HS2

Woore: Air Quality Monitoring Report

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1 Introduction

1.1.1 Following a petition by Woore Parish Council and Woore residents, Ove Arup & Partners Ltd (Arup) was commissioned by High Speed Two (HS2) Ltd to undertake an air quality monitoring survey in and around the village of Woore to inform an appraisal of the air quality information presented in the HS2 Phase 2a Environmental Statement[1] (ES) and the potential air quality impacts of HS2 construction traffic at Woore.

1.1.2 Woore is a village and civil parish in the north east of Shropshire, close to Stoke-on-Trent and Crewe. The main roads through the village are the A525 Newcastle Road/ Audlem Road (east to west) and the A51 London Road (north to south). It is anticipated that the A525 to the east will be used by HS2 construction vehicles accessing work sites during construction of the Phase 2a scheme.

1.1.3 The air quality assessment undertaken at Woore is detailed in the HS2 Phase 2a ES. Updated environmental information, changes to the design and construction assumptions and amendments to the hybrid Bill were published in March 2018 (HS2 Phase 2a Supplementary Environmental Statement (SES) and Additional Provision Environmental Statement (AP ES[2]) and February 2019 (SES2 and AP2 ES[3]). The changes in construction traffic movements as a result of these amendments did not trigger the need for a revision to the air quality assessment undertaken at Woore and therefore no additional assessment was undertaken.

1.1.4 This report is structured as follows:

- Section 2 provides an overview of the air quality assessment undertaken at Woore in the Phase 2a ES;
- Section 3 provides information on the monitoring survey;
- Section 4 presents the results of the monitoring survey; and
- Section 5 presents a comparison of the monitoring data against the baseline assessment assumptions reported in the Phase 2a ES and the conclusions of this report.

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[1] HS2 Ltd (2017), *High Speed Rail (West Midlands – Crewe) Environmental Statement.* Available online at: https://www.gov.uk/government/collections/hs2-phase-2a-environmental-statement

[2] HS2 Ltd (2018), *High Speed Rail (West Midlands – Crewe) Supplementary Environmental Statement and Additional Provision Environmental Statement.* Available online at: https://www.gov.uk/government/collections/hs2-phase-2a-supplementary-environmental-statement-and-additional-provision-environmental-statement

[3] HS2 Ltd (2019), *High Speed Rail (West Midlands – Crewe) Supplementary Environmental Statement 2 and Additional Provision 2 Environmental Statement.* Available online at: https://www.gov.uk/government/collections/hs2-phase-2a-supplementary-environmental-statement-2-and-additional-provision-2-environmental-statement-february-2019

2 ES air quality assessment

2.1 Pollutants of concern

2.1.1 The main pollutants of concern for local air quality in relation to road traffic emissions are nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$). These are the pollutants included in the Phase 2a EIA.

2.1.2 This report focusses on NO_2 since this is the pollutant most likely to cause exceedances of the air quality standards (described in section 2.2) as a result of increases in traffic flows from construction and operation of the Phase 2a scheme. There is no risk of an exceedance of the PM_{10} and $PM_{2.5}$ air quality standards, as concentrations of these pollutants in the area are well below the standards with the addition contribution of construction traffic as a result of the Proposed Scheme.

2.1.3 Defra's daily air quality index[4] includes reference to other pollutants for air quality, such as sulphur dioxide (SO_2) and ozone (O_3). However, there will be no emissions of SO_2 from the Phase 2a scheme and ozone is a regional pollutant, and therefore these are not relevant for the assessment of air quality for this scheme.

2.2 Air quality standards

2.2.1 Air quality limit values and objectives are quality standards for clean air for the protection of human health. In the Phase 2a ES, the term 'air quality standard' has been used to refer to both the English air quality objectives and the air quality limit values introduced in the UK based on European Union (EU) Directives. The standards have been used in the assessment to determine the significance of impacts to local air quality resulting from the Proposed Scheme.

2.2.2 The air quality standards for NO_2 are:

- $40\mu g/m^3$ as an annual mean; and
- $200\mu g/m^3$ as a 1-hour mean (not to be exceeded more than 18 times a year).

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[4] Defra, *Daily Air Quality Index,* https://uk-air.defra.gov.uk/air-pollution/daqi

2.2.3   These are set by EU Directive 2008/50/EC[5] based on recommendations by the World Health Organisation. They have been transposed into national legislation in England by the Air Quality Standards Regulations 2010[6], as amended in 2016[7].

2.3   Method of assessment

2.3.1   The method of assessment is detailed in the HS2 Phase 2a Scope and Methodology Report (SMR) and SMR Addendum, which are provided as part of the Phase 2a ES[8,9] and summarised below. The method of assessment follows best practice guidance, including that of the Institute of Air Quality Management (IAQM), and has been developed since the assessment of air quality undertaken for the HS2 Phase One scheme. Extensive consultation of the SMR was undertaken, including with environmental health departments of local authorities, and a summary of the consultation responses are set out in Section 4.7 of the Phase 2a EIA SMR Consultation Summary Report[10]. Following review of the draft SMR consultation responses, no comments were considered to alter the scope and methodology for air quality.

2.3.2   The air quality assessment has been undertaken following the approach detailed in the Design Manual for Roads and Bridges (DMRB) Volume 11 Section 3 Part 1[11]. This is in common with the assessment of air quality for other large infrastructure projects, especially highway schemes. The assessment takes into account road traffic emissions and other local sources to predict pollutant concentrations at sensitive receptors and compare against the relevant air quality standards.

