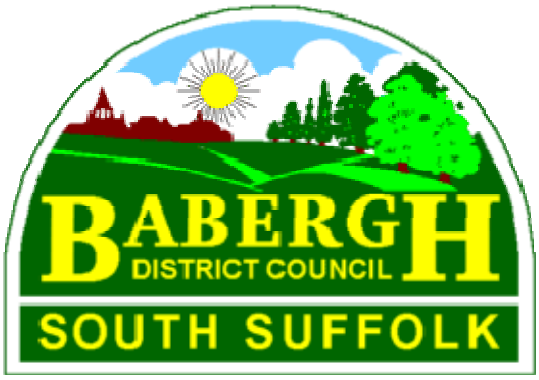

NATURAL AND BUILT ENVIRONMENT

DETAILED ASSESSMENT REPORT

AIR QUALITY IN CROSS STREET AND BALLINGDON STREET SUDBURY

MAY 2008

EXECUTIVE SUMMARY

Part IV of the Environment Act 1995 requires local authorities "from time to time" to review and assess the current, and likely future, air quality in their areas against those (health-based) objectives in the national Air Quality Strategy. Where objectives are not likely to be met then the local authority is required to designate an Air Quality Management Area (AQMA) at the relevant locations. The local authority must then draw up an Action Plan setting out the measures it intends to take in pursuit of the Air Quality Objectives within the area covered by the AQMA.

A review and assessment is the initial step in the formal Local Air Quality Management process. The structure of the reviews and assessment are set out in the guidance made under the Act.

Babergh District Council, in common with all other local authorities, is required to carry out 3-yearly "Updating and Screening Assessments" of air quality across its district. Authorities are also required to produce annual "Progress Reports" in between the 3-yearly assessments in order to report progress on implementing local air quality management.

The Council's last Progress Report, published in May 2007, indicated that there was a risk that the **annual mean objective for nitrogen dioxide** might be exceeded at certain monitoring locations along Cross Street and the northern end of Ballingdon Street in Sudbury. However, it was necessary to obtain more widespread monitoring data to confirm whether a long-term problem existed, to better understand the reasons for the elevated concentrations at the specific locations and to determine the spatial distribution of nitrogen dioxide concentrations along the roads concerned.

The Department for Environment, Food and Rural Affairs' (DEFRA) Local Air Quality Management Policy Guidance states that "At any time during the Progress Reporting years, if a local authority identifies a risk of Air Quality Objective exceedances, then that authority should proceed to carrying out a Detailed Assessment to identify formally the need to designate any AQMAs. Local authorities in this situation should not delay until the next full round of reviews and assessments".

The Council has therefore carried out a Detailed Assessment for nitrogen dioxide along Cross Street and the northern end of Ballingdon Street in Sudbury. The assessment also included Church Street as the Council routinely monitors nitrogen dioxide concentrations on this road. The purpose of the Detailed Assessment was to:

- Assess nitrogen dioxide monitoring results to establish whether they represent a risk of exceedance of the annual mean Air Quality Objective or the annual mean EU Limit Value at locations with relevant exposure;

- If such a risk exists, to determine whether an AQMA needs to be designated and, if necessary, to define the extent of that AQMA.

The technical approach taken for the Detailed Assessment is consistent with DEFRA's Technical Guidance and the Local Air Quality Management review and assessment helpdesk.

The Detailed Assessment concludes the following:

- Current and forward-predicted exceedances of the annual mean Air Quality Objective for nitrogen dioxide and the annual mean EU Limit Value have been identified on Cross Street. No exceedances have been identified on Ballingdon Street or Church Street;

- The spatial extent of exceedances of the annual mean nitrogen dioxide objective can be defined with reasonable certainty and includes areas of relevant public exposure i.e. the front façades of properties on Cross Street from the junction with Church Street to 5/89 Cross Street. It is unlikely that the annual mean Air Quality Objective will be exceeded at the rear façades of properties on Cross Street. However, where there are no (intervening) buildings, the annual mean objective is likely to be achieved at a distance of approximately 10.0m from the pavement on Cross Street.

As a result of the Detailed Assessment, an Air Quality Management Area should be designated for Cross Street in Sudbury. This recommendation is made in accordance with section 83(1) of the Environment Act 1995.

The full conclusions and recommendations of the Detailed Assessment are contained in Section 3 of this report. A proposed AQMA boundary has been drafted for further consultation and is detailed in Section 4.

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CONTENTS

1. INTRODUCTION

1.1 Local Air Quality Management and Detailed Assessments

Part IV of the Environment Act 1995 requires local authorities "from time to time" to review and assess the current, and likely future, air quality in their areas against those (health-based) objectives in the national Air Quality Strategy. Where objectives are not likely to be met then the local authority is required to designate an Air Quality Management Area (AQMA) at the relevant locations. The local authority must then draw up an Action Plan setting out the measures it intends to take in pursuit of the Air Quality Objectives within the area covered by the AQMA.

A review and assessment is the initial step in the formal Local Air Quality Management (LAQM) process. The structure of the reviews and assessment are set out in the guidance made under the Act:

- 3-yearly *Updating and Screening Assessments* to identify those matters that have changed since the last review and assessment, which might lead to a risk of an Air Quality Objective being exceeded. The Council's last Updating and Screening Assessment was published in April 2006.

- Interim annual *Progress Reports* in order to report progress on implementing LAQM. The Council's last Progress Report was published in May 2007.

- Where either an Updating and Screening Assessment or an annual Progress Report identifies a risk that an Air Quality Objective might be exceeded, a *Detailed Assessment* must be carried out. A Detailed Assessment provides an accurate assessment of the likelihood of an objective being exceeded at locations with relevant exposure. This should be sufficiently detailed to allow the designation of any necessary AQMAs.

1.2 Conclusions from 2007 Progress Report

The Council's last Progress Report indicated that there was a risk that the **annual mean objective for nitrogen dioxide (40 micrograms per cubic metre (µg/m^3)**, which applied from 31 December 2005) might be exceeded at certain monitoring locations along Cross Street and the northern end of Ballingdon Street in Sudbury. It was therefore necessary to carry out a Detailed Assessment to obtain more widespread monitoring data to confirm whether a long-term problem existed, to better understand the reasons for the elevated concentrations at the specific locations and to determine the spatial distribution of nitrogen dioxide levels along the roads concerned.

The most important source of nitrogen dioxide at the locations concerned is likely to be road traffic emissions and concentrations are likely to be adversely affected by the “street canyon” nature of certain sections of the roads.

