London Borough of Richmond upon Thames Air Quality Annual Status Report for 2019
Date of publication: 29th May 2020

This report provides a detailed overview of air quality in the London Borough of Richmond Upon Thames during 2019. It has been produced to meet the requirements of the London Local Air Quality Management statutory process[1].

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[1] LLAQM Policy and Technical Guidance 2016 (LLAQM.TG (16)). https://www.london.gov.uk/what-we-do/environment/pollution-and-air-quality/working-boroughs

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Executive Summary

The London Borough of Richmond upon Thames is committed to improving air quality in the Borough. The Council is demonstrating its political leadership; taking action; leading by example; monitoring air quality; using the planning system; integrating air quality into the public health system; and informing the public. This 2020 Annual Status Report reviews recent air quality monitoring in the Borough in accordance with Defra LAQM guidance. In doing so, it fulfils one further aspect of this ongoing commitment.

The report identifies that:

For carbon monoxide, benzene, 1,3-butadiene, lead and sulphur dioxide there is not a significant risk of the objectives being exceeded in the Council's area.

In December 2000, the Council designated an AQMA across the whole Borough for nitrogen dioxide and particles (specifically PM_{10}). The findings from this report indicate that the AQMA should be maintained.

In view of the findings from the report, the Council will undertake the following actions:

1. Undertake consultation with the statutory and other consultees as required.
2. Maintain the existing monitoring programme.
3. Update and implement its Air Quality Action Plan in pursuit of the AQS objectives.
4. Prepare for the submission of its next Air Quality report.

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Abbreviations

AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
AQO	Air Quality Objective
BEB	Buildings Emission Benchmark
CAB	Cleaner Air Borough
CAZ	Central Activity Zone
EV	Electric Vehicle
GLA	Greater London Authority
LAEI	London Atmospheric Emissions Inventory
LAQM	Local Air Quality Management
LLAQM	London Local Air Quality Management
NRMM	Non-Road Mobile Machinery
PM_{10}	Particulate matter less than 10 micron in diameter
$PM_{2.5}$	Particulate matter less than 2.5 micron in diameter
TEB	Transport Emissions Benchmark
TfL	Transport for London

Air Quality Objectives

The air quality objectives applicable to LAQM in England are set out in the Air Quality (England) Regulations 2000 (SI 928), The Air Quality (England) (Amendment) Regulations 2002 (SI 3043), and are shown in Table A. This table shows the objectives in units of micrograms per cubic metre $\mu g\ m^{-3}$ (milligrams per cubic metre, $mg\ m^{-3}$ for carbon monoxide) with the number of exceedences in each year that are permitted (where applicable).

Table A.   Summary of National Air Quality Standards and Objectives

Pollutant	Objective (UK)	Averaging Period	Date[1]
Nitrogen dioxide - NO_2	200 $\mu g\ m^{-3}$ not to be exceeded more than 18 times a year	1-hour mean	31 Dec 2005
	40 $\mu g\ m^{-3}$	Annual mean	31 Dec 2005
Particles - PM_{10}	50 $\mu g\ m^{-3}$ not to be exceeded more than 35 times a year	24-hour mean	31 Dec 2004
	40 $\mu g\ m^{-3}$	Annual mean	31 Dec 2004
Particles - $PM_{2.5}$	25 $\mu g\ m^{-3}$	Annual mean	2020
	Target of 15% reduction in concentration at urban background locations	3 year mean	Between 2010 and 2020
Sulphur Dioxide (SO_2)	266 $\mu g\ m^{-3}$ not to be exceeded more than 35 times a year	15 minute mean	31 Dec 2005
	350 $\mu g\ m^{-3}$ not to be exceeded more than 24 times a year	1 hour mean	31 Dec 2004
	125 $\mu g\ m^{-3}$ mot to be exceeded more than 3 times a year	24 hour mean	31 Dec 2004

Note: [1]by which to be achieved by and maintained thereafter

1. Air Quality Monitoring

The latest monitoring results for 2019 confirm that air pollution in the LBRuT still exceeds the Government Air Quality objectives, and therefore there is still a need for LBRuT to be designated as an AQMA and to pursue improvements in air quality.

The Council (and NPL for $PM_{2.5}$) routinely monitor the pollutants below:

- NO_2
- PM_{10}
- Ozone (O_3)
- $PM_{2.5}$

The Council previously monitored SO_2 (ceased in April 2011), CO (ceased in April 2012), and Benzene (ceased in January 2012) which are not included in this report. Please see previous Council reports for further information. The LBRuT have l complied with EU limit values for these pollutants for a minimum of 3 years prior to cessation of monitoring.

1.1 Locations

Automatic Monitoring Sites

Our continuous monitors collect real time data, which are stored as 15-minute 'means' and can then be converted into the various averages. This type of equipment provides accurate measurements of pollution levels but is expensive, so using them for a large coverage of LBRuT is cost prohibitive.

The sites (see Table B) are also representative of relevant exposure either at the site or very close by. The three Richmond operated sites are part of the King's College London Air Quality Network, as is the site at the National Physical Laboratory (NPL) This site also part of the government's UK Automatic Urban and Rural Network (AURN). Richmond also has a mobile Air Quality monitoring unit, which was stationed at Chertsey Road throughout 2019. The results are included in this report.

All data undergoes quality assurance and quality control (QA/QC) procedures to ensure that the data obtained is of a high quality. The standards of QA/QC at the LAQN sites are similar to those of the government's AURN sites. For QA/QC purposes, all the continuous analysers are manually checked and calibrated every two weeks, serviced every six months and audited by an independent auditor (the National Physical Laboratory) every six months. Subsequent data ratification is undertaken by King's College London. Further details of the sites can be found at www.londonair.org.uk.

Table B. **Details of Automatic Monitoring Sites for 2019**

Site ID	Site Name	X (m)	Y (m)	Site Type	In AQMA?	Distance from monitoring site to relevant exposure	Distance to kerb of nearest road (N/A if not applicable)	Inlet height	Pollutants monitored	Monitoring technique
RI1	**Castelnau Library**, Barnes	522500	177165	Roadside	Y	8m	3m	2.35m	NO2, PM10	Chemiluminescent; TEOM
RI2	**Wetlands Centre**, Barnes	522991	176495	Suburban	Y	Children in adjacent play area/people attending Wetlands Centre	N/A	3.2m	NO2, PM10,O3	Chemiluminescent; TEOM
RHG	**Mobile** Air Quality Unit, Chertsey Rd,TW2	515354	173994	Roadside	Y	2.3m	1.6m	2.9m	NO2, PM10	Chemiluminescent; TEOM
TD0	**NPL -** Teddington AURN	515542	170420	Suburban	Y	N/A	N/A	N/A	PM2.5 and O3	Chemiluminescent; FDMS

Non-Automatic Monitoring Sites

Table C lists the details of the NO2 diffusion tube monitoring locations in the LBRuT. The tubes are a relatively cheap and accurate method of monitoring, which allows samples to be taken across the whole LBRuT and gives a Borough-wide view. The results are provided as monthly averages and so provide an indication of NO2 pollution levels. The accuracy of the diffusion tube readings can be increased when their results are compared, and then bias adjusted, with data from the more accurate continuous monitors. The Council had a network of 64 diffusion tube sites across the Borough in 2019. Three of the diffusion tubes sites are triplicate and co-located with all 3 Council automatic monitoring sites. All sites are kept under constant review and a few will be amended or moved, often in response to requests for more area specific monitoring, at the beginning of each year.

Table C.   Details of Non-Automatic Monitoring Sites for 2019

Site ID	Site Name	X (m)	Y (m)	Site Type	In AQMA?	Distance of tube to kerbside	Distance of receptor to kerbside	Inlet height (approx.)	Pollutants monitored	Tube co-located with an automatic monitor.
						(m)	(m)	(m)		(Y/N)
1	Hampton Court Rd, Hampton	515824	168815	roadside	Y	1.7m	1.9m	2.2m	NO2	N
2	Percy Rd, Hampton (nr. Oldfield Rd)	513229	169712	roadside	Y	1.3m	3.0m	2.2m	NO2	N
4	Hampton Rd, Teddington (nr. Bushy Pk Gardens)	514882	171155	kerbside	Y	0.6m	9.8m	2.2m	NO2	N

7	Broad St, Teddington (Boots)	515624	170975	kerbside	Y	0.8m	2.5m	2.2m	NO2	N
9	Hampton Rd, Twickenham	514842	172346	kerbside	Y	0.6m	2.0m	2.2m	NO2	N
10	Twickenham Rd, Twickenham (opp. Fulwell golf course)	513278	172199	kerbside	Y	0.6m	7.2m	2.2m	NO2	N
11	Percy Rd, Whitton (nr. Percy Way)	514050	173189	kerbside	Y	0.6m	9.1m	2.2m	NO2	N
12	Hanworth Rd, Whitton	512600	173404	kerbside	Y	0.6m	7.4m	2.2m	NO2	N
13	Whitton Rd, Whitton, (opp. rugby ground)	515228	174082	kerbside	Y	0.8m	6.3m	2.2m	NO2	N
14	Cross Deep, Twickenham (nr Poulett Gardens)	516133	173051	kerbside	Y	0.3m	2.7m	2.2m	NO2	N
15	Richmond Rd, Twickenham (opp. Marble Hill Pk)	517197	173939	kerbside	Y	0.6m	1.8m	2.2m	NO2	N
17	Red Lion Street, Richmond	517822	174755	roadside	Y	1.2m	2.0m	2.2m	NO2	N

18	Lower Mortlake Rd, Richmond (nr. Trinity Rd)	518822	175590	kerbside	Y	0.9m	9.3m	2.2m	NO2	N
19	Kew Rd, Kew (nr. Walpole Av)	518637	176161	kerbside	Y	0.7m	16m	2.2m	NO2	N
20	Mortlake Rd, Kew (nr. Kent Rd)	519205	177221	kerbside	Y	0.6m	2.8	2.2m	NO2	N
22	Castelnau, Barnes (nr. Hammersmith Bridge)	522845	177904	kerbside	Y	0.5m	4.2m	2.2m	NO2	N
23	Castelnau Library, Barnes (static site)	522502	177166	roadside	Y	3.3m	9m	2.2m	NO2	N
24	Lonsdale Road, Barnes (nr. Suffolk Rd)	521750	177056	kerbside	Y	0.3m	6.3m	2.2m	NO2	N
25	URRW, (nr. East Sheen Prim Schl)	521211	175457	roadside	Y	2.3m	2.5m	2.2m	NO2	N
26	URRW, Sheen (nr. Courtland Estate)	519031	175021	roadside	Y	3.2m	11.8	2.2m	NO2	N
27	Queens Rd, Richmond (nr. Russell Walk)	518663	174208	kerbside	Y	0.7m	6.8m	2.2m	NO2	N

28	Holly Lodge, Richmond Pk	519467	173993	urban background	Y	2175m	N/A	2.2m	NO2	N
29	Petersham Rd, Ham (nr. Sandy Lane)	517967	172543	kerbside	Y	0.6m	3.6m	2.2m	NO2	N
31	A316 (nr. Chudleigh Rd)	515438	174048	roadside	Y	1.0m	6.4m	2.2m	NO2	N
32	Kings St, Twickenham	516226	173195	roadside	Y	1.0m	3.2m (2.8m pavement café)	2.2m	NO2	N
33	Heath Rd, Twickenham	515927	173129	roadside	Y	3.3m	6.9m	2.2m	NO2	N
34	Thames St, Hampton	513552	169498	roadside	Y	1.4m	1.3m	2.4m	NO2	N
35	High St, Hampton Wick	517524	169583	roadside	Y	1.3m	1.4m	2.2m	NO2	N
36	Upper Richmond Road West (URRW) nr Sheen Lane	520545	175400	roadside	Y	2.1m	2.2m	2.2m	NO2	N
37	Wetlands, Barnes (static site)	522989	176727	urban background	Y	1160m	230m	2.2m	NO2	Y

39	Richmond Rd, nr. Richmond Bridge, East Twickenham	517592	174404	roadside	Y	1.2m	2.7m	2.2m	NO2	N
40	Staines Rd, Twickenham	514278	172521	roadside	Y	1.0m	11.4m	2.2m	NO2	N
41	Paradise Rd, Richmond	518102	174854	kerbside	Y	0.9m	5.6m	2.2m	NO2	N
42	The Quadrant/Kew Rd, Richmond	518080	175259	roadside	Y	0.7m	2.9m	2.2m	NO2	N
43	Hill St, Richmond	517771	174701	kerbside	Y	0.7m	1.6m	2.2m	NO2	N
44	Sheen Rd, Richmond (near shops)	518458	175042	kerbside	Y	0.5m	0.5m	2.2m	NO2	N
45	154 High St, Teddington,	516383	171154	kerbside	Y	0.5m	3.3m	2.2m	NO2	N
48	Stanley Rd, Teddington (junc. Strathmore Rd)	515059	171758	roadside	Y	2.2m	5.4m	2.2m	NO2	N
50	URRW, nr. Clifford Av, Sheen	519962	175321	kerbside	Y	0.7	2.7	2.2m	NO2	N

51	Sheen Lane, E. Sheen (nr railway crossing)	520492	175695	kerbside	Y	0.4m	1.3m	2.2m	NO2	N
52	Clifford Av, Chalkers Corner	519776	175746	kerbside	Y	0.5	2.2	2.2m	NO2	N
53	co-located on mobile Air Quality unit	3 sites	3 sites	roadside	Y	varies	varies	2.2m	NO2	Y
54	Mortlake Road, adjacent to West Hall Road, Kew	519585	176492	kerbside	Y	0.6	1.4	2.2m	NO2	N
55	Mortlake Road, adjacent to Cemetery Gates,	519793	176142	kerbside	Y	0.6	4.1	2.2m	NO2	N
56	A316 (St Magarets)	516788	174519	roadside	Y	1.0m	9.6m	2.2m	NO2	N
57	A316 (Lincoln Avenue)	513915	172899	roadside	Y	1.00m	16.4m	2.2m	NO2	N
58	London Road, Twickenham	516039	173766	kerbside	Y	0.7m	6.4m	2.2m	NO2	N
59	Whitton Rd, Twickenham (near Twickenham bridge)	515980	173758	kerbside	Y	0.6m	1.4m	2.2m	NO2	N

61	London Road, Twickenham (near Waitrose)	516224	173444	roadside	Y	1.8m	4.3m	2.2m	NO2	N
62	High Street, Barnes	521651	176430	kerbside	Y	0.4m	2.3m	2.2m	NO2	N
63	High Street, Whitton	514181	173875	kerbside	Y	0.8m	3.2m	2.2m	NO2	N
64	High Street, Hampton Hill	514484	171251	kerbside	Y	0.5m	1.6m	2.2m	NO2	N
65	York Street, Twickenham	516339	173366	kerbside	Y	0.5m	2.7m	2.2m	NO2	N
66	South Circular, Kew Green	519060	177428	roadside	Y	2.1m	3.3m	2.2m	NO2	N
67	Petersham Rd opp Poppy Factory,	518042	174095	roadside	Y	1.4m	2.7m	2.2m	NO2	N
68	Rocks Lane, Barnes	522434	176507	roadside	Y	3.2m	3.8m	2.2m	NO2	N
69	Uxbridge Rd nr Longford Cl, TW12	513494	171729	roadside	Y	2.0m	2.9m	2.2m	NO2	N
70	Stag Brewery, Lower Richmond Rd, SW14	520465	175965	roadside	Y	1.8m	2.1m	2.2m	NO2	N
71	A316, St Stephens Primary School	516574	174456	roadside	Y	2.9m	9.9m	2.2m	NO2	N

72	St Margarets Rd, nr St Margarets station, TW1	516839	174238	roadside	Y	0.8m	2.5m	2.2m	NO2	N
73	Hospital Bridge Rd, nr Homelink	513722	172873	roadside	Y	2.1m	8.4m	5.0m	NO2	N
74	Lower Richmond Rd (nr A316)	519856	175856	kerbside	Y	2.6m	5.9m	2.2m	NO2	N
Rut 01	Civic Centre, York St, Twickenham	516356	173365	roadside	Y	2.9m	3.0m	5.0m	NO2	N
Rut 02	George Street, Richmond	517917	174928	kerbside	Y	0.7m	2.2m	2.2m	NO2	N

Sites changes for 2019: sites 6, 16, 47 and 60 were closed; site 70, 71, 72 and 73 were opened; site 21, was renamed site 74 for clarity in response to resident's requests as it was moved 200m to be closer to Chalker's Corner junction on 2/1/18. All grid references in this chart are correct for 2019. Please see 2018 ASR for former grid references

1.2 Comparison of Monitoring Results with AQOs

The results presented are after bias adjustment and "annualisation" where required (annualisation was not required at any site in LBRuT for 2019 as all sites achieved a data capture rate of 75% or higher).