2.3.3   The traffic thresholds detailed in DMRB Volume 11 Section 3 for local air quality have been used to define an affected road network. These thresholds are:

- a change in daily traffic flows by 1,000 or more as annual average daily traffic[12] (AADT); or

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

[6] The Air Quality Standards Regulations 2010, SI 2010/1001

[7] The Air Quality Standards Regulations 2016, SI 2016/1184

[8] HS2 Ltd (2017), *High Speed Rail (West Midlands – Crewe) Environmental Statement* – Volume 5: Technical Appendices, Environmental Impact Assessment Scope and Methodology Report (CT-001-001)

[9] HS2 Ltd (2017), *High Speed Rail (West Midlands – Crewe) Environmental Statement* – Volume 5: Technical Appendices, Environmental Impact Assessment Scope and Methodology Report Addendum (CT-001-002)

[10] HS2 Ltd (2016), *HS2 Phase 2a: West Midlands to Crewe Environmental Impact Assessment Scope and Methodology Report: Consultation Summary Report.*

[11] Highways Agency (2007), *Design Manual for Roads and Bridges: Volume 11, Section 3 Part 1 HA 207/07 Air Quality*. Available online at: http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section3/ha20707.pdf [Accessed June 2019]

[12] Annual average daily traffic is a measure of the total volume of traffic on a road for a year, divided by 365 days to derive the average daily traffic.

- a change in daily flows of Heavy Duty Vehicles (HDV) by 200 AADT or more; or
- a change in road alignment by 5m or more; or
- a change in daily average speed by 10kph or more; or
- a change in peak hour speed by 20kph or more.

2.3.4   Traffic flows on the highway network have been provided for a 'without scheme' and 'with scheme' scenarios. The data used in the air quality assessment take account of predicted changes in traffic as a result of all committed developments[13] in the area.

2.3.5   Sensitive receptors (residential properties, schools, hospitals, nursing homes) have been selected within 200m of the affected road network and NO_2 concentrations have been predicted using atmospheric dispersion modelling.

2.3.6   The calculation of pollutant concentrations at sensitive receptors near to a road is undertaken using a dispersion model. The model predicts the contribution from vehicle emissions on roads near to a receptor. This road contribution is then added to a background concentration which takes into account all the pollutant sources not explicitly included in the dispersion model. The value for the background concentration is usually taken from a suitable monitoring site located away from a road (referred to as an "urban background site") or from estimates produced by Defra.

2.3.7   Air quality impacts as a result of the Phase 2a scheme have been predicted following guidance from the IAQM and Environmental Protection (UK) (referred to as 'IAQM/EPUK guidance')[14], as shown in Table 1.

2.3.8   Receptors predicted to experience negligible or slight impacts are described as having no significant air quality effects. Receptors predicted to experience moderate or substantial impacts are described as having significant air quality effects.

Table 1: Impact descriptors (adapted from the IAQM/EPUK guidance)

Predicted annual mean concentration in relation to standard	Percent change in concentrations as a result of the Phase 2a scheme in relation to air quality standard			
	1%	2 – 5%	6 – 10%	10%
< 75%	Negligible	Negligible	Slight	Moderate
76 – 94%	Negligible	Slight	Moderate	Moderate

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[13] Committed developments included in the traffic data are those land parcels that have current planning permission or have been allocated in adopted development plans.

[14] Moorcroft and Barrowcliffe et al. (2017), *Land-Use Planning & Development Control: Planning for Air Quality.* London: Institute of Air Quality Management.

Predicted annual mean concentration in relation to standard	Percent change in concentrations as a result of the Phase 2a scheme in relation to air quality standard			
	1%	2 – 5%	6 – 10%	10%
95 – 102%	Slight	Moderate	Moderate	Substantial
103 – 109%	Moderate	Moderate	Substantial	Substantial
> 110%	Moderate	Substantial	Substantial	Substantial

2.4   Existing baseline conditions

2.4.1   The village and civil parish of Woore lies within the Whitmore Heath to Madeley Community Area 4 (CA4). The main sources of air pollution in this community area is road traffic along the M6, the A53 Newcastle Road/A53 Whitmore Road, the A525 Bar Hill Road/A525 Newcastle Road, the A51 London Road and the A5182 Trentham Road.

2.4.2   The A51 London Road is the main road through Pipe Gate, Ireland's Cross and Woore. The A525 Newcastle Road intersects the A51 London Road in Woore by the Cooper Arms.

2.4.3   Estimates of background air quality have been obtained from the Department for Environment Food & Rural Affairs (Defra). Defra provides estimates of background pollutant concentrations across the UK in 1kmx1km squares. These take into account emissions of local sources, such as roads, and emissions transported into an area from further away. The 'background' concentration is what would be left over if all local emission sources were taken out. In rural areas, the background contribution is usually the dominant proportion of the total pollutant concentration.

2.4.4   As presented in the Phase 2a ES assessment, background NO_2 concentrations in the village of Woore, Ireland's Cross and Pipe Gate ranged between 9.7µg/m³ and 10.1µg/m³ in 2015[15]. Later updates of the Defra background data show lower background NO_2 concentrations in this area, ranging from 6.7µg/m³ to 7.1µg/m³ in 2015[16]. The Defra background data are revised periodically due to updates in the underlying information, including emission factors. In all cases, the background NO_2 concentrations are well below the air quality standard of 40µg/m³.

2.4.5   No air quality monitoring is undertaken by Shropshire Council in the vicinity of Woore. The closest monitoring sites are in Madeley to the north-west and Market Drayton to the south-east. However, both of these locations are not representative

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[15] At the time the air quality assessment was undertaken for the Phase 2a ES, background concentrations were available from Defra based on a 2013 base year and projected annually until 2030.

[16] Defra background data based on a 2015 base year and projected annually until 2030.

of the area around Woore and therefore the monitored concentrations there are not comparable with Woore.