1.3 General Description of the Detailed Assessment Location

Cross Street and Ballingdon Street form part of the A131 southwestern approach into Sudbury and, as such, form part of the Eastern Region Primary Route Network.

Sudbury town centre comprises a medieval network of streets that are often narrow and offer few alternative routes for motor vehicles, particularly through the town’s historic core. Cross Street in particular is very narrow - approximately 4.90m at its narrowest point, with pavements approximately 1.0m wide on either side. Cross Street is lined with (mainly terraced) 2-storey and some 3-storey residential properties abutting the pavement on both sides and so it can be considered as “canyon-like” in nature.

Sudbury has seen major growth in the last 50 years, but still relies on this medieval highway network. Further development to the south and west of the town is constrained by the River Stour and its water meadows. This has resulted in the highway access to Sudbury from the southwest being concentrated in the A131 corridor. Cross Street and Ballingdon Street experience high volumes of traffic passing many houses and historic buildings.

The flow of traffic on the sections of road under investigation is two-way, but this is restricted to one lane at a number of locations by several on-street parking bays and at one location by a build-out constructed to prevent passing vehicles mounting the kerb.

The County Council carried out a 1-week ad-hoc count on Cross Street in February 2006. The weekday, 24-hour (midnight-midnight) average flow was 9828 vehicles. The 7-day, 24-hour flow was 9207 vehicles. The average speed was 24.3mph.

Cross Street leads into Ballingdon Street where the County Council has an Automated Traffic Counter. The counter recorded the following traffic data for 2007:

5-day Annual Average Flow, 24-hours (midnight-midnight) 15286 vehicles;
7-day Annual Average Flow, 24-hours (midnight-midnight) 14510 vehicles;
The average speed was 29.9mph;
The percentage of Heavy Duty Vehicles was 11.7%.

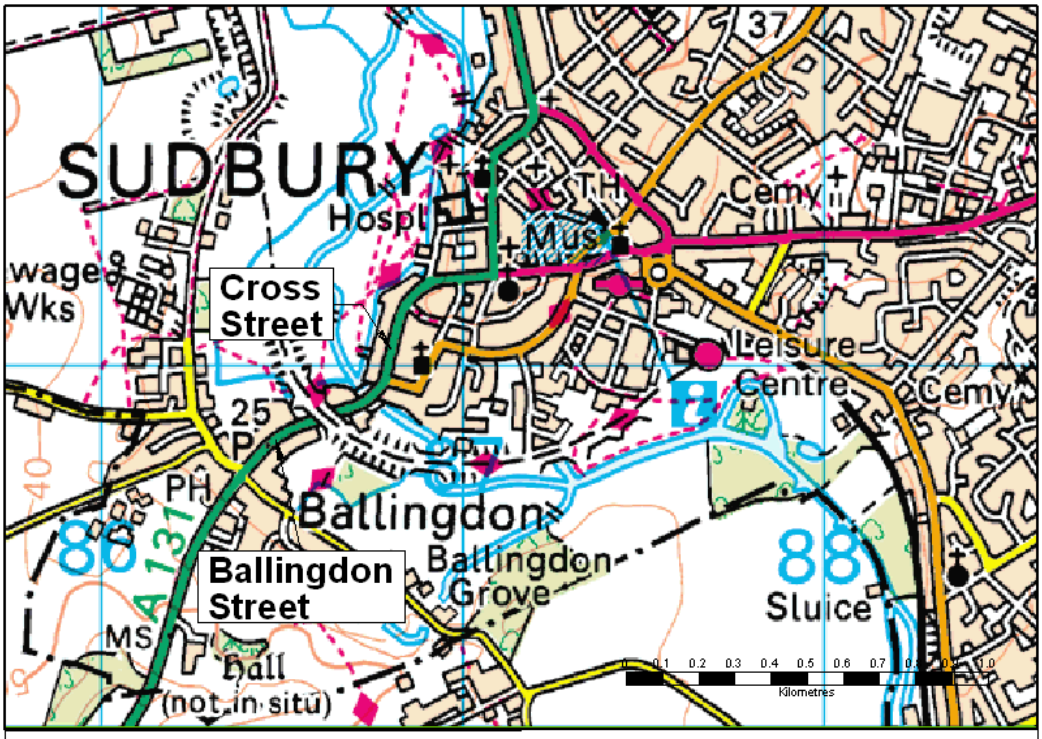
The County Council’s Local Transport Action Plan was being developed on the basis of the provision of a Western Bypass for this part of the A131, with associated measures in the town to deal with

problems of through traffic. However, the bypass has been rejected by Ministers who concluded that the positive transport economic benefits are outweighed by the adverse environmental impact. Ministers indicated that measures should be implemented in the town centre to reduce and manage the impact of high traffic volumes. Ministers recognised that these measures may not meet in full the objectives of the bypass and that the situation should be monitored over a number of years before any further consideration is given to bypassing the town.

The Council's 2006 Updating and Screening Assessment examined all relevant domestic and industrial sources of nitrogen dioxide pollution that may affect the Detailed Assessment area and concluded that no significant point or fugitive emission sources were present. As a result, the overwhelming contribution to pollutant levels is likely to come from exhaust pipe emissions from road transport.

The general location of Sudbury showing the Detailed Assessment area and major road links is shown in Figure 1.

Figure 1: General Location – Detailed Assessment Area



1.4 Air Quality Objectives for Nitrogen Dioxide

Nitrogen oxides, including nitrogen dioxide, are formed from the burning of fossil fuels (oil, coal and their products) e.g. in motor vehicles, power generation and heating. Nitrogen dioxide gas is a respiratory irritant, may exacerbate asthma and possibly increase susceptibility to infections.

The current Air Quality Objectives for nitrogen dioxide are set out in the Air Quality (England) Regulations 2000 and in the Air Quality (England) (Amendment) Regulations 2002. The objectives are recommended by a panel of medical and scientific experts to protect human health. Performance against these objectives is monitored where people are regularly present and might be exposed to air pollution (so called "relevant locations"). Under the LAQM regime, local authorities must work towards achieving the objectives at relevant locations.

Objectives for air pollution are concentrations over a given time period that are considered to be acceptable in the light of what is known about the effects of each pollutant on health and on the environment. They can also be used as a benchmark to see if air pollution is getting better or worse. The Government's Air Quality Objectives for nitrogen dioxide are:

- An annual mean concentration of 40 µg/m^3. This objective applied from the end of 2005;

- A 1-hour mean of 200 µg/m^3, not to be exceeded more than 18 times in a year. This objective applied from the end of 2005.

