particulate matter (PM_{10}) automatic analyser.

All of the diffusion tubes were 50% triethanolamine (TEA) in acetone and were supplied and analysed by Environmental Services Group (ESG) at Harwell Scientific Services. The automatic analysers are a chemiluminescence analyser for NO_x and a Tapered Element Oscillating Measure (TEOM) for PM_{10}. Quality Assurance and Quality Control (QA/QC) information for the monitoring is in Appendix 1.

3.1 Park Way and Upper Tilehouse Street, (Hitchin Library / Paynes Park roundabout), (A505/A602), Hitchin

Figure 3.1 shows the extent of the monitoring network in this area, with NH6 identifying the location of the automatic analysers. Table 3.1 summarises the details of the monitoring network in this area.

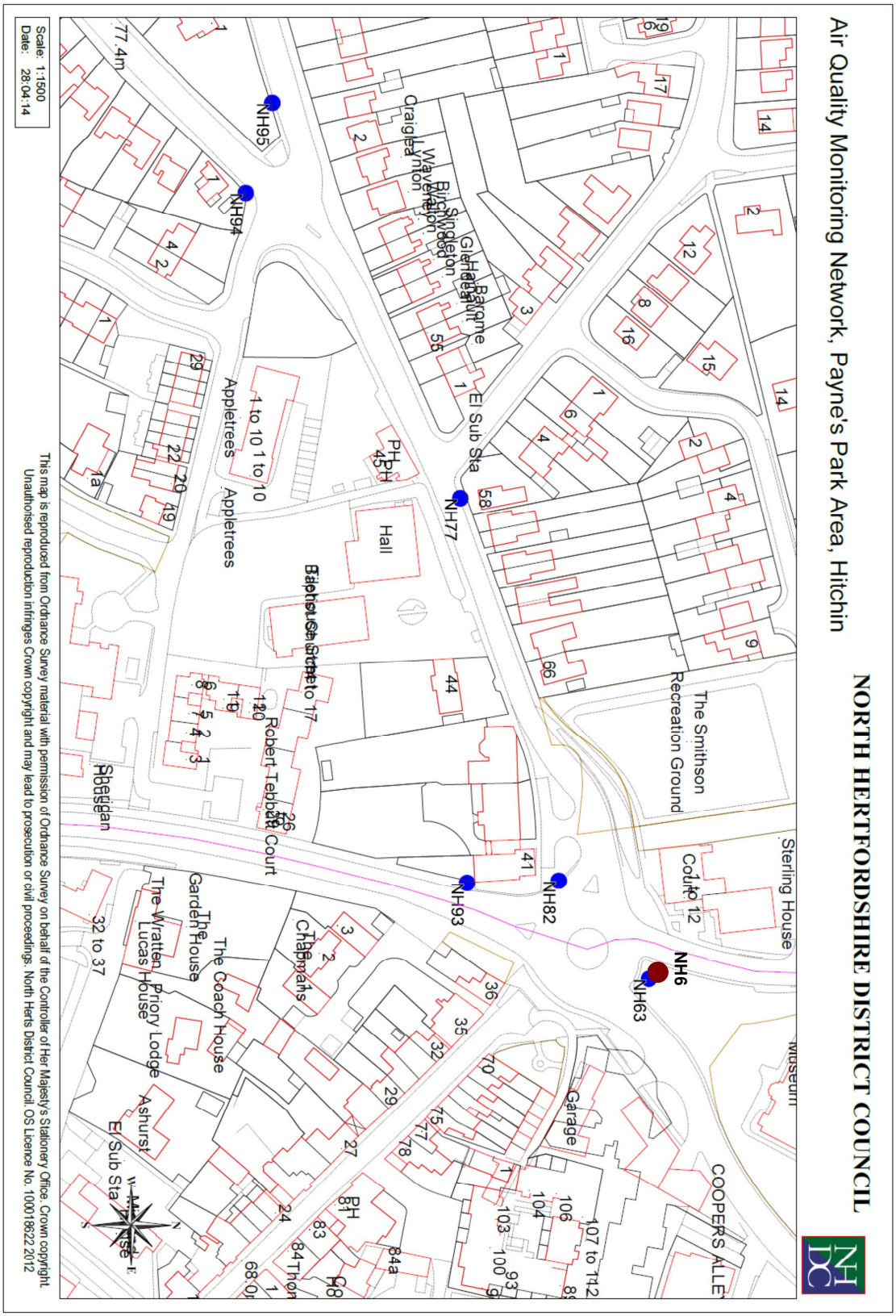

Figure 3.1: Air Quality Monitoring Locations in the Payne's Park and Upper Tilehouse Street Area of Hitchin (including the automatic NO_2 & PM_{10} analyser NH6)

The PM_{10} analyser and the NO_x analyser are located at the Payne's Park (Hitchin Library) roundabout site where the A602 (Park Way) meets the A505 (Upper Tilehouse Street), but only the NO_x analyser is of relevance to this report. The NO_x analyser has been collecting data at that location since the start of 2011. At the time of reporting the analyser is still operating at the Payne's Park roundabout site.

Calibration visits are undertaken regularly by TRL staff. In addition TRL is employed to undertake an annual service/maintenance visit and to respond in the event of any maintenance issues encountered during daily operation. The calibration readings are currently reported to AQDM which is retained by NHDC to verify and ratify the data generated by the analyser.

Table 3.1: Details of Air Quality Monitoring Locations in the Payne's Park and Upper Tilehouse Street Area of Hitchin

Site Name	Site Type	OS Grid Ref.	Pollutants Monitored	In AQMA?	Relevant Exposure	Distance to kerb of nearest road	Worst-case exposure
Upper Tilehouse St (crossing) Hitchin (NH77)	Roadside	518006, 229032	Nitrogen Dioxide	No	Y (5m)	1.5m	Y
Upper Tilehouse St (round -about) Hitchin (NH82)	Roadside	518129, 229065	Nitrogen Dioxide	No	Y (7m)	1.5m	Y
Hitchin Library, Hitchin (NH63)	Roadside	518160, 229092	Nitrogen Dioxide	No	Y (30m)	3.5m	N
Pirton Road, Hitchin (NH95)	Roadside	517886, 228975	Nitrogen Dioxide	No	Y (22m)	1.3m	Y
Offley Road, Hitchin (NH94)	Roadside	517915, 228967	Nitrogen Dioxide	No	Y (7m)	2.3m	Y
Park Way, Hitchin (NH93)	Roadside	518130, 229036	Nitrogen Dioxide	No	Y (3m)	1.6m	Y
Paynes Park, Hitchin (NH6)	Roadside **automatic**	518161, 229092	PM_{10} & NOx	No	Y (25m)	3m	N

Table 3.2 summarises the nitrogen dioxide data collected since 2010. The diffusion tube data reported have been bias adjusted and where necessary annualised. The automatic analyser data have been fully ratified.

The AQS Objective for NO_2 Annual Mean = 40μg/m^3.
The AQS Objective for number of exceedences of NO_2 hourly of 200μg/m^3 = $\leq$18.

Table 3.2: NO_2 Results of 2010-2013 Air Quality Monitoring in the Payne's Park Area of Hitchin

		Annual Mean Concentration (μg/m^3) (diffusion tubes bias adjusted)			
Site	**Site Location**	**2010**	**2011**	**2012**	**2013**
NH77	**Upper Tilehouse St (crossing) Hitchin**	**48.7**	**44.4**	39.5	**42.0**
NH82	**Upper Tilehouse St (roundabout) Hitchin**	**44.4**	**42.8**	**40.4**	**40.3**
NH63	**Hitchin Library, Hitchin**	**44.0**	**43.9**	39.4	36.6
NH95	**Pirton Road, Hitchin**	No data	35.6	36.5	36.0
NH94	**Offley Road, Hitchin**	No data	33.6	32.2	33.2
NH93	**Park Way, Hitchin**	No data	**53.1**	**54.8**	**52.1**
NH6	**Hitchin Library (automatic)**	No data	35	36	35

Bias (2010 annual bias correction factor) = 0.85 Bias (2011 annual bias correction factor = 0.84)
Bias (2012 annual bias correction factor) = 0.79 Bias (2012 annual bias correction factor = 0.80)

4. Dispersion Modelling Methodology

Detailed dispersion modelling of NO_2 was undertaken by Air Quality Consultants (AQC) using the ADMS-Roads v3.2 model. The model is used extensively in local air quality management and has formed the basis for many Detailed Assessments. The full details of the methodology and the model inputs can be found within the Modelling Report (6), which is included as Appendix 2 to this report.