2.4.6   Since no air quality monitoring is undertaken in the vicinity of Woore, the Phase 2a ES was based on the Defra background concentrations for this area. Therefore, the results from this HS2 air quality monitoring survey are compared against the Defra backgrounds in Section 4.5 of this report.

2.5   Road traffic emissions

2.5.1   Emissions of road traffic on the A51 London Road and the A525 Newcastle Road are included in the Phase 2a ES assessment. In the SES2 and AP2 ES, there were minor reductions in traffic flows in this area, and therefore remodelling of air quality concentrations was not required.

2.5.2   Table 2 presents the traffic data flows in AADT and heavy goods vehicles (HGV) along the main roads through Woore, Pipe Gate and Ireland's Cross. The data is presented for the 'without scheme' and 'with scheme' scenarios, along with the change due to the Phase 2a scheme. The data is also presented for the Phase 2a ES assessment and the reduced traffic flows in the SES2 and AP2 ES. The location of these road links is shown in Figure 1.

Table 2: Construction traffic data used in the air quality assessment in the Phase 2a ES

Environmental Statement	AADT			HGV		
	2020 without scheme	2020 with scheme	Change	2020 without scheme	2020 with scheme	Change
AQ-168[17]: A51 At Willoughbridge (between Maerway Lane and B5026 London Road)						
Phase 2a ES	4,193	4,637	444	325	630	305
SES2 and AP2 ES	4,193	4,400	207	96	228	132
AQ-169: A51 London Road (between B5026 London Road and Newcastle Road)						
Phase 2a ES	7,077	7,521	444	450	755	305
SES2 and AP2 ES	7,077	7,284	207	193	325	132
AQ-170: A525 Newcastle Road (between Gravenhunger Moss and London Road)						
Main ES	2,713	3,073	360	360	654	294
SES2 and AP2 ES	2,713	2,863	150	41	173	132
AQ-171: A51 London Road (between A525 Newcastle Road and Yew Tree Lane)						
Main ES	5,837	6,000	163	375	448	73

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[17] The AQ reference (for example AQ-168) is the identification of the road in the air quality model. The ID corresponds to the traffic data information presented in the HS2 Phase 2a Background Information and Data (BID) BID-AQ-002-000, which is available at: https://www.gov.uk/government/publications/hs2-phase-2a-background-information-and-data-air-quality-assessment.

Environmental Statement	AADT			HGV		
	2020 without scheme	2020 with scheme	Change	2020 without scheme	2020 with scheme	Change
SES2 and AP2 ES	5,837	5,914	77	146	158	12

Figure 1: Modelled roads in air quality assessment in the Phase 2a ES
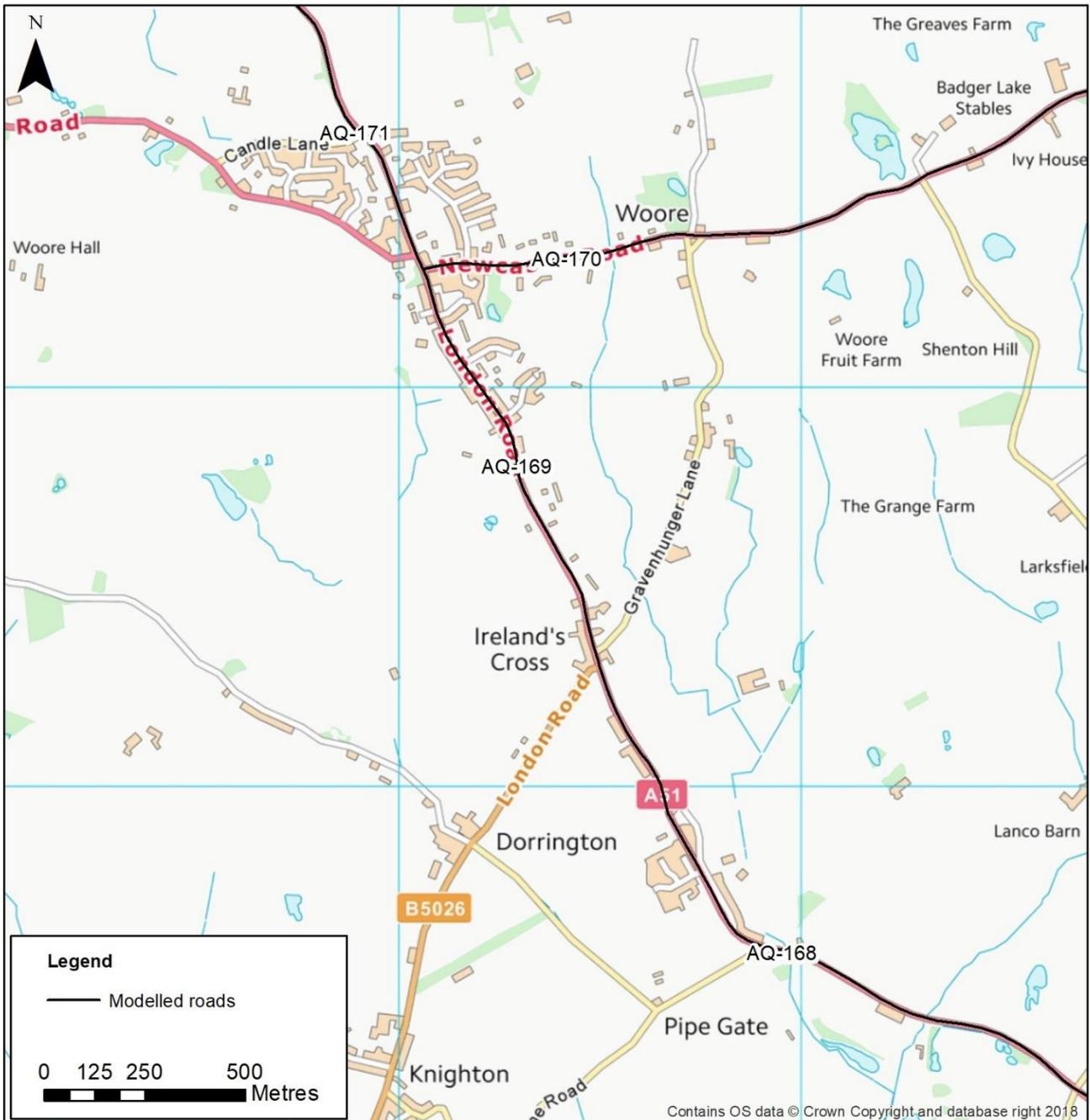
2.6 Air quality impacts