The first EU Air Quality Daughter Directive also sets limit values for nitrogen dioxide, which have been transposed into UK legislation:

- An annual mean limit value of 40 µg/m^3 to be achieved by 1 January 2010.

- A 1-hour limit value of 200 µg/m^3, not to be exceeded more than 18 times in a year, to be achieved by 1 January 2010.

It should be stressed that there is no statutory requirement on local authorities to assess the likelihood of the EU limit values not being achieved.

2. DETAILED ASSESSMENT METHODOLOGY

2.1 Monitoring Scope and Methodology

A Detailed Assessment should conclude by identifying whether an AQMA should be designated within the area and under section 83(1) of the Environment Act 1995, local authorities have a duty to declare (by means of an official order) an AQMA in those areas where the Air Quality Objectives are **unlikely** to be met in time (or beyond the deadline).

The Detailed Assessment should be based on new, appropriate, air quality monitoring (or modelling), which has been validated and ratified. The assessment should indicate the spatial extent of Air Quality Objective exceedences and indicate a tentative AQMA boundary. An

AQMA boundary should only be set within areas where people might reasonably be exposed.

In general terms, the approach taken to the Detailed Assessment was:

- The retention of existing nitrogen dioxide (duplicate) diffusion tube monitoring sites for improved analysis of long-term trend and continuance of data collection;

- Enhanced monitoring based upon a greater spatial spread of monitoring data obtained from new (duplicate) diffusion tube monitoring sites in order to establish the likely extent of areas of Air Quality Objective exceedances;

- Management of monitoring in accordance with UK national guidance and best-practice;

- A minimum monitoring period of 12 months from commencement of Detailed Assessment (January to December 2007), to account for seasonal variations in pollutant concentrations and to allow for direct comparison with UK Air Quality Objectives;

- Validation of the diffusion tube results and adjustment for laboratory bias using the "national" combined factor determined from co-location studies throughout the UK that have been collated by the DEFRA Review & Assessment Helpdesk.

The above approach places particular emphasis on roadside pollutant concentration measurement, albeit using the diffusion tube method.

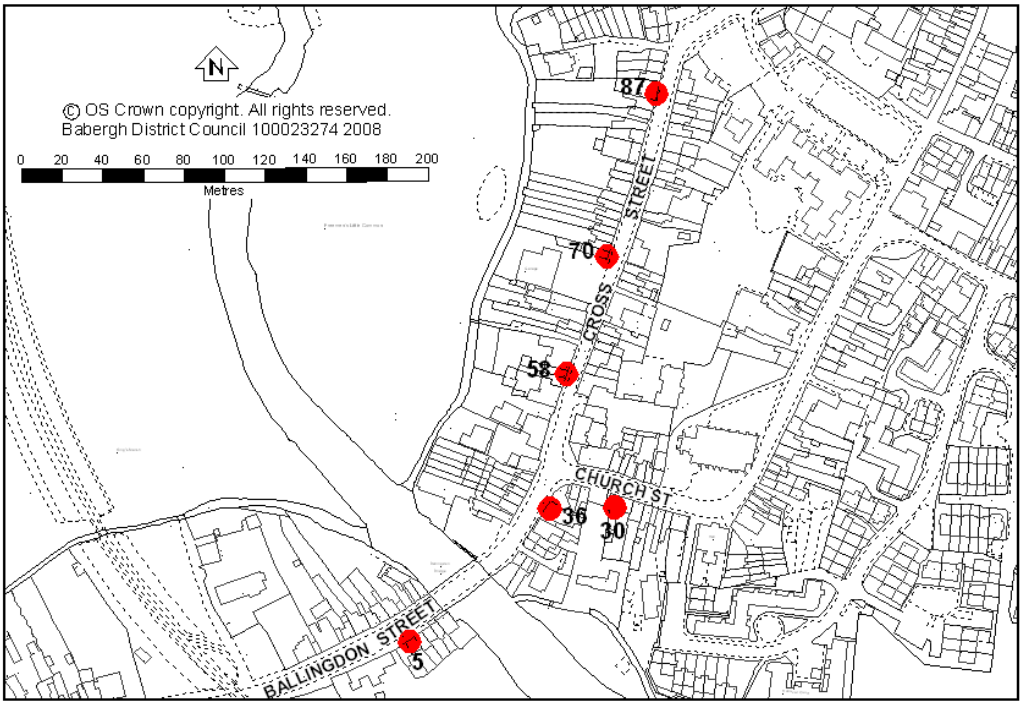
A Detailed Assessment would ideally include monitoring using a continuous (chemiluminescent or equivalent) sampler positioned alongside the road(s) concerned and/or dispersion modelling. However, this was not possible due to the time constraints and resources available to complete the Detailed Assessment and the lack of a suitable location to site a continuous sampler.

Correspondence with DEFRA's Review and Assessment Helpdesk has confirmed that continuous monitoring and/or dispersion modelling are not absolutely essential for the purposes of a Detailed Assessment and that the methodology outlined above is acceptable and fully consistent with the statutory LAQM Technical Guidance (LAQM.TG(03)).

2.2 Previous Nitrogen Dioxide Monitoring

The Council has used diffusion tubes for a number of years to monitor annual mean nitrogen dioxide concentrations at locations on Cross Street, Ballingdon Street and Church Street. The location of these long term monitoring sites is shown in Figure 2.

Figure 2: Monitoring Sites Prior to Detailed Assessment



Full details of the previous monitoring programme can be found in the Council's 2006 Updating and Screening Assessment and 2007 Progress Report, available on the its Internet site: www.babergh.gov.uk). The results were an important component in the decision to undertake a Detailed Assessment based upon predicted exceedances of the annual mean Air Quality Objective.

2.3 Nitrogen Dioxide Monitoring for Detailed Assessment

Previous monitoring has always indicated that, despite the relatively heavy traffic flows, the annual mean Air Quality Objective is not in danger of being exceeded along most of Ballingdon Street. This is due to the fact that Ballingdon Street is relatively wide along most of its length, thereby allowing vehicle exhaust emissions to dissipate rapidly in the atmosphere. However, the Council's 2007 Progress Report identified a risk that the annual mean objective could be being exceeded at the northern-most end of Ballingdon Street: the 2006 annual mean nitrogen dioxide concentration measured at 5 Ballingdon Street was 40 µg/m^3. It was therefore decided that monitoring at this location should be continued as part of the Detailed Assessment in order to confirm whether a long-term problem exists.

