2010 Air Quality Detailed Assessment of Leicester Road, High Street and Rugby Road Lutterworth for Harborough District Council

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

Date (August 2010)

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Report Reference number	LAQM.DA.Lut.NO2.2010
Date	

1 Executive Summary

This report has been undertaken to meet the councils statutory duty under Part IV of the Environment Act 1995. Previous reports undertaken to meet the council's statutory duty found that the annual mean air quality objective (AQO) for nitrogen dioxide (NO_2) was being exceeded outside of the current air quality management area (AQMA) and that a detailed assessment of the areas was needed to identify any required extensions to the AQMA.

Monitoring to the north of the AQMA found that it was not necessary to extend the AQMA to the North of the currently declared area.

Monitoring to the south has found that the length of high street and the junction with Stoney Hollow and Rugby Road need to be declared. Following the declaration of this area a further assessment will be necessary, in order to improve the data held and ensure that a greater area than that identified in this report is not exceeding the annual mean AQO for NO_2 further NO_2 diffusion tubes should be placed along Rugby Road.

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2 Introduction

2.1 Description of Local Authority Area

Harborough District Council is a diverse, largely rural authority covering approximately 590Km^2 (230 square miles) of Southern Leicestershire, as shown in Figure. 1. Geographically it is the largest of the Leicestershire districts. Approximately 83,400 people (estimated June 2009 by The Office for National Statistics [31]) live within the District.

The two major population centres are the market towns of Market Harborough and Lutterworth, providing the main shopping and business services. These two towns, together with the villages of Thurnby, Bushby and Scraptoft adjoining Leicester City, and the villages of Broughton Astley, Great Glen, Kibworth and Fleckney accommodate 67% of the district population. The remaining residents live in villages varying from populations of several hundreds to hamlets comprising of a handful of dwellings.

The District borders on to the suburbs of Leicester in the north, Rutland to the east, Warwickshire to the west and Northamptonshire to the south.

Located at the heart of England, Harborough District has excellent communication links. The M1, M6 “Catthorpe” interchange connects Harborough District to Felixstowe, Birmingham, London and Edinburgh. The M1 and M6 and A14 are all identified on the Trans-European Network. The A5, A6, A5199 and A47 also run through the district which are a major part of the East Midlands road network and consequently are heavily used.

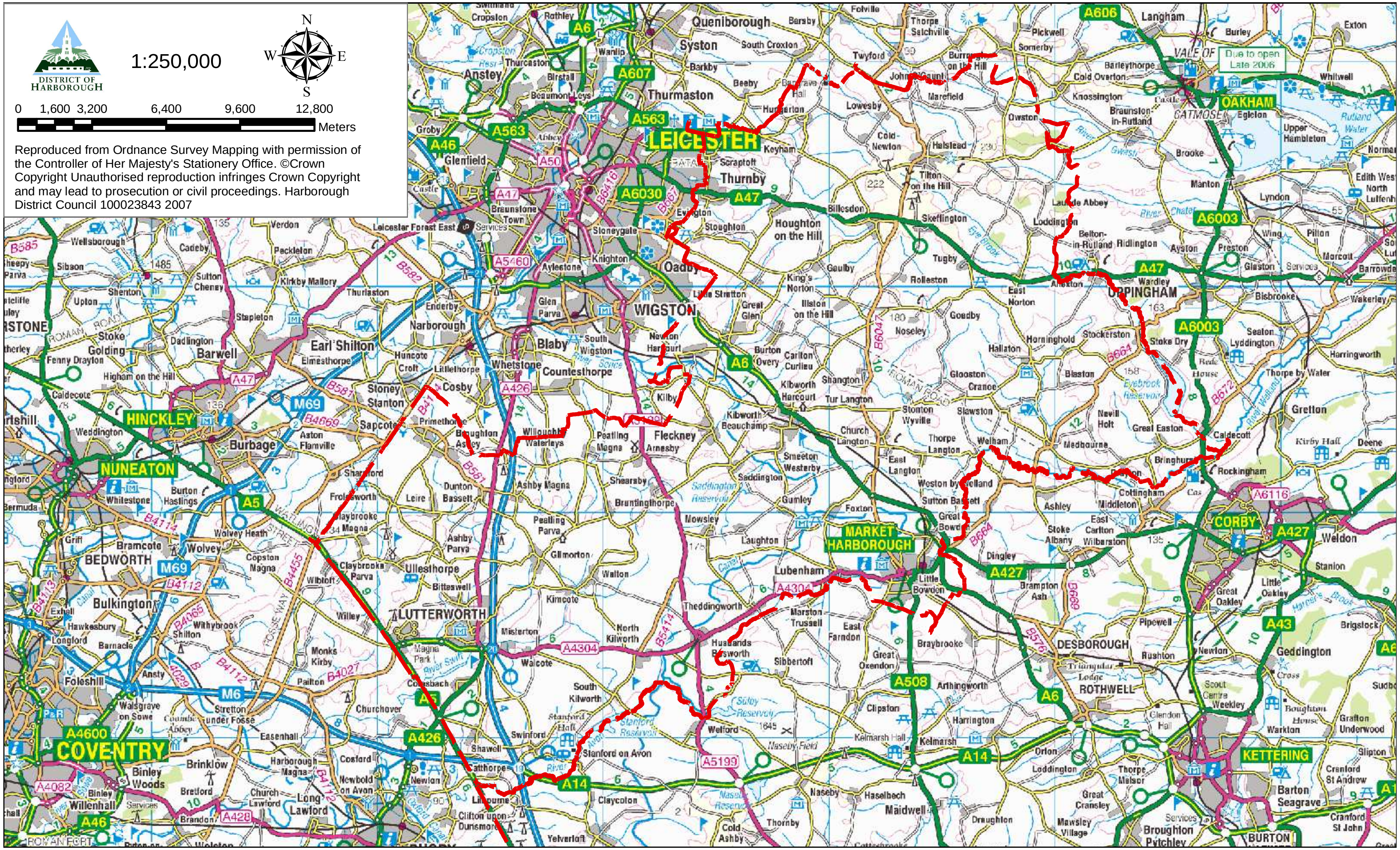
The Midland Main Line railway runs through the district and Market Harborough has an Inter-City station with direct links to London St. Pancras.