2.6.1 There are six receptors reported in the Phase 2a ES that are located in this area: four receptors in the village of Woore; one receptor along the A51 London Road between Woore and Ireland's Cross; and one receptor along the A51 London Road between Ireland's Cross and Pipe Gate. These have been selected at worst case locations near the assessed roads. Concentrations further away from the roads will be lower than those predicted at these roadside sensitive receptors.

2.6.2 The predicted NO_2 concentrations during construction of the Proposed Scheme at these receptors are presented in Table 3 (taken from the Phase 2a ES). Their locations are shown in Figure 2.

2.6.3 It can be observed that NO_2 concentrations are predicted to be between 9.1µg/m^3 and 11.1µg/m^3 in 2020 which is well below the air quality standard of 40µg/m^3. The change in NO_2 concentrations due to construction of the Phase 2a scheme in this area is predicted to be up to 0.2µg/m^3 in Woore. Negligible impacts are predicted at all receptors and therefore no significant effects are anticipated during construction of the Phase 2a Scheme.

Table 3: Predicted NO_2 concentrations (µg/m^3) at sensitive receptors during construction

Receptor ID[18]	Description	OS coordinates	2020 without scheme (µg/m3)	2020 with scheme (µg/m3)	Change (µg/m3)	Impact	Effect
4-C-H21	The Square, Woore	373088, 342289	10.9	11.1	0.2	Negligible	Not significant
4-C-H30	Holly Cottage, Pipe Gate	373661, 341023	9.0	9.1	0.1	Negligible	Not significant
4-C-H31	The Chalway, London Road, Woore	373115, 342168	10.4	10.5	0.1	Negligible	Not significant
4-C-H38	Rose Cottage, Newcastle Road, Woore	373623, 342355	9.1	9.2	0.1	Negligible	Not significant
4-C-H39	Oak Cottage, London Road, Ireland's Cross	373377, 341655	9.9	10.0	0.1	Negligible	Not significant
4-C-H40	Nantwich Road, Woore	373008, 342385	9.6	9.6	< 0.1	Negligible	Not significant

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[18] The receptor ID is a unique identification number for each sensitive receptor included in the air quality assessment.

Figure 2: Location of sensitive receptors in air quality assessment in the Phase 2a ES
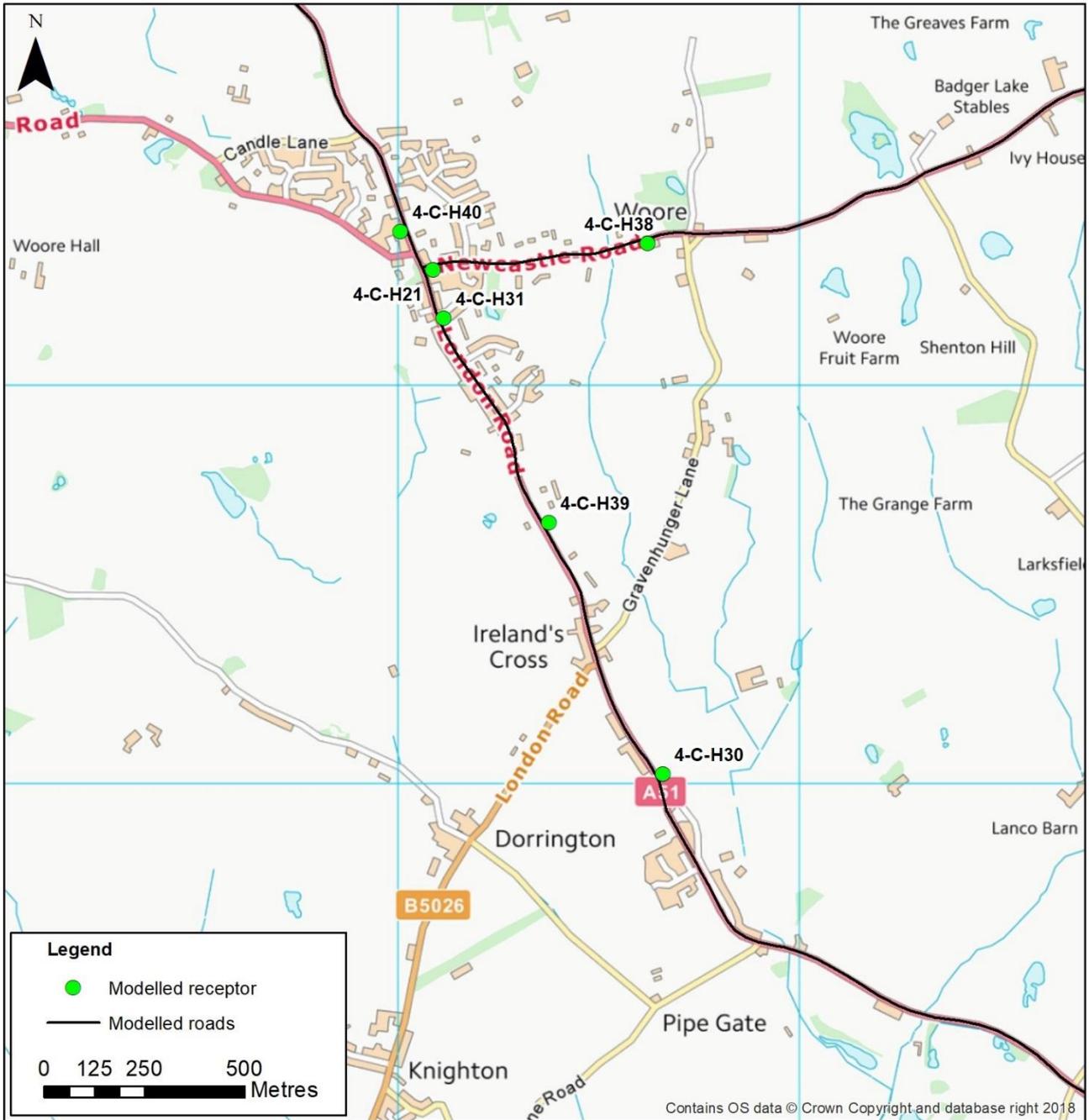
3   Monitoring survey