Table D. Annual Mean NO2 Ratified and Bias-adjusted Monitoring Results (μg m-3) For results that indicate the exposure estimate, calculated for the nearest residential façade see **Appendix A3**.

Site ID	Site type	Valid data capture for monitoring period %	Valid data capture 2019 %	Annual Mean Concentration (μgm⁻³)						
				2013	2014	2015	2016	2017	2018	2019
Castelnau Library, Barnes (RI1)	Roadside	100%	99%	39	37	34	36	31	31	27
Wetlands Centre, Barnes (RI2)	Suburban	100%	95%	24	25	21	25	21	20	21
Mobile- Chertsey Rd, TW2 (RHG)	Roadside	100%	97%	**43**	**42**	N/A	N/A	37	34	36
NPL - Teddington AURN (TD0)	Suburban	N/A	N/A	21	27	19	22	N/A	N/A	N/A
1	Roadside	100	100	**47**	**49**	**41**	**56**	**55**	**41**	35

2	Roadside	100	83	32	33	28	31	29	32	29
3	Roadside	100	Closed	**44**	**44**	**41**	**42**	39	closed	closed
4	Kerbside	100	100	**44**	**44**	36	**40**	36	35	31
5	Kerbside	closed	Closed	closed	closed	closed	closed	closed	closed	closed
6	Kerbside	100	Closed	**43**	**41**	36	37	30	34	closed
7	Kerbside	100	100	**61**	**54**	**47**	**49**	**43**	**45**	39
8	Kerbside	closed	Closed	closed	closed	closed	closed	closed	closed	closed
9	Kerbside	100	100	**49**	**48**	**42**	**45**	**40**	**40**	**35**
10	Kerbside	100	100	**46**	**47**	**43**	**44**	**42**	**41**	**40**
11	Kerbside	100	100	**49**	**48**	**44**	**48**	**47**	**46**	34
12	Kerbside	100	100	**49**	**46**	**41**	**45**	**41**	**44**	**40**
13	Kerbside	100	100	**48**	**47**	**42**	**42**	**40**	**39**	36
14	Kerbside	100	83	**46**	**45**	39	**40**	36	36	33
15	Kerbside	100	92	**40**	**40**	37	**41**	38	34	32
16	Roadside	100	Closed	**44**	**43**	41	**42**	38	37	closed
17	Kerbside	100	92	**68**	__68__	__63__	__69__	__60__	54	**50**
18	Kerbside	100	92	**71**	__66__	__67__	56	58	46	**46**
19	Kerbside	100	83	**53**	**55**	**48**	**49**	**49**	**42**	**37**
20	Kerbside	100	100	**51**	**55**	**48**	**47**	**45**	38	38
21 (74)	Roadside	100	Closed	**44**	**41**	37	39	36	**closed**	**closed**
22	Kerbside	100	100	**57**	**59**	**53**	__65__	**52**	**45**	**32**
23	Roadside	100	100	39	38	35	35	35	31	26
24	Kerbside	100	92	**40**	**40**	35	37	34	31	28
25	Roadside	100	92	**47**	**51**	**51**	**45**	**46**	38	36
26	Roadside	100	100	**42**	**43**	**42**	**40**	**40**	36	34
27	Roadside	100	92	**40**	38	37	**43**	**41**	37	32

28	Urban background	100	100	21	18	17	21	17	18	17
29	Kerbside	100	92	39	36	30	32	30	31	28
30	Roadside	100	Closed	38	34	29	33	closed	closed	Closed
31	Roadside	100	100	61	62	54	54	52	49	45
32	Roadside	100	100	74	73	62	64	59	56	47
33	Kerbside	100	100	62	69	61	61	53	52	40
34	Roadside	100	100	38	40	33	36	35	32	30
35	Roadside	100	100	52	48	43	46	45	42	36
36	Roadside	100	100	56	56	49	50	60	63	61
37	Urban background	100	100	25	22	21	25	20	21	20
38	Kerbside	closed	Closed	closed	closed	closed	closed	closed	closed	Closed
39	Kerbside	100	100	56	56	52	55	52	45	39
40	Kerbside	100	100	41	40	36	45	42	41	35
41	Kerbside	100	100	42	41	38	39	36	34	32
42	Roadside	100	92	58	54	47	82	89	72	62
43	Kerbside	100	100	87	80	80	85	78	59	46
44	Kerbside	100	100	45	45	39	42	41	40	37
45	Kerbside	100	100	48	45	35	37	35	33	32
46	Kerbside	closed	Closed	closed	closed	closed	closed	closed	closed	Closed
47	Roadside	100	Closed	40	37	32	33	31	29	closed
48	Roadside	100	100	45	45	39	41	40	40	33
49	Kerbside	100	Closed	45	45	39	44	31	closed	Closed
50	Kerbside	100	100	61	60	57	55	53	52	50

51	Kerbside	100	100	34	34	28	32	35	33	30
52	Kerbside	100	100	**59**	**<u>62</u>**	**55**	**57**	**50**	**59**	**55**
53	varies	100	100	**48**	**48**	N/A	N/A	**44**	**43**	**41**
54	Roadside	100	100	**54**	**56**	**51**	**49**	**48**	**40**	**40**
55	Roadside	100	100	**52**	**55**	**50**	**50**	**45**	**41**	**40**
56	Kerbside	100	92	**46**	38	37	**51**	**50**	**43**	39
57	Kerbside	100	92	39	36	33	**44**	**42**	**43**	37
58	Kerbside	100	100	**58**	**50**	**46**	**50**	**47**	**43**	**40**
59	Kerbside	100	83	**46**	**42**	**40**	**44**	39	**40**	34
60	Kerbside	100	Closed	32	32	27	29	29	29	Closed
61	Roadside	100	100	**58**	**54**	**48**	**49**	**45**	**43**	38
62	Kerbside	100	100	**54**	**52**	**46**	**51**	**50**	**43**	**43**
63	Kerbside	100	92	**43**	**42**	38	**41**	38	38	33
64	Kerbside	100	100	**54**	**<u>60</u>**	**55**	**53**	**49**	**45**	**41**
65	Kerbside	100	100	Not open	Not open	Not open	**<u>75</u>**	**<u>68</u>**	**55**	**50**
66	Kerbside	100	92	Not open	Not open	Not open	**49**	**49**	**42**	**40**
67	Roadside	100	100	Not open	Not open	Not open	Not open	**44**	**41**	32
68	Roadside	100	100	Not open	Not open	Not open	Not open	Not open	**55**	**40**
69	Roadside	100	100	Not open	Not open	Not open	Not open	Not open	38	31
70	Roadside	100	100	Not open	Not open	Not open	Not open	Not open	Not open	**42**
71	Roadside	100	100	Not open	Not open	Not open	Not open	Not open	Not open	**52**
72	Roadside	100	100	Not open	Not open	Not open	Not open	Not open	Not open	**42**
73	Roadside	100	100	Not open	Not open	Not open	Not open	Not open	Not open	**43**

74 (21)	Roadside	100	100	Not open	Not open	Not open	Not open	Not open	**50**	**52**
Rut 01	Roadside	100	100	**60**	**56**	45	**50**	**51**	38	36
Rut 02	Kerbside	100	100	**94**	**96**	**88**	**96**	**82**	**72**	**63**

Notes: Exceedance of the NO_2 annual mean AQO of 40 μgm^{-3} are shown in **bold (orange/red)**.

NO_2 annual means in excess of 60 μg m^{-3}, indicating a potential exceedance of the NO^2 hourly mean AQS objective are shown in bold and underlined(red).

The bias adjustment factor used for **all roadside/kerbside** sites is **0.90** calculated using the average of LBRUT stations for 2019. The bias adjustment factor for **background sites** 28 and 37 is **0.99** calculated using the Wetlands site. For more information, see Appendix A.2

In 2015 the taxi rank was moved from outside Richmond station to opposite Richmond station. 6/1/16 site 42 moved along Quadrant from near bus stops to near new taxi rank.

From 6/1/16 site 57 was moved nearer the road, no longer behind a small section of green screening to better represent most of this section of the A316.

From 3/1/17 sites 25, 36, 49, 51, 56 were moved slightly (<20m) largely in response to residents requests for marginally better monitoring locations. All grid references are correct for 2017, 2018 and 2019 monitoring. Please see our 2016 Annual Status Report for earlier coordinates.

From 2/1/18 sites 3 and 49 were closed; sites 68 and 69 opened; site 21 was moved approx. 200m in response to resident's requests and is now close to the junction at Chalkers Corner, so for clarity has been renamed site 74. Site 36 and 51 were moved slightly (<20m); See Table C for correct grid references for 2018, 2019 and 2017 ASR for earlier grid references.

From 9/1/19 sites 6, 16, 47 and 60 were closed; sites 70, 71, 72 and 73 were opened. Site 74 is the moved and renamed site 21 (see above)

Diffusion Tube Monitoring Data

Table D shows the NO2 diffusion tube monitoring results, with bias corrected values for each year from 2013 to 2019. (Note – see Table M for monthly data for 2019 and Table K for the distance corrected). The results in bold (orange/red) indicate an exceedance of the annual mean objective of 40 μg m-3 and the results underlined (red) indicate NO2 annual means in excess of 60 μg m-3 indicating a potential exceedance of the NO2 hourly mean AQS objective.

The data capture for 2019 for all sites was very good (98.2%). No site recorded a data capture of less than 75%, so annualising in line with DEFRA guidance, TG (16) was not required.

The total number of sites where monitoring was undertaken was 64; 3 of these were triplicates, co-located next to real time analysers, 2 were background. The remainder were roadside or kerbside. The results from the 2019 monitoring show that the objective of 40 μg m-3 was exceeded at 27 sites, which is quite a significant reduction from the 41 sites exceeding in 2018. All sites, except site 74, have remained the same or reduced. 59 sites (92.2%) have gone down, 1

site (1.6%) has gone up and 4 sites (6.3%) have remained the same. This is exceptionally good news and is the most significant percentage decrease we have seen in the last 20 years, though more improvement is still required. Three of these sites also exceeded an annual mean of 60 µg m-3 which indicates that the 1 hour-mean objective may also have been exceeded at these locations.

These same three sites exceeded the 1 hour-mean objective in 2018, though the two in Richmond town centre indicate significant reductions. East Sheen is down by 1ug/m3. Congestion along this section of the South Circular remains high, partly exacerbated by the closure of Hammersmith Bridge for major repairs, which is likely to remain closed for some years.

These two events – the introduction of the ULEZ (on 8th April 2019) and the closure of Hammersmith Bridge (on 10th April 2019) as can be seen, happened within days of each other, so we cannot see the effect of one without the other. Sadly, improvements in fleet from the ULEZ appear to be negated by the increase in the number of vehicles on the road from the bridge closure.

The main decreases in 2019 are borough wide, on most main roads in LBRUT together with town centres. This follows on from decreases in most town centres annually from 2016. This is very encouraging. Teddington in particular is looking encouraging with all sites, including site 7 on Broad St, outside Boots, and 45 on High St, outside Cook, complying.

A small downward trend in levels of NO2 from 2017 to 2018 to 2019 is now materialising and a return to higher levels of pre 2016 is looking less likely although it is still too early to be absolutely sure. Contributory factors are likely to be the introduction of cleaner buses and possibly the slow introduction of cleaner taxis, and EV's into the fleet mix together with a general upgrading to cleaner cars, which on real world driving cycles really are cleaner.

Dieselgate was definitely beneficial for the air quality agenda. Recent 2019/2020 Euro 6 cars and light vehicles are delivering improvements on the earlier Euro 6 versions and EV's are at last showing real increases in sales, both of which is encouraging.

The LEZ, which has encouraged the use of Euro 4 or better for commercial vehicles, applicable along the A316, does seem to have resulted in benefits indicated by lower trend data at site 56, 57 and 31, although 18 remained static this year. George Street, Richmond, which had recorded some of the highest exceedances every year has shown a marked decrease from 2016 – 2019 decreasing from 96 ug/m3 in 2016 to 82 ug/m3 in 2017, to 72ug/m3 in 2018 and 63ug/m3 in 2019.

As mentioned above, new hybrid/cleaner buses were introduced in 2017-2019 on routes R68, R70, 65, 267 and 285. All sites along these routes show continual decreases - site 42 and Rut 2 in Richmond, site 32, 33 and 65 in Twickenham, site 64 in Hampton Hill and site 45 and 7 in Teddington. Hampton Hill and Teddington are particularly affected, as these routes form a significant part of the bus fleet for these areas. This is encouraging and we will continue to monitor progress.

The borough has continued to lobby the Mayor for swifter upgrades across the entire bus fleet. We are advised that all bus fleets serving LBRuT will be hybrid or retrofitted/ upgraded to meet Euro VI emission standards, reducing bus emissions of NOx by up to 95%, by 26th October 2020. This may now be delayed slightly due to the financial implications of COVID19 but LBRUT will try and ensure it is progressed..

Site 42 is next to the Richmond station taxi rank, a lot of work has been carried out during 2018 and 2019 both top down and bottom up, with the GLA and with the taxi drivers. We have had anti idling articles published in taxi trade magazines, signage erected and officer time and idling action campaigns have been spent talking to taxi drivers reminding them to not idle; this appears to be showing benefits.

Taxi drivers are now switching off regularly when queuing in the taxi rank, which is very welcome. On 1/3/19 LBRUT started using traffic wardens to enforce against engine idling. Traffic wardens adopted a soft touch approach, speaking to divers from 2/1/19 advising them of the need to switch off and upcoming enforcement. All traffic wardens now speak to idling drivers on a daily basis and require switch off. Any that refuse are issued with a fine. From February 2019 – February 2020 traffic wardens spoke to 13,582 drivers – this is having a noticeable impact on engine idling.

