AIR QUALITY MONITORING REPORT
HAMPSTEAD POLICE STATION, LONDON

REC REFERENCE: AQ106285-2

REPORT PREPARED FOR: RIDGE AND PARTNERS ON BEHALF OF THE DEPARTMENT FOR EDUCATION

DATE: JUNE 2019

National Consultancy, Locally Delivered

A CONCEPT LIFE SCIENCES COMPANY

Issue/revision	Issue 1	Revision 1	Revision 2	Revision 3
Remarks	-	Minor Client Amendments		
Date	30/05/2019	14/06/2019		
Prepared by	Josh Jones	Josh Jones		
Signature				
Position	Air Quality Consultant	Air Quality Consultant		
Checked by	Conal Kearney	Conal Kearney		
Signature				
Position	Head of Noise and Air	Head of Noise and Air		
Verified by	Conal Kearney	Conal Kearney		
Signature				
Position	Head of Noise and Air	Head of Noise and Air		
Project Number	AQ106285-2	AQ106285-2		

EXECUTIVE SUMMARY

Resource and Environmental Consultants Ltd was commissioned by the Department for Education to undertake three months of Air Quality Monitoring in support of the proposed development at the former Hampstead Police Station, London.

The proposal comprise the change of use and refurbishment of the site to provide a permanent location for Abacus Belsize Primary School.

The site is located within an area identified by London Borough of Camden as experiencing elevated pollutant concentrations. Subsequently there is the potential that the proposals have the potential to introduce future site users into an area of high pollutant concentrations.

Monitoring of nitrogen dioxide concentrations has therefore been undertaken at several locations in the vicinity of the proposed development site over a total period of three months in order to support the air quality assessment report and verify baseline conditions.

The triplicate monitoring carried out at the Camden kerbside automatic monitoring location indicated that the diffusion tube monitors slightly under predicted concentrations and, as a result, a bias correction factor was applied to all diffusion tube monitoring results.

As a result of the three month monitoring period, the monitoring results indicate that bias adjusted nitrogen dioxide concentrations did not exceed the air quality standards at any location at the development site.

Comparison with the modelled concentrations estimated in the air quality assessment shows that the monitored concentrations are less than the modelled predictions. This indicates that the predictions in the assessment represent a robust estimate of pollutant concentrations at the development site and that any mitigation measures based on the assessment should be sufficient as to make the development acceptable.

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Background

Resource and Environmental Consultants (REC) Ltd was commissioned by the Department for Education to undertake three months of Air Quality Monitoring in support of the proposed development at the former Hampstead Police Station, London.

The proposals comprises the change of use and refurbishment of the site to provide a permanent location for Abacus Belsize Primary School.

1.2 Site Location and Context

The site is located at the former Hampstead Police Station, London at approximate National Grid Reference (NGR): 526880, 185560. Reference should be made to Figure 1 within Appendix I for a location plan.

The proposed development is located within the London Borough of Camden (LBoC) Air Quality Management Area (AQMA) which has been declared for exceedances of the annual mean Air Quality Objective (AQO) for nitrogen dioxide (NO_2) and the 24-hour mean AQO for and particulate matter with an aerodynamic diameter of less than 10µm (PM_{10}). Subsequently, the development has the potential to introduce future site users to poor air quality.

An Air Quality Assessment has been carried out (REC Ref. AQ106285r1) using dispersion modelling in order to quantify pollutant concentrations at the site and assess potential exposure of future users. Concentrations of annual mean NO_2, PM_{10} and $PM_{2.5}$ were predicted across the development site and were subsequently verified using local monitoring results obtained from LBoC.

Exceedances of the annual mean AQO for NO_2 were predicted across areas of sensitive use on the ground floor level. The modelling indicated classrooms on the ground floor (Reception, Year 1 and Year 2) may require mitigation measures to protect future users from elevated pollutant concentrations.

Monitoring of nitrogen dioxide (NO_2) concentrations has therefore been undertaken at several locations in the vicinity of the proposed development site over a total period of three months in order to verify the findings of the assessment.