3.1.1   Monitoring of NO_2 concentrations at Woore was undertaken for 12 months, between September 2018 and August 2019. The measurements were obtained using Palmes diffusion tubes (Figure 3), which is a passive monitoring method widely used in the UK for measuring ambient concentrations of NO_2. The diffusion tubes consist of a small plastic tube containing a chemical reagent which absorbs the pollutant (in this case NO_2) to be measured directly from the air.

Figure 3: Palmes diffusion tubes for measuring NO_2 concentrations
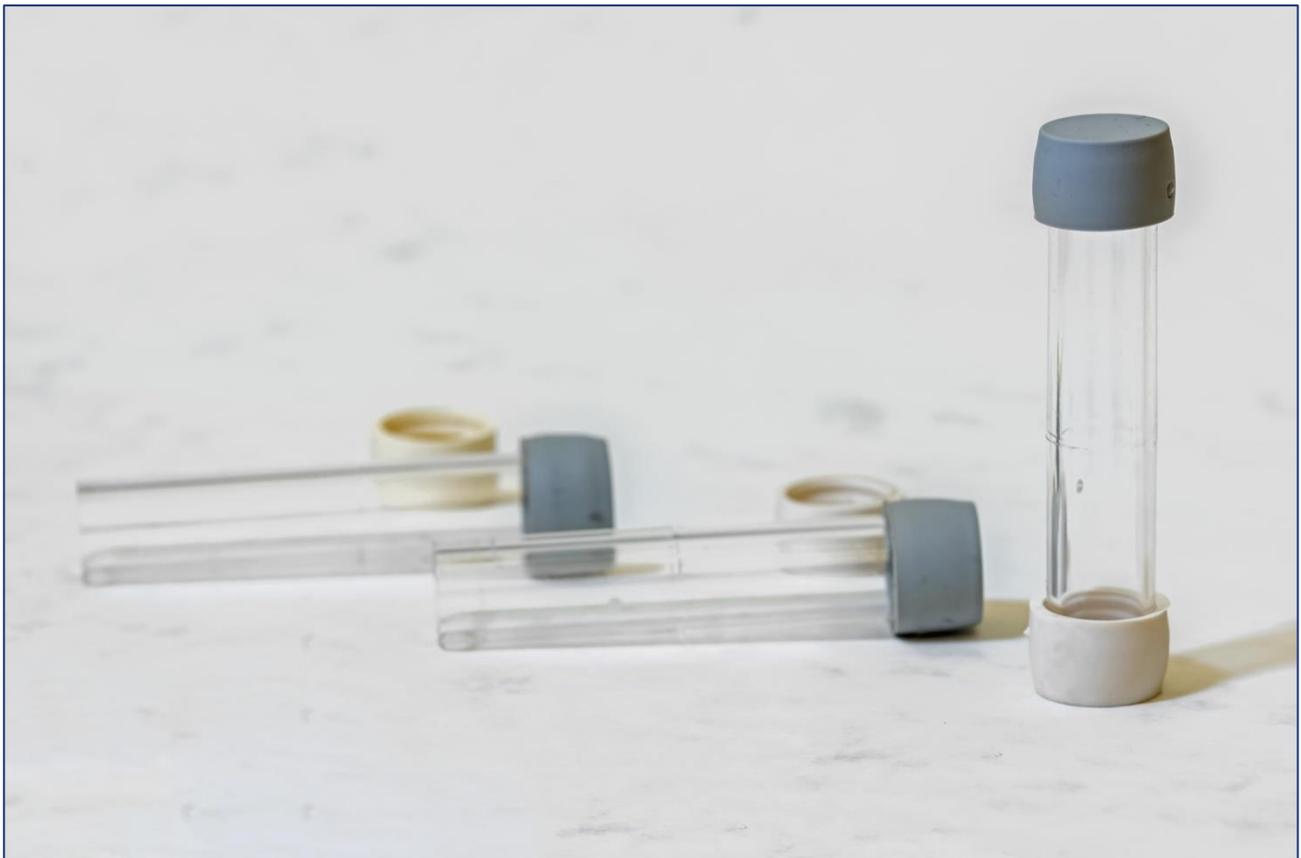
3.1.2   Diffusion tubes were attached to street furniture (lamp posts, telegraph poles, road signs etc.) and at the façade of properties (with prior consent). Duplicate tubes were used at each location and a travel blank was also used to identify any possible contamination while in transit and storage.