AQC was instructed by NHDC to target the air pollution dispersion modelling at the Payne's Park area of Hitchin with the aim of informing a decision on whether it is necessary to declare an Air Quality Management Area (AQMA).

- Park Way & Upper Tilehouse Street, (Hitchin Library / Payne's Park Roundabout), (A505/A602), Hitchin. (Figure 4.1).

Relevant traffic data was supplied to AQC by NHDC via Hertfordshire County Council.

5. Interpretation of Air Quality Monitoring Results

Section 5 considers the results of the monitoring from the area of interest and discusses the need, or otherwise, to declare an Air Quality Management Area.

5.1 Payne's Park Area of Hitchin - Park Way and Upper Tilehouse Street, (Hitchin Library roundabout) (A505/A602), Hitchin

Air quality monitoring in this area covers NO_2 and PM_{10}. The main source of this pollutant is attributable to road traffic using the A602 and the A505. The A602 (Park Way) runs on a broadly north/south axis, through the west edge of Hitchin, via the Hitchin Library roundabout where the A505 (Upper Tilehouse Street) converges with it. The B655 (Pirton Road) converges with the (A505) Offley Road at Upper Tilehouse Street which is to the west of the Payne's Park roundabout. (Figure 1.1).

Three diffusion tubes (NH93, NH63 and NH82) are located within 5m of the roundabout, as is the automatic NO_2 analyser (NH6). Diffusion tubes NH77, NH94 and NH95 are positioned west of the roundabout on Upper Tilehouse Street, Offley Road and Pirton Road respectively (Figure 3.1).

The Hitchin Library roundabout has commercial and community buildings located immediately to the north, off Old Park Road (A505) and to the north east, off Payne's Park (A505) north east.

A 148 unit residential development (132 flats and 6 houses) (receptors 35 & 36) is located within 15m of the Hitchin Library roundabout accessible via Payne's Park (a one-way system feeding into the roundabout).

To the south-west of the roundabout 41 Upper Tilehouse Street (receptor 1) is located within 10m of the roundabout, on the west side of Park Way, but with access via Upper Tilehouse Street. 36 Tilehouse Street (receptor 30) backs onto Park Way and is about 10m from the roundabout. Park Way (A602) itself has no addresses associated to it but residential properties (receptors 31-34) back onto it from the east and west.

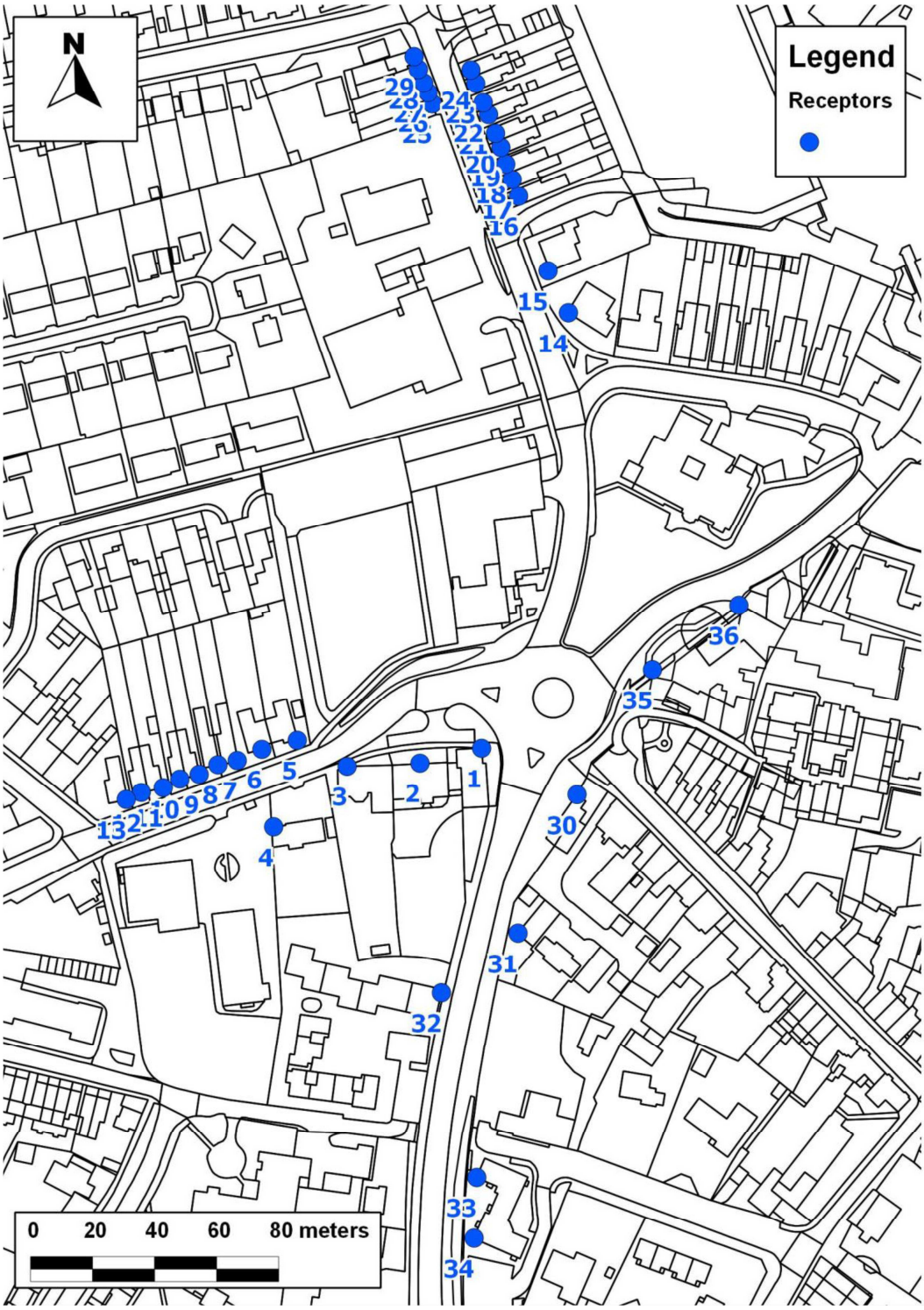

Figure 4.1: Receptor Locations within the Modelled Area in the Payne's Park / Upper Tilehouse Street Area of Hitchin

To the west of the roundabout on the south of Upper Tilehouse Street there are a few large residential buildings (receptors 1-4) and along the north side of Upper Tilehouse Street there are pairs of semi-detached houses (receptors 5-13).

Therefore, public exposure to elevated NO_2 in the area to the east, south and west of the Hitchin Library roundabout is possible.

Considering the proximity, to the Hitchin Library roundabout road network, of the residences at Payne's Park and Upper Tilehouse Street and the regular measurement by diffusion tubes of NO_2 concentrations in excess of the 40μg/m^3 objective it was deemed necessary to carry out dispersion modelling for NO_2 in the area. This was previously undertaken in 2011 justified on the basis of 2010 data, but it is now necessary to revisit the detailed assessment on the basis of having increased the number of diffusion tubes in the area from three to six for 2011, 2012 and 2013.

The dispersion modelling report is included as Appendix 2, which is where the detailed inputs to and outputs from the model can be reviewed. A number of key points arising from the modelling are summarised below:

- A total of 36 (buildings) receptors were considered within the study area. They included residences along Upper Tilehouse Street, Old Park Road, Park Way, the residential development on Payne's Park and properties adjacent to Park Way. The same 36 receptors for this study area were considered by the 2011 dispersion modelling.