1.3 Limitations

This report has been produced in accordance with REC's standard terms of engagement. REC has prepared this report solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from REC; a charge may be levied against such approval.

2. MONITORING UNDERTAKEN

2.1 Equipment Used and Laboratory Analysis

Monitoring of NO_2 was undertaken using NO_2 diffusion tubes (20% TEA in Water) supplied by Gradko International Ltd, a UKAS accredited laboratory.

Laboratory analysis of the results was also undertaken by Gradko International Ltd, using colorimetric techniques in accordance with Gradko International Ltd UKAS accredited (ISO/IEC 17025) internal laboratory procedures. The details in these procedures adhere to the DEFRA document 'Diffusion Tubes for Ambient NO_2 Monitoring: Practical Guidance for Laboratories and Users, Issue 1a Feb 2008'[1], issued by AEA Energy and Environment. Reference should be made to Appendix I for full details of tube preparation, analysis methods, quality control procedures and quality assurance employed by Gradko International Ltd.

2.2 Monitoring Locations

Monitors were installed in triplicate at six locations in the vicinity of the development site with the purpose of verifying the modelling predictions and monitors were also installed in triplicate at the Camden Kerbside Automatic Monitoring Station to allow a comparison of passive and automatic monitoring data to be undertaken and a diffusion tube bias correction factor to be derived. Each diffusion tube was left in situ for a period of approximately one month before being sent to Gradko International Ltd for analysis. Monitoring was undertaken over a period of three months, from February 2019 to May 2019.

The monitoring locations at the proposed development site are detailed in Table 1.

Table 1 Diffusion Tube Monitoring Locations

Location	Approximate NGR (m)	
	X	Y
ML1	526896.5	185569.0
ML2	526881.4	185563.2
ML3	526865.8	185538.8
ML4	526847.8	185553.5
ML5	526858.9	185566.8
ML6	526867.8	185572.7
ML7 (Camden Kerbside AURN CD1)	526633.0	184390.0

Reference should be made to Figure 1 and Figure 2 within Appendix II for a graphical representation of the monitoring locations at the development site and at the Camden Kerbside (CD1) automatic

[1] Diffusion Tubes for Ambient NO_2 Monitoring: Practical Guidance for Laboratories and Users. AEA Energy & Environment, 2008.

monitor respectively.

The monitoring periods for all locations are shown in Table 2.

Table 2 Diffusion Tube Monitoring Periods

Location	Month 1		Month 2		Month 3	
	Tube Start	Tube Finish	Tube Start	Tube Finish	Tube Start	Tube Finish
All Locations	09/02/2019	07/03/2019	07/03/2019	05/04/2019	05/04/2019	09/05/2019

2.3 Data Annualisation

DEFRA Technical Guidance LAQM (TG16)[2] Box 7.9 recommends that where the monitoring period is less than 12 months, monitoring data from nearby continuous monitoring sites can be used to annualise the data based on the ratio between the monitored average concentrations for the 12 month period and that for the diffusion tube monitored period. The guidance recommends that between 2 and 4 background monitoring sites should be used for a complete year however as stated above there is one kerbside automatic monitoring site in the vicinity of the site.

Therefore the kerbside site at Camden was used for data annualisation. At the time of writing of this report there was not a complete year of data for 2019 and therefore an alternative approach from that used in from LAQM (TG16)[2] guidance was used. A 12 month period that included the monitoring period from the 2 consecutive calendar years was used. As such, a period from 9th May 2018 to 9th May 2019 was used to obtain annual mean concentrations from the AURN and data was downloaded from the UK Air Quality website[3]. This was compared with the mean continuous monitor concentration from the diffusion tube monitoring periods to obtain the ratio between the automatic and periodic monitoring concentration as shown in Table 3.

Table 3 Annualisation Ratios

Background Site	Diffusion Tube Location	Monitored NO_2 Concentration ($\mu g/m^3$)		Ratio (A_m/P_m)
		Annual Mean (A_m)	Monitoring Period Mean (P_m)	
Camden Kerbside (CD1)	All Locations	50.35	54.90	0.917

The ratio calculated in Table 3 was then applied to the monitored diffusion tube data to annualise the period averages.