3.1.3   The diffusion tubes were exposed on site every month and then sent to a laboratory for analysis. The exposure dates for each month are presented in Table 6 (Appendix A) along with a comparison against the recommended exposure times by Defra[19].

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[19] Defra, (2019), *Recommended exposure periods.* Available online at: https://laqm.defra.gov.uk/diffusion-tubes/data-entry.html

3.1.4   The performance of the laboratory is a factor that needs to be taken into consideration, since different laboratories may systematically over or under-estimate concentrations. This is mainly due to the procedures of preparing and analysing the tubes at each individual laboratory. The laboratory used for this survey was Gradko[20], which is UKAS accredited, and the preparation method for the diffusion tubes was 20% triethanolamine (TEA) in water.

3.1.5   Details of the monitoring sites are presented in Table 4 and their locations shown in Figure 4. The raw monthly measurements from the laboratory are presented in Table 7 (Appendix A). The locations of the monitoring sites were selected to represent conditions near the main roads (roadside and kerbside locations). Two urban background locations were also selected to measure pollutant concentrations at sensitive receptors further away from the roads.

Table 4: Details of monitoring sites

Site ID	Description	OS coordinates	Height (m)	Distance to kerb (m)	Location type[3]
1	Woore Methodist Chapel	373018, 342331	2.05	1.47	Roadside
2	Church Farm	372934, 342356	2.05	1.04	Kerbside
3	Coopers Arms[1]	373051, 342325	2.00	2.50	Roadside
4	St Leonard's Church	373033, 342365	2.10	1.40	Roadside
5	Nantwich Road	373004, 342419	1.91	1.25	Roadside
6	Newcastle Road junction	373072, 342291	2.08	1.31	Roadside
7	Churchfields	373105, 342309	2.07	1.48	Roadside
8	The Cottage	373183, 342304	2.06	1.20	Roadside
9	School House	373083, 342206	2.02	1.22	Roadside
10	Woore Primary School entrance	373118, 342131	2.08	2.40	Roadside
11	Northlands	373147, 342069	2.02	1.19	Roadside
12	Manor House [2]	373009, 342287	2.11	n/a	Urban background
13	Woore Primary School building	373045, 342121	2.09	n/a	Urban background
14	Ireland's Cross	373480, 341299	2.06	1.61	Roadside
15	Priory Gardens, Pipe Gate	373741, 340777	2.01	1.84	Roadside

[1] Site 3 was moved to this location in February 2019 (period 6 of the survey) due to the introduction of a new speed sign. It was previously located at 373047, 342332.
[2] Site 12 was moved to a new location in July 2019 (period 11 of the survey) due to tree felling. The location for periods 11 and 12 was at 373005, 342285.
[3] Roadside locations are defined by Defra as those sites typically within one to five metres of the kerb of a busy road. Kerbside locations are defined by Defra as those sites typically within one metre of the kerb of a busy road. Urban background locations are defined by Defra as those sites at urban settings away from pollution

20 Gradko, https://www.gradko.com/

Site ID	Description	OS coordinates	Height (m)	Distance to kerb (m)	Location type[3]
sources and therefore representative of city-wide background concentrations (for example, urban residential areas).					

Figure 4: Location of diffusion tube monitoring locations
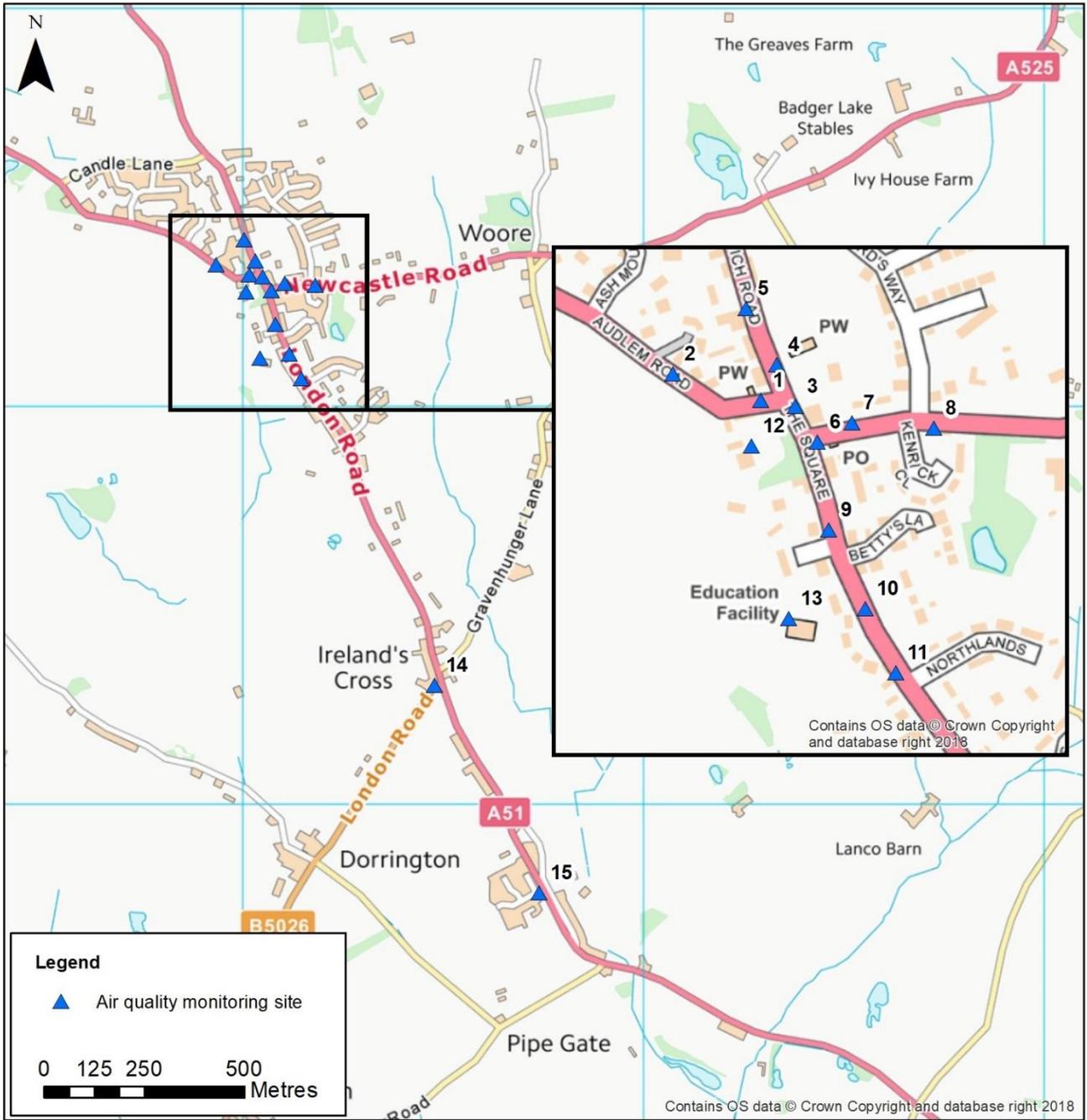
4 Monitoring data analysis