- The modelling predicted no exceedences of the 40μg/m^3 mean annual average NO_2 objective at the designated receptor.

- The 2014 modelling predicted mean annual average NO_2 concentrations close to the NO_2 objective at the following 2 receptors:
  - 41 Upper Tilehouse Street (receptor 1)
  - 43 Upper Tilehouse Street (receptor 3)

- A simple comparison of the mean annual average NO_2 concentrations predicted by the 2014 and 2011 modelling is:
  - Of the 36 receptors in 2014 modelling the predicted concentrations were higher at 17 receptors and lower at 19 receptors
  - Table 5.1 compares the predicted concentrations at the most exposed receptors in 2011 modelling with the predicted concentrations in 2014

Table 5.1: Modelled NO_2 Concentrations in 2011 and 2014 at Selected Receptors

		Modelled Annual Mean Concentration (μg/m^3)	
Receptor Number	**Receptor Address**	**2011 (2010 data)**	**2014 (2013 data)**
R1	**41 Upper Tilehouse Street**	38.2	39.5
R3	**43 Upper Tilehouse Street**	39.3	38.8
R30	**36 Tilehouse Street**	38.3	37.0

Public exposure to NO_2 that exceeds the annual mean average AQS objective of 40μg/m^3 has not been proven at the receptors identified in Figure 4.1. However, there is the possibility of an exceedence at the south-east corner of 41 Upper Tilehouse Street (Receptor 1) (Figure 5.1).

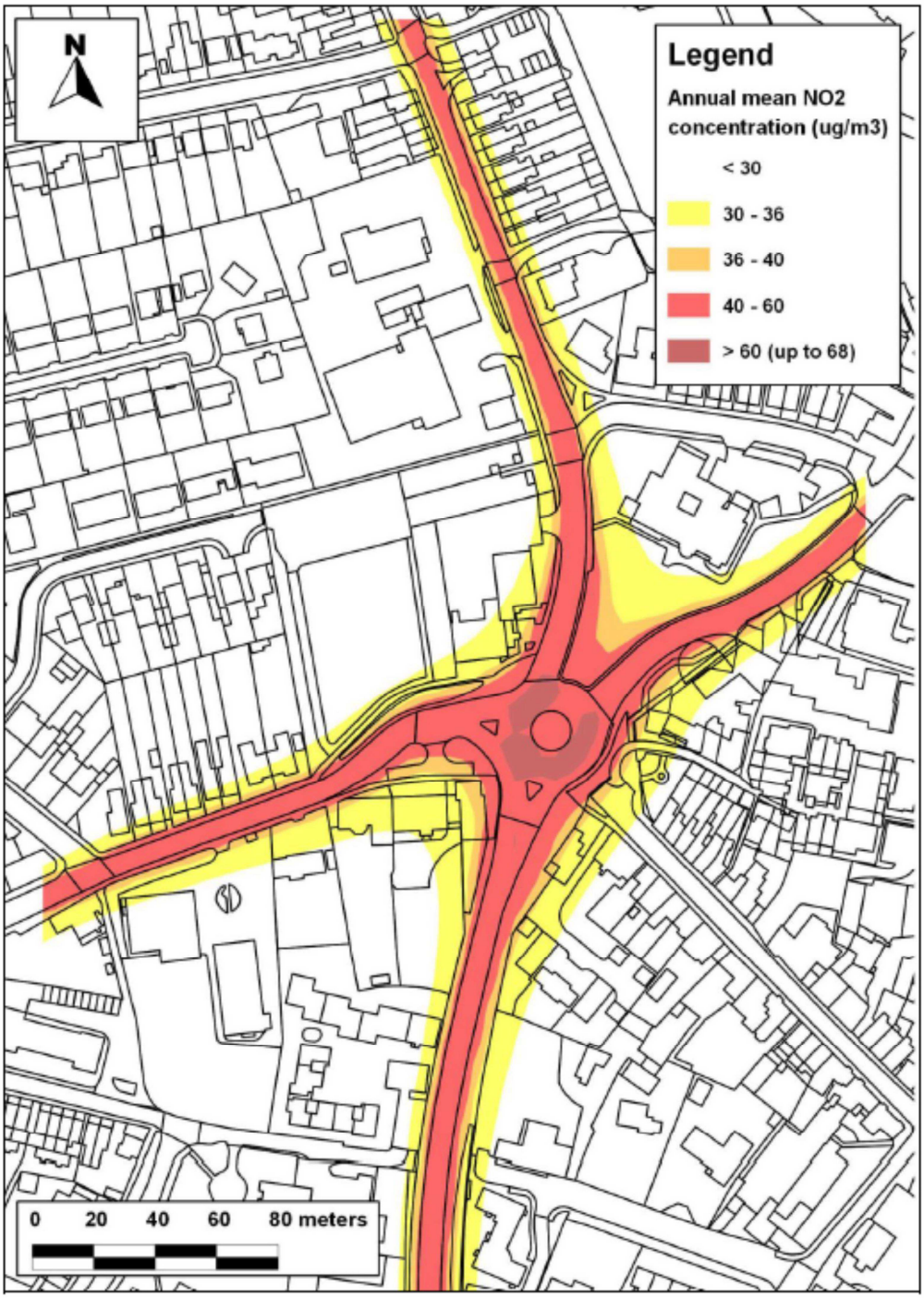

Figure 5.1: Modelled Annual Mean Nitrogen Dioxide Concentrations in the Payne's Park / Upper Tilehouse Street Area of Hitchin, 2013

6. Conclusions and Recommendations

The Payne's Park area of Hitchin has been subject to a detailed assessment and the interpretation of and conclusions drawn from the results of the monitoring are specified below along with a recommendation.

6.1 Payne's Park Area of Hitchin - Park Way and Upper Tilehouse Street, (Hitchin Library roundabout) (A505/A602), Hitchin

The results of the diffusion tube monitoring indicate that the area is subjected to annual mean average concentrations of NO_2 above the 40μg/m^3 air quality objective. The real time analyser located in the area recorded NO_2 at below the 40μg/m^3 air quality objective.

The air pollution dispersion modelling undertaken in this area predicts that the 40μg/m^3 air quality objective will not be exceeded at the relevant receptors. However, at one house (41 Upper Tilehouse Street) a NO_2 concentration of 39.5μg/m^3 was predicted and the isopleth mapping highlighted the potential for an exceedence to occur at the south east façade of the same property.

Despite the potential for a marginal exceedence of the 40μg/m^3 air quality objective at 41 Upper Tilehouse Street it is concluded that **the evidence is not strong enough to demonstrate relevant exposure to NO_2 and therefore insufficient justification for the declaration of an Air Quality Management Area**.

The following actions are recommended:

- Maintain the existing diffusion tube network in the area.
- Continued assessment of the results of air quality monitoring undertaken in area.

7. References

1. NHDC. May 2014. LAQM Progress Report 2014.
2. Defra. 2011. The United Kingdom Air Quality Strategy 2011. https://www.gov.uk/government/publications/the-air-quality-strategy-for-england-scotland-wales-and-northern-ireland-volume-1
3. Defra. 2010. The Air Quality Standards Regulations 2010 No. 1001. The Stationery Office.
4. Defra. 2009. LAQM Policy Guidance PG(09), Part IV of the Environment Act 1995. The Stationery Office.
5. Defra. 2009. LAQM Technical Guidance TG(09), Part IV of the Environment Act 1995. The Stationery Office.
6. AQC July 2014. North Hertfordshire District Council: Paynes Park, Hitchin, Detailed Assessment Modelling: July 2014.

Appendix 1: Quality Assurance / Quality Control (QA/QC)

1. Automatic Monitoring

1.1 Calibration and Rescaling

The API M200 analyser is subject to calibration checks and filter checks by TRL staff who also undertake bi-annual service/maintenance visits and to respond in the event of any maintenance issues encountered during daily operation. The calibration readings are reported to AQDM. AQDM is retained by NHDC, as part of the larger Herts and Beds Air Quality Network, to verify and ratify the data generated by the analyser.