Due to the street canyon-like nature of Cross Street, combined with relatively high traffic flows, the Council has closely monitored nitrogen dioxide concentrations along this road.

Suffolk County Council installed a temporary "build-out" at the southern end of Cross Street in July 2005, which was constructed to prevent passing vehicles mounting the kerb and gives priority to southbound

traffic. It was recognised that the restriction of the traffic flow to one lane at this point could have an impact on the localised air quality. The 2006 annual mean nitrogen dioxide concentration measured at 58 Cross Street, which is on the side of the road adjacent the build-out (and therefore furthest from the traffic flow) was 39.0 µg/m^3. Babergh District Council has therefore worked in partnership with the County Council to monitor and assess the impact of the build-out on air quality.

The build-out scheme on Cross Street also highlighted that there could be an impact on air quality where the traffic on this road is effectively reduced to one lane by on street parking bays. The 2006 annual mean nitrogen dioxide concentration measured at 87 Cross Street, which is on the side of the road opposite a parking bay (and therefore closest to the traffic flow) was 59.4 µg/m^3. As part of the Detailed Assessment, an additional five diffusion tube sites were therefore installed along Cross Street to provide widespread coverage and enable a thorough assessment at all locations where the road width is constrained to one lane.

An additional diffusion tube monitoring site was installed on Church Street for comparative purposes and to better define long-term trends.

The diffusion tube monitoring programme encompassed the following:

- All of the monitoring sites comprised duplicate diffusion tubes supplied and analysed by Harwell Scientifics Limited;

- The diffusion tubes were exposed for monthly periods from January to December 2007;

- The diffusion tubes were located at building facades for worst-case assessment where there is relevant exposure;

- All diffusion tubes were sited away from localised sources, or sinks of nitrogen dioxide, or disturbances to airflow e.g. close proximity to heater flues, overhanging buildings or vegetation, air conditioning outlets or extractor vents;

- All diffusion tubes were positioned at a height of between 2.0m and 3.0m;

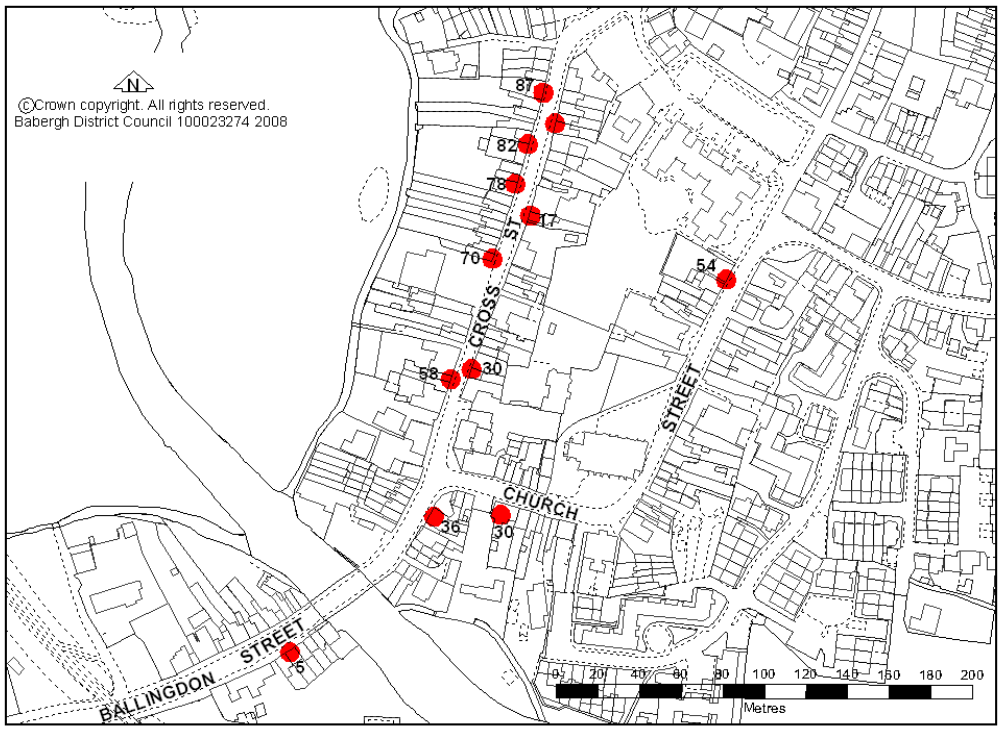
- Monitoring locations with relatively good site security were selected to minimise data loss and enable long-term monitoring;

- All monitoring sites met (as far as possible) all other site selection criteria specified in the DEFRA sponsored “Diffusion Tubes for Ambient Nitrogen Dioxide Monitoring: Practical Guidance” and “Nitrogen Dioxide Tubes for LAQM: Guidance Note for Local Authorities”.

- The locations of the diffusion tube monitoring sites used for the Detailed Assessment are shown in Figure 3.

- Full information in respect of the monitoring techniques is given in Appendix I, including data validation (Quality Control and Assurance) procedures.

Figure 3: Monitoring Sites used for Detailed Assessment



2.4 Monitoring Results

The monthly results of the survey are presented in full at Appendix II. The results are summarised in Table 1. The annual mean results shown have been adjusted for a laboratory bias of 0.81 as determined from co-location study data collected by the University of the West of England (see Appendix II).

Annual mean nitrogen dioxide concentrations for the year 2010 have been predicted using the "Year Adjustment Factors Spreadsheet (v2.2a)" published on the Air Quality Archive by NETCEN, which applies appropriate correction factors to measured data according to whether the site is at a roadside or background location. The Year Adjustment Factor for 2010 is 0.8948.