[2] Local Air Quality Management Technical Guidance 2016 LAQM (TG16), DEFRA, 2016.
[3] http://www.ukairquality.net/

2.4 Bias Adjustment

It is standard practice to co-locate diffusion tubes with local automatic monitoring sites in order to obtain a bias adjustment factor, in this case the closest automatic site, Camden Kerbside (located at NGR: 526633, 184390) approximately 1.1km south of the development site as indicated in Figure 2 within Appendix II. Therefore it was considered that co-locating diffusion tubes in triplicate at this location would provide a more locally representative bias adjustment factor than using a nationally derived correction.

The bias adjustment factor was calculated for each monitoring period from the ratio of the mean triplicate diffusion tube monitored concentration and the automatic monitored concentration as shown in Table 4 and the calculation s[preadheet are shown in Appendix II.

Table 4 Diffusion Tube Bias Adjustment Factors

Monitoring Period	Mean Triplicate Diffusion Tube NO_2 Concentration ($\mu g/m^3$)	Camden Automatic NO_2 Concentration ($\mu g/m^3$)	Bias Adjustment Factor
Month 1	62	54.34	0.89
Month 2	55	51.47	
Month 3	52	44.74	

The relevant bias adjustment factor derived in Table 4 could then be applied to the annualised data.

3. MONITORING RESULTS

3.1 Results

Table 5 details the monthly average NO_2 concentrations at each of the monitoring locations as provided monthly by Gradko International Ltd.

Table 5 Average Diffusion Tube Monitoring Results

Monitoring Location	Monitored NO_2 Concentration (µg/m^3)						
	Month 1	Month 2	Month 3	Average	Location Average	Annualised Average	Bias corrected Average
ML1a	35.99	29.23	22.23	29.15	23.98	21.99	19.57
ML1b	27.83	15.13	13.61	18.86			
ML1c	30.36	27.63	13.83	23.94			
ML2a	37.55	27.45	19.40	28.13	26.66	24.45	21.76
ML2b	34.52	28.22	20.75	27.83			
ML2c	37.08	14.63	20.32	24.01			
ML3a	38.82	30.73	23.44	31.00	30.88	28.32	25.20
ML3b	40.23	29.03	24.20	31.16			
ML3c	40.11	26.46	24.90	30.49			
ML4a	48.55	38.21	31.44	39.40	38.28	35.10	31.24
ML4b	47.07	37.75	30.04	38.29			
ML4c	42.71	38.05	30.66	37.14			
ML5a	49.45	41.23	29.84	40.17	38.26	35.08	31.22
ML5b	45.43	40.24	24.52	36.73			
ML5c	43.00	41.35	29.25	37.86			
ML6a	44.80	37.99	26.06	36.28	35.13	32.22	28.67
ML6b	42.79	35.26	24.69	34.25			
ML6c	43.10	37.67	23.82	34.86			
ML7a (AURN)	58.42	54.88	52.77	55.35	55.52	50.91	45.31
ML7b (AURN)	63.23	55.57	50.34	56.38			
ML7c (AURN)	57.85	54.01	52.61	54.82			

As shown in Table 5, the monthly diffusion tube NO_2 concentrations do not exceed the annual mean AQO for NO_2 (40µg/m^3) at any location at the development site. Exceedances of the AQO were monitored at the co-located AURN Camden Kerbside site.

3.2 Discussion

An annualisation correction factor of less than 1 was expected as the monitoring was carried out during a 3 month period when nitrogen dioxide concentrations tend to be relatively high when compared against warmer months.

The triplicate monitoring carried out at the Camden Automatic Monitoring location indicated that the diffusion tube monitors slightly under predicted concentrations and, as a result, a bias correction factor was applied to all diffusion tube monitoring results.

The three month monitoring results indicate that average annualised NO_2 concentrations do not exceed the AQO at any locations within or at the boundary of the development site.