As with most accurate measurement equipment, the API 200A must be calibrated to determine its function. Calibration is simply the testing of equipment against a known quantity to determine whether it produces expected results. In the case of both nitrogen dioxide analysers, calibration takes the form of two routines:

a) The response of the analyser to high concentrations of nitric oxide is assessed by a “span calibration”. Simply, a nitric oxide (at a known high concentration) is passed into the analyser and the result produced by it is noted.

b) The response of the analyser to sample containing no oxides of nitrogen (NO_x) is assessed by passing air which as been “scrubbed” clean of NO_x (“zero air”) into the analyser and thus conduct a “zero calibration” and the analysed result noted.

The analyser should produce a result, which is close to the absolute concentration at both ends of the scale - the span range.

Span and zero calibrations are conducted regularly by the NOx analyser automatically and stored in the datalogger for periodic inspection. To ensure a consistently high quality assurance standard, the NO_x analyser is calibrated, for both zero and span, every 10 - 14 days and the result used for validation.

For a host of reasons, analysers such as the API M200 do not always produce calibration results that are exactly in line with the anticipated levels during both the span and zero calibration operation. This does not mean that the data produced must be discarded because it is not accurate. “Calibration drift” is common and can be compensated by the use of a scaling calculation; any under/over reading by the analyser is distributed over the span range so that the data produced routinely is altered to reflect any inaccuracy.

The result of rescaling is to ensure that data from the analyser is accurate at the concentrations encountered routinely. Rescaling is not conducted by North Hertfordshire District Council, but is undertaken by AQMA. Rescaling takes place after every manual calibration to ensure a robust data set.

2. Diffusion Tubes

2.1 Factor from Local Co-location Studies (if available)

North Hertfordshire District Council undertakes no co-location studies.

2.2 Laboratory Analysis

The diffusion tubes are 50% triethanolamine (TEA) in acetone and are supplied and analysed by Environmental Services Group (ESG) at Harwell Scientific Services. ESG/HSS follows the procedures set out in the Harmonisation Practical Guidance. ESG/HSS also participates in the Workplace Analysis Scheme for Proficiency (WASP) and is currently ranked as a Category Satisfactory laboratory. This information was used in selecting the below bias adjustment factor.

2.3 Bias Adjustment Factors

Data from the diffusion tubes has been compared and bias corrected to the factors produced from the UK co-location database. The bias adjustment factor has been taken from the March 2014 version of the Diffusion Tube Bias Adjustment Factors spreadsheet available from the Defra Review and Assessment website (http://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html).

According to the above database the bias adjustment factor for Harwell Scientific Services in 2013 was 0.80.

3. Short-term to Long-term Data Adjustment (Annualisation) for Automatic and Non-Automatic Monitoring

Where it has only been possible to carry out monitoring at a location, whether automatic or non-automatic, at a site for less than 12 months the results need to be adjusted to enable an estimate of the annual mean for that location to be calculated.

It should be noted that a minimum 6 month period is necessary for this process to be valid. There were no monitoring locations where less than 6 months data were collected during 2013. As such no annualisation was required for 2013 data.

Appendix 2: AQC – North Hertfordshire District Council: Paynes Park, Hitchin Detailed Assessment Dispersion Modelling Report (July 2014)

Air Quality CONSULTANTS

North Hertfordshire District Council:

Paynes Park, Hitchin, Detailed Assessment Modelling

August 2014

Experts in air quality management & assessment

Document Control

Client	North Hertfordshire District Council	**Principal Contact**	David Carr

Job Number	J2039

Report Prepared By:	Suzanne Hodgson and Laurence Caird

Document Status and Review Schedule

Report No.	Date	Status	Reviewed by
J2039/1/D1	28th August 2014	Draft Report	Prof. Duncan Laxen

Air Quality Consultants Ltd
23 Coldharbour Road, Bristol BS6 7JT Tel: 0117 974 1086
12 Airedale Road, London SW12 8SF Tel: 0208 673 4313
aqc@aqconsultants.co.uk

Registered Office: 12 St Oswalds Road, Bristol, BS6 7HT
Companies House Registration No: 2814570

Contents

1 Introduction

1.1 This report describes the methodology and results of dispersion modelling carried out to inform North Hertfordshire District Council's Detailed Assessment of air quality in the Paynes Park area of Hitchin.

1.2 The modelling has been undertaken by Air Quality Consultants Ltd. on behalf of North Hertfordshire District Council who will use the results of the dispersion modelling to determine whether or not there is a need to declare and Air Quality Management Area (AQMA) in the Paynes Park area of Hitchin.

1.3 This report contains the results of dispersion modelling and the methodology used. It is designed to provide input to the Detailed Assessment to be prepared by the Council.

2 Assessment Methodology

Modelling

2.1 Modelling has been carried out for the area around the Upper Tilehouse Street / Park Way roundabout near Hitchin Library. Annual mean nitrogen dioxide concentrations in 2013 have been predicted within the study area using the dispersion model ADMS-Roads v3.2. The model outputs have been verified against the nitrogen dioxide monitoring described in Appendix A1. Further details of the modelling methodology and model verification are provided in Appendix A1.

2.2 Concentrations have been predicted at 36 worst-case receptor locations within the study area, which are listed in Table 1 and illustrated in Figure 1. Concentrations have also been predicted for a grid of receptors (located at 1.5 m height), with a resolution of 4 m, across the study area to allow concentration isopleths to be plotted.

Table 1: Receptor Locations [a]

Receptor	Receptor Name	X	Y
R1	41 Upper Tilehouse	518128	229057
R2	42 Upper Tilehouse	518108	229052
R3	43 Upper Tilehouse	518084	229051
R4	44 Upper Tilehouse	518061	229032
R5	66 Upper Tilehouse	518068	229060
R6	65 Upper Tilehouse	518057	229057
R7	64 Upper Tilehouse	518049	229053
R8	63 Upper Tilehouse	518043	229052
R9	62 Upper Tilehouse	518036	229048
R10	61 Upper Tilehouse	518030	229047
R11	60 Upper Tilehouse	518025	229044
R12	59 Upper Tilehouse	518018	229043
R13	58 Upper Tilehouse	518013	229040
R14	12 Nuns Close	518156	229197
R15	72 Old Park Rd	518149	229211
R16	71 Old Park Rd	518139	229235
R17	70 Old Park Rd	518137	229240
R18	69 Old Park Rd	518135	229245
R19	68 Old PArk Rd	518134	229250
R20	67 Old Park Rd	518132	229255
R21	66 Old Park Rd	518130	229261
R22	65 Old Park Rd	518128	229265
R23	64 Old Park Rd	518126	229271
R24	63 Old Park Rd	518124	229275
R25	29 Old Park Rd	518112	229264
R26	30 Old Park Rd	518110	229268
R27	31 Old Park Rd	518109	229271
R28	32 Old Park Rd	518107	229275
R29	33 Old Park Rd	518106	229280
R30	36 Tilehouse St	518158	229042
R31	3 Park Way	518139	228997
R32	26-29 Robert Tebbutt	518115	228978
R33	32-37 Park Close	518126	228919
R34	23-31 Park Close	518125	228899
R35	New Flats Payne Park	518183	229082
R36	New Flats Payne Park	518210	229103