Table 1: Diffusion Tube Monitoring (Full Results in Appendix II)
Annual Mean Nitrogen Dioxide
2007-Measured and 2010-Predicted Concentrations

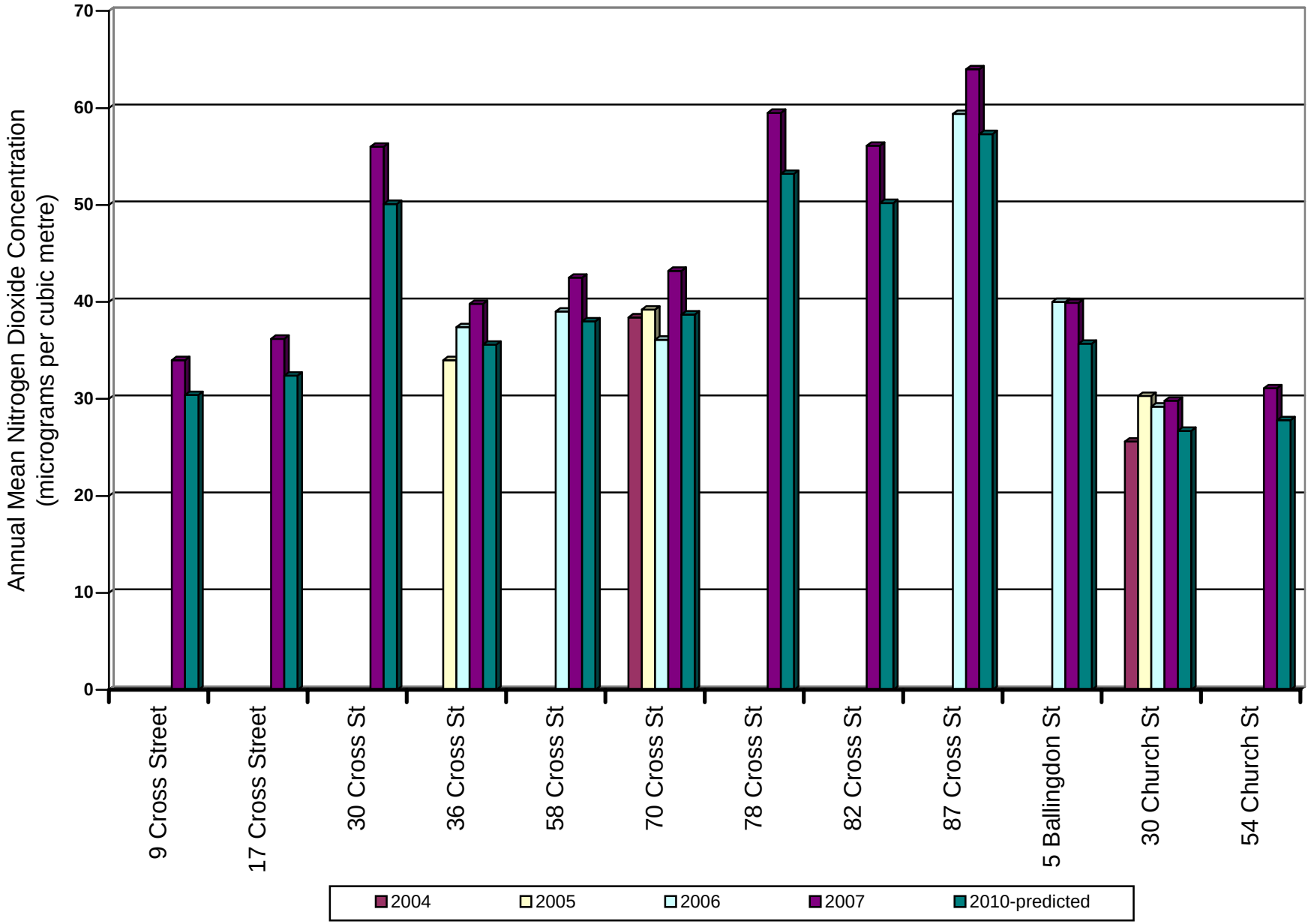
Location	2007-Measured Annual Mean NO_2 ($\mu g/m^3$)	2010-Predicted Annual Mean NO_2 ($\mu g/m^3$)
9 Cross Street, Sudbury	34.0	30.4
17 Cross Street, Sudbury	36.2	32.4
30 Cross Street, Sudbury	56.0	50.1
36 Cross Street, Sudbury	39.8	35.6
58 Cross Street, Sudbury	42.5	38.0
70 Cross Street, Sudbury	43.2	38.7
78 Cross Street, Sudbury	59.5	53.2
82 Cross Street, Sudbury	56.1	50.2
87 Cross Street, Sudbury	64.0	57.3
5 Ballingdon Street, Sudbury	39.9	35.7
30 Church Street, Sudbury	29.8	26.7
54 Church Street, Sudbury	31.1	27.8

Results in red exceed the 2005 Annual Mean Air Quality Objective or the 2010 Annual Mean EU Limit Value

Trends in Nitrogen Dioxide Concentrations

The results from monitoring of nitrogen dioxide concentrations since 2004 are presented in Figure 4.

Figure 4: Trend in Nitrogen Dioxide Concentrations



2.5 Assessment of Monitoring Results Against Air Quality Objectives

2.5.1 Cross Street

In considering these monitoring results, it should be borne in mind that the diffusion tubes were located on building facades for worst-case assessment where there is relevant exposure. Several of these monitoring sites were within 1–2 metres of the kerbside and hence could have been affected by turbulence from passing traffic, which may have caused them to over-estimate the nitrogen dioxide concentration.

The results confirm that the annual mean Air Quality Objective for nitrogen dioxide was exceeded at a number of locations along Cross Street during 2007. It is also predicted (assuming the current traffic flows and road network) that the annual mean objective and the annual mean EU Limit Value will be exceeded in 2010. Predicted concentrations are systematically lower in 2010, due to expected reductions in background concentrations and improvements in vehicle emissions through implementation of national policies.

Based on monitoring at 36 Cross Street (2007-measured annual mean of 39.8 µg/m^3) it would appear that the spatial extent of the exceedances at the southern end of Cross Street is limited to the junction with Church Street. This would be expected because the road widens at this point and the building topography is no longer "canyon-like". The monitoring programme has not defined the northern limit of the exceedances, although concentrations would be expected to fall off significantly beyond 5/89 Cross Street, where the road widens and is no longer "canyon-like".

Within the "street-canyon" part of Cross Street (i.e. between 5/89 Cross Street and the junction with Church Street) it is evident that there is a complex relationship between the building topography and the design of the road, which can have a significant effect on the nitrogen dioxide concentration at any given location.

The annual mean nitrogen dioxide concentration varies above and below the Air Quality Objective along the length of Cross Street. The diffusion tube monitoring sites were very close to the kerbside and so the measurements will only be representative over a very small area, as nitrogen dioxide concentrations close to sources vary considerably, even over short distances.

Some of the monitoring sites were located (approximately) opposite each other on either side of the road, at points where the traffic is restricted to one side of the road (refer to Figure 3). Comparison of the results from these "paired" monitoring sites confirms that nitrogen dioxide concentrations decline rapidly with distance from the flow of traffic:

- A fall of 22.1 µg/m^3 over 10.0m between 82 and 9 Cross Street.

- A fall of 23.3 µg/m^3 over 9.9m between 78 and 17 Cross Street.
- A fall of 13.5 µg/m^3 over 7.5m between 30 and 58 Cross Street.