The data for 2019, for the first time in the last 20 years, indicates that more than half the sites (37 sites, which is 57. 8%) comply with the objective of 40 μg m-3 and that less than half (27 sites, which is 42.2%) exceed the objective of 40 μg m-3 with no sites recording double the objective. After the distance correction, the annual mean objective is exceeded at 24 sites. This is a significant improvement. However 3 sites still exceed the annual mean concentration of 60 μg m-3, which as advised, indicates that the 1 hour-mean objective may also have been exceeded at these locations. These sites are:

Site 42 -The Quadrant, Richmond (62 μg m-3)

Site Rut 2 - George Street, Richmond (63 μg m-3)

Site 36 - Upper Richmond Rd West, near Sheen Lane, East Sheen (61μg m-3)

Site 36, after distance correction for nearest façade, still exceeds the annual mean concentration of 60 μg m-3, which as advised, indicates that the 1 hour-mean objective may also have been exceeded. TfL have plans to improve the section of the South Circular between Sheen lane and Priest Bridge in 2020/2021 which may help drive pollution reductions.

There has been strong encouragement for modal shift to more sustainable forms of transport in LBRUT throughout 2019 – both through air quality initiatives and the declaration of the Climate Change emergency and Climate Change/Air Quality summits in October 2019. Post COVID-19, re-assignment of street space in favour of walking and cycling is being prioritised. This could be the real game changer, reducing the number of vehicles on the road as well as cleaning up the fleet.

The overall monitoring results for the Borough therefore show that NO2 concentrations exceeded the UK annual mean objective (as it has done for each year since 2002). This is also in line with the modelling prediction of the Borough (reported in the 2015 Annual Status Report). Improvements are still required.

This year as well as including bar charts of data for all sites ranked in order of exceedance, we have again looked back at 10 sites covering town centres, main roads, a level crossing and a background site from 2002 – 2019 to give more perspective to levels of NO2 over a long time period. We hope this is enlightening.

Figure 1: Nitrogen Dioxide Bias Adjusted Annual Average Concentrations for all sites for 2019 (split over 2 graphs)

Bias adjusted annual average NO2 data in ug/m3 for 2019.
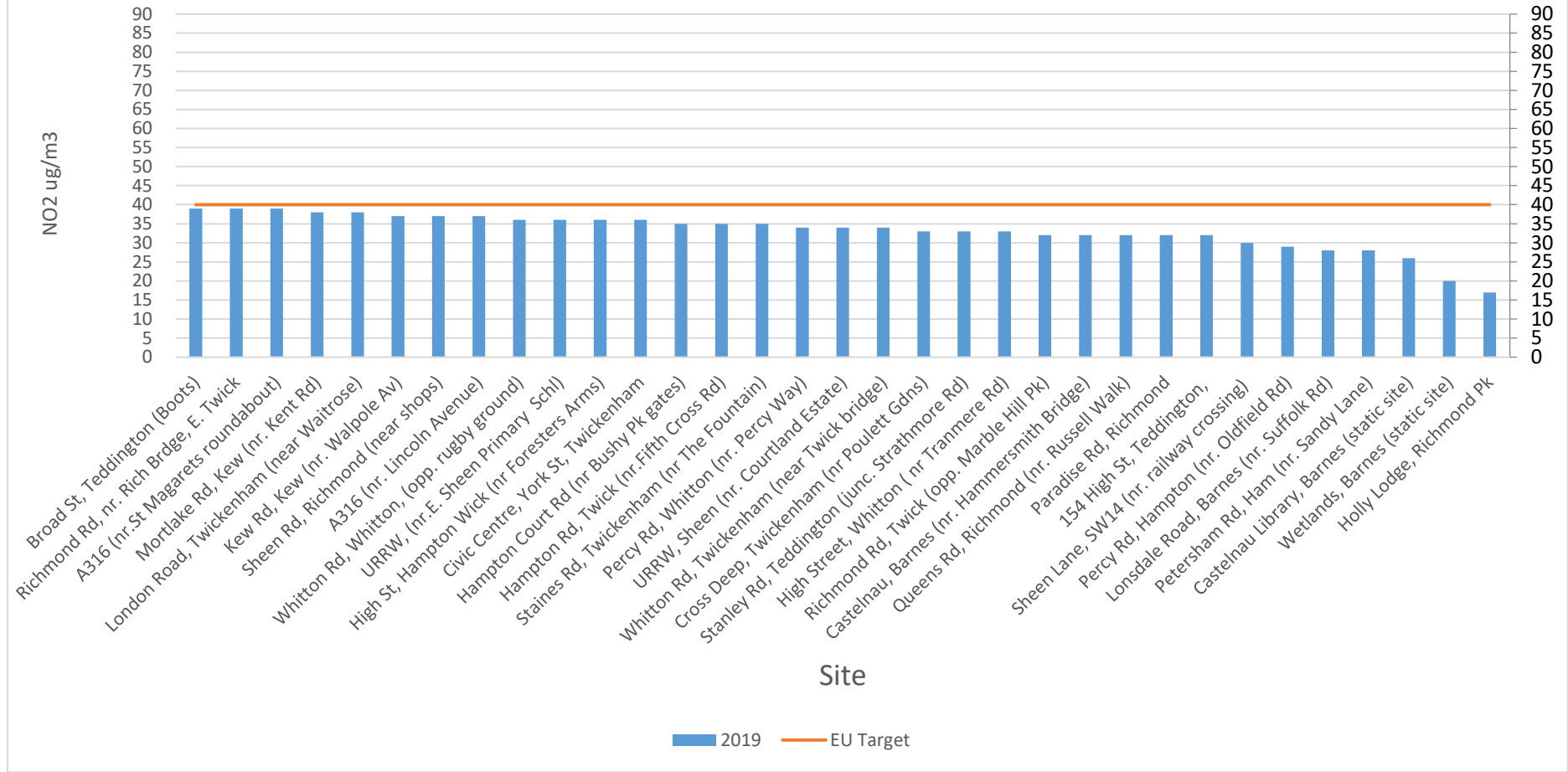Sites which exceed or equal EU limit values (40ug/m3).
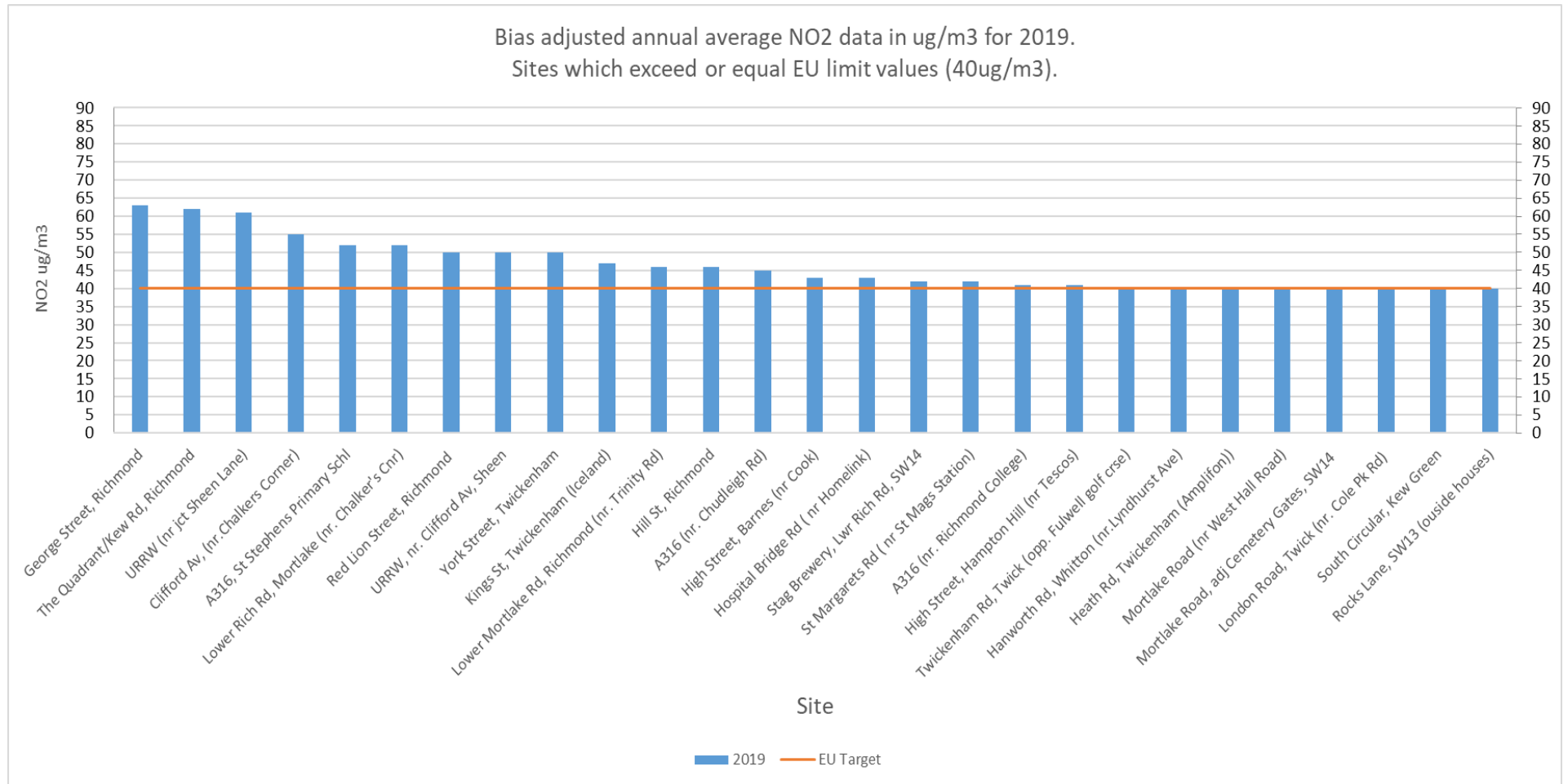
Bias adjusted annual average NO2 data in ug/m3 for 2019.
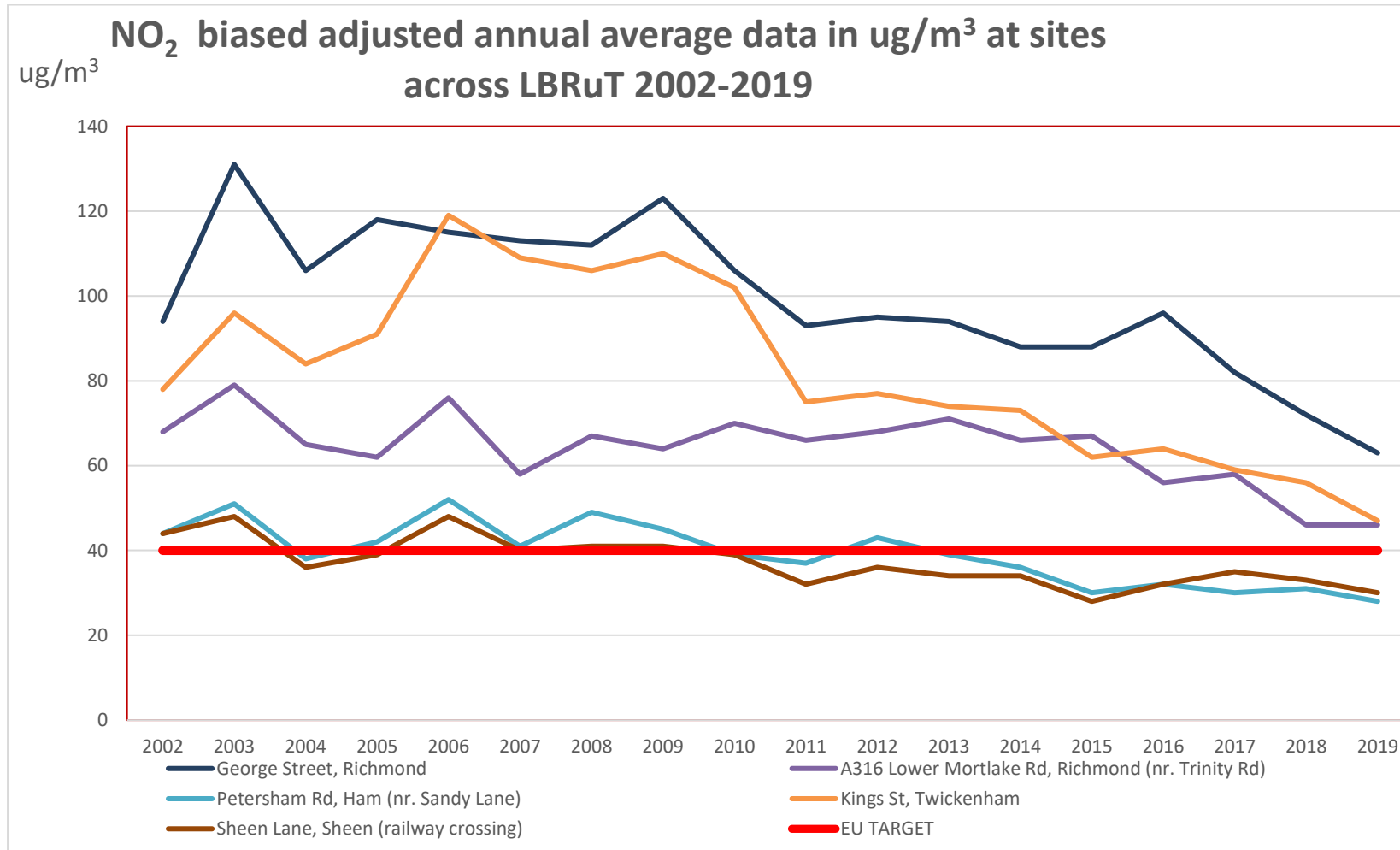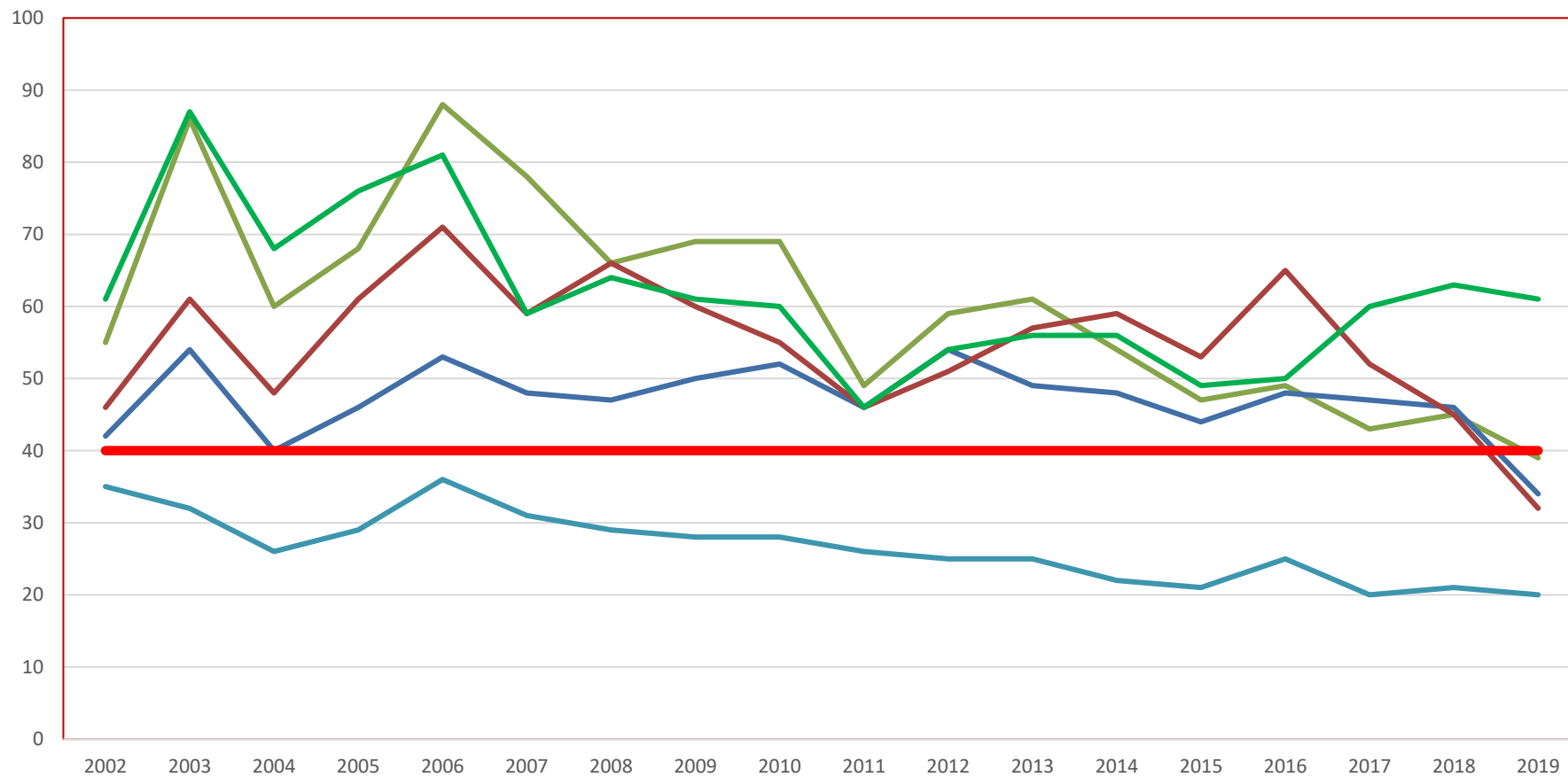Sites which comply with EU limit values (40ug/m3).