[a] Receptors have been modelled at a height of 1.5 m

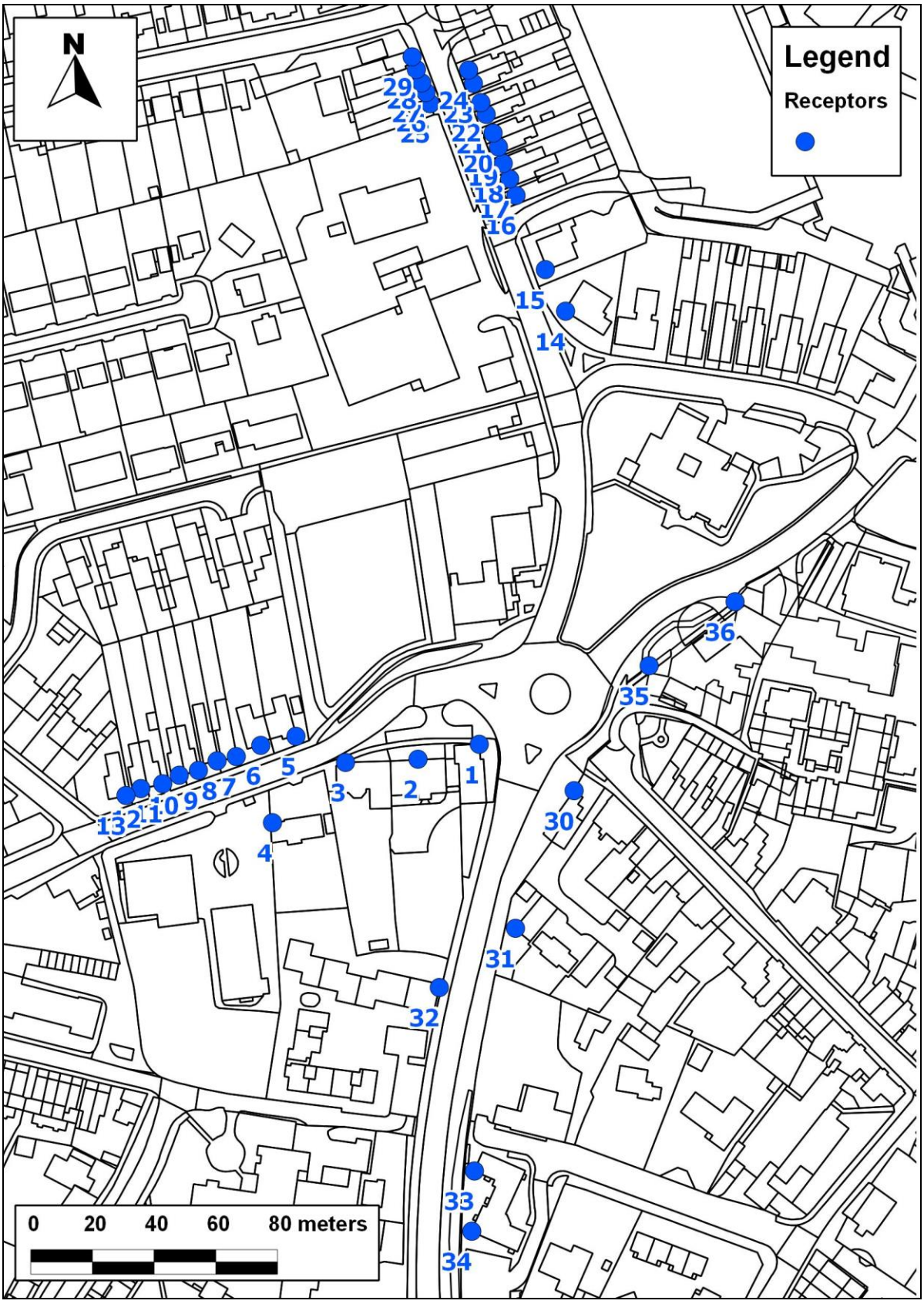

Figure 1: Locations of Receptors

3 Model Results

3.1 Predicted annual mean concentrations of nitrogen dioxide at each receptor location are set out in Table 2. An isopleth map of the predicted annual mean nitrogen dioxide concentrations, at ground-floor level, across the study area are also presented in Figure 2.

Table 2: Modelled Annual Mean Nitrogen Dioxide Concentrations

Receptor Number	Receptor Name	X	Y	2013 (µg/m^3)
R1	41 Upper Tilehouse	518128	229057	39.5
R2	42 Upper Tilehouse	518108	229052	32.8
R3	43 Upper Tilehouse	518084	229051	38.8
R4	44 Upper Tilehouse	518061	229032	30.1
R5	66 Upper Tilehouse	518068	229060	34.7
R6	65 Upper Tilehouse	518057	229057	32.8
R7	64 Upper Tilehouse	518049	229053	33.3
R8	63 Upper Tilehouse	518043	229052	32.3
R9	62 Upper Tilehouse	518036	229048	33.0
R10	61 Upper Tilehouse	518030	229047	32.2
R11	60 Upper Tilehouse	518025	229044	32.9
R12	59 Upper Tilehouse	518018	229043	31.7
R13	58 Upper Tilehouse	518013	229040	31.9
R14	12 Nuns Close	518156	229197	30.9
R15	72 Old Park Rd	518149	229211	31.7
R16	71 Old Park Rd	518139	229235	31.7
R17	70 Old Park Rd	518137	229240	31.7
R18	69 Old Park Rd	518135	229245	31.9
R19	68 Old PArk Rd	518134	229250	31.4
R20	67 Old Park Rd	518132	229255	31.4
R21	66 Old Park Rd	518130	229261	31.3
R22	65 Old Park Rd	518128	229265	31.5
R23	64 Old Park Rd	518126	229271	31.6
R24	63 Old Park Rd	518124	229275	31.5
R25	29 Old Park Rd	518112	229264	30.9
R26	30 Old Park Rd	518110	229268	30.9
R27	31 Old Park Rd	518109	229271	30.8
R28	32 Old Park Rd	518107	229275	30.7
R29	33 Old Park Rd	518106	229280	30.9
R30	36 Tilehouse St	518158	229042	37.0
R31	3 Park Way	518139	228997	34.0
R32	26-29 Robert Tebbutt	518115	228978	33.6

Receptor Number	Receptor Name	X	Y	2013 (µg/m^3)
R33	32-37 Park Close	518126	228919	31.1
R34	23-31 Park Close	518125	228899	30.7
R35	New Flats Payne Park	518183	229082	37.2
R36	New Flats Payne Park	518210	229103	34.7
	Objective			**40**

3.2 At all the specified receptor locations, predicted annual mean nitrogen dioxide concentrations are below the annual mean objective. The isopleth map shown in Figure 2, however, shows that concentrations are predicted to exceed the annual mean objective at the façade of 41 Upper Tilehouse Road with Park Way, which is a different location to that represented by receptor 1 (which has a façade with Upper Tilehouse Road). At R1, predicted concentrations are just below the objective value of 40 µg/m^3 (39.5 µg/m^3). There are a number of receptors where annual mean nitrogen dioxide concentrations are predicted to be just below the objective (between 36 and 40 µg/m^3), at 41 and 43 Upper Tilehouse Street (R1 and R3) and 36 Tilehouse Street.