The highest measured concentration was 64.0 µg/m^3 and given that there will also be vertical dispersion of nitrogen dioxide, it is unlikely that the annual mean Air Quality Objective will be exceeded at the rear façades of properties on Cross Street.

2.5.2 Ballingdon Street and Church Street

The 2007-measured annual mean concentration at 5 Ballingdon Street was 39.9 µg/m^3, which is just below the annual mean Air Quality Objective. Assuming the current traffic flows and road network, concentrations are predicted to decline to a level of 35.7 µg/m^3 by 2010.

Nitrogen dioxide concentrations at both monitoring locations on Church Street were well below the annual mean Air Quality Objective in 2007 and (assuming the current traffic flows and road network) this is predicted to continue.

3. CONCLUSIONS AND RECOMMENDATIONS

3.1 Conclusions

From the results of the Detailed Assessment, it is concluded that:

- Current and forward-predicted exceedances of the annual mean Air Quality Objective for nitrogen dioxide and the annual mean EU Limit Value have been identified on Cross Street. No exceedances have been identified on Ballingdon Street or Church Street.

- The spatial extent of exceedances of the Air Quality Objective can be defined with reasonable certainty and includes areas of relevant public exposure i.e. the front façades of properties on Cross Street from the junction with Church Street to 5/89 Cross Street. It is unlikely that the annual mean Air Quality Objective will be exceeded at the rear façades of properties on Cross Street. However, where there are no (intervening) buildings, the annual mean objective is likely to be achieved at a distance of approximately 10.0m from the pavement on Cross Street.

3.2 Recommendations

Based on this Detailed Assessment and review of the monitoring data, the following recommendations are made:

- **An Air Quality Management Area (AQMA) should be designated on Cross Street in respect of nitrogen dioxide, because the annual mean Air Quality Objective is unlikely to be met. The AQMA should be designated by means of an official Council Order and, as a minimum, should include the**

area identified as the extent of likely exceedance of the annual mean nitrogen dioxide objective.

This recommendation is a statutory obligation under section 83(1) of the Environment Act 1995 following the conclusions of the Detailed Assessment.

- **A draft boundary for the AQMA should be detailed at this stage of the review and assessment process for wider consultation purposes (see Section 4 for the proposed extent of the AQMA).**

  This is not a statutory requirement, but is considered best practice by the Government and as such is an expectation of any Detailed Assessment report under the DEFRA appraisal process.

- **The boundary of the AQMA should be finalised following the public consultation and the formal AQMA Order made within four months of this report.**

  This recommendation is important if an AQMA is to be designated within four months of recognition of the need to designate, as specified in current DEFRA LAQM Policy Guidance, LAQM.PG(03).

- **Following designation of the AQMA, a "Further Assessment" should be carried out within 12 months to confirm the conclusions of this Detailed Assessment and to supplement the information the Council already has. The Further Assessment should apportion the various pollutant source contributions (e.g. from different vehicle classes) and estimate the reduction in emissions required to achieve the objective.**

  This recommendation is a statutory obligation under section 84(1) of the Environment Act 1995.

- **The Further Assessment should incorporate an assessment of whether the 1-hour mean Air Quality Objective for nitrogen dioxide is being exceeded at relevant receptor locations on Cross Street.**

- **The Further Assessment should also consider whether the close proximity of the diffusion tube monitoring sites to the kerbside on Cross Street may have caused the tubes to be affected by turbulence from passing traffic and hence caused them to over-estimate nitrogen dioxide concentrations.**

- **An Air Quality Action Plan should be completed within 18 months of designation of the AQMA. The Action Plan should be developed in partnership with Suffolk County Council's Environment and Transport Department and should set out what measures the authority intends to introduce in pursuit of the nitrogen dioxide Air Quality Objective(s). It**

should also include timescales to indicate by when the measures will be implemented.
The production of an Action Plan is a statutory obligation following designation of an AQMA, under section 84(2) of the Environment Act 1995.

- **The monitoring results for 36 Cross Street and 5 Ballingdon Street were just below the annual mean Air Quality Objective (39.8 µg/m^3 and 39.9 µg/m^3 respectively). The Council should therefore continue to closely monitor annual mean nitrogen dioxide concentrations at these locations.**

4. PROPOSED AIR QUALITY MANAGEMENT AREA BOUNDARY

4.1 Guidance on Setting the Boundaries of AQMAs

The boundaries for an AQMA must include, as a minimum, all areas of exceedance of the relevant Air Quality Objective. However, there are no hard or fast rules for determining the boundaries and an element of judgement is required. In drawing a proposed boundary, the Council has considered the following points from the DEFRA Policy Guidance LAQM.PG(03):

- While the Order needs to designate the parts of the local authority's area to which the AQMA status is to be attached, the DEFRA expected delineation should make appropriate use of relevant physical and geographical boundaries. This may entail designating a wider area than just the area of exceedance of the Air Quality Objective. It may be administratively much simpler and avoids the need to draw artificially precise lines on maps covering the area of exceedance of the Air Quality Objective.

- Wherever the boundaries of the AQMA are drawn, the Action Plan is likely to need to cover a wider area.

In drafting a proposed AQMA boundary, the Council has consulted a DEFRA-recommended toolkit provided by the (former) National Society for Clean Air and Environmental Protection ("Air Quality Management Areas: A Review of Procedures and Practice for Local Authorities"), and has applied local knowledge and professional officer judgement.