Figure 2: Nitrogen Dioxide Bias Adjusted Annual Average Concentrations for 10 sites across LBRuT 2002 -2019 (split over 2 graphs)

NO₂ biased adjusted annual average data in ug/m³ at sites across LBRuT 2002-2019

Legend:
- George Street, Richmond
- A316 Lower Mortlake Rd, Richmond (nr. Trinity Rd)
- Petersham Rd, Ham (nr. Sandy Lane)
- Kings St, Twickenham
- Sheen Lane, Sheen (railway crossing)
- EU TARGET

NO₂ biased adjusted annual average data in ug/m³ at sites across LBRuT 2002-2019

Legend:
- Broad St, Teddington (Boots)
- Castlenau, Barnes (Hammersmith Bridge)
- Wetlands, SW13 (static site)
- Percy Rd, Whitton (nr.Percy Way)
- Upper Richmond Rd West (URRW) (nr Sheen Lane)
- EU TARGET

Table E.   NO$_2$ Automatic Monitor Results: Comparison with 1-hour Mean Objective

Site ID	Valid data capture for monitoring period %	Valid data capture 2019 %	Number of Hourly Means > 200 µgm^{-3}						
			2013	2014	2015	2016	2017	2018	2019
Castelnau Library, Barnes (R1)	100	99	2	0	0	0	0	0	0
Wetlands Centre, Barnes (R2)	100	95	0	0	0	0	0	0	0
Mobile- Chertsey Rd, TW2 (RHG)	100	97	0	0	0	0	0	0	0

Notes: Exceedance of the NO$_2$ short term AQO of 200 µgm^{-3} over the permitted 18 days per year are shown in **bold**.

 Automatic Monitoring Site data

The NO$_2$ monitoring results for the three LBRuT automatic sites are compared directly to the annual mean and hourly mean objectives. The data for 2019 is fully ratified. The Mobile Air Quality Unit was located at Chertsey Rd, Twickenham throughout 2019. Data has therefore been included in this report.

The 2019 NO$_2$ data capture for Castlenau, Wetlands and the Mobile was very good, representing 99% data capture for the RI1 (Castelnau), 95% for RI2 (Wetlands) and 97% for RHG (the Mobile).

Table D provides the 2019 results of the NO$_2$ automatic monitoring and a comparison with the annual mean objective.

The 2019 results show that all three sites met the objective of 40 μg m^{-3}. The 2019 annual mean for the RI2 (Wetlands) was 21 μg m^{-3} This site is a background site and therefore representative of low pollution in the Borough. The annual mean at the RI1 (Castelnau) and RHG Mobile site on Chertsey Rd, Twickenham, both roadside sites was 27 μg m^{-3} and 36 μg m^{-3} respectively.

This represents a slight increase from 2018 data for Wetlands and Chertsey Rd and a decrease for Castlenau. It should be noted that Castlenau, although a roadside station is no longer representative of typical roadside concentrations for LBRUT. This is because Hammersmith Bridge at the end of Castlenau has been restricted to traffic since May 2016, so volume of traffic along this stretch has been reduced significantly. On 10th April 2019 the bridge was closed for safety reasons until strengthening work is completed, which is likely to take at least 3 years.

From Saturday 28 May 2016 and throughout 2017 and 2018 in order to preserve the lifespan of Hammersmith Bridge, it was necessary to limit the number of buses using the structure. HGV's were also limited – the bridge had a weight restriction of 7.5 tonnes preventing many HGV's from crossing and therefore reducing their number past the Air Quality cabin at the library. This means there has been a large reduction in the number of vehicles along Castlenau from 2016-2019 and a corresponding reduction in levels of NO2. Consideration has been given to relocating the site. On balance, following discussions with the Council and Kings College London, for data continuity and trend data purposes, it has been decided to leave it in situ. This will be reviewed annually.

 Table E provides the results of automatic monitoring for NO2 for the 1-hour mean objective of 200 μg m-3. It was met at all sites and for every year reported

with the exception of Castlenau where this standard was exceeded twice in 2013. This is encouraging news.

Table F. Annual Mean PM$_{10}$ Automatic Monitoring Results (μg m^{-3})

Site ID	Valid data capture for monitoring period % [a]	Valid data capture 2019 %	Annual Mean Concentration (μgm^{-3})						
			2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Castelnau Library, Barnes (RI1)	100	89	22	20	22	20	18	19	15
Wetlands Centre, Barnes (RI2)	100	95	20	18	17	16	15	15	16
Mobile- Chertsey Rd, TW2 (RI2)	100	96	25	N/A	N/A	N/A	18	21	20

Notes: Exceedance of the PM$_{10}$ annual mean AQO of 40 μgm^{-3} are shown in **bold**.
In 2014, 2015 and 2016 the mobile was sited at more than 1 site. Annual data is therefore not available.

PM$_{10}$

The LBRuT uses a Tapered Element Oscillating Microbalance (TEOM) to continuously monitor PM$_{10}$. All TEOM results are converted to reference equivalence using the Volatile Correction Method (VCM), which is administered by King's College London, when they process our monitoring data. As mentioned in section 1, PM$_{10}$ is a specified pollutant for the whole Borough AQMA.

The PM10 monitoring results for the LBRuT automatic sites are compared directly to the annual mean and 24 hour mean objectives. Tables F and G provide results for the period from 2013 to 2019 inclusive. The data for each year is fully ratified.

PM10 measurement was undertaken at three sites and the data capture was good at R12 Wetlands and the RHG mobile sites achieving 95% and 96% data capture respectively. In 2019 the RI1 Castelnau site achieved 89%, below the 90% data capture rate required. PM10 data at RI1 Castlenau should be treated with caution, as it may not be representative of the full year and should be used for guidance only.

Table F provides results of automatic monitoring of PM10 and a comparison with annual mean objective. The objective of 40 μg m-3 was met at each site for every year reported.

The 2019 annual mean for PM10 at both the roadside site in Castlenau Barnes and the roadside site on the A316, Chertsey Rd has gone down – reasonably at Castlenau and slightly at the A316; the background site at the Wetlands Centre in Barnes has gone up slightly. As has been pointed out under the NO2 section, Castlenau has seen significantly less traffic in 2019 due to the closure of Hammersmith Bridge, at the end of Castlenau, to all traffic from 10th April 2019. The bridge is undergoing major repairs and is likely to remain closed for a number of years.

PM10 is proving very difficult to reduce. Over the 7 year period from 2013 – 2019 it has gone up and down slightly one year to the next but a slight downward trend overall has been achieved. This is encouraging. However, it has gone up as well as down fractionally year on year, so we cannot get complacent and need to keep an eye on this. We will reassess this in next years' report. The level at our Mobile Monitoring Station can be compared to 2017 and 2018 as it was at the same site – it cannot be compared to former years as these were monitoring different locations.

It does indicate an increase in 2018 from 18μg m-3 to 21μg m-3 and then a slight decrease to 20μg m-3 in 2019. This means all sites meet the EU limit value (40 μg m-3) and in 2019 just meet the stricter WHO guidelines (20 μg m-3) for PM10. However, modelling indicates there are some exceedences of PM10 on some sections of major roads within the borough, including near Richmond on the A316, so vigilance is required.

Table G provides the comparison with the 24-hour mean objective for PM10. The objective of no more than 35 days exceeding 50 μg m-3 was met at each site for all years reported. All sites however exceeded this daily standard at least once for all years reported. 2019 has seen an increase at all sites from 2018 and a significant increase at the mobile on A316. However, the number of days exceeding the daily standard remains relatively low at all sites for the last 7 years. 2018 appears to have been a low year for PM10. Again, levels are going up and down year on year so vigilance is required.

Elevated PM10 levels can result from episodes, which are often the result of local combined with imported transboundary conditions from elsewhere in the UK and Europe.

The concentrations measured in Richmond are considered typical of those measured elsewhere across London (KCL, 2012).

Table G.   PM$_{10}$ Automatic Monitor Results: Comparison with 24-Hour Mean Objective

Site ID	Valid data capture for monitoring period %	Valid data capture 2019 %	Number of Daily Means > 50 µgm^{-3}						
			2013	2014	2015	2016	2017	2018	2019
Castelnau Library, Barnes (RI1)	100	89	10	4	5	7	4	1	3
Wetlands Centre, Barnes (RI2)	100	95	6	3	1	3	3	0	3
Mobile-Chertsey Rd (RHG)	100	96	8	N/A	N/A	N/A	1	1	8

Notes: Exceedance of the PM$_{10}$ short term AQO of 50 µg m^{-3} over the permitted 35 days per year or where the 90.4th percentile exceeds 50-µg m^{-3} are shown in **bold**. Where the period of valid data is less than 90% of a full year, the 90.4th percentile is shown in brackets after the number of exceedances.

Table H.   Annual Mean PM₂.₅ Automatic Monitoring Results (µg m⁻³)

Site ID	Valid data capture for monitoring period %	Valid data capture 2019 %	Annual Mean Concentration (µgm⁻³)						
			2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
NPL **Bushy Park, Teddington** **(TD5)**	100	93	16.7	N/A	N/A	N/A	10	11	12

Notes: Exceedance of the PM₂.₅ annual mean AQO of 25 µgm⁻³ are shown in **bold**.

Table H provides results of automatic monitoring of PM2.5 by NPL in Bushy Park and a comparison with the annual mean objective. The objective of 25 µg m-3 was met for every year reported. The data capture was good (93%) but the data for 2019 is not fully ratified so should be treated with caution.

This does reinforce results of compliance for particulate matter in the London Borough of Richmond Upon Thames. The Council, together with many other local authorities in London, does not currently have a PM2.5 monitor.

2. Action to Improve Air Quality

Table J. Commitment to Cleaner Air Borough Criteria

Theme	Criteria		Achieved (Y/N)	Evidence
1. Political leadership	*1.a*	Pledged to become a Cleaner Air for London Borough (at cabinet level) by taking significant action to improve local air quality and signing up to specific delivery targets.	Y	Richmond established a cross-party Scrutiny Committee to review and monitor measures to improve air pollution in the Borough in 2017-8. Political leadership changed in the May 2018 Council elections. The new administration pledged strong support for air quality and created a new Committee specifically for Transport and Air Quality. In 2019 Officers formed a new Council Air Quality Community group attended by the Cabinet Member and representatives from groups borough wide. Suggestions resulted in a new interactive Air Quality Action Plan, backed by members. This went out for consultation in, Autumn 2019, alongside a robust Climate Change Strategy. Two large, well-attended Air Quality and Climate Change summits were held in Oct 2019, one for pupils addressed by Sir David Attenborough and one for residents/community groups. This put Air Quality and Climate Change high on the political agenda. Following feedback and updates, the new AQAP 2020 – 2025 was adopted on 10th March 2020.
	1.b	Provided an up-to-date Air Quality Action Plan (AQAP), fully incorporated into LIP funding and core strategies.	Y	The AQAP for 2018-23 was put on hold following local elections Throughout 2019 a new AQAP 2020 – 2025 was developed and consulted on; this was adopted on 10th March 2020. See above for more detail. The intention was to make the new AQAP more robust, public facing and interactive and the best in London.
2. Taking action	2.a	Taken decisive action to address air pollution, especially where human exposure and vulnerability (e.g. schools, older people, hospitals etc.) is highest.	Y	In 2018 we produced a new Local Implementation Plan (LIP3) supporting the Mayor's Transport Strategy. This includes the headline target for 75% of trips to be by walking, cycling and public transport from a baseline of 61%. The LIP also includes specific targets to reduce CO2, NOX, PM10 and PM2.5 emissions in the borough. In 2019 we continued to develop our Active Travel Strategy outlining how the borough will implement the Mayor's Healthy Streets Approach. The Active Travel Strategy is due to be adopted in June 2020.We were working to introduce School Streets for 2020 at a small number of schools. COVID-19 has resulted in urgent re-assigning and reprioritising of street space , particularly in town centres and around schools to help enable safe walking, cycling and social distancing ; this is likely to include the introduction of School Streets at some locations.