Comparison with the modelled concentrations estimated in the air quality assessment shows that the monitored concentrations are less than the modelled predictions. This indicates that the predictions in the assessment represent a robust estimate of annual mean NO_2 concentrations at the development site and that any mitigation measures based on the assessment should be sufficient as to make the development acceptable.

As these results have been annualised and bias corrected they are considered a valid representation for NO_2 concentrations at the development site.

4. CONCLUSION

Resource and Environmental Consultants (REC) Ltd was commissioned by the Department for Education to undertake three months of Air Quality Monitoring in support of the proposed development at the former Hampstead Police Station, London.

The proposals comprise the change of use and refurbishment of the site to provide a permanent location for Abacus Belsize Primary School.

An Air Quality Assessment has been carried out (REC Ref. AQ106285r1) using dispersion modelling in order to quantify pollutant concentrations at the site and assess potential exposure of future users. Exceedances of the annual mean AQO for NO_2 were predicted across areas of sensitive use on the ground floor level. The modelling indicated classrooms on the ground floor (Reception, Year 1 and Year 2) may require mitigation measures to protect future users from elevated pollutant concentrations.

Monitoring of nitrogen dioxide (NO_2) concentrations has therefore been undertaken at several locations in the vicinity of the proposed development site over a total period of three months in order to verify the findings of the assessment.

The triplicate monitoring carried out at the Camden Kerbside automatic monitoring location indicated that the diffusion tube monitors slightly under predicted concentrations and, as a result, a bias correction factor was applied to all diffusion tube monitoring results.

As a result of the three month monitoring period, the monitoring results indicate that corrected NO_2 concentrations did not exceed the AQO at any location. As these results have been annualised and bias corrected they are considered a valid representation for NO_2 concentrations at the development site.

Comparison with the modelled concentrations estimated in the air quality assessment shows that the monitored concentrations are less than the modelled predictions. This indicates that the predictions in the assessment represent a robust estimate of annual mean NO_2 concentrations at the development site and that any mitigation measures based on the assessment should be sufficient as to make the development acceptable.

APPENDIX I SUMMARY OF NO_2 ANLAYSIS

gradko environmental

SUMMARY FOR ANALYSIS OF NITROGEN DIOXIDE PASSIVE DIFFUSION TUBES

Tube Preparation: The preparation of the tubes shall be 50% Triethanolamine / 50% Acetone or 20% Triethanolamine / 80% Water according to the customer's requirements. The preparation procedures adhere to the guidance detailed in the document 'Diffusion Tubes for Ambient NO2 Monitoring: Practical Guidance for Laboratories and Users', Issue 1a Feb.2008 (issued by AEA Energy and Environment).

For technical queries or complaints relating to service, the point of contact is Technical Support: Phone 01962 860331 or e-mail diffusion@gradko.com

For laboratory analysis enquiries the point of contact is the Laboratory Manager or the Laboratory Technician responsible for NO2 analysis: Phone 01962 860331 or e-mail enquiries@gradkolab.com

Analysis Methods: Analysis of the NO2 diffusion tubes is carried out using colorimetric techniques in accordance with Gradko International Ltd UKAS accredited (ISO/IEC 17025) internal laboratory procedures. The details in these procedures adhere to the DEFRA 'Diffusion Tubes for Ambient NO2 Monitoring: Practical Guidance for Laboratories and Users, Issue 1a Feb 2008', issued by AEA Energy and Environment.