These good communication links have encouraged a number of industrial estates to develop, containing medium sized businesses carrying out a

range of coating and spraying activities, moulding, and timber processes. In the south west of the District there is a cluster of mineral activities including sand and gravel extraction, cement batching plants and other associated products.

Although agriculture still plays an important role in the local economy, manufacturing and distribution are of ever increasing importance. At the extreme western side of the District is Magna Park, which is a major warehousing and distribution site, covering approximately 2.3Km^2 (0.9 square miles). A number of the major manufacturers within the UK are located on this site and the 24-hour operation results in a great deal of traffic as most of the products are transported by road. Magna Park is located between the M1 and the A5, therefore a majority of the traffic is directed onto these major roads; however the nearby town of Lutterworth is affected by the increase in road traffic.

Figure. 1. Map of Harborough District



2.2 Purpose of This Report

Harborough District Councils 2009 Update and Screening report found that the annual mean air quality objective for Nitrogen Dioxide (NO_2) is likely to be being exceeded outside of the current AQMA in Lutterworth which was declared in 2001 [6]. If a local authority has reason to believe that an Air Quality Objective (AQO) is, or will be, exceeded then it is required to undertake a Detailed assessment following the method described in the technical guidance LAQM.TG(09) [9]. This report fulfils the council's duty in that respect.

Where a Detailed Assessment finds that an exceedence is likely the assessment should be sufficiently detailed to determine the geographic extent and magnitude of said exceedence.

2.3 Air Quality Objective

The air quality objectives applicable to Local Air Quality Management (LAQM) in England are set out in the Air Quality (England) Regulations 2000 (SI2000/No.0928) [2], the Air Quality (England) (Amendment) Regulations 2002 (SI2002/No.3043) [3], Air Quality Standards Regulations 2007 (SI2007/No.0064)[4], and The Air Quality Standards Regulations 2010 (SI2010/No.1001)[5]. The AQO relevant to this report is shown in Table 1. This table shows the objectives in units of microgrammes per cubic metre μgm^{-3}.

Table 1. Air Quality Objectives relevant to this report included in Regulations for the purpose of Local Air Quality Management in England.

Pollutant	Concentration	Measured as	Date to be achieved by
Nitrogen dioxide	40 μgm^{-3}	Annual mean	31.12.2005

2.4 Summary of Previous Review and Assessments

The Review and Assessment of the local air quality takes place over a number of stages. The First Stage Review and Assessment carried out in Harborough district concluded that further investigation would be required for Carbon Monoxide, Lead, Particulates and Nitrogen Dioxide. The