4.1 Annualisation

4.1.1 The survey was carried out for 12 months between September 2018 and August 2019, and all sites had an acceptable data capture of over 75% as defined by Defra.

4.2 Precision and bias

4.2.1 Precision refers to the ability to consistently reproduce a measurement, i.e. how similar the results of duplicate tubes are to each other. The precision is calculated using the coefficient of variation (CV) and is categorised as 'good' or 'poor'.

4.2.2 The precision of this monitoring survey was good. There were a few instances of the duplicate diffusion tubes having poor precision and, in that case, the outlier concentrations were disregarded from the analysis where appropriate.

4.3 Bias

4.3.1 Bias refers to the possibility of the diffusion tubes systematically over or under-reading the concentrations. To correct for this bias, Defra recommends that an adjustment factor is applied to the measured concentrations. The bias adjustment factor can be derived from either co-location locally with a continuous monitor or from the national database on co-location studies available from Defra[21] for each laboratory in the UK. For this study, the national factor was used which was 0.92 for 2018. There are very minor changes to the bias adjustment factor from one year to the next for this laboratory (Gradko) and therefore, the 2018 factor is considered representative of the 2019 period of monitoring for this study.

4.4 Processed data

4.4.1 Table 5 presents the annual mean NO_2 concentrations recorded (bias adjusted) and the data capture. It can be observed that monitored NO_2 concentrations are well below the air quality standard of 40µg/m^3 at all locations.

4.4.2 The change of location for sites 3 and 12 during the monitoring survey has not affected the analysis of the measurements. This is because the revised locations are adjacent to the original sites and therefore the measurements are representative of these areas.

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[21] Defra, *The National Diffusion Tube Bias Spreadsheet (September 2019)*, Available from: https://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html.

4.4.3   Measurements of NO_2 at roadside locations are higher than at locations further away from the road, as expected. Roadside measurements range from 10.4µg/m^3 (at Pipe Gate) to 23.6µg/m^3 (at the Coopers Arms junction). Measurements at urban background locations range from 8.6µg/m^3 (at the Woore primary school building) to 9.0µg/m^3 (at Manor House).

Table 5: Bias adjusted annual mean NO_2 concentrations (µg/m^3)

Site ID	Description	Location type	Annual mean NO_2 concentration (µg/m^3)	Data capture
1	Woore Methodist Chapel	Roadside	15.7	100%
2	Church Farm	Kerbside	13.1	100%
3	Coopers Arms	Roadside	23.6	100%
4	St Leonard's Church	Roadside	17.9	100%
5	Nantwich Road	Roadside	16.0	100%
6	Newcastle Road junction	Roadside	19.2	100%
7	Churchfields	Roadside	18.3	100%
8	The Cottage	Roadside	17.8	100%
9	School House	Roadside	19.5	100%
10	Woore Primary School entrance	Roadside	13.7	92%
11	Northlands	Roadside	18.1	100%
12	Manor House	Urban background	9.0	100%
13	Woore Primary School building	Urban background	8.6	100%
14	Ireland's Cross	Roadside	16.7	100%
15	Priory Gardens, Pipe Gate	Roadside	10.4	100%

4.5   Conclusions

4.5.1   As set out in paragraph 2.3.6, the air quality assessment requires information on background pollutant concentrations which are then added to the modelled contribution from the local road network. In the Phase 2a ES, this information was taken from the Defra background maps, since no local background monitoring sites were located in this area. Information from roadside locations is not used in the air quality assessment and therefore no direct comparison can be made.

4.5.2   The NO_2 measurements at the urban background locations (Manor House and Woore primary school building) from the survey are comparable to the background concentrations from Defra used in the Phase 2a ES assessment. The Defra background NO_2 concentrations at these locations were 10.1µg/m^3 in 2015 (as reported in the Phase 2a ES assessment) and the measurements from the survey ranged from 8.6µg/m^3 to 9.0µg/m^3. It is therefore concluded, that the air quality assessment presented in the Phase 2a ES is robust and no significant effects would

be anticipated during construction and operation of the Phase 2a scheme in this area.