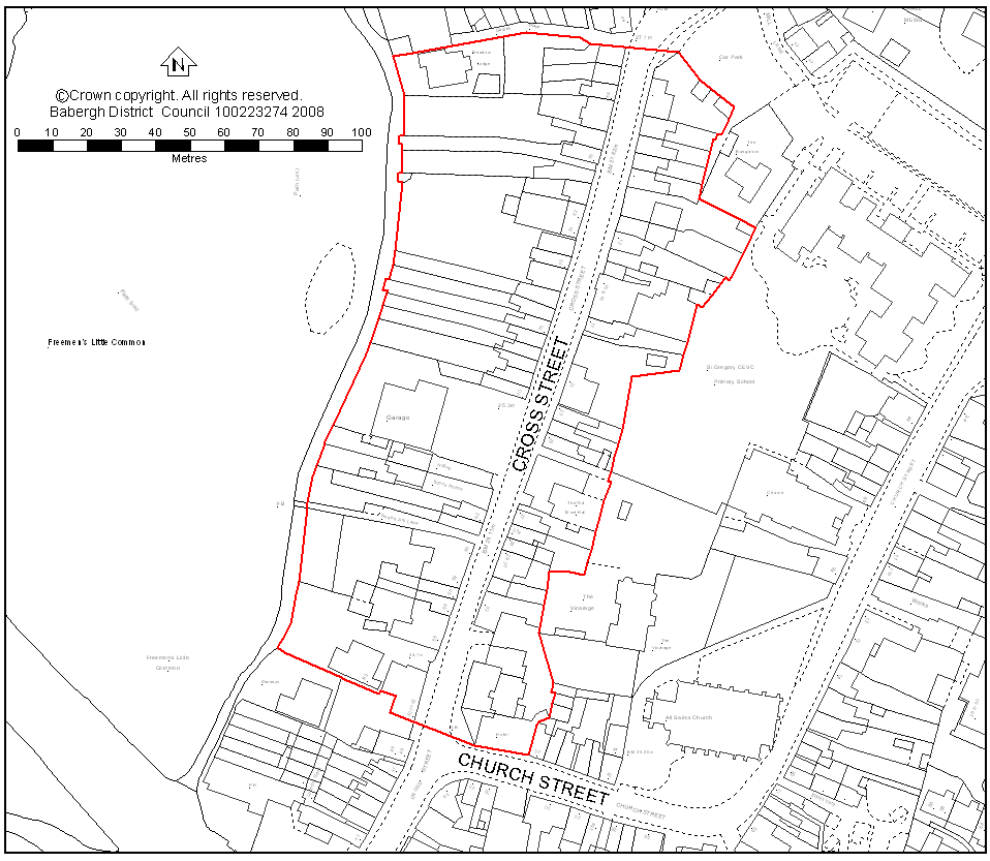
4.2 Proposed AQMA Boundary

The annual mean nitrogen dioxide concentration varies above and below the Air Quality Objective along the length of Cross Street. The diffusion tube monitoring sites were very close to the kerbside and so the measurements will only be representative over a very small area, as nitrogen dioxide concentrations close to sources vary considerably, even over short distances.

It would not be practical to define every specific area of exceedance of the annual mean objective along Cross Street and it is therefore appropriate to designate a single AQMA covering the length of Cross Street from the junction with Church Street to 5/89 Cross Street, where the road widens and is no longer “canyon-like”.

The monitoring results indicate that it is unlikely that the annual mean Air Quality Objective will be exceeded at the rear façades of properties on Cross Street. However, where there are no (intervening) buildings, the annual mean objective is likely to be achieved at a distance of approximately 10.0m from the pavement on Cross Street. However, rather than drawing an “artificial” boundary at this distance on either side of the road, it is proposed that the AQMA should be defined by the boundaries of those properties fronting onto Cross Street. The proposed boundary of the AQMA is shown in Figure 5.

Figure 5: Proposed Boundary of Air Quality Management Area



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APPENDIX I

Babergh District Council Diffusion Tube Monitoring Programme
QA/QC Summary and Calculation of Laboratory Bias

(A) Laboratory QA/QC

All diffusion tubes were supplied and analysed by Harwell Scientifics Ltd, Didcot, Oxfordshire. The tubes were of the Palmes type, manufactured from polyethylene. The absorbent used was a 50:50 mix of Triethanolamine and acetone. The grids were soaked in the mixture and the excess removed by "dabbing" the grids on sorbent paper before assembly.

When selecting a laboratory for the supply and analysis of diffusion tubes, it is important to ensure they follow the correct Quality Assurance and Quality Control procedures. In this respect, Harwell Scientifics Ltd participate in inter-laboratory round-robin exercises, including the Workplace Analysis Scheme for Proficiency, Aquacheck and the monthly doping solution test organised by AEA Technology. AEA Technology co-ordinate the UK National nitrogen dioxide Diffusion Tube Survey, which is subjected to scrutiny through Quality Assurance procedures and inter-comparison. Harwell Scientifics Ltd is also formally accredited to UKAS standards for the analytical method.

(B) Tube handling procedures

Babergh District Council's nitrogen dioxide diffusion tube monitoring is completed in full accordance with the approved guidance issued for the UK nitrogen Dioxide Diffusion Tube Network, although results are not completed as part of the UK network.

Prior to sampling, the nitrogen dioxide tubes are stored in a cool location within the supplied packaging until use. All handling is carried out in a clean, well-ventilated environment. The tube end caps are not removed until the tube has been placed at the monitoring location at the start of the monitoring period.

Once sampling is completed, tubes are recapped with the storage caps and returned as quickly as possible to the clean storage environment. All tubes are then re-enclosed in the supplied packaging and returned to Harwell Scientifics Ltd for analysis.

(C) Data ratification

All reported results are well within the documented limit of detection and uncertainty of the measurement technique and all results are laboratory blank corrected.

All results are examined on a monthly basis to identify any spurious data (e.g. very high or very low data) and any suspect data is investigated further. Nitrogen dioxide monitoring data tends to follow a comparable trend across a number of local monitoring sites, with concentration trend, but not concentration level, similar across all monitoring locations. Therefore, all

results are inter-compared for trend, thus providing further evidence of a suspect individual result if other monitoring locations are following a comparable trend excluding the result in question.

At all times, monitoring sites are regularly assessed to identify changes that may positively or negatively affect the monitoring results. Examples include roadworks, local new combustion sources, road closures and vegetation cover. Site conditions during the relevant monitoring periods are always taken into account during data ratification.

Nitrogen dioxide diffusion tubes provide a cost-effective means of monitoring a wide range of monitoring locations. However, the accuracy of tubes is variable depending on the tube handling procedures, the specific tube preparation/adsorbent mixture and the analysing laboratory.

A study by Air Quality Consultants (AQC) in November 2002 on behalf of DEFRA looked at the various common nitrogen dioxide tube preparations (10%, 20% and 50% TEA in either acetone or water, analysed by the various UK laboratories) and statistically examined the results of nitrogen dioxide diffusion tube/chemiluminescence analyser co-location studies completed by local authorities across the UK. The study concluded that, of the preparation methods studied, all nitrogen dioxide tubes under read and that it was possible to establish a default correction factor specific to the laboratory and preparation method. Since the publication of this report, further work has been conducted on behalf of DEFRA by AQC and the University West of England (UWE) to collate and assess data from nitrogen dioxide co-location studies across the UK.