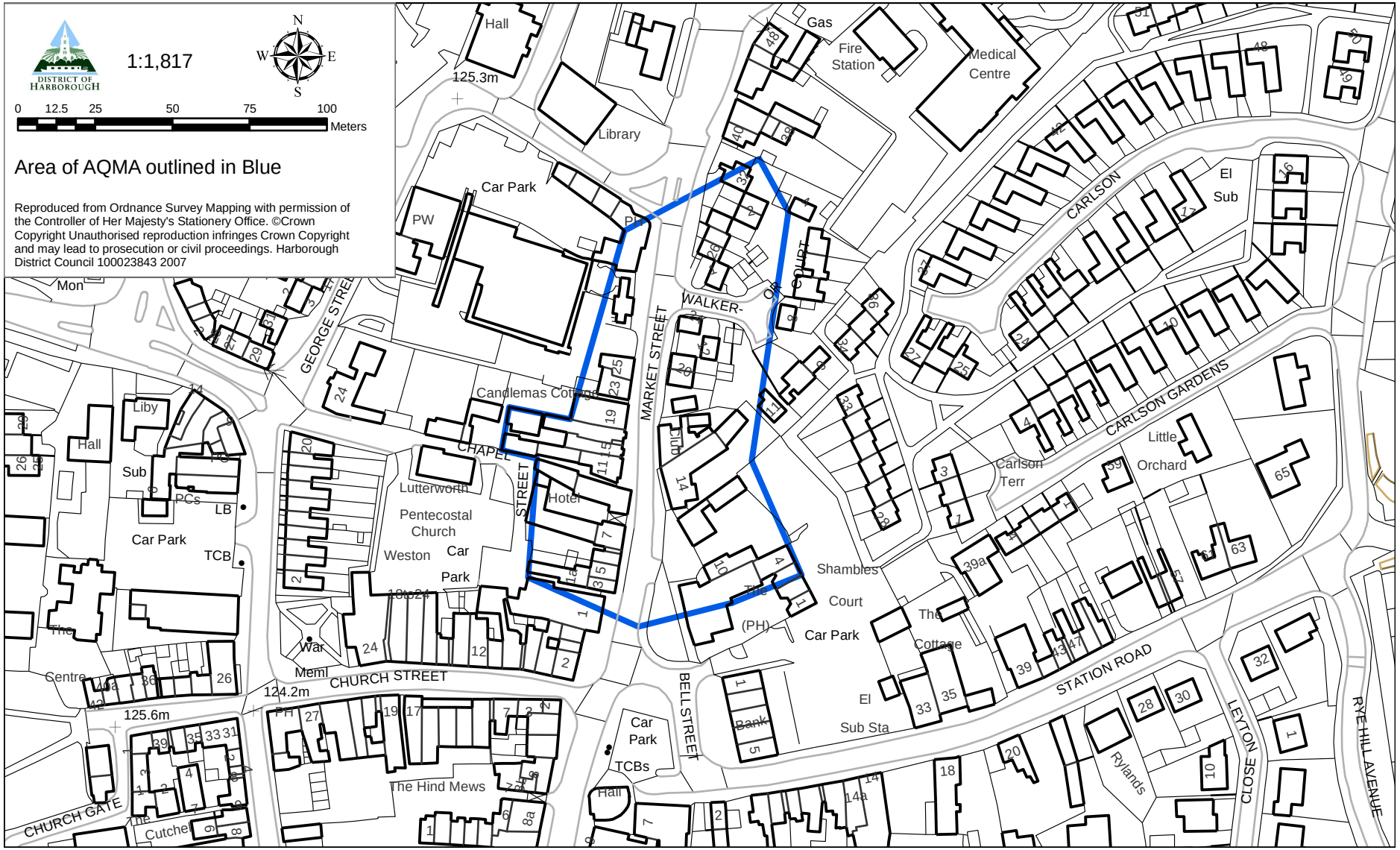
Second and Third Stage review concluded that with the exception of Nitrogen Dioxide all of the National Air Quality Objectives would be met within the appropriate time frame. As it was anticipated that the nation objective for Nitrogen Dioxide was unlikely to be met in Lutterworth Town Centre, an Air Quality Management Area (AQMA) was declared in July 2001 [6]. Figure. 2

Following the declaration of the Air Quality Management Area a Stage 4 assessment was required to give the council the opportunity to supplement any information already gathered in earlier review and assessment work.

The findings of the Stage 4 assessment confirmed that the annual average National Air Quality Objective for Nitrogen Dioxide was unlikely to be achieved. New Monitoring Data confirmed the source of the problem was traffic related, then an Action Plan was developed which was incorporated into the Leicestershire County Council Local Transport Plan.

In 2009 the Council undertook an update and screening assessment which found that generally the air quality in Harborough district is very good; however the air quality in Lutterworth remains high and exceeds the National Air Quality Objective. During 2008 it became apparent that the diffusion tubes in the area were showing a potential exceedence of the objective levels outside of the existing Air Quality Management Area (AQMA). It was necessary to relocate some of the diffusion tubes to confirm the initial findings, and was recommended that a detailed assessment of High Street, Lutterworth and Leicester Road, Lutterworth would be required to confirm whether the existing AQMA needs to be extended.