	2.b	Developed plans for business engagement (including optimising deliveries and supply chain), retrofitting public buildings using the RE:FIT framework, integrating no engine idling awareness raising into the work of civil enforcement officers, (etc. etc.)	Y	We have drafted a new Code of Practice for the boroughs construction industry that incorporates NRMM & dust and emission controls, as well as embedding the best practice forf construction logistics.
				We have developed London Wide NRMM guidance for Planners and EH professionals
				Through the Cycling and business engagement project we continue to work closely with businesses to develop pollution free cycling Maps for the borough.
				In 2019 3 x successful Idling awareness events as part of the MAQF took place and hundreds of drivers were engaged and switched off. Additional ad hoc Council anti idling campaigns took place at 3 further schools and enforcement by CEO's was launched by the Council with events at Richmond station and Sheen Lane level crossing in late January 2019. Enforcement for idling went live 1/3/19.
				Further engagement is planned with Richmond town Centre businesses to trial ecargo bike deliveries and co-ordinated refuse collection through CAV3 in 2020-2022
	2.c	Integrated transport and air quality, including by improving traffic flows on borough roads to reduce stop/start conditions	Y	In 2019 The Council introduced 20mph on most roads throughout the borough. The Council works with TfL to identify junctions where traffic signal timings can be improved to help smooth traffic flows. As part of any wider transport schemes, opportunities are also taken to review signal timings and junction layouts where congestion is an issue. Chalkers Corner was reviewed as part of the Stag Brewery planning application in 2019. The borough is trying to increase the mode share for walking, cycling and public transport and improve bus speeds to help encourage sustainable transport, which in turn will help reduce reliance on the private car helping to ease congestion. COVID 19 has encouraged reprioritising of street space in favour of pedestrians and cyclists.
	2.d	Made additional resources available to improve local air quality, including by pooling its collective resources (s106 funding, LIPs, parking revenue, etc.).	Y	The Council makes use of a range of funding sources to help deliver its transport schemes, which in turn deliver air quality benefits. In 2019 sources included TfL LIP funding, Community Infrastructure Levy, Borough Cycle Programme, Bus Priority Programme, s106 funding, Council uplift funding, Council revenue funding and Mayor's Air Quality funding. The Council has continued to support school projects with successful implementation of additional fencing and green screening in 2019 plus monitoring at many schools all year and citizen science awareness-raising lessons. As a result of COVID-19, the LIP funding is being re allocated or reviewed, this will impact on resources for improving air quality. However, temporary measures to improve walking and cycling should also improve air quality.

3. Leading by example	3.a	Invested sufficient resources to complement and drive action from others	Y	Maintain Revenue staff funding for air quality and monitoring. Access funding streams through Section106, Local Implementation Plan and the Community Infrastructure Levy
	3.b	Maintained an appropriate monitoring network so that air quality impacts within the borough can be properly understood	Y	All of the Councils monitoring network has been maintained and is continually updated. Sites are reviewed and updated annually. We also maintain mobile monitoring equipment that can be deployed for specific projects or loaned to other partner authorities. In 2019 we conducted air quality monitoring at a potential LEN and surrounding area to aid Highways decision making. More joint working is planned.
	3.c	Reduced emissions from council operations, including from buildings, vehicles and all activities.	Y	In 2019 LBRUT replaced 60% of its street lighting with LED's. Work continues. LBRUT has installed solar panels on the roof of the Civic Centre to help reduce emissions, upgraded Council fleet and set conditions for contractor fleet through procurement. Staff are encouraged to get to work and visit sites sustainably. Cycle to work scheme is encouraged. Good cycle facilities, shower rooms, lockers etc. are maintained at the Civic Centre. Staff cycle parking is increased by removing car parking bays as demand increases.
	3.d	Adopted a procurement code which reduces emissions from its own and its suppliers activities, including from buildings and vehicles operated by and on their behalf (e.g. rubbish trucks).	Y	50% of the fleet are Euro 4 50 % of fleet are Euro 5/6 New refuse contract with strict emission criteria was introduced in Apr 2020.
4. Using the planning system	4.a	Fully implemented the Mayor's policies relating to air quality neutral, combined heat and power and biomass.	Y	All approved planning applications meet the Mayor's requirements relating to AQ neutral and CHPs. CHP's are discouraged; non-combustion is encouraged.
	4.b	Collect s106 from new developments to ensure air quality neutral development, where possible	y	The AQ Officer requests S106 payments wherever possible from developers as part of mitigation measures on major developments. Air Quality is now a specific focus of the new Local Plan and the borough has finalised a new Richmond specific AQ SPD focused on the council's priorities for new developments, including formalising the Section 106 conditions. Adoption at the end of March 202 was delayed due to lockdown – it is hoped to become policy in June 2020.

	4.c	Provided additional enforcement of construction and demolition guidance, with regular checks on medium and high risk building sites.	Y	Strict planning conditions for construction and demolition applied to all major sites. Complaints responded to. NRMM conditions applied to all major sites. Site visits requiring compliance to NRMM carried out.
5. Integrating air quality into the public health system	5	Included air quality in the borough's Health and Wellbeing Strategy and/or the Joint Strategic Needs Assessment	Y	Health and Wellbeing Strategy includes air quality as a key theme. A new JSNA on Air Quality will soon go live on the LBRUT website. More joint working is proposed in the new AQAP 2020 – 2025.
6. Informing the public	6.a	Raised awareness about air quality locally	Y	LBRuT's Communication dept. has played an important role in AQ awareness raising this year, through social media, website, newspapers , letters to local companies etc. on priorities such as anti-idling and use of authorised fuel/approved wood burning appliance in smoke control areas. airTEXT is promoted on the website and at local events. LBRuT continued to host 3 more successful idling action events in 2019-20 as part of the Mayor's campaign, involving many volunteers and speaking to hundreds of drivers. All events were based around schools and level crossings or town centres. More events are planned for later in 2020. As part of this, lessons are given to local schools to raise awareness for air quality. CEO's trained in anti-idling issue anti idling warnings daily. In 2019 they issued 13,856 warnings to drivers raising awareness of anti-idling in LBRUT.

2.1   Air Quality Action Plan Progress

Table K provides a brief summary of the London Borough of Richmond upon Thames' progress against the Air Quality Action Plan in place throughout 2019. New projects, which commenced/continued/were completed in 2019, are mentioned throughout.

The Council approved an updated AQAP for 2020 – 2025 on 10th March 2020. Delays to previous Plans were interrupted by a number of Local and General elections This put a hold on the consulted and approved AQAP for 2018 – 2023 and a substantial re-write to represent the changes in political priorities. We believe this will be beneficial for air quality in LBRuT. The new AQAP has involved direct consultation and engagement with community groups before the re-write. The result is a more robust, more transparent, more accountable AQAP, which is interactive and public facing. Improving air quality in the borough was a top manifesto commitment for the incoming administration. The new AQAP reflects changes in air quality policy, creating an environment that is welcoming

to sustainable transport and aimed at the pedestrian and/or cyclist, identifying specific bold and brave measures to tackle pollution in local 'hot-spots' within the borough and prioritising schools.

The updated AQAP 2020 – 2025 is supported by the departmental Heads of Service for Environmental Health, Transport and Planning, Public Health, the Director of Public Health, the Director of Environment and Cabinet members. It will use an interactive dashboard and adopted measures will include quarterly updates and targets and include Community pages. It will be reported in the 2021 Annual Status Report.

Table K.　　　**Delivery of Air Quality Action Plan Measures**

A. Londonwide and Regional Measures
B. Boroughwide Measures
C. Local Measures

A　　LONDONWIDE AND REGIONAL MEASURES

Measure	Action	Progress	Further information
1	Participate in the development of a low emission zone (LEZ) and engage with TfL for further measures to reduce pollution in London.	LBRUT has engaged fully with the Mayor and TfL in the implementation of the LEZ and all consultations, including the T (toxicity) charge, implemented in the central congestion charging zone in October 2017 and then ULEZ, implemented 24/7 in central London in April 2019. It has also engaged with the prosed extension of the ULEZ to the North and South circulars from 25th October 2021.	The LEZ has forced the most polluting commercial diesel vehicles driving in London to become cleaner. The introduction of the T charge in 2017 and the ULEZ in 2019 helped further. Tighter restrictions for the LEZ in Oct 2020/Feb 2021 will further contribute. The Council has actively taken part in all engagement meetings with TfL and responded to every consultation, for LEZ, T charge and ULEZ. It is

Measure	Action	Progress	Further information
			very keen to improve air quality but concerned at possible disbenefits of an expanded ULEZ. The Council will continue to engage as an active participant but has sought an exemption for the Council's main Waste and Recycling facility. We are keen to improve air quality but also encourage recycling and discourage fly tipping.
2	Encourage Heathrow Airport Ltd to take action to reduce emissions at Heathrow from surface access traffic, site traffic, aircraft and other sources.	The topic of poor air quality continues to be of supreme concern with the evidence that many thousands of people will experience worse air pollution due to increases in air traffic and airport related road traffic.	Our concern remains that the use of an extra runway together with intensified runway use will lead to increases in aircraft movements in the sky, and increases in road traffic movements on the ground, both leading to greater pollution emissions. We oppose any increase in airport capacity, which is at the expense of keeping any gains in air quality and noise improvements. We will continue to do this.

Measure	Action	Progress	Further information
3	Lobby the Mayor of London to ensure that, as a minimum buses and taxis meet the LEZ EURO III and IV criteria	This standard has now been met. The bus fleet continues to improve. Zero Emission Capable taxis only (ZEC) have been registered from 1st January 2018. LBRUT has concerns regarding the contribution of emissions from buses and taxis in town centres, particularly in Richmond and will continue to encourage early upgrades by lobbying TfL	TfL bus upgrade continued in 2019 significantly benefiting areas with a concentration of buses and taxis. Idling of buses and taxis is an ongoing issue and LBRuT are in regular contact with TFL to try to ensure compliance. Much successful work was carried out during 2019, especially in Richmond town centre, to get all black taxicabs to switch off when waiting. Most now comply. All TfL buses serving LBRuT should be upgraded by 26th Oct 2020 to Euro VI emission standards, which will have significant benefits to town centres.
4	Lobby the Mayor to achieve London-wide improvements for pedestrians, cyclists and public transport where there will be local benefits.	Through the 2018 /19 LIP Funding process, we have delivered a number of successful cycling, walking & bus schemes. LBRUT engaged in joint projects with Network Rail to identify additional cycle parking at stations throughout 2019. LBRuT have agreed plans with SW Trains for a Richmond cycling hub and cycle parking for 2020. 4 cycle hangers were installed in 2018 and discussions for more continue.	In 2019 the borough effectively lobbied TfL to help implement the borough's strategic cycle network, focusing initially on the A307 Kew Road and Kingston-Twickenham via Broom Road and Strawberry Vale. In 2020 we are investigating installation of temporary cycle lanes on these routes pending availability of funding to develop the full schemes.

Measure	Action	Progress	Further information
			Cycle parking is ongoing. Residents are encouraged to request additional cycle stands at convenient locations online. A Brompton docking station for Twickenham was installed with a view to installing a similar one for Richmond. Improved facilities for pedestrians continue. LBRuT now has hybrid buses operating on routes R68, R70, 65, 267 and 285 and more are programmed for 2020. It is hoped that by 26th Oct 2020 the entire TfL bus fleet serving LBRuT will be hybrid or retrofitted (pending any impacts from COVID-19 funding).
5	Work with other SW London Boroughs in SWELTRAC Schemes	The SWELTRAC partnership ended in 2011 It was replaced by a South London Transport Partnership and the South London Transport Strategy Board. One of the most important developments is the setting up and running of EV charge points by Source London. LBRUT adopted an Electric Vehicle Charging Strategy in November 2016, setting out proposals to add over 200 new charge points in	This target has already been achieved. By the end of 2019, 200 lamp column charge points had been installed allowing overnight charging for residents who do not have off-street parking. Another 60-70 lamp column charge points are planned to be installed across the Borough in the summer of 2020 and funding has been secured for approximately 90-100 more by the end of 2020. Electric Vehicle Charging points are a priority and are being rolled out across the borough. Any

Measure	Action	Progress	Further information
		the borough across 80 locations by 2025/26 and to encourage take up of electric cars in the borough. Trialling of lamp column mounted charge points to allow overnight charging in residential areas for residents with no off-road parking was introduced in 2017 and promoted throughout 2018/2019 on LBRuT website, delivered by ubitricity.	resident with no off road parking can apply online for a lamp column EVCP. 46 Source London charge points were installed across the Borough in 2018 for Phase 1 and 2 in 18 locations, mainly on the Surrey side of the borough - in Kew, Barns, Mortlake and Barnes Common, North Richmond, East Sheen and South Twickenham. The public consultation of Phase 3, for the Middx side of the borough was completed in late 2019. These will require planning permission; it is anticipated these will be installed by Autumn/Winter 2020. The wards covered by Phase 3 are Hampton Wick, Heathfield, St. Margaret's and North Twickenham, Teddington, Twickenham Riverside, West Twickenham, and Whitton. This is in addition to the 2 x rapid charge points installed by TfL to facilitate rapid charging for businesses as well as residents. Future improvements will be monitored in our new AQAP 2020 – 2025.

Measure	Action	Progress	Further information
6	Work with the adjacent Boroughs and West London Alliance local authorities, to develop co-ordinated AQAPs across the region.	The shared service of LBRUT and LB Merton has led the NRMM program to address pollution from development sites across 30 LA's. By Dec 2019 they had visited 514 development sites. Joint working with both South and West London authorities is ongoing and resulted in the Clean air4schools program funded by the MAQF This was continued by Officers, in house, in LBRUT in 2019	LBRUT and LB Merton will continue to lead the NRMM program in 2020/2021. This will have a significant effect on improving air quality in the local area around each development site and contribute to the improvement in air quality in London. LIP funding continued to support Air Quality awareness programs with schools in 2019 which included members of the community.

B   BOROUGHWIDE MEASURES

Measure	Action	Progress	Further information
8	Continue to pursue land use policies within the saved UDP and Local Development Framework to encourage travel choice with the aim of reducing emissions and to ensure that major new developments are accessible	These actions have been completed The approved AQAP for 2020 – 2025 is now adopted and will be beneficial for air quality in LBRuT.	The new AQAP involved direct consultation with community groups before the re-write. The result is a more robust, more transparent, more accountable AQAP, which is interactive and public facing. Improving air quality in the borough was a top manifesto commitment for the administration. The new AQAP reflects changes in air quality policy, creating an environment that is welcoming to sustainable transport and aimed at

Measure	Action	Progress	Further information
	to public transport. The LDF will take such policies forward.		the pedestrian and/or cyclist, identifying specific bold and brave measures to tackle pollution in local 'hot-spots' within the borough and prioritising schools.
11	Promote the Council Travel Plan for the Council employees	Throughout 2019 the Council encouraged the use of Oyster cards for business travel on public transport and the use of personal cycles. Cycle facilities on Twickenham campus include showers and changing rooms The Council has become a corporate car club member. Parking is only provided for essential car users, usually for 2 days a week. Free parking for all other officers, of all grades, has been abolished.	The Council continues to promote healthier travel habits for its staff, including walking, cycling and using public transport , both to get to/from work and whilst at work, which will help reduce emissions. Good cycle facilities, shower rooms, lockers etc. are maintained at the Civic Centre. Staff cycle parking is increased by removing car parking bays as demand increases. More joint working is planned for 2020/2021 with our Climate Change team.