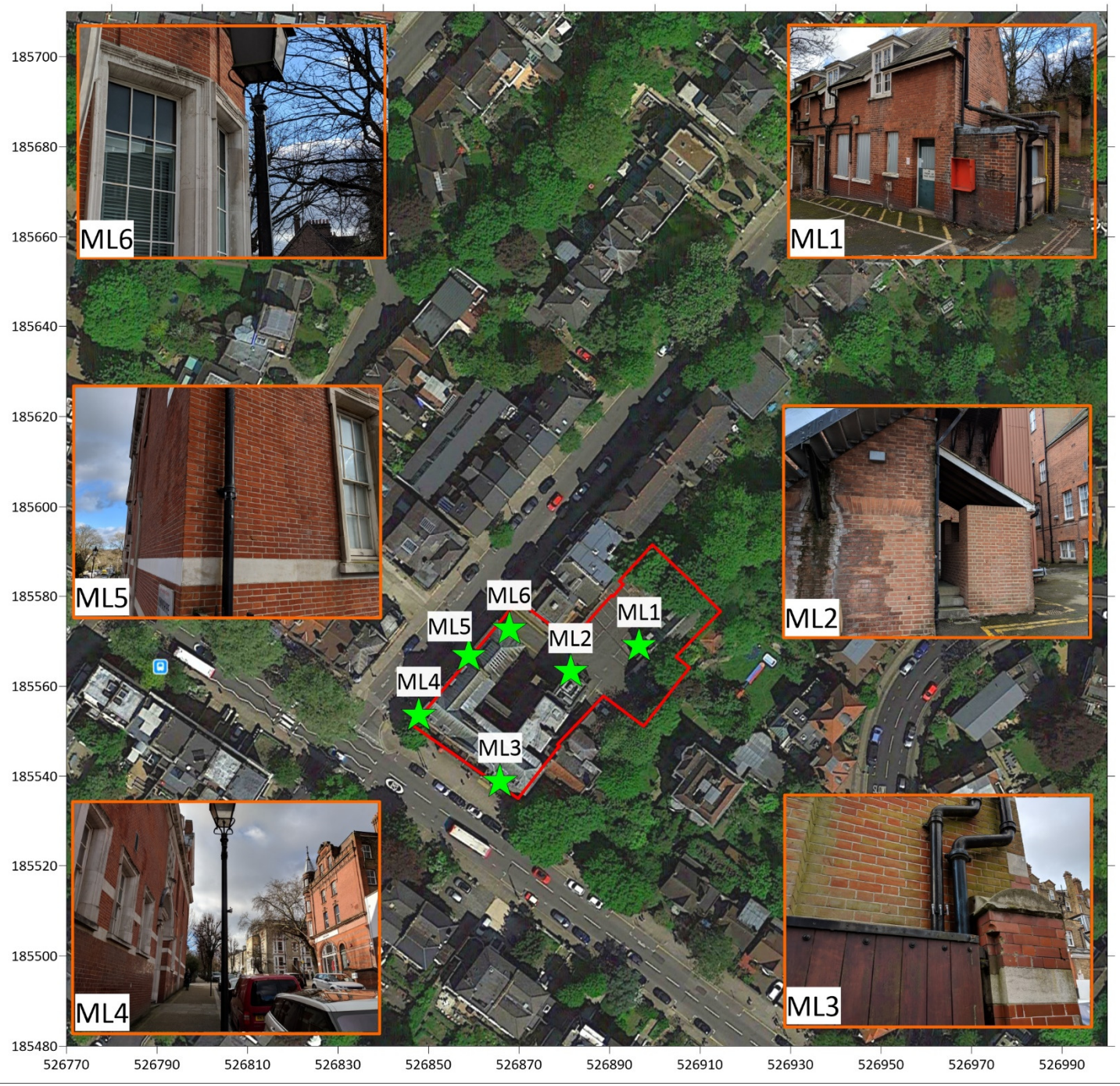
Reporting of the NO2 analysis results is sent electronically to each authority in PDF format or if requested EXCEL format. The report is issued within 10 working days from receipt of the exposed diffusion tubes.

Quality Control Procedures: All tube components are maintained in a high state of cleanliness. New absorbents are prepared by the Laboratory and checked for levels of contamination.

The diffusion tubes are prepared in a dedicated clean laboratory and stored under refrigerated conditions to maintain stability. Each batch of tube components is checked before use.

Method Calibration: A full five to seven (dependant on range of concentrations being measured) point calibration is carried out monthly using NIST certified nitrite standards. The linear graph acceptance is $r^2 = 0.999$. At the start of every batch of tubes analysed, two nitrite standards are run to check the accuracy of the calibration graph, this is repeated at the end of the analysis run. Statistical graphs are maintained using the plots of the daily standard results and the acceptance criteria achieved before an analysis run is made. An instrument calibration is run every two months using certified optical filters plus an annual preventative maintenance programme carried out by an external engineer is in operation.