Figure. 2. Map of AQMA Boundaries



3 Monitoring Data

3.1 Summary of Monitoring Undertaken

As part of Harborough District council's normal monitoring regime the council had several monitoring points in and around the Lutterworth AQMA. However in 2008 it became apparent that the annual mean AQO for NO_2 may be being exceeded outside of the current AQMA. As a result Harborough District Council relocated 2 diffusion tubes to the area north of the AQMA. Details of the Diffusion tube locations are presented in Table 3 and are shown on Figure. 3.

The councils diffusion tube supplier was changed 02 April 2009. Diffusion tubes for the months of January, February and March were analysed by Bureau Veritas Laboratories. Diffusion tubes for the remaining months were analysed by Lambeth Scientific services.

Both laboratories have a defined quality system, which forms part of the UKAS accreditation programme.

Bureau Veritas tubes are prepared by spiking with 20% TEA in water. Lambeth Scientific tubes are prepared by spiking with 50% TEA in acetone

Workplace Analysis Scheme for Proficiency (WASP) rounds 103 to 107 which covered the WASP scheme for October 2008 to October 2009 were all category 1 (good) using the current RPI criteria Lambeth scientific score as acceptable using the new RPI criteria which will come in with round 111 (October 2010). Results as detailed in Table 2

Table 2. Laboratory WASP scores

Laboratory	Performance on basis of RPI, current CRITERIA, best 4 out of the 5 rounds 103-107	Performance on basis of RPI, NEW CRITERIA, best 4 out of the 5 rounds 103-107
Bureau Veritas	Good	Good
Lambeth Scientific Services	Good	Acceptable

Bias adjustment factors are taken from the National Bias Adjustment Factor Spreadsheet [33] The Bias adjustment factor for Bureau Veritas 20% TEA in water is 0.81. The Bias adjustment factor for Lambeth Scientific 50% TEA in acetone is 1.03

As 2 different tube methods and suppliers have been used the most conservative of the 2 bias adjustment factors will be used i.e. 1.03.

3.1.1 Façade Corrections

Some diffusion tubes have undergone a façade correction (presented in Table 5) the corrections were undertaken using the procedure outlined in Box 2.3: Predicting nitrogen dioxide concentrations at different distances from road of the technical guidance [9] (reproduced below for reference).

Box 2.3: Predicting nitrogen dioxide concentrations at different distances from roads

A method has been developed to allow NO_2 measurements made at one distance from a road to be used to predict concentrations at a different distance from the same road. It is appropriate for distances between 0.1 m and 140 m of the kerb.

Step 1: Identify the local background concentration in μgm^{-3}, either from local monitoring or from the national maps published at www.airquality.co.uk. (Note that the background concentration must be less than the measured concentration).

Step 2: apply the following calculation

$$C_z = \left(\frac{C_y - C_b}{-0.5476 \times Ln(D_y) + 2.7171} \right) \times (-0.5476 \times Ln(D_z) + 2.7171) + C_b$$

Where:

- C_z is the total predicted concentration (μgm^{-3}) at distance D_z;
- C_y is the total measured concentration (μgm^{-3}) at distance D_y;
- C_b is the background concentration (μgm^{-3});
- D_y is the distance from the kerb at which concentrations were measured; and
- D_z is the distance from the kerb (m) at which concentrations are to be predicted.
- $Ln(D)$ is the natural log of the number D.

Results derived in this way will have a greater uncertainty than the measured data. Further assistance with this procedure and interpretation of the results can be obtained from the Review and Assessment helpdesk (www.uwe.ac.uk/aqm/review).

Calculator

The equation above is available as a simple calculator (available at http://www.airquality.co.uk /archive/laqm/tools.php). This is set up to work from 0.1 to 50 m from the kerb, as this is the range that is likely to be relevant for Local Air Quality Management (LAQM) work. Kerbside sites should be treated as being at 0.1 m from the kerb. The calculator works for receptors either closer to or further from the kerb than the monitor. The greater the distance between the receptor and monitor, the greater the uncertainty in the derived receptor concentration. It is therefore recommended that if the receptor is further from the kerb than the monitor it should be no more than 20 m away. If the receptor is closer to the kerb, then it should be no more than 10 m from the monitor.

Modified from Box 2.3 page 2-6 of the technical Guidance 2009 [9] (modification are improved layout of equation and insertion of hyperlinks where footnotes are present in the original.)