Measure	Action	Progress	Further information
12	Promote Travel Plans for schools Encourage both public and private sector schools to adopt school travel plans and associated walking and cycling initiatives Set up database to monitor progress of all Travel Plans	LBRUT strongly supports the TfL school travel plan accreditation scheme – STARS. It rewards schools for their engagement with the school community and for carrying out initiatives, which result in more pupils and staff travelling sustainably to school. We provide cycle, pedestrian and scooter training for schoolchildren and enjoy a very good take-up. We provide a Junior Citizenship week, twice a year, which includes promoting walking, cycling and public transport.	Support for cycle and scooter training is ongoing and strongly supported by LBRuT. LBRuT continues to robustly support school travel plans through a designated Officer. School travel plans are included in the new AQAP 2020- 2025 and target driven. In 2019 we continued working with several schools, raising awareness for air pollution, including walking/cycling/scootering low pollution routes to school. We assisted and supported the Mayor's school audit team and match funded a Mayor's recommendation for a new acoustic fence and green wall at East Sheen Primary School in 2018. In 2019 we provided similar fencing and green screening for Queens Primary School, fronting the Sth Circular in Kew. Throughout 2019 we carried out a thorough monitoring regime, which has demonstrated significant air quality benefits of the screening, helping to protect students from pollution from the South Circular, directly outside their playground. Support to more schools is ongoing and several school streets are planned.

Measure	Action	Progress	Further information
16	To continue to press for and promote travel choice through improvements for pedestrians, cyclists and public transport in terms of increased capacity, reliability, accessibility and quality	The Borough continues to promote www.Walkit.com through its website and advice from Officers. Please see measure 4 for cycle and pedestrian improvements.	The development of the borough's Active Travel Strategy 2020 details plans for promoting walking, cycling and access to public transport. Throughout 2019 sustainable travel choices were promoted through the planning process. Many ongoing cycle projects to improve cycle facilities and increase a modal shift towards cycling were supported throughout 2019 (Please see measure 4) In 2019 we introduced a borough-wide 20mph speed limit. It is hoped that this has made roads safer and more hospitable to walking and cycling. In 2019, we lobbied TfL to help develop additional strategic cycle routes from Hampton Court Bridge to Kingston Bridge, Kingston Bridge to Twickenham town centre and along the A307 Kew Road. These routes will provide safe, attractive options for cyclists and will connect several key locations within the borough. In 2020 we are increasing space for pedestrians in town centres and around schools and working to introduce cycle lanes on a temporary basis.

21	Concern for low emission vehicles to be used on Council business extends to the use of vehicles by contractors. The Council seeks to control emissions from contractor's vehicles by checking that their environmental policy includes specifically its use of transport.	Euro emissions on all fleet vehicles are euro IV or above. All contractor vehicle emissions are controlled through procurement.	Ongoing. During 2019 procurement contracts for the renewal of the refuse fleet from April 2020 were initiated. All contractors were required to provide clean, ULEZ compliant vehicles for collections borough wide. A new refuse contract commenced in April 2020 with strict emission criteria.
24	To continue to promote the Council's 'Smoke Control Zone'	An awareness raising campaign on correct fuels to burn in smoke control areas was launched in Feb/March 2017 and was repeated again in January 2018 and January 2019. Guidance is given about smoke control on the Council's website. A bid was submitted to Defra for a more substantial smoke control campaign but was unsuccessful.	In 2019 all retail outlets selling fuel or appliances were written to by LBRUT and asked to display posters regarding correct fuel to be burnt in smoke control areas. We requested employers enlighten employees who could pass information to customers. A campaign was launched on social media, through e letters to community groups and on the website. All complaints about possible breaches are investigated and compliance required.
25	To continue to promote composting in preference to bonfires	The Council encourages people to avoid bonfires as they cause air pollution and the emissions can be harmful to health or a nuisance. There is advice for residents on the Council's website. The Council banned bonfires on all Council allotments from September 2019.	Poor air quality due to bonfires may be very localised but can cause considerable distress to neighbours and is actively addressed. In 2018 the Council banned bonfires on all Council allotments from 30th Apr – 16th Sept each year. In 2019 it tightened these regulations with a complete ban on bonfires at all times on Council owned allotments.

			Composting or Council green waste collection is encouraged on all private allotments and in residential properties.
26	To continue to inspect and enforce clean air requirements at 'Part B' processes in the Borough.	Annual inspections of premises producing industrial emissions. The database of premises for control is routinely updated.	Maintain established benefits of controlling emissions from certain industrial processes within the borough identified as 'Part B' of the Regulations.
28	Support the development and use of 'Car Clubs' in new residential developments, by station interchanges and in town centres.	On going with support from the Council. Car free developments have already been secured in the borough through the development control process. Future car free developments will include the use of car clubs. The Council uses a car club for essential staff car journeys in preference to using pool cars.	Car clubs operate throughout the borough and are positively endorsed by the Council. Use and siting of car club bays is under ongoing scrutiny. If car club bays are proved not to be used their space is withdrawn, in agreement with the car club. In 2019 there were 74 car club bays in operation.

C.   LOCAL MEASURES

Measure	Action	Progress	Further information
29	Refuse planning consent for activities, which are likely to lead to a significant worsening of air	All major planning applications are considered for air quality impacts and conditioned for required mitigation. Section 106 monies are requested.	In 2019 a robust Supplementary Planning Document was drafted and went out for public consultation. Adoption was delayed

Measure	Action	Progress	Further information
	pollution in 'hot spot' areas.	Consideration is also given to the cumulative effect of nearby developments. A draft Air Quality Special Planning Document is awaiting approval. Biomass and CHP are generally discouraged.	in March 2020 due to COVID 19. It is hoped to become policy by June 2020
31	To consider ways to further reduce the impact of road traffic and parking problems on Twickenham RFU days.	"No engine idling" for taxis and PHV required by liaison with RFU's contractors, ad hoc Officer intervention and CEO enforcement on major match days at RFU during 2019/20. EVCP required for new conference space for RFU built in 2018/ 2019 a and robust travel plan.	Support given to proposals by RFU to encourage non-car use as part of Travel Plan Idling enforcement by traffic wardens commenced borough wide 1/3/19. Strictly enforced on match days.
33	Consider controls for coach parking in Kew and Hampton Court, to protect residents, workers and visitors from the impact of vehicle emissions	On-going discussions with Kew Gardens in 2019 to ensure continued monitoring of no idling by coaches.	Summer of 2019 spot checks made by Council Officer to ensure driver compliance with no engine idling policy. Drivers spoken to by Officer. 100% compliance observed.

3.   Planning Update and Other New Sources of Emissions

Table K.   Planning requirements met by planning applications in the London Borough of Richmond Upon Thames in 2019

Action	Number	Notes
a) Number of planning applications where an air quality impact assessment was reviewed for air quality impacts	84	All major developments are passed to the Noise and Air Quality Officers in Environmental Health for comment. All major developments are required to submit an AQA. All relevant Mayoral policies applied in all cases.
b) Number of planning applications required to monitor for construction dust	29	All sites considered on a case-by-case basis. If moderate or high risk to receptors, dust monitoring is required
c) Number of CHPs/Biomass boilers refused on air quality grounds	0	All CHP/biomass not recommended and developers urged to select non combustion/ultra low NOx. Requirements as per London Plan, which meant none could be refused on grounds of AQ in 2019.
d) Number of CHPs/Biomass boilers subject to GLA emissions limits and/or other restrictions to reduce emissions	13	All boilers subject to standard GLA emission conditions
e) Number of developments required to install Ultra-Low NO_x boilers	84	As a minimum all boilers in all developments subject to standard GLA emission conditions
f) Number of developments where an AQ Neutral building and/or transport assessments undertaken	All major developments 84	All major developments
g) Number of developments where the AQ Neutral building and/or transport assessments not meeting the benchmark and so	8	AQ neutral benchmark is often not challenging enough. Mitigation is required due to expected worsening of NO2 in an AQMA and regularly results in hard fought battles.

	required to include additional mitigation		
h)	Number of planning applications with S106 agreements including other requirements to improve air quality	3	S106 frequently requested for local policies. Rarely successful. More robust AQ SPD has been drafted and will be adopted mid-2020.
	Number of planning applications with CIL payments that include a contribution to improve air quality	0	AQ not a specific CIL requirement.
i)	**NRMM: Central Activity Zone and Canary Wharf** Number of conditions related to NRMM included. Number of developments registered and compliant. Please include confirmation that you have checked that the development has been registered at www.nrmm.london and that all NRMM used on-site is compliant with Stage IIIB of the Directive and/or exemptions to the policy.	Not applicable.	Not applicable
	NRMM: Greater London (excluding Central Activity Zone and Canary Wharf) Number of conditions related to NRMM included. Number of developments registered and compliant. Please include confirmation that you have checked that the development has been registered at www.nrmm.london and that all NRMM used on-site is compliant with Stage IIIA of the Directive and/or exemptions to the policy.	During 2019 NRMM conditions were applied at all major planning sites. LB Merton undertook 5 Site Audits,2 Sites achieved Self-Compliant status, 2 sites worked towards and achieved Compliance and 1 Site failed to achieve Compliance.	NRMM is a standard planning condition applied to all major developments. We have 6 designated Officers based in Merton, who assess all major sites for NRMM compliance, visit sites and check the NRMM database on a regular basis. Site visits within LBRUT was on the low side in 2019. This has been raised with the NRMM team and will be addressed going forward.

3.1 *New or significantly changed industrial or other sources*

No new sources identified.

Appendix A Details of Monitoring Site QA/QC

A.1   Automatic Monitoring Sites

All data undergoes quality assurance and quality control (QA/QC) procedures to ensure that the data obtained are of a high quality.

Each NO2 continuous analyser is automatically calibrated every night and also manually checked and calibrated every two weeks by the contractor, TRL, employed by LBRuT for LSO visits during 2019. There is a need for frequent calibration adjustments as the gradual build-up of dirt within the analyser reduces the response rate. This fall off in response needs appropriate correction, to ensure the recording of the true concentrations. The calibration process involves checking the monitoring accuracy against a known concentration of span gas. The span gas used is nitric oxide and is certified to an accuracy of 5%. Both the automatic and manual calibrations use this same certified span gas (i.e. the automatic overnight one does not use the less accurate permeation tube method).

The NO2 and ozone continuous analysers are serviced every six months by TRL and also audited by NPL every six months as part of the King's LAQN QA/QC procedure, to ensure optimum data quality.

Teddington (AURN) monitoring station at NPL is part of the AURN and the QA/QC for this station is managed by AEA Technology. For more information go to www.airquality.co.uk/archive/index.php (Defra, 2009d).

PM10 particulates are measured using Tapered Element Oscillating Microbalance (TEOM) analysers, with the data presented as the gravimetric equivalent.

No automatic or fortnightly calibrations are carried out on TEOMs. Calibrations are only carried as part of the routine servicing and regular independent audits. The on-going performance of the monitor is checked on-line, by the King's College London Duty Officer. The role of the LSO at the fortnightly visits is to make more detailed performance checks. The LSO is also on standby at other times, to change the TEOM's monitoring filter as required, depending on the filter loading.

Since 2009, TEOM data have been improved by routine adjustments, using the volatile correction method (VCM). This corrects for the loss of any volatile mass, which has been driven off by the heat applied in the TEOM's inlet column. The VCM adjustments are carried out by King's College London, prior to dissemination of the data.

The TEOM equipment is serviced every six months by TRL and also audited by NPL every six months as part of the King's LAQN QA/QC procedure, to ensure optimum data quality. Both sites are part of

the LAQN and KCL are responsible for the daily data collection, storage, validation and dissemination via the LAQN website (www.londonair.org.uk). KCL ratifies the data periodically, viewing data over longer time periods and using the results from fortnightly checks, equipment services and equipment audits.

A.2   Diffusion Tube Quality Assurance / Quality Control

Directive 2008/50/EC of the European Parliament and of the Council on ambient air quality and cleaner air for Europe (EC, 2008) sets air quality objectives for NO_2 along with other pollutants. Under the Directive, annual mean NO_2 concentration data derived from diffusion tube measurements must demonstrate an accuracy of ±25 % to enable comparison with the NO_2 air quality objectives of the Directive.

In order to ensure that NO_2 concentrations reported are of a high quality, strict performance criteria need to be met through the execution of QA and QC procedures. A number of factors have been identified as influencing the performance of NO_2 diffusion tubes including the laboratory preparing and analysing the tubes, and the tube preparation method (AEA, 2008). QA and QC procedures are therefore an integral feature of any monitoring programme, ensuring that uncertainties in the data are minimised and allowing the best estimate of true concentrations to be determined.

Our NO2 diffusion tubes are analysed for us by Gradko using 50% TEA in acetone method of preparation. Gradko take an active role in developing rigorous QA and QC procedures in order to maintain the highest degree of confidence in their laboratory measurements. Gradko were involved in the production of the Harmonisation Practical Guidance for NO2 diffusion tubes (AEA, 2008) and have been following the procedures set out in the guidance since January 2009. Since April 2014 Gradko has taken part in a new scheme AIR PT, which combines two long running PT schemes: LGC Standards STACKS PT scheme and HSL WASP PT scheme.

This section contains details of Gradko International Ltd.'s Results of laboratory precision

- Performance in AIR NO2 PT Scheme (Jan 2018 – November 2019)

- Summary of Precision Scores for 2017 – 2019

- UKAS schedule of accreditation (April 2020)

Gradko International Ltd is a UKAS accredited laboratory and participates in laboratory performance and proficiency testing schemes. These provide strict performance criteria for participating laboratories to meet, thereby ensuring NO2 concentrations reported are of a high calibre.

Summary of Laboratory Performance in AIR NO2 Proficiency Testing Scheme (Jan 2018 – November 2019)

Gradko participate in the AIR PT NO_2 diffusion tube scheme which uses artificially spiked diffusion tubes to test each participating laboratory's analytical performance on a quarterly basis. The scheme is designed to help laboratories meet the European Standard. Gradko demonstrated "good" laboratory performance in 2019 for 50% TEA in Acetone.

The laboratory follows the procedures set out in the Harmonisation Practical Guidance and participates in the AIR proficiency-testing (AIR-PT) scheme. Previously to the Air-PT scheme, Gradko participated in the Workplace Analysis Scheme for Proficiency (WASP) for NO2 diffusion tube analysis. Defra and the Devolved Administrations advise that diffusion tubes used for LAQM should be obtained from laboratories that have demonstrated satisfactory performance in the AIR-PT scheme.

Laboratory performance in the AIR-PT is also assessed by the National Physical Laboratory (NPL), alongside laboratory data from the monthly NPL Field Inter-Comparison Exercise carried out at for Gradko at Marylebone Road, central London. A laboratory is assessed and given a 'z' score, a score of ± 2 or less indicates satisfactory laboratory performance. Gradko International Ltd's performance for 2019 is covered by rounds AR024 to AR034 of the AIR-PT scheme. For 2019 the laboratories results were deemed to be good for 96 participating local authorities and poor for 7 participating local authorities based upon a z score of ≤ ± 2.

In 2019, the tube precision for NO2 Annual Field Inter-Comparison for Gradko International using the 50% TEA in acetone method was 'good' for the results of all 8 participating local authorities and poor for no participating local authority.

Table 1: Laboratory summary performance for AIR NO$_2$ PT rounds AR0024, 25, 27, 28, 30, 31, 33 and 34

The following table lists those UK laboratories undertaking LAQM activities that have participated in recent AIR NO$_2$ PT rounds and the percentage (%) of results submitted which were subsequently determined to be **satisfactory** based upon a z-score of $\leq \pm 2$ as defined above.