APPENDIX II FIGURES



Legend

Site Boundary

Diffusion Tube Monitoring Locations

Title

Figure 1

Diffusion Tube Survey Monitoring Locations

Project

Air Quality Assessment
Hampstead Police Station

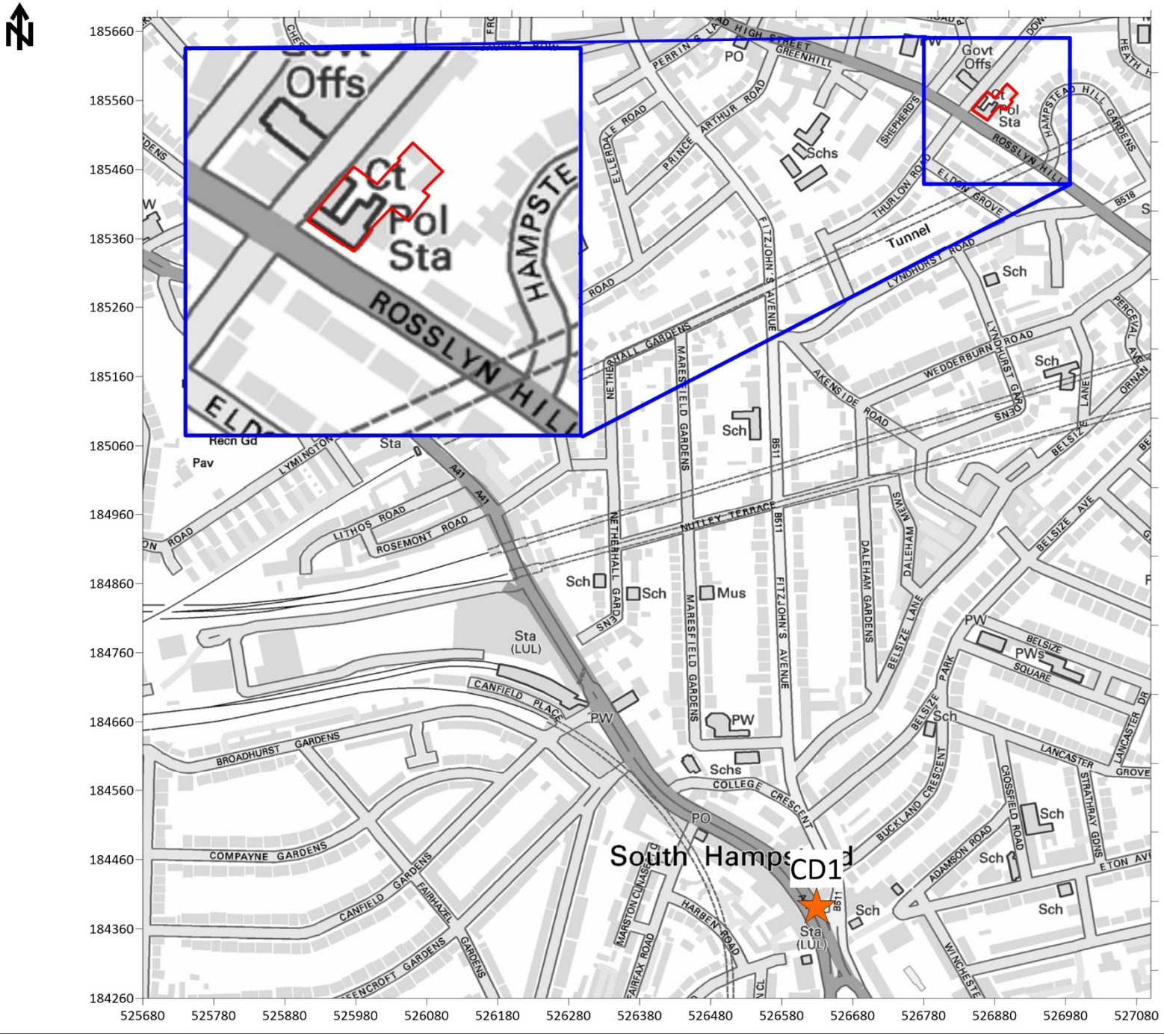
Project Number

AQ106285

Client

Ridge and Partners on behalf of the Department for Education

REC
Resource and Environmental Consultants Ltd
Osprey House, Broadway, Manchester M50 2UE
Tel – 0161 868 1300 Fax – 0161 868 1301
www.recltd.co.uk