4.5.3   The NO_2 measurements at the roadside and kerbside locations ranged from 13.1μg/m^3 to 23.6μg/m^3 in Woore and were 16.7μg/m^3 Ireland's Cross and 10.4μg/m^3 at Pipe Gate. These are all well below the air quality standard of 40μg/m^3 as an annual mean.

Appendix A

A.1 Exposure times

A.1.1 Table 6 presents the exposure times for the diffusion tubes and comparison against the recommended exposure times by Defra.

Table 6: Exposure times

Period	Month	From	To	Exposure days	Defra recommended exposure days
1	September 2018	05/09/2018	03/10/2018	28	28
2	October 2018	03/10/2018	01/11/2018	29	28
3	November 2018	01/11/2018	04/12/2018	33	35
4	December 2018	04/12/2018	08/01/2019	35	35
5	January 2019	08/01/2019	06/02/2019	29	28
6	February 2019	06/02/2019	07/03/2019	29	28
7	March 2019	07/03/2019	03/04/2019	27	28
8	April 2019	03/04/2019	02/05/2019	29	28
9	May 2019	02/05/2019	04/06/2019	33	35
10	June 2019	04/06/2019	03/07/2019	29	28
11	July 2019	03/07/2019	07/08/2019	35	35
12	August 2019	07/08/2019	05/09/0219	29	28

A.2 Laboratory measurements

A.2.1 Table 7 presents the raw NO_2 measurements from the laboratory prior to analysis.

Table 7: Raw monitoring data (NO_2 μg/m³)

Site ID	Sep 2018	Oct 2018	Nov 2018	Dec 2018	Jan 2019	Feb 2019	Mar 2019	Apr 2019	May 2019	June 2019	July 2019	Aug 2019
1	12.4	18.7	22.8	20.9	20.7	22.7	12.6	20.8	15.3	14.1	13.0	10.4
	11.4	20.2	22.0	21.6	19.7	24.2	12.2	20.2	15.6	14.3	13.5	9.6
2	9.8	14.4	15.5	18.3	20.8	19.9	11.1	15.6	11.5	11.8	9.6	8.9
	10.4	15.4	16.4	18.5	19.8	20.3	10.0	20.1	11.6	11.2	12.0	8.3
3	21.5	29.3	29.3	30.7	33.2	34.3	21.5	23.2	21.6	22.8	21.0	17.8
	22.9	28.0	29.1	30.6	29.4	35.6	24.5	24.5	23.3	20.4	20.5	20.1
4	17.0	22.7	22.3	27.5	26.3	26.0	19.1	14.6	15.8	15.0	12.8	12.1

Site ID	Sep 2018	Oct 2018	Nov 2018	Dec 2018	Jan 2019	Feb 2019	Mar 2019	Apr 2019	May 2019	June 2019	July 2019	Aug 2019
	16.9	22.0	25.0	25.6	27.0	25.8	18.8	16.6	16.1	14.8	14.7	12.3
5	14.7	20.1	22.2	22.9	21.5	28.0	13.6	18.8	12.1	13.3	11.6	11.7
	14.9	18.3	23.9	22.4	22.5	25.9	12.5	19.3	13.1	11.9	12.1	10.5
6	18.3	21.5	23.2	26.3	30.3	20.2	21.9	21.4	18.3	17.3	16.6	12.9
	19.0	25.1	20.9	25.7	28.8	26.8	21.8	21.9	18.0	15.8	16.5	13.2
7	16.2	22.9	21.2	27.2	28.9	27.0	20.1	18.1	16.4	15.8	15.0	13.1
	16.9	21.9	23.6	27.8	28.5	28.5	19.8	19.4	14.4	10.4	12.7	12.8
8	14.8	21.8	23.5	22.8	22.4	24.7	17.5	26.0	16.1	15.9	13.7	12.2
	15.0	21.8	24.7	24.5	23.2	24.3	16.4	26.4	16.5	16.0	12.8	12.1
9	17.5	25.7	26.7	22.1	31.6	28.5	19.4	21.7	18.7	16.4	15.2	12.6
	16.9	27.5	24.9	24.6	31.4	25.4	18.5	20.8	17.3	15.9	7.6*	13.6
10	8.5	16.9	19.3	20.6	20.4	21.9	12.0	15.4	10.1	9.9	8.9	7.7
	10.5	17.0	18.9	20.2	20.8	21.4	12.6	15.3	12.0	N/A	9.4	6.8
11	17.3	20.7	22.9	26.5	29.3	27.0	16.9	18.3	15.4	13.8	14.1	11.1
	17.1	22.8	23.7	25.3	28.9	25.4	18.3	19.4	16.8	14.2	14.0	12.1
12	6.9	11.4	13.1	12.2	14.2	13.6	7.1	11.3	7.3	7.5	6.5	4.4
	6.9	13.2	12.4	14.0	14.4	14.2	7.0	10.9	7.8	7.6	6.4	4.7
13	6.0	12.6	13.8	14.0	12.4	13.5	5.6	10.4	6.6	5.8	6.0	3.5
	6.4	12.9	14.0	13.7	13.0	14.6	5.7	10.6	6.3	6.5	6.3	3.3
14	17.5	22.6	20.4	22.0	20.2	25.3	14.8	18.9	16.3	16.1	15.1	12.5
	16.6	21.4	17.5	20.7	21.5	24.4	14.6	18.6	14.7	15.5	15.1	13.6
15	7.5	14.1	14.3	16.4	19.2	16.2	7.8	12.3	8.7	9.4	6.5	5.0
	8.8	N/A	15.7	16.3	16.8	15.5	8.2	12.4	8.2	8.4	5.1	5.3

N/A: Tube missing
* Erroneous measurement – discounted from data analysis.