AIR PT Round	AIR PT AR024	AIR PT AR025	AIR PT AR027	AIR PT AR028	AIR PT AR030	AIR PT AR031	AIR PT AR033	AIR PT AR034
Round conducted in the period	January – February 2018	April – May 2018	July – August 2018	September – October 2018	January – February 2019	April – May 2019	July – August 2019	September – November 2019
Aberdeen Scientific Services	100 %	100 %	100 %	100 %	75 %	100 %	100 %	100 %
Cardiff Scientific Services	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Edinburgh Scientific Services	100 %	100 %	100 %	100 %	100 %	NR [2]	100 %	25 %
SOCOTEC	100 % [1]	100 % [1]	100 % [1]	100 % [1]	87.5 % [1]	100 % [1]	100 % [1]	100 % [1]
Exova (formerly Clyde Analytical)	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Glasgow Scientific Services	100 %	100 %	50 %	100 %	100 %	100 %	100 %	50 %
Gradko International [1]	100 % [1]	100 %	100 %	100 %	75 %	100 %	100 %	100 %
Kent Scientific Services	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Kirklees MBC	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Lambeth Scientific Services	NR [2]	NR [2]	NR [2]	25 %	50 %	100 %	50 %	100 %
Milton Keynes Council	100 %	75 %	100 %	100 %	100 %	100 %	50 %	100 %
Northampton Borough Council	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Somerset Scientific Services	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
South Yorkshire Air Quality Samplers	100 %	100 %	100 %	100 %	100 %	100 %	100 %	75 %
Staffordshire County Council	50 %	100 %	100 %	100 %	100 %	75 %	75 %	75 %
Tayside Scientific Services (formerly Dundee CC)	100 %	NR [2]	100 %	NR [2]	100 %	NR [2]	100 %	NR [2]
West Yorkshire Analytical Services	50 %	75 %	100 %	100 %	100 %	100 %	100 %	50 %

[1] Participant subscribed to two sets of test results (2 x 4 test samples) in each AIR PT round.
[2] NR No results reported
[3] Northampton Borough Council, Kent Scientific Services, Cardiff Scientific Services, Kirklees MBC and Exova (formerly Clyde Analytical) no longer carry out NO2 diffusion tube monitoring and therefore did not submit results.

2017 - 2019 Summary of Precision Results for Nitrogen Dioxide Diffusion Tube Collocation Studies for Gradko Laboratory 50% TEA in Acetone

Gradko, 50% TEA in Acetone	
2017	G
2017	G
2017	G
2017	G
2017	G
2017	G
2017	G
2017	G
2017	G
2017	G
2017	G
2017	G
2017	G
2017	G
2017	G
2017	G
2017	G
2017	G
2017	G
2017	G
2017	G
2017	G
2017	P
2017	P
2018	G
2018	G
2018	G
2018	G
2018	G
2018	G
2018	G
2018	G
2018	G
2018	G
2018	G
2018	G
2018	G
2018	G
2018	G
2018	P
2019	G
2019	G
2019	G
2019	G
2019	G
2019	G
2019	G
2019	G

P	Poor Precision
G	Good Precision

2017 — Results of study carried out in 2017

2018 — Results of study carried out in 2018

2019 — Results of study carried out in 2019

Numerical results for this data are contained in the National Bias Adjustment Spreadsheet version 03/19

Gradko is accredited by UKAS for the analysis of NO₂ diffusion tubes. It undertakes the analysis of the exposed diffusion tubes by ultra violet spectrophotometry.

Schedule of Accreditation
issued by
United Kingdom Accreditation Service
2 Pine Trees, Chertsey Lane, Staines-upon-Thames, TW18 3HR, UK

UKAS **TESTING** **2187** **Accredited to** **ISO/IEC 17025:2017**	**Gradko International Ltd** **(Trading as Gradko Environmental)** **Issue No:** 024 **Issue date:** 15 April 2020

St Martins House **77 Wales Street** **Winchester** **Hampshire** **SO23 0RH**	**Contact: Mr A Poole** **Tel: +44 (0)1962 860331** **Fax: +44 (0)1962 841339** **E-Mail: diffusion@gradko.co.uk** **Website: www.gradko.co.uk**

Testing performed at the above address only

DETAIL OF ACCREDITATION

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used
ATMOSPHERIC POLLUTANTS Collected on diffusion (sorbent) tubes and monitors	<u>Chemical Tests</u>	Documented In-House Methods
	Ammonia as ammonium (NH_4^+)	GLM 8 by Ion Chromatography
	Benzene Toluene Ethyl benzene Xylene	GLM 4 by Thermal Desorption/ FID Gas Chromatography
	Hydrogen chloride as chloride (Cl^-) Nitrogen dioxide as nitrite (NO_2^-) Sulphur dioxide as sulphate (SO_4^{2-}) Hydrogen fluoride as fluoride (F^-)	GLM 3 by Ion Chromatography
	Hydrogen sulphide	GLM 5 by Colorimetric determination (UV Spectrophotometry)
	Ozone as nitrate (NO_3^-)	GLM 2 by Ion Chromatography
	Nitrogen Dioxide as nitrite (NO_2^-)	GLM 7 by Colorimetric determination (UV Spectrophotometry)
	Sulphur dioxide as sulphate (SO_4^{2-})	GLM 1 by Ion Chromatography
	Formaldehyde as formaldehyde-DNPH	GLM 18 by HPLC
	Volatile Organic Compounds including: Benzene Toluene Ethylbenzene p-Xylene o-Xylene	GLM 13 by Thermal Desorption GC-Mass Spectrometry

	Schedule of Accreditation issued by **United Kingdom Accreditation Service** 2 Pine Trees, Chertsey Lane, Staines-upon-Thames, TW18 3HR, UK
UKAS TESTING 2187 Accredited to ISO/IEC 17025:2017	**Gradko International Ltd** **(Trading as Gradko Environmental)** **Issue No:** 024 **Issue date:** 15 April 2020
	Testing performed at main address only

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used
ATMOSPHERIC POLLUTANTS Collected on diffusion (sorbent) tubes and monitors (cont'd)	Chemical Tests (cont'd)	
	Qualitative Analysis and Estimation of Volatile Organic Compounds on diffusion (sorbent) tubes and monitors	GLM 13 by Thermal Desorption GC-Mass Spectrometry with estimations in accordance with ISO standard 16000-6
	Naphthalene	GLM 13-1 by Thermal Desorption GC-Mass Spectrometry
	Tetrachloroethylene Trichloroethylene	GLM 13-2 by Thermal Desorption GC-Mass Spectrometry
	trans-1,2-Dichloroethene cis-1,2-Dichloroethene	GLM 13-3 by Thermal Desorption GC-Mass Spectrometry
	Indane Styrene	GLM 13-4 by Thermal Desorption GC-Mass Spectrometry
	1,2,3-Trimethylbenzene 1,2,4-Trimethylbenzene 1,3,5-Trimethylbenzene	GLM 13-5 by Thermal Desorption GC-Mass Spectrometry
	1,3-Butadiene	GLM 13-6 by Thermal Desorption GC-Mass Spectrometry
	Carbon Disulphide	GLM 13-7 by Thermal Desorption GC-Mass Spectrometry
	Vinyl Chloride	GLM 13-8 by Thermal Desorption GC-Mass Spectrometry
	Flexible scope for quantitative analysis of Volatile Organic Compounds on diffusion (sorbent) tubes and monitors in accordance with methods developed and validated by in-house procedure LWI 47	LWI 47 by Thermal Desorption GC-Mass Spectrometry
END		

NO$_2$ **diffusion tube analysis method**

NO$_2$ diffusion tubes are passive monitoring devices. They are made up of a Perspex cylinder, with two stainless steel mesh discs, coated with TEA absorbent held inside a polythene cap, which is sealed onto one end of the tube. Diffusion tubes operate on the principle of molecular diffusion, with molecules of a gas diffusing from a region of high concentration (open end of the tube) to a region of low concentration (absorbent end of the tube) (AEA, 2008). NO$_2$ diffuses up the tube because of a concentration gradient and is absorbed by the TEA, which is present on the coated discs in the sealed end of the tube. All Richmond NO$_2$ diffusion tubes are prepared by Gradko using 50% v/v TEA with Acetone as the absorbent.

Prior to and after sampling, an opaque polythene cap is placed over the end of the diffusion tube opposite the TEA coated discs to prevent further absorption. The NO$_2$ diffusion tubes are labelled and kept refrigerated in plastic bags prior to and after exposure.

Discussion of Choice of Factor to Use

Diffusion Tube Bias Adjustment Factors from Local Co-location Studies

In 2019 the Borough undertook co-location studies at three continuous NO$_2$ monitoring sites, with 3 x NO$_2$ diffusion tubes at the following the locations:

- **Richmond 1 Castelnau (site 23):** a roadside site, in Castlenau Library Barnes. In 2019 the annual average for the Castelnau diffusion tubes (№ 23) was 29.24 μg m^{-3}; for the continuous site (RI1) it was 27.1 μg m^3. The bias adjustment factor is **0.93**

- **Richmond 2 Barnes Wetlands (site 37):** a suburban background site. In 2019 the annual average for the Wetlands diffusion tubes (№ 37) was 21.69μg m^{-3}; for the continuous site (RI2) it was 21.1μg m^3. The bias adjustment factor is **0.99.**

- **Richmond RHG Mobile (site 53):** a roadside site on the A316 in Twickenham near Egerton Rd and Richmond College. In 2019 the annual average for the Mobile diffusion tubes (№ 53) was 45.94 μg m^{-3}; for the continuous site (RHG) it was 35.5 μg m^3. The bias adjustment factor is **0.77**

- **The National bias adjustment factor** for Gradko using 50% TEA in acetone for 2019 was **0.87. In previous years we have used either Castlenau roadside site or the National bias adjustment factor for Gradko using 50% TEA in acetone. In 2019, as in 2014, it was decided to use the average of the 3 x Richmond sites, which was 0.90 to bias adjust all roadside sites for 2019 (see below).**

The overall precision and data capture for all co-location studies were very good, as they have been over recent years. Choice of bias adjustment factor was given very careful consideration. In order not to attempt to underestimate levels of NO2 throughout the borough for 2019 it was decided to average the 3 x Richmond sites, which gave a bias adjustment factor of **0.90** rather than employ the national Gradko bias adjustment factor of **0.87.** This same procedure was adopted in 2014**.** The result is slightly more conservative than using the national Gradko biased adjustment factor as it falls between the Castlenau local biased adjustment factor of **0.93 and** the national Gradko biased adjustment factor of **0.87** and was considered a prudent option. We neither wish to under estimate or over report levels of NO2 in the borough.

Factor from Local Co-location Studies

The local bias adjustment factors for the Borough are provided in Table A.1 for 2013 to 2019. From 2013 to 2016 all kerbside and roadside sites in the Borough are bias adjusted using the factor from the local roadside co-location site at Richmond 1 Castelnau. This is with the exception of 2014 and 2019. In 2014 and 2019 the bias adjustment factor was the average of the three static sites in the borough – the third was the Air Quality mobile, which was at the same roadside site for the duration of 2014 and 2019. In 2017 and 2018 the bias adjustment factor was the national bias adjustment factor for Gradko using the 50% TEA in acetone methodology. All background sites in the Borough for all years are bias adjusted using the factor from the local suburban co-location site at the Richmond 2 Barnes Wetlands. In 2019 the bias adjustment factor was once again the average of the three static sites in the borough – the third was the Air Quality mobile, which was at the same roadside site for the duration of 2019; all sites had very good data capture.

The methodology for calculating the bias adjustment was followed using the guidance on the AEA spreadsheet.

Table A.1 2013 to 2019 NO2 diffusion tube bias adjustment factors for the Borough

Source of bias adjustment factor	2013	2014	2015	2016	2017	2018	2019
Local roadside co-location study at Richmond 1 Castelnau	**0.96**	**0.95** [b]	**0.92**	**0.98**	**0.97** [a]	**0.92** [a]	**0.90** [b]
Local background co-location study at Richmond 2 Wetlands Barnes	**0.95**	**1.09**	**1.00**	**1.08**	**1.00**	**0.93**	**0.99**

[a] Gradko national bias adjustment factor

[b] *average of 3 x LBRUT static sites*

A.3 Adjustments to the Ratified Monitoring Data

Short-term to Long-term Data Adjustment

For monitoring sites where data capture is less than 75% of a full calendar year (less than 9 months), the mean of the 'raw' concentrations should be "annualised" in accordance with Box 7.10 of the LLAQM Technical Guidance (TG16) before being compared to annual mean objectives. In 2019 data capture at all sites was very good and above 75% so this was not necessary.

PM_{10} Adjustment

Measured mean PM_{10} concentration for all 3 x LBRuT automatic monitoring sites for 2019 was 15-20μg/m3 based on data capture rates of 89% - 96%. Since this was above the 75% data capture threshold "annualisation" of data was not necessary. (This is in accordance with the procedure detailed in LLAQM Technical Guidance (TG16)).

A.3 Adjustments to the Ratified Monitoring Data

Distance Adjustment

All NO 2 diffusion tube results have been adjusted to represent exposure at the nearest façade. The concentration at the nearest receptor has been estimated using the LAQM NO2 Fall-off with Distance Calculator (Version 4.1) in line with the procedure detailed in LLAQM.TG (16).

The methodology consists of comparing the monitored annual mean NO_2 concentrations at a given point against known relationships between NO_2 concentrations and the distance from a road source.

The monitored annual mean value used in the calculation has been bias adjusted and the background concentration is derived from the Wetlands background site.