Legend

Site Boundary

Automatic Analyser Monitoring Location

Title

Figure 2

Automatic Analyser Monitoring Locations

Project

Air Quality Assessment
Hampstead Police Station, London

Project Number

AQ106285

Client

Ridge and Partners on behalf of the Department for Education

REC
Resource and Environmental Consultants Ltd
Osprey House, Broadway, Manchester M50 2UE
Tel – 0161 868 1300 Fax – 0161 868 1301
www.recltd.co.uk

Legend

Site Boundary

Diffusion Tube Monitoring Locations

Title

Figure 3

Bias Corrected Annual Average NO_2 Diffusion Tube Concentrations

Project

Air Quality Assessment
Hampstead Police Station

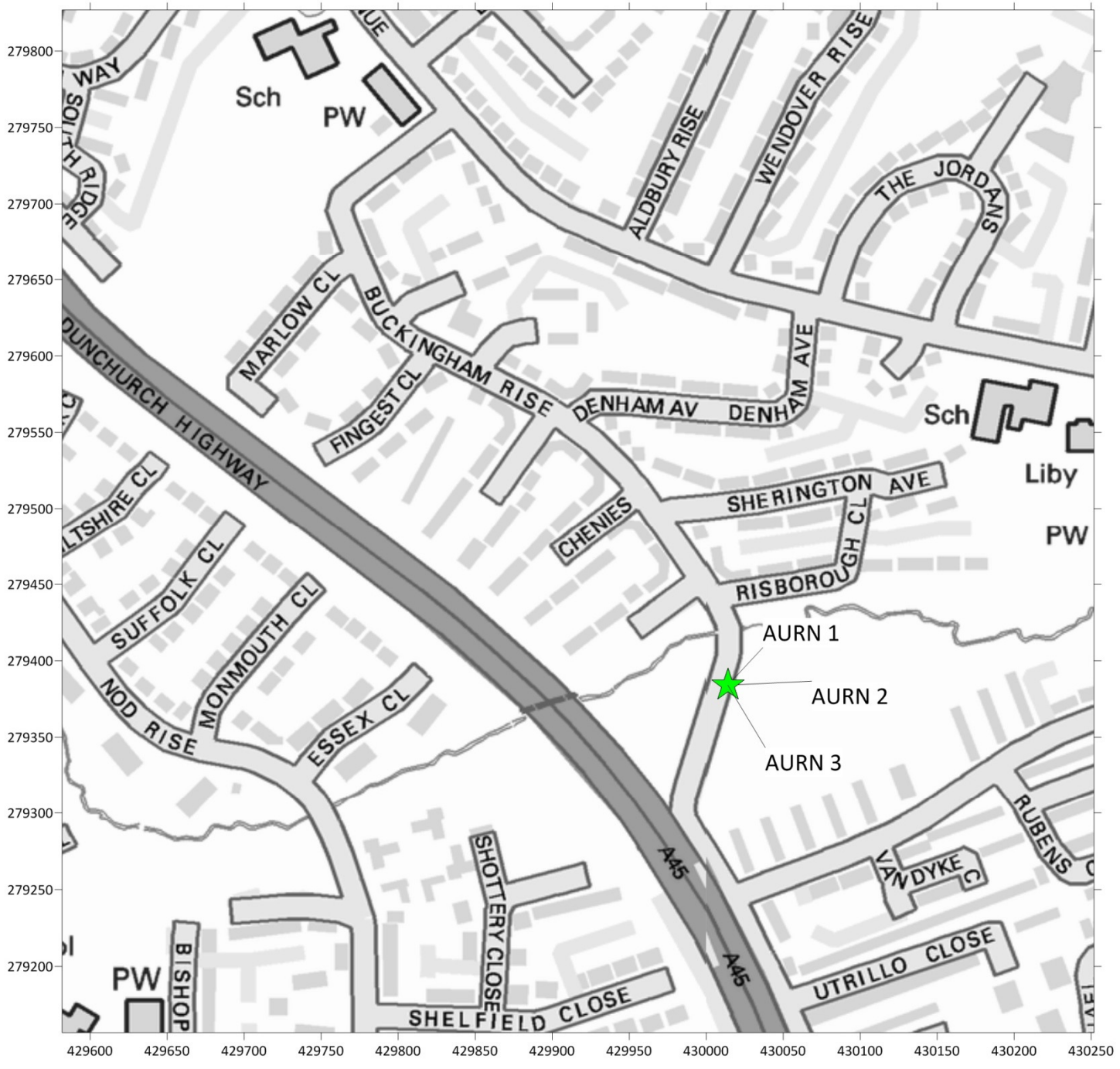
Project Number

AQ106285

Client

Ridge and Partners on behalf of the Department for Education

REC
Resource and Environmental Consultants Ltd
Osprey House, Broadway, Manchester M50 2UE
Tel – 0161 868 1300 Fax – 0161 868 1301
www.recltd.co.uk



Legend

Diffusion Tube Co-location Site

Title

Figure 2

Diffusion Tube Co-location Site

Project

Air Quality Monitoring Report
University Hospital, Clifford Bridge Road, Coventry

Project Number

AQ106257-2

Client

Prime (UK) Developments Ltd

REC
Resource and Environmental Consultants Ltd
Osprey House, Broadway, Manchester M50 2UE
Tel – 0161 868 1300 Fax – 0161 868 1301
www.recltd.co.uk

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements										Automatic Method		Data Quality Check	