3.3 Elsewhere, annual mean nitrogen dioxide concentrations are predicted to be well below the objective in 2013.

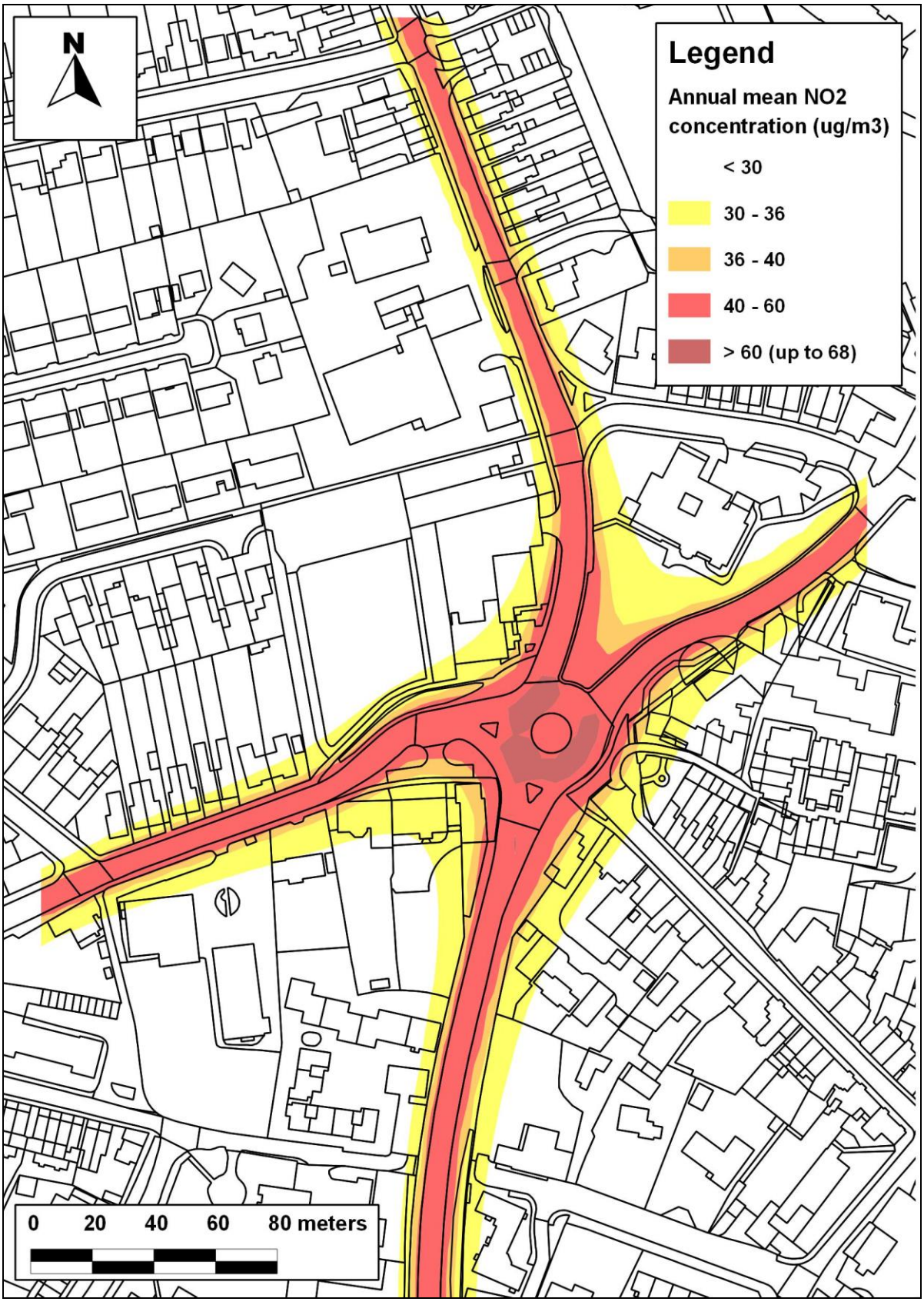

Figure 2: Modelled Annual Mean Nitrogen Dioxide Concentrations, 2013

4 References

AQEG, 2007. Trends in Primary Nitrogen Dioxide in the UK.

Defra, 2009. Review & Assessment: Technical Guidance LAQM.TG(09).

Defra, 2014. Defra Air Quality Website at: http://www.defra.gov.uk/environment/quality/air/airquality/

A1 Dispersion Modelling Methodology

Meteorological Data

A1.1 The model has been run using the full year of meteorological data that corresponds to the most recent set of nitrogen dioxide monitoring data (2013). The meteorological data has been taken from the monitoring station located at Stansted Airport, which is considered suitable for this area. The wind rose for 2013 from the Stansted Airport meteorological station is displayed in Figure A1.1 and shows the strong influence of south westerly winds during 2013.

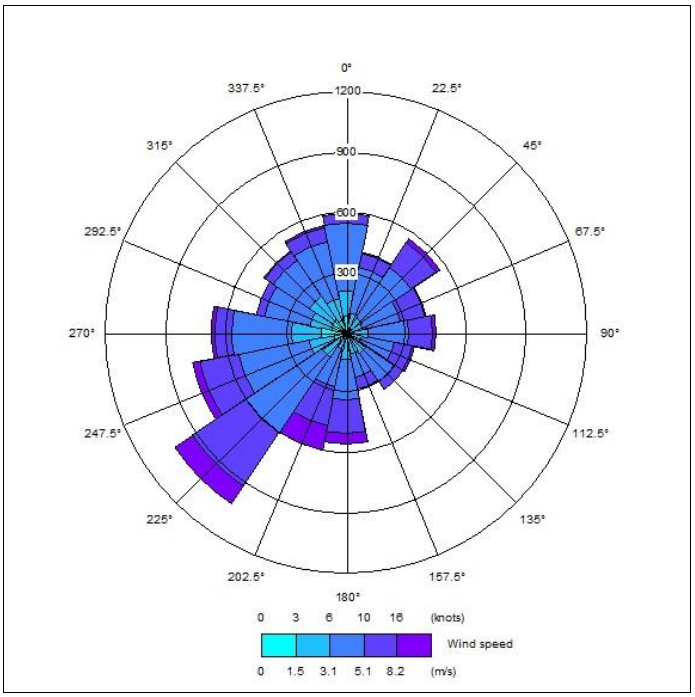

Figure A1.1: 2013 Wind Rose for Stansted Airport Meteorological Station

Background Concentrations

A1.2 The background concentrations across the study area have been defined using the national pollution maps published by Defra (2014). These cover the whole country on a 1x1 km grid and are published for each year from 2011 until 2030. The maps include the influence of emissions from a range of different sources; one of which is road traffic. There are some concerns that Defra may have over-predicted the rate at which road traffic emissions of nitrogen oxides will fall in the future. The maps currently in use were verified against measurements made during 2011 at a large number of automatic monitoring stations and so there can be reasonable confidence that the maps are representative of conditions during 2011. Similarly, there is reasonable confidence that the reductions which Defra predicts from other sectors (e.g. rail) will be achieved.

A1.3 In order to calculate background nitrogen dioxide and nitrogen oxides concentrations in 2013, it is assumed that there was no reduction in the road traffic component of backgrounds between 2010[1] and 2013. This has been done using the source-specific background nitrogen oxides maps provided by Defra (2014). For each grid square, the road traffic component has been held constant at 2010 levels, while 2013 values have been taken for the other components. Nitrogen dioxide concentrations have then been calculated using the background nitrogen dioxide calculator which Defra (2014) publishes to accompany the maps. The result is a set of 'adjusted 2013 background' concentrations.

A1.4 As an additional step, the 'adjusted 2013 background' mapped values have been calibrated against national background measurements made as part of Defra's AURN monitoring programme during 2013 (see Figure A1.2). Based on the 52 sites with more than 90% data capture for 2013, the maps under-predict the background concentrations by 5.5%, on average. This has been allowed for in production of the calibrated 'adjusted' 2013 background concentrations.

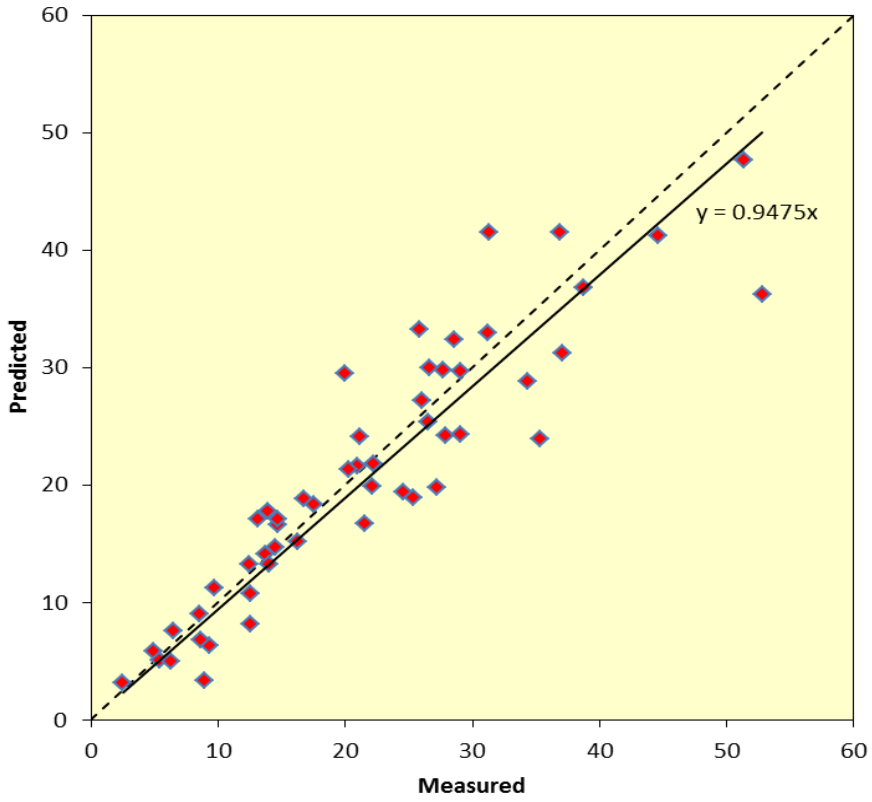

Figure A1.2: Predicted Mapped versus Measured Concentrations at AURN Background Sites in 2013