Table K. Distance Adjustment - Monitored Annual Mean NO2 compared to exposure at nearest façade (μg m-3)

Site ID	Address	Background Conc.	Measured Annual mean Conc.	Distance Corrected Conc.
1	Hampton Court Rd, Hampton	21	35	34.6
2	Percy Rd, Hampton (nr. Oldfield Rd)	21	29	27.6
4	Hampton Rd, Teddington (nr. Bushy Pk Gardens)	21	31	25.5
7	Broad St, Teddington (Boots)	21	39	35.0
9	Hampton Rd, Twickenham	21	35	31.9
10	Twickenham Rd, Twickenham (opp. Fulwell golf course)	21	**40**	31.4
11	Percy Rd, Whitton (nr. Percy Way)	21	34	27.5
12	Hanworth Rd, Whitton	21	**40**	31.3
13	Whitton Rd, Whitton, (opp. rugby ground)	21	36	30.0

14	Cross Deep, Twickenham (nr Poulett Gardens)	21	33	28.7
15	Richmond Rd, Twickenham (opp. Marble Hill Pk)	21	32	29.8
17	Red Lion Street, Richmond	21	**50**	**46.9**
18	Lower Mortlake Rd, Richmond (nr. Trinity Rd)	21	**46**	34.5
19	Kew Rd, Kew (nr. Walpole Av)	21	37	27.6
20	Mortlake Rd, Kew (nr. Kent Rd)	21	38	33.2
22	Castelnau, Barnes (nr. Hammersmith Bridge)	21	32	27.9
23	Castelnau Library, Barnes (static site)	21	26	24.7
24	Lonsdale Road, Barnes (nr. Suffolk Rd)	21	28	24.5
25	URRW, (nr. E.Sheen Primary School)	21	36	35.7
26	URRW, Sheen (nr. Courtland Estate)	21	34	26.9
27	Queens Rd, Richmond (nr. Russell Walk)	21	32	27.1
28	Holly Lodge, Richmond Pk	21	17	17.0
29	Petersham Rd, Ham (nr. Sandy Lane)	21	28	27.7
31	A316	21	**45**	36.0
32	Kings St, Twickenham	21	**47**	**40.9**
33	Heath Rd, Twickenham	21	**40**	36.3
34	Thames St, Hampton	21	30	30.1
35	High St, Hampton Wick	21	36	35.8
36	Upper Richmond Road West (URRW), Sheen Lane	21	<u>**61**</u>	<u>**60.6**</u>
37	Wetlands, Barnes (static site)	21	20	23.3
39	Richmond Rd, Richmond Bridge, East Twickenham	21	39	35.9
40	Staines Rd, Twickenham	21	35	28.1
41	Paradise Rd, Richmond	21	32	28.0
42	The Quadrant, Richmond	21	<u>**62**</u>	**51.0**
43	Hill St, Richmond	21	**46**	**42.1**
44	Sheen Rd, Richmond (near shops)	21	37	37.0
45	High St, Teddington,	21	32	28.3
48	Stanley Rd, Teddington (junc. Strathmore Rd)	21	33	30.4
50	URRW, nr. Clifford Av, Sheen	21	**50**	**42.6**
51	Sheen Lane, Sheen (level crossing)	21	30	29.2
52	Clifford Av, Chalkers Corner	21	**55**	**50.0**
53	co-located on mobile unit, A316, Chertsey Rd (nr Egerton Rd) in 2019	21	**41**	38.4
54	Mortlake Road, adjacent to West Hall Road, Kew	21	**40**	37.3
55	Mortlake Road, adjacent to Cemetery Gates, Kew	21	**40**	33.3
56	A316 (St Magarets)	21	39	30.8
57	A316 (Lincoln Avenue)	21	37	28.0

58	London Road, Twickenham	21	40	32.1
59	Whitton Rd, Twickenham (near Twickenham bridge)	21	34	32.0
61	London Road, Twickenham (near Waitrose)	21	38	34.6
62	High Street, Barnes	21	43	36.5
63	High Street, Whitton	21	33	29.8
64	High Street, Hampton Hill	21	41	36.9
65	York St, Twickenham	21	50	41.4
66	Sth Circular, Kew (nr. Kew Green)	21	40	38.0
67	Petersham Rd opp Poppy Factory,	21	32	30.4
68	Rocks Lane, Barnes	21	40	39.1
69	Uxbridge Rd, TW12	21	31	28.9
70	Stag Brewery, Lwr Rich Rd, SW14	21	42	41.3
71	A316, St Stephens Primary Schl	21	52	42.2
72	St Margarets Rd (nr St Mags Station)	21	42	37.4
73	Hospital Bridge Rd (nr Homelink)	21	43	35.8
74	Lower Rich Rd, Mortlake (nr. Chalker's Cnr)	21	52	45.7
RUT01	Civic Centre, York St, Twickenham	21	36	35.9
RUT02	George Street, Richmond	21	63	54.0

Appendix B   Full Monthly Diffusion Tube Results for 2019

Table M.   NO$_2$ Diffusion Tube Results

Site ID	Valid data capture for monitoring period % [a]	Valid data capture 2019 % [b]	Jan	Feb	March	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Dec	Annual mean – raw data [c]	Annual mean – bias adjusted [d]
															Annual Mean NO$_2$	
1	100	100	47.02	45.42	44.53	42.17	35.25	34.92	36.11	35.07	33.42	33.96	47.58	35.89	39	35
2	100	100	44.51	39.85	34.90	36.77	23.58	24.95	25.02	24.60	29.78	31.71	41.68	33.18	33	29
4	100	100	45.91	41.01	36.58	43.70	30.48	32.27	25.99	21.14	30.27	28.33	50.38	31.01	35	31
7	100	100	55.04	43.74	47.97	57.95	39.37	43.53	35.48	30.39	39.24	38.99	51.52	35.16	43	39
9	100	100	55.34	45.80	39.43	43.09	32.75	30.99	31.42	30.66	38.19	36.73	53.93	34.40	39	35
10	100	100	54.98	54.35	48.29	41.39	36.44	34.46	41.69	44.29	41.30	42.40	55.24	42.68	45	40
11	100	100	61.08		40.54	38.35	34.25	32.57	24.18	29.26	36.11	34.69	46.17	35.22	37	34
12	100	100	49.02	58.03	45.39	46.22	42.90	39.96	37.06	37.39	40.34	41.15	54.61	39.45	44	40
13	100	100	57.71	47.19	38.24	42.53	35.56	31.63	31.38	23.40	37.30	36.84	57.79	40.21	40	36
14	100	83	45.90	42.24	38.07	40.89	31.73	32.19	27.28	29.82			47.35	33.32	37	33
15	100	92	48.07	45.91	37.28	36.71	27.47	32.76	31.52	31.20	31.59		38.58	28.58	35	32
17	100	92	68.19	70.02	56.07	54.93	44.06	54.21	49.34		49.32	48.83	59.76	53.31	55	50
18	100	92	60.22	65.10	50.59	55.74	46.22	53.19	29.32	48.00	47.85		62.80	44.52	51	46
19	100	83	55.90	61.70	46.78	41.21	36.53	39.03	34.46	31.67	38.19	30.16			42	37
20	100	100	50.51	56.50	39.63	44.01	38.05	42.04	35.09	40.76	38.37	34.26	48.98	42.99	43	38
22	100	100	57.73	77.99	47.90	36.34	20.76	22.53	17.59	18.08	24.37	26.43	37.99	35.65	35	32
23	100	100	42.04	43.54	32.69	32.31	21.96	22.67	18.22	18.87	22.82	25.98	35.95	30.21	29	26

24	100	92	38.82	45.65	31.72	29.75	27.73	28.48	23.31	18.50	29.77	31.20		32.50	31	28
25	100	92	45.46	51.69	44.38	52.06	36.78	37.65	34.41	23.41	36.75	35.27	42.26		40	36
26	100	100	50.01	40.15	38.51	47.10	32.16	31.71	29.46	28.67	35.30	30.26	48.09	41.08	38	34
27	100	92	41.56	49.60	35.32	47.33		28.15	27.64	26.50	30.16	30.28	41.95	26.90	35	32
28	100	100	30.93	25.74	17.78	20.72	12.92	14.52	11.68	10.62	14.66	16.93	27.96	16.60	18	17
29	100	92	35.31	38.36	28.98	39.79	27.94	26.05		20.83	25.84	27.52	43.45	30.15	31	28
31	100	100	56.54	61.61	57.64	52.55	45.02	42.78	46.92	46.60	44.52	41.96	63.72	45.54	50	45
32	100	100	62.44	64.15	57.68	59.46	45.77	47.86	49.05	48.27	44.75	38.41	64.61	48.00	53	47
33	100	100	51.30	43.94	47.59	57.28	42.16	40.98	41.23	33.49	42.83	36.54	59.45	35.47	44	40
34	100	100	42.37	36.47	32.98	43.58	29.92	26.91	25.47	32.01	29.21	29.46	40.52	26.82	33	30
35	100	100	55.58	50.01	41.37	40.40	34.82	33.68	35.09	35.09	36.29	33.93	46.58	43.53	41	36
36	100	100	74.94	78.37	65.14	75.07	59.50	63.12	57.96	63.96	64.05	59.10	81.50	70.26	68	61
37	100	100	32.17	29.19	21.29	23.76	16.30	17.73	14.34	12.51	17.85	22.12	30.39	22.62	22	20
39	100	100	54.59	54.24	47.15	49.01	38.68	41.39	35.27	33.93	34.64	35.17	44.02	47.83	43	39
40	100	100	49.32	45.12	39.99	44.19	35.09	30.95	35.20	32.81	36.80	33.83	44.57	33.11	38	35
41	100	100	48.92	43.95	34.53	37.83	28.80	27.18	26.24	23.25	31.90	35.78	50.25	31.40	35	32
42	100	92	80.60	80.68		57.01	59.57	63.55	72.23	68.00	71.34	59.11	75.87	72.91	69	62
43	100	100	66.92	64.20	53.01	52.19	43.61	49.43	42.47	44.16	45.13	47.01	55.83	47.52	51	46
44	100	100	48.68	52.34	43.07	47.03	36.67	31.77	31.48	30.67	39.64	37.16	55.32	42.41	41	37
45	100	100	44.75	45.86	34.78	34.68	29.43	31.11	28.06	28.84	30.70	32.46	45.93	33.72	35	32
48	100	100	49.72	48.01	43.34	37.49	35.54	30.70	30.10	28.14	33.40	33.14	42.41	34.36	37	33
50	100	100	59.75	59.24	52.31	65.10	48.74	56.88	53.67	48.47	50.19	53.53	67.30	45.63	55	50
51	100	100	47.39	43.18	31.92	39.84	26.04	29.84	25.75	24.65	29.26	29.37	40.97	31.21	33	30
52	100	100	74.40	75.41	59.05	65.06	62.82	57.57	65.57	62.17	60.12	38.83	61.79	55.98	62	55
53	100	100	57.73	52.68	51.93	46.37	45.16	41.32	42.70	38.91	41.50	39.16	57.16	36.72	46	41
54	100	100	58.48	48.60	47.39	45.69	43.50	39.78	40.73	34.62	38.45	37.88	57.72	46.38	45	40
55	100	100	52.49	49.35	39.64	48.73	37.05	43.88	37.84	36.63	43.12	55.55	49.22	38.97	44	40
56	100	92	59.45	52.29	48.81		36.53	42.48	34.59	31.68	39.86	41.95	51.22	41.74	44	39
57	100	92	48.20	46.95	42.27	47.01	35.54	33.33	35.76	35.34	39.13	38.44	49.27		41	37

Site	a	b	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	Result1	Result2
58	100	100	58.45	52.94	42.38	51.63	38.53	33.95	34.86	32.92	38.53	40.75	58.86	46.74	**44**	**40**
59	100	83	47.43	46.07	33.38	52.00		36.26	32.01	28.49	26.61		51.61	25.72	38	34
61	100	100	56.01	51.57	52.43	43.08	38.91	34.56	37.58	32.17	39.33	33.00	48.27	43.18	**43**	38
62	100	100	57.70	63.21	60.04	49.13	45.25	48.09	40.16	33.65	41.26	38.81	50.76	45.10	**48**	**43**
63	100	92	45.89		41.10	41.96	33.28	33.01	28.21	29.51	34.00	33.36	44.55	37.74	37	33
64	100	100	63.18	52.33	51.07	48.32	39.25	42.52	41.07	37.22	42.62	34.03	53.40	36.17	**45**	**41**
65	100	100	68.77	70.70	51.79	53.25	46.47	52.65	53.52	58.46	51.78	41.25	55.22	58.00	**55**	**50**
66	100	92	51.91	54.20	48.59	41.76	40.02	38.79		43.14	43.80	37.29	37.91	50.41	**44**	**40**
67	100	100	42.45	41.81	29.56	42.81	28.27	36.18	30.08	29.89	33.01	32.91	47.36	30.90	35	32
68	100	100	61.62	75.91	62.43	40.62	35.10	33.93	32.21	31.20	35.13	35.64	45.56	42.85	**44**	**40**
69	100	100	54.45	47.77	39.77	41.63	35.19	24.72	22.24	18.87	25.33	25.46	44.19	30.86	34	31
70	100	100	52.72	49.78	38.41	49.10	42.20	47.31	42.99	37.95	44.43	44.70	61.06	46.95	**46**	**42**
71	100	100	60.89	77.43	51.28	70.46	49.84	64.78	58.72	53.95	53.56	42.09	52.96	57.21	**58**	**52**
72	100	100	65.59	62.67	48.69	51.65	39.18	39.60	38.49	37.19	37.44	46.10	58.40	40.03	**47**	**42**
73	100	100	60.23	63.94	50.78	41.83	40.73	42.74	41.70	46.10	43.71	44.59	55.54	47.89	**48**	**43**
74	100	100	60.21	63.94	52.13	64.38	54.48	56.51	53.97	50.37	52.21	58.13	63.21	58.73	**57**	**52**
Rut 01	100	100	49.47	52.58	37.59	37.62	34.76	34.98	35.61	37.84	35.40	35.27	49.86	42.34	**40**	36
Rut 02	100	100	80.93	79.62	74.22	71.36	59.73	69.64	71.21	66.23	67.73	55.70	83.56	65.24	**70**	**63**

Exceedance of the NO$_2$ annual mean AQO of 40 µgm^{-3} are shown in **bold**.

[a] data capture for the monitoring period, in cases where monitoring was only carried out for part of the year

[b] data capture for the full calendar year (e.g. if monitoring was carried out for six months the maximum data capture for the full calendar year would be 50%)

[c] Means should be "annualised" in accordance with LLAQM Technical Guidance, if valid data capture is less than 75%. Data capture rate above 75% in 2019 at all sites so not necessary.

d The bias adjustment factor used for all roadside/kerbside sites is 0.90 which is calculated using the average of the 3 x static Richmond sites. The bias adjustment factor for both background sites 28 and 37 is 0.99 calculated using results from Wetlands.

For Triplicate sites see below.

Triplicate NO2 diffusion tube results for sites 23, 37 and 53 in ug/m3

Site Code	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual mean
23	41.97	44.33	31.92	33.35	20.96	22.99	17.77	17.79	23.94	26.38	36.21	30.19	28.98
23/2	43.30	45.00	34.15	30.16	21.87	23.82	18.67	19.53	21.55	27.56	36.86	32.52	29.58
23/3	40.86	41.30	32.02	33.41	23.06	21.19		19.29	22.98	24.00	34.78	27.93	29.17
Average	42.04	43.54	32.69	32.31	21.96	22.67	18.22	18.87	22.82	25.98	35.95	30.21	29.24
37	31.16	28.67	20.48	22.76	16.83	16.88	14.28	12.29	15.80	22.26	29.95	23.14	21.21
37/2	30.43	29.37	21.44	23.30	16.11	17.79	14.10	12.63	18.93	21.46	30.56	22.85	21.58
37/3	34.91	29.53	21.95	25.22	15.96	18.51	14.64	12.61	18.81	22.65	30.66	21.86	22.27
Average	32.17	29.19	21.29	23.76	16.30	17.73	14.34	12.51	17.85	22.12	30.39	22.62	21.69
53	63.34	48.88	53.00	44.06	47.44	42.95	40.55	39.70	44.38	35.97	66.31	37.18	46.98
53/2	60.64	53.86	48.80	46.95	44.83	40.37	43.11	38.78	45.20	40.14	53.25	41.65	46.46
53/3	49.20	55.30	53.99	48.11	43.22	40.65	44.43	38.23	34.91	41.37	51.91	31.33	44.39
Average	57.73	52.68	51.93	46.37	45.16	41.32	42.70	38.91	41.50	39.16	57.16	36.72	45.94