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 μgm^{-3}	Tube 2 μgm^{-3}	Tube 3 μgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
1	07/02/2019	07/03/2019	58.4	68.2	57.9	62	5.8	9	14.5	54.34072	99.83974359	Good	Good
2	07/03/2019	05/04/2019	54.9	55.6	54.0	55	0.8	1	1.9	51.47466	98.70689655	Good	Good
3	05/04/2019	09/05/2019	52.8	50.3	52.6	52	1.4	3	3.4	44.7354	94.98164015	Good	Good
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
										Overall survey -->		Good precision	Good Overall DC

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

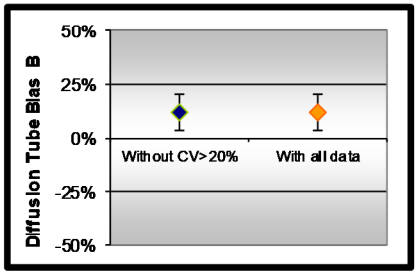
(Check average CV & DC from Accuracy calculations)

Site Name/ ID:

Precision 3 out of 3 periods have a CV smaller than 20%

Accuracy (with 95% confidence interval) without periods with CV larger than 20%	
Bias calculated using 3 periods of data	
Bias factor A	0.89 (0.83 - 0.97)
Bias B	12% (3% - 20%)
Diffusion Tubes Mean:	56 μgm^{-3}
Mean CV (Precision):	5
Automatic Mean:	50 μgm^{-3}
Data Capture for periods used:	98%
Adjusted Tubes Mean:	50 (47 - 54) μgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 3 periods of data	
Bias factor A	0.89 (0.83 - 0.97)
Bias B	12% (3% - 20%)
Diffusion Tubes Mean:	56 μgm^{-3}
Mean CV (Precision):	5
Automatic Mean:	50 μgm^{-3}
Data Capture for periods used:	98%
Adjusted Tubes Mean:	50 (47 - 54) μgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

If you have any enquiries about this spreadsheet please contact the LAQM Helpdesk at: LAQMHelpdesk@uk.bureauveritas.com