[1] This approach assumes that has been no reduction in emissions per vehicle but also that traffic volumes have remained constant. This is not the same as the assumption made for dispersion modelling, in which emissions per vehicle are held constant while traffic volumes are assumed to change year on year. Overall, this discrepancy is unlikely to influence the overall conclusions of the assessment.

A1.5 Background concentrations of nitrogen dioxide have been taken from the national maps of background concentrations published by Defra (Defra, 2014). The background nitrogen dioxide concentrations used in the modelling is 18.2 µg/m^3.

Traffic Data

A1.6 Predictions have been carried out using the ADMS-Roads dispersion model (v3.2). The model requires the user to provide various input data, including emissions from each section of road, and the road characteristics (including road width). Vehicle emissions have been calculated based on vehicle flow, composition and speed data using the Emission Factor Toolkit (Version 6.0.1) published by Defra (2014).

A1.7 Traffic data used in the modelling have been provided by North Hertfordshire District Council, and are summarised in Table A1.1.

Table A1.1: Summary of Traffic Data used in the Assessment (AADT)

Road Link	AADT	% HDV
Payne Park	17,420	1.5
Old Park Road	13,188	10.1
Upper Tilehouse Street	24,189	2.8
Park Way	25,202	2.7

A1.8 Figure A1.3 shows the road network included within the model and defines the study area.

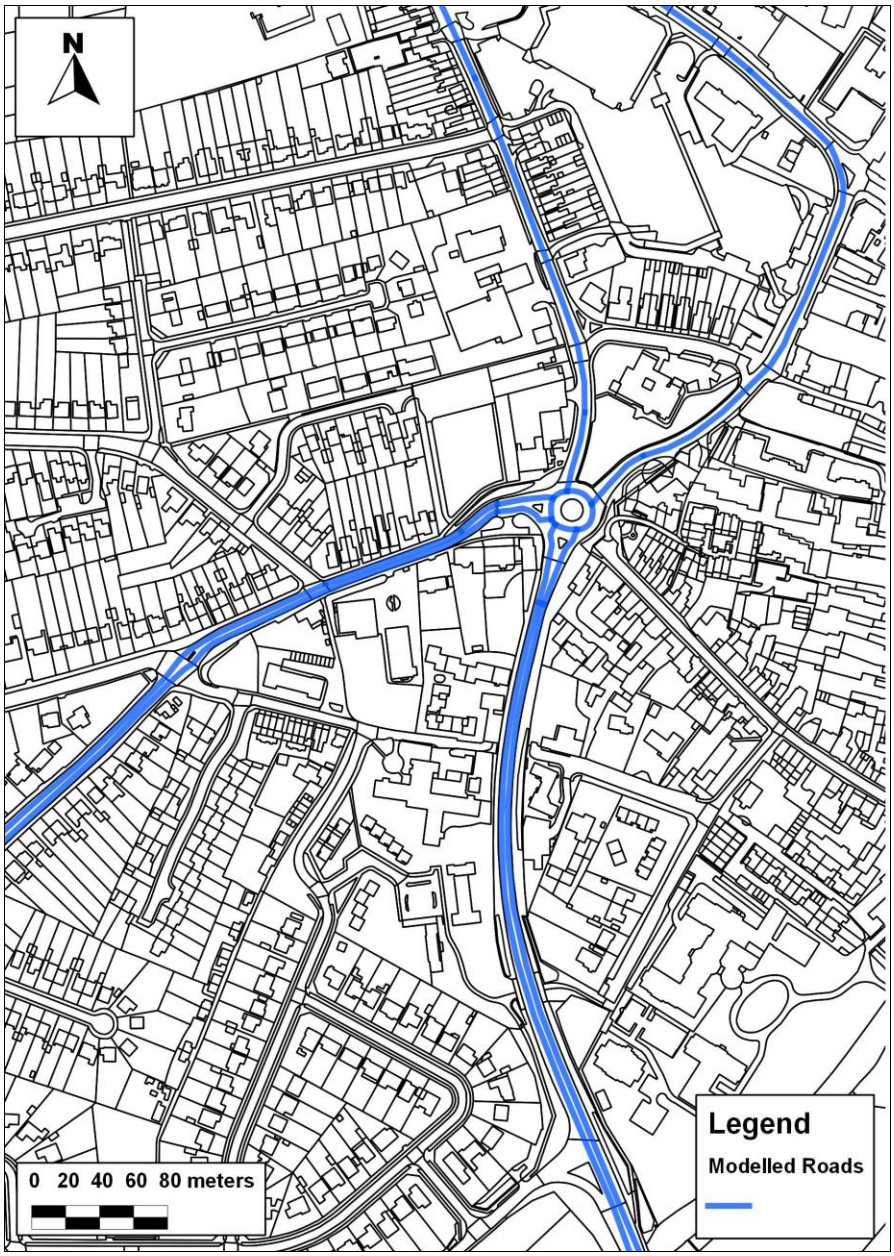

Figure A1.3: Modelled Road Network

Model Verification

A1.9 Most nitrogen dioxide (NO_2) is produced in the atmosphere by reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions of nitrogen oxides (NOx = NO + NO_2). The model has been run to predict the annual mean NOx concentrations during 2013 at the automatic analyser adjacent to the library and five diffusion tube monitoring sites located within the study area. One local diffusion tube site was omitted from the verification process; NH95 on Pirton Road, as traffic data was not available for this road. A summary of the monitoring sites included in the verification is displayed in Table A1.1.

Table A1.2: Annual Mean Nitrogen Dioxide Monitoring Used for Model Verification

Site ID	Location	Site Type	X	Y	2013 (µg/m^3)
NH63	Hitchin Library Roundabout	Automatic Analyser	518160	229092	35.0
NH77	Upper Tilehouse Street	Diffusion Tube	518006	229032	**42.0**
NH78	Wests Hill	Diffusion Tube	518099	229229	29.0
NH82	Upper Tilehouse Street	Diffusion Tube	518129	229065	**40.3**
NH93	Park Way	Diffusion Tube	518130	229036	**52.1**
NH94	Offley Road	Diffusion Tube	517915	228967	36.0

A1.10 The model output of road-NOx (i.e. the component of total NOx coming from road traffic) has been compared with the 'measured' road-NOx. Measured road-NOx has been calculated from the measured NO_2 concentrations and the predicted background NO_2 concentration using the NOx from NO_2 calculator (Version 4.1) available on the Defra LAQM Support website (Defra, 2014a).

A1.11 A primary adjustment factor has been determined as the slope of the best-fit line between the 'measured' road contribution and the model derived road contribution, forced through zero (Figure A1.4). This factor has then been applied to the modelled road-NOx concentration for each receptor to provide adjusted modelled road-NOx concentrations. The total nitrogen dioxide concentrations have then been determined by combining the adjusted modelled road-NOx concentrations with the predicted background NO_2 concentration within the NOx to NO_2 calculator. A secondary adjustment factor has finally been calculated as the slope of the best-fit line applied to the adjusted data and forced through zero (Figure A1.5).