Figure. 3. Map of Monitoring Locations in and around Lutterworth AQMA (AQMA outlined in Blue NO_2 tube locations in red)

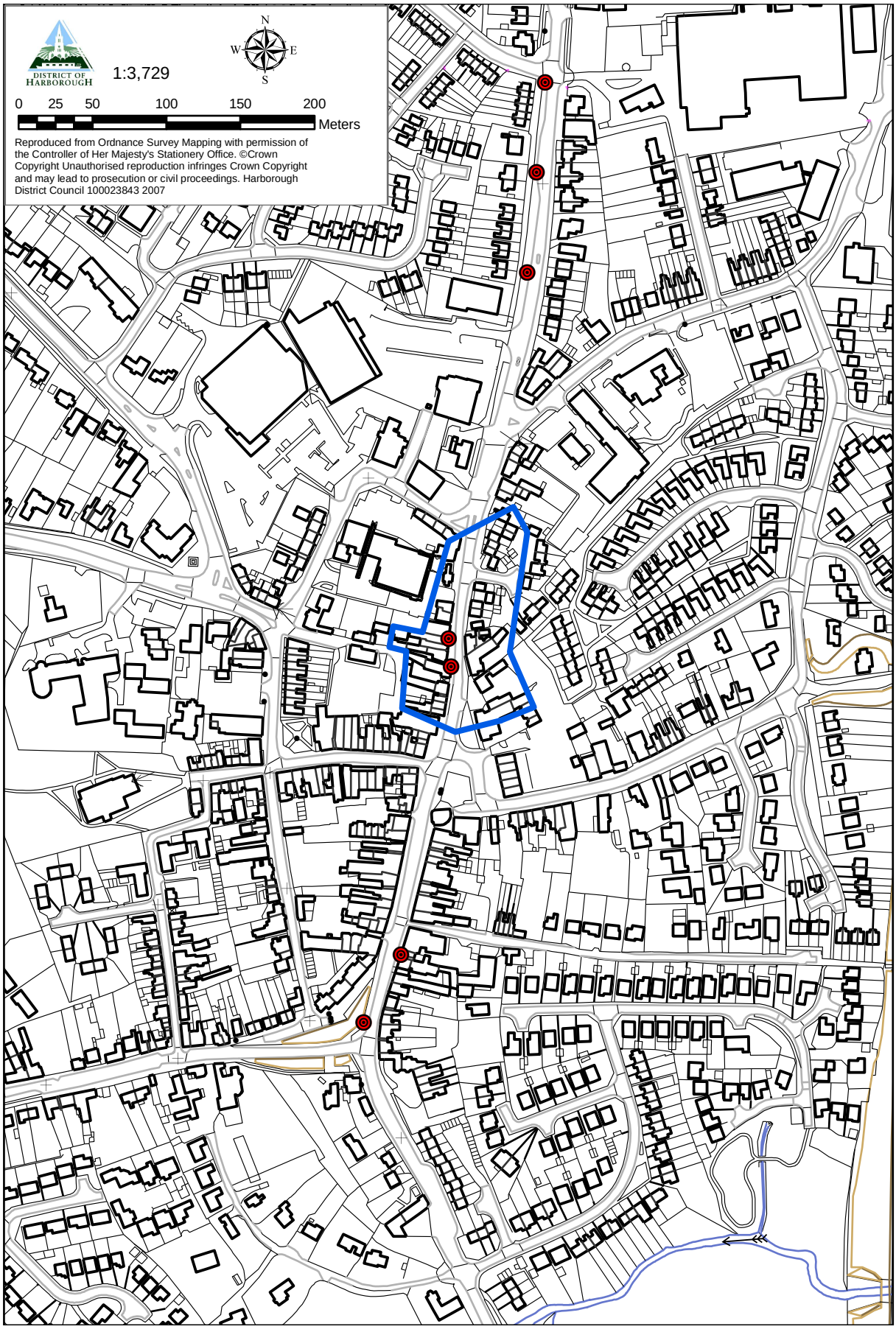


Table 3. Details of Non- Automatic Monitoring Sites

National AQ archive Site details	location	Site Type	Grid Reference		Our Tube No.	Pollutants Monitored	In AQMA ?	Relevant Exposure ? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Worst-case Location ?
			X	Y						
82705- Harborough 01n	Lutterworth Service Shop	Roadside	454475	284560	2	NO_2	Y	0	4.2	Y
83024- Harborough 05n	Lutterworth Regent Road	Roadside	454418	284303	1	NO_2	N	21	4.3	N
84430- Harborough 06n	Monitoring Station	Roadside	454476	284541	5	NO_2	Y	0	2.6	Y
84435- Harborough 11n	Day Nursery	Roadside	454539	284932	10	NO_2	N	9	1.3	N
84448- Harborough 18n	Jazz Hair	Roadside	454443	284348	17	NO_2	N	0	3	Y
86381- Harborough 20n	3 Leicester road Lutterworth	Roadside	454527	284805	4	NO_2	N	13.7	1.9	Y
86382- Harborough 21n	19 Leicester road Lutterworth	Roadside	454551	285430	13	NO_2	N	13.6	3.3	Y