As a result of the AQC/UWE work, new annual mean correction factors are now available for the specific Harwell Scientifics 50:50 mix of Triethanolamine and acetone combination of tubes used by Babergh District Council. This work is regularly updated as new studies are completed (see UWE Review and Assessment website, Spreadsheet Version Number: 03/08: www.uwe.ac.uk/aqm/review).

For this report, a bias adjustment factor of 0.81 was retrospectively applied to the annual mean diffusion tube results. The correction factor and the data used to derive it are reported below.

Local Authority*	Site Type	Length of Study (months)	Diffusion Tube Mean Concentration (Dm) (µg/m^3)	Automatic Monitor Mean Concentration (Cm) (µg/m^3)	Bias %	Tube Precision	Bias Adjustment Factor (Cm/Dm)
Adur DC	R	12	47	33	45.0	G	0.69
Ashford BC	R	12	45	31	45.8	G	0.69
Gravesham BC	BI	12	35	29	19.9	G	0.83
Gravesham BC	R	12	57	51	11.4	G	0.90
Hambleton DC	R	11	28	22	30.3	G	0.77
Leeds CC	R	12	44	39	11.7	P	0.90
Swale BC	R	11	28	27	5.9	G	0.94
Swale BC	B	12	29	27	6.9	G	0.94
Falkirk Council	R	10	34	25	36.1	G	0.73
Falkirk Council	R	11	49	32	54.0	G	0.65
Falkirk Council	UB	10	26	19	36.7	G	0.73
Cambridge CC	R	12	43	42	4.0	G	0.96
Swansea CC	R	12	37	30	20.5	G	0.83
Swansea CC	R	12	44	36	21.6	G	0.82
Swansea CC	R	12	41	36	14.9	G	0.87
AEA Tech Intercomparison	K	9	129	106	22.2	G	0.82
		Overall Factor (16 studies)					**0.81**

*Diffusion tubes analysed by Harwell Scientific Ltd using 50% TEA in acetone

APPENDIX II

Results of Babergh District Council's Nitrogen Dioxide Diffusion Tube Monitoring in Sudbury, January 2007 – December 2007 (µg/m^3)

Monitoring Location	Grid Reference		Distance from Kerbside (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean	Bias Corrected Mean*
	X	Y															
9 Cross St	586848	241133	1.65	36.4	58.6	44.0	37.1	38.8	40.6	36.4	35.2	37.8	41.1	58.8	54.3	41.9	34.0
9 Cross St	586848	241133	1.65	41.6	44.7	34.4	41.3	38.1	38.9	34.0	33.7	33.8	47.3	46.8	53.0		
17 Cross St	586836	241089	2.00	39.4	51.9	44.9	44.9	40.7	39.7	40.3	37.7	35.5	55.2	48.6	50.4	44.7	36.2
17 Cross St	586836	241089	2.00	36.5	52.2	45.8	45.1	44.5	39.6	34.7	37.9	44.6	54.3	54.7	54.3		
30 Cross St	586808	241015	0.95	65.0	79.6	71.3	75.9	64.5	70.1	70.2	60.4	67.1	81.9	74.4	80.8	69.1	56.0
30 Cross St	586808	241015	0.95	56.7	79.4	67.8	64.8	56.8	69.5	59.6	57.5	59.4	80.3	73.1	72.1		
36 Cross St	586790	240944	1.50	43.9	56.4	56.7	53.3	51.0	41.0	41.9	42.2	45.4	67.1	59.1	60.9	49.2	39.8
36 Cross St	586790	240944	1.50	37.7	56.0	51.8	46.3	46.5	32.7	33.0	41.1	43.8	59.4	56.4	56.4		
58 Cross St	586798	241010	3.30	56.1	55.3	55.0	53.7	52.4	46.5	50.5	49.0	51.0	61.7	61.9	54.5	52.5	42.5
58 Cross St	586798	241010	3.30	53.5	52.8	53.3	50.8	42.5	41.7	48.8	48.3	50.9	57.3	59.1	54.1		
70 Cross St	586818	241068	1.40	46.6	53.5	49.8	54.4	62.2	72.6	36.4	47.4	56.9	63.8	61.4	51.9	53.3	43.2
70 Cross St	586818	241068	1.40	43.4	47.3	52.6	56.0	45.7	73.3	33.3	49.2	45.8	64.9	56.6	54.7		

*** Bias correction of 0.81 applied (refer to Appendix I)**

Continued….

APPENDIX II Continued

Monitoring Location	Grid Reference		Distance from Kerbside (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean	Bias Corrected Mean
	X	Y															
78 Cross St	586829	241104	1.15	54.8	75.3	73.4	75.1	72.9	38.7	62.9	69.0	72.4	96.6	95.1	75.6	73.5	59.5
78 Cross St	586829	241104	1.15	77.0	79.5	78.0	78.1	81.1	46.5	68.5	76.6	60.7	87.6	87.5	80.6		
82 Cross St	586835	241123	1.50	68.9	80.3	67.9	67.1	67.3	62.2	66.3	65.4	64.6	88.2	90.4	77.0	69.2	56.1
82 Cross St	586835	241123	1.50	66.0	72.3	65.2	65.4	64.5	56.1	60.1	65.0	54.2	75.4	84.8	66.9		
87 Cross St	586842	241148	0.90	75.3	89.1	75.5	73.4	93.6	78.0	86.1	70.5	79.9	86.4	93.9	85.4	79.0	64.0
87 Cross St	586842	241148	0.90	75.0	77.2	71.7	65.0	84.6	70.6	76.2	67.7	71.4	76.6	89.5	82.3		
5 Ballingdon St	586721	240879	3.60	53.2	63.5	49.4	44.1	45.5	44.9	40.4	38.3	44.2	56.1	63.9	69.9	49.3	39.9
5 Ballingdon St	586721	240879	3.60	51.1	57.8	48.2	39.0	41.5	42.3	42.5	37.8	38.6	52.6	55.7	63.2		
30 Church St	586822	240952	0.90	33.1	45.6	43.0	32.9	44.1	30.6	30.6	32.7	33.7	43.3	46.1	46.3	36.8	29.8
30 Church St	586822	240945	0.90	35.9	37.7	39.2	36.6	32.6	25.3	26.9	25.7	24.7	42.9	45.4	48.7		
54 Church St	586930	241058	1.70	38.9	43.4	43.4	34.6	39.4	29.5	32.7	30.0	33.7	42.1	58.7	47.6	38.4	31.1
54 Church St	586930	241058	1.70	37.8	39.9	38.9	32.8	31.1	29.2	31.1	27.3	32.5	41.7	58.0	47.0		

* Bias correction of 0.81 applied (refer to Appendix I)