A1.12 The following primary and secondary adjustment factors have been applied to all modelled nitrogen dioxide data:

- Primary adjustment factor : 1.692
- Secondary adjustment factor: 1.016

A1.13 The results imply that the model has under predicted the road-NOx contribution. This is a common experience with this and most other models. The final NO_2 adjustment is minor.

A1.14 Figure A1.6 compares final adjusted modelled total NO_2 at each of the monitoring sites, to measured total NO_2, and shows a 1:1 relationship.

A1.15 The final plot has a correlation coefficient of 0.58, root mean square error of 6.86 µg/m^3 and fractional bias of 0.02.

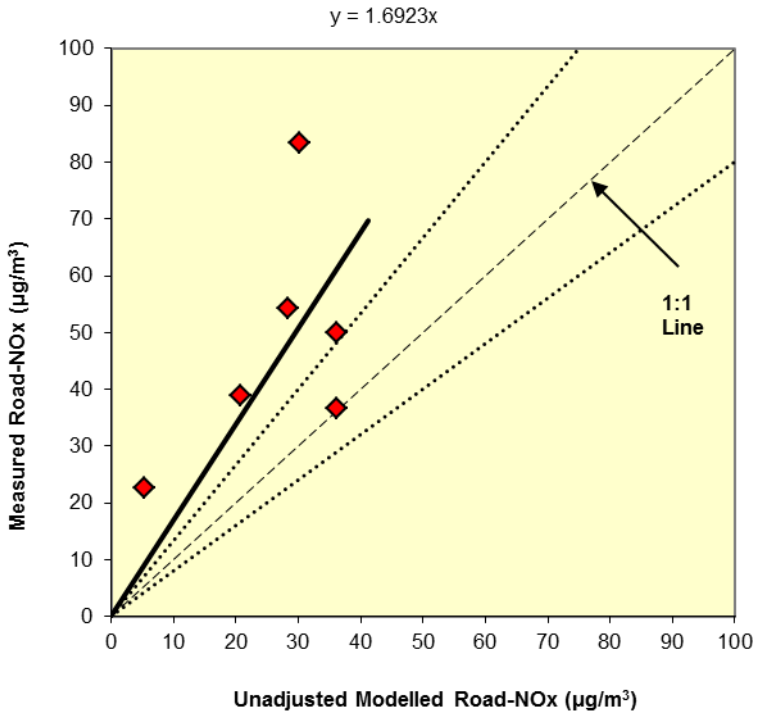

Figure A2.1: Comparison of Measured Road NOx to Unadjusted Modelled Road NOx Concentrations

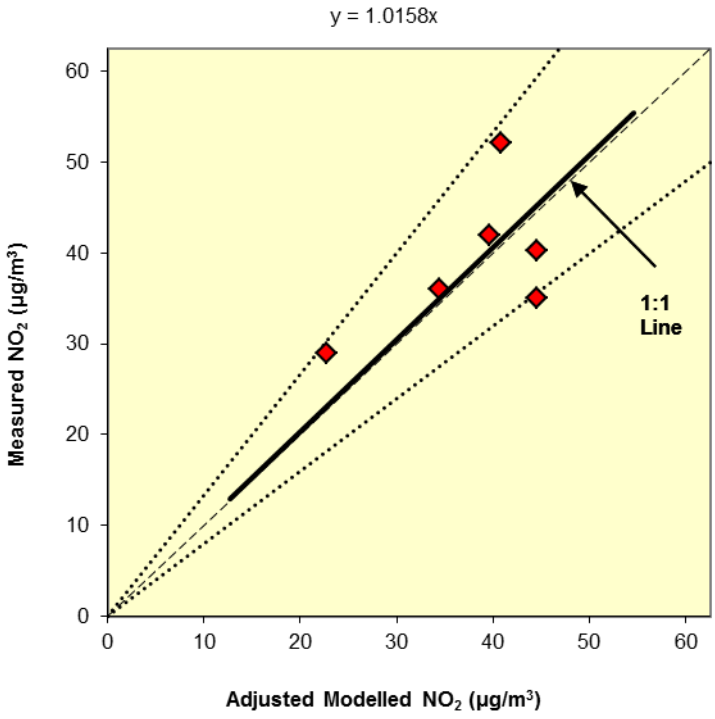

Figure A2.2: Comparison of Measured Total NO_2 to Primary Adjusted Modelled Total NO_2 Concentrations

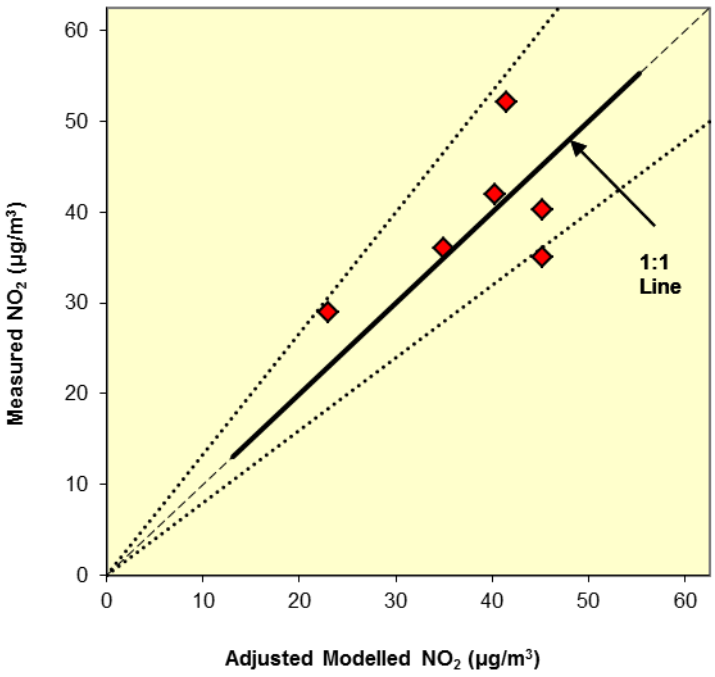

Figure A2.3: Comparison of Measured Total NO_2 to Final Adjusted Modelled Total NO_2 Concentrations, Showing 10% Confidence Limit in 1:1 Relationship

Model Post-processing

A1.16 The model predicts road-NOx concentrations at each grid point. These concentrations have then been adjusted using the primary adjustment factor, which, along with the background NO_2, is processed through the NOx from NO_2 calculator available on the Defra LAQM Support website (Defra, 2014). The traffic mix within the calculator has been set to "All other-urban UK traffic", which is considered suitable for the study area. The calculator predicts the component of NO_2 based on the adjusted road-NOx and the background NO_2. This is then adjusted by the secondary adjustment factor to provide the final predicted concentrations.

Uncertainty

A1.17 Uncertainty is inherent in all measured and modelled data. All values presented in this report are the best possible estimates, but uncertainties in the results might cause over- or under-predictions. All of the measured concentrations presented have an intrinsic margin of error. Defra (2009) suggests that this is of the order of plus or minus 20% for diffusion tube data and plus or minus 10% for automatic measurements.

A1.18 The model results rely on traffic data provided by North Hertfordshire District Council, and any uncertainties inherent in these data will carry into this assessment. There will be additional uncertainties introduced because the modelling has simplified real-world processes into a series of

algorithms. For example: it has been assumed that wind conditions measured at Stansted Airport during 2013 will have occurred throughout the study area during 2013; and it has been assumed that the dispersion of emitted pollutants will conform to a Gaussian distribution over flat terrain.

A1.19 An important step in the assessment is verifying the dispersion model against the measured data. By comparing the model results with measurements, and correcting for the apparent under-prediction of the model, the uncertainties can be reduced. The limitations to the assessment should be borne in mind when considering the results set out in the following sections. While the model should give an overall accurate picture, i.e. one without bias, there will be uncertainties for individual receptors. The results are 'best estimates' and have been treated as such in the discussion.