Table 4. Results of Nitrogen Dioxide Diffusion Tubes

Site ID	Location	Within AQMA ?	Data Capture for monitoring period [a] %	Data Capture for full calendar year 2009 [b] %	Annual mean concentrations (µgm^{-3}) [c, d, e, f]				
					2005	2006	2007	2008	2009
82705- Harborough 01n	Lutterworth Service Shop	Y	100%	100%	**48.24**	**55.13**	**55.20**	**50.03**	**59.23**
83024- Harborough 05n	Lutterworth Regent Road	N	67%	67%	**55.96**	**51.69**	**60.03**	**54.25**	**76.61**
84430- Harborough 06n	Monitoring Station	Y	92%	92%	**49.59**	**46.55**	**56.54**	**41.43**	**57.96**
84435- Harborough 11n	Day Nursery	N	100%	100%	**43.84**	**47.68**	**44.40**	**48.62**	**36.39**
84448- Harborough 18n	Jazz Hair	N	92%	92%	**41.72**	**44.54**	**51.68**	**48.90**	**53.47**
86381- Harborough 20n	3 Leicester road Lutterworth	N	100%	100%				**37.46**	**45.58**
86382- Harborough 21n	19 Leicester road Lutterworth	N	100%	100%				**38.53**	**39.48**

a) i.e. data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.
b) i.e. data capture for the full calendar year (e.g. if monitoring was carried out for six months the maximum data capture for the full calendar year would be 50%.)
c) Means should be "annualised" as in Box 3.2 of TG(09), if monitoring was not carried out for the full year. Annualised data highlighted in green
d) Annual mean concentrations for previous years are optional.
e) Values exceeding the AQ objective are shown in red
f) Values exceeding 36µgm^{-3} (1 standard deviation below the AQ objective) are shown in Blue.

Table 5. Façade corrected data

Site ID	Location	Within AQMA?	Estimated Background concentration 2009 (DEFRA 2008) [32].			Annual mean concentrations (μgm^{-3}) [a, b,]	
			X	Y	background NO_2 (μgm^{-3})	Annual bias adjusted mean	Façade corrected Annual bias adjusted mean [c]
83024-Harborough 05n	Lutterworth Regent Road	Y	453500	283500	12.72	**66.94**	**44.29**
84435-Harborough 11n	Day Nursery	N	454500	284500	22.63	31.80	30.33
86381-Harborough 20n	3 Leicester road Lutterworth	N	454500	284500	22.63	**39.83**	34.39
86382-Harborough 21n	19 Leicester road Lutterworth	N	454500	284500	22.63	34.50	32.18

a) Values exceeding the AQ objective are shown in red
b) Values exceeding 36μgm^{-3} (1 standard deviation below the AQ objective) are shown in Blue
c) Calculated following procedure outlined in box 2.3: Predicting nitrogen dioxide concentrations at different distances from roads. Page 2-6 of LAQM.TG(09). Reproduced in **Error! Reference source not found.** for reference

4 Data Analysis

4.1 North of Current AQMA

There are currently 3 Diffusion tube monitoring points located to the north of the AQMA. These are monitoring locations:

- 84435- Harborough 11n, Day Nursery
- 86381- Harborough 20n, 3 Leicester road Lutterworth
- 86382- Harborough 21n, 19 Leicester road Lutterworth

The latter 2 monitoring locations were created following continuous exceedences of the annual mean at the monitoring point 84435 – Harborough 11n as it was envisaged that the exceedences were caused by the volume of traffic passing along Leicester Road, as it is likely there is very little change in the volume of traffic between this location and the AQMA to the south.

The monitoring points 86381- Harborough 20n and 86382- Harborough 21n have shown elevated levels of NO_2 which are approaching the AQO of 40 μgm^{-3}. However following a façade correction in line with section 3.1.1 (see Table 5) the level of NO_2 at the appropriate receptor locations is significantly below the AQO.

The monitoring point 84435- Harborough 11n did not record an exceedence of the AQO for the first time in 5 years it was however within 1 standard deviation from the AQO (36 μgm^{-3}). There is not a relevant receptor located within 10m of the kerb of the junction. Following a façade correction in line with section 3.1.1 (see Table 5) the level of NO_2 at the nearest receptor location is significantly below the AQO.

4.2 South of the Current AQMA

Monitoring locations 83024- Harborough 05n and 84448- Harborough 18n have been in place for several years and have consistently exceeded the annual mean AQO for NO_2 as can be seen in Table 4.

Monitoring location 84448- Harborough 18n is placed on the façade of a property which is a relevant receptor.

5 Conclusions and Proposed Actions

Following the monitoring results in around the AQMA it is apparent that the annual mean AQO for NO_2 is being exceeded along High street Lutterworth to the south of the AQMA.

Leicester Road Lutterworth to the north of the current AQMA is not exceeding the annual mean AQO for NO_2.

As a result it is necessary for Harborough District Council to extend the AQMA, to the south of the area declared in 2001, along High street to include the junction with Rugby Road, and Stoney Hollow. The area to be included in the revised AQMA is shown in Figure. 4.

Following declaration of the proposed area a further assessment will be required; it is recommended that further NO_2 monitoring points be installed along Rugby Road to ensure that areas outside of those identified in this report are not exceeding the annual mean AQO for NO_2. The Proposed monitoring locations are shown in Figure. 5.

Figure. 4. Map of proposed extension to the Lutterworth AQMA

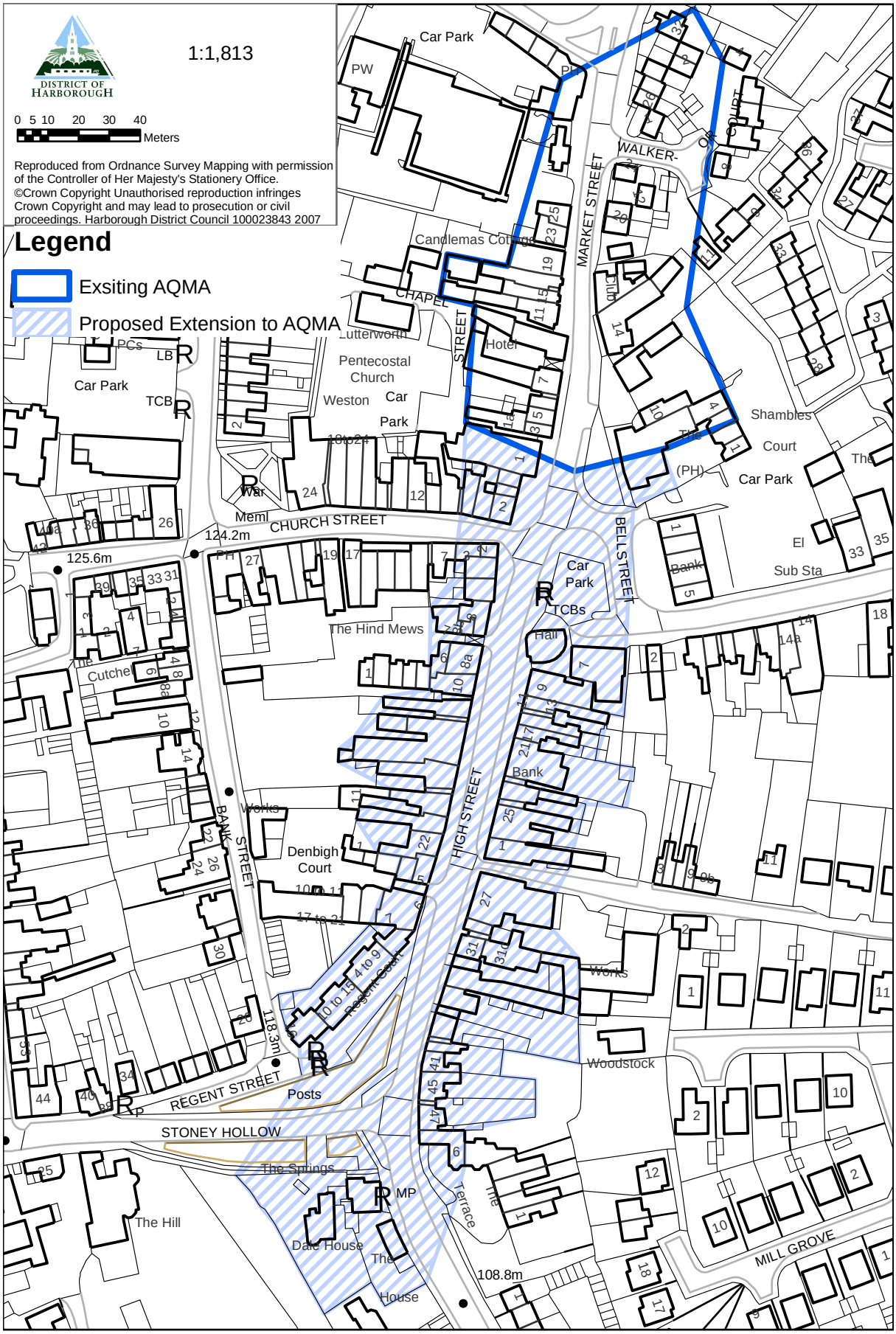
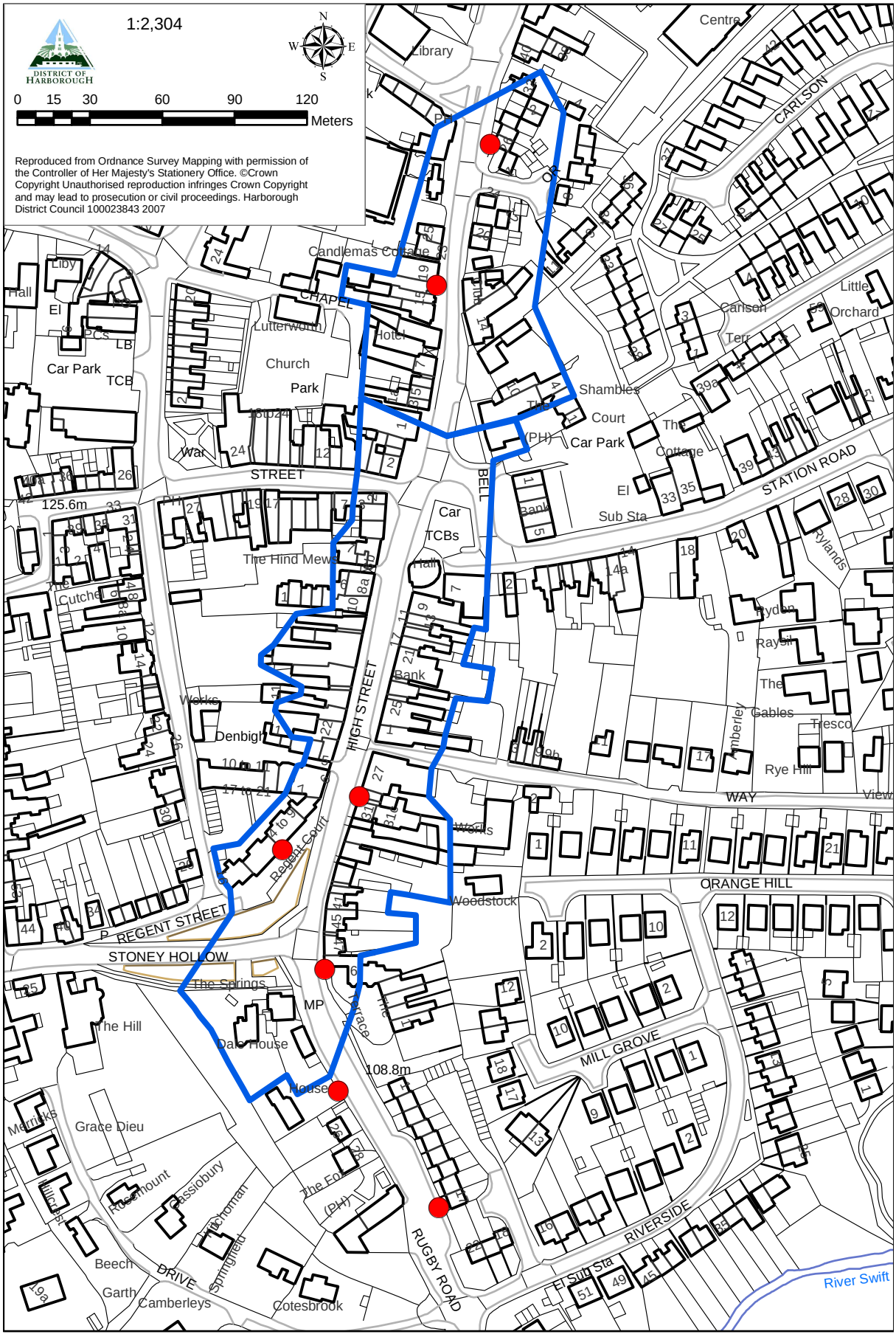


Figure. 5. Map of proposed monitoring locations for further